THE APPLICATION OF PRODUCTION FUNCTIONS TO THE HIGHER EDUCATION SYSTEM – SOME EXAMPLES FROM PORTUGUESE UNIVERSITIES

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ABSTRACT

Production functions were established for the Arts and Law Faculties of Coimbra and Lisbon Universities and for the Higher Institute of Engineering of Lisbon, in which the number of enrolled students was related to the number of professors and assistants. It was possible to find in Coimbra and Lisbon Universities the existence of possibilities of substitution among those factors and economies of scale. In the case of the Higher Institute of Engineering there seems to exist a relation of complementarity between the number of professors and assistants. Also with regard to this Institute, a production function for graduates was estimated which relates them to the expenditures on academic staff and materials. It was found that in this case it was necessary to introduce time as a representative of technological progress, although it was found to be negative. These results are discussed, and the interest and the limitations of the use of production functions for educational management purposes are outlined.

Although the application of production functions in the field of educational management has often been proposed and discussed by several authors (Vaizey, 1970; Verry, 1970), there have been very few practical cases in the field of higher education where actual use of these functions has been attempted. Some examples have been presented in the United States but they relate to secondary rather than tertiary education (Hansen, 1970).

There are several reasons why studies on this subject remain on a theoretical level and why the results obtained have not been regarded with confidence. To list just a few, one could refer to the difficulties in identifying and measuring the outputs of educational systems, the difficulties in
selecting and measuring representative factors for a given educational technology, and the fact that the education system is not subject to the same rules as those which apply to perfectly competitive markets.

If the difficulties can be overcome and the limitations taken into account, the application of production functions may be of interest for the study of some educational technologies (defined as particular combinations of educational factors). These functions may give indications of the possibilities of economies of scale, of substitution between inputs, of the range of combinations, and of a better identification of the efficiency of these combinations on economic or other grounds.

It is usually found in European universities that the major costs are academic staff, technical and administrative staff, materials and equipment; these ought to reflect the major factors to be considered in the educational technologies of the various courses.

This is true for the Portuguese universities for which we have undertaken a time-series investigation (from 1958/59 to 1970/71) on the changing numbers of students, graduates, professors, assistants and expenditure with staff and materials; eighteen courses offered by the four continental Portuguese universities were considered (Freire and da Silva, 1973); they were aggregated in two types, which we will refer to as "laboratory" and "classroom" courses, following the common practice.

The examination of the available data suggested some relationships between the above-mentioned factors: substitutability among the different grades of academic staff (such as professors and assistants), complementarity between factors such as academic staff and materials and equipment. Both items relate closely to the needs of existing classes or the numbers of enrolled students. It must be stressed that the relationships which can be detected on the basis of time-series, particularly the estimated production functions, do not have the meaning they have in macro- or micro-economics; indeed, the very definition of production functions involves arguments of a technological nature, as they do not represent all the different technical possibilities of combining productive factors but only the most efficient combinations, i.e., they correspond to the frontier of the possible combinations defined by criteria of technical efficiency.

In the field of education we cannot use similar arguments; for instance, it is not always possible to ensure the most efficient combinations of professors and assistants, at least in the case of the Portuguese universities. The assistant/professor ratios are determined by the scarcity of professors, hence the demand is not very elastic. The costs of the factors (wages plus addition earnings for supplementary service) are defined by law and the changes of composition of the staff are mainly due to a variety of other causes, such as the prestige of the institutions or the appeal of the cities in