

Nonprofit Public Libraries and Organizational Performance: Assessing the Impact of Intermediate Outputs on Technical Efficiency With Two-Stage DEA

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ABSTRACT

This study applied a two-stage data envelopment analysis (DEA) model with variable return to scale (VRS) to assess the impact of intermediate outputs on the technical efficiency of nonprofit public libraries (NPLs) in the United States (US) with respect to attaining service and program outcomes. The findings revealed that 46% of the NPLs were technically efficiency with respect to attaining the intermediate outputs at stage one. At stage two, 7% of the libraries were efficient with respect to attaining their service and program outcomes. The findings also revealed that the libraries which were efficient at stage one had an average reciprocal inefficiency score of 0.396 at stage two. By contrast, libraries which are inefficient at stage one had higher efficiency scores at stage two. The DEA analysis also produced estimates in regard to the optimal level of performance the NPLs should attain for each intermediate output to increase the level of technical efficiency at stage two.

KEYWORDS

Data Envelopment Analysis, Financial Inputs, Human Capital, Intermediate Outputs, Nonprofit Public Library, Program Outcomes, Technical Efficiency, Two-Stage DEA

1. INTRODUCTION

Over the past 25 years, the number of studies which have used data envelopment analysis (DEA) methods to assess the technical efficiency of academic and public libraries has increased greatly (e.g., Shim, 2003; Stroobants and Bouckaert, 2014). Numerous DEA-based studies have examined the technical efficiency of academic libraries with respect to book circulation, reader visits, and reference transactions (e.g., Chen, 1997; Kwack, 1993; de Carvalho, Jorge, Jorge, Russo, & de Sá, 2012; Reichman, 2004; Saunders, 2003; Shim, 2000). Other DEA-based studies have analyzed the technical efficiency of public libraries with respect to operating hours per week, the number of registered users, the number of books borrowed per reader, and total circulation (e.g., De Witte and Geys, 2011; Guajardo, 2018; Hammond, 2002; Li and Yang, 2014; Miidla and Kikas, 2009; Sharma, Leung, and Zane, 1999; Stroobants and Bouckaert, 2014; Vitaliano 1998; Vrabková 2016, 2017; Worthington 1999). While the majority of the DEA-based studies have assessed the technical efficiency of public libraries in terms of achieving specific outputs such as book circulation, reader visits, and reference transactions, Guajardo (2018), Saunders (2003), and Vitaliano (1997) examined exclusively the technical efficiency of libraries with respect to operating costs related directly to salaries and the procurement of library books and materials. Although previous DEA-based studies have evaluated the

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cost and technical efficiency of academic and public libraries and have contributed to understanding how inputs are converted to service and program outputs and outcomes, they have been paid little attention to how intermediate outputs such as visitors per operating hour and program attendees per full-time equivalent (FTE) effect the technical efficiency of libraries in attaining service or program outcomes such as FTE salary expenditures per visitor, FTE salary expenditure per program, and library expenditures per visitor.

Despite the growth of digital libraries, county-, municipal-, and special district-operated public libraries and nonprofit public libraries (NPLs) with physical buildings and space in the United States (US) will continue to exist and will continue to receive government- and tax-based funding into the foreseeable future. Because US public libraries receive and rely on tax-based funding to provide services and programs to children, to young adults, and to senior citizens in their service area, the financial and operations performance of US public libraries is important to a plethora of internal and external stakeholders. Simply stated, library executives and managers are responsible for ensuring that the public library which they manage and oversee is fiscally healthy and that programs and services are delivered to customers as efficiently as possible. In the case of NPLs, the financial and operations performance of the institutions is important to the board of directors, to corporate donors, and to individual donors who have a keen interest in the financial health and in the performance of the institutions. In addition, the financial and operations performance of US public libraries is important to business, community, political leaders because US public libraries with physical buildings and space produce local and regional economic benefits as measured by return on investment (ROI) and return on assets (ROA).

From a financial management and operations perspective, the concurrent assessment of intermediate outputs and program and service outcomes helps to determine whether NPLs in the US are technically efficient with respect to converting financial and nonfinancial inputs to produce intermediate program and service outputs such as visitors per hour and whether the technical efficiency associated with the production of the outputs subsequently increases or decreases the technical efficiency of the NPLs in attaining program and service outcomes such as operating costs per visitor (e.g., Chen, Liang, Zhu, 2009; Chen, Wade, Ning, Zhu, 2009; Chen and Zhu, 2004; Golden, Brockett, Betak, Smith, and Cooper, 2012). A two-stage DEA model recognizes that the production of outputs and the attainment of program and service outcomes are interrelated and that the technical efficiency associated with the attainment of program and service outcomes depends on the production of intermediate outputs (e.g., Chen et al., 2009; Golden et al., 2012). With respect to assessing the intermediate outputs produced by US NPLs, a two-stage DEA model benchmarks the technical efficiency of US NPLs in converting financial and nonfinancial inputs to intermediate outputs. At two-stage, a two-stage DEA model uses the intermediate outputs as inputs to obtain technical efficiency coefficients which assess whether an organization's efficiency is increased or decreased due to its production of intermediate outputs (Chen et al., 2009; Chen and Zhu, 2004).

From a technical inefficiency perspective, a two-stage DEA model identifies whether inputs should be minimized or whether intermediate outputs should be increased to achieve technical efficiency at stage one. If an output-oriented two-stage DEA model is used, an increase in the production of intermediate outputs would improve the technical efficiency of the US NPLs as inputs are held constant. At stage two, an output-oriented two-stage DEA model would provide performance targets for each program and service outcome which should be achieved to attain technical efficiency.

Considering the gap which exists in the extant research with respect to how intermediate outputs produced by public libraries subsequently affect the attainment of program and service outcomes, this study analyzes concomitantly the technical efficiency of US NPLs in producing outputs and then of how the production of those outputs impacts the technical efficiency of the NPLs in attaining program and service outcomes. The simultaneous analysis of intermediate outputs and program and service outcomes is accomplished by conducting a two-stage DEA analysis. By undertaking a two-stage DEA analysis, this study addresses the following research questions (RQs) concurrently:

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