Abstract

In this study, we assess efficiency, productivity, and technical change of the Italian public state libraries in the period 2003-2010 using a Malmquist productivity index that we decompose into technical efficiency, scale efficiency and technological change that allow to identify the source of productivity changes. To examine the relationship between the libraries’ basic inputs, intermediate measures and final outputs a simple two-stage network model has been employed. Recent developments in bootstrapping techniques are used to correct productivity estimates for bias and to construct confidence intervals for the various components of the Malmquist index. We are able to show that there is virtually no significant productivity variation over the period studied argue that the public state libraries could suffers from “Baumol’s disease”.

Keywords: Malmquist index; Productivity; DEA; Library: Bootstrapping; Cultural economics

JEL: D24; Z11; Z18.

* Corresponding author: Department of Economics and Business, University of Catania, Corso Italia 55, 95129 Catania, Italy, e-mail address: a.mignosa@unict.it.
1. Introduction

Baumol’s cost disease is one of the seminal ideas in the field of cultural economics as well as one of the richest sources of debate in the area. The underlying idea is both simple and at the same time compelling (Baumol and Bowen, 1966): in certain sectors which are not very open to embracing technical change, such as the cultural sector, productivity tends to stagnate, whilst the total wage bill grows at least at the same rate as the economy or as other more productive sectors, thus leading to increased labour unit costs, which are not offset by any growth in productivity. This is coupled with the inevitable rise in the cost of goods and services in the sector. This pressure between rising costs and static productivity forces the organisations involved in managing culture to either increase their final costs over time or to run into severe financial debt and have to rely on donations and public funding. The alternative for managers might also be to reduce to the absolute minimum the use of inputs and commit to artistic production which is less demanding, thus offsetting the fiscal deficit, in this case, by having to resort to an “artistic deficit”, in other words sacrificing quality and cultural production (Heilbrun, 2001)

Despite these compelling arguments and the dark clouds looming over the future of low productivity sectors, there are solutions which can make up for, or at least delay in time, the effects of cost disease. Firstly, economic growth and enhanced levels of education can mean that any increase in the price of cultural goods can be borne by the public, given the positive link between cultural consumption and the level of rent and human capital, respectively (Seaman, 2006). Inflation in an economy over time may even help to offset or mask rising prices in the cultural sector (Peacock et al., 1982). There may also be changes in supply, broadening the potential for cultural production as well as enhancing the versatility and range of new products, multiplying the possibilities of cultural facilities and, as a result, bolstering revenue too. Finally, we cannot overlook possible improvements in managerial skills or the emergence of innovations and technical progress which might impact on the cultural sector and, therefore, enhance its performance. The coexistence of sectors which are relatively less productive should not therefore be seen as a hindrance, but rather sometimes as a necessary complement to the more ground-breaking sectors, since having higher skilled and more cultured workers may contribute towards the growth of an economy’s overall productivity.

The performing arts have been the area par excellence in the study of cost disease (DeBoer, 1985; Heilbrun, 2003; Last and Wetzel, 2011). Nevertheless, said malady may also be applied to other areas such as cultural heritage, since the underlying idea regarding the tension between stagnant productivity and rising costs remains. Indeed, institutions involved in managing cultural heritage (monuments and archaeological sites, museums, archives, libraries, and so on.)
display a productive structure which is determined by an intrinsic capital (cultural and artistic capital) which remains virtually unchanged and which is barely affected by technical progress, whereas maintenance, dissemination and research are labour-intensive and, as a result, increasingly costly within the context of the economy.

This does not imply that cultural heritage is totally impervious to innovation and technological change. Quite the contrary, since over the last few years wide-ranging progress has been made that has affected the way it is both provided and consumed (Navarrete, 2013; Gucio et al., 2016; Rizzo, 2016), and which may be summed up in three main areas: conditions of accessibility, the creation of new products and the impact of technical breakthroughs on management, restoration and maintenance. With regard to the first of these, we might think for example of how the digitisation of documents has influenced the performance of archives, or the appearance of e-books and online subscriptions to collections of journals, thus expanding loan services and the use of libraries for consultation purposes. The efficiency of social networks and the online availability of information and news (web connection) has substantially improved accessibility to museums and heritage ensembles, cutting access costs and doing away with restrictions of time and space. Moreover, new heritage-based digital products or others which can offer fresh additional content are now in a position to compete in terms of appeal with the enjoyment of an in situ visit and can also enhance the supply of available culture (Navarrete and Mackencie Owen, 2016). Finally, technological progress can also have an impact on the performance of how cultural heritage is managed and maintained, even though at times adopting and embracing these innovations may in the short term lead to a substantial increase in the number of specialised staff, which may be offset by gains in productivity (Baumol and Blackman, 1983). For these reasons, it is both useful and interesting to carry out a dynamic analysis of productivity in cultural heritage institutions and to gauge the extent to which cost disease has had an impact on the sector over time.

Despite the interest this has aroused, few studies have devoted themselves to the issue, at least if compared to the abundant number of cases that have dealt with the performing arts. This may be due to the difficulties which occasionally arise when attempting to obtain detailed information concerning the costs of the various functions undertaken by these institutions, coupled with the additional problem of seeking to objectivise in market terms several of the services involved, given the public nature of many institutions. Most of the studies carried out in this regard have assessed the efficiency of groups of cultural heritage institutions, also embracing a dynamic analysis of productivity and breaking it down into various components (technological progress, technical efficiency and efficiency of scale) thanks to the Malmquist Indices approach. The first utility of this analysis is that
we can ignore the difficulty involved in any monetary valuation of the various inputs and outputs and focus on analysing technical efficiency as a problem of optimisation between the factors and results of a production function. The second utility lies in the fact that we can ascertain the causes underlying the progress (or setbacks) in these institutions’ productivity, and whether this is due to overall technological improvements (technical progress or a shift in the efficiency frontier), performance improvements of the units in hand (technical efficiency or shifts towards the efficiency frontier) or more efficient adaptation to the optimal production scale (efficiency of scale). Some of the studies conducted to date seem to distinguish, for example, between the fact that museums achieve enhanced productivity owing mainly to improvements in management and better performance (del Barrio and Herrero, 2014), whilst libraries are principally affected by technological change rather than by better internal administration (Simon et al., 2011; Reichmann and Sommersguter-Reichmann, 2010). These findings are important since they might have implications for cultural policy vis-à-vis justifying the resources invested as well as devising incentives based on efficiency bonuses.

Libraries are one of the most representative institutions in the field of cultural heritage, their basic function being the safekeeping, maintenance and updating of bibliographical heritage so as to make it available to the general public through a range of services, which basically consist of consultation and loan, although other effects are also involved (research, education, identity, etc.). They have provided one of the most widely investigated areas of study when assessing the efficiency of cultural institutions as well as in specific studies exploring cost disease, and which have even involved W. Baumol himself in 1967 and 1983 (see compilation of texts in Towse, 1997). Indeed the productive structure of libraries is based on merging a capital which it is hard to replace (documentary heritage and at times even the building itself, which may have historical value) with a workforce striving to ensure the maintenance, recording and diffusion of bibliographical material. They therefore satisfy the conditions of limited productivity and rising costs, in other words, the inevitable cost disease.

Moreover, given the particular nature of the service they provide, libraries offer an extremely suitable case for conditioned efficiency studies and two-stage evaluation, since those in charge of them have very little room for manoeuvre with regard to controlling inputs, whilst the scope and scale of a library’s performance may depend on non-discretional external factors such as accessibility and the socioeconomic conditions of the area in which they are located. For this reason, since the first efficiency evaluation studies were carried out into libraries (Vitaliano, 1998, Hammond, 2002) analyses have divided the production function into two stages. In the first stage, managers deal with basic resources (staff and
factors) in order to achieve intermediate outputs related to maintaining and making bibliographical heritage available. The second stage assesses how successful these intermediate factors are in helping to provide the services inherent to the library, in other words circulation and loan. This basic analysis structure has grown more complex over the years and has been fine-tuned in subsequent studies, adding a third stage which evaluates the impact of external factors, as in Simon et al. (2011) in their study of Spanish university libraries, or gauging the effect of contextual factors, as in the analysis of Flemish libraries carried out by De Witte and Geys (2011 and 2013). Guccio et al. (2017) also adopt a two-stage model to assess Italian libraries using a centralised network DEA model. Yet, to the best of our knowledge, few studies have explored the development of productivity in these institutions over time, except for the above-mentioned works of Simon et al. (2011) and Reichmann and Sommersguter-Reichmann (2010), who perform a dynamic analysis of efficiency in a sample of American and European libraries using the Malmquist Indices approach. Thus, this kind of analysis not only allows for a detailed appraisal of the production process of libraries as cultural institutions but also provides an analysis of changes in productivity over time and its drivers.

2. Data sample and empirical strategy

In Italy, there are 46\(^1\) public state libraries, which are managed by the MIBACT through the *Libraries and Cultural Institute General Directorate (DGBIC)*.\(^2\)

The 46 public state libraries’ mission is wide: they preserve and valorise their historical collections, collect and conserve Italian as well as international publications related to their collection and provide services to the public offering information on their collections, bibliographical information, and allowing the circulation of documents.

It is interesting to outline that they represent a rather heterogeneous set which is the result of a complex stratification with three historical cores. Under the label ‘public state libraries’ there are some University libraries, some ecclesiastic ones and institutions ranging from Renaissance libraries to Post-Unitarian ones.\(^3\) Two public state libraries (in Rome and Florence) are labelled ‘national’ and have also

---

\(^1\) Public state libraries have been recognized and organized in 1995. Originally they were 47 but since 2006 the University Library of Bologna has been removed, being under the supervision of the Ministry of Education, University and Research.

\(^2\) MIBACT organization has been reformed in 2014; detailed information on DGBIC organization can be found at [http://www.librari.beniculturali.it/](http://www.librari.beniculturali.it/)

\(^3\) A detailed description of the different types of Italian public state libraries is offered by [http://www.internetculturale.it/opencms/opencms/it/pagine/mostre/pagina_106.html?l=it](http://www.internetculturale.it/opencms/opencms/it/pagine/mostre/pagina_106.html?l=it)
a bibliographical function, i.e. to collect everything that is published in Italy\(^4\). Moreover, unlike other peripheral MIBACT structures, such as historical archives, national libraries are not located in provincial capital towns. On the contrary, they are in cities of different size, even in very small ones, and their geographical distribution is also quite uneven across Regions\(^5\). Public state libraries have very wide and rich historical collections currently consisting of almost 40 million items, including manuscripts, printed volumes, *incunabula*\(^6\), *cinquecentine*\(^7\), maps, music scores and drawings.

Public state libraries are part of the national network of Italian libraries, labelled National Library System (SBN)\(^8\) with an online catalogue and an index referring to a multimedia database of almost 10 million records to promote public access and borrowing. According to official figures, SBN has about 100 million online accesses, with about 20 million researches per year. Within the national statistic programme, MIBACT carries out a yearly investigation on public state libraries, collecting data on their inputs and outputs\(^9\).

The data we use are drawn from the Italian MIBACT database that includes data on each library collected on yearly basis by MIBACT Statistical office. The dataset consists of a sample of cross-sectional and time series observations for 45 Italian public state libraries\(^10\) for 8 years (2003-2010), thus resulting in 360 observations. The library service production process is considered to be represented by the use of multiple inputs to produce several outputs. On the input side we distinguish between current and capital inputs. Current inputs are generally the personnel and expenditures, as well as libraries collections of books, manuscripts, maps, periodicals and other collections.

In our empirical assessment we use as current inputs: the number of personnel (PERS) and current library expenditure (EXP), excluding current labour costs, libraries collections of books (BOOKS), manuscripts (MANUSCRIPT),

\(^4\) By law, they receive a copy of what is published in Italy. These institutions are granted special autonomy
\(^5\) 15 are located in Lazio (of which 9 are in Rome) 6 in Tuscany and none in some Regions.
\(^6\) A pamphlet that was printed – not handwritten – before the year 1501.
\(^7\) They are 16th century books.
\(^8\) More than 4,000 libraries join the system, which is coordinated at the central level. Overall, in Italy there are about 13,000 public and private libraries.
\(^9\) Using these data, a recent study carried out by the State General Accounting Department (*Ragioneria Generale dello Stato* - RGS) (2012) provides a clear picture of the various dimensions of public state libraries with respect to the size of collections, the number of users, the personnel size, and offering also some partial indicators of productivity which show a high variability across libraries. In what follows an in-depth investigation of the performance of libraries is carried out, aiming at overcoming the limitations of partial indicators.
\(^10\) One library has been excluded by the sample because data are incomplete
periodicals (PERIODICAL) and other collections (OTHER_COLLECTION)\textsuperscript{11}. The capital resources are measured by two variables: the total shelf’s dimension in linear meters (SHELF) and the number of seats for lectures and consultations (SEAT). Both current and capital inputs are used to fulfil two main tasks of the public state libraries: the fruition function (i.e. readers visits, circulation of various types of material, inter-library loan activity, etc.) and the conservation function.

With reference to outputs, annual data for Italian public state library include: readers’ visits and attendance (READERS); the consultation of different types of items (CONSULTED_ITEMS); the number of users’ requests and enquiries processed (LOAN), inter-library loan activity (INTER_LOAN).\textsuperscript{12} Table 1 provides an illustration of inputs, outputs and models employed whereas Table 2 shows the sample statistics.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|}
\hline
\textbf{Variable} & \textbf{MOD\_1} & \textbf{MOD\_2} & \textbf{MOD\_3} \\
\hline
\textbf{Inputs} & & & \\
PERS & ♦ & ♦ & ♦ \\
\text{EXP x 1,000} & ♦ & ♦ & \\
SHELF & & & ♦ \\
SEAT & & ♦ & ♦ \\
\hline
\textbf{Intermediate measure} & & & \\
BOOKS & ♦ & ♦ & ♦ \\
MANUSCRIPT & ♦ & ♦ & ♦ \\
PERIODICAL & & ♦ & ♦ \\
OTHER\_COLLECTIONS & & ♦ & ♦ \\
\hline
\textbf{Final outputs} & & & \\
READERS & ♦ & ♦ & ♦ \\
CONSULTED\_ITEMS & ♦ & ♦ & ♦ \\
LOAN & ♦ & ♦ & \\
INTER\_LOAN & ♦ & ♦ & ♦ \\
\hline
\end{tabular}
\caption{The estimated models}
\end{table}

\textit{Source:} our elaboration

\textsuperscript{11} In this category graphics, microfilms, multimedia items are included.

\textsuperscript{12} Data on other possible outputs such as exhibitions and presentations are unavailable.
### Table 2 – Descriptive statistics of employed variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs.</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERS</td>
<td>360</td>
<td>54.14</td>
<td>65.31</td>
<td>2.00</td>
<td>327.00</td>
</tr>
<tr>
<td>EXP x 1000</td>
<td>360</td>
<td>849.26</td>
<td>1056.22</td>
<td>22.92</td>
<td>10379.08</td>
</tr>
<tr>
<td>SHELF</td>
<td>360</td>
<td>17500.13</td>
<td>25234.24</td>
<td>1178.00</td>
<td>135551.00</td>
</tr>
<tr>
<td>SEAT</td>
<td>360</td>
<td>147.08</td>
<td>160.02</td>
<td>12.00</td>
<td>920.00</td>
</tr>
<tr>
<td><strong>Intermediate measure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOOKS</td>
<td>360</td>
<td>519446.02</td>
<td>1000641.47</td>
<td>25590.00</td>
<td>5751130.00</td>
</tr>
<tr>
<td>MANUSCRIPT</td>
<td>360</td>
<td>4363.56</td>
<td>8726.73</td>
<td>0.00</td>
<td>52244.00</td>
</tr>
<tr>
<td>PERIODICAL</td>
<td>360</td>
<td>1367.40</td>
<td>2812.65</td>
<td>29.00</td>
<td>17986.00</td>
</tr>
<tr>
<td>OTHER_COLLECTION</td>
<td>360</td>
<td>199116.73</td>
<td>460664.79</td>
<td>215.00</td>
<td>2829951.00</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>READERS</td>
<td>360</td>
<td>35392.48</td>
<td>50285.89</td>
<td>195.00</td>
<td>322111.00</td>
</tr>
<tr>
<td>CONSULTED_ITEMS</td>
<td>360</td>
<td>53680.03</td>
<td>107351.88</td>
<td>1062.00</td>
<td>713680.00</td>
</tr>
<tr>
<td>LOAN</td>
<td>360</td>
<td>6400.95</td>
<td>7270.42</td>
<td>2.00</td>
<td>39254.00</td>
</tr>
<tr>
<td>INTER_LOAN</td>
<td>360</td>
<td>534.02</td>
<td>617.67</td>
<td>0.00</td>
<td>3538.00</td>
</tr>
</tbody>
</table>

*Source:* our elaboration on data provided by MIBACT Statistical office
References


