

## **Assessing library performance in the short and long runs: efficiency analysis and empirical application**

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### **Purpose**

To present a sequential approach to library assessment in the short and long runs from an efficiency standpoint.

### **Design**

The sequential model combines Data Envelopment Analysis and Markovian Analysis and consists of three steps. First, optimal scores are computed from the estimation of selected DEA models to rank individual libraries. Second, DEA results are again used to provide optimal allocative corrections providing “inefficient” units with quantitative paths toward efficiency.

Third, a long run evaluation of library performance is accomplished by Markovian analysis applied to the observed transition matrices.

The empirical illustration is supported by a convenience sample of 37 libraries pertaining to a federal university in Rio de Janeiro, Brazil. Data relate to three inputs (number of employees, physical area in square meters and number of volumes) and four outputs (number of visits, of loans, of registers and of consultations).

### **Findings**

Since every “efficient” library has a score equal to 1, the performance of the 8 libraries in that situation cannot be improved along 2000-2007. These 8 libraries present a robust performance and deserve attention no matter how “benchmark” is understood. Relatively “inefficient” libraries received a score less than 1. Some “inefficient” libraries have never visited the efficiency frontier and are even far away of it; in that sense they also deserve managerial attention. One library has been “efficient” along the whole period except for one year. Why has that been so? Should this situation be ascribed to measurement error or does it mean a negligible loss in performance? Any managerial answers to those questions should involve individual follow-ups.

Operation plans are always provided as a typical output from a DEA solution for each (“inefficient”) library and each year. In the present example several resource decreases and output increases occurred simultaneously, a result that again deserves managerial attention. The same attention is due to volume discards: they deserve special attention because collections may not be altered, as well as some individual titles (such as current textbooks or books of historical interest) should not be arbitrarily disposed of.

The mean first passage time from “inefficiency” to “efficiency” was computed as approximately equal to 1 year and 10 months. This means that if a given unit is inefficient today and if no managerial action is taken, then on average it will take 22 months for the unit to become efficient. This delay may be compared to the time required for any possible remedial measures to become effective, say revised budgeting or training.

The Markovian approach also directly provided the mean recurrence time for each state of the system – “efficient” or “inefficient” – that is, the mean time required before the system returns to a given state having started in that same state. The mean recurrence time is

approximately equal to 2 years in both cases, so that the period of two years seems to be critical in the sense of monitoring the return of a state to itself. In the case of inefficiency it represents a sort of “safe mean time span” for managers willing to change the operative conditions facing inefficient units. Since operative corrections do already point to “optimal changes” by library, library managers may evaluate for which libraries those changes would be feasible within (the next) two years. In addition, on average an “inefficient” library will return to inefficiency just two months after it may reach efficiency for the first time, if no managerial action is taken, so that two months is a really critical time span for that action to occur.

The long run distribution of the library system between the two states was computed as:

$\pi_E$  ( percent efficient ) = 51, 5%;  $\pi_{NE}$  ( percent inefficient ) = 48,5% .

Since the mean score percent equals 48,7%, there is still no strong evidence as to whether long run results are of a different numerical nature *vis-à-vis* the arithmetic of numerical individual scores.

### **Implications**

The application of a nonparametric approach implies that, although libraries are mostly not-for-profit organizations, the proposed model is analogously applicable to other types of organizations for which the objective function is a priori unknown or too costly to be made empirically usable. Optimal allocative changes implied by the DEA model may also be compared against observed actions on a yearly basis for each library and to that extent will help evaluate individual performance. The third step introduced a very simple long run perspective. To the extent that individual libraries are yearly assigned to a “state” according to their performance and that “transitions” refer precisely to those states, our approach is aggregate in the sense that only “systemic” information remains. Hence levels of efficiency scores relating to specific libraries are in that sense voluntarily lost.

### **Conclusions**

Since there is evidence that inputs may be reduced alongside with outputs being increased, library managers must keep alert and proactive as to take advantage from potential efficiency gains along time. In the first steps, typical DEA models provided both rankings and operation plans that not only help evaluate performance, but also help “inefficient” libraries in their quest for efficiency. The third step provided better knowledge concerning the time delay required for efficiency to be attained for the first time when a prescribed operation plan happens to be adopted, as well as about the time during which an undesired (“inefficient”) situation will persist if that adoption is postponed. Summing up, the proposed model uncovers quantitative aspects that may be of assistance to library managers committed to efficiency in the short and long runs. Future research – e. g. based on either alternative ways of using scores to define “states” or on alternative ways of obtaining a transition matrix to start the process – is likely to provide further theoretical as well as empirical information that will allow for a better assessment of the proposed model.

### **Originality and value**

Among the characteristics of interest of DEA models that are relevant for the assessment of libraries – mostly subject to operate under the restriction of an a *priori* limited budget – mention must be made of the possibility to include in the analysis several inputs and outputs estimated by different units of measurement. Therefore the direct use of any empirically

available inputs and outputs eliminates the need to define or redefine either resource or performance “indicators” of any such type as can be frequently found in the literature. The combination proposed here – involving DEA and Markovian Analysis – has not been found in any previous reviews of the corresponding literatures.

*Biographical note*

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