Omega 41 (2013) 61–79

Contents lists available at SciVerse ScienceDirect

Omega

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

A survey on bank branch efficiency and performance research with data envelopment analysis

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ARTICLE INFO

Processed by B. Lev
Available online 6 February 2012

Keywords:
Data envelopment analysis
Banking
Performance
Efficiency
Benchmarking

ABSTRACT

The banking industry has been the object of DEA analyses by a significant number of researchers and probably is the most heavily studied of all business sectors. Various DEA models have been applied in performance assessing problems, and the banks' complex production processes have further motivated the extension and improvement of DEA techniques. This paper surveys 80 published DEA applications in 24 countries/areas that specifically focus on bank branches. Key issues related to the design of DEA models in these studies are discussed. Much advice is included on how to design future experiments and studies in this domain. A number of areas where further research could be fruitful are suggested.

1. Introduction

As the principal sources of financial intermediation and channels of making payments, banks play a vital role in a country's economic development and growth. In addition to their large economic significance, the existence of an increasingly competitive market highlights the importance of evaluating the banks' performance in order to continuously improve their functions and monitor their financial condition. There are many uses for performance analyses by bank management concerned with the identification of the sources of operating inefficiency, gaps in effective resource allocation, the impacts of ongoing regulation changes on bank operations, and their ability to realign their businesses with the current and most profitable business trends, etc.

Among the wide spectrum of modeling techniques in the banking sector Data Envelopment Analysis (DEA) is one of the most successfully used operational research technique in assessing bank performance [1]. Due to its powerful optimizing ability, DEA allows management to objectively identify the best practitioners and the areas in need of improvement within the bank's complex operating situations. Although a considerable number of papers have been published on the banking industry using DEA since the technology was introduced, they mainly focused on studies at the institutional level. For example, we found 275 DEA applications in the banking sector between 1985 and 2011, among them 195 studies examined banking institutions as a whole, but only 80 on the branch level. There are three survey papers that reviewed DEA applications in the banking industry. However, all of them focused on the studies that analyzed efficiency at the bank level. Berger and Humphrey [2] were the first to review five major efficiency analysis techniques including DEA that were typically used to examine the efficiency of financial institutions in order to make some useful comparisons between their average efficiency levels. Out of the total of 130 studies reviewed by them, there were 57 DEA based papers, 42 focusing on the bank level and 15 on the branch level. Berger [3] reviewed over 100 applications of frontier techniques that compared bank efficiencies across nations. Fethi and Pasiouras [1] reviewed 196 studies employing operational research and artificial intelligence techniques in the assessment of bank performance. Among the 196 studies, 151 of them used DEA-like techniques to measure bank efficiency and productivity growth, and only 30 studies focused on the branch level.

Because the availability of data and the measures that matter to a bank, as an entity, or to a branch, as a unit, are very different, different approaches must be taken when studying banks as the decision making units (DMUs) as opposed to the cases where the bank branches are the DMUs. Furthermore, the purposes of the studies at the bank and branch level are also different. Based on our survey of 195 published studies at the bank level, the main application issues are

1) Efficiency changes over time due to banking liberalization and deregulation, market structure and economic environmental changes.
2) Effects of ownership and bank types.
3) Bank performance benchmark and improvement.
4) International comparison.

While the diversity of the business objectives of DEA applications at the branch level are enormous, most of them focused on

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doi:10.1016/j.omega.2011.08.010

evaluating the branch's specific operating aspects with a purpose of eliminating deficiency that can be controlled by branch managers, such as branch labor use efficiency, profitability, intermediation efficiency, cost efficiency, and investigating the determinants of efficiency, such as the business environment, branch size, technical innovations, etc.

Bank branch performance measurement is a very difficult task. Branches come in a variety of sizes, offering different services to different customers while operating in different economic regions. A relevant and trustworthy bank branch performance evaluation should be able to: (1) capture the essential aspects of the bank's internal operating processes; (2) lead to a better understanding of such processes in terms of what is achieved and how it is achieved; (3) provide management improvement guidelines by identify the best practices and the worst practices; and (4) allow a meaningful investigation of various hypotheses concerning the sources of inefficiency.

From many aspects, such analyses at the branch level are more desirable and more important than at the banking institutions' level. First, information on branch performance may help improve our understanding of the underpinnings of efficiency at the bank level and help resolve some measurement problems in the standard bank-level analysis [2]. Second, a bank's branch network represents typically the largest source of operational expenses for a bank. From a managerial point of view, cost management is more efficiently controlled at the branch level; hence the results from the analyses affecting the bottom line are close at hand. Furthermore, according to the information from the U.S. Federal Deposit Insurance Corporation (FDIC), the number of commercial banks in the U.S. had been declining since 1985, dropping by almost 52% in the period between 1985 and 2009. However, at the same time the number of bank branches had been steadily increasing by more than 90%, as shown in Fig. 1. Third, although the rapid technical evolution has led to new channels through which financial products and services can be delivered, such as automated teller machines, online banking, mobile banking, etc., it is through a branch that customers do a large percentage of their more value added banking. A Canadian study found that 61% of bank customers still visited their bank branches and on average made four trips per month (NFO CFgroup Poll, "Tellers still popular, study finds", The Toronto, Canada Globe and Mail newspaper, January 23, pp. B5, 2003). The research conducted by The Boston Consulting Group found that the financial crisis of 2008 had deepened the need among consumers and small businesses for reliability, reassuring face-to-face contact, and would result in a more important role for the local bank branch in the post crisis era ("Building a high-powered branch network in retail banking", The Boston Consulting Group, March 10, 2010). Therefore, the ability to continuously improve branch performance is crucial to help a bank win in an extremely competitive financial services marketplace and well-executed branch strategies, based on sound analyses, will, almost for certain, improve a bank's overall operating results.

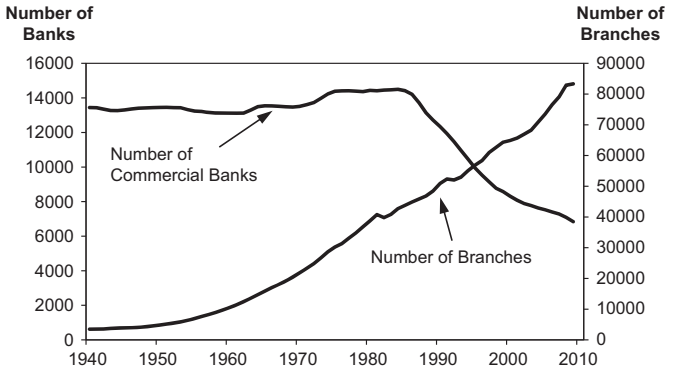

Fig. 1. Trends of the number of banks and branches in U.S.
(Data source: U.S. Federal Deposit Insurance Corporation, Historical Statistics on Banking).

With a growing number of studies using DEA in bank branch analysis, a survey of this field would be useful and timely. Since the first published paper about DEA application in a U.S. bank branch setting by Sherman and Gold [4], our survey identifies 80 DEA applications at the bank branch level. Section 2 discusses several most common performance measurement approaches that have been applied in the banking industry at the branch level. In Section 3, we summarize some interesting findings observed from the 80 studies examined, such as the distributions of the studied nations, the sizes of data sets used, and the timing of the publication of results. Section 4 reviews and segments studies according to their main research purposes. In Section 5, some considerations about model building are discussed with references to past work that could be helpful for researchers and practitioners when applying DEA to study bank branch issues. In Section 6, the areas needing further research are discussed and in Section 7 we draw our conclusions.

2. Performance measurement approaches applied to bank branches

Due to the rapidly increasing complexity of today's business environment, there is no universal agreement on the specification of bank branch performance and the challenge still remains in selecting the most suitable methodology for this important problem. At least four different approaches are commonly employed: ratio analysis, regression analysis, frontier efficiency analysis, and other artificial intelligence techniques, such as neural networks, analytic hierarchy processes and balanced scorecards, just to mention a few.

2.1. Ratio analysis

Historically, ratio analysis has been the standard technique used by regulators, industry analysts and management to examine performance at all levels. Ratios measure the relationship between two variables chosen to provide insights into different aspects of the branch's multifaceted operations, such as profitability, capital adequacy, asset quality, risk management, and many others. Any number of ratios can be designed depending on the objective of the analysis, the traditional financial ratios for estimating bank branch performance are return on total assets; return on investment; loans per employee; deposits per employee; cost to income and many others [5].

Although the traditional ratio measures are attractive to analysts due to their simplicity and ease of understanding, there have been many methodological problems and limitations that must be considered [5–8]. Its main weakness is that each of the ratios examines only a part of the unit's activities, which fails to reflect a bank branch's multidimensional nature and, hence, fails to yield enough performance information. Moreover, there seems to be an unlimited number of ratios that can be created from financial statement data and the results can be contradictory and confusing, and thus ineffective for the assessment of a branch's overall performance. Ratios, by their nature, are constant returns to scale and that is also clearly a problem when looking at a variety of branches where this does not apply. Furthermore, although ratios do provide certain useful information on the performance of a unit on specific aspects they are not suitable for setting improvement targets for inefficient units. Perhaps more importantly, from a human perspective, the branch