The impact of size and specialisation on universities’ department performance: A DEA analysis applied to Austrian universities

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Abstract. This paper explores the performance efficiency of natural and technical science departments at Austrian universities using Data Envelopment Analysis (DEA). We present DEA as an alternative tool for benchmarking and ranking the assignment of decision-making units (organisations and organisational units). The method applies a multiple input and output variables approach, which is a clear advantage to other approaches using simple performance ratios. To deliver reasonable results, suitable input and output variables have been determined in a previous step using correlation analyses and OLS regression. The results validate the methods applied, and reveal performance differences and scale effects. The use of multiple output variables enables the revealing of detailed improvement or reduction amounts of each input and output of the evaluated units and furthermore for identifying the specialisation of teaching, research, and industrial cooperation. We find significant evidence that the size of a department influences its overall and specialisation performance; both small and large departments perform above average, which proves that simple linear scale effects do not exist.

Keywords: Austria, benchmarking, Data Envelopment Analysis, efficiency evaluation, scale effects, specialisation patterns, Austria universities

Introduction

In the last few years efficient resource allocation has not only received the attention of private corporations, but also of public institutions. Worldwide, organisations are increasingly forced to improve their performance efficiency to justify the assignment of scarce public budgets and to attract additional third-party funds. European universities have recently faced deep structural changes since they are provided with
greater autonomy and thus have to make decisions on resource allocation with respect to their tangible and intangible assets (e.g. Dill 2001). As a result, they have started to implement modern management techniques. However, to date quantitative and financial methods have merely played a minor role in determining efficiency and in identifying inefficiencies.

Despite well-known discussions on resource allocation and university organisation, as well as vast amounts of literature on evaluation systems (e.g. Roessner 2000), researchers and practitioners identify a great demand for new methodologies. So far, only a few studies have analysed relationships between various indicators of universities employing statistical methods (e.g. Teodorescu 2000; Fairweather 2002). Some have applied these indicators to determine the efficiency of universities (e.g. Athanassopoulos and Shale 1997). Among others, Data Envelopment Analysis (DEA) was explicitly used by Beasley (1995), Bonaccorsi and Daraio (2002), Fandel (2003), Johnes and Johnes (1993), Sinuany-Stern et al. (1994) and by Vakkuri and Mälkiä (1996). We are the first to propose DEA as a method to evaluate the efficiency of Austrian university departments.

DEA was introduced by Charnes et al. (1978) who extended Farrell’s pioneering work (1957) on estimating technical efficiency as the distance between observed values and an estimated ideal efficient production frontier. DEA incorporates both qualitative and quantitative information into the analysis and copes with variables of different scale by handling simultaneously multiple inputs and outputs. Furthermore, it shows improvement potentials for the evaluated units by benchmarking them with target values of peer units. In our paper, we are especially interested in revealing whether university, field of study, and size of a university department influence its efficiency and whether the internal structure of a university may determine its departments’ performance, given identical external conditions.

The empirical part of the paper adds to international findings. It employs DEA as a suitable measure to distinguish between efficient and less efficient departments, to rank them according to their performance, and to reveal their improvement capacities. This information is necessary to develop key aspects of future activities and to reallocate financial funds. We apply an input-oriented DEA model for all technical and natural science departments at Austrian universities and run various models using teaching, research, and industrial cooperation outputs to show the departments’ specialisation. The data refers to the years 2000.