

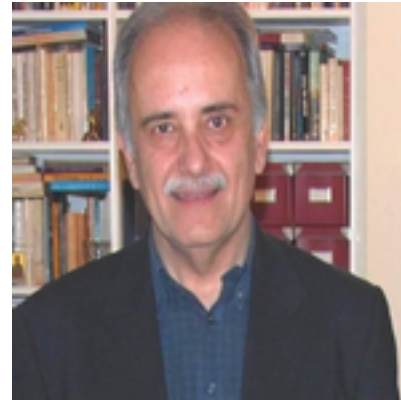
## **Prof. Dimitris K. Despotis**

**Prof. Dimitris K. Despotis** received a B.Sc. in Mathematics from the University of Athens (1980) and a PhD in Operations Research from the University of Piraeus (1988). He is currently Professor of Decision Science at the Department of Informatics, University of Piraeus, Greece. He has been elected and appointed to the position of Vice-Rector of University of Piraeus for the period 2004-2008. He is currently Vice-Chair of the Research Centre, University of Piraeus. His specialization is in performance measurement and multicriteria decision modelling and systems. His current research focuses on data envelopment analysis and performance measurement. He is the author of over 50 research papers published in various international scientific journals (Decision Support Systems, European Journal of Operational Research, Journal of the Operational Research Society, OMEGA, International Journal of Information Technology and Decision Making, etc.) and in proceedings of international conferences. He is member of international societies and working groups (European Working Group on Multiple Criteria Decision Making, European Summer Institute Group on Multicriteria Analysis –ESIGMA, International Society on Multiple Criteria Decision Making, British Operational Research Society). He is a member of the editorial board of the Journal of Information and Optimization Systems, the International Journal of Applied Management and the International Journal of Multicriteria Decision Making, as well as member of the organizing and/or scientific committee of several international conferences.

## Talk 5: Two-stage Data Envelopment Analysis (DEA) models: Foundation and recent developments

### Prof. Dimitris K. Despotis

University of Piraeus  
Department of Informatics  
80, Karaoli & Dimitriou Street  
18434 Piraeus, Greece  
<http://sites.google.com/site/dimitrisdespotis/>  
E-mail: [despotis@unipi.gr](mailto:despotis@unipi.gr)



### Abstract:

Data envelopment analysis (DEA) is the leading technique for measuring the efficiency of decision making units (DMU) in the presence of multiple inputs and outputs. The two milestone DEA models, namely the CCR (Charnes, Cooper and Rhodes, 1978) and the BCC (Banker, Charnes and Cooper, 1984) models have become standards in the literature of performance measurement under the assumptions of constant and variable returns-to-scale respectively. Castelli, Pesenti and Ukovich (2010) provide a comprehensive categorized overview of models and methods developed for different multi-stage production architectures.

In this talk, however, we focus on the typical architecture of a two-stage production process, which assumes that the external inputs entering the first stage of the process are transformed to a number of intermediate measures that are then used as inputs to the second stage to produce the final outputs. In this model, nothing but the external inputs to the first stage enters the system and nothing but the outputs of the second stage leaves the system. Seiford and Zhu (1999) studied such a production process in the banking sector by treating the two stages independently, i.e. without assuming any relationship between the two stages. Kao and Hwang (2008) introduced a novel approach that takes into account a series relationship of the two stages and developed a model that estimates the overall efficiency of the production process as the product of the efficiencies of the two individual stages. Their approach is based on the reasonable assumption that the values of the intermediate measures (virtual intermediate measures) are the same, no matter if they are considered as outputs of the first stage or inputs to the second stage. Chen, Cook, Li and Zhu Chen (2009) introduced the additive efficiency decomposition in two-stage process under the assumption of series relationship. They derive the overall efficiency of the production process as a weighted average of the efficiencies of the individual stages.

In this talk, after communicating a short DEA primer, we will present the above basic two-stage DEA approaches (independent, multiplicative and additive). We will discuss their assumptions and shortcomings. Then we will present some recent developments in assessing the efficiency of two-stage processes.