



The efficiency of Norwegian road toll companies

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ABSTRACT

This paper analyses the level of efficiency at which road toll companies are operated in Norway. Two alternative methods are applied for this purpose: data envelopment analysis (DEA) and stochastic frontier analysis (SFA). The data comprise a total of 20 toll companies that have been in operation in the period 2003–2008. The findings of the paper are as follows: 1) There is a great potential for efficiency improvement in the sector, irrespective of the method used, but the variation in the efficiency scores is dependent on the method used; 2) there is no evidence of economies of scale, as has been found by other authors, such as Odeck 2008, How efficient and productive are road toll companies? Evidence from Norway, *Transport Policy*, 15, 232–241 and, Amdal, E., Bårdsen, G., Johansen K. and Welde M., 2007. Operating costs in Norwegian toll companies: a panel data analysis. *Transportation*, 34, 681–695. These results suggest that toll companies could generate significant savings by employing industry best practices. Further, decision makers are warned not to be indifferent to the approach used i.e., DEA and SFA, as these may give very different results.

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1. Introduction

Tolls are used as an instrument to finance new road infrastructure throughout the world, and the increasing share of toll financing compared to public finance and the increasing number of companies involved illustrate that the practice of toll financing and -collection has become an industry of its own. Norway provides an example of a country that relies heavily on tolls; currently, more than 40 percent of the country's total annual budget for road construction is paid for by tolls. According to the newly released National Transport Plan for the years 2010 to 2019, this percentage is expected to increase in the future.

Toll financing is organised differently between countries. From pure commercial enterprises responsible for construction, maintenance and finance, through public-private partnerships with varying degrees of risk sharing, to not-for-profit companies established solely with the purpose of providing finance to get roads constructed faster, toll roads are organised in many different ways. What all toll roads have in common, though, is a need to collect tolls from the motorists as efficiently as possible, that is, to run the charging points or toll stations at a minimum of cost and to minimise the disturbance to traffic while tolls are collected. From

a commercial point of view, the costs of collecting tolls, the operating costs, reduce profit margins and increase the payment period of loans. Operating costs are real costs and are also important from a socio-economic point of view; higher operating costs lead to a lower net present value of a toll-financed road. As stated by Amdal et al. (2007), all toll roads should provide a net benefit in terms of a social cost-benefit analysis, generate substantial net revenues and be acceptable to a major proportion of the public. Minimising the operating costs is critical for meeting all three of these criteria.

Data on operating costs in toll companies are rare and often regarded as competition-sensitive information, which is not readily available to researchers. In this context, Norwegian toll financing provides an interesting case. Here, detailed cost data from over 40 toll companies operating in different geographical regions and employing different tolling technologies are available to the authorities annually. This allows us to answer several interesting questions. These are as follows: (1) Do companies operate as efficiently as their peers? (2) Do they progress in their operations? (3) Which factors outside the toll companies' control determine their inefficiency? And finally, but not least: (4) What could be done to improve the efficiency of toll companies? These questions should be of interest to toll companies, authorities and motorists alike. Because tolls are removed as soon as possible once the costs of constructing the road are covered, this means that if toll companies operate efficiently, then tolls can be removed even earlier. Because

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tolls are a cost to road users, their removal will incur benefits to roads user and to society. Studies of elasticities in 20 Norwegian toll projects suggests an average elasticity of -0.56 , meaning that an increase in generalised costs due to tolls by 10% will reduce traffic by 5.6% (Odeck and Bråthen, 2008). Further, gauging the impact of factors that may influence efficiency such as the technology for toll collection may give additional information relevant for improving performance in the toll road industry.

The literature on the efficiency measurement of toll operations is limited, even if tolling is practised widely throughout the world. However, a related issue that has been debated in the transportation literature are the operating costs of tolls; see, for instance, Prud'homme and Bocajero (2005), Mackie (2005) and Raux (2005) regarding the operating costs in the London congestion-charging scheme. The Stockholm congestion-charging system has attracted great attention from researchers since its implementation in 2006. Eliasson (2009) has conducted a cost-benefit analysis of the scheme and have found the operating costs to represent the highest loss to society, but also to be the variable with the largest potential for efficiency improvements. The Italian motorway network is mainly financed by tolls. There, Benfratello et al. (2008) have studied the costs of the motorway concessionaires over the years 1992–2004 and found significant technical progress and sizable economies of density and scale with an L-shaped average cost curve over the range of output. In the Norwegian context, which we relate to in this paper, Welde and Amdal (2006) and Amdal et al. (2007) have investigated the levels of operating cost per vehicle in the Norwegian toll road industry. They applied regression analysis using panel data and found that operating costs varied tremendously from 5% to 40% of gross revenues with the larger toll companies serving larger traffic levels having lower operating costs per vehicle served. With an L-shaped average cost curve and most companies operating at traffic levels below their minimum efficient scale, the authors concluded that there were very important unexploited economies of scale in the industry and that inefficiencies most likely were present. Odeck (2008a,b) extended these studies, but in the context of efficiency and productivity measurement using data envelopment analysis (DEA). He verified the claims by Welde and Amdal (2006) and Amdal et al. (2007) to the extent that there are scale economies in the sector and that there are potentials for efficiency improvements and added that toll companies have in fact improved their productivity over the years studied, possibly as a result of using new technologies for toll collection. The objective of this paper is to contribute further to the debate surrounding the performance of toll companies in Norway. Specifically, this study extends those of Odeck (2008a,b) in two particular directions; it uses newer data and compares two methods to efficiency measurements (DEA and SFA) to determine how the magnitudes of inefficiencies are impacted by the method being used.

The rest of this paper is organised as follows. Section 2 gives a short overview of the tolling industry in Norway. Section 3 assesses the potential for efficiency improvements in light of principal agent theories. Section 4 gives a brief account of the theoretical model to be applied. Section 5 describes the data to be used in the analysis, and Section 6 presents the results. Concluding remarks are given in section 7.

2. The organisational framework of Norwegian tolling

Norwegian toll financing is often described internationally as a success story given that more than 100 projects have been realised using tolls and given that new ones are constantly being proposed. Currently, toll financing of road projects accounts for about 40% of the total road budget and indicates the popularity of this mode of finance. The organisational framework of the Norwegian mode of toll financing has been discussed extensively in

the literature – see, for instance, Odeck and Bråthen (2002), Amdal et al. (2007), Odeck (2008a,b) and Bråthen and Odeck (2009). Therefore, only the main properties of Norwegian toll financing are explained below.

Each toll project is based on an initiative from the local municipality, local authorities or other members of the local community. This initiative is based on a real or perceived need for new roads in the area and will usually result in the founding of a toll company, organised as a limited liability company and non-recourse to the Norwegian Public Roads Administration (NPRA). The toll company acts as an enthusiast and will, often along with local politicians, work to establish political acceptance for the project. Once the road project is realised, the role of the toll company is to operate the toll system, often through the employment of commercial toll road operators, and to administer the toll revenues.

It should be noted that not all construction costs are covered by tolls. Some percentage of the cost, normally 20–50%, is supplemented with government funds. This percentage is proposed by the toll companies, evaluated by the NPRA and may be accepted and sanctioned by the parliament. Factors determining this percentage would include the level of traffic, the total construction costs, and the level of toll fees. There are also instances in which local authorities finance a certain percentage of the construction costs. Briefly summarised, the process by which toll companies come into being is as follows; see Odeck (2008a):

- I. Local authorities represented by the local government, local road authorities and local interest groups (e.g., industrial organisations) foresee that a much-needed road project cannot be realised in the near future within the government budget. Therefore, they propose toll financing.
- II. The proposal for toll financing of the particular project is sent to the NPRA for evaluation of its socio-economic and financial worthiness. The considerations are: (1) an application of toll financing should include the formation of a toll company to cater for the collection of funds, that is, the down payment of the loan taken to fund the project and operation of the toll stations, and (2) the application includes a financial assessment proving that it is possible to repay the loan within 15 years of the start of toll collections. The rates are proposed by the local initiators but must be within an 'acceptable' range suggested by guidelines issued by the NPRA.
- III. Once it is approved by the NPRA, the proposal is forwarded to the Ministry of Transport, which prepares a bill to be tabled in Parliament. Once passed by Parliament, the toll company starts its operations by taking up a loan to begin road construction. Typically, the collection of tolls starts after the road has been built. There have, however, been instances where tolls have been collected in parallel with road construction work.
- IV. Once in operation, toll companies are monitored by the NPRA according to guidelines issued by the Ministry of Transport and Communication. In other words, it is the NPRA that has the task of controlling the companies' accounts to ensure that operations proceed in accordance with the guidelines.

The toll company is organised as a non-profit enterprise and the share owners receive no dividends. The NPRA is responsible for all road construction and maintenance through the use of private road contractors. Local toll companies provide the finance needed to get the roads constructed faster, and national and/or international banks provide loans that normally are guaranteed by local or regional authorities, securing low interest rates. As such, toll companies could be described as special-purpose vehicles

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