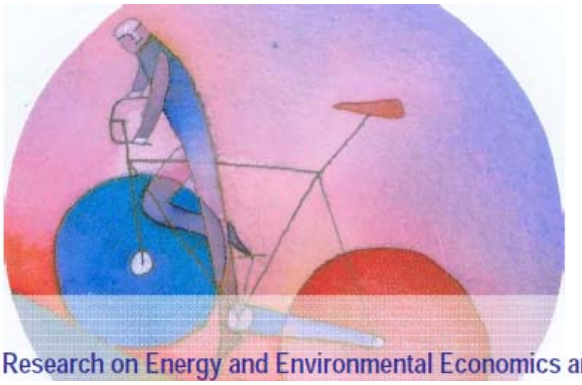

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Contract and Procurement Design for PPPs in Highways: the Road Ahead[1]

Elisabetta Iossa[2]

6th January 2014

Abstract

We review international practice in concession-based public private partnerships (PPPs) for highways, in the light of the economic theory of incentives, procurement and regulation.
In particular, we analyse alternative funding mechanisms to cover highway costs, and their impact on demand risk allocation, incentives, cost of capital, and likelihood of renegotiation. We note how real tolls must pursue a number of contrasting objectives, which may be best served by introducing tariff discrimination. We discuss alternative tariff regulations used in practice and warn against tariff mechanisms that transfer demand risk to users and depart from the principles of price cap regulation. We highlight that it is desirable to transfer some traffic risk to the concessionaire but the level of risk transfer should be lower at the beginning of the contract, especially for greenfield projects where little demand information is initially available. We discuss the procurement of highway PPPs, focusing on the choice of the bidding variables, and on the distortions that renegotiations introduce at bidding stage. We stress the importance of strong institutions and absence of political interference in regulatory matters, and we highlight the benefit of respecting and standardizing contract terms.

Keywords: contracting out, highways, incentives, procurement, regulation, transport.
JEL Classification: D21, L2, L33, L5, L9.

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Summary

1. INTRODUCTION/EXECUTIVE SUMMARY

There is an increasing interest in the use of private finance for transport infrastructure through concession-based Public Private Partnerships (hereafter simply referred to as "PPPs"). Transport PPPs are long term contractual agreements between the private and the public sector, where the private sector takes responsibility for the design, construction, maintenance, and operation of the transport infrastructure.

The economics literature on PPPs has emphasized how bundling building and management of transport infrastructure into one single contract with one private entity can bring important efficiency gains. If coupled with appropriate risk transfer, bundling can provide the contractor with strong incentives to take into account how infrastructure quality will impact on users demand and on operating costs, thus incentivizing a "whole-life approach" that can result in more cost effective and higher quality infrastructures.[3]

But concerns arise on all fronts.

Public sectors are concerned that PPPs will be too costly to implement. Private capital may require excessive returns and concessionaires may try to renege on their contractual obligations when liabilities materialize.

Private sectors fear expropriation of their investment, due to legal uncertainty, political risk and regulatory risk. They worry that governments may modify sector regulations and renege on contract terms, when high profits materialize and investments are sunk.

Citizens and users are concerned that private concessionaires will not pursue the public interest, and that the public sector will be complacent in its management and monitoring role, leading to high tariffs and low service.

Notwithstanding these concerns, there is somehow a perception that the "game must go on". The trend towards downsizing of governments is ongoing, and the financial crisis has limited the ability of governments to invest in infrastructures. The scientific debate has shown the potential efficiency gains from transferring highways responsibility to the private sector, and it now focuses more on the appropriate design of PPP contracts and procurement mechanisms rather than questioning the potential benefit of PPPs.

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[3] This point was initially made by Hart (2003) and Bennett and Iossa (2006) in an incomplete contracting framework. A number of contributions have then extended this insight to other contexts. Results have been shown to be robust; see Iossa and Martimort (2014) for a review of the literature.

Bank recapitalisation in the wake of the financial crisis is however meaning that investment banks have less capital available for providing finance to PPP project than before the crisis. This has reduced the share of PPPs in project finance in recent years. Furthermore, the constraints on public spending to control deficits limit the ability of governments to commit to PPP agreements unless these are financed by revenues from user tariffs rather than government contributions. There is also evidence to suggest that the PPP market for highway projects may not yet be mature in many countries. A developed PPP market requires certainty of rules and easiness of entry and exit, based on competiveness and performance. Instead, in practice we often observe that rules are changed during the life of the contract, that failing concessionaires are bailed out and that new entry is difficult due to the long duration of the concessions.

These factors call for a reassessment of PPPs to see if PPP procurement and contracts can be designed in ways that can enhance competition and deliver the promised improvements in the provision of public services.

In the present paper, we review some of the international experience with PPPs for highways, to discuss the main procurement and regulatory issues that emerge under these contractual arrangements.

We focus on the impact of alternative procurement and contractual/regulatory designs in the light of the economic theory of incentives, procurement and regulation. We build on these considerations to make some suggestions as to how to improve the design of these PPP arrangements.

The paper starts by describing alternative tolling systems used in different countries, noting how real tolls have to achieve a number of sometimes contrasting objectives, from allocative efficiency to equity, universal access, competitiveness and financing. We discuss real tolls contingent on e.g. time of day, day of the week, frequency, congestion and vehicle type and emissions, and note that tariff discrimination may be an effective way to combine these contrasting objectives.

We then analyze alternative funding mechanisms to cover highway project costs, including availability payments, real tolls and shadow tolls, and discuss their impact on demand risk allocation, incentives, cost of capital and likelihood of renegotiation. We stress that strong political and regulatory institutions are necessary conditions for developing a functioning PPP market, whatever the funding mechanism in place. We further note that it may not be optimal to fully transfer demand risk to the concessionaire or keep demand risk allocation constant over the life of the contract, as risk tends to be higher at the beginning of the contract, especially for greenfield projects where little information on potential demand is initially available. We emphasize how Least Present Value Revenue Auction can be an effective way to shield the contractor from some traffic risk without causing undue burden on users or taxpayers. A combination of real tolls and availability payment with time-increasing risk allocation could also optimally trade off incentives and cost of capital.

Finally, we discuss some of the key choices in the competitive procurement of PPP contracts for highways, in the light of international practice, and their implications on competition and efficiency. We focus on the choice of the bidding variables, and the preferred bidder negotiation, highlighting the distortionary effect that anticipated ex post renegotiations generate at procurement stage. We stress the importance of using standardized contract terms, and appropriate traffic risk allocation in order to reduce its incidence.

2. REAL TOLLS

AIM: The aim of this section is to discuss the use of real tolls to charge motorway users, the objectives that they pursue and the variety of practices observed. We describe alternative criteria of tariff regulation that are used in practice and discuss their economic rationale and efficiency.

2.1. The Variety Of User Tolls

Real tolls are fees charged to motorway users, and are widely used in PPP contracts for highways across the world. They may be set uniformly across the country or vary with the concession contract. A case of **uniform tariffs** set centrally is India. The Indian government implemented a huge plan to improve the highway network. It established the National Highways Authority of India (NHAI) in 1988 for the development, maintenance and management of national highways, and issued the National Highways Development Programme to introduce new projects. The NHAI decided to uniform the rate of users fee in the whole country, establishing a common framework for tariff regulation in 2008.[4]

Decentralized tariffs setting is instead used in **Chile**. Initially, tariffs were set by the concessionaire as part of its bid. This created several problems because firms charged excessively low tolls that were not sufficient to cover costs, making pressure on governments to renegotiate the concession agreement frequently. This induced the Ministry of Transport to change the law for procuring highways, making the tariff an exogenous variable to the concession awarding. The government now issues informational documents to the potential concessionaires specifying the toll rate. The rate is revised annually, according to rules specified in the contract.[5]

In general, real tolls (per km) may be contingent on:

a) Category of vehicle (size, weight, Euro emission class, number of axles. etc.)
b) Expected traffic (peak and off peak tariffs or congestion tariffs) or realized traffic
c) Type of user (e.g. local user) and vehicle occupancy.
d) Frequency of use

We discuss these cases in more detail below.

(a) In most motorways - heavier or longer vehicle pay a higher tariff – typically to reflect their greater impact on congestion, damage from accident risk, and asphalt deterioration.[6] Figure 1

[4] Haldea (2013).

[5] Hill (2011).

[6] Type of terrain (e.g. rural vs mountain) also matter because of their impact on the cost of building the infrastructure.

shows the geographical coverage of road user charging systems for heavy goods vehicles in the European Union and Switzerland. Only a handful of countries have no widespread user road charging system in place, namely Finland, Estonia, Malta and Cyprus (Rumscheidt, 2014). Road user charging for heavy good vehicle is regulated by the European Directive 1999/62 to ensure that Member States do not inflict high charges on heavy good vehicles in order to raise the costs of transport for companies from other Member States. Under the EU Directive 2011/76/EU on *EuroVignette*, there are differentiated tariffs for heavy good vehicles based on the vehicle emission class, so as to account for their different external cost of **pollution**.[7] Road user charges for light private vehicle are instead unregulated.

(b) Peak tariffs may be set during rush hours or week days and they are higher than off peak tariffs. The idea behind peak tariffs is twofold. First, charging higher tariffs during times when traffic is heavier can help reduce congestion and thus **manage traffic more efficiently**. When there is congestion, an additional user exerts a negative externality on other users (reducing their travel time and increasing accident risk) – charging higher tariffs at peak times induces users to internalize this externality, reducing their motorway usage. When there is no congestion and the negative externality is lower, a discounted off-peak tariff may be set.

Second, charging higher tariffs during peak times can help **tariff discriminating** across consumers according to their income level, favouring horizontal equity. Business users with high income and rigid time schedules may have a more rigid demand than low income users, occasional travellers or leisure travellers, who may be willing to modify their travel time so as to pay less. Raising tariffs at peak times and offering off peak discounts, thus helps to discriminate across high income-rigid demand users and low-income elastic demand users.

This tariff discrimination may be both **revenue enhancing and total welfare enhancing**. The off peak discount may bring an increase in the total demand that more than compensates the demand contraction at peak times. Lower-income users who would otherwise take an alternative free road or a cheaper means of transport may be priced into the market by the off-peak discounts.[8]

Peak and discounted off-peak tolls were introduced in September 2004 in Loudoun County, Northern Virginia (US) to better manage peak period congestion.[9] In the motorway Costanera

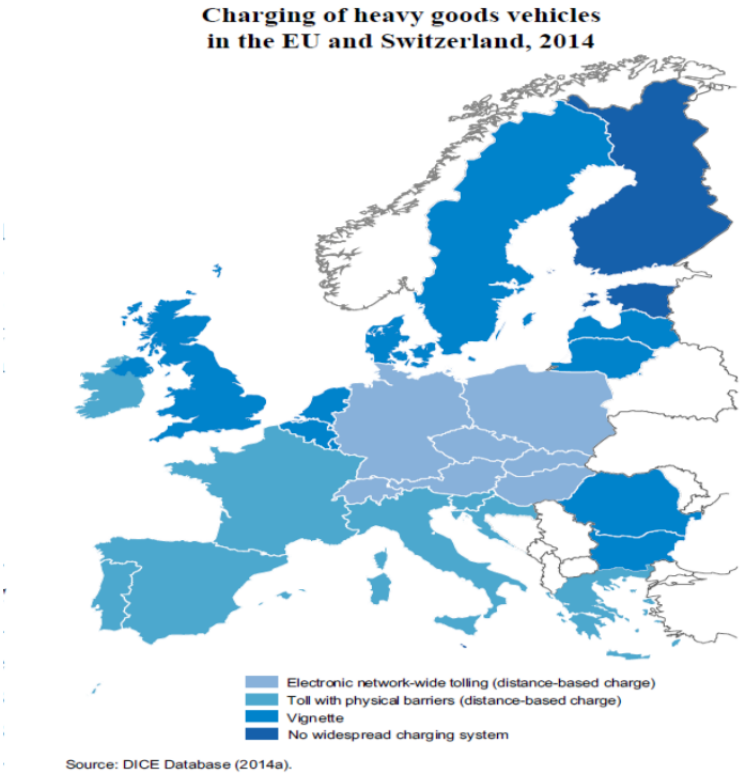
[7] https://secure.tiscover.com/media/14831/Informazioni%20pedaggi%20classi%20di%20emissioni.pdf

[8] The evidence of this potentially welfare improving effect of price discrimination is largely provided by the success story of low cost airlines.

[9] http://www.fhwa.dot.gov/ipd/project_profiles/va_dulles_greenway.aspx

Norte of **Chile**, there are 3 different variable tariffs depending on the expected traffic and the real traffic. The following formula is applied[10]:

1. Fixed Tariff (FT)
2. Peak tariff (average: FT * 1,71)
3. Congestion Tariff (average: FT * 2,80)



In Britain the M6 PPP project surrounding Birmingham uses a variable toll charged to users. The amount of the fee differs for working days and week-ends and there are also day-time prices and night-time prices.[11]

In most of the U.S. real tolls are used to improve the speed of traffic flow in some critical areas. [12] An interesting system was implemented in the State of Texas where tariffs change with realized traffic. The project, called LBJ Express, is aimed to alleviate the congestion risk in the city of Dallas. The concession period started in 2009 and the project received several awards like "Public-Private Partnership Transaction of the Year" given by Infrastructure Investor magazine in 2011. The toll payment is based on the concept of **managed lanes or express toll lanes.** The design of the project allows drivers to choose if to pay a toll to exploit the highest speed of the managed lanes system or to use the parallel free highways. The average fee varies with the traffic conditions during the day to maintain the target traffic speed.[13,14]

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[10] www.costaneranorte.cl

[11] Brown et al. (2009).

[12] http://www.fhwa.dot.gov/ipd/p3/

[13] http://www.cintra.es/en/Concessions/LBJ-Express-eng.

[14] In the US I-595 Corridor Roadway, user tolls are charged for the three reversible Express Lanes in the median of I-595. With the Express Lanes, motorists have the choice of paying for a reliable travel time. By offering additional travel choices for each trip, the Express Lanes provides the means to relieve congestion on the I-595 mainline while

(c) In India steep discounts are applied for **local users** in all of the country. In some contracts, like the Delhi-Agra Concession Agreement, local users are exempted to pay in their area of residence. There are several applicable discounts for frequent users, for instance for multiple journeys in one day.[15] In the US LBJ express, applicable tariffs depend on number of passengers in the vehicle. A minimum of two passengers (including the driver) are considered high **occupancy** vehicles (HOV) and pay half-price during peak travel periods. Passengers can activate the HOV status through an online application.[16]

(d) A particular type of user tariff that is time based and therefore makes the cost of a single journey change with frequency of usage is the **vignette system**, where tickets are bundled together across time. The price of a ticket increases less then proportionally with the time validity (multi-days, monthly, annual), making frequent users pay proportionally less. A vignette system is used in seven EU countries for light private vehicles: Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovakia, Republic and Slovenia. Vignettes are also compulsory in Switzerland. Germany is planning to introduce a vignette for light vehicles in 2016.[17]

The variety of approaches followed in practice reflects the fact tha, generally, the decisions regarding the level of user charges for motorway services must achieve more, often **contrasting objectives**: political and thus equity objectives, allocative efficiency, congestion management, budgetary considerations and environmental considerations.

What determines the level of charges? Real tolls have the effect of charging users of the motorway services rather than general taxpayers. This favours **horizontal equity** as well as allocative efficiency, that is an efficient use of motorway services. Optimal pricing theory suggests that real tolls should be used to induce an efficient consumption of the infrastructure, which obtains when the toll level is set equal to the total cost that an additional user imposes on the system. This "marginal cost" includes the direct cost, such as the impact of the vehicle on the road infrastructure, and the external cost, that is the impact of the vehicle on the benefit that other users may obtain. The increase in congestion and accident probability and potential damage are some of the indirect marginal costs that a user should take into account when deciding whether to consume the motorway service.

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providing a free-flow alternative that will reduce delays and lower total driving hours. The public authority will set the toll rates and retain the toll revenue. See http://www.fhwa.dot.gov/ipd/project_profiles/fl_i595.aspx. The concession contract is available at: http://www.i-595.com/About-Documents.php

[15] "Concession Agreement Delhi-Agra" issued by the National Highways Authority of India in July 2010 with DA Toll Road Private Limited. Available on: http://www.nhai.org.in/

[16] http://www.lbjexpress.com/FAQs.asp

[17] Rumscheidt (2014).

Real tolls must achieve a number of sometimes contrasting objectives:

- Allocative efficiency;
- Horizontal equity;
- Competitiveness and EU integration;
- Financing of infrastructure construction and operations.

As a result, from an **allocative efficiency** perspective, the toll price should be higher:

- The greater the marginal private cost of that additional vehicle, that is the increase in the cost of operating and maintaining the infrastructure. This implies for example that heavier vehicles should be charged more because their impact on infrastructure maintenance cost is higher.
- The greater the external cost associated to the vehicle, that is the increase in external social costs in terms of pollution, noise and congestion. This implies for example that vehicles should be charged more during peak times, as congestion is higher.
- The greater the marginal private benefit for that one additional vehicle. This suggests that vehicles with more passengers should be charged more. However, taking into account the impact on accident rates and congestion of one additional vehicle explains why high occupancy may be instead rewarded through lower tariffs.

Allocative efficiency however is not the only criterion for setting charges. Motorway charges have always been a sensitive political decision, causing havoc and citizens oppositions in a number of countries (just recently, a number of episodes have been registered in Spain, Portugal and Greece).[18] Important **equity** issues are involved, as transport services are essential service to which universal access should be ensured and thus the availability of alternative means of transport is crucial.

Transport costs have also significant impact on **competitiveness**, which makes heavy vehicle charges an instrument for industrial policy and European integration, which explains why heavy good vehicles tariffs are regulated at the EU level.

Furthermore, and this is a critical aspect in these recent years, charge levels may be dictated by **budgetary constraints** and thus the need to cover the construction of the infrastructure with private capital, given the constraints or difficulties to use public budgets. Regardless of whether toll revenues are then enjoyed by the concessionaire or the public sector, the objective of allocative efficiency has to be balanced against the need to cover the fixed and operating costs of the infrastructure. A study for the European Commission found that most European Member States do not recover full infrastructure costs from road charging due to a lack of methods to relate charges to costs or where charges are set by political decisions. Germany and Austria to

[18] In Spain, for example, the expansion of free highways in the last two decades has created a widespread perception of inequity, as tolls are charged in some territories but not in others.

some extent, are the only two countries that are currently reflecting charges to recover investment and operating costs across the national network. For example, the revenues from vignettes only covers a small part of infrastructure costs; the rest is covered by other road and fuel taxes, subsidies or government contributions.[19]

Introducing a well-designed **tariff discrimination system**, with tariff discounts off peak and for frequent travellers appears to be an effective way to combine these contrasting objectives, increasing equity and reducing the allocative distortion that budgetary constraints create. If tariff differentiations is appropriately designed, the increase in demand for high elasticity users faced with lower tariff levels can increase in the overall level of traffic revenues. This effect may be stronger in the long run, as users' choice of transport mode changes to adapt to the new tariff schemes.

2.2. Tariff Regulation: Practice

Tariff regulation sets levels and adjustments rules for the unitary base tariff when traffic revenues are enjoyed by the concessionaire. The unitary base tariff typically indicates a weighted average of the different tariffs charged to users, with weights given by previous year traffic volumes.

The main contractual approaches used for highways PPPs are inspired to the regulatory systems used for privatized public utilities. They range from pure Price Cap Regulation to Banded Rate of Return Regulation. [20]

Under pure Price Cap Regulation, tariffs are set and adjusted, at least in principle, independently of realized revenues and costs. A typical price cap plan will allow the regulated firm to increase its prices, on average, at the rate of inflation, less an offset factor, called the X factor, to reflect industry-wide productivity improvements. The pure price cap formula is therefore:

$$\Delta T = \Delta P - X$$

where ΔT is the allowed annual tariff change, ΔP is the inflation rate, and X is the X factor.

Under Banded Rate of Return Regulation, the concessionaire is permitted to keep all of the earnings it generates, provided they constitute a return on capital that is sufficiently close to a specified target rate of return. If realized earnings exceed the maximum authorized level of earnings, the difference between actual and authorized earnings is returned to users via lower tariffs. If realized earnings fall short of the minimum level of acceptable earnings, user tariffs are raised sufficiently to ensure that projected earnings fall within the band of authorized earnings.

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[19] Ricardo-AEA (2014).

[20] See Sappington (2002) for a review of these tariff regulations.

The two approaches differ markedly in their view of regulation. The logic behind Price Cap regulation is to replicate the discipline that competition would impose if it were present in the market. Under competitive pressure, firms pass on to customers in the form of higher prices unavoidable cost increases due to higher input prices, but deliver to customers realized increases in productivity in the form of lower prices. Therefore, in a competitive economy, prices rise at a rate equal to the difference between the rate at which input prices rise and the rate at which productivity increases, which is exactly the rule for setting price caps.

The logic behind Banded Rate of Return Regulation is instead to regulate directly firm's earnings, avoiding that lack of competition in the market may result either in excessive profit at the expense of consumers or in lack of profit that can compromise the financial stability of the firm. Tariffs are then adjusted so as to ensure that returns fall within the admissible range.

Among these two extreme cases lies a multitude of intermediate cases, where tariffs are regulated so as to take into account investment levels, quality factors, earning and risk sharing objectives due to traffic fluctuations or exogenous factors beyond the control of the concessionaire (e.g., force major events). In the concession contract with toll revenues implemented worldwide, **the tariff adjustments formulas** that we have observed set tariff adjustments rules dependent upon one or more of the following factors:

- Forecasted or realized Inflation (measured e.g. by the consumer price index)
- Realized traffic (or traffic revenues) compared to expected traffic
- Service or infrastructure quality indicators
- Realized operating costs.
- Realized earnings
- Productivity improvements
- Planned or realized infrastructure investment
- Macroeconomic conditions (measured e.g. by Real GDP)

We discuss each of these factors in turn.

An inflation rate adjustment rule is widely used for updating tariffs. It provides for a weighted average of user tariffs to increase annually up to a cap proportional to inflation. All concession contracts that we have observed use it, although with different weights. This inflation adjustment shields (all or in part, depending on the weight) the concessionaire from the risk of an increase in input prices due to inflation, which is efficient as this a risk that the firm cannot control, but may exacerbate inflation, as transport costs impacts on production cost, and thus ultimately on the

price of final goods. A number of contracts trade off among these two effects by considering only partial inflation adjustments with weights less than 1 (e.g. in India[21] or in France[22])

Tariffs adjustments reflecting traffic fluctuations have been used for example in **Spain.** In this country, most highway investments are made by the public sector and funded through taxation. Only a share of about 20% of the whole network is composed by toll highways. The competition from state owned roads makes demand risk quite high. The tariff adjustment formula takes this element into consideration by containing the level of demand risk that the concessionaire bears, including a variable ΔD for traffic fluctuations:

$$\Delta T = \Delta P - \Delta D,$$

where $\Delta D = (1/100)\ (D_{actual} - D_{predicted})/D_{predicted}$. Thus, ΔD is equal to a fraction of the percentage difference between the effective average daily traffic (D_{actual}) and the estimated one ($D_{predicted}$). A cap on ΔD is also set depending on the concession.

This formulation links tariffs adjustments to the actual evolution of traffic. It implies that unexpected traffic revenues will be shared between concessionaires and users, via tariffs reduction, and that the concessionaire will be compensated for unexpected fall in traffic through tariffs increase.

In the US project Dulles Greenway in the State of Virginia, which opened in 2005, the 2012 tariff adjustment rule specified for the period 2013-2020 of the concessions escalation provides for the maximum toll schedule can escalate annually at **the highest of**:

1. The change in consumer price index plus 1%;
2. Real GDP change;
3. 2.8% per annum.[23]

Note the direct impact of **macroeconomic conditions** on the tariff formulation. Increasing tariffs when macroeconomic conditions improve reflects the higher demand from users that typically realizes when a nation GDP increases.

Some **Chilean** concessions have allowed a margin of flexibility to the concessionaire for the decision of the toll rate. In the Vallenar-Caldera contract, the tariff adjustment formula is:

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[21] "Concession Agreement Delhi-Agra" issued by the National Highways Authority of India in July 2010 with DA Toll Road Private Limited. Available on: http://www.nhai.org.in/

[22] Giuricin (2010).

[23] http://www.fhwa.dot.gov/ipd/project_profiles/va_dulles_greenway.aspx

$$\Delta T \leq \Delta P\,(1+RR_{t-1})$$

The variable RR, called Maximum Real Applicable Adjustment, corresponds to a value between 0 and 0,01 for the first 10 years of the concession. It is equated to 0 for all the rest of the concession. This formula is characterized by lower demand risk transfer at the beginning of the concession: the contractors can discretionally increase the tariff of an additional 1% for the first 10 years, whilst for the remaining years the tariff variation follows a rigid price index adjustment rule.

In some concessions in **Italy**, tariffs adjusted with an index of **quality of service** to capture infrastructure quality and accident rates. Quality dependent formulas bring the benefit of giving the contractor the incentive to make extra-contractual effort to improve upon these dimensions.

Tariff regulation formulas also provide for tariffs adjustments to reflect realized **investment**; adding a term **K** to the formula. This ensures that the concessionaire gets rewarded for its investment as it progresses, and that users pay when the infrastructure network improves.

A number of concession contracts in Italy face a regulation that is closer in spirit to Banded Rate of Return, and which is characterized by:

$$\Delta T = \Delta P - \pi_{Neturality} + K$$

The term $\pi_{Neturality}$ is calculated to ensure the earning neutrality of the tariff adjustments, once accounted for the capital remuneration and the cost of investment.[24]

2.3. Tariff Regulation: Economic Considerations

The number of approaches used in practice, and briefly summarized in the previous section, can be linked to the principles of pure price cap regulation and rate of return regulation, which are the forms of price regulations used for privatized regulated public utilities. The long experience accumulated worldwide with regard to price regulations for public utilities can therefore help us to make some initial considerations on the incentives that they provide.

Compared to price cap regulation, banded rate of return regulation shows a number of shortcomings:[25]

(i) **Limited extra contractual incentives for cost reduction and innovation:** Tariff adjustments rules based on the principles of banded rate of return regulation match allowed revenues to realized costs. This matching limits incentives for the regulated firm to reduce operating costs or introduce innovative approaches. Any reduction in costs leads to a corresponding reduction in

[24] See IRPA (2014) for a description of the Italian regulatory system.

[25] See Sappington (2002) for a more in depth discussion.

allowed traffic revenues, so the concessionaire enjoys little gain from exerting the effort required to reduce costs toward their minimum possible levels. Instead, price cap regulation provides maximal incentives for cost reduction, as the firm can appropriate all of the increase in profit that its cost saving effort may be able to generate in between price reviews (and also beyond these if the X factor is set based on industry wide indicators of productivity improvements rather than firm level data, as it should).

(ii) **Limited extra-contractual incentives to raise user demand by increasing service quality:** The matching of revenues and costs limits incentives for the regulated firm to increase user demand and raise service quality. Any traffic increase does not change allowed traffic revenues, so the concessionaire enjoys little gain from exerting the effort required to increase user demand. Instead, price cap regulation provides stronger incentives for demand increase, as the firm can appropriate the increase in revenues that its effort may be able to generate (however these incentives are not maximal either as the firm cannot raise prices in the face of greater delivered benefit).[26]

It is at tender stage that excessive earnings should be appropriated via the bidding competition, and not at implementation stage via the tariff regulation.

Tariff regulations for concession PPPs should instead:

- **Ensure allocative efficiency;**
- **Provide incentives for cost reduction and quality improvement leading to higher service quality and lower costs;**
- **Ensure that project risks are allocated efficiently**
- **Be transparent so as to favour accountability.**

(iii) **Over-capitalization**: If the allowed rate of return is above its fair level, the concessionaire will have incentive to expand capital-intensive investments beyond their cost minimizing level, in order to enjoy this higher return. This effect is instead absent under price cap regulation.

(iv) **High costs of regulation and lack of transparency and accountability**: The information that needs to be gathered, elaborated, reported and verified in order to adjust tariffs when earnings diverge from the target level is much higher than what a price cap regulation requires. The level and complexity of the data analysis also leaves great scope for data manipulation and misreporting. Such complexity, joined with data confidentiality issues, makes it very difficult for users or media to verify the economic justification of permitted tariff changes.

(v) **Excessive demand risk imposed on users.** Allowing tariffs to increase when traffic volumes fall short of predicted levels, and so do earnings, implies a transfer of demand risk to users. This can be very costly on users, especially if we think that they will face tariff increases precisely when their financial conditions may already be very negative because of macroeconomic downturns. It can be also very inefficient in terms of allocative efficiency: Under rate of return tariff regulation,

[26] Iossa and Stroffolini (2002).

users face tariff increases during macroeconomic downturns, which exacerbates the fall in demand. Pure price cap regulation instead shields users from demand risk (totally, when the price cap is binding), leaving this risk with the concessionaire.

(vi) Cost shifting; inappropriate technologies: Concessionaires typically operate more than one concession, and they often are also present in different sectors (e.g. airports and highways). Rate of return regulation creates incentives for shifting their cost to the concession with rate of return tariff reduction so as to raise authorized revenues from highways activities without affecting actual operating costs, thereby increasing the firm's aggregate profit. This effect is not present under price cap regulation, especially when the X factor is calculated industry wide data.

For all the above reasons, the trend in incentive regulation for privatized utilities has been to move from rate of return to price cap regulation. This shift is even more desirable for concession contracts. Contracts for PPPs have a set duration after which the infrastructure returns to the public sector. Instead of trying to appropriate excess profits during the contract implementation, by using rate of return regulations - which brings a number of negative incentive consequences (as discussed above) - governments should aim to ensure the well-functioning of the market so that the tendering of PPP contracts manifest its full potential. **It is at tender stage that excessive earnings should be appropriated** via a fair competition, and not at implementation stage via tariff regulation.

Tariff regulation should instead focus on ensuring optimal risk allocation and efficient incentive provision under conditions of transparency and accountability, so that the tariff regulation process can inspire trust in citizens and attract new investors.

3. FUNDING MECHANISMS

AIM: The aim of this section is to discuss the key factors to consider when choosing the funding mechanism for PPP contracts in the highway sector. To this purpose, we describe alternative systems used in different countries, and analyse their impact on demand risk allocation, incentives, cost of capital and risk of renegotiation.

3.1. Background

PPP arrangements require revenue sources to provide a return on equity investments and on capital, operating, financing, and transaction costs. A variety of funding mechanisms is used in practice. These include real tolls, shadow tolls, direct payments and mixed models. Ancillary revenues derived from commercial development or land use arrangements along a motorway, such as service stations, restaurants, or utility corridors, can also be a source of funding.

We review below the alternative funding mechanisms for PPP motorway projects. Before proceeding, it is important to note that the question on which mechanism should be used is **separated** from the one related to whether or not users should pay for the motorway service. A pass through toll system may indeed be devised where users pay for the service but traffic revenues are enjoyed by the government, who then pays a contribution to the concessionaire that is independent of realized traffic.[27]

Which funding mechanism should be used to finance the highway construction and operation is a question that should be addressed bearing in mind that the choice of funding scheme and its design has implications on how traffic risk is allocated between concessionaires, taxpayers and users.

We have discussed in the previous section, the possibility that real tolls are used to finance construction and operation of highway infrastructures. Providing for the concessionaire to recoup its investment through toll revenues however does not necessarily imply that the concessionaire bears traffic risk. Indeed, when real tolls are used as funding mechanism, then traffic risk is borne entirely by the concessionaire only if tariffs do not adjust when traffic levels change. When instead tariff regulation does provide for real tolls to increase so as to compensate the concessionaire for low traffic (as under rate of return regulation); users bear demand risk, as they face a tariff increase when traffic level is low.

Similarly, when the concessionaire's revenues come from direct government contributions, it does not mean that the concessionaire will not bear traffic risk. Indeed, the allocation of demand risk in

[27] This is the case for example of Florida I-595 motorways.

this case will depend on whether these direct contributions change with traffic levels. Two alternatives are observed in practice for highways PPPs: shadow tolls and availability payments.

3.2. Shadow Tolls

Shadow tolls are payments from the public authority to the contractor based on the number of vehicles using the highway. Shadow tolls thus pass traffic risk to the concessionaire.

Shadow tolls can be used alone or in conjunction with real tolls or with direct government contributions independent of user numbers (e.g., availability payments). They may be used alone or in conjunction with government contributions, when it is decided, possibly for political reasons, that users should not pay directly for the motorway services. They may instead be used in conjunction with real tolls, when real tolls alone are insufficient to cover the cost of the infrastructure construction and management, and shadow tolls complement real tolls as revenues for the concessionaire.

Shadow tolls in conjunction with real tolls are used for example in **Portugal**. The risk allocation in Portugal varies across concession contracts, and it depends on the expected traffic level at the time the concession is awarded. The Authority responsible for oversight and development of the national highway network (Estradas de Portugal, EP) evaluates the expected traffic for a proposed PPP project and then recommends the funding/tolling mechanism to the government who makes the final decision.[28]

When highways are characterized by limited expected demand (possibly but not necessarily because of law requiring to build alternative free road), the EP recommends either shadow tolls only or a mixed system of real toll and shadow toll.[29] The real toll is fixed and independent of traffic volumes. The shadow toll has two components: (a) a service payment linked to the traffic volume, (ii) a direct payment, which is like an availability payment, that is linked to the availability of the service and its level. Part (a) decreases with traffic volume. If traffic volumes increase, the level of toll revenues increases consequently, and the shadow toll decreases. In general, we note that if the shadow toll reduction is more than proportional to the increase in traffic revenue, there is an element of **revenue sharing** between the government and the concessionaire.

Shadow tolls also change with usage (type of vehicle and its weights); and the link between the service payment and the shadow toll is defined depending on traffic levels compared to four traffic bands.[30] These per-band shadow tolls are not set by the authority but by bidders at

[28] Brown et al. (2009)

[29] When demand is particularly low, incurring the fixed cost of setting up toll stations may not be convenient.

[30] Fernandes (2006).

procurement stage. **Bidders have to specify a price for each of 4 traffic bands**, with the top band being charged zero. The idea is that for those projects where the real tolls are generating sufficient revenues, shadow tolls should be eliminated.

Spain also exhibits cases where there are both real tolls alone, shadow tolls alone, and mixed models, with both real and shadow tolls, and where the shadow toll depends on the traffic volume. In particular, of the 4,300 km (2,672 mi) of the National Highway System under PPP contracts, 3,800 km (2,361 mi) use real tolls, while 500 km (310 mi) use shadow tolls.[31] In the Madrid metropolitan area, shadow tolls alone are generally used for PPP projects. The shadow tolls paid during a period usually are linked to traffic volume and the level of service provided. Only one PPP project in the Madrid region relied exclusively on real tolls. Other regions in Spain rely more heavily on real tolls. Like Portugal, Spain also requires construction of toll-free connector roads as part of some of its concession agreements.

Other examples of shadow tolls exist in the UK[32] and Finland.[33] They were also proposed for the German A Betreiber Modell; a model, a multilane extension of an existing motorway section (the German F Modell is a classic financing toll system).[34]

3.3. Direct Payments/Availability Payments

Availability payments are direct government payments independent of demand levels but contingent on lane availability, performance standards and safety. With availability payment, the concessionaire is shielded from traffic risk.

Entitlement to the availability payments is generally based on the 'availability' of the project to vehicular traffic and the concessionaire's conformance with the operation and maintenance criteria established in the PPP agreement. Availability payments to the concessionaires can be used both when users pay a toll and when they do not.

Performance-based availability payments are typically made monthly during the operating period of the project. A maximum availability payment is set at the beginning of the concession period and escalates annually. If quality and performance requirements stipulated in the contract as well

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[31] Brown et al. (2009)

[32] UK Highway Agency (2006).

[33] See Pekka Petäjäniemi, Director of Finnish Transport Agency, "PPP Experiences in Finland", 2014, Available on: http://portal.liikennevirasto.fi/portal/page/portal/f/uutiset/tapahtumat/EU_transport_corridors_seminar/2014_02_13_PPP_conclusions_pxp%20Pet%E4j%E4niemi.pdf

[34] Fayard (2005).

as availability of the roadways to traffic are not met, then the availability payments is subject to downward adjustments in accordance with the contract.

Availability payments are used for example in the UK for the M25, in Norway[35], and in the US where the I-595 Corridor Roadway represented the first U.S. application of availability payments to a transportation project. One of the latest case is the Benavente Zamora highway in Spain.[36]

3.4. Allocation Of Demand Risk To The Concessionaire: Trade Offs.

The question of which funding mechanism should be used to finance a PPP project is intimately related to the question **who should bear demand risk.** Demand risk refers to the risk of lower revenues because the users demand falls short of the demand forecasted.

Depending on the way the funding mechanism is designed, each of the following party may be the one who ultimately bears the risk:

- The public contracting authority and thus indirectly taxpayers – irrespective of whether they are users or not
- The concessionaire (and its financiers)
- The users of the motorway.

From an optimal contract design perspective, the allocation of risk should be chosen so as to optimally **trade-off the incentives of the contracting party and the risk premium** due to the party for bearing that risk. Budget constraints however limit the extent to which governments can bear traffic risk, and add new considerations, as we shall discuss below.

On the one hand, for incentive purposes, demand risk should be allocated **to the party that is best able to forecast, control and manage it**, as this will give this party the incentive to gather accurate information on the potential demand, and to manage demand risk effectively. The effect of risk transfer on the incentives for accurate information gathering is very important in highways, given the difficulty to forecast demand, especially for greenfield projects. The effect of risk transfer on the incentives for higher service quality is also very important for all those activities and

[35] Billehaug, Manager of the PPP Road Program of the Norwegian Public Roads Administration: "The Norwegian PPP Pilot Road Program Kjersti", Available on: http://nvfnorden.org/lisalib/getfile.aspx?itemid=1556

[36] http://infrapppworld.com/pipeline-html/awarded-emea/a-66-benavente-zamora-concession

performance aspects that can have an impact on realized demand but cannot be easily specified in the contract, and thus monitored and enforced.[37]

On the other hand, allocating demand risk to the concessionaire lowers its expected utility, and thus his willingness to bid for the concession contract. If the concessionaire is asked contractually to bear demand risk, it will have to receive a compensation for the risk it is bearing. This "**risk premium**" will be higher the greater the risk aversion of the concessionaire and the higher the demand risk.[38]

Transferring demand risk to the concessionaire:

- Strengthens its incentives to gather accurate information on potential traffic and invest only in projects with high demand potential.
- Strengthens its incentives to provide high-quality motorway services and infrastructures.
- Makes potential bidders choose less aggressive economic offers, anticipating the demand risk.
- Raises the cost of capital, raising the risk premium asked by financiers for providing the necessary funding.
- Exposes governments to greater risk of firm-led renegotiation when realized demand is less than expected.
- Exposes firms to greater risk of government-led renegotiation when realized demand is higher than expected.

In practice, this means that, at procurement stage, as more risk is transferred to the contractor **less aggressive bids** will be submitted by potential contractors, and the interest demanded by financiers for financing the project will be greater. Risk transfer thus raises the cost of capital, and this higher cost is ultimately paid by the contracting authority via the lost revenues from the competitive selection process.

Furthermore, demand risk transfer implies that firms' profits depend on bidders' demand forecast. There is therefore a common value component in the project value. A company that participates in the tender anticipates that it is more likely to win if it has made over-optimistic demand estimates and will bid more conservatively. Thus, risk transfer. reduces the benefit of competition due to the "winner's curse" problem.[39] Using a dataset of toll road concessions worldwide, Athias and Nunez (2008) find empirical evidence of this phenomenon.

Finally, more risk transfer to the concessionaire raises the risk that ex post **renegotiations** will occur. On the one hand, when revenues are below the level expected and the concessionaire finds itself in financial difficulties, the public sector may be tempted to bail out the

[37] See Iossa and Martimort (2011) and Iossa, Spagnolo and Vellez (2007a,b) for further discussion on optimal risk allocation in PPPs.

[38] Small and medium size firms are typically more risk averse than large corporations, because they have fewer opportunities to diversify risk or less access to the capital market. Risk transfer thus reduces their competitiveness, as they will be able to make less aggressive bids.

[39] See Kagel and Levin (2009) for an in depth analysis of the winner's curse problem.

firm in order to avoid service disruptions or the bankruptcy of the concessionaire. On the other hand, when traffic revenues are higher than expected, the government may find itself tempted to appropriate some of the additional gains through legislative changes that authorize lower user charges.

When concessionaire bears traffic risk, as when its revenues come from shadow tolls or from real tolls that do not adjust with traffic level, the above considerations imply that demand risk transfer produces a number of contrasting effects. On the one hand, it strengthens the incentives of the concessionaire to forecast demand appropriately and manage the motorway services at its best so as to increase its quality and the level of demand.

On the other hand, transferring demand risk to the concessionaire increases the cost of private finance and may generate weak support by financial institutions.[40] It also exposes governments and firms to great risk of opportunistic ex post renegotiations.

Instead, availability payments isolate the concessionaire from traffic risk. For the reasons explained above, this lowers the risk premium, reducing the cost of capital, but the priva will not have extra-contractual incentives to make accurate traffic forecast and in fact may strategically overestimate demand forecast in order to get the project approved. The concessionaire will also not have extra-contractual incentives to manage the motorway services at its best so as to increase quality and demand.

Funding through availability payments - No demand risk to concessionaires:

- Provides little incentives for the concessionaire to make accurate traffic forecast, and strategic incentives for optimistic traffic forecast to get project approved.
- Weakens the concessionaire's extracontracual incentives to raise demand by improving service and infrastructure quality.
- Lowers the cost of capital.
- May be coupled with tolling, to favour allocative efficiency and horizonal equity.
- Makes non-compete clauses unnecessary

If coupled with absence of tolling, availability payments imply that all taxpayers pay for the motorway service regardless of whether they use it or not. Letting users pay a toll to the government who then pays an availability payment to the concessionaire, favours horizontal equity and allocative efficiency, and will generally be preferable to using availability payments without real tolls. This unless the highway construction is key to the country's infrastructure development, and non-compete clauses that constrain the governments from building alternative roads may severely limit the infrastructure development. For this reason, availability payments may be more appropriate for those countries in great need of infrastructure

[40] The US Florida Department of Transport (FDOT) considered using shadow tolls for the I595-Florida highway. However, this delivery mechanism was rejected because the FDOT concluded that the risk transfer to the private sector would cost the public sector an additional $144 million as compared to an availability payment system.

development .

Hybrid schemes with traffic risk sharing. A number of hybrid models combine benefits and costs of the above two extreme options, for example by providing for real tolls to be topped up with direct government contributions depending only on service levels (e.g. the Portuguese case discussed above). There are also schemes that are hybrid in the sense that they use both availability payments and real tolls.

Transferring demand risk to users via tariffs increase when demand is low:

- Further decreases traffic volumes when demand is already low, thus exacerbating the fall in demand.
- Worsens allocative efficiency
- Strengthens incentives of bidders to engage in low-balling at bidding stage.
- Worsens incentives of contractors to misreport forecasted traffic demand

The Least Present Value Revenue (LPVR) Auction. In Chile the principle of a flexible contract duration is used to share demand risk between the public and private sector. In LPVR auction, real tolls are enjoyed by the concessionaire but the contract duration depends on whether the total revenues collected, appropriately discounted, reach the level specified in the financial bid of the winning contractor. When they do, the concession ends.[41] Thus:

-(i) If demand is low, revenues will be low, which triggers an increase in contract duration. The contractor faces the risk of low revenues, for which he does not receive a direct compensation from the contracting authority, but he receives a partial compensation from the increase in future revenues that the raise in contract duration will bring. The contracting authority does not have to compensate the contractor for the low revenues but it faces the cost of ensuring longer monopoly power to the contractor. The authority thus foregoes the potential benefits that a more efficient contractor could bring, were a new tender issued.[42]

(ii) If demand is high, revenues will be high, which triggers a reduction in contract duration. Similar reasoning as above shows that the benefit from the higher revenues is shared between the contractor and the public contracting authority.

[41] The law however does not allow a contract duration greater than 50 years.

[42] A longer contract duration has opposite effects on the efficiency and sustainability of the PPP contract. On the one hand, it ensures that the concessionaire has more time to recoup its initial investment and that it will take a long term approach to its investment strategy. This may improve the project bankability and also the incentives of the contractor to correctly maintain the infrastructure. On the other hand, a longer contract duration implies that the contractor enjoys monopoly power for longer time. If new and more efficient firms enter the market, they will not be able to make offers so as to replace less efficient contractors. Furthermore, shielded from competition for a longer period, the contractor's incentives to maintain the infrastructure may decrease.

LPVR auctions can also provide with some revenue guarantees to reduce the expected duration of the concession and the traffic risk borne by the concessionaire. For example, in the Chilean Vallenar-Caldera highway, the maximum concession period is 35 years.[43]. The contract ends when the realized revenues (VPI_m) reach an expected discounted revenue level (ITC) specified in the bid. The VPI_m comprises both the revenues from tolls (IM_i) and a (monthly) minimum revenue guarantee (IMG_i), net of the costs incurred for new investments requested by the public contracting (up to a max of 15%):

$$VPI_m = \sum_{i=1}^{m} \frac{IM_i}{\prod_{j=1}^{t}(1+r_j)^{\left(\frac{1}{12}\right)}} + \sum_{i=1}^{m} \frac{IMG_i}{\prod_{j=1}^{t}(1+t_j)^{\left(\frac{1}{12}\right)}} - \sum_{i=1}^{d} CS_i$$

Revenues are weighted by:

$r_j = r_f$(4%yearly)+Θ_1(5% risk premium).

tj= r_f(4%yearly)+Θ_2(2% risk premium).

where the risk premium is lower on the revenue guarantee component. CS_i is the monthly reimbursement for investments exceeding a specified threshold, with *d* denoting the duration of the change of service.[44],[45] Demand risk is shared between the concessionaire and the contracting authority:[46]

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[43] "Bases de Licitaciòn Concesiòn Ruta 5 Norte Tramo: Vallenar-Caldera" issued by Gobierno de Chile, (2008), Ministerio de Obras Pùblicas, Coordinaciòn de concesiones. Available on: http://www.concesiones.cl/proyectos/Paginas/default.aspx

[44] "Concession Agreement Delhi-Agra" issued by the National Highways Authority of India in July 2010 with DA Toll Road Private Limited. Available on: http://www.nhai.org.in/

[45] Minimum **revenue guarantees are offered by** the public contracting authority who guarantees a minimum level of revenues, should demand be too low. Minimum revenue guarantees were widely used in Korea and then abolished in the 2006 Annual Plan by the Ministry of Planning and Budget. If set too high, they clearly remove any effective risk transfer to the concessionaire.

[46] **India** also provides for a **flexible contract duration**, although to a lesser extent. In the Delhi-Agra concession for example the base duration set in the Model Contract Agreement (MCA) is 26 years, but depending on the level of actual traffic the contract duration may increase or decrease. In particular, on a target day specified in the contract, the Target Traffic is compared to Actual Traffic – given by a traffic average across years, based on traffic sampling. If the difference in absolute value between target traffic and actual traffic is above 2.5%, the contract duration is modified in the following way:

- For each 1% of less traffic, the concession period is increased by 1.5% (up to a max of 20% increase)

As emphasized by Engel (1997) and Engel et al. (1997), the basic principle underlying LPVR auctions is that the contractor should not make losses when the long-run demand for the highway is sufficient to pay all costs. Revenues are the same even when demand realizations are different, so the risk borne by the concessionaire is far smaller than under fixed term franchises, and so is the risk premium.

It is also easy to adjust tolls. If tolls need to be raised because of congestion, the only effect is that the contract ends earlier. If demand for the highway is highly uncertain before it is built, the setting of tolls can be postponed until after construction.

Opportunistic behaviour by the bidders at procurement stage is also constrained: The winning bid determines the fair compensation for termination of the contract at any time as the difference between the present value of revenue earned and the original bid. If demand exceeds expectations and requires an expansion of the highway, the concessionaire can be paid the fair compensation given by the difference between the present value of revenue earned and the original bid, and the franchise re-auctioned.

In LPVR concessions, compared with fixed term contracts with full demand risk transfer, there are weaker – though still positive - incentives to engage in demand enhancing activities. Any expense that increases demand shortens the franchise and this increases profits only through the effect that it frees the contractor's resources and assets earlier on, to be employed for alternative use.

3.5. Which Funding Mechanism?

The above discussion suggests that there is no one-size-fit all mechanism. Allocating demand risk to the concessionaire brings benefits and costs. These benefits and costs are affected by the project characteristics (e.g. expected traffic) and by the characteristics of the country (e.g. strength of regulatory and political institutions, infrastructure development); the optimal level of demand risk transfer may therefore change from country to country and from project to project.

With weak regulatory and political institutions however it is really hard for highway PPPs to deliver the expected benefit, regardless of how demand risk is transferred to the concessionaire.

First, there is no benefit from transferring full demand risk to the concessionaire, if this risk transfer becomes unattainable in practice because political considerations intervene ex post, changing the rules or bailing out failing concessionaires. Also, the difficulty to raise private finance for such risky projects has seen the public sector entering directly as shareholder in the special

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- For each 1% of more traffic, the concession period is decreased by 0,75% (up to a max of 10% decrease). However if the concessionaire pays a further premium of 25% of the Realizable Fee then it can keep the contract duration unchanged.

purpose vehicle managing the concession agreement, creating strong conflict of interests. Loans from state banks worsen the problem as they make it very hard for governments not to give in the temptation to bail out failing contractors.

Second, availability payments are not safe either, as the firm and the public authority can "**collude**" against taxpayers by unduly raising availability payments. Lack of user fees will silence users whilst the difficulty for the general public to estimate what is a "reasonable" government contribution will make it very difficult for the media or third party to argue that the payment level is too high. The long duration of PPP contracts also imply that undoing the wrongs done in the past is extremely costly to achieve.

Third, revenue sharing systems providing for state contingent payments or tariff increases are typically more difficult to monitor than the above two extreme systems, and also their implementation may involve high transaction costs.

Under strong institutions, the demand risk allocation can instead be effective at optimally trading off incentives and cost of capital, and in the light of the discussion in the previous section, we can make a number of observations:

1. **It is important to provide the contractor with incentives to correctly estimate traffic demand.** The business case for highways relays heavily on forecasted traffic demand and thus revenues. Forecasts of traffic flows are notoriously unreliable.[47] **Optimism bias** has been consistently observed. Standard and Poor's (2003) estimated that in 2003, the mean error in traffic demand forecasts for 68 PPP highways worldwide to be 25% in Year 1. Forecasting performance improves with a country's experience in toll roads, but it remains a constant feature of PPP projects for highways also in experienced countries. The unreliability of traffic flows has also been observed in other contexts. See e.g. Flyvbjerg et al. (2002, 2005).

2. **Traffic information and traffic risk change** over the life of a PPP contract. Gauging consumers' response to the opening of a new highway appears difficult, as there is no data on consumers' past choices. Lack of information is indeed what makes **greenfield** projects typically more risky than brownfield projects. However, once the contract starts, uncertainty decreases, as users' needs and attitudes are slowly revealed. Over time, the base demand level is revealed and the uncertainty becomes confined to those demand fluctuations that are related to exogenous shocks, fluctuations of fuel prices, available income and macroeconomic cycles.

[47] See Flyvbjerg, Holm and Buhl (2005).

3. **Infrastructure investments** is made early in the relationship, and this is when risks matter most. Greater certainty of revenues can significantly reduce the cost of their financing early in the relationship.

4. **Incentives are important to boost traffic demand but exogenous factors also matter.** Motorway demand is indeed also affected by factors that are not controllable by the concessionaire such as macroeconomic conditions, the nation pro capita income, the existence of alternative cheaper roads or modes of transports, the weather conditions.

5. **Greater differences between expected toll revenues and realized toll revenues are more likely to trigger renegotiation**. This effect goes both ways. On the one hand, if revenues are significantly below their expected level, the firm is likely to face significant financial difficulty and it will use this as leaver to demand more favourable contract terms. Anticipating great economic and social costs from terminating the contract with the contractor, public authorities may give in and accept to renegotiate the contract in favour of the concessionaire. On the other hand, if realized revenues are significantly above their expected level, governments will be under more pressure from citizens and the electorate to lower tariffs or appropriate excess revenues. Public authorities may then give in the temptation to renegotiate the contract in their favour.

These observations have a set of implications.

For brownfield projects that require low capital investments, transferring demand risk to the concessionaire may provide the right extra-contractual incentives without letting the cost of capital become excessive.

For greenfield projects, letting the concessionaire bear some traffic risk can have important beneficial effect on extra contractual incentives but transferring all demand risk may not be suitable. Who should then bear the residual traffic risk? Ensuring a direct compensation to the concessionaire when some index of macroeconomic condition worsens implies that governments will face high liabilities in periods of economic downturns, especially if the same approach is followed under all PPP motorways in the country. The alternative of transferring macroeconomic risk to users via higher tariffs is not without problem either, as it exacerbates the demand reduction.

Shielding the private sector from some traffic risk seems to be best achieved through the increase in contract duration, as under LPRV auctions, which also avoids that users observe higher tariffs crisis or that governments face great liabilities in periods of economic downturns.

However, when the expected traffic is low, LPVR auctions may result in excessively long concession contracts. An alternative possibility is then to use hybrid systems that combine real tolls and availability payments, where the former are used to provide extra contractual incentives, and the latter are used to provide some certainty of returns on the infrastructure investment.

These hybrid systems could be designed so as make demand risk transfer start small at the beginning of the project, where little data on user preferences is available and infrastructure investment is highest, and then increase. The system could also provide for some traffic revenues to be shared between the government and the concessionaire, via revenue bands. See Figure 1 below, where the continuous blu line represents (average) tolll revenues; the red dashed line the adjusted revenues for the concessionaires.

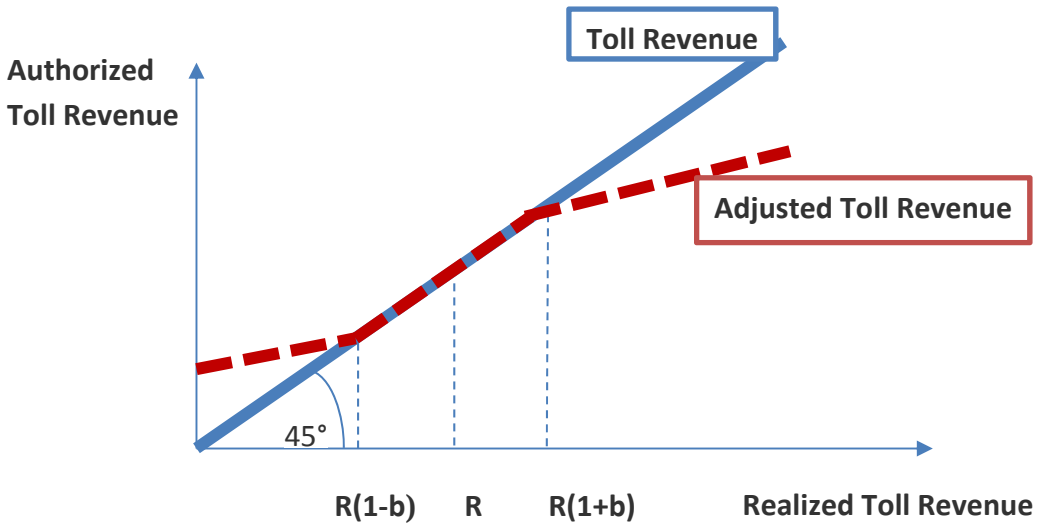

Fig. 1.

4. PROCUREMENT DESIGN

AIM: The aim of this section is to briefly review the competitive procurement for PPP contracts for highways, in the light of international practice. We discuss the choice of the bidding variables, and the distortions due to ex post renegotiation We provides some economic considerations and policy recommendations on the use of standardized contract terms.

4.1. The Tender Design

The procurement system should ensure the selection of the contractor who is best able to build and operate the highway cost effectively and with satisfactory standards. The procurement system and the contractual agreement are strictly interrelated, as the rules defined in the contract determine the expected contract value for the potential bidders, upon which bidders should choose their bidding strategy.

A typical PPP motorway tender is organized as a multi-stage procurement process were bidders submit a financial and a technical offer, and the contract is adjudicated based on criteria that include the lowest toll, the lowest public contribution, and the shortest concession. When the best offer is selected, the preferred bidder(s) negotiates the final terms of the contract with the public authority, until financial closure is reached. Being out of public eye and after the selection has been made, this contract negotiation should be confined to minor details.

The procurement process. A first important choice regards the **criteria to adjudicate the tender,** and thus what should constitute a bid variable, and what should instead be pre-established by the contracting authority during the call for tender and inserted in the contract terms appended to the tender documents.

The key **economic variables** that we have observed for PPP projects in the highway sector are:

- Tariffs charged to users;
- Governmental contribution and shadow tolls;
- Net present value (NPV)/ Present Value of Revenues (PVR);
- Duration of the contract;
- Allocation of risks;
- Government revenue share.

Different approaches are used in practice. Under earlier concessions in **Spain,** tolling rates and structures and the concession duration constituted bid parameters. In **Portugal**, there are examples where the contracting authority sets traffic bands and firms bid on shadow tolls for each of the pre-specified traffic bands (Brown et al. 2009).

In **India**, a typical procurement mechanism comprises two stages**.** The first one selects the eligible firms depending on the Request for Qualification (RFQ) document, which includes the technical and financial capacity of the firm. Alternatively, the contracting authority creates a list of prequalified firms, and sends them an invitation to submit a Request for proposal (RFP). The prequalified firms take part to the second stage of the procurement process where the technical and the financial proposal of the bid are evaluated. All project parameters such as the concession period, toll rates, price indexation and technical parameters are stated upfront in the tender documents. Bidders are required to specify the amount of state grant sought by them, and may offer to **share the project revenues** with the Government. The Government may provide a capital grant of up to a maximum of 20 per cent of the project cost (Haldea, 2013).[48] This makes the negotiation phase with the selected bidder normally very fast, it takes just one to two days, because the main contractual clauses have already been determined in the standardized contract.[49]

In the **United Kingdom** the procurement process for M25 orbital Motorway that encircles London started with a prequalification of five firms. Before the formal tender the British Highway Agency sent an Invitation to Submit Outline Proposal (SOP) to prequalified firms to evaluate technical qualities of competitors. This operation was aimed to **restrict the number of bidders** to three and reduce transaction costs. The three qualified firms were assessed by three different negotiation and evaluation teams that worked independently, coordinated by the same chief procurement official. The procurement mechanism was based on a **three stages process**.

The first stage concerned the technical assessment; only firms exceeding a minimum threshold score for each criterion would take part to the financial assessment. The second stage was the financial assessment. As the contractor would be rewarded through availability payments, the financial competition was based on the level of gross annual payments that the firm request (the availability payment), and the winning bid was represented by the lowest net present value. The possibility of a third stage was included in the M25 base procurement in case there were bids within the 5% of the lowest net present value submitted. In this case, the score awarded in the

[48] In the concession agreement of the Ghaziabad-Aligarh Section of NH-91 the NHAI, for example, the financial proposal was evaluated first, according to the experience for the assignment, the quality of methodology and work plan proposed, the qualification and competence of the key staff. After the evaluation of the technical Proposal a short list of 3 eligible firms was finalised and these firms were invited to submit a Financial Proposal. For the overall score of the bid the technical proposal was weighted 80% and the financial proposal 20%. The firm with the highest overall score won the tender. If two or more firms obtained the same score the firm with the highest technical proposal would have won the tender.

[49] Contract Agreement between National highway Authority of India and M/s. SPAN Consultants Pvt. Ltd.(2011). Independent engineer services for 4/6 laning of Ghaziabad-Aligarh. Available on: http://www.nhai.org.in/

technical proposal would be taken into account, with the technical score weighted at 15% and the financial score at 85% of the final score.[50]

Chile went through three different procurement approaches (OECD 2013). At the beginning several criteria were relevant, such as the duration of the contract, the tariff rate, the toll price and the amount of subsidies. This system was then perceived as too **complex** and inefficient for selection. A second approach was then undertaken with the government fixing the concession period and making firms compete for the lowest toll rate. This approach however also generated several problems: When bids were too low, the firms faced financial difficulties during the concession, and the government **renegotiated** the original agreements. The third approach, built on the experience gathered with the two previous methods, and it is the current system applied for highway public procurement. Now, the only bid variable is the **net present value of revenues** that the contractor wants to obtain from the concession. The contract does not have a fixed duration: the concession lasts until the firm collects all the revenues it bid for during the tender . Chile was the first country to use least net present value of revenue (LPVR) as the sole criteria for awarding a PPP concessions with the Santiago to Valparaiso highway in 1988.

The preferred bidder and the time to financial closure. Most procurement mechanisms for PPP highways that we have observed choose to select only one preferred bidder and negotiate the details of the final contract with that selected bidder only. This approach has the clear benefit of reducing **transaction costs** and bidders participation's cost and time, but it has its downside of exposing the public contracting authority to the risk that **financial closure** is not achieved, unless favourable contractual conditions are ensured to the concessionaire and its lenders, and that negotiations protract for a long time.

In **Portugal** the JAE (Junta Autónoma das Estradas, now EP) issued in the 1997 the first public procurement for shadow toll highways. The main aim was to develop the transportation network in the poorer interior part of the country. Six public concessions with an upfront established duration of 30 years were totally issued. Typically, the whole procurement process now lasts eighteen months. A two stage competitive procurement with negotiation is used, with the interesting feature that there is more than one selected bidder. The tender does not include a prequalification phase, but a two stage process comprising a bid-selection and a negotiation procedure. Firms have four months to deliver their proposal.

The two best bids take part to the negotiation phase. This last stage is divided in three parts. In the first one the imprecise technical aspects of the original bid are corrected to allow a homogeneous assessment. The second stage considers contractual aspect, in particular the risk-sharing related to critical situations following force majeure, environmental problems and the unforeseen construction of parallel roads. The last part includes the final economic bid. The method of

[50] Brown et al. (2009).

assessment is the same of the first stage and the new bid can only equate or lower the original one.[51]

Having two preferred bidders clearly raises transaction costs. However, it may bring the benefit of weakening the opportunism of concessionaires who attempt to renegotiate more favourable contractual conditions once the tender has been adjudicated.

Choosing bidding variables and award criteria. On the one hand, it is important to have simple and transparent criteria for the bidding. If bidders have to satisfy a long list of technical and financial criteria, all with different weightings, **transparency** will be difficult to obtain. Higher weights on technical criteria compared to economic criteria that are non-objectively measured also reduce transparency.

On the other hand, economic theory suggests that the public contracting authority should set as bidding variables all those relevant variables whose costs of provisions are easier to identify for the bidders, either because they require market knowledge or because they have elements of bidder specificity. With heterogeneous bidders, that is bidders who may be differently efficient in terms of contractual dimensions, leaving bidders to choose on which dimensions to bid more aggressively helps to favour competition. Bajari and Lewis (2011) gather an extensive data set of highway repair projects awarded by the California Department of Transportation between 2003 and 2008. Comparing tenders with time incentives introduced making time completion a bidding variable with those who did not, they show that the welfare gains to commuters from quicker completion substantially exceeded the increase in the winning bid.

Also, more bidding variables with relative weights helps to ensure that the bidders are selected along dimensions that reflect the real preferences of the contracting authority. Thus, for example, a contracting authority that is more risk averse or budget constrained, or that follows a policy of uniform tariffs setting, will assign different weights to economic and technical aspects than an authority with different priorities.[52]

4.2. The Distortionary Effect of Firm and Government Led Renegotiation

[51] See Fernandes (2006).

[52] For a thorough discussion on procurement design, see Dimitri, Piga, Spagnolo (2006)

One of the main issue in PPPs is the extent to which it is reasonable to expect that the contractual agreement between the public authority and the concessionaire will remain effective during the execution of the contract.[53] We do not refer here to the possibility to renegotiate the contract so as to accommodate changes in user needs which require a change in service. This may be achievable through well designed **change-management contractual clauses** necessary to limit potential abuses, from the public contracting authority attempting to hold up the concessionaire expropriating it of its past investment, and from the concessionaire, exploiting its lock-in position to demand unreasonable compensations.

The likelihood that the contract will be renegotiated depends on:

- The strength of political and regulatory institutions
- The characteristics of the contract (tariffs setting rules, risk allocation, time of periodic reviews, contract rigidity, contract incompleteness).

We refer instead to the possibility to the possibility of opportunistic behaviour from either side, aimed at obtaining more favourable contract terms when certain circumstances materialize. In particular:

- The concessionaire may request more favourable **contractual** conditions because of financial difficulties encountered due to traffic demand being lower than expected. This case may be referred as "Firm-led Renegotiation".
- The public contracting authority or the government may review the tariff setting rule that is more favourable to users or that it improves public finances. This case may be referred to as "Government-led Renegotiation".

Both these types of renegotiations are a sign of PPP failure.

A typical example of Firm-led Renegotiation in PPP highways occur when the concessionaire initially agrees to take on (all or part) of demand risk, by linking its revenues to the level of traffic, but then demands a government subvention when expected demand does not materialize.

A typical example of Government-led Renegotiation in PPP highways occur instead when the Government requests a reduction in tariffs or in other contractual conditions, upon having observed that traffic or profits are higher than expected.

Firm-led Renegotiation. With regard to the former, the literature on soft budget constraint helps in identifying negative effects of recurrent, and thus expected, contract renegotiations on the

[53] See Iossa, Spagnolo, Vellez (2007a) for an extensive discussion on the trade off involved.

private partner's incentives, risk exposure as well as on firm selection at procurement stage.[54] The key the problem is that entrepreneurial incentives are distorted by the managers' belief that the public sector will **bail out** firms in the future if they are at risk of bankruptcy. This belief is supported by an objective fact: ex post, it is often in the interest of the public sector to rescue firms to avoid the social costs of investment project termination. In particular, ex ante, the public sector should commit not to bail out firms in order to get entrepreneurial incentives right and to discourage entrepreneurs from undertaking bad investment projects or manage projects inefficiency. However, such a commitment is not credible because ex post, once investments are sunk, the public sector will do better by bailing out all bad projects already undertaken. Thus soft budget constraint may lead to more bad projects being financed, and to weaker incentives to operate efficiently.

The implications for PPP highways is that transferring all demand risk to the concessionaire may not be feasible. If political and economic conditions prevent governments to commit not to bail out failing firms, insisting on transferring demand risk to the concessionaire ex ante will create **quadruple costs** for users and taxpayers.

- First, risk transfer will increase the risk premium and thus the cost of capital at procurement stage;
- Second, it will lead to tariff increases or government subventions during project implementation.
- Third, it will trigger more renegotiations, bringing about a cost in terms of **reputational loss**: if abused in the past, the public sector's reputation will be weakened and this will reduce the incentive power of future contracts and distort competition in future tenders.
- Fourth, expectation of renegotiation will alter the competition in the tendering in two ways: (i) by inducing aggressive, financially-unsustainable bids by the participants, counting on ex post contract revisions; Thus, for example, the expectation of renegotiation prompts firms to bid artificially low tolls (to "**lowball"**), expecting better terms after the contract has been awarded, and to strategically overestimate traffic forecast ; (ii) by favoring firms with political ties who can then bid more aggressively, sure of their future opportunity to renegotiate contract terms.
- Fifth, renegotiations require negotiation and bargaining between the concessionaire and the public contracting authority. This involves haggling costs, which increase the cost of the transaction.

Ample evidence of widespread renegotiations in many PPPs is reported in Guasch (2004), Guasch, Laffont and Straub (2008) and Guasch and Straub (2006), where the contract revisions lead to

[54] Kornai (1979).

rescheduling investment requirements, increasing tariffs, granting subsidies or tax exemptions, lengthening the contract duration, etc. An example of renegotiation in PPPs is what occurred in the project Dulles Greenway. The project started in the State of Virginia in 1993. The PPP concession should have lasted till 2036, but after tolling was introduced, the traffic rate resulted significantly lower than the expected one. The Virginia State Corporation Commission (SCC) tried to decrease the toll rate and the level of traffic increased consequently. Nevertheless this was not sufficient to enhance profits and the SCC decided to renegotiate the concession period. The new agreement lasts till 2056 (20 years more).

As emphasized by Engel (1997), this is also one of the reasons why the LPVR auction reduces the scope for opportunistic behaviour by the concessionaire through renegotiation. As the contract duration automatically increases if traffic is lower than expected, it is less likely that concessionaire will face financial distress and therefore will demand renegotiation. This lower risk for the contractor also means that the winner's curse is less likely, because bids are less dependent on demand forecast. For the same reason, the incentive of bidders to engage in lowballing by bidding aggressively and then renegotiate contract terms will also be less likely.

We can also expect that also other mechanisms which provide for some traffic demand risk sharing will be less subject to renegotiation than pure price cap systems with full risk transfer. There is evidence to suggest that price cap regulation was indeed more extensively renegotiated than rate of return regulation in concession contracts such as PPPs (see Guasch, 2004).

The likelihood that the contract will be renegotiated depends on:

- Political factors
- Economic pressure
- Past performance
- The quality of institutions
- The characteristics of the contract (tariffs setting rules, risk allocation, change mechanisms clauses, time of periodic reviews, contract rigidity, contract incompleteness).

Government-led Renegotiation. Several reports on PPP contracting highlight the cost of changes in user needs that have sometimes triggered very costly renegotiation (see e.g. HM Treasury 2006). In the UK it was reported that changes occurred during negotiations with the contractors for 33% of Central Government Departments PPP projects signed between 2004 and 2006. The changes amounted to a value of over £4m per project per year equivalent to about 17% of the value of the project (NAO, 2007).

Government-led renegotiation may also occur for purely opportunistic reasons. In the study of Guasch, Laffont, and Straub (2006), almost two-thirds of the concession renegotiations (in all sectors in Latina America and Caribbean Countries) were initiated by the public-sector party, and most of them took place in periods surrounding elections, so as to indicate a political motive to increase chance of being re-elected by decreasing tariffs on sensitive public services. Renegotiations may also be motivated by a desire by fiscal or political constraints

to expand spending, that push government to attempt to get private partners to contribute indirectly (Guasch, 2004, Engel et al. 2014).

In the short-run, public partners may benefit from politically-oriented renegotiations, managing to secure better conditions for user (e.g. via tariffs reductions). But in the long run they are likely to lose from a change in contractual terms. Government led-renegotiations have long-term negative effects not just on the ongoing concession contracts but also on future ones, because of the impact they generate on the cost of finance. **Regulatory risk raises the cost of capital** and the risk-premium (higher tariffs, or smaller transfer price) paid for a PPP contracts. For LAC countries, Guasch and Spiller (1999) estimated that regulatory risk added between 2 to 6 percentage points to the cost of capital, depending on country and sector. An increase of 5 percentage points in the cost of capital to account for the regulatory risk leads to a reduction of the offered transfer fee or sale price of about 35% or equivalently it requires a compensatory increase in tariffs of about 20%. Political risk also discourages investors. In the £16 billion London Underground project of 2002-03 a heated political controversy made lenders withdraw their financial commitment.

Considering a sample of US highway paving contracts, Bajari, Hougton and Tadelis (2011) show that bidders respond strategically to anticipated renegotiations and that haggling costs are an important determinants of their bids. Expectation of renegotiation account for 8-14 percent of the winning bid.

4.3. Enhancing Competition

When the conditions of the contract are **renegotiated** after the tender has been adjudicated, and the competitive pressure has subsided much of the efficiency of the procurement process is taken away. With significant ex post changes in contract terms, there is no longer a guarantee that the selected concessionaire was indeed the best bidder; in hindsight, had these changes been anticipated, competitors might have bid differently, and a different contractor might have won.[55] Furthermore, expectation of renegotiations create scope for strategic lowballing and for overestimation of traffic forecasts; contracts may then be awarded even when the infrastructure project should not have received the go-ahead.

Ex post renegotiations can nullify the benefit of competitive procurement.

Leaving key aspects of the contract aside to be the object of bilateral negotiations between the preferred bidder and the contracting authority is also worrisome, as this occurs out of public eye and may lead to new terms being defined which would have altered the competition at bidding

[55] The phenomenon is widespread across different sectors. A sample of UK PPP projects reported that 33% of Central Government Departments PPP projects were renegotiated during contract negotiation between 2004 – 2006 (National Audit Office, NAO, 2003).

stage, had the other bidders been allowed to make their bids knowing these terms. The procurement system and the contractual agreement are strictly interrelated - the rules defined in the contract determine the expected contract value for the potential bidders who will then choose their bidding strategy accordingly. For this reason, contract terms should be **set in advance** in all those dimensions which affect risk transfer and thus the competition at procurement stage. **Standardized PPP contracts** can help in this direction, ensuring transparency and an equal level playing field at bidding stage. The Indian program provides for the creation of a standardised framework of documents to improve transparency, certainty of rules, and thus to boost competition during the implementation of public procurements.

A last though not the least important consideration: we have focused on concession type PPPs rather than on **institutionalized PPP contracts**. However, there are a number mixed ownership concession contracts that we have observed in Europe. Their existence maybe explained by the difficulty of the public sector to attract sufficient private funding to cover the infrastructure costs; but their very existence undermines the possibility that renegotiation will cease to be so widespread. For competition to manifest its full potential, firms should be allowed not only to make high profit when circumstances materialize and their effort is rewarded, but also be allowed to fail. Mixed ownership will certainly create a conflict of interest that can hardly be compatible with development of a competitive market for highway PPPs.

5. Concluding Remarks

Public Private Partnerships for building and managing highways have the potential to deliver higher quality and more cost-effective highway infrastructures. Bundling of construction and operation in one single contract, coupled with an appropriate risk allocation, induces the contractor to internalize the externalities that exist across the stages of the infrastructure and service provision. This provides the contractor with extra-contractual incentives to invest in better quality infrastructures and reduce whole-life costing.

But strong institutions are required to ensure that what is specified ex ante in the contract and agreed at procurement stage is then implemented ex post. Certainty of contract terms and absence of political interference in regulatory matters are a necessary condition for this to occur. A performing competitive market for highways PPPs cannot be developed unless there is easiness of entry and of exist. The temptations of governments to bail out failing concessionaires and renegotiate contract terms or to expropriate the firm of its investments are all together incompatible with any notion of PPP market. The only way PPPs can manifest their potential for delivering more cost effective and quality enhancing infrastructures and services is through an appropriate allocation of risks. Whilst this is true for all PPPs, it is particularly important for highways PPPs, given their high capital investment and long contract duration.

In this paper we have discussed international practice on procurement and contract/regulatory design of highway PPPs, analyzing the economic rationale of alternative tariffs regulation, demand risk allocation, and procurement design. We have highlighted the numerous trade-offs that emerge under PPP provision, and provided a number of suggestions as to how to best combine often contrasting objectives. A number of choices however ultimately require a quantitative impact assessment.

In fact, the variety of practices that we have observed in highway PPPs procurement and contract design suggests that it is now urgent to quantify their impact, and empirically estimate the *pros* and *cons* of the various procurement and regulatory alternatives. It is somewhat surprising how little best-practice information is currently available, let alone procurement or performance data.

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