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EDITORIAL

Editorial: Special issue on data envelopment analysis

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Data Envelopment Analysis (DEA) originally developed by Charnes et al. (1978) is an optimization method of mathematical programming to generalize the Farrell (1957) single-input/single-output technical efficiency measure to the multiple-input/multiple-output case by constructing a relative efficiency score as the ratio of a single virtual output to a single virtual input. Thus, DEA become a new tool in operational research for measuring technical efficiency. Since 1978 over 10,000 articles, books and dissertation have been published (Emrouznejad and Yang 2018) and DEA has rapidly extended to many other fields with applications to evaluate and compare educational departments (schools, colleges and universities), health care (hospitals, clinics), agricultural production, banking, armed forces, sports, market research, transportation (highway maintenance), courts, benchmarking, index number construction and many other applications. The International DEA Society organized several international DEA conferences in order to spread the use of DEA in both theoretical and application views. Past DEA conferences were held in many countries including Russia, UK, India, USA, Lebanon, Greek, Brazil, Turkey, Malaysia, China, Germany, and Czech Republic. The program in each conference includes tutorials, plenary talks, invited and contributed parallel sessions as well as social events and tours. In each of these conferences there was a high number of participants from many countries over the world showing that DEA is an attractive scientific discipline with important new theoretical developments and practical applications. The 15th International Conference on Data Envelopment Analysis was held at the University of Economics, Prague in June

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26–29, 2017, and co-organized by the Czech Society for Operational Research. The number of participants was more than 250 from 54 countries of all continents. This special issue contains selected papers presented at this conference. The manuscripts submitted to the special issue have been rigorously reviewed by editors and anonymous reviewers and finally 12 papers were accepted for inclusion in this special issue. The editors are very grateful to the contributors; and, the reviewers for their tremendous time, effort, and service to critically review manuscripts submitted to this issue.

Many applications of DEA models with incomplete data or missing data have been already published Dobos and Vörösmarty (2018). In this issue, the paper (Boďa et al. 2018) focuses on situations in which decision-making units carry out their production activities with some inputs or outputs unobservable or omitted, and when there are a priori known constraints on the relative significance of otherwise observable (or explicitly considered) inputs and outputs.

The approach for selecting efficient projects presented in (Fiala 2018) can be used for various types of projects, such as information system projects (Toloo et al. 2018). It can also be used for other types of problems, such as selecting an efficient subset of supply chain members with subsequent profit allocation (Fiala 2016).

Focusing on the main air pollutants, Fu (2018) presents a comprehensive study from the target region selection in China to the benefit allocation analysis. Both radial and non-radial two-stage DEA models with undesirable intermediate measures are applied to evaluate the regional air quality improvement efficiencies in China (2005–2014). This study analyzes various two-stage DEA models including the improved SBM DEA model developed by Jablonský (2018).

To meet environmental requirements, a technology with no disposability of undesirable outputs is often considered and the outputs are assumed to be only weakly disposable. Halická and Trnovská (2018) show that the combination of this type of technology with the hyperbolic measure may lead to a misleading efficiency score of the unit under evaluation.

Fuzzy DEA is often a subject of attention of many researchers—see e.g. Foroughi and Shureshjani (2017). In this special issue, Hatami-Marbini et al. (2018) present the fuzzy input and output-oriented two-stage DEA models to calculate the global and pure technical efficiencies of a system and sub-processes when some data are fuzzy. To this end, the authors propose a possibilistic programming problem and then convert it into a deterministic interval programming problem using the α-level based method.

The study (Holý and Šafr 2018) measures the research and development efficiency of all 28 member countries of the European Union in the years 2008–2014. The number of citations as output of basic research, the number of patents as output of applied research and research and development expenditures with manpower as inputs are used in the models. The authors extend in their study models introduced in (Jablonský 2016).

The aim of the paper (Jablonský 2018) is to formulate and verify the model for ranking the countries according to their results in sporting events. The aim is not only to evaluate the absolute achievements of the countries but evaluate but evaluate their performance with respect to their available resources. The proposed models are extensions of the models introduced in (Jablonský 2016). Their results are illustrated

on the case of Olympic Games 2016 and compared with results given by traditional approaches.

The paper (Matulová and Fitzová 2018) analyzes changes in the efficiency of urban public transport in the Czech Republic. A study of the same topic for the Slovak conditions has been published in (Rohacova 2015). A network DEA and cluster analysis were applied to data from 19 urban public transport systems during 2004–2016. The series structure of the network was considered, including production and consumption stages with three external inputs, one final output, and two intermediate variables.

Pastor et al. (2018) propose to extend the so far generated knowledge about bounded additive models to the family of directional distance function models in DEA, giving rise to a completely new subfamily of bounded or partially-bounded models. They finally check the new approach on a real agricultural panel data set estimating efficiency and productivity change over time, resorting to the Luenberger indicator in a context where at least one variable is naturally bounded. A similar topic is the subject of research of Halická and Trnovská (2018).

Resource allocation is an attractive and important topic of research—see (Takano et al. 2017). The paper (Shao et al. 2018) proposes a new DEA based approach to allocate the resources in branch network system which is not covered by the existing resource allocation works under a centralized decision-making environment.

Toloo et al. (2018) introduce a DEA approach to find most efficient information system projects while considering subjective opinions and intuitive senses of decision makers. This work is a continuation of the research published in (Toloo et al. 2017). The proposed approach is validated by a real world case study involving 41 information system projects at a large financial institution as well as 18 artificial projects which are defined by the decision makers.

Results of DEA models heavily depend on the dimensionality of the variables, and previous studies address the problem by decreasing the dimensionality with a minimal loss of information (Branda and Kopa 2014). Since the lost information can also have the impact on the evaluation performance, the paper (Xie et al. 2018) proposes an original approach to improve the discriminatory power of DEA without losing any variables information and without requiring any additional preferential information.

Overall, the papers included in the special issue give us a small but representative picture of the recent research on Data Envelopment Analysis. All papers in this issue contribute either to the theory or applications in the field and should be of interest to both academics and practitioners.

To conclude, we are grateful to all the authors and to the many reviewers who made this special issue possible. Although it is not possible to include all submitted manuscripts, the editors hope that all authors found the feedback helpful for their future work. Finally, the editors would like to thank Professor Ulrike Leopold-Wildburger, Editor-in-Chief of the Central European Journal of Operations Research, for giving us the opportunity to prepare this special issue.

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