

Transport Pricing and Public-Private Partnerships¹

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Abstract

Public-Private Partnerships have become a favoured way of introducing private capital into transport projects whilst maintaining an element of public interest. This paper considers the potential conflicts that might arise between the freedom of the private operator within a PPP and other elements of the public sector's transport policy. Specifically it tackles the question of the problems that might arise when the public sector wishes to implement a type of price regulation, for example SMC Pricing, which might appear to limit the freedom of the private interest to maximise its value from the PPP according to the contract. The paper demonstrates theoretically the potential inconsistencies between such policies and suggest ways in which they may be overcome.

We first briefly discuss Public-Private Partnerships in transport: what are the defining characteristics and what are the main types that exist in the different modes of transport? Next we consider the economics of Public-Private Partnerships, in particular from the viewpoint of incentives. Subsequently we identify and examine the issues that arise when Social Marginal Cost Pricing is to be incorporated in PPPs as a regulation with regard to pricing in the transport sector. Lastly, we investigate the possibilities of resolving these issues.

1 Introduction

Public-Private Partnerships (PPPs) have become a much favoured way of introducing private capital into transport projects whilst maintaining an element of public interest. This paper considers the potential conflicts that might arise between the freedom of the private operator within a PPP and other elements of the public sector's transport policy. Specifically it tackles the question of the problems that might arise when the public sector wishes to implement Social Marginal Cost Pricing (SMCP) as a form of transport pricing, which might appear to limit the freedom of the private interest to maximise its value from the PPP according to the contract. In this paper we demonstrate theoretically the potential inconsistencies between such policies and suggest ways in which they may be overcome.

In section 2 we begin with a discussion on Public-Private Partnerships in transport: their defining characteristics and the main types that exist in the different modes of

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transport, In section 3 we consider the performance drivers that are important within PPP-contracts: the elements within the PPP-contract that produce 'value-for-money' and how they do this. After a brief introduction to Social Marginal Cost Pricing, this informs an analysis of potential problems that may arise when trying to incorporate SMCP within a PPP-contract in section 4. Section 5 examines possible solutions to the issues identified in section 4. Section 6 presents our main conclusions.

2 Public-Private Partnerships in Transport

Public-Private Partnerships in the transport sector encompass many different kinds of contracts: BOT (Build-Operate-Transfer), BOO (Build-Own-Operate), DBFMO (Design-Build-Finance-Maintain-Operate), concessions, etc. These different contract types share several features:

- Public responsibility is retained. This distinguishes PPP from privatisation, in which public responsibilities are transferred to the private sector. However, similar to privatisation, a commercial private party is given an opportunity to deliver a 'public service' and is allowed to make a profit doing so.
- Multiple tasks are integrated in one contract. Whereas in more traditional forms of procurement there is a separate contract for e.g. the design, the construction, the maintenance, the operation, etc. of a certain asset, in case of PPP several of these tasks are integrated in one contract.
- Along with the integration of multiple tasks, there is a substantial transfer of risks to the private party. For example the risks of cost overruns, delays in construction, the scale of operational and maintenance expenditures, etc. may be devolved upon the private party. This distinguishes PPP from more traditional forms of procurement, in which most of the risks are usually borne by the public party. In the PPP-contract risks are allocated between the public and private party, and this will also determine e.g. ownership of the asset, liability, restrictions in operation for the private party, etc.

PPP-contracts can however differ according to the following characteristics:

- Scope of tasks. PPP-contracts can vary in accordance to the tasks they encompass. PPPs may involve an investment in a new asset (greenfield) or the rehabilitation of an existing asset (brownfield). The contract will usually cover the design, construction and maintenance, and often also the operation/exploitation of the asset.
- Payment for the transfer of the asset. When responsibility and/or ownership is transferred from the private party to the government at the end of the contract period, contracts may, or may not, stipulate a payment for the residual value of the asset.
- Revenue Generation. Many PPP-projects get their revenues directly from exploitation (user payments by way of e.g. toll, charges, or ticketing). However PPP-projects may also be funded indirectly through public funding that is performance based (e.g. shadow toll, availability payments). Combinations of direct payments by users and performance based public payments also exist.

This last point especially will be important later in this paper: PPP-contract types exist in which revenues are **not** generated directly from exploitation, but instead are

generated through performance based payments paid by the government (see box below).

The SoPC (Standardisation of PFI Contracts) by HM Treasury of the UK, and the standard DBFM contract of Rijkswaterstaat (Highways Agency) of The Netherlands each describe a payment mechanism based on availability. The one in the Rijkswaterstaat standard DBFM contract works as follows. From the moment the road is operational until the end of the contract period, the private operator receives an availability payment every quarter of a year. This availability payment is a fixed payment of which a reduction is subtracted depending on whether lanes of the road can be (fully) used or not during the reporting period. The following conditions can apply: a lane needs to be closed, a lane needs to be narrowed, or the speed is limited for a lane. For each of these categories a fee applies which also depends on whether the closure, narrowing or reduction of speed causes much inconvenience to road users. This latter is determined by the traffic intensities for different moments for each day in the week. When a lane is closed during a point in time that traffic is normally very intensive the fee is high, when the speed on a lane is only reduced at a point in time that there is little traffic, the fee is low. These fees are multiplied by the number of hours this condition holds. In this way the total amount of reduction to the fixed amount is calculated for the period. In addition to the reduction due to diminished operation of lanes, the payment may also be reduced because of a failure from the part of the operator that leads to a traffic accident or a hazardous situation, or an observed non-conformity to the contract (e.g. in the reporting demands). (*Source: Rijkswaterstaat (March 2006): DBFM Basis Overeenkomst, version 1.1; and HM Treasury (March 2007): Standardisation of PFI Contracts, Version 4*)

The different contract types can also be tied to different sections of the transport sector. Concessions in which revenues are generated through exploitation are especially prevalent in public transport services (urban public transit and railway operations), ports and airports. All the different types of PPPs (toll concessions, BOT, BOO, DBFMO, etc.) are used for road and railway infrastructure. PPPs with performance based payment mechanisms are also frequently applied in road and railway infrastructure, especially in North-West Europe. PPPs for inland waterway infrastructure – i.e. canals, locks or dams – do not currently exist. However the situation would be in important ways similar to road and railway infrastructure, so the same contract types could be applied.

3 Performance drivers within PPP-contracts

The key economic characteristic of the relationship between public and private parties in a PPP is the extreme degree of 'asset specificity' (Williamson, 1975, 1985). The possibilities to generate revenues in ways other than designated in the contract are non-existent, or very limited. In the case of an investment in transport infrastructure it will moreover not be possible to relocate the asset, and generate revenues elsewhere. Once the private party has made the initial investment it is therefore in a highly vulnerable position since it cannot employ the investment in other ways than specified in order to generate an adequate return. Because of this level of asset specificity, the

private party may be subject to so-called hold-up situations: other parties (the government, suppliers, users) may try to obtain the benefits the private party hoped to derive from the investment by abandoning the agreement or withholding crucial inputs after the investment has been made.

This large level of asset specificity also confers on the private party, a 'temporary monopoly'. There is only one party that can exploit, operate and manage the asset at a time; there will be no competitors to do the same tasks for the same asset. Moreover, when the private party generates its revenues from exploitation, it will want to reduce any risk of competing initiatives that reduce the possibilities of generating sufficient revenues. Typical of the 'temporary monopoly' that is extended in the case of PPP, is that it is almost entirely regulated upfront through the PPP-contract. Therefore there is very little room for adjustments and 'ad hoc regulation' (as is usual in the regulation of monopolies in e.g. network industries) during the course of the contract.³ The government will hence also be in a vulnerable position in a PPP: it retains ultimate responsibility, but it ceases to have direct control over the substantial tasks and responsibilities it has delegated to a private party that now holds a temporary monopoly. When the provision of infrastructure or transport services is deemed inadequate or when policy objectives in these areas change, the contracting government will, on the one hand be answerable to the general public for these matters, but on the other hand be tied to a long term agreement to a private party.

In a PPP-contract there is thus a delicate balance to be found between the interests of the contracting government and those of the contracted private party. Both parties will need assurances: the government wants to have certainty that the private party is 'up to the job' and does what is required to deliver adequate services, and the private party needs to be confident that the government will abide by the contract and let it generate sufficient returns on its investment.

Achieving this balance between the interests of the public party and the private party is however complicated by the asymmetry of information that exists between both parties. The private party ('the agent') has information on its skills, effort and input, that the public party ('the principal') does not have. This information asymmetry can lead to both ex ante inefficiencies and ex post inefficiencies. Ex ante inefficiencies can arise when the principal is not able to select the most appropriate agent for a specific task because the abilities of the agent are not completely known to the principal. Ex post inefficiencies will occur when the agent takes advantage of the principal by pursuing goals of his own, because the principal does not have all the information about the effort of the agent in a particular job ('moral hazard'). With regard to PPP-contracts, this implies that the contracting government will have to select the right private party through a well-designed tender procedure to overcome the ex ante inefficiencies. The ex post inefficiencies (issues with moral hazard) need to be dealt with by formulating a contract that contains adequate incentives, and by strictly monitoring and enforcing the provisions in the contract.

³ In practice it is however possible to make some adjustments and renegotiate specific terms during the course of the contract.

Despite the inherently complicated nature of Public-Private Partnerships, several studies⁴ have found that through PPPs a substantial amount of ‘value-for-money’ (better quality with less costs) can be realised: PPPs can lead to cost efficiency gains of 10 to 20 percent⁵, and to a significant reduction of the incidence of time and cost overruns^{6,7}.

The key to realising value-for-money are the performance driving elements within PPP-contracts. The main performance drivers can be subsumed under three headings:

- Integration of tasks;
- Allocation of risks;
- Supplying adequate incentives.

The challenge with regard to PPPs is to set up the tender procedure in such a way that competitive pressures within the procedure ensure that private parties submit bids in which these three performance driving elements are enhanced. Ideally this will lead to a PPP-contract with an optimal integration of tasks, allocation of risks, and supply of incentives. Especially the allocation of risks and supply of adequate incentives are of great importance with regard to the question as to how SMCP may be feasibly incorporated within PPPs.

3.1 Integration of tasks

Characteristically, a PPP contract is written over the flow of services rather than the build process (Grout, 1997). Specification of required services instead of specification of the building process implies integration of tasks: the design and construction of an asset are integrated with maintenance, operation and/or exploitation.

Integration of the design and construction with maintenance and operation can lead to increased incentives for life cycle optimisation when compared to a situation where design/construction and maintenance/operation are separately procured. This is because externalities may exist between design/construction and maintenance/operation (Dewatripont and Legros, 2005; Iossa and Martimort, 2008).

⁴ These studies not only encompassed PPPs in the transport sector, but also PPPs in government housing, hospitals, schools, water supply, water treatment, etc.

⁵ Cost efficiency here not only relates to a reduction in costs, but also to a reduction of risks (of which a valuation is included in the different estimates). The National Audit Office of the UK (1999) found a 10 to 20 percent cost efficiency for 7 PPP projects in the UK. Arthur Andersen and Enterprise LSE (2000) found that PPPs are 17 percent more cost efficient in a study of 29 projects in the UK. A statistical analysis of 21 PPPs and 33 traditionally procured contracts in Australia by The Allen Consulting Group (2007) found an average cost efficiency of 11 percent in the period between signing the contract and realisation of the contract and even 31 percent if the period is extended from the project inception to realisation.

⁶ Mott MacDonald (2002) showed that PPPs in the UK on average do not experience time or cost overruns, while traditionally procured projects do experience overruns of several tens of percents. The National Audit Office (2003) found in a study that 78 percent of the PPP-projects in the UK are realised within the scheduled costs and 76 percent within scheduled time, while this is 27 and 30 percent respectively for traditionally procured contracts. The Allen Consulting Group (2007) concluded that PPP-projects are completed slightly ahead of time on average, while traditionally procured projects are subject of a time overrun of 24 percent on average.

⁷ For critical assessments of such studies however, see Edwards and Shaoul (2003), and Hodge (2004).

These externalities may exist because an extra investment in the design/construction phase may lead to a decrease in operating costs in the operational phase (e.g. better quality of the asset will lead to reduced costs of maintenance) (Hart, 2003; Bentz, Grout and Halonen, 2004; Martimort and Pouyet, 2006; Iossa and Martimort, 2008) and/or an increase in the residual value of the asset (Benett and Iossa, 2005; Iossa and Martimort, 2008). When design/construction and maintenance/operation are separately procured such extra investments will not be made, because the private party contracted for design and construction will not derive any benefit from them; the benefits will all go to either the government (when the benefits of the extra investment are verifiable) or the private party contracted for maintenance/operation (when the benefits are not verifiable).

3.2 Allocation of risks

Within a PPP it is possible to effectuate a distribution of risks that is more efficient when compared to more traditional forms of procurement. The most important categories of risks with regard to a transport infrastructure project or transport service, are listed below (Iossa, Spagnolo and Vellez, 2007-1; Loosemore, 2007; Hodge, 2004); within these categories more specific risks can be distinguished.

- Statutory / Planning risks. Risks associated with the planning process: planning permission is not granted, the planning process takes longer than expected, etc.
- Design risks. Risk that the design process costs more or takes longer than expected. As well as the risk that the design fails to meet the requirements.
- Construction risks and time schedule risks. Risks associated with the construction process: construction may cost more and/or longer than expected due to changes in labour and materials costs, inadequate cost management, inefficient construction practices, adverse site and weather conditions, delays in obtaining approvals and permits, protester action, etc. Also the risk that the construction fails to deliver the quality expected fall within this category.
- Operation risks. Risks that lead to an increase in operation costs and failure to meet performance standards, such as changes in labour and materials costs, poor maintenance schedule, inadequate cost management, etc.
- Demand risk. The risk that revenues are lower than expected due to lower-than-expected demand for the service.
- Risk of changes in public needs. The risk that output specifications in the contract become inadequate because of changes in society's preferences.
- Legislative/Regulatory risks. Risk of changes in legislative and regulatory framework, e.g. changes in tax legislation, labour conditions, tariff-setting rules, etc.
- Financial risks. Risks resulting from exchange rate fluctuations, inflation, changes in interest rate, etc.
- Residual value risks. Risk that the value of the asset at the end of the contract is lower than anticipated.

Risk is made up of two components: chance of occurrence, and consequences when the risk occurs. A party may be able to influence the occurrence, or may be in a better position to control the consequences when a risk occurs. With regard to the

occurrence of a risk, we can discriminate between two types of risk (Dewatripont and Legros, 2005; Sadka, 2007):

- Exogenous risk is risk of which the occurrence is entirely beyond the control of both contracting parties (risk due to external events), nor is either party better informed about this risk than the other. For example adverse site and weather conditions during construction, changes in material costs, exchange rate fluctuations, etc.
- Endogenous risk is risk of which the occurrence can be influenced by the contracting parties, and/or risk that one party is better informed about. Examples include inadequate cost management, poor maintenance schedules, tariff-setting rules, etc. By creating the right incentives endogenous risks may be prevented from occurring.

In general, an efficient allocation of risks (i.e. an allocation that optimises value-for-money) will be accomplished when the following two principles are followed (Iossa, Spagnolo and Vellez, 2007):

1. Given partners with similar risk-aversion, a particular risk should be allocated to the party that has relatively more control over the occurrence and/or consequences of a the risk;
2. Given partners with similar responsibility or control over occurrence and/or consequences of a particular risk, the risk should be allocated to the party that is more able to bear it, i.e. the less risk-averse party.

This implies that it is suboptimal to transfer exogenous risks to the private party if it is not in a better position to reduce the consequences (Dewatripont and Legros, 2005; Sadka, 2007; Iossa, Spagnolo and Vellez, 2007). If the private party is required to bear such risks, it will just require a higher return to compensate for increased risks, without any concomitant benefits in terms of higher quality or lower infrastructure costs.⁸

Many of the risks are however at least partly endogenous: one of the parties in the contract is in a better position to control the occurrence of a particular risk, or is better informed – or one of the parties is in a better position to abate the consequences of a risk. Several of the risks that are related to the statutory / planning process and legislation and regulation may be (partly) controlled by the government, hence in theory they should be distributed to the public party.⁹ Likewise, the private party is in a better position to manage many of the risks associated with the design, construction and operations; these should be borne by the private partner therefore. To make sure that the private party actually manages these risks to the best of its capabilities

⁸ Only when a private party is very big and carries out multiple contracts, exogenous risks of the same type may be pooled together. In that case the private party could act as an ‘insurance company’, and hence the private party would be less risk averse as the public party. However, this is generally an exception.

⁹ Though it should be noted that the contracting public party concerned may not have much influence on these risks as the government may be legally bound to follow certain procedure, and/or other parts of the public sector may be responsible for the statutory / planning process. In that case these risks are exogenous. Then they should normally nonetheless be borne by the government because transferring these risks to the private party will not be efficient.

(ensuring that costs are saved and a better quality in provision is achieved), it is crucial that adequate incentives are supplied. The next section will discuss this further.

In practice it is often difficult to determine exactly to what extent the private party is able to influence the occurrence and consequences of certain risks. Hence, when attempting to transfer endogenous risks to the private party (many risks associated with design, construction, operation, etc.), some exogenous risks will be transferred as well (e.g. bankruptcy of important suppliers, adverse weather conditions, quicker wear and tear than expected, etc.). There will thus be a trade-off between on the one hand the increased incentives generated by transfer of risks to the private party, and on the other hand the higher risk-premium the private party will charge due to its risk aversion from exogenous factors that are concomitantly transferred.

3.3 Supplying adequate incentives

The most important elements in the PPP-contract that determine the incentives, are the following: the payment mechanism, provisions for non-conformity and early termination, and provisions for transfer of the asset. We will discuss each component in turn.

3.3.1 Payment mechanism

As discussed in section 2, two basic revenue generating sources can be distinguished with regard to PPPs: revenues generated directly from exploitation (user payments, such as ticketing, charges, toll, etc.), and revenues generated indirectly through performance based payments by the government. In this latter category, we can make a distinction between payments based on actual usage (e.g. shadow tolls) and payments based on availability (Abdel Aziz, 2007; Iossa, Spagnolo and Vellez, 2007-1). In many PPPs these main payment mechanisms are complemented by bonuses and penalties for specific objectives: keeping the time schedule for construction, user satisfaction, traffic safety, cleanliness, etc (Abdel Aziz, 2007).

Crucially, user payments, usage payments or availability payments lead to a different distribution of the demand risk between private and public parties. With user payments the demand risk is fully transferred to the private party, which provides an incentive for the private party to encourage service and manage demand through setting prices. Transferring the demand risk in this way is only efficient if the private partner is able to influence demand for the service in question (through quality of the service, marketing, and/or tariff setting) (Iossa and Martimort, 2008). Usage payments may also transfer the demand risk, but normally mitigate this risk: often bands are used – a lower band that guarantees a minimum payment, and an upper band that caps total payments to bound the public party's financial liability. Availability payments on the other hand imply that the private sector party does not carry any demand risk. The private party is paid according to objective measures defining service availability, e.g. lanes ready-to-use in roads, a railroad that is open for use, etc. When the service is unavailable to users, payments are reduced through deductions. If availability surpasses some predefined level then bonus payments may be made. This will incentivise the private party to build a high-quality facility that is available for use as much as possible and to schedule maintenance in a way that is most convenient for

users. Essential for usage and availability payments is that usage and/or availability are indeed adequate proxies for service quality, and that the government can in fact effectively specify and monitor usage and/or availability. If this is not the case then usage or availability payments will not produce the right incentives and service quality can suffer (Hart, Shleifer and Vishny, 1997; Grout, 1997, Iossa and Martimort, 2008).¹⁰

Furthermore, the PPP-contract may contain a one-off capital payment by the government at the end of the building phase. From an incentive point of view it is not necessary for the initial investment to be completely financed by private parties: it is only necessary that private parties finance a large enough part as to have a sufficiently big stake in the performance of the project. In practice the costs of capital for the part of the investment sum that contains limited risks (earning it back does not depend on the performance by the private party), are lower for the government than for the private party. This is a consequence of the fact that the creditworthiness of the government will normally be rated higher. It is hence often advantageous when the private party retrieves part of the initial investment from the government immediately after construction, instead of earning it back over the course over the project (Moszoro and Gasiorowski, 2008).

3.3.2 *Non-conformity and early termination*

The contract will normally contain provisions in case the private party does not conform to the contract (e.g. quality of service is much lower than agreed, the asset is ready for operation much later due to delays in the construction, availability of infrastructure is much less than contracted). These provisions should follow the principle of 'tickle – hurt – kill'. This means that when a non-conformity is established for the first time, the private party is incentivised to remedy the situation as soon as possible. This will happen through the regular system of penalties and bonuses, and constructive dialogue on a plan for improvement, on which the government monitors progress. The contract should contain a provision in case the situation still does not improve: then the private party should be given a large penalty. This will create additional incentives to resolve the situation as soon as possible. This penalty should be large enough to really 'hurt' the private party (and its shareholders), but at the same time not as large as to put the private party into financial distress as this will raise the cost of capital (because suppliers of finance will require a higher risk premium). When there is still no recovery then the contract should be terminated. The contract should contain a proper settlement for this.¹¹

¹⁰ The different payment mechanisms (user, usage and availability payments) may be combined in order to effectuate an efficient distribution of risks (especially with regard to demand risks). They may moreover ensure the bankability of the project when user charges alone will not generate sufficient revenue to cover operational costs and recoup initial investments: usage or availability payments may constitute a performance based type of revenue support supplementing user payments.

¹¹ The settlement in the contract should stipulate that the private party indemnifies the public party for all damages incurred because of early termination. Furthermore, it should in all conceivable circumstances be more beneficial for the private party to continue the contract rather than to terminate the contract: early termination should never be an attractive option even when the total amount of penalties to be paid is already high and/or the project is not as profitable for the private party as expected.

3.3.3 *Transfer of the asset*

A third component that is important for the creation of incentives in the PPP-contract, are the provisions surrounding the transfer of the asset to the public sector at the end of the contract. When no provisions are made the private partner has an incentive to run the asset down especially in the last years of the contract: maintenance costs can be reduced while service delivery is still not much affected (Webb and Pulle, 2002; Sadka, 2007, Iossa and Martimort, 2008). Hence, the government should specify and monitor that the asset is in good condition before it is transferred. Transfer may also be accompanied with a payment for the residual value of the asset, which – if the payment is tied to the actual state of the asset – will also keep the private party from running down the asset.¹² Such a transfer payment may be fixed (a fixed amount agreed to in the PPP-contract, to be paid when the asset is in adequate state) or may be a price that reflects the actual residual value. The latter may generate extra incentives for high-quality design and construction, as well as adequate maintenance, as the private party will then consider the entire life cycle of the asset instead of only the contract period. However, it may be difficult to formulate an objective and fair procedure for determining an adequate price.

4 **Social Marginal Cost Pricing and its effects on performance drivers within PPP-contracts**

4.1 **Social Marginal Cost Pricing**

The Social Marginal Cost Price is the price at which all costs to society associated with one additional user are taken into account.¹³ At this price each user will take all the relevant costs to society he or she is causing into consideration in his or her buying decisions. For transport this would imply that the SMCP would incorporate the marginal costs (i.e. the costs of one additional user) of infrastructure, of congestion, of noise, of air pollution, of global warming, and of accident.

In the short run SMCP, only marginal costs at current capacity are considered. The long run SMCP also takes capacity changes into account. Under some ideal circumstances (perfect competition, no externalities, no economies of scale, no indivisibilities) the short run and long run Social Marginal Cost Prices will coincide, and would moreover emerge automatically from the interplay of supply and demand. What is more, if these conditions would exist on all markets in the economy, the economy would in theory attain a long run general equilibrium that is Pareto optimal (i.e. no improvements in

¹² Transfer payments are often applied when it is expected that revenues from user payments generated during the contract period are not sufficient for the private party to earn a reasonable return on investment. PPPs that generate revenues from performance payments (usage or availability), will normally not encompass a transfer payment at the end of the contract period.

¹³ See for instance TRT – *Transporti e Territorio SRL, a.o.* (2008): *ENACT – Design Appropriate Contractual Relationships, Deliverable 2, Part 1, Chapter 2*, and Technum Flanders Engineering a.o. (2001): *ATENCO - Analysis of the Cost Structures of the Main TEN Ports, Final Report, Section 3.1*, for elaborate discussions of the theory behind Social Marginal Cost Pricing.

the allocation of resources and goods can be made without at least one person being worse off).

Because of the attributes described above, SMCP is often advocated as a general pricing rule in the transport sector. The European Commission's White Paper "Fair payment for Infrastructure Use" (1998) outlined that transport infrastructure should in principle be charged in accordance with Social Marginal Cost Pricing, as this will contribute to resolving a number of issues in the European transport sector:

- Distortions of competition between Member States;
- Distortions of competition between modes of transport, and within modes;
- The failure to consider social and environmental aspects of transport (so the relative environmental impact of different ways of making the same journey is not reflected in prices).
- Difficulties in funding infrastructure investments, by increasing the level of cost recovery by way of charging users.

Applying the principle of SMCP to determine the charge a user should pay, is however not unequivocal. Different options with regard to application exist along two dimensions:

- Backward looking versus forward looking. The SMCP can be based on the marginal costs of use as established in the past (backward looking); or could also be based on anticipated marginal costs in the future, incentivising users to save on social costs (forward looking).
- Static versus dynamic. The SMCP can be a fixed price over time based on an average of costs (static), or could be constantly adjusted to reflect real time costs (dynamic). Especially with regard to congestion costs this can be important: are charges based on the average costs of congestion over a length of time, or the real costs of congestion at a certain point in time?

Applying SMCP in a backward looking and static way is clearly the most straightforward. It is safe to suppose that this approach would be the principal mode of application in practice, but one which may be supplemented by elements of forward looking and dynamic pricing (e.g. varying charges at different hours of the day to reflect actual congestion). Hence we will assume for the remainder of the discussion that SMCP will mostly be implemented in a backward looking and static manner.

Moreover, it is important to note that in the transport sector the circumstances of perfect competition, no externalities, no economies of scale, and no indivisibilities, almost never hold. This is of course the very reason why interventions in transport pricing are necessary. But this also implies that several difficult issues with regard to Social Marginal Cost Pricing arise: methodological problems of establishing the exact level of social marginal costs, and practical implementation problems, e.g. public acceptability, political feasibility, institutional obstacles, technological issues, etc.

In relation to PPP, the application of SMCP may furthermore give rise to some particular issues. When there are economies of scale and/or indivisibilities, price setting at the (short run) SMCP will not yield enough revenues to cover long run

average costs. Thus when a PPP-contract exists with a private party to exploit a piece of transport infrastructure or transport service, commercially viable exploitation may be difficult to attain, unless external costs are very high. In addition, when SMCP is to be incorporated with PPP-contracts this will affect the performance drivers discussed in the previous section. The implementation of SMCP will have an effect on the allocation of risks and the incentives supplied in the PPP-contract.

In section 5, we will discuss further how these last two issues may be dealt with. Below we will however first examine the effects that incorporating SMCP in a PPP-contract may have on performance drivers.

4.2 Effects on performance drivers within PPP-contracts

With regard to the allocation of risks, incorporation of SMCP within the PPP contract will have the following effects:

- It will imply that the demand risk is entirely borne by the private party. This is only efficient when the private party can actually influence demand, or when the costs for the private party are related to demand. In many cases however demand will be exogenous for the largest part, and the largest part of the costs (the investment) will not be related to demand. This will be true for most PPPs in road, rail and inland waterways, where demand for a particular piece of infrastructure is largely dependent on autonomous traffic flows and developments within the broader network, and a large upfront investment is required. Hence requiring the private party to bear the demand risk will in most cases not lead to additional value-for-money, but will instead lead to higher financing costs due to the need for compensation of increased risks. In those cases where private parties are able to influence demand (especially ports, airports, and public transport services), they can do so by the quality of service, by marketing, or by price setting¹⁴. If SMCP is implemented as a rigid price regulation (based on a historic average of the social marginal costs), this will imply severe limitations with regard to the instrument of price setting. This will then mean that the private party will lose ways to affect demand, and the demand risk will become more exogenous.
- The Social Marginal Costs consist of components which are almost entirely determined by external factors. Environmental costs will depend for a large part on vehicle and fuel technologies. Also the marginal costs of congestion and accidents contain elements over which the private operator will not have much influence (e.g. the value of time lost due to congestion, or medical costs due to accidents). Changes in these cost components will constitute an exogenous risk for the private party, and hence it will demand a higher risk premium.
- Price setting according to SMCP may also have non-linear effects on the revenues for the private party, i.e. with more users revenues do not rise proportionally but disproportionately. From a certain point a larger number of users will cause more congestion. Congestion costs will then go up, leading to a higher SMCP for every user; this price increase will then in turn adjust the number of users slightly downwards, until an equilibrium is achieved. Environmental costs (especially

¹⁴ By e.g. price discrimination (charging different prices for different types of groups), and / or yield management (price setting to influence capacity use (and through this maximise revenues)).

emissions) may also be affected: more congestion will mean a lower average speed, more stop and run activity and longer engine working times. So as the number of users increases, also environmental costs for each user will rise and hence the SMCP; and through the price elasticity the number of users will again diminish somewhat. Because of these non-linear effects the uncertainty surrounding the revenue stream is increased and the private party may thus want a larger risk premium to be compensated for the increased uncertainties.

With regard to incentive effects, incorporation of SMCP within the PPP contract will also have consequences. As part of the SMCP a private operator will receive a 'compensation' for the external costs: environmental costs, cost of congestion, and costs of accidents. This may give rise to perverse incentives:

- When the external costs of one type of user (e.g. older airplanes which have high emissions and are noisy) are higher than of other types of users (e.g. newer airplanes), the former kind of user would be more profitable for the private operator than the latter. This may influence its behaviour towards the two types of users (e.g. by favouring older airplanes to newer airplanes in case of tight capacity). From a social point of view, this is undesirable.
- In the long run the private party operating a PPP will have an incentive to keep the external marginal costs as high as possible. Hence, when the level of the SMCP is regularly reviewed and adjusted, the private party has an incentive to attempt to drive up environmental costs per user, create extra congestion, and neglect to prevent accidents as to ensure that the SMCP is adjusted upwards.
- If the costs of congestion are high and demand is relatively inelastic, SMCP will be high when there is much congestion, and the private operator may have inadequate incentives to invest in capacity expansion even when this would be socially desirable. An investment in order to accommodate more users, may thus not be interesting for a private party because it prefers fewer numbers of users paying a higher SMC-price (because of high congestion).

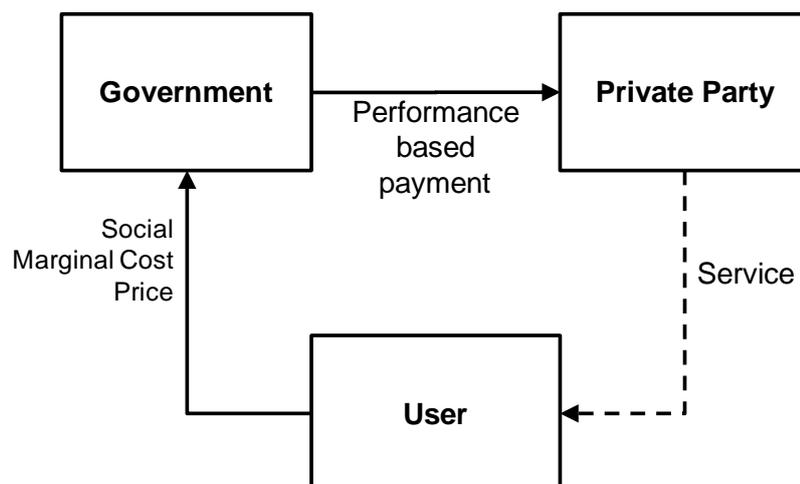
5 Possible solutions

In this section we will discuss possible solutions for the issues described in the previous section when combining PPP and SMCP: perverse effects on performance drivers, and insufficient cost recovery. The proposed solutions differ for different segments of the transport sector.

5.1 Road, railway and inland waterway transport infrastructure

As discussed in section 2, there are also PPP-contract types in which the private operator does not depend on charging users for its revenues, but instead on a performance based payment by the government. SMCP can then be implemented by having users pay the SMCP to the government, while the government pays a private party for the provision of infrastructure through performance based payments. The reward for provision is then separated from the income from charges. This is represented schematically in Figure 1.

Figure 1 – Separation of reward for provision and income from charges



Through such a scheme the issues of insufficient cost recovery and of perverse effects on performance drivers within the PPP-contract, can be entirely avoided. This solution will work well for PPPs in road, railway and inland waterway transport infrastructure. PPPs with performance based payments are already frequently applied for road and railway infrastructure, and could also easily be applied for investments in inland waterway transport (as this also concerns linear infrastructure instead of nodal infrastructure, as ports and airports). Hence for PPPs in road, railway and inland waterway transport, suitable performance indicators can be constructed as a basis of remuneration which will incentivise the private operator to deliver good quality of service and be cost efficient.

Moreover, the requirement to charge SMCP would mean that the demand risk is borne by the private operator. But for road, railway, and inland waterway transport, demand is normally mostly an exogenous risk, and neither are costs for infrastructure in these modes of transport closely related to demand. Hence it makes little sense from a value-for-money perspective to have the private party charge users directly. This will only lead to higher financing costs because of increased risks to be borne by the private operator. It will in these cases be better to separate reward for provision from the income from charges, and institute a payment mechanism based on availability. If the private operator does have some influence on demand, or costs are to some extent determined by demand (e.g. maintenance costs), a payment system in which usage is also taken into account to a certain degree can provide extra incentives to attract users, provide good quality of service and keep costs low.

Network effects are also of great importance in road and railway transport. Especially in the case of road infrastructure and to a lesser degree within railway infrastructure, pricing may be used to influence the size and the pattern of traffic flows within the network: through pricing, users may be persuaded to choose certain hours and avoid other hours, and to use certain roads or railway lines rather than others. This way congestion may be diminished, or even avoided. Moreover, the excess revenues of certain parts of the network (which are very busy), may be used to offset losses in other parts (which are less busy). When PPPs are applied in which the private party

charges the user directly for only a small part of the network, the abilities to influence traffic flows within the network will be very small. Coordination between different private parties and the government is likely to be bothersome: private operators have a natural incentive to attract as many users to their part of the network, and hence may not cooperate in trying to distribute traffic flows more evenly. This provides an additional reason to prefer PPP with performance based payments for projects in road and railway infrastructure.

5.2 Ports and airports

For ports and airports, PPP-contracts with performance based payments will not lead to an optimal situation, and hence the solution of separating reward for provision and income from charges will not work. This is because demand is often less exogenous: ports and airports to some extent compete with other ports and airports, and hence pricing, quality of service and marketing do make a difference to the number of users they attract. The instrument of pricing is important to attract users and increase revenues, as various forms of yield management and price discrimination are frequently applied to influence capacity use. Some measure of freedom in price setting behaviour should hence be extended to the private operator. Because of this, it is preferable that the operator charges the users directly. A government will probably not be as good at applying yield management and /or price discrimination, because it does not have the same incentives as private parties to maximise revenues, and it will not be able to process information on capacity use and types of users and translate this in price adjustments with the same speed and cleverness. Furthermore, network effects are of less importance, as port and airport represent a node rather than a line in a network.

However, the very reason why it would be better to let a private operator charge users directly, may also present an obstacle to incorporating SMCP into PPPs for port and airport operation. If SMCP were to be applied as a rigid price regulation based on historic averages, this would limit the private operator severely in the use of price setting to influence demand. This will then take away the possibilities for yield management and price discrimination from the operator, through which it attempts to optimise use of available capacity.

Furthermore, cost recovery will be an issue that will have to be dealt with when implementing SMCP in PPPs for port operation, as indivisibilities are important and it is practically impossible to allocate marginal effects per vessel (let alone tonne). (see Meersman et al. in this volume). For airports, the prospects for cost recovery are more favourable (see TIS.PT et al., 2009), but it is still likely that some (especially smaller) airports will not achieve cost recovery. Subsidies to supplement the revenues of the private party can be a solution. However, at larger ports and airports a large proportion of the main beneficiaries may be from outside the country in which the port or airport is located, and hence from outside the 'tax paying community'. But why should a 'tax paying community' subsidise a piece of infrastructure that benefits mainly users from outside that community? In addition, it will be difficult to determine

the exact amount of subsidies needed.¹⁵ Furthermore, as described above, SMCP will have several undesirable effects on performance drivers in PPP-contracts.

For these reasons, the recommended solution for ports and airport will be to harmonise competition between ports and airports, and regulate pricing. Price regulation should however not be based on SMCP but on some second best alternative to SMCP, that does allow operators to apply yield management and price discrimination, while at the same time the goals behind SMCP – fair competition between and within modes of transport, and internalisation of external costs – are taken into account as much as possible. For airports much of the basic regulation for this, is actually already in place. Though the recent Directive on Airport Charges (2009/12/EC) would have to be adjusted to take better account of the internalisation of external costs, and would have to be applied to all airports, instead of only airports whose annual traffic is over five million passenger movements (or the airport with the highest passenger movement in a Member State). For ports regulation would however be required which moves far beyond initiatives to make port dues and state aid merely transparent (Communication on a European Ports Policy (COM(2007)616)). Here entirely new regulation would need to be developed and implemented.

5.3 Public transport services

Also in the operation of public transport services, demand is less exogenous. Public transport services compete with alternatives in other modes of transport (cars, bikes, walking), and operators are usually able to attract additional users with pricing, quality of service and marketing. In public transport services yield management and/or forms of price discrimination are also important. Hence, as with the operation of ports and airports, PPPs with performance based payments will normally not lead to an optimal situation. So when combining SMCP and PPP, separating reward for provision and income from charges will not be a good way to resolve the issues described in section 4.

The implementation of SMCP can mean higher costs for public transport operators, as they will be faced with higher infrastructure costs especially for road, but also rail (when they do not own the infrastructure of the railway, metro or tram system themselves). At the same time, charging according to SMCP principles will probably imply revenues that will not cover long run average costs. However, in the current situation in Europe it is already the case that many public transport operators do not achieve cost recovery, and are hence subsidised on a regular basis. Contrary to ports and airports, these subsidies do not normally face the objection of benefiting mainly users from outside the country (i.e. the 'tax paying community'). Moreover, for the operation of public transport services the amount of subsidies needed may be easier

¹⁵ A well designed tender procedure can elicit much information on the amount of subsidies needed. Bidding private operators will however likely not only be assessed on subsidies needed, but also other aspects (infrastructure costs, quality of design, etc.). So bidders will attempt to optimise their bids, which can imply providing false information on the amount of subsidies needed. This issue may only be imperfectly remedied, as for complex, one-off infrastructure projects (which port and airport facilities may be) no good independent information (from similar projects elsewhere) may be available to counteract these tendencies during the tender procedure.

and more reliably estimated than for the operation of ports and airports. Some benchmarking information will usually be available from similar public transport services operations elsewhere, while such information is often not on hand for the more specific, one-off investments in ports and airports.

Hence for public transport services, PPPs (normally concessions) can be combined with SMCP by regulating a private operator to charge according to SMCP principles. These regulations will however have to leave enough room to the operator to apply some important forms of yield management and/or price discrimination. Moreover, as described in section 4, several extra risks and perverse incentives will then exist. These additional risks and perverse incentives are a result of incorporating a 'compensation' for external costs in the price the private party will charge to users. The operator will then be vulnerable to unexpected changes in the external cost components that make up the SMCP, and non-linear, unpredictable effects on its revenues when the number of users goes up or down. Furthermore, the operator may in that case be disposed to favouring users with high external costs above those with low external costs, keeping external costs artificially high, and refusing to make necessary investments in capacity expansion. A way to counteract these additional risks and perverse incentives, is by requiring the private operator to pass the share of the SMCP related to external costs on to the government. The government can then combine this money with the money available for subsidies, and provide appropriate incentives (e.g. rewards and additional payments for environmental friendliness, prevention of overcrowded trains and buses, traffic safety, etc.).

6 Conclusions

Incorporating SMCP in PPPs, may give rise to a number of issues: insufficient revenues to cover long run average costs, but also perverse effects on the performance drivers of PPPs. In this latter category, implementing SMCP may mean additional risks, because of changes in the external cost components that make up the SMCP, and non-linear, unpredictable effects on revenues when the number of users increases or decreases. In addition, perverse incentives may work on the private operator as it may be tempted to favour users with high external costs, keeping external costs artificially high, or avoiding to invest in capacity expansion.

For PPPs in road, railway and inland waterways, a PPP-model in which the income from charges and reward for provision are separated (i.e. the operated receives performance based payments from the government), is in most cases the best option to avoid these issues, when SMCP is to be introduced. However, also in that case each PPP-contract should be designed to take the specific circumstances into account: e.g. some part of performance can be tied to actual usage to reflect the influence the private party may still have over traffic, or the cost components (maintenance) that are tied directly to demand.

For PPPs related to the operation of port and airports however performance based contracts seem a less attractive option, and a better option is to harmonise competition and regulation policies for ports and airports for the European Union to

attain the most important goals behind Social Marginal Cost Pricing: a level playing field within and between the modes of transport, and internalisation of external costs.

For public transport services, integrating SMCP into the PPP contract seems the best alternative, supplementing revenues with subsidies in case cost recovery is not achieved. This is not much different from current practice, in which additional subsidies are already supplied through Public Service Obligations. Again, adequate incentives need to be supplied in the contract to offset possible perverse incentives.

7 References

- Abdel Aziz, A.M. (2007): A Survey of the Payment Mechanisms for Transportation DBFO Projects in British Columbia, *Construction Management and Economics*, Vol. 25, pp. 529-543.
- Allen Consulting Group (2007), *Performance of PPPs and Traditional Procurement in Australia*. Melbourne.
- Arthur Andersen and Enterprise LSE (2000): *Value for Money Drivers in the Private Finance Initiative*. London.
- Bennett, J. and E. Iossa (2005): *Building and Managing Facilities for Public Services*, University of Bristol Working Paper No. 05/137.
- Bentz, A., P.A. Grout and M.L. Halonen (2004): *What should Governments Buy from the Private Sector – Assets or Services?*, University of Bristol Working Paper.
- Dewatripont, M. and P. Legros (2005): PPPs: Contract Design and Risk Transfer, *European Investment Bank Papers*, vol. 10, no. 1, pp. 120–41.
- Edwards, P. and Shaoul, J. (2003): Partnerships: For Better, For Worse?, *Accounting, Auditing and Accountability Journal*, Vol 6, No. 3, pp. 397-421.
- European Commission (1998): *Fair payment for Infrastructure Use: A phased approach to a common transport infrastructure charging framework in the EU*, White Paper, COM(1998) 466 final, Brussels.
- Grout, P.A. (1997): The Economics of the Private Finance Initiative, *Oxford Review of Economic Policy*, Vol. 13, No. 4, pp. 53-66.
- Hart, O., Schleifer, A., and Vishny, R. (1997): The Proper Scope of Government: Theory and Applications to Prisons, *Quarterly Journal of Economics*, Vol. 112, No. 4, pp. 1127-1161.
- Hart, O. (2003): Incomplete contracts and public ownership: Remarks and an application to public-private partnerships, *The Economic Journal*, Vol. 113, pp. 69-76.
- HM Treasury (March 2007): *Standardisation of PFI Contracts*, Version 4, HM Treasury, London, www.hm-treasury.gov.uk.
- Hodge, G.A. (2004): The Risky Business of Public-Private Partnerships, *Australian Journal of Public Administration*, Vol. 63, No.3, pp. 37-49.
- Iossa, E., G. Spagnolo and M. Vellez (2007-1): *Contract Design in Public-Private Partnership*. World Bank, Washington.
- Iossa, E., G. Spagnolo and M. Vellez (2007-2): *Best Practices on Contract Design in Public-Private Partnership*. World Bank, Washington.
- Iossa, E., and D. Martimort (2008): *The Simple Micro-Economics of Public-Private Partnerships*, Mimeo, Institut d'Économie Industrielle, University of Toulouse.

- Loosemore, A. (2007): Risk Allocation in the Private Provision of Public Infrastructure. *International Journal of Project Management*, Vol. 25, pp. 66-76.
- Martimort, D. and J. Pouyet (2006): "Build It or Not": Normative and Positive Theories of Public-Private Partnerships, *International Journal of Industrial Organization* Vol. 26, No 2, pp. 393-411.
- Moszoro, M. and P. Gasiorowski (2008): *Optimal Capital Structure of Public-Private Partnerships*, IMF Working Paper WP/08/01.
- Mott MacDonald (July 2002): *Review of Large Public Procurement in the UK*. London.
- National Audit Office (August 1999), *Examining the Value for Money of Deals under the Private Finance Initiative*. Stationery Office, London.
- National Audit Office (2003): *PFI Construction Performance*. Stationery Office, London.
- Rijkswaterstaat (March 2006): *DBFM Basis Overeenkomst*, version 1.1, Rijkswaterstaat, The Hague, www.ppsbijhetrijk.nl.
- Sadka, E. (2007): *Public-Private Partnerships – A Public Economics Perspective*, CESifo Economic Studies, Vol. 53, No. 3, pp. 466-490.
- Technum Flanders Engineering et al. (2001): *ATENCO - Analysis of the Cost Structures of the Main TEN Ports*, Final Report, www.espo.be.
- TIS.PT - Transportes Consultores em Transportes, Inovação e Sistemas S.A. et al. (2009): *ENACT – Design Appropriate Contractual Relationships*, Deliverable 5.1, <http://www.tis.pt/proj/enact/>
- TRT – Transporti e Territorio SRL et al. (2008): *ENACT – Design Appropriate Contractual Relationships*, Deliverable 2, Part 1, <http://www.tis.pt/proj/enact/>
- Webb, R. and B. Pulle (2002): *Public-Private Partnerships: An Introduction*. Department of the Parliamentary Library, Australia, Research Paper No.1 2002-3.
- Williamson, O. E. (1975): *Markets and Hierarchies: Analysis and Antitrust Implications*. Free Press, New York.
- Williamson, O. E. (1985): *The Economic Institutions of Capitalism*, Free Press, New York, NY.