Preface

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Four of the contributions contained in this volume were presented during a seminar on local government finance organised by the Institute of Economic and Regional Research of the University of Neuchâtel in June, 1993**. George Sheldon's paper on measuring the gains in efficiency in the Swiss banking sector was presented at the 1994 Congress of the Swiss Society for Statistics and Political Economy. This work has an obvious place in this volume devoted to performance measurement.

Traditionally, the performance of public or private firms has been measured on the basis of financial indicators or accounting ratios. The seminal work done by FARRELL (1957) gave rise to a new approach to efficiency, based on comparing actual production levels with the ideal production which could be achieved with the resources available. The concept of a production frontier plays an essential role in this perspective. The frontier corresponds to an ideal level of efficiency in relation to which the degree of efficiency of the firms or municipalities in question is defined.

The productivity of a production unit is determined by the output to input ratio. Variations in productivity may stem from increases or decreases in technical efficiency and/or from technological change. Technical efficiency is measured by comparing the actual production with an ideal, i.e. totally efficient, level of production, for a given state of the art. Technical progress may be defined as the capability to produce more with the same inputs due to technical innovations (LOVELL, 1993). A distinction is sometimes drawn between technical efficiency and allocative efficiency.

Following FARRELL's contribution (1957), numerous books and articles were written on technical efficiency. The methods currently used in this area can be classified in accordance with two criteria: firstly, as parametric or non-parametric, and secondly, as deterministic or stochastic.

In all cases, a production frontier has to be determined on which efficient firms are located. The degree of efficiency of firms is measured in relation to the frontier. A deterministic parametric frontier is obtained on the basis of a production function, the coefficients of which have usually been estimated using the least squares method. The graph for this function is then shifted along the outputs axis by a distance equal to the largest residual, for example. The shifted graph constitutes the production frontier. For any envisageable combination of quantities relating to the production factors (inputs), this frontier indicates the output which a firm would have to supply to be considered

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efficient. In principle, only one firm is located on the frontier. All the others are below it, which means they are inefficient. A firm's degree of efficiency is, by definition, the ratio between its production and that determined by the frontier, which implies that the gap between the effective production and the corresponding frontier point (ideal output) is attributed solely to inefficiency. Now in reality firms can be located in environments which make it more or less difficult to produce the service. This fact should be taken into account by introducing environmental variables.

It should be noted that the gap between an observed value and the frontier is influenced by factors extraneous to the determination of firms's performance levels – errors in specifying the production function, omission of certain variables, statistical noise, etc. Using a stochastic parametric frontier offers a way of remedying this situation. To do this, two random variables are introduced – the ordinary least squares error term and a term which is either negative or equivalent to zero, which is intended to represent inefficiency. With regard to the second term, the choice of a statistical distribution – half-normal, exponential, gamma, etc. – is left to the discretion of the user, which consitutes a weak point in the method. As a general rule, it can be stated that the simplest methods are not necessarily the worst (VANDEN EECKAUT and WUNSCH, 1993).

The main non-parametric deterministic methods are FDH (free disposal hull) and DEA (data envelopment analysis). With regard to FDH, a method which Henry Tulkens played a major part in developing, the production frontier – in the case of one input and one output (two dimensions) – looks like a staircase, the steps being determined by the efficient firms. Any firm for which it is possible to find at least one other observation which contains the same or more outputs but strictly less of at least one input or which uses the same or less inputs to produce strictly more of at least one output is inefficient. The production set is non-convex. The advantage of the method for the manager is that it implies that comparisons are always made in relation to real firms. On the other hand, the number of companies found to be efficient risks being rather high, in contrast to the result obtained using a parametric method.

In a DEA model, the frontier is obtained by resolving a linear programming problem. The frontier "envelops"all the observations, as in most other methods of determining a frontier. In contrast to FDH, the frontier obtained through the DEA method is convex. Stochastic non-parametric methods are being developed (LOVELL, 1993).

It frequently happens that the supply of a service cannot be correctly characterised by only one output. The problem arises, in particular, when the quality of the service is a factor of considerable importance. Non-parametric methods are then indicated.

The areas of application for the above methods are very numerous. They concern both private companies (banks, insurance companies, financial services, agriculture, etc.) and public or private companies operating as a network (power generation and distribution, railways, coach services, airlines, postal services, ambulance services, etc.), and public services (health, education, the courts, social services, waste collection and processing, road maintenance, fire services, national parks, etc.). The areas most often studied are those for which output can easily be defined – hence the large amount of work done on

transport and waste collection. Education and health, for example, are not so often considered, due to the difficulty of defining their output.

Efficiency analysis is of particular interest in the area of public services. In effect, firms operating in a competitive market are forced to be efficient or disappear. In the public sector, where competition does not usually exist, there are no market pressures forcing production units to be efficient. However, comparing performance between one municipality and another may provide an incentive for improving levels of performance. In this connection, being able to evaluate the degree of efficiency involved is a valuable tool.

Tulkens and Wunsch study the economic performances of the Société des Transports Intercommunaux de Bruxelles using three indicators: partial factor productivity, productive efficiency and effectiveness. The analysis is based on monthly data relating to the period between 1977 and 1992. The authors use two methods to measure efficiency. The first (sequential efficiency measurement, demonstrating local technical progress), which calls on a production frontier of the FDH type, is intended to distinguish between gains in efficiency and technical progress as factors in improving economic performance levels. The second, which measures efficiency using an index of technical progress or regress (the BPR index, Benchmark Progress-Regress), has the advantage that it can handle the possibility of both technical progress and technical regress. In order to obtain a measurement of efficiency, the authors compare transport supply (number of seat-km.) with demand (passenger-km.) over time and space, with the aim of determining whether there is good match between these two values.

Using data relating to the services supplied by 589 Belgian municipal authorities, Borger, Kerstens, Moesen and Vanneste evaluate the advantages and drawbacks of the FDH approach using various measurements of technical efficiency. The authors are particularly interested in the sensitivity of the method as a function of the selection of measurement of efficiency, the number of inputs and outputs, the size of the sample and of the presence or absence of outliers. One special feature of the study is that it covers not only one service, as is the usual practice, but all the services delivered by the municipalities. The supply of services from the municipality comprises five outputs, the last being a residual output. The only input involved is the labour factor. The conclusion reached by the article is that there are considerable advantages in using FDH, compared with other approaches, in particular where public services are concerned. It will be noted that the method is based on hypotheses which impose few restrictions, and that it constitutes a good management tool.

Distexhe and Perelman study the performance of 33 airlines in a context of deregulation. The analysis runs from 1977, the year before air travel in the United States was deregulated, to 1988. The intention was to find out whether operating in a more competitive environment produced productivity gains. Moreover, did the fact that an airline was privately or publicly owned have an influence on its performance? Technical efficiency was evaluated using the DEA method. The frontier was re-estimated every three years. The productivity gains, calculated using a Malmquist productivity index, were broken down into changes in technical efficiency and technical progress. The study

brings out the reasons why deregulation of air travel favoured mergers. Only airlines operating on a world-wide scale would be able to obtain the full benefit of technical progress.

Sheldon examines the effects of increased competition in the Swiss banking sector following the liberalisation of operations in this area. Productivity changes are broken down into variations in technical efficiency and technical progress or regress. The production frontier required to obtain a value for technical efficiency is determined using the DEA method. Using a Malmquist index makes it possible to measure gains or losses in total factor productivity .

The empirical analysis covers more than 400 banking institutions in Switzerland and runs from 1987 to 1991. Seven outputs and three inputs were used. It seems that, as a general rule, the improvement in productivity observed over the period in question was mainly due to greater technical efficiency. The influence of technical progress, on the other hand, was not great. However, there were considerable variations, depending on the type of institution involved.

Burgat and Jeanrenaud's paper concerns the collection of household waste in Swiss municipalities with populations of over 5,000 inhabitants. The aim was to estimate the influence of the mode of service delivery (municipal service, sub-contracting, co-operation between municipalities) and other institutional variables on the efficiency of the service in question. The technical efficiency values were obtained using the SOLS (shifted ordinary least squares) method, on the basis of a Cobb-Douglas production function. The degrees of efficiency were then regressed on the institutional variables – mode of delivery, financing mechanism, presence or absence of competition – using dummy variables, which led to the constitution of twelve categories of municipality. The coefficients of the regression equation, in isolation or in association, represent the average efficiency for each category. The best efficiency is obtained when the service is provided by an association of municipalities, with production sub-contracted and financing raised through a user charge. The approach utilised has theoretical and practical advantages in relation to tests concerning the differences in the average values for the various categories taken two by two.

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