European Journal of Operational Research 232 (2014) 654–663

Contents lists available at ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Innovative Applications of O.R.

Bank branch sales evaluation using extended value efficiency analysis

Juha Eskelinen, Merja Halme *, Markku Kallio

Department of Information and Service Economy, Aalto University School of Business, POB 21210, FIN-00076 AALTO, Finland

ARTICLE INFO

Article history:
Received 10 September 2012
Accepted 5 August 2013
Available online 20 August 2013

Keywords:
Data envelopment analysis
Value efficiency analysis
Sales performance
Bank branches

ABSTRACT

This article results from our collaborative project with a Finnish bank aiming to evaluate the sales performance of bank branches. The management wishes to evaluate the branches' ability to generate profit, which rules out the pure technical efficiency considerations. The branches operate in heterogeneous environments. We deal with the heterogeneity by subdividing the branches according to the bank specification into overlapping clusters and analyze each cluster separately. The prices of the branch outputs are hard to assess as the results from the sales efforts can only be observed with long delays. We employ benchmark units similarly as in value efficiency analysis (VEA). However, we extend VEA in two ways. First, in standard VEA the benchmark unit is assumed to yield the maximum profit among the set of feasible technologies; instead, our benchmark technology may or may not be in the feasible set. Second, we consider efficiency tests employing a benchmark with respect to both profit and return. We propose a solution strategy for these extensions. The bank uses the study to support decisions concerning new branches, changes in the operations of inefficient branches, and actions aiming to more flexible deployment of the staff.

1. Introduction

The banks have traditionally been forerunners in adopting new approaches to improve operating efficiency. However, no standard system exists to benchmark the bank branches. The initiative for this paper was the need to compare the performance of the branch sales activities of Helsinki OP Bank, part of the OP-Pohjola Group which is a leading financial service group in Finland. The monitoring of branches of Helsinki OP Bank has so far been done on a relatively short-term basis. By carrying out the branch efficiency analysis with several years of perspective and combining the results with other information sources, the bank management seeks for a more profound understanding of the operational process in the branches to tackle three major challenges: what are the desirable characteristics of new branches in consideration, how to reorganize inefficient branches, and how to deploy the personnel in the branch network. To achieve valuable results, our analysis was carried out in close collaboration with the bank management.

The surveys on efficiency studies in financial institutions by Berger and Humphrey (1997) and by Fethi and Pasiouras (2010) report more than 300 studies since the early 1980's. Even though the majority of the literature has focused on the comparison of banks, there are a number of publications with the focus on bank branches that are discussed by a recent review of 80 DEA applications (Paradi & Zhu, 2013). According to the surveys almost all of the published branch level studies use the data envelopment analysis (DEA) with some chosen sets of inputs and outputs.

The choice of inputs and outputs for DEA depends on the specific purpose of the analysis. For instance, Mahajan (1991) deals with branch sales performance, Nash and Sterna-Karwat (1996) consider cross-selling in the bank branches, and Cook, Hababou, and Tuenter (2000) distinguish between the sales and service function and their respective resources. Paradi, Yang, and Zhu (2011) distinguish three approaches of DEA to assess efficiency in bank branches: production, profitability and intermediation approaches; see also Berger, Hanweck, and Humphrey (1987). The production approach considers the branch using inputs (such as labor, capital, and space) to generate output services such as loans, deposits and insurances. The profitability model examines how efficiently a branch uses its cost factors of inputs to create revenues from outputs. The intermediation approach considers the bank as an intermediary collecting funds for loans and other revenue earning activities. Thanassoulis (1999) distinguishes two forms of the intermediation approach: liquidity efficiency reflecting the solvency risk measured on the bank level, and market efficiency reflecting the ability to convert the inputs as well as the market potential (as an additional input) into sales. Athanassopoulos (1998) is a pioneer in utilizing the market efficiency model for clusters of branches. Thanassoulis (1999) lists example branch studies that have adopted the production approach or the market efficiency form of the intermediation approach.

* Corresponding author. Tel.: +358 403538081.
E-mail addresses: juha.p.eskelinen@aalto.fi (J. Eskelinen), merja.halme@aalto.fi (M. Halme), markku.kallio@aalto.fi (M. Kallio).

0377-2217/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ejor.2013.08.005

For the banking outputs and/or inputs the unit prices may not be easily available. The results of sales efforts in banks are often observed with a long delay. The exact specification of prices for the outputs is not realistic, for instance, because it is uncertain when a customer will withdraw from an investment fund or how long the actual period of lending is. Even though the monetary value of earnings in a period could be used, it cannot be matched with the sales activity of the same period (see also Smith, 1990) but with the activity of several periods. Moreover, the bank offers a wide range of services the price of which for a customer may depend on the assortment of services that she/he uses: e.g., a customer with a long-lasting and stable relationship with the bank often gets a loan with a lower margin than other customers. The revenues from the sales of services are based on both interests and commissions and fees. This further challenges the explicit definition of prices especially if the outputs are on an aggregate level.

Also Thanassoulis (1999) recognizes the need of improvement in the price measurement in branch studies. As a consequence of the price measurement problem, the bank branch studies often measure branch operations' technical efficiency. However, there are also studies on the cost efficiency (Hartman, Storbeck, & Byrnes, 2001), output-mix efficiency (Camanho & Dyson, 2005) or profit efficiency (Portela & Thanassoulis, 2005; Portela & Thanassoulis, 2007) that employ some price information.

The branches of Helsinki OP Bank have both the roles of a service provider and selling. Our interest lies in such previous work that includes sales type outputs. Furthermore, it was in the interest of the management of Helsinki OP Bank to evaluate each branch – the decision making unit (DMU) – in terms of monetary value. Therefore, we excluded from consideration pure technical efficiency. In principle, the market efficiency approach may be adopted in the analysis of branches. However, due to the lack of data on the market potential of the branches, we rejected that type of approach. We utilize transactional sales volumes of financial services as output and workforce effort as input. Commonly in DEA, input and output weights are interpreted as scaled prices. However, the scaling can be different for inputs and outputs in which case the monetary units are different as well. Instead, our input and output weights of the analysis have monetary interpretations, which enable us the assessment of revenues, costs, profit and return. Furthermore, in place of standard DEA approaches (CCR by Charnes, Cooper, & Rhodes, 1978, and BCC by Banker, Charnes, & Cooper, 1984) we extend and employ value efficiency analysis VEA by Halme, Joro, Korhonen, Salo, and Wallenius, 1999 to make efficient use of managerial judgment in the analysis.

1.1. Value and return efficiency analysis of bank branches

Few studies have included clear managerial value judgments in the analysis. Among others, Schaffnit, Rosen, and Paradi, 1997 and Cook and Zhu (2005) and Paradi and Schaffnit (2004) employ weight restrictions. Yang, Wong, Liu, and Steuer (2010) made the managers and directors search for the most preferred solution on the efficient frontier. We employ management preference information in several ways: (i) we carry out performance evaluation separately in several overlapping branch clusters which are relatively homogenous and subjectively defined by the management based on environmental factors such as existing customer base of the branch, for instance; (ii) for efficiency tests we employ benchmark units also defined by the management; (iii) we employ managerial judgment in the form of pair-wise comparison of branches belonging to the same cluster; and (iv) we use judgmental lower limits on the profitability of individual services of a benchmark branch. All such judgmental information has an impact in prices used for efficiency evaluation.

We employ the benchmark units in the analysis in two different ways: using value efficiency analysis (VEA) by Halme et al. (1999) that compares the profits of the units, or using return efficiency analysis (REA) by Kallio and Kallio (2002) that compares the return of the units. In the context of sales evaluation we define the profit as the margin between revenue generated from the sales and cost of sales activity. The return is correspondingly the ratio of revenues to costs.

Originally VEA assumes that the benchmark is the most preferred unit (MPU) of the cluster and it is efficient among the set of production possibilities. We extend VEA in a way that a benchmark, a desired technology (DT), is not necessarily in the current set of feasible technologies defined using existing DMUs.[1] However, DT is a conceivable technology to be adopted in the future. After all, it is up to the management to choose such a technology of interest. This amendment to the VEA is well justified from the point of view of the bank branch application, for instance. The bank management found it natural and straightforward to think of an ideal unit consisting of the best salespeople forming a "dream team". The superior competencies of such a team have a significant effect on the branch performance.

Also Sowlati and Paradi (2004) suggest the use of targets for efficient units not in the current production possibility set. They point out that based on a DEA analysis no further improvement can be indicated for efficient units (Sowlati & Paradi, 2004, p. 261): "Nevertheless, it is important for management to indicate targets for their efficient units if the organization is to improve as a whole. Based on possible variations in the input and output levels of efficient DMUs, new units which are more efficient than DEA efficient units can be created". Such variations are based on management's judgment.

Our approach thus deviates from standard DEA in several ways: we use clusters of units that are partially overlapping, within homogeneous clusters we compare profits in addition to return, and we use preference information in terms of benchmarks supplemented possibly by other types of preference information. The use of the clusters tends to increase efficiency scores of the units compared with those of the standard DEA. The impact of preference information restricting the set of admissible prices is opposite: accounting for the preference information introduces additional restrictions into an LP problem – thus it never results in more optimistic scores and tends to decrease efficiency scores.

The performance of the bank branches is considered specifically from the point of view of their long-term sales performance in order to mitigate the short-term random effects in the outputs. We use data of four years and carry out the efficiency analysis employing benchmarks in a number of homogeneous clusters.

We consider efficiency tests employing benchmarks with respect to both profit (VEA) and return (REA). The VEA, including its extension, is carried out using linear programming. While the efficiency tests for REA involve nonconvex optimization problems which may have multiple local optima, we propose a solution strategy for global optimization.

As far as our terminology is concerned, VEA refers to value efficiency analysis[2] or its extension and REA to return efficiency analysis or its variation. The respective efficiency measures are *profit efficiency* and *return efficiency*. Scores for each efficiency measure are

[1] In this article, a technology refers to a pair of input and output vectors. For instance, each point in the production possibility set refers to one particular existing technology.

[2] Value enters the name of the method because the starting point in VEA by Halme et al. (1999) in comparing alternative technologies is based on a pseudo-concave value function; however, linear approximation of the value function at the optimum technology can be interpreted as using profit in place of value.