PRINCIPLES OF THE TOLL ROADS PRICING

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Abstract:

In this paper the authors refer to the method of commercial provision of road infrastructure called BOT (build-operate-transfer) under Public-private partnerships (PPPs) scheme. First we present the investment criteria for transportation PPP projects as well as application of price theory. Then we recognize that the different participants in PPP projects have distinct goals and requirements that must be met in order for them to be able to participate in an effective partnership. The main challenge for the toll road pricing is to determine the economically viable toll rate that takes into consideration the diverse and sometimes conflicting interests of different stakeholders involved in the project. The main objective is to review the theory of economic principles for optimal toll roads pricing and to review the existing approaches to transportation projects appraisal. Then the authors show how to formally derive the condition for toll rate that meets 2 criteria: 1) is socially optimal and 2) covers operator's costs. For this purpose we use II type Tőrnquist function, a member of an Engel family of functions. This function models the relationship between income and consumption of inferior and normal goods. Tőrnquist function is a mathematical representation of the well-known Engel curves. These curves record the relationship between the quantity of goods purchased and total income. They are not necessarily straight lines. The demand for some "luxury" goods may increase proportionally more rapidly than income, whereas the demand for "necessities" may grow proportionally less rapidly than income. The precise shape will depend on the individual's preferences for goods as reflected in the indifference curve map. We deem the highway trip to be a "second necessity good". There is number of economists who apply the Tőrnquist function for microeconomic analysis. The extremely simple form of the Tőrnquist function allows to get the solution in a closed form.

Key words:
PPPs, toll roads, Engel curves, Tőrnquist function

1. Introduction

The development of transportation infrastructure is usually associated with high level of financial investment. The need for finding the sources of financing is obvious for different categories of transportation project investments. Public budgets, however, are under long lasting and severe constraints and demand for public service linked expenditures exceeds resources usually available and allocated to that purpose. Commercial provision of transport infrastructure may effect in revenues for private investors with important public benefits: meeting the social needs together with reducing burden of expenditures on financially constrained government as well as it may increase investment ability of public sector (Roth, 1987). Public-private partnerships (PPPs) between state and private enterprises can be an efficient way to promote transportation infrastructure investments. PPPs have been broadly used in the past three decades to deliver transport capital projects and services around the world. Between 1990 and 2013 1680 PPP contracts were signed within the European Union representing an investment of over EUR 300 billion with transport being the largest sector in value (up to 75% of the overall market value) and therefore setting Europe as the key region of PPP development (Carbonara, Suárez-Alemán and Roumboutsos, 2016). In the United States PPPs are being used for projects involving mainly highway and rail transportation. In developing countries PPP projects have grown steadily since the 1990s. Between 2000 and 2010 17 countries out of the 23 in East Asia and Pacific region implemented 908 privately funded infrastructure projects worth USD 154 billion (Iossa, Martimort, 2015).

PPPs are contractual relationships between the public partner and the private one, aiming at involvement of the private sector in the process of providing public goods (Liberadzki, 2014). PPPs combine wide array of forms in which such cooperation is realized, from simple delivery of services (public goods) in return for the fee, to sophisticated forms of co-financing, building, operating, maintaining and transferring ownership. In many cases the profile and specific character of PPP determines the scope of involvement of the private sector and the role of the partners in the whole undertaking.

In this paper we refer to the basic representative method of PPP known as BOT (Build – Operate – Transfer). In BOT scheme private investor (Sponsor) bears costs of construction and operation on the basis of concession granted by the government (Grantor) whereas the future cash flows generated by that project are the underlying source of the return for the Sponsor. Every BOT project needs to be contractually structured to combine the interests of various parties involved. Usually Sponsors establish a *Special Purpose Vehicle* (SPV) for the implementation of the project. At the end of the concession period concessionaire is required to transfer back infrastructure facility to grantor.

The major participants in BOT structure are: the Grantor (government, municipality, government agency), project Sponsors bringing the share capital into the SPV (concessionaire) and Creditors (usually banks and bond holders). It is important to recognize that the different participants in PPP projects have distinct goals and requirements that must be met in order for them to be able to participate in an effective partnership. While certain goals are complimentary, others are not. For Sponsors, the first requirement for any type of involvement is the potential to derive a reasonable profit. Grantors, being committed to promoting equity and maximizing the well-being of their citizens, are generally willing to allow their private partner make a reasonable profit in exchange for improving service and efficiency. Since pledge over assets of a concessionaire is of no significant value to Creditors, they will put more emphasis on getting control over projects cash flows. It should be borne in mind that Creditors have only limited or no recourse to the Sponsor. This 'project finance'[1] structure of BOT transport projects makes user charges the primary source of debt repayment. To make things worse, as SPV credited is usually highly leveraged, there is little equity to absorb potential losses.

In this trilateral PPP negotiation framework the Sponsor, the Grantor and the Creditor negotiate over the three most important parameters of the BOT

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[1] Project finance is a special model of financing big projects with high capital intensity and risk, in particular the infrastructure ones. This type of financing features high percentage of debt financing (70-80% typically). Repayment takes place using the cash flows generated by the project. The SPV assets secure the loan. There is limited or no recourse to the Sponsors.

deal: toll rate, concession length and level of Grantor's subsidies (Carbonara, Costantino and Pellegrino, 2016), (Iossa, 2015). All of these variables are interrelated and should take into consideration the diverse and sometimes conflicting interests of different stakeholders involved in the project. Private entities base their investment decisions primarily on such parameters as: net present value (NPV) and expected rate of return. Therefore private investor seeks profit-maximizing prices to charge users with. Each private participant in the motorway project has to take into account on the earliest stage of the investment, that such beneficial price determination will be often impossible in practice. The reason for that is public sector basing on 'public' cost – benefit criteria rather than 'private' profit – loss measurements.

The Grantors act with the aim to choose road capacity and the level of toll so as to maximize social welfare. The toll should be set that each driver pays a trip equal to a marginal social cost (Berechman and Pines,1991). Since this result holds regardless of whether capacity is optimized, it demonstrates the optimality of short-run marginal cost pricing. The capacity should be expanded to the point where the reduction in total user costs, the marginal social benefit of capacity, equals the increase in capacity costs, the marginal social cost of capacity (Arnott and Krauss, 2003).

As a general principle, tolls on a largely underused road that equal to marginal costs will not cover average costs and result in loss. The reasons are lumpiness of investment and long initial periods of negative cash-flows. The highway operator incurs capacity costs and receives toll revenues. Under optimal pricing and investment, one may ask a question on what proportion of capacity costs is financed of toll revenues. Toll revenue is insufficient to finance optimal capacity when long average cost is (locally) decreasing. With increasing costs in capacity provision, the revenue raised from the optimal toll exceeds the amount needed to pay for the optimal ca-

pacity – the road is self-financing. An obvious implication is that the magnitude of a government subsidy depends on the degree of returns to scale in capacity provision (Arnott and Krauss, 2003). Berechman and Pines (1991) proposed how to measure scale economies associated with the supply of road capacity. Therefore, it is necessary to explicitly distinguish a socially optimal toll rate from the one that covers operator's costs. In face of budgetary constraints, public authority would rather allow the operator to charge monopolistic[2] prices i.e. higher than socially optimal to cover total average costs. The monopolist maximizes profit when marginal revenue equals marginal cost at the output lower than socially optimal. Monopolistic behavior of the provider reduces the consumer surplus causing two effects: distributional and allocational. Distributional effect means that as a result of establishing price above marginal cost consumer surplus decreases by value equal to a profit of the monopolist. The loss of the consumer surplus is not a reduction of general welfare, but only a transfer of resources from consumer to the producer (service provider) (Nicholson, 1983). However, such transfer means that Pareto criterion does no longer stand and it affects 'just' distribution of goods[3]. Social loss is caused by the second, allocational effect[4]. Provided that extra-profit is still not sufficient to compensate the average cost, rest part of consumer surplus is also transferred to the provider in the form of subsidy, which constitute a cost for tax payers (Liberadzki, 2014)

In order to keep traffic volume at socially optimal level with the price lower than monopolistic and simultaneously avoid the necessity of subsidizing, the Grantor should give right to the private entity to abandon one general rate of toll and to diversify the price depending on the user category. Usually such segregation leads to different prices for the same good in the particular segments of the market. Effective separation of such particular 'submarkets' from each other occurs when consumers can't take advantage of the difference of prices (Hirschleifer, 1984). It seems that toll motorway segment is a good

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[2] One may assume that to some extend natural monopoly situation applies to the road infrastructure, see Roth (1997), Liberadzki (2014).

[3] Given economic situation is optimal in the Pareto sense when resources and production in a given economy are allocated in such manner, that any other allocation, providing additional benefits to some individual would take place at the expense of some part of welfare to someone else – in the analyzed case increase of the producer surplus takes place at the expense of the consumer surplus, so the optimum is not ensured.

[4] It is commonly referred to as the deadweight loss.

example of the market suitable for such segregation. Separation of users depending on the type of the vehicle (whether it is a car, a truck or a bus) is relatively easy and not costly. Toll rates may be varied flexibly (even discontinued) according to hour, day of the week or season. Then the question arises, how to determine price level not necessarily maximizing monopolist's profits being above marginal cost, so that operator would not suffer loss. When income equals costs, in order to achieve effectiveness, the price should not be equal to the marginal costs, but to be in inverse proportion to the price elasticity of demand. It has to be noted, that the profit achieved by the monopolist will be lower than his/ her maximum profit (Wilson, 1980). Two goals are to be achieved – to maximize effectiveness[5] with simultaneous ability of the motorway investment to finance itself. It is however pointed out that such pricing can result in high tonnage vehicles, with highly elastic demand, paying less than cars with much more inelastic demand, which clearly runs counter to common sense of equity (Izquierdo, Vassallo, 2002). Another example is if transit passengers are disproportionally poorer than car users. As such discriminatory pricing ignore equity considerations, the planner may want to take equity considerations into account in pricing. Disregarding such extreme situations, one should assume that in the case of discriminatory pricing, car users may pay proportionally more with respect to the costs which they cause, than trucks and buses, because price elasticity of demand is higher in the second group. In practice the marginal-cost pricing (first-best charging scheme) is inexact due to other constraints than only resources and technology: transaction costs, political constraints (as abovementioned equity considerations) inability to vary tolls continuously over time. The second – best policy minimizing the loss in social surplus due to distortions is more practical. Yang, Xuu and Heydecker (2010) assessed the maximum efficiency loss of a general second-best road pricing scheme due to inexact marginal-cost pricing in comparison with the first-best pricing in general networks.

After all however, it lies also in the Grantor's interest to create commercially feasible investment in relation to other, alternative capital investments. When

toll alone is not sufficient to cover total average costs, in order to attract private financing, the Grantor can directly support the private entity or allow setting the monopolistic prices (i.e. above socially optimal level) with simultaneous regulation of the maximum price level. The public authorities can also set a 'concession period' parameter. The date of concession expiration marks transfer of the highway facilities to the Grantor. If concession period is too short private concessionaire has to charge users with prices above marginal costs to obtain required rate of return in short time and for a given traffic volume. The duration of the concession should result from project's ability to generate sufficient revenues. When Grantor deems tolls to be too high or too low, a concession period may be changed without engaging into fraught negotiations and raising too many disputes between the parties, because receiving the required return by the concessionaire is less dependent on the toll rates.

In this paper the authors show how to formally derive the condition for toll rate that meets 2 criteria: 1) is socially optimal and 2) covers operator's costs. For this purpose we use II type Tőrnquist function, a member of an Engel family of functions. This function models the relationship between income and consumption of inferior and normal goods. Tőrnquist function is a mathematical representation of the well-known Engel curves (Nicolson, 1985; Hirshleifer, 1984). These curves record the relationship between the quantity of goods purchased and total income. They are not necessarily straight lines. The demand for some "luxury" goods may increase proportionally more rapidly than income, whereas the demand for "necessities" may grow proportionally less rapidly than income. The precise shape will depend on the individual's preferences for goods as reflected in the indifference curve map (Nicholson, 1985). There is number of economists who apply the Tőrnquist function for microeconomic analysis (Arefjevs, 2013; Kubicova L., Lusnakova Z., 2010, Nicolae et al., 2010). The extremely simple form of the Tőrnquist function allows to get the solution in a closed form.

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[5] In fact, lost value of consumer surplus is higher than the value of producer surplus increase, so the net effect is social loss – see Wilson (1980).

2. The existing approaches to transportation projects' evaluation

Based on above mentioned considerations one may conclude that transportation projects may be appraised quite differently by public authorities and by private investors, for the goals of involvement of the governments are different from those of private investors. On this basis project financial analysis, conducted by the private entity is distinguished from project economic analysis, carried out by the government. Project financial analysis takes into account, primarily, the cash flows generated by the investment to the owners. Private entrepreneur does not however consider the externalities, which are costs and benefits that are not cash flows and are not either reflected in the accounting records. The economic merit of a given project should be evaluated by performing a Cost-Benefit Analysis (CBA) of the project which takes into account i.a. travel cost "savings", "avoided losses" and externalities (like values attributed to air pollution and traffic noise level). On the other hand, the project must have clear and defined revenues that will be sufficient to service principal and interest payments on the project debt over the term of the loans and to provide a return on equity, which is commensurate with development and long term, project risk taken by equity investors. Economic analysis alone is unsuitable to assess the financial viability or bankability of a given project.

Cost Benefit Analysis is the most frequently used evaluation technique for assessing infrastructural investments. In the transport field, it is the basic tool in the majority of countries in Europe and in the rest of the world it is also widely adopted by all the international bodies (Beria, Maltese and Mariotti, 2012). CBA of transportation is firmly based in economic science (Adler, 1987; Liberadzki 2014; Meyer, Straszheim, 1971; Wilson, 1980) and is often used in practice. Greene, Jones and Delucchi (1997) do comprehensive cost estimation, characterize status indicators, performance measures and benefit – cost analysis for assessing U.S. transport (incl. roadway infrastructure). Demir, Huang, Scholts and Van Woensel (2015) review externalities in quantitative terms, and then provide pricing studies of these costs per unit of freight transported by transportation mode. De Rus and Socorro, (2014) consider the existence of a given transport infrastructure and analyze the optimal conditions for investing in a complementary or rival new infrastructure.

A number of official guidelines exist that provide framework for economic evaluation of transport investments. For example, European Commission (EC) defines in its Guide to Cost-Benefit Analysis (2008) objectives of CBA: to appraise the social value of the investment. EC recognizes economic and financial analysis as necessary elements of CBA project appraisal. Economic analysis investigates project's net impact on economic welfare. Externalities are taken into account and given a monetary value. Economic analysis is to prove that project is desirable from a socio-economic point of view. The financial analysis should demonstrate the existence of a funding gap and need for EU assistance to make the project financially viable (European Commission, 2008). Transport oriented CBA usually quantifies the investment plus running cost of a scheme and compares it with direct benefits that usually are represented by time, running costs and environmental cost savings. Recently, CBA can also include wider benefits, i.e. macroeconomic benefits (Beria, Maltese and Mariotti 2012). Future costs and benefits are discounted using a social sicount rate. If present value of benefits (evaluated in monetary terms) clearly exceeds present value of costs, it seems reasonable to presume that society would gain if project were to implemented (Ergas 2009).

It is very important to understand the link between financial and economic viability in toll roads because a distinctive feature of toll roads is that the realization of the economic benefits expected from the investment depends heavily on the financing option chosen. In other words, there are "trade-offs" between the economic and financial viability of a toll road, which often tend to be overlooked. Given project costs, expected traffic and financing structure (interest payments, debt/equity ratio), the level of toll rates that meet debt service and financial returns may cause traffic diversion to an alternative, which can be a highly inefficient outcome in terms of traffic allocation in the corridor. The free-access public road, which is likely to be of less capacity, lower level of service and less well maintained, gets more traffic than it is economically efficient while the newly built toll road is under-used and wasted.

Project financial analysis uses primarily cash flows generated by the investment as the basis for present value of investment calculation as well as debt service cover ratios. Profitability has two important ad-

vantages for the assessment of road projects: 1) investments made on the basis on this criterion can be compared with other revenue – earning investments; 2) such investments can be carried out by the private sector (Roth, 1997).

Application of microeconomic theory to resource allocation in the transportation sector is reflected in two basic principles: First, efficiency in resource allocation: this entails pricing at short-run marginal social cost or, where this is not practicable, pricing as close to short-run marginal cost as practicable. Second, capacity should be expanded to the point where the social benefit from additional capacity equals the social cost (Arnott and Kraus, 2003). An individual's trip price equals the user cost plus any fee he/she is charged for taking the trip, which we term toll.

When comparing the investment criteria 'profitability' and CBA it is important to realize that profitability is concerned only with the profits accruing to those who provide the service being assessed. CBA, on the other hand, attempts to bring into comparison not only the benefits to the producers, but also the benefits to be enjoyed by those who would gain from the proposed projects.

3. The model
3.1. Introduction

As already mentioned in the introductory notes, the Engel curve relates consumption quantity to income. We assume that the highway trip is a normal good, because the quantity purchased increases as income increases. The normal goods are divided into "necessity" and "luxury" ones. The normal goods are "necessity" in the sense that the fraction of expenditures devoted to them declines as income increases. On the other hand, the good is luxury if more than the total increase in income is being devoted to consumption of such a good. In the view of the above, highway trip should be deemed to be necessity good or to be more precise a "second necessity good" (see Goryl et al. 2000, or Gruszczyński, Podgórska 1996). Consumer's demand for highway is proportionally lower than his/her income increase. Then, at some point the consumption stagnates. To describe this relation one may use an Engel function, which shows how expenditure varies with household income. From the huge family of possible choices we select the so

called type II (T_2) Tőrnquist function which illustrates the relation between demand for second necessity goods (Y) and consumers' incomes (X).

$$Y = T_2(X) = \frac{\alpha(X - \gamma)}{X + \beta}, \quad \alpha, \beta, \gamma > 0.$$

The demand rises as income increases and stagnates at level equal to α, i.e. the graph of T_2 has a horizontal *asymptote*. The demand falls to zero when the income decreases and finally lapses for the income lower than limiting level γ (see Figure 1).
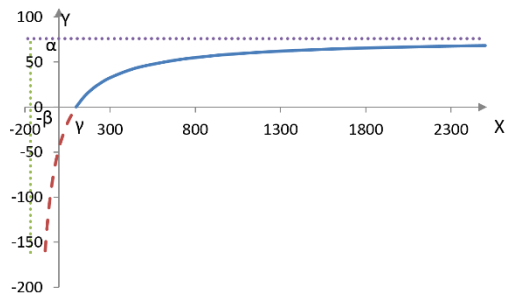

Fig. 1. Type II Tőrnquist function

We assume in the following that demand for highway is measured by a number of unit road sections passed during a given time interval (ex. one year). The total demand in given time interval can be expressed as follows:

$$N = N(P) = T_2\left(\frac{D}{P}\right) = \frac{\alpha(D - \gamma P)}{D + \beta P}, \quad \alpha, \beta, \gamma > 0,$$

where D stands for average annual income of road user and P denotes toll level per unit highway section. Notice, that if the price tends to 0 then demand rises to saturation level $\alpha = N(0)$. When the price equals D/γ than there is no demand.

$$N\left(\frac{D}{\gamma}\right) = 0.$$

3.2. Cost- and income- function
We assume that the cost function is linear.

$$K = K(N) = K_0 + K_1 N,$$

where K_0 denotes fixed costs, and $K_1 N$ number of trips related costs. For the investment to be profitable the inequation $K_1 < D/\gamma$ must hold. For prices between K_1 and D/γ the profit can be expressed as follows:

$$
\begin{aligned}
G(P) &= PN - K = PN(P) - K_0 - K_1 N(P) \\
&= \frac{\alpha(D - \gamma P)}{D + \beta P} \cdot (P - K_1) - K_0.
\end{aligned}
\tag{1}
$$

3.3. Efficient price

We call the price P 'socially efficient', if:
i.   it is profit making, $G(P) > 0$
ii. is lower than other prices at which the profit is the same:

$$
\forall P_1 \quad G(P_1) = G(P) \Rightarrow P_1 \geq P.
$$

Let's denote maximum profit as G_{Max} and the lowest possible price, where it is attained, as P_{Max}. Notice, that the set of socially efficient prices is non-empty only when $G_{Max} > 0$. If this condition holds, then we denote the lowest price at which the firm is still profit making as P_0

$$
P_0 = \min\{P : G(P) = 0\}.
$$

Theorem 1 *For the profit function G presented in the formula (1)*

$$
G_{Max} =
$$
$$
\alpha \frac{D\beta + \beta\gamma + 2D\gamma - 2\sqrt{D\gamma(\beta K_1 + D)(\beta + \gamma)}}{\beta^2} - K_0.
$$

If $G_{Max} > 0$ then the set of socially efficient prices is an interval

$$
(P_0, P_{Max}],
$$

where

$$
P_0 = \frac{D\alpha + \gamma\alpha K_1 - \beta K_0}{2\gamma\alpha} -
$$
$$
\frac{\sqrt{\beta^2 K_0^2 - 2(D\beta + \beta\gamma K_1 + 2D\gamma)\alpha K_0 + (D + \gamma K_1)^2}}{2\gamma\alpha},
$$

$$
P_{Max} = \frac{-D\gamma + \sqrt{D\gamma(\beta K_1 + D)(\beta + \gamma)}}{\beta\gamma}.
$$

Proof.

Notice, that after substitution

$$
b = \frac{\beta K_1}{D}, \; c = \frac{\gamma K_1}{D}, \; k = \frac{K_0}{\alpha K_1},
$$

we get

$$
G(tK_1) = \alpha K_1(f(t) - k),
$$

where f is a rational function studied in the Appendix below. Hence

$$
G_{Max} = \alpha K_1 f_{Max} - K_0, \; P_{Max} = K_1 t_{Max}, \; P_0 = K_1 t_k.
$$

To conclude the proof one needs to "re-parametrize" results from Lemma 1.

3.4. Appendix: A study of a certain rational function

We consider a rational function given by:

$$
f : [-b, \infty] \to \mathbf{R}, \; f(t) = \frac{(1 - ct)(t - 1)}{1 + bt}, \; 0 < c < 1, \; b > 0.
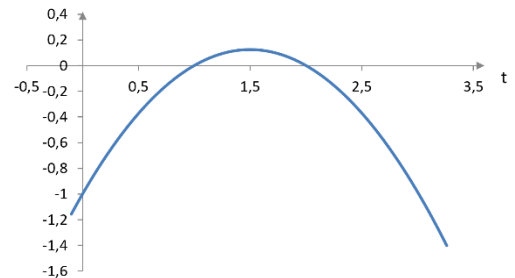$$

Figure 2: Graph of the function $f(t)$ for $b = 0,005$ and $c = 0,5$

Lemma 1
1) The function f has a global maximum at a point

$$
t_{Max} = \frac{-c + \sqrt{c(b+1)(b+c)}}{bc},
$$

which is equal to

$$f_{Max} = f\left(t_{Max}\right) = \frac{b + bc + 2c - 2\sqrt{c(b+1)(b+c)}}{b^2}.$$

Furthermore, t_{Max} belongs to an interval $\left(1, \frac{1}{c}\right)$, and f_{Max} is positive.

2) In the interval (-b, t_{Max}] the function f is strictly increasing and in the half-line [t_{Max}, ∞) strictly decreasing.

3) For every k from the interval [0, f_{Max}], a point

$$t_k = \frac{1 + c - bk - \sqrt{b^2k^2 - 2(b+bc+2c)k + (1-c)^2}}{2c}$$

belongs to the interval (1, t_{Max}] and $f(t_k) = k$.

Proof.
Note, that $f(1) = f(1/c) = 0$ and these are the only points at which f vanishes.
Moreover

$$\lim_{t \to -b^+} f(t) = \lim_{t \to +\infty} f(t) = -\infty.$$

In the interval $\left(1, \frac{1}{c}\right)$ the function f is positive and in the interval (-b,1) and the half-line $\left(\frac{1}{c}, \infty\right)$ negative. Hence the maximum of f is positive, and t_{Max} belongs to the interval $\left(1, \frac{1}{c}\right)$. To begin with, let us consider a quadratic equation with parameters a, b, k

$$(1-cx)(x-1) = k(1+bx),$$
$$0 < c < 1, \quad b > 0, \quad k \in \mathbf{R}. \tag{2}$$

Discriminant equals

$$\Delta = (1 + c - bk)^2 - 4c(1+k) =$$
$$b^2k^2 - 2(b+bc+2c)k + (1-c)^2.$$

It vanishes at two points k_+ i k_-,

$$k_{\pm} = \frac{b + bc + 2c \pm 2\sqrt{c(b+1)(b+c)}}{b^2}.$$

The smaller one is equal to the maximum of f function

$$f_{Max} = k_- = \frac{b + bc + 2c - 2\sqrt{c(b+1)(b+c)}}{b^2}.$$

Indeed, for $k < k_-$ equation $f(x) = k$ has two solutions, and for $k = k_-$ one double. It is easy noticeable, this double root is a point of a maximum.

$$t_{Max} = \frac{1 + c - bk_-}{2c} = \frac{-c + \sqrt{c(b+1)(b+c)}}{bc}.$$

To conclude the proof, please notice that for k from (0, f_{Max}) the equation (2) has two solutions. The smaller one belongs to the interval (1, t_{Max}) and equals

$$x_- = \frac{1 + c - bk - \sqrt{\Delta}}{2c} =$$
$$\frac{1 + c - bk - \sqrt{b^2k^2 - 2(b+bc+2c)k + (1-c)^2}}{2c}.$$

Hence $f_k = x_-$ meets conditions form point 3.

4. Conclusions

PPPs offer opportunity to raise additional finance in an environment of budgetary restrictions, make the best use of private sector operational efficiencies to reduce cost and increase quality to the public and the ability to speed up infrastructure development.

When infrastructure is privately funded user charges are the primary source of funding. Apart from this, charging users of infrastructure possesses unique advantage as an instrument for efficient pricing of infrastructure use and for rational resource allocation. However, the various possible objects of any charge scheme can conflict; as for instance do pricing at marginal cost and full cost recovery, or equity for infrastructure users and for users of alternate infrastructure.

The efficient pricing requires prices to equal marginal costs: hence in transportation toll rates should closely reflect or equal marginal cost. Since this result holds regardless of whether capacity is optimized, it demonstrates the optimality of short-run

marginal cost pricing. There is no argument to support the often asserted objective of full recovery of a road cost through tolling. Even when traffic levels are high, such target revenue is seldom achieved over the initial road debt period.

This paper looks into broad consensus between economic and financial (profitability) analysis. This consensus will pave the way for the better preparation of the decision making process in respect of privately funded infrastructural projects. The most important aim is to achieve greater uniformity in the economic assessment of infrastructural projects in order to provide decision makers with a best financial structure possible.

A toll road investment is assessed which does not mean that proposed approach cannot be a reference for transport infrastructure in general.

Acknowledgments

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