1. Introduction

This paper is aimed to ascertain whether the selected transport companies are effective in using their inputs and outputs.

For the evaluation of effectiveness of these entities, the DEA (Data envelopment analysis) will be used; or more precisely, the input-oriented BCC model will be used under the conditions of variable revenue of scale (BCC).

The DEA method is a specialized model tool used especially to assess the effectiveness, performance and productivity of the homogeneous production entities. The selection of these entities was made upon the identical production, i.e. with the same inputs and outputs. This method is aimed to break the entities down into the effective and ineffective ones as well as to recommend reduction or increase in the inputs or outputs.

The DEA-method based models consider the set of admissible options formed by possible combinations of inputs and outputs. For graphic representation, the so-called effective boundary is used, i.e. the entities lying on this effective boundary are considered effective. Otherwise, they are considered ineffective and the changes thereof need to be proposed.

The CCR model maximizes the rate of effectiveness of the evaluated entity as a quotient of weighted outputs and weighted inputs on condition that the rates of effectiveness of other entities are less than or equal to one. The input-oriented CCR model focuses on such an amount of inputs which are consequently evaluated by this model. The model recommends such changes so that the ineffective entity becomes the effective one. At the same time, the model foresees the constant revenue of scale; i.e. the change in the amount of inputs will be directly proportional to the change in the output amount. For each entity this model will set individual weights of inputs and outputs to maximize the technical efficiency coefficient.

Certain conditions, however, must be met, namely:

• Weights cannot be negative;
• When using this set of weights for all entities, no coefficient of the technical efficiency must be greater than one.

The input-oriented BCC model is the modification of the previous model CCR. This model already takes into consideration the variable revenue of scale, i.e. increasing, decreasing or constant revenue. It foresees the variable, in certain parts linear revenue of scale and can evaluate the efficiency of entities for the generally non-constant output of scale [1 and 2].

Table 1 contains the basic input data to evaluate the economic health of the specific transport company. For the evaluation purposes, the regional towns without a specific traffic (except for Prague and Brno) were selected [3 - 5].

Table 2 contains the values recommended by the DEA method so that the management of the specific transport company is effective, i.e. the company effectively uses its income to perform traffic services. To take the saving measures, it is appropriate to consider the modification of those inputs which do not have a direct effect on the traffic services, i.e. they will concern only...
the modification of the scope of travelled kilometres. Here, the effective tool can be the modification of employment in the context of optimization of the number of vehicles (better distribution of vehicles throughout the day - optimization of circulations and the related optimization of the number of employees - optimization of shifts). The appropriate tool is also the modification of sales from the transportation activity. However, with respect to the current issue, i.e. the massive growth of private motor vehicle transport.

Basic input data of selected transport companies

| Source: Authors |

Recommended values as per the input-oriented BCC model

| Source: Authors |

Total evaluation as per the input-oriented BCC model

| Source: Authors |

Recommended percentage changes as per the input-oriented BCC model

| Source: Authors |
this point depends on the promoter’s decision on how the urban traffic will be promoted. This aspect is not directly depending on the transport company. With respect to this fact all values of the modification of sales are zero!!! The results of recommended modifications are listed in Table 4 [6, 7, 8 and 9].

2. Results

Table 3 shows that the transport companies in the towns of Chomutov - Jirkov, Jihlava, Karlovy Vary, Liberec, Olomouc, Teplice, Zlin - Otrokovice and Usti nad Labem are the effective entities, i.e. the model entities for the ineffective transport undertakings. Based on the model entities, the % change is recommended for the ineffective entities to make them effective. For the needs of the specific percentage changes, the input-oriented BCC model has been proposed (i.e. minimization of the costs under the conditions of maintaining the same volume of outputs (sales, number of transported passengers). The transport companies marked in blue (Table 4) are ineffective.

The transport company in Pardubice is the least effective and, therefore, the result is not only the input change but also the output change. To achieve higher effectiveness, it is recommended to increase the number of transported passengers by 22.54%, i.e. by 5,843,268 transported passengers and, at the same time, to reduce the number of employed vehicles by 26.5%. It follows that the time interval should be increased by a few minutes and the number of links should be reduced or cancelled.

In case of the Most - Litvinov transport company, nearly 40% changes are recommended for some inputs, however, this recommended change is practically unreal. The prerequisite would be reduction of some inputs if the situation allowed so. The highest and the most recommended change is the cost of sales which includes, but is not limited to, the consumption of material and services. It is, therefore, appropriate to find a more effective method for the management of material and other items. Personnel costs represent the next group of recommended changes. Here, it is necessary to distinguish the wages of the drivers, clerical employees, managers and other staff. It is advised to decrease the salaries of senior managers, however, the wages of drivers should be maintained on the same level.

The transport company in Ceske Budejovice is the second most ineffective entity. The biggest change is foreseen in the personnel cost item. This case is identical with the transport company in Most - Litvinov. The next important item to be changed is the number of employees which is closely related to the change in the number of employed vehicles. The cost of sales concern all ineffective entities and it is generally recommended to find more appropriate methods of use of materials and other items.

The transport company in Hradec Králové should also shift its focus on the cost of sales. Reduction of the number of employees and the number of vehicles concern all transport undertakings. Of all ineffective transport companies, the required change of the personnel costs is, however, the lowest. The same also applies to the travelled kilometres in relation to the specific route [10 - 14].

3. Conclusion

Based on the above table it can be concluded that the cost of sales of selected transport companies require the necessary changes. The task is to find an appropriate way how to manage the cost of sales items.

The input-oriented BCC model where only the minimization of inputs was applied while maintaining the same outputs (sales, number of transported passengers). The transport companies marked in blue (Table 4) are ineffective.

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The DEA method focuses on a few models: the CCR and BCC models, which evaluate effectiveness of the entities using the set parameters in terms of constant revenue of scale and variable revenue of scale. The goal is to determine the preference of transport companies, i.e. if they want to expect the increase (maximization) in outputs or decrease (minimization) in inputs. Each of the applied models will evaluate the effectiveness of entities with the recommended different changes [15 - 19].

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