Analysing Traffic Demand Risk in Road Concessions

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Abstract

In spite of many decades of experiences in privately financed, built and operated toll road projects around the world one key challenge still remains for the stakeholders: managing traffic demand risk. It is supposed to be one of the most critical factors with respect to the overall success of the project. Forecasts of traffic volume and achievable revenues represent the basis of the project's economical and financial structure. Their reliability is crucial for its success or failure. Most risks occurring in BOT (build, operate, transfer) projects can be clearly allocated to one of the project's stakeholders, as they are supposed to have control over causes and effects and are able to manage them efficiently. While this is available for the majority of risks in BOT road projects, the allocation of traffic demand risk has to be considered very thoroughly. None of the stakeholders has complete control over this risk because a substantial part of the factors influencing traffic demand risk are of a systematic nature. Therefore an inappropriate allocation can lead to inefficient solutions consuming the economic advantages of this procurement method. To understand the complexity of traffic demand risk better, this paper will look at the different factors influencing traffic demand and assesses the level of uncertainty attached to them. To achieve a substantial understanding of this field, expert interviews have been conducted. This will lead to a scheme of practical relevance used to produce a project specific risk profile, since the level of uncertainty varies within the framework condition of the project (e.g. greenfield or brownfield project, economic volatility). In the next step determinants for efficient risk allocation of traffic demand risk will be identified. Among them are control over certain influences, costs of risk bearing and choice of risk allocation instruments. Along these determinants an approach of how to deal with the complexity of traffic demand and how to allocate it efficiently will be developed. It will be shown that knowing about the nature of traffic demand risk, about economic characteristics of allocation instruments as well as of potential risk bearers in road concession can enhance the projects overall efficiency.

Keywords: BOT projects, road concessions, risk allocation, traffic demand risk

1. Relevance and problems of traffic demand risk

1.1 Private engagement in the provision of road infrastructure

Considerable meaning has to be attached to the location factor of road infrastructure in an economy. However, worldwide it can be observed that the gap between demand and the public financial scope for the provision of infrastructure - to meet the high demand - is constantly growing. Hereby, demand comprises several measures starting from newly built roads to extensions and refurbishment. The lack of public budgets requires the postponement of costs to the future as well as to user finance (Boede (2004), p. 4). It is the dictate of lacking financial resources ruling over the sector (Spiegl (2002), p. 41).

In industrial nations it is more about modernisation and adjustment of the already well developed road network to meet the current demand, in less developed countries the focus is set on the provision of basic facilities (Alfen et al. (2006), p. 40). To provide urgently required infrastructure while being able to realise efficiency advantages expected with private engagement at the same time, the state turns to the private sector.

Therefore, it can be considered a logical development that the private sector's role becomes more important for an efficient provision of major road infrastructure. The volume of private investments and engagement in major road infrastructure and the number of projects with functional privatisation have increased steadily at an international level during the last decades. The worldwide total investment of privately financed and operated toll roads was estimated to be approximately €45bn from 1999 to 2009. This corresponds to approximately 150 to 200 projects with a respective project volume of $200 to 250mn. (Hochtief (2004)). These figures clearly emphasise that there exists a considerable market potential and it can be assumed that in the future continuous optimisation will be necessary and reasonable.

1.2 Relevance of traffic demand risk

Given this overarching mandate it is the state's duty to provide adequate infrastructure for the sake of welfare. The delegation of formerly state tasks to the private sector, for example BOT projects, creates new interfaces. Solutions have to be developed to set up the best possible arrangement of this partnership in order to realise expected economic advantages. Especially the long duration of the contractual relationship, being one of the typical characteristics for public private partnerships, requires a clear and at the same time flexible set of rules considering the high specificity and complexity of the contract's subject matter.

In this context an essential issue represents the question for the allocation of risks, the issue being - which project partner takes on which risks and at which phase during the project. Unanimously, a fair and optimal risk transfer is required among the project partners in literature (Hauptverband der

Deutschen Bauindustrie (1999), p. 33; Vassallo (2006), p. 360). In this, an optimal transfer implies the most efficient solution to the risk allocation. The principle for efficient risk allocation postulates that risks should be allocated to the party best able to influence a risk. Following this, the lowest cost of risk bearing will be generated (Fishbein/ Babbar (1996), p. 10).

This principle is applicable to many risks in road infrastructure projects. However, a key risk remains very unpredictable and thus uncontrollable - traffic demand risk. It is often referred to as being the most critical risk for a BOT project's economic success (Fishbein/Babbar (1996), p. 12; Thomas et al. (2006), p. 411; Singh/Kalidindi (2006), p. 605, p. 612; Beckers/Miksch (2002) p. 14; Beckers (2005), p. 109). This statement is justified and supported by studies analysing the accuracy and reliability of traffic forecasts. Flyvbjerg et al. (2006) have shown for toll road projects that the risk is subject to a high degree of uncertainty. In this analysis 210 BOT road projects from 14 countries with an investment volume of US$58bn were taken into account (also citing this source: JTRC/ITF (2007), p. 133). Up to 50% of the projects examined show deviations of plus or minus 20% of the forecasted traffic after the start-up phase. 25% of the projects even presented deviations of more than 40%, plus or minus, of the forecasted figures.

Other authors come to similar results: In half the projects surveyed by Bain/Platagie (2004) the standard deviations were on average 0.20-0.30 in the first year of operation. 87 projects were examined. Further studies with similar results were conducted again by Flyvbjerg et al. (2005) who examined 183 projects and Vassallo (2006) who studied 18 projects.

In concession projects in Mexico, an average of only 68% of the state licensor's projected traffic volume could be achieved. In only five out of 32 projects, the forecasts had been exceeded, and half of the 32 projects did not even approach 50% of the forecasted demand. Similar figures were observed on the M1 project in Hungary. Even more striking developments were seen with the Dulles Greenway project in the U.S., in which only one third of the projected traffic materialised. Even after a reduction of tolls by 40% the traffic volume increased to only two thirds of the forecast values (Estache et al. (2000), p. 5). However, not only significant shortfalls are reported internationally, but they do obtain much more attention in literature because of their critical importance for a concession project.

The data discloses the extent of risk to which risk bearers are exposed to. This is of special relevance for the concessionaire in the event that the volume of traffic risk is fully transferred to him and his revenue is linked to traffic volume. This is a critical factor when the level of uncertainty connected with the forecast traffic demand is assumed to be high. This is because all investments by the concessionaire are of highly irreversible nature and unreliable traffic forecasts form the basis for the economic structure of the concession project. If toll payments by users are the only source of income for the concessionaire during the operation phase, the special relevance of an accurate forecast in terms of amount and time component becomes clear. So the management of traffic demand risk in the road concession models represents one of the biggest challenges in the successful implementation of public-privately provided highway infrastructure.

1.3 Problems arising from traffic demand risk

As mentioned before, a problem under these circumstances represents the fact that the economic existence of a private concessionaire depends on the forecast's accuracy especially in the case when his payments are linked to traffic. While the majority of influences on different types of risks are controllable by one or the other party, traffic demand strongly depends on macroeconomic developments such as the development of the economy, the general user acceptance or intermodal competition. This reduces the concessionaire's influence to a minimum. Moreover, if the concessions duration as well as the amount of toll tariff to be levied is fixed by the regulating entity refinancing his investment becomes a kind of random match. However, economic failure will lead to a loss of all efficiency potential expected with private provision. In the end road users and tax payers might have to pay the bill.

In addition, it has been observed that the uncertainty about future development of traffic can result in one or the other party seeking their individual advantages. This can lead to strategic bids and realisation of white elephants (economically not viable projects), both going along with a loss of welfare. Depending on the design of the procurement process, the bidder has the opportunity for optimistic forecasts allowing him to pretend more efficiency in his bid than actually realistic. If a bidder with a strategic bid wins the concession, the overall efficiency of the project is likely to suffer.

On an international level different approaches to allocate traffic demand risk have been developed. Approaches range from full risk bearing by the private sector to large state guarantees, for example in terms of minimum traffic revenue. In addition, there are also models in which the remuneration is made independently from traffic demand. Similarly, other approaches exist in which road users will be obliged to be risk bearers. The continuous concern to develop instruments for the allocation of traffic demand risk to several parties, without eliminating economic incentives and achieving an efficient allocation mirrors the complexity of the problem.

2. Characterising traffic demand risk

Traffic demand risk represents one of the most critical risks on toll road project's success (Fishbein/Babbar (1996), p. 12; Estache et al. (2000), p. 19; Thomas et al. (2006), p. 411; Singh /Kalidindi (2006), p. 605 / p. 612; Beckers/Miksch (2002), p. 14; Beckers (2005), p. 109 / p. 136; World Bank (2002); Hauptverband der Deutschen Bauindustrie (1999), p. 29, Gomez-Lobo/Hinojosa (2000): Broad Roads, S. 27). This chapter will take a closer look at the characteristics of traffic demand risk as well as traffic and revenue forecasts as tools of risk reduction. Later, an in-depth analysis of the various factors influencing traffic will be conducted to lay down the foundation for efficient allocation of traffic volume risk and to present the complexity of the problem, transparently.

2.1 Features of traffic demand risk

According to the definitions of degrees of uncertainty (see Tegner (2003), p. 28f; JTRC/ITF (2007), p. 125) traffic demand risk can be classified as indistinctness. This characterises a condition that certain statements can be made neither about the date of an event nor about the likelihood of occurrence nor the possible extent.

Traffic demand risk incorporates many influences, that are partly systematic and partly specific in nature. This is because it is subject to the general economy on the one hand and to sector-specific conditions on the other hand.

Due to the uniqueness of each road project and the lack of a collective of identical activities under constant conditions, traffic demand risk can be classified as a subjective risk with subjective probability of occurrence. Every statement about probabilities is based on the analysed data and extrapolated past experience.

2.2 Traffic and revenue forecasts

In concession projects traffic and revenue forecasts represent the method of choice to produce insights into the economic feasibility of a project. They have the status of a market analysis (Walther (2001), p. 1). They form the essential foundation for the economic structure of the project and represent a risk reduction strategy from a risk management's perspective (Hauptverband der Deutschen Bauindustrie (1999), p. 29).

In particular, the high complexity of real traffic requires that the input data and traffic models are condensed to the essentials. In transport models relationships of causes and effect are taken into account under various conditions and activities that arise from the demand of the sector's stakeholders and are depicted as realistically as possible. Traffic models are used on the one hand as ex-post analyses to explain certain developments that have taken place. On the other hand they are used for ex-ante analyses and therefore forecasting purposes. For the forecasts' accuracy the robustness of the models and the input data key are the most important criterions (Eckey/Stock (2000), p. 176).

To reduce the traffic demand and revenue risks, forecasts are prepared by the state grantor and often also by the bidding consortia. Preparation of forecasts by different parties is due to the high relevance of the prediction for the individual party. Moreover, an exclusive relationship to a traffic consultant conducting the forecast is of high relevance. The bidders have to rely on the forecast's robustness in terms of the projected traffic volume and the willingness of users to pay a certain toll, before they use an alternative route (Hauptverband der Deutschen Bauindustrie (1999), p. 29).

Of particular relevance is the long duration of the concession contract period and therefore also the period of the forecast which can comprise several years to decades. In addition to the risk of methodological errors, overly optimistic assumptions are common to both the public and the bidding consortia, they are one of the main reasons for variances between the forecasts and real traffic in the

course of the project. This *optimism bias* can be found more frequently in toll road projects than one would expect (Estache et al. (2000), p. 19).

To sum up, the causes for discrepancies between traffic and revenue forecasts and the actual performance can be described as follows:

- limited rationality of the stakeholder, as they are naturally not able to foresee future developments;
- high complexity and interdependencies of the influences on traffic demand;
- incomplete data to be used for the forecasts;
- general error in the forecast;
- optimism bias, i.e. the (human) tendency to overestimate positive development and to underestimate negative development (e.g. overestimation of economic and population growth, demand during ramp-up phase and operation phase, underestimation of the influence of competing modes etc.) (Mackie/Preston (1998), p. 5);
- opportunism by seeking self-interest with the help of cunning and guile;
- negligence and lack of care in the preparation of forecasts.

Considering the great relevance of forecasts in concession projects it becomes clear that the first five of these causes show systematic characteristics and that there is little chance of eliminating them. The possibility to opportunistically exploit their individual scope of action, however, is related to the contractual structure of the concession. The same applies for incentives, to prepare forecasts in their own interest as carefully as possible.

2.3 Influences on traffic demand risk

Many investment decisions depend on the existence of an efficient transport sector. In turn economic developments influence the transport sector's development, so that one can speak of interdependency. In the following, factors will be identified that have an effect on fluctuation in demand and have therefore to be considered as part of traffic demand risk. These factors can be assigned to the cost and the revenue side of a concession project.

- **Traffic volume risk on the revenue side:** The requirement for any revenue is the existence of physical traffic on the tolled road. The uncertainty attached to the future development of traffic is called traffic demand risk. It is mainly characterised by the number of road users. In case of different pricing systems for different types of vehicles also the composition of users is of relevance. Economic, socio-economic and political factors can be identified as major

influences on the traffic demand risk on the revenue side. Moreover, the availability of the road and the user acceptance play important roles.

- **Traffic demand risk on the cost side:** On the cost side the so-called indirect traffic demand risk is of importance, since in particular heavy vehicles impact maintenance costs due to the high wear and tear of the road. [1]
- **Toll collection risks on revenue side:** In addition, toll collection itself is subject to different types of risks. One can therefore speak of toll collection risks arising from uncertainty about the actual collectable amount of toll. The influences on these revenues are of a legal and technical nature: the legal basis for toll collection, the reliability of electronic toll collection technology, and the enforcement of toll collection and the debt collection. The following figure illustrates the correlations described above.

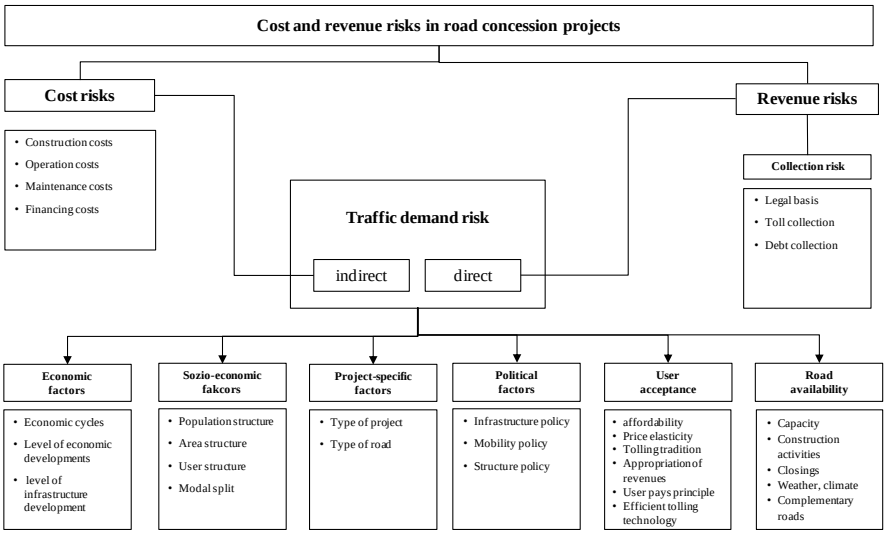

Figure 1: Influences on cost and revenue risks in road concession projects (own)

The large number of influencing factors in particular on the revenue side supports the hypothesis that dealing with traffic demand risk represents a challenge to all project stakeholders. It therefore seems reasonable to prioritise the influences. This enables the participants to find out which factors require special attention in the forecast. This in turn depends on the level of uncertainty since a factor with a high level of uncertainty should be looked at more carefully when being forecasted. Table 1 summarises the author's considerations about specific levels of uncertainty assumed with influences on traffic demand in forecasts. The justifications for the assumed uncertainty levels are listed in the last column of the table.

[1] While heavy good vehicle traffic causes high wear and tear to the road, passenger cars do not increase maintenance costs to a high extent. (Beckers (2005), p. 110)

Influencing factors on traffic demand	Level of uncertainty in forecast	Comment on reason for assessment
Economic factors		
• in industrial nations	medium	• economic cycles are not steady • special effects and structural breaks unpredictable with respect to timing and impact • less fluctuation from the average in developed countries due to stabilizing economic systems • higher economic volatility in less developed countries
• in less developed countries	high	
Socio-economic factors		
• in industrial nations	medium	• data base critical to robustness of forecast • more substantial data base in economically developed countries (higher density of data, longer retention periods)
• in less developed countries	high	
Project specific factors		
• greenfield projects	high	• lack of experience on traffic demand development on greenfield projects • revenues in greenfield projects generated further in the future
• brownfield projects	high	
Political factors		
• in industrial nations	high	• high probability of political risk due to long project duration • impact on specific project hardly to be estimated
• in less developed countries	high	
User acceptance		
• countries with tolling tradition	medium	• habituation effect results in higher acceptance, higher willingness to pay respectively lower price elasticity of demand
• countries without tolling tradition	high	
Availability of road		
(general)	medium	• danger of limiting the availability of the trail through political lobbying, local conditions, user behavior

Table 1: Level of uncertainty assumed with influences on traffic demand in forecasts (own)

This summary shows that none of the factors examined can be forecasted with a low level of uncertainty but are all associated with medium to high levels of uncertainty. The table can provide an early indication of the total level of uncertainty connected with forecasts of traffic demand in toll road projects.

2.4 Project specific risk profiles

The findings of this analysis can now be applied to concrete projects. By way of example the specific risk profile of two fictitious projects will be developed. The illustration is supposed to raise awareness to which factors special attention has to be paid to, since they are associated with a high level of uncertainty. In the example, the different priorities of each project can be indicated easily: The factors associated with a high level of uncertainty in their prediction can be found in the top area of the figure. Therefore, they should be taken into account very carefully in the forecast.

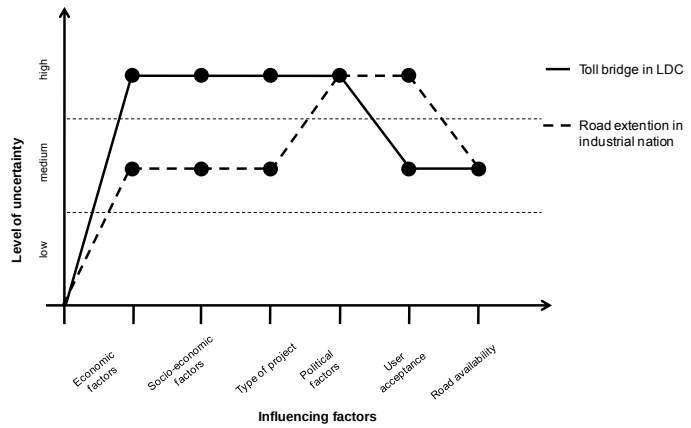

Figure 2: Project specific risk profiles (own)

3. Efficiency in the allocation of traffic demand risk

3.1 Principles of efficient risk allocation

After having analysed the influences on traffic demand, their uncertainties and relevance for road concessions, the next step is the focus on the allocation of traffic demand risk. To find a realistic and efficient allocation of risk that contributes to the overall efficiency of the project and increase its value, it is necessary to observe certain principles of allocation:
The maxim for an efficient risk allocation, as it is often referred to in literature, requires that risks are transferred to the partner best able to control the risk (Meyer-Hofmann et al. (2005), p. 121; Kerf (1998), p. 42; ADB (2000), p.101; World Bank (2002); Kerali (1999), p. 7; Partnership Victoria (2001), p. 20; Irwin (2007), p. 54/57f; Estache et al. (2000), p. 16; Irwin et al. (1999), p. 234).

Besides this main principle, more statements of efficient risk allocation can be found:

- *Divide and manage* (Irwin (2007), p. 54) risks.
- In case that none of the parties are able to control the causes of risk, it should be borne by the party with the lowest risk bearing costs (Irwin (2007), p. 6; Kerf (1998), p. 42).
- Risks should be borne by the stakeholder, who has the potential benefits from the realisation of the project (Bergmann et al. (1990), p. 5). This principle meets the requirement for a fair allocation of risk (Hauptverband der Deutschen Bauindustrie (1999), p. 33).

- That partner who can diversify the risks should bear it (Kerf (1998), p. 42). Hereby, hedging respectively diversification means to reduce total risk by variation of oppositely correlating single risks. Risks and chances balance each other in the risk portfolio. (Gabler (1997), p. 1766f).
- The allocation of risk should always be accompanied with the establishment of incentives structures (World Bank (2002)). The objective is to create incentives for the risk bearing party to reduce risk to the utmost (Kerf (1998), p. 42).
- Due to long-term contracts the risks allocation should be understood as flexible position to allow for renegotiation in case of major changes in the project. (World Bank (2002)).

In practice, difficulties to implement the guidelines of risk allocation in a project often occur for several reasons (JTRC/ITF (2007), p. 128; Kerf (1998), p. 42). Often it cannot be uniquely determined which party has the most control over the cause or effect of each risk. Moreover, out of all the factors influencing traffic demand none of them has significant influence, and therefore no conclusion can be drawn to which potential risk bearer the risk should be clearly assigned to (Vassallo/Sánchez-Soliña (2007), p. 11). The question for allocation becomes even more complex due to the large number of influencing factors on traffic demand, their interdependencies and the different causes of the risk.

3.2 Development of the analytical framework

To develop an approach for efficient allocation of traffic demand risk a framework was set up containing criteria to assess efficiency. Two main areas can be identified, they have to be taken into account when assessing efficiency of risk allocation: First, there are the characteristics of the potential risk bearers, namely the public authority, the private concessionaire and the road users. The choice of different risk allocation instruments decides if traffic demand risk remains with the public authority, is transferred to the concessionaire or assigned to the road users, either partly or in total. In the analysis the characteristics of the potential risk bearers is examined with respect to the following principles of efficient risk allocation:

- Which potential risk bearer has control over which influences of traffic demand?
- Which potential risk bearer benefits individually from the realisation of the toll road project?
- What costs of risk bearing result from the different risk bearers, if uncontrollable risk is transferred to them?

The second scope of analysis is represented by the characteristics of the different risk allocation instruments applied in road concession projects on an international level. Internationally, a wide range of instruments for allocation of traffic demand risk is available. Main categories of instruments are, e.g. state subsidies and grants, guarantees, user-based payment mechanisms and performance-based payment mechanisms. The following principles of efficient risk allocation were applied to assess the efficiency of risk allocation mechanisms:

- Does the particular instrument allow for risk-sharing among the parties?
- What incentive structures are established by the design of property rights? Do they enable exploitation of individual scope of action that goes along with a loss of welfare?
    - *prior to contract closing:* are there incentives for opportunistic and less careful forecasts, which can lead to strategic bidding and thus support implementation of projects that are not economically viable, so called *white elephants*?
    - *after contract closing:* are there incentives for less economic provision of road infrastructure, for exploitation of scope of action, for renegotiations and incentives to influence traffic demand as far as possible.
- What transaction costs result from the application of the instrument?
- Do principal-agent problems occur? Do they generate agency-costs?

The figure below illustrates the analytical framework for efficiency assessment.

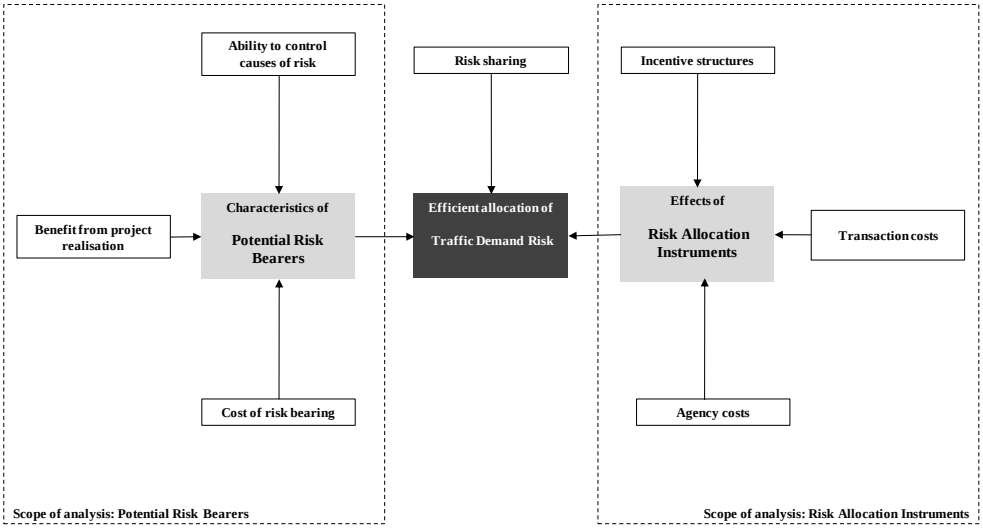

Figure 3: Framework for efficiency assessment (own)

3.3 Results of analysis

According to this framework a substantial analysis has been conducted by the author, but would be to extensive to be displayed here. Therefore, only the most important results are presented in the following.

It appeared that in principle, for economic reasons, a **risk-sharing** between the **potential risk bearers** represents a requirement for efficient risk allocation. Reasons can be found in the characteristics of the road as good (e.g. high sunk costs, high specificity and heterogeneous groups of uses), the fixed duration of most concession contracts and the need to transfer risk for establishment of incentive structures.

In the next step each influence on traffic demand was scrutinised for **controllability** by the potential risk bearers. It turned out that most influences on road availability can be controlled by the concessionaire and should therefore be borne by him. With respect to the users representing a risk for road availability they too should also be considered as risk bearers.

Political influences on traffic demand are controlled by the public authority. However, they need to be distinguished between project-specific and systematic influences. In the case that project-specific political risks (e.g. speed limits, construction due to changes in quality and safety standards) occur the concessionaire should be compensated for the losses. In the case of political risks which have an impact on the whole system (e.g. changes in taxes concerning the transport sector) a case-to-case consideration is needed. The table below summarises the extent of each parties' control over the different influencing factors of traffic demand.

Table 2: Control over influencing factors on traffic demand (own)

	Public authority	Concessionaire	Users
Economic factors	+	o	o
Socio-economic factors	+	o	o
Project specific factors	+	o	o
Political factors	++	o	o
User acceptance	+	+	o
Road availability	+	++	+

- Control over political factors-> project specific political risks remain with the public authority
- Case-to-case decisions with systematic political risks

- Control over road availability -> transferred to concessionaire

++ substantial control / + little control / o no control

Afterwards, it was found that the three potential groups of risk bearers, state, concessionaire and user, have individual **benefits** from the implementation of a road project, and should, in accordance with the principles for fair allocation, therefore be considered as risk bearers for the remaining systematic parts of traffic demand risk.

The next aspect in the analysis looked at the **cost of risk bearing** resulting from the individual risk bearer groups. The main point here was that all parties incur costs for risk bearing. This finding was in contrast to the frequently cited argument that the state can take risks at no or at least lower cost than the private sector. This assumption was disproved. Also the road users costs of risk bearing was identified. Thus, with respect to cost of risk bearing, no clear statement could be made to which party causes the lowest cost and should therefore bear the remaining traffic demand risk.

The next step in the analysis was to look at the effects of **risk allocation instruments** on the overall efficiency of a road concession project. A selection of internationally applied risk allocation instruments was introduced, the way in which they allocate risk was explained and their characteristics were evaluated by their **incentive structures**, their associated **transaction costs** and

their **agency costs** originating from principal-agent problems. The qualitative results were transferred to a semi-quantitative assessment for easier comparison. It turned out that state grants and guarantees always come along with strong incentive problems and high agency costs. Their application should be considered thoroughly and put into relation to the project's benefit for the economy. With user-based payment mechanisms too much uncontrollable influences on traffic demand is transferred to the private party, causes high risk premiums and opens up potential for exploitation of scope of action resulting in adverse selection and winner's curse. Performance-based payment mechanisms such as availability payment and active management payments offer the highest overall efficiency. Here the problem of uncertainty in traffic demand development with its negative consequences for the concession agreement does not come into effect and only the risk that can be controlled by the concessionaire is transferred to him. The table below shows half-quantitative assessment of all instruments examined.

Table 3: Effects of risk allocation instruments on efficiency (own)

Risk allocation instruments	Incentive structure	Transaction costs	Agency costs	Total assessment
Initial state grant (ex ante)	- -	+/-	- -	*very negative*
Guarantee of *Economic Balance*	- -	- -	-	*very negative*
Traffic and revenue guarantee (p.a.)	- -	+/-	-	*very negative*
Traffic and revenue guarantie (least present value)	+	-	+	*positive*
Revenue Distribution Mechanism	++	+/-	++	*very positive*
User toll payment	- -	-	-	*very negative*
Shadow toll payments	-	-	-	*negative*
availability / active management payment	++	+/-	+	*very positive*

-- very negative effect - negative effect +/- neutral + positive effect ++ very positive effect

4. Conclusion

Private engagement in the provision of road infrastructure is worldwide required to meet the high demand while public budgets are scarce. Concessions represent a frequently applied arrangement to close this gap. Among other issues in these public private partnerships the allocation of traffic demand risk represents one of the most critical risks. Due to its high level of uncertainty problems of a different nature arise in the phases before and after contract closing. They can lead to loss of total project efficiency and welfare. It was shown in the analysis that to achieve an efficient allocation of this risk is it necessary to look at several components which determine the allocation's efficiency: the factors that influence traffic demand and therefore also traffic demand risk, the characteristics of the potential risk bearers in concession projects, the public authority, the private concessionaire and the road users, and the effects of risk allocation instruments on project efficiency. These three areas were analysed and assessed with regard to allocation of traffic demand risk.

Although there were some findings on more or less efficient approaches one has to bear in mind that there cannot be only one solution to this problem. The project stakeholders always have to consider the concrete framework of the project and to decide about allocation in accordance to it.

Beside all considerations one cannot expect to achieve overall efficiency in a concession project while disregarding the most relevant issue of all: the common willingness for a real partnership between the public and the private side.

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