Foreword

This special issue of the Journal of CENTRUM Cathedra (JCC) on data envelopment analysis and its applications to management coincides with the achievement of Triple Crown accreditation by CENTRUM Católica. The Triple Crown denotes business schools that have received accreditation from the Association to Advance Collegiate Schools of Business (AACSB), the European Quality Improvement System (EQUIS), and the Association of MBAs (AMBA). In one decade, under the vision and direction of its Director General, Dr. Fernando D’Alessio, CENTRUM Católica has become the only business school in Peru and the seventh in Latin America to attain the Triple Crown.

Data envelopment analysis (DEA) is one of the optimization methods of mathematical programming that measures the technical efficiency of a decision-making unit (DMU) in a multiple-input/multiple-output setting, relative to that of peer DMUs. In its simplest form, the technical efficiency measure is expressed as a ratio of weighted outputs produced by the DMU to weighted inputs consumed by that DMU. The vast literature shows that researchers have applied DEA to almost all the fields of management, and we can trace its intellectual roots in economics back to the early 1950s. With its rapid pace of dissemination, DEA has become an increasingly popular management tool due to its versatile applicability. The purpose of this special issue is to contribute to the mounting DEA literature.

This special issue of the JCC includes nine articles in the area of DEA. The respective authors are from Canada, China, Greece, Japan, New Zealand, Peru, Spain, and the United States of America. Within the framework of DEA, researchers have proposed and applied different approaches in these articles to various industries, such as banking, the automobile industry, steel fabrication plants, sports, thermal power plants, electric utilities, stock exchanges (exchange-traded funds), and airlines. Thus, this special issue of the journal reflects the multidisciplinary character of DEA from a global perspective.

Despite the growing literature on bank efficiency over the last decade, researchers have neglected the Peruvian banking sector. In “Benchmarking Peruvian Banks using Data Envelopment Analysis,” Vincent Charles, Mukesh Kumar, Luis Felipe Zegarra, and Beatrice Avolio investigate the efficiency of Peruvian banks using DEA to benchmark existing banks based on their super-efficiency scores between 2000 and 2009. The authors propose a technique, known as the Fibonacci weighted geometric mean, to average the efficiency scores and compare the approach to the progressive time-weighted mean approach. Their findings show an increasing trend in technical efficiency between 2000 and 2009, which illustrates the affirmative effect of the reform process in the Peruvian banking sector. On average, the study indicates that multinational banks performed better than did domestic banks throughout the period, except in 2007, where a sharp decline in efficiency performance for both groups was apparent, possibly a result of global financial turmoil. Furthermore, the findings show that inefficient banks require policies that are more rigorous with respect to the allocation of funds for additional loans as well as other earning assets. In this way, presently inefficient banks may approach the efficiencies of best-practice banks.

The automobile industry crisis between 2008 and 2010 formed part of the global financial downturn that affected U.S., European, and Asian automobile manufacturers. This crisis raises questions about how the automobile manufactures were performing during and after the economic recessions of the early 1990’s. In “Productivity of Automobile Industries Using the Malmquist Index: Evidence from the Last Economic Recession,” Yao Chen focuses on productivity changes in the global automobile industry, including automakers from the United States, Europe, Japan, and South Korea, between 1991 and 1997. Chen assesses the productivity changes of the automobile industry, represented by 22 Fortune Global 500 automobile companies, using DEA to identify the empirical performance frontier and DEA-based Malmquist productivity indexes to analyze the two Malmquist components further. The study findings illustrate that the Malmquist productivity indexes not only reveal productivity trends of industries and companies but also indicate the strategy shifts of companies over time and, furthermore, provide information on whether the shifts are beneficial.

In the original formulation of DEA and in the vast literature that followed, the assumption was that all members of the input bundle affected the output bundle. However, in many settings measured for efficiency, some inputs may not influence certain outputs. In “Data Envelopment Analysis in the Presence of Partial Input-to-Output Impacts,” Wade D. Cook and Raha Imanirad discuss an extension of the conventional DEA methodology that allows for the measurement of technical efficiency in situations where only partial
input-to-output impacts are evident. The authors examine the measurement of efficiency within the context of a set of steel fabrication plants in which the phenomenon of partial impacts of inputs on outputs is apparent.

In “Avoiding Large Differences in Weights in Cross-Efficiency Evaluations: Application to the Ranking of Basketball Players,” William W. Cooper, Nuria Ramón, José L. Ruiz, and Inmaculada Sirvent address the problem of unrealistic weighting schemes in cross-efficiency evaluations through an extension of the multiplier bound approach based on “model” DMUs. Their approach guarantees nonzero weights while at the same time attempts to avoid large differences in the values of those weights. For the application to the ranking of basketball players, the authors specify a limit for allowable differences in the relative importance that players attach to different aspects of the game by reflecting those observed in the weight profiles of some model players, selected according to expert opinion. The authors’ approach provides results that are consistent with basketball expert opinion. They further illustrate why the classical approaches to cross-efficiency evaluation, which include the benevolent and aggressive formulations, may lead to unreasonable results.

In “Coalition Formation and Data Envelopment Analysis,” Rolf Färe, Shawna Grosskopf, and Dimitris Margaritis introduce a framework and exemplify how one can formulate and estimate optimal coalitions using DEA methods. The framework offers some insights and tools for helping companies to decide whether they should acquire potential partners.

Interval efficiency measures can alert decision makers to the fact that efficiency is not a fixed value, allowing them to plan subsequent decisions more carefully, considering uncertainty. In “Scale Efficiency Measurement in Data Envelopment Analysis with Interval Data: A Two-Level Programming Approach,” Chiang Kao and Shiang-Tai Liu propose a two-level programming technique to formulate the problem of determining the bounds of the interval scale efficiency, never before discussed. The associated models are essentially nonlinear programs; one can modify conventional techniques, such as the quasi-Newton method, for unconstrained nonlinear programming problems to solve the two-level programs. The study includes two key points. First, the two-level programs for calculating the bounds of scale efficiencies are nonlinear. Second, because the lower (upper) bound of the scale efficiencies is not simply the ratio of the lower (upper) bound of the overall efficiencies to the upper (lower) bound of the technical efficiencies, the interval of the former is not wider than those of the latter two. The authors apply the proposed method to thermal power plants with interval data.

In “Applying an Efficiency Measure of Desirable and Undesirable Outputs in DEA to U.S. Electric Utilities,” Kaoru Tone and Miki Tsutsui put forward a new efficiency measure that can address both desirable (good) outputs and undesirable (bad) outputs in a unified framework under conditions in which certain nonseparable associations between some inputs and outputs exist. The new measure is a nonparametric DEA scheme. The discussion includes an application of the model to 30 U.S. electric utilities between 1996 and 2000. The results indicate an improvement in the overall efficiency on average, which means that the utilities made progress in efficiency regarding both desirable outputs and undesirable outputs during the study period.

In “Natural Resources Exchange Traded Funds: Performance Appraisal using DEA Modeling,” Ioannis E. Tsolas evaluates the performance of a sample of natural resources exchange traded funds (ETFs) by applying a two-stage procedure. In the first stage, the generalized proportional distance function (GPDF) in the DEA context is used for the first time to measure the relative efficiency of sectoral ETFs. In the second stage, a Tobit model is employed to identify the drivers of performance. The results indicate scope for efficiency improvement for about half, or more, of the sample funds depending on the variables used in the assessments. Fund performance can be explained by fund persistence and the beta coefficient.

In the final contribution, “Airlines’ Performance via Two-Stage Network DEA Approach,” Joe Zhu measures airline performance using a centralized efficiency model via a two-stage process, which allows for insights not available from the standard DEA approach. In the first stage, fuel, salaries, and other factors are used as resources to maintain the fleet size and load factor. In the second stage, the fleet size and load factors generate revenue. Moreover, the author has not ignored the internal structure relative to the measures characterizing airline operations performance, as compared to similar studies in this field.

The many academics and researchers who contributed articles and the experts from the DEA field who reviewed the articles have made this special issue of the journal possible. We thank you. We further extend
our gratitude to the administrative and editorial staff of CENTRUM Católica, CENGAGE, and Language Online. Special recognition goes to Professor Fernando D’Alessio, the Director General of CENTRUM Católica; Professor Beatrice Avolio, the Deputy Director General of CENTRUM Católica; Professor Sergio Chion, Editor of the JCC; Professor John Kuiper, Associate Editor of the JCC; and Professor Mukesh Kumar.

The articles published in this special issue of the JCC should be of considerable interest. They reflect the breadth of DEA and its applications to management. We wish you, our readers, good reading.

Vincent Charles