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O.R. Applications

On the performance of universities in North Rhine-Westphalia, Germany: Government's redistribution of funds judged using DEA efficiency measures

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Abstract

In Fandel and Gal (2001) [Fandel, G., Gal, T., 2001. Redistribution of funds for teaching and research among universities: The case of North Rhine-Westphalia, *European Journal of Operational Research* 130, 111–120] a solution for a real process of redistributing funds for teaching and research among the universities in North Rhine-Westphalia in Germany according to specific criteria was presented. The solution was based on aggregated proportional data and was determined by a negotiation process. Now that the absolute data with respect to the different subject areas of the universities are available, it is studied, to which extent the results of the redistribution can be justified by the relative efficiency measures using data envelopment analysis. Moreover, the inefficiencies or slacks, respectively, in the usage of personnel give reasons to reallocate the staff among the universities or to reduce it correspondingly.

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1. Background

1.1. Government's redistribution

In the last few years a large number of approaches has been developed in Germany for studying the efficiency and the success of universities (HIS, 1997, A9/97 and A10/97; Wüstemann et al., 2000; Andersen

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et al., 2001; Ziegele, 2001). They are now being applied for the redistribution of funds among universities on the basis of performance and success. By orders of the parliament of North Rhine-Westphalia, the Ministry of Science and Research started such a redistribution among the region's fifteen universities. In 1997, the total sum of redistribution amounted to DM 148.58 million and was raised by the universities from their own budgets.

As redistribution criteria for teaching the Ministry used:

- (1) the proportionate number of posts for academic personnel,
- (2) the proportionate number of students in semesters 1–4, and
- (3) the proportionate number of graduates in the respective universities.
 - (a) The subject areas 'Humanities and Social Sciences', 'Natural Sciences' and 'Engineering Sciences' were weighted in the ratio 2:5:5 in order to calculate the proportions for (1)–(3) above. The weights correspond to the curricular standards used by the authorities when the workload of the universities is calculated in comparison to their capacities.

As redistribution criteria for research the Ministry used:

- (4) the proportion of third-party (outside) funding, and
- (5) the proportionate number of doctorates in each university.
 - (b) A moving average for the last three years was determined for the proportions of third-party funding in (4), and the subject areas 'Humanities and Social Sciences', 'Natural Sciences' and 'Engineering Sciences' were given weights of 7:2:1 for their third-party funding. The rationale behind this weighting is that it is reverse to the ratios by which the subject areas are funded by the National Research Foundation.
 - (c) For the calculation of the proportionate number of doctorates the subject areas were given the same weights as in (a) based on the same underlying rationale.

The data in (1) referred to the sum of academic personnel in the universities over the years 1993 to 1995. The data in (2) were based on winter semester 1995/96. The data in (3) and (5) resulted from the sum of graduates and doctorates, respectively, over the years 1992 to 1994. A three-year average of the actual expenses in the budget years 1992 to 1994 served as a proxy to the third-party funding in (4). The purpose of selecting these periods and data was to minimise the annual randomness in the differences between the universities.

The outcome of the redistribution is shown in Table 1; the gains and losses were the results of a negotiation process between the universities and the ministry as outlined in Fandel and Gal (2001). In this process the weighting vector $g = (g_1, \dots, g_5) = (0.2; 0.2; 0.35; 0.2; 0.05)$ was determined in order to calculate the aggregated percentage score

$$P_i^S = \sum_{j=1}^5 g_j \cdot a_{ij}, \quad i = 1, \dots, 15,$$

for each university concerning the target distribution of funds B. Thereby a_{ij} denotes the proportionate score of university i regarding redistribution criterion j , $j = 1, 2, \dots, 5$, in accordance with the information provided in (1)–(5) and the supplementary explanations (a)–(c).

Column 1 lists the universities in North Rhine-Westphalia included in the redistribution of funds. They are numbered consecutively in Column 2, $i = 1, 2, \dots, 15$. Column 3 shows the aggregated percentage scores regarding the target distribution of funds B (Col. 4), which the universities raised from the actual budgets B_i^A (Col. 6 total, percentages in Col. 5). The gains and losses for the universities (difference between Cols. 4 and 6) are shown in Column 8. Their relative changes with regard to the actual distribution can be read off in Column 7.

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