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EDITORIAL

Preface to the special issue on performance measurement and efficiency analysis—theory and practice

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New public management theories and austerity measures have reinforced the importance of public organizations working in an efficient way (D'Inverno and De Witte 2020b). Similarly, the increasing competition for goods and services in manufacturing and service sectors urges private companies to benchmark their performances and improve efficiency in the production process. In the performance measurement literature, organizations are evaluated considering the level of inputs used to obtain the outputs, so that new targets can be established whenever an opportunity for productivity improvements is detected (Silva et al. 2020). For private companies, performance evaluation and benchmarking methods are relevant tools to increase competitiveness. From a public sector perspective, authorities can benefit from performance assessment tools to monitor public service provision (De Witte and Geys 2013), enhance regulatory frameworks and finally improve citizens' satisfaction. Earlier literature is characterized by a huge amount of papers evaluating both private companies (e.g., airlines, bus companies, banks) and public services (e.g. libraries, water and waste

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utilities, education, public spending). Over the years, the needs of real-world applications have driven the extension of the original models to address specific challenges (Ahn et al. 2018; Emrouznejad et al. 2019). In many cases, the need for new methodologies has been driven by the pitfalls and limitations arising directly from the evaluation processes and by the special needs of particular sectors (Liu et al. 2016; Daraio et al. 2019, 2020; Kerstens et al. 2019). Examples of relevant extensions to the performance literature are the integration of the stakeholders' preferences in the benchmarking process (D'Inverno et al. 2020a), the construction of ad hoc environmental indicators to be included in the performance measurement (Allevi et al. 2019), the ranking of the evaluated units under different perspectives (Oliveira et al. 2019), the data uncertainty modeling (Peykani et al. 2020a; Salahi et al. 2020b), the innovative use of new solution methods, the future performance prediction (Olesen and Petersen 2016) and the inclusion of a strategic approach in the efficiency analysis (Allevi et al. 2018; Fang 2020; Li et al. 2020). The six papers chosen for this Special Issue offer some methodological contributions to the current debate.

Basso and Funari provide a nice example of how the peculiarities of a specific performance evaluation process can lead to an innovative combination of several techniques. They evaluate the municipal museums in Venice taking into account the four dimensions of the balanced scorecard (BSC) scheme. Each dimension is evaluated using a proper data envelopment analysis (DEA) model. Next, a global indicator is built to provide an overview of overall performance, taking into account the preferences of museum experts regarding the relative importance of the BSC dimensions. In light of the above, Basso and Funari propose two different innovative integrations of the analytic hierarchy process (AHP) technique to support the decision-making process. In the first one, the AHP technique allows to define the weights by which the four DEA-BSC scores are aggregated. In the second one, the global indicator is determined by a DEA model with weight restrictions: starting from the expert judgments, the AHP technique is used to construct such weight restrictions. Related to the AHP technique, Ishizaka and Siraj address the rank reversal issue that may occur when an alternative is added or removed. This pitfall is related to the weights normalization and to the strong locally inconsistent pairwise comparisons. The proposed algorithm aims to control inconsistencies and avoid rank reversal, so that the method becomes more reliable when used for decision support or as a performance assessment tool.

In the Special Issue, another paper gives some good food for thought with respect to the application of new optimization techniques in the benchmarking framework. Similarly to other performance measurement approaches, the DEA models are efficiently solved by means of linear programming (LP). At the same time, they can be easily seen as a suitable class of rank-two optimization problems. This different perspective might lead to alternative modeling of particular types of inputs and outputs, such as undesirable outputs, ratios, recycled inputs and geographical Z-variables. In such a case, the new conceived models might not be necessarily reduced to LP. Thus, there is the necessity of paying attention to rank-two problems and their resolution algorithm. In this light, Cambini suggests a new partitioning method to solve rank-two optimization problems. The proposed algorithm is based on some theoretical conditions on localization and underestimation functions, and its performance is assessed by a computational test.

Still looking at the relationship between performance measurement and optimization theory, we can think of how to cope with uncertainty in a mathematical programming framework. Over the years, the standard deterministic DEA model has been extended in different directions. Two papers of the Special Issue focus their attention on data uncertainty by providing insights into two different branches of the literature. Following the robust DEA approach, Mensah builds two robust counterpart optimization models related to two ellipsoidal uncertainty sets. The different specification of the ellipsoidal sets allows to deal with different kinds of data uncertainty. Decision-making units (DMUs) are evaluated taking into account the risk preference of the decision maker, and they are classified accordingly in fully robust efficient, partially robust efficient and robust inefficient. Moreover, the author presents a robust version of the standard additive DEA model. All the proposed models are illustrated with the evaluation of the Italian banking sector. Beraldi and Bruni deal with uncertainty following a different approach, namely the chance constrained DEA approach (CCDEA). In this context, specific distributions of data are assumed, and efficiency scores are evaluated accordingly by solving a suitable stochastic programming problem. The authors suggest a new model which imposes a discrete random variables' distribution and takes into account the risk by introducing the $\gamma-$tail mean safety measure. In this way, the size of the worst performance realizations can be easily specified. As the authors observe, the suggested method looks particularly fruitful whenever the decision maker aims at finding insights into future performance of the evaluated DMUs. This is definitively the case of the credit risk assessment. Using the suggested stochastic model, Beraldi and Bruni evaluate medium enterprises belonging to the Italian leather manufacturing and wholesale industry. Firms are evaluated in terms of their ability of fulfilling their financial commitments, and the efficiency scores are seen as "warning" signals to indicate expected credit failure.

Lastly, Biancardi, Maddalena and Villani relate the notion of efficiency to the correct procedure of groundwater extraction. Limited water availability, together with the need to preserve it for future generations, imposes the monitoring of the behavior in terms of the dynamic of the water table and the height of the aquifer. Following a strategic approach, the authors conceive a differential game where the strategies of extractors are described by feedback Nash equilibria. The model is validated by means of numerical simulation, where several parameters are specified and efficiency is analyzed in terms of optimal water table evolution.

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We wish a good reading with the hope that this Special Issue will inspire and promote further research in performance measurement and efficiency analysis.

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