Impact of IT on Cost Efficiency of German Banks

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Extended Abstract

(Area of Interest: Econometric models of IT's effects: i.e., the evaluation of implemented systems, or measures of productivity and other economic impacts)

We develop a model that allows us to determine the optimal use of specific input factors given a production technology. The production technology is expressed as a cost frontier. This is determined on the basis of empirical observations of input-output combinations and input prices faced by a group of units with the same type of inputs and outputs and a similar production technology. The method used is a linear programming approach based on the philosophy of Data Envelopment Analysis (DEA). First, we construct the cost frontiers under the assumption of constant and variable returns to scale. Next, we calculate for each observation unit the total cost efficiency and factor it into scale efficiency and "pure cost efficiency". The pure cost efficiency can be further broken into technical and allocative cost efficiency. All these calculations can shed light on important issues in any production, e.g., the ideal production levels in terms of cost efficiency or to determine best practice units. Using the variable returns to scale cost frontier it is also possible to determine the input quantities that are necessary to make units with a pure cost efficiency below one, i.e., those that operate cost inefficiently, cost efficient. However, we want to explore in more detail how the use of an individual input factor, specifically information technology, impacts the total production costs and other inputs.

For each input "i" in an input bundle we determine its minimal quantity given the input-output possibilities in the variable returns to scale technology. Then, we calculate the impact of changes in that input factor above this minimum but below a constant on the costs of producing the given output bundle. We refer to the resulting costs as the "i-restricted" minimal cost. The advantage of this approach is that cost inefficiences are eliminated from the i-restricted minimal cost. This way we can calculate whether increases in the quantity of the i^{th} input lead to lower or higher total costs and the impacts on other input factors.

We applied our analysis approach to data obtained from an organization of small German banks with total assets in the range from 0.2 to 6 Billion German Mark in 1994. All banks in this organization are served by the same data center and face the same prices for information system services. Thus, differences in their expenditures for information technology result from different levels of use of information technology rather than from different prices or different managerial skills within IS departments. We chose the production approach to the

modeling of bank production. The model contains three inputs and three outputs: real estate property and buildings, number of employees, and IT expenses on the input side and number of accounts of three different types of accounts on the output side. We assigned the 30 banks to three size groups for the analysis. The calculations were performed for the years 1989 and 1994.

The results revealed that most of the banks in the middle group (1 to 3 Billion German Mark in total assets) operated at an optimal scale size. This is in accordance with most studies on bank production which suggest that the optimal scale size in banking is reached at relatively low size levels. Small banks exhibited best cost efficiency levels. The potential for cost savings from greater IT use was significant in 1989, especially in smaller banks. In 1994 the effects of IT on cost efficiency were only small.