AUDIENCE SUCCESS OR *ART FOR ART'S SAKE*? EFFICIENCY EVALUATION OF DANCE COMPANIES IN THE USA

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Abstract

Our aim is to evaluate the performance of American dance companies, considering that the production process may be subdivided into consecutive stages consisting of fundraising, artistic production, and social impact. A three-stage network-DEA model is applied which takes account of the links between stages in the form of intermediate inputs/outputs and provides an overall indicator of efficiency together with partial performance indicators in the stages. Given the lack of information for some variables, we previously undertook a process to impute missing values following MICE (multiple imputation by chained equations) procedures. Results show that the highest levels of efficiency are achieved during the cultural creation stage, whereas the lowest correspond to social impact, indicating that dance companies pursue artistic excellence in their cultural programming, irrespective of

their activity's commercial outcomes. Moreover, public and private funds are seen to be channeled following this guideline, thereby justifying the non-profit status of these entities.

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1- Introduction

Since the twentieth century, economists have associated financial vulnerability with performing arts companies, which of course includes large American not-for-profit dance ensembles, such that they were proclaimed to lack immunity from Baumol and Bowen's (1966) cost disease. The principal argument concerning this malady is that dance companies, as for the whole performing arts sector, are eminently labor-intensive with almost stagnant productivity. It is not possible to speed up production or to reduce the amount of labor involved. This means that labor costs per product unit continue to rise over time, leading to an inevitable gap with potential revenue and, therefore, to the possible financial collapse of arts companies (Brooks, 2000). Whereas in other activities of the same production type in the economy this endemic disease is dealt with through price increases, in the performing arts and particularly in dance spectacles, this is not a very operative solution given the policy of setting prices for long periods (seasons) coupled with the possible danger of losing spectators in the medium and long term (Smith, 2003-b). This is partly why most initiatives in this field are ultimately geared towards non-profit organizations, particularly in the US market, as an institutional form which benefits to a greater or lesser degree from public and private subsidies.

Although there is room for for-profit activities in the performing arts sector, certain circumstances justify the substantial presence of non-profit entities. Such factors are related to the cost structure of producing performing arts and to the problem of contract failure (Hansmann, 1980 and 1981). This type of performance attracts a very limited audience and entails high fixed costs in terms of staging, although once performances are underway the cost of attracting new spectators is low. Companies thus face the dilemma of either setting a price that is high enough to cover all the production costs for only a small number of performances or of maintaining a price close to marginal costs in order to ensure larger audiences and so increase the number of performances[1]. Hansmann (1981) states that the solution to this problem involves price discrimination, whether through objective reasons, where it is possible to charge higher prices for seats with a better view, sound, or offering preferential treatment to certain spectators, etc.; or through the possibility of securing additional contributions when the work's perceived value exceeds the entrance price (Heilbrun and Gray, 1997). This would be the case when staging performances with a guaranteed quality standard. Here is where non-profit organizations are more trusted because their corporate structures offer no incentive to cheat, thus overcoming the contract failure problem (Hansmann 1980). Adopting the non-profit institutional form is therefore justified because it is a way of channeling the provision of a public service, particularly one of a cultural and artistic nature, so that it ensures the affinity and independence of its mission and helps to secure public and private funding to make its activities viable or to carry them out in accordance with higher quality standards. Nonetheless, many non-profit organizations are also beginning to recognize that a successful market orientation involves successful stakeholder management, and now accept the paradigm of pursuing internal efficiencies or even focusing on the marketplace (Shoichet, 2003).

Whatever the case, the artistic production side of the dance market in the USA is mainly organized through non-profit dance companies which, according to Toepler and Wyszomirski (2012), account for 75% of all existing entities and 85% of the income generated by the dance sector. The non-profit model for developing the dance company sector implies that, although the principal mission is artistic, in other words, to produce a dance spectacle, this must be combined with management obligations aimed at securing resources and adopting a strategy geared towards audience success and social impact, as this will ultimately determine these entities' visibility and recognition in the medium term. This is why the production function of dance companies should be seen as a multi-objective function, involving several inter-reliant inputs and outputs split between various stages of the activity, each of which perform better or worse.

These circumstances also underpin the timeliness of efficiency studies in the dance sector; firstly, because efficient performance supports perceiving public funding to achieve a desirable social and cultural objective, and secondly because measuring the efficiency of these entities helps gauge to what extent the goals for which they were created are being achieved, providing valuable information to managers and private donors alike (Grizzle, 2015). Despite this, there are very few efficiency evaluation studies in the field of dance. On occasions, this is due not only to the difficulty involved in having adequate data available for analysis, but also because of the problem of defining this sector's production technology. Our work thus also seeks to posit a valid method for analyzing performance in the field of dance, and attempts to carry out an empirical application, specifically in a representative sample from the non-profit dance sector in the United States, which means most of the market. As a reference, we thus take previous studies into the performing arts that have

drawn on efficiency evaluation using frontier techniques, particularly Data Envelopment Analysis (DEA), which measures efficiency as a distance vis-à-vis optimal cases from an allocated production function. In most cases, simple evaluation models with a single analysis stage are posited, where all the entity's activities are valued jointly. Yet, to the best of our knowledge, no studies in the performing arts sector have to date evaluated efficiency taking into account the links between the various stages involved in the production process such as fundraising, which provides for building the specific cultural or artistic supply and which finally attracts the audience and generates social impact. Ignoring these links might yield evaluations that are not true to reality since the results from one stage might shape the performance of the next. Our contribution seeks to overcome this difficulty by introducing a network-DEA model based on the works of Tone and Tsutsui (2009) which, in addition to providing an overall efficiency indicator for each entity, also give a measure of efficiency for each stage identified in the model, thereby offering clearer insights into sources of inefficiency.

The study is based on data supplied by SMU DataArts[2] relating to 268 US dance companies in 2016. SMU DataArts gathers data from around 20% of the dance companies operating in the United States, although they in fact account for some 80% of all the sector's financial resources, such that the sample may be deemed to include the largest companies. This also allows us to obtain the required homogeneity in the data for applying the DEA method. The remainder of the paper is structured as follows: first, we theoretically design a production function of a dance sector company with the basic tasks and purposes to be carried out; second, we conduct a review of previous works that address efficiency evaluation in the performing arts sector and in the dance sector in particular. We then describe the network-

DEA method and posit the description of the chosen variables, the available data and their processing. Due to the problem of missing data, we opted for a process of multiple imputation which limits bias in the information processed. The fifth section presents the results obtained on overall and partial efficiency in the dance sector, and their discussion. The final section deals with the conclusions.

2- The production process in the dance sector

As mentioned, dance company management should be evaluated from a triple perspective: first, assessing how successful they are at raising the resources required to put together the entity's artistic supply; second, analyzing each entity's performance in designing its cultural supply; and third, gauging the success of the program in terms of audiences and social impact. We now provide a justified individual analysis of each of the three stages involved in the production process and explain why we approach them in a differential, albeit interrelated, manner.

Firstly, as pointed out earlier, the non-profit sector is predominant in the dance sector. This means that the entity receives two types of revenues: earned income, obtained through ticket sales from spectators and other related services; and non-earned income, which are mainly external funds from private donors, explained under the concept of voluntary price discrimination (Hansmann, 1981), or public subsidies, justified through performing arts activities being deemed as a public good and a merit good[3]. Internally generated income in the dance sector accounts for around 30% of the resources available to such entities (Smith, 2003-b), although the degree of dependence may vary substantially: ballet companies derive most of their revenue from earned income, whereas modern dance companies have

the opposite funding pattern, deriving most of their revenue from contributed income (Felton, 1994). Seeking out and securing such contributed funds is key in the first step of dance companies' activities and we wish to know how these donated funds might afterwards determine artistic output and, ultimately, dance company success.

Different studies have explored fundraising in the non-profit domain and in the culture and arts sector in particular. Many of these studies attempt to pinpoint which factors influence the decisions taken by public and private donors. One group of works focuses on how accounting information and measures of financial performance from arts nonprofits can influence fundraising efficiency (Grizzle, 2015). Another group of works addressing fundraising efficiency seeks to analyze whether public subsidies compete with private donations. Song and Yi (2011) and Kim and Van Ryzin (2014) point to the existence of a crowding-out effect for cultural entities as a whole, whereas Smith (2007) finds that symphony orchestras and music companies experience a modest crowd-in, while dance and ballet companies experience a small crowd-out. Conversely, Hughes et al. (2014) find crowd-out effect for symphony orchestras. Nonetheless, Smith (2003-a) also finds that non-profit dance companies usually apply for NEA grants because these funds specifically crowd-in between $4 and $16 in private and other public funds. Curiously, major government funder affects negatively for public fundraising in other sectors (Zhao and Lu, 2019).

The second activity in the dance sector production process is the actual creation of the cultural supply, and involves selecting which works are to be presented to the public, in other words, the repertoire. This might be geared towards quality criteria, by staging works that cater to more refined tastes or which are more ground-breaking or imply a greater technical challenge and which obviously pose a greater risk vis-à-vis attracting audiences. In

contrast, the program might focus on more popular and well-known works, which entail less risk and ensure larger audiences and probably higher takings. Focusing on one criterion or another depends to a certain degree on companies' specialization and reputation, but also on the economic and institutional context. For instance, Heilbrun (2001) found that US opera companies have been shifting their programming toward a more popular, less demanding repertoire to ward off financial pressure. McGrath et al. (2017) demonstrate that Canadian orchestras, which are predominantly dependent on public funding, tend toward more standardized and safer repertoires in times of financial crisis as a means of ensuring and justifying audience success to government. As regards donors, Dimaggio (1983) argues that, broadly speaking, major patrons tend to be more supportive of innovation and new creations in arts organizations, while medium and smaller donors support established prestigious organizations, excluding non-traditional or experimental endeavors. In this line, Pierce (2000) finds for American opera companies that local government funding encourages program conventionality, while federal support such as the NEA encourages repertoire risk-taking. Finally, as regards the connection between program quality and audience success, Pompe et al. (2011) show that increased funding from ticket sales, endowments, and local government increases the likelihood of a US symphony orchestra performing a non-standard repertoire. A similar result is also found for American theaters, where market dependence (as opposed to grants and contributions) is associated with greater repertoire conformity (DiMaggio and Stenberg, 1985).

All of these issues are related to the final phase of the dance company production process, which concerns service provision (cultural supply) to the public and whose impact is measured in the form of audiences and social visibility. However, this final stage has one

distinguishing feature; namely that whereas decisions in the previous stages are taken internally by managers, in the final stage the public play an active part in the decisions, such that the entity loses part of the control over the process's output, with there being external factors that might impact the scale of success (De Witte and Geys, 2013). Public demand, i.e. number of spectators, has traditionally been used to measure performing arts success, since it involves the number of in situ experiences related to the performances. Nevertheless, today's technology and communication tools offer fresh possibilities for interacting with audiences (Bakhshi and Throsby, 2012), by creating new cultural products (media and content products), but particularly by acting as a means to engage with and create new audiences (Ostrower and Calabresse, 2019). This is why most entities, and dance companies, are making a concerted effort to develop social communication platforms which can enhance their achievements in terms of visibility and social impact.

Finally, we should be aware that performance during the final part of the production process as regards new audiences and social visibility may affect the dance company's behavior during the previous stages, cultural programing, and fundraising. Public demand and social impact do not always go hand in hand with artistic and creative trends, such that the entity is forced to choose one strategy or another; in other words, success in terms of public and audiences or in terms of cultural production, i.e. art for art's sake. For that reason, approaching the dance companies' production process in this interrelated manner entails the need to evaluate performance during the various stages separately, whilst not forgetting that all the stages are connected, since decisions taken at one stage shape the outcomes of the next. There is where our research question emerges, and which involves exploring whether dance companies pursue cultural or commercial goals. For this, we design

a complex efficiency evaluation method which considers the existence of different objectives to be met and the sequential design of the production function in three different activities subject to optimization. These stages are shown in Figure 1 and involve fundraising, artistic creation, and cultural programing and, finally, audience success and social impact.

FIGURE 1

3- Efficiency evaluation of performing arts: state of the art

To date, there have been fewer efficiency studies in the performing arts sector than those addressing other cultural institutions. Even though many studies focus on the efficiency evaluation of entities such as museums (Del Barrio-Tellado and Herrero-Prieto, 2019) or libraries (De Witte and Geys, 2013), in the case of performing arts, most works have tended to deal with theaters, in other words, evaluating the performance of the venues where the service is provided. However, there are hardly any efficiency studies focusing on the actual entities involved in the creative and production side of the service (theater companies, dance companies, opera companies, orchestras, etc.). On occasions, this may well be due to the impossibility of having stable data available, given that performing arts companies very often change depending on the program they wish to stage, or when such ensembles are created for a specific purpose and with a limited lifespan linked to a particular project. Despite the difficulties this might entail, such studies prove justified since, as pointed out, most performing arts entities act as non-profit and depend on funding, whether public or private.

Most efficiency studies in the performing arts sector are grounded on a notion of technical efficiency; in other words, they aim to analyze whether it is possible to achieve a greater level of outputs using as few resources as possible. Most methods have tended to focus on constructing efficient frontier behaviors, determining each institution's level of performance by calculating the distance from said frontier. There are two basic analytical approaches for estimating efficient frontier behaviors (Coupet and Berrett, 2019): parametric methods (Stochastic Frontier Analysis) which require a specification of the production function and where we find applications for theaters in Poland (Fernández-Blanco et al., 2019), Germany (Last and Wetzel, 2010), Switzerland, and Austria (Zieba, 2011); and non-parametric methods (DEA, and Free Disposal Hull) which require no such specification and therefore afford greater flexibility. Works include theaters (Marco Serrano, 2006) and dance (Del Barrio-Tellado and Herrero-Prieto, 2018) in Spain. The later posit a DEA methodological approach from a twin perspective; efficiency evaluation of theaters involved in a public circuit and dance companies who offer their creative program to the choice of theaters.

As pointed out, most works focus their case study on the venues where the cultural program created by theater companies, dance companies or orchestras is offered to the public. Our aim in this work is to evaluate those entities directly responsible for cultural creation, namely the dance companies. Nonetheless, one small group of works focuses on measuring the efficiency of the entities responsible for the creative part of the cultural product, such as the case of orchestras and performing arts companies. In this particular domain, the work of Castiglione et al. (2018) seeks to identify which factors determine the technical efficiency of a set of 107 firms involved in the performing arts sector in Italy, applying a DEA model. Also using DEA, Boyle and Throsby (2012) estimate the relative

efficiency of a small sample of orchestras in Australia, and Hong (2014) does the same for a group comprising 48 young orchestras in the United States, although in this case the performance evaluation is designed using a two-stage DEA model; the first evaluating fundraising and the second measuring performance in the provision of the cultural service.

All of the works thus far described posit an evaluation using simple DEA models, either because all of the activity may be summed up in a single stage or because, even though the production process is divided into different stages, the possible relations between them are not taken into account, and the performance for each activity involved in the production process is measured independently. This is where it proves more appropriate to adopt multi-stage approaches that define the various production processes separately but in an interconnected manner through intermediate inputs/outputs, thus helping to identify the observed causes of inefficiency. Applying network-DEA models such as proposed by Tone and Tsutsui (2009) thus proves appropriate in the line of new developments in DEA models. These models calculate efficiency at each stage, whilst simultaneously providing an overall efficiency indicator for each institution. Although network-DEA has been used to analyze efficiency in other areas such as energy, health, finance or hotels (Avkiran and Tone, 2016), to the best of our knowledge, there are still no applications to the performing arts sector, even though the manner in which they conduct their activities and the link between fundraising, cultural production, and final presentation, would seem to advocate their use.

4- Methodology and data

As pointed out previously, although certain works focusing on measuring efficiency in the performing arts sector posit the use of DEA models involving various stages, none have

taken into consideration the links between these stages, but have calculated efficiency indices separately for each activity. Our study puts forward a multi-stage evaluation model which analyzes the various sequences that make up the entity's activity, taking account of the interrelations wherein the output from one activity becomes the input for a subsequent activity. Our model identifies three production processes in dance companies, which are linked in the form of stages and which are summed up in Figure 1. The first stage addresses the fundraising process where, given that it is a non-profit entity, we consider all the donations and subsidies received which may be public or private and which are deemed unearned incomes. Said fundraising determines the second stage of the production process, the actual artistic production which, through different versions of capital and labor, is reflected via specific output, namely cultural programming. The final stage of the model measures performance when providing the service, in other words, the success of the artistic production in terms of attracting audiences or social impact.

The network-DEA models adapt well to our case study and provide an overall efficiency index for each unit as well as an efficiency index for each activity or stage in the cultural production process. This makes it possible to gauge the impact of a specific activity's inefficiency on the entity's overall level of efficiency. Following Tone and Tsutsui (2009), we apply a network-SBM model (slacks-based measure) with a non-radial focus, in other words, avoiding the radial model assumption of proportional changes in inputs and outputs. This seems appropriate in our case study, dance companies, where inputs are measured in terms of work and capital, which are factors that may partially be considered substitutive and that do not always change proportionally. Medina-Borja and Triantis (2014) also point out that, in the case of service organizations, non-radial models offer the most suitable approach to

reflect the behavior of variables such as service quality or achievement in terms of outcomes. In addition, the model we propose is a non-oriented model that includes information related to slacks in both inputs and outputs, providing a *strong* measure of efficiency, as opposed to the concept of *weak* efficiency offered by conventional radial models that fail to take account of slacks information. As for the optimization problem, no restrictions are placed on weights as regards inputs and outputs. According to Dyson et al. (2001), restrictions on weights in the optimization process must be significant and well justified in order to ensure the model's reliability. As a result, we decided not to establish weights, but rather to let the data speak for itself; in other words, in terms of input and output intensity. Nor did we establish different weights between the stages of the production process, since we felt the three stages offered a balanced reflection of how dance companies behave in the market[4]. In addition, this sequential process would be compatible with an order of inverse sequences: in other words, first the artistic product is identified and then funding is sought, since the content of each stage's activity is maintained, as well as the basic rule of measuring efficiency as a distance compared between resources used and results obtained at each sequence. Finally, as regards the technological hypothesis, the model assumes variable returns to scale which provides a less restrictive evaluation than constant returns to scale. Moreover, discretional disposition of intermediate products is assumed (free link-case), with the managers of these entities being assumed to have a free hand with regard to the resources available at each stage.

Data for our study were provided by the SMU-DataArts which, through the Cultural Data Profile (CDP) gathers financial and programming data for different size non-profit organizations in the art, culture and humanities sector for all disciplines in the United States.

Primary data refer to non-profit entities in the dance sector that were operational in 2016, and which covered a total of 472 companies. Based on this data, small homogeneity adjustments were made, ruling out companies who notified their data to the Internal Revenue Service (IRS) using the abbreviated form (Form 990-EZ) as well as all entities outside the specific category of Performing Group in the NISP classification [5]. This yielded a final set of 306 entities. For the sake of reliability (Jacobs and Marudas, 2009), we undertook a fresh review of the data focusing on criteria reflecting a lack of activity in the year studied (zero management expenses, zero staff or total assets expenses, no tickets made available, etc.) such that the final reliable sample came down to 268 dance companies for 2016.

The variables used in the analysis were chosen bearing in mind the different tasks identified in dance companies' activities. The particular relation of inputs and outputs in each, as well as the intermediate interconnected resources, are shown in Figure 2, which we now explain. First, the variables identified to evaluate fundraising by each company are, on the input side, managerial expenses (MANG) and expenses devoted specifically to capturing financial resources (FUNDEXP). Output from this stage is reflected in the total amount of resources secured externally in the shape of public and private contributions (CONTOT). Selection of the variables is consistent with prior literature evaluating efficiency in fundraising by non-profit entities (Medina-Borja and Triantis, 2014) and more specifically in the domain of cultural institutions in the United States (Hong, 2014). The second stage relates the resources employed to the entity's cultural offerings. This process involves various facets of capital resources (total amount of donated funds raised during the previous stage, CONTOT, plus the entity's total assets, TASSETS) and labor (total staff expenses, PERS; and number of hours' work done by volunteers, VOLUNT), in accordance with other performance

evaluation studies carried out for the performing arts (Marco-Serrano, 2006). The chosen outputs from this stage seek to reflect all of the activities and services offered by dance companies which, in most cases, are not confined to merely staging performances but also embrace an array of complementary activities. We thus consider the total number of seats offered for the scheduled performances (SEATS), which is a proxy of the main artistic supply[6], together with the number of complementary activities (classes/workshops, field trips, festivals, competitions, conferences, exhibits, etc. DIFEVENT). The last stage of our model seeks to measure the final impact of the activities organized by the dance companies. In this case, outputs from the second stage become intermediate inputs to obtain the final outcomes, such as the total number of participants or spectators (PARTOT), social network followers (SMFOLL) and visits to the company's webpage. In this case, the outputs aim to measure the company's final impact, not only in terms of the number of those attending the scheduled artistic activities but also the interest the company is able to generate amongst the public.

FIGURE 2

Table 1 shows the variables chosen for our study together with the basic descriptive statistics. As can be seen, our database displays missing values for some of the variables considered with different degrees of impact. Assuming the randomness of the missing data, we implement a multiple imputation procedure using chained equations (MICE) and apply predictive mean matching with 40 iterations to obtain a set of ten missing data imputation (See Appendix for more detail). The efficiency analysis through Network DEA is thus performed on a set of these ten data imputations, the results of which appear in Table 2.

TABLE 1

TABLE 2

5- Results

We calculate the overall efficiency indices as well as for each of the stages in which we structure dance companies' managerial and cultural activities. The final rows of Table 2 show the mean efficiency indices and the standard deviation to emerge from the ten imputations mentioned above. The efficiency values for each imputation are close to one another, as reflected by the low standard deviation values, thus further evidencing the robustness of the results. We now look at the mean efficiency values obtained, both for the sample of dance companies as a whole and for the individualized data.

Analyzing the results of the production process by stages (Table 2) reveals how the stage at which entities obtain the best results is when they create their actual cultural offering (0.44); in other words, in the part of the activity most closely linked to the artistic and creative aspects that justify the companies' very existence as cultural entities. Results are worse with regard to the ability to raise funds (0.21), and drop to very low levels when analyzing their activity's social impact (0.06), evidencing that attracting large audiences does not appear to be the companies' principal concern. Rather, there simply seems to be a desire to engage in their artistic activity, for which they do seem to make something of an effort to raise funds. Table 3 shows the efficiency indices for the 25 companies who exhibit the best overall efficiency performance[7], and evidences the major differences in terms of efficiency levels between the companies studied, with only two emerging as efficient overall for all of the imputations. The best evaluations mainly correspond to well-established companies with a mean age of over 40. The styles showing the best results are classical

ballet, with 12 companies ranked in the top 25, followed by modern dance with seven. There also seems to be a link between geographical location and levels of efficiency, since 18 of the 25 companies displaying the best results are located in the north-east of the country.

TABLE 3

When taking a detailed look in terms of individual stages, Table 4 shows the mean efficiency indices in the three phases considered in the production function for the 25 companies with the best results. As regards the first step of fundraising, six companies reach maximum efficiency during this stage, while only a third of the whole sample are above mean efficiency, which is in fact quite low, 0.21, meaning they have ample room to improve their performance using the same resources. Companies displaying the best efficiency levels in this case belong to two clearly distinguishable categories: small companies who barely devote any resources to raising funds and over 80% of whose unearned income derives from public contributions, and large companies who actively search for funding, and over 90% of whose unearned income derives from private contributions. As a result, and as can be deduced from the research, these are companies funded in full by the various public authorities, together with those who are well-established and recognized in the market and who are able to attract a significant amount of private funding.

TABLE 4

In the second stage of the model (Table 4), which deals with artistic creation and cultural programming, four companies emerge as efficient, added to which there is better overall performance, with 137 companies above the mean efficiency level in this range, which

stands at 0.44. Once again, the best performing companies at this stage can be grouped into two different categories. On the one hand, there are large companies who are able to put together a wide-ranging and varied cultural offer that is made available to audiences in large theaters. On the other hand, there are small companies who are extremely active vis-à-vis the cultural services they offer, but who operate with only a small number of seats during their performances, since they stage their works at small venues. A comparison of data for the 25 best companies at stages 1 and 2 shows how ten are again found amongst the best in terms of efficiency in both cases. It can also be seen how the large and recognized dance companies occupy the top spots in terms of efficiency, and how there is a group of small companies who are efficient by being able to adjust their cultural offerings to the limited resources available to them.

Finally, the efficiency results in the third stage (Table 4), which evaluates social impact and audience success, are much worse in mean terms, with only three companies emerging as fully efficient. Mean efficiency in this segment is only 0.05, and only 41 companies are above this threshold. In this case, it is the large and most recognized ballet companies who are able to attract audiences, which is reflected both in performance attendance as well as in the interest they arouse in social networks or the large numbers of visits to their information pages. The difference compared to small companies is insurmountable, since the latter lose their capacity to attract audiences and fall to extremely low levels of efficiency in this part of their activity.

Figure 3 shows the geographical distribution of the dance companies that register an efficiency ratio above the average at each stage. A large concentration of companies with the best practices in all three senses can be seen especially in the New York area. Second,

the poles of San Francisco, Los Angeles, Chicago and Houston are also noticeable. There appears to be a certain concentration of companies with superior performance in the most important metropolitan areas in the country, which seems to support the idea that the potential for demand and the scale of the existing performing arts market act as drivers of efficiency levels.

FIGURE 3

In light of the results, we posited a correlation analysis in an effort to establish possible links between the efficiency levels of different stages. Table 5 shows the Pearson correlation coefficients between the three stages of the production process as well as for the overall efficiency indicator. As can be seen, there is a positive, significant and noticeable relation between the results from the fundraising stage and the creation of cultural offerings, which reflects to a certain extent the necessary connection between financing and cultural programming. However, there appears to be no relation between efficiency levels in the first stage of fundraising and the final stage measuring the impact of the companies amongst the public (the coefficient is significant but very small), or between the efficiency values in the second and third stages (non-significant coefficient). This would seem to indicate that dance companies focus their efforts on the creative part that leads to artistic production, irrespective of what effects this might have in terms of audience success and social impact. It would appear that dance companies sometimes obtain funding in order to finance a pre-conceived cultural project, regardless of how successful it might be and what impact it might have. The desire to attract large audiences would not, therefore, seem to determine the cultural programming at least among the creators, the people in charge of artistic creation, who tend to pursue artistic and creative rather than commercial goals. In

addition, the positive and significant relation between efficiency at the fundraising stage and the creative production stage appears to show that the criterion of those who contribute funds when making their decisions relates more to the companies' recognition and is again more associated to purely artistic and creative parameters than to others of a commercial nature. Finally, these latter two circumstances prove consistent with the legal status adopted by entities, who distance themselves from commercial objectives linked to financial outcomes, and pursue other more cultural aims that are typical of non-profit entities.

TABLE 5

The lack of any major and significant relation between efficiency when raising funds and the goals of attracting audiences and achieving social impact led us to explore whether those providing the funding, both public and private, really take companies' performance into account when deciding where to channel their resources. With this goal in mind, we introduced into the correlation analysis the variables corresponding to the public and private funds obtained by the entity. The results (Table 5) first reveal a positive relation between public and private funds, highlighting the complementary nature of the two sources of funding in dance companies and evidencing that the interaction between the two sources takes place in terms of crowding in more than crowding out synergies, as also found by Smith (2003-a/b). Secondly, a positive significant correlation of the overall efficiency index emerges both with the flow of public as well as private funds, although no such relation exists when analyzing the results individually for each stage in the model. This seems to suggest that donors make their decisions after valuing the performance of the entity's overall management and not only its results in terms of audience success and social

impact. This challenges the preconceived idea that it is companies which sell the most tickets who attract most sponsorship (DiMaggio, 1983; Smith, 2003-b). It is true, however, that entities who perform best in the three sequences tend to be the most widely recognized companies, which leads to a belief in the enormous power of so-called star-companies when it comes to fundraising. It is a kind of reputation spillover effect which can also be found in funding partnership (Willems et al., 2019). Nevertheless, and by way of an additional comment, it should be remembered that, whereas the first and second stages in the dance activity sequence are controlled by management, the third stage is envisaged as a co-production with the public, who ultimately decide whether or not to attend (De Witte and Geys, 2013). This decision might be related to the quality of the entity's cultural program. Yet there are also understood to be certain external factors involved which are, therefore, beyond management control, such as the public's cultural level, their per capita rent or personal preferences, the urban atmosphere and the scale of potential demand, all of which shape the decisions taken by individuals regarding cultural consumption and consequently audience scope and typology. This latter idea advocates the need to consider new studies geared towards exploring how environmental factors impact consumers' decisions in the dance sector.

6- Conclusions

This work presents a methodological approach to analyze the performance of a representative sample of US dance companies. Non-profit entities in the performing arts field, and particularly in the dance sector, do not usually generate enough internal resources to cover their costs, even when they sell many tickets (Felton, 1994; Smith, 2003-b;

Ostrower and Calabresse, 2019). It is therefore necessary to take into account other forms of financing, such as public subsidies and private contributions. Gaining an insight into how such resources are secured and how they are used in the cultural production process can help to understand how dance companies survive in the market in a context of ever-increasing competition and in which public grants and private donations can even experience crowd-out effects (Smith, 2007). This strategy might also encourage companies to consider whether they should be giving their cultural programs a more commercial focus, or one linked solely to artistic and creative considerations, and whether they should relax or strengthen the need to generate more resources internally through ticket sales or other activities. It also proves enlightening to gain an understanding of dance companies' production process and to analyze whether this focuses on cultural production that adopts artistic criteria or whether it seeks audience success and social impact.

Our study is based on data provided by DatArts for a set of 268 US dance companies in 2016. The existence of missing data in some of the variables in our sample led us to posit an initial imputation process for missing data following the MICE procedure. In order to analyze the performance of dance companies, we sought to define their production process through three successive stages: fundraising, creating the cultural offerings, and the results of the services provided. We then set out a non-oriented network-DEA model that measures organizations' overall efficiency, as well as the efficiency at each of the stages into which their activities are divided, taking into account the chained relations that exist between the various stages. Results show generally low levels of efficiency, with few companies able to reach the efficient behavior frontier. This might be because, in most cases, high levels of efficiency at one stage do not guarantee good results at another stage. The correlation

analysis between efficiency indices only points to a positive relation between levels of performance at the first (funding) and second stages (cultural production), reflecting the fact that companies prioritize the artistic and creative aspects of their activity, regardless of the effects which such criteria might have on audience success. This focus on "art for art's sake" justifies dance companies' status as non-profit entities as the most suitable institutional form for offering high quality performing arts productions (Hansmann, 1981 and DiMaggio, 1983), given that the lack of synchrony between programming and commercial demands would not make it feasible to engage in such an activity in the for-profit sector. Nevertheless, there seem to be two major groups of companies: the largest and most well-recognized, who are efficient when raising public and private funds, and who offer a wide-ranging program that has substantial impact; and another group covering a large number of small companies, who depend on public funding, and who also emerge as efficient when preparing their cultural program, albeit one that is smaller and has less impact. These results lead us to envisage fresh research opportunities such as evaluating efficiency through homogeneous groups of companies in terms of size, location, artistic styles, etc., which might give rise to different and distinctive behaviors. There is also the possibility of studying large star-companies who, thanks to their level of recognition, evidence good results in the three sequences of activity and which are some way above the average. However, such goals lie outside the scope of the present work, which is confined to analyzing efficiency in the US dance market as a whole.

Finally, we carry out a correlation analysis between the public and private funds received by companies as well as the overall and partial efficiency indices of each stage of the production process. Results reveal a relation between the amount of resources, both public

and private, that companies receive and the entity's overall performance. Nevertheless, said relation does not hold when considering the degree of efficiency at the social impact stage. Contrary to the pre-conceived notion that dance companies who sell the most tickets are the ones able to raise the most funds (DiMaggio, 1983; Smith, 2003-b), the results of our work underscore the idea that donors value the company's overall activity and follow the guideline marked out by their global efficiency indices. This leads to the belief that donors are aware of a process of citizen co-participation in the provision of the service, which prevents full control over its social impact, such that they then attach greater importance to artistic excellence. As mentioned, this points to a new analytical challenge, namely studying to what extent variables characterizing the environment might affect dance companies' level of performance and, therefore, their funding decisions, cultural programming and impact strategy on the public.

Appendix

DEA models are sensitive to any variation in data, as a result of which the literature has sought to come up with a range of solutions to deal with the presence of missing values (Kuosmanen, 2009). The procedure considered to be the most widely used to tackle the missing data problem is multiple imputation proposed by Rubin (1987), which allows missing values to be replaced by a vector of plausible values, thus embracing the uncertainty associated to imputation. In our case, we opted to apply a MICE procedure which uses the distribution of observed data to estimate a set of plausible values that complete the missing data. Applying this method requires a prior analysis of the degree of randomness of the missing data which, in our case, is shown in Figure A1.

FIGURE A1

Our sample evidences a percentage of missing data of around 20% of the total, with major differences between variables. Missing observations may follow a MCAR behavior (missing completely at random), MAR (missing at random) or MNAR (missing not at random). In the first case, the presence of missing data does not depend either on the value of the variable or the other variables in the data panel; in the second, the existence of a missing value is independent of the values reached by the variable but does depend on the values of other variables in the data panel; finally, in the case of a non-random missing data pattern the existence of missing data depends on the value reached by the variable. In an effort to confirm the pattern of randomness in the missing data, we apply the Little Test, which confirms the presence of a MCAR pattern. Results indicate that the missing data in our sample do not behave totally randomly. Nevertheless, a pattern of MCAR data is over-restrictive, and applying the MICE procedure only requires the assumption that the missing

data follow a MAR pattern. Although there is no test to confirm this pattern, nothing suggests this condition is not met, such that we assume that it is. In an attempt to explore the behavior of the data in greater depth, we present a correlation matrix for the variables with missing data (Table A1), which shows a high degree of correlation between missing variables for certain cases. We also propose a correlation matrix between observed variables and variables with missing data (Table A2). In this case, the presence of high values would indicate a high correlation of the variables in rows with missing data. However, this is not the case, since they show low values for the correlation coefficients in all instances.

TABLE A1

TABLE A2

Assuming, therefore, the randomness of the missing data, we implement a MICE procedure applying predictive mean matching with 40 iterations so as to obtain a set of ten imputations. Figure A2 shows the mean and standard deviation of the imputed values, confirming the non-existence of a trend, and maintaining data variability, as can be seen through the trace lines. After this imputation process, we have ten sets of complete data on which to apply the network-DEA models in order to obtain the efficiency indices corresponding to the units in the sample at the various stages identified to evaluate their performance. These results are shown in Table 2.

FIGURE A2

Acknowledgments

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FIGURES

Figure 1: Performance evaluation model for dance companies

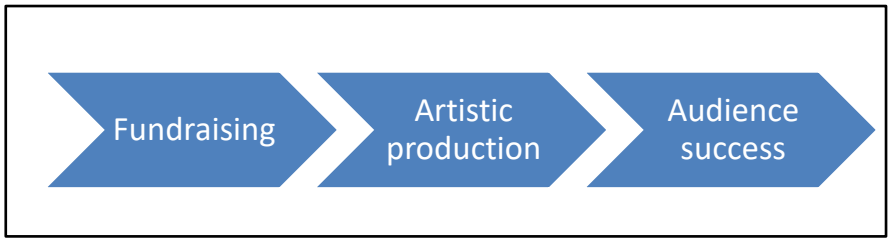


Figure 2: Production technology for dance companies

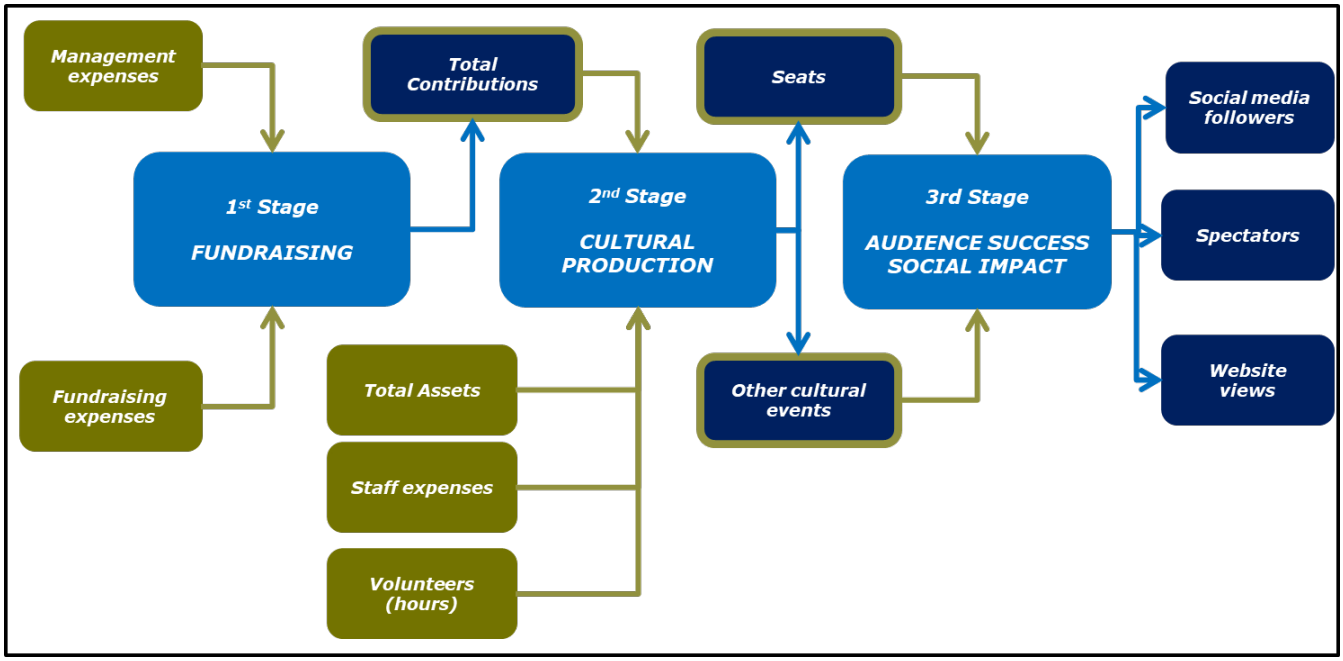


Figure 3: Territorial distribution of dance companies and efficiency intensity

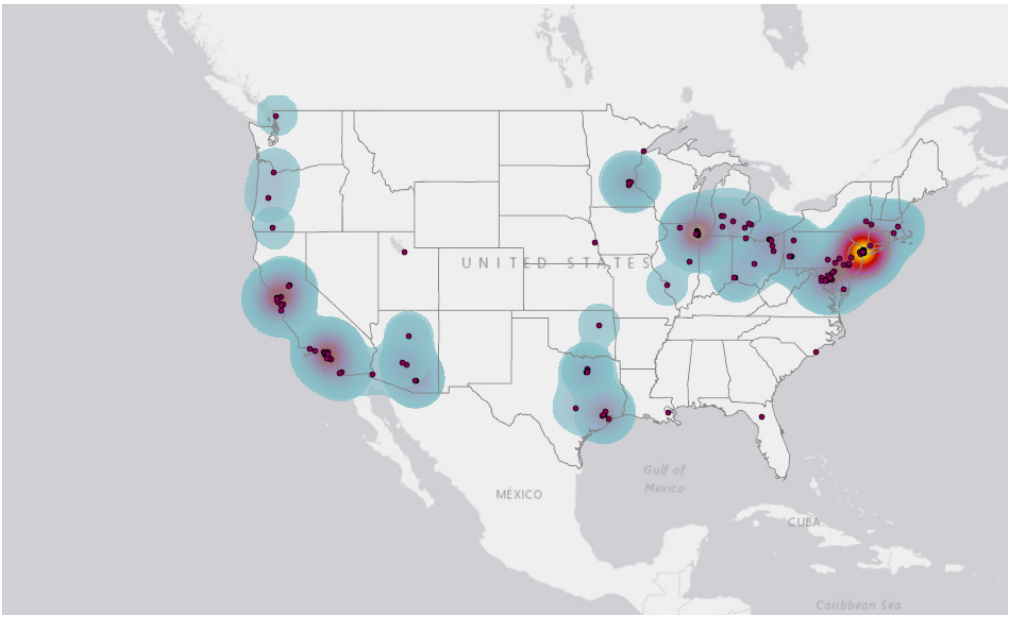
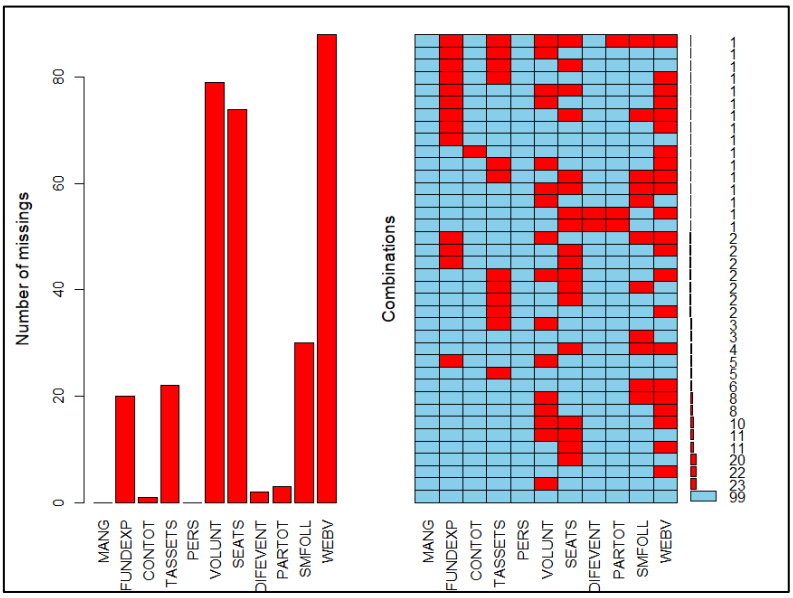
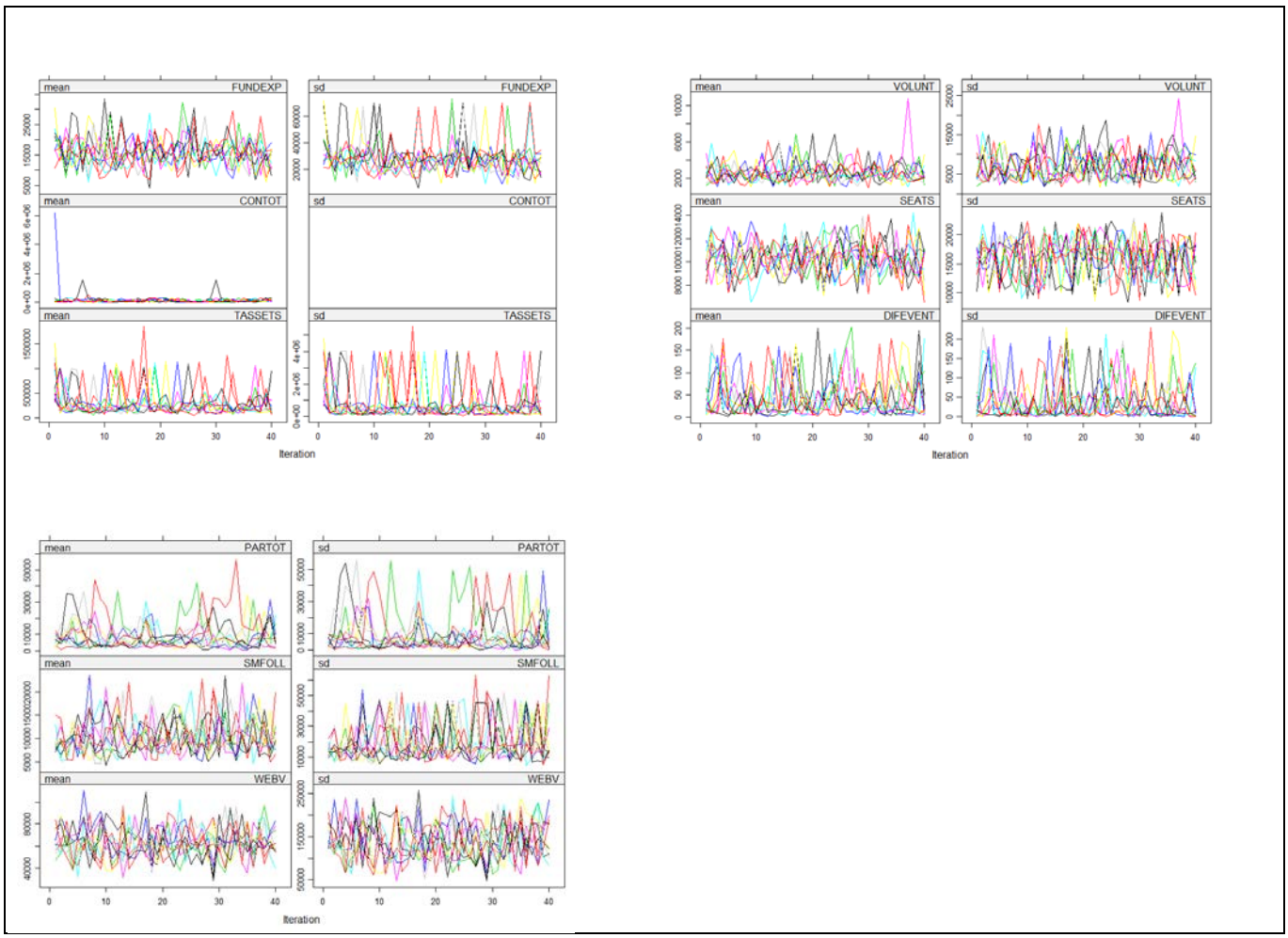


Figure A1: Pattern of missing data



Source: authors' own

Figure A2: Mean and standard deviation of the imputed values



Source: authors' own

TABLES

Table 1: Variables and descriptive statistics

Variables	Description	Missing values	Mean	Standard Deviation	Maximum	Minimum
MANG	Management expenses	0	194388.358	818408.988	9266384	155
FUNDEXP	Fundraising expenses	20 (7.5 %)	106755.71	464133.269	5768387	0
CONTOT	Total contributions (grants + private contributions)	1 (0.4 %)	748612.172	2833923.14	31707298	2944
TASSETS	Total assets	22 (8.2 %)	3338008.26	21283175.6	225118007	108
PERS	Total staff expenses	0	971287.787	4632185.83	57603888	1000
VOLUNT	Total volunteer hours	79 (29.5 %)	2263.71429	7161.07508	77000	0
SEATS	Total seats available for performances	74 (27.6 %)	17938.2732	54097.5249	443702	57
DIFEVENT	Total distinct events (classes/workshops, field trips, festivals, competitions, conferences, exhibits)	2 (0.8 %)	43.3646617	68.389882	623	1
PARTOT	Total participation in people	3 (1.1. %)	16811.2113	46085.2533	532248	80
SMFOLL	Social media followers	30 (11.2 %)	19703.4412	92089.2614	962088	0
WEBV	Estimated website page views	88 (32.8 %)	272739.333	1152248.49	11234589	0

Source: authors' own

Table 2: Mean overall efficiency indices and by stages

Imputations	Overall Score	Stage1	Stage2	Stage3
1	0.0593	0.1983	0.3652	0.0614
2	0.0570	0.1961	0.2987	0.0607
3	0.0643	0.2196	0.5102	0.0634
4	0.0554	0.2231	0.4477	0.0540
5	0.0485	0.2206	0.4733	0.0469
6	0.0700	0.2215	0.5305	0.0664
7	0.0472	0.2032	0.3133	0.0490
8	0.0624	0.2195	0.5215	0.0588
9	0.0660	0.2232	0.5139	0.0616
10	0.0545	0.2105	0.4574	0.0540
Mean	0.05846	0.21356	0.44317	0.05762
Standard deviation	0.00740513	0.01066002	0.08705415	0.00638519

Source: authors' own

Table 3: Mean overall efficiency indices and by stages (top 25 companies)

Organizations	Overall Score	Stage 1	Stage 2	Stage 3
C109	0.999946	0.999904	0.999945	0.999969
C126	0.999942	0.999943	0.99987	0.999998
C82	0.916171	0.720603	0.999982	0.999986
C29	0.625478	0.345006	0.470986	0.921038
C74	0.545146	0.140715	0.487325	0.849573
C1	0.345938	0.003664	0.039008	0.708506
C4	0.298035	0.045762	0.527753	0.271633
C182	0.277321	0.007862	0.068092	0.449864
C77	0.249694	0.017967	0.388299	0.269761
C154	0.244558	0.046099	0.301817	0.348776
C129	0.224322	0.003012	0.041991	0.339294
C51	0.220077	0.007612	0.372767	0.228743
C165	0.219306	0.013099	0.254478	0.26034
C116	0.20715	0.002803	0.023022	0.310735
C120	0.200412	0.045331	0.453274	0.195113
C243	0.168363	0.277287	0.901224	0.12538
C30	0.161025	0.012495	0.116565	0.191293
C81	0.156855	0.003592	0.033683	0.205467
C64	0.147158	0.014753	0.131074	0.170891
C106	0.14215	0.022963	0.308351	0.136669
C38	0.139458	0.005271	0.115543	0.160722
C114	0.136331	0.005315	0.035856	0.169548
C194	0.127561	0.008808	0.129125	0.143725
C108	0.126086	0.015968	0.350004	0.113799
C250	0.116717	0.015349	0.209482	0.115764

Source: authors' own

Table 4: First, second and third stage mean efficiency indices (top 25 companies)

	Stage 1		Stage 2		Stage 3	
Rank	Organizations	Score	Organizations	Score	Organizations	Score
1	C52	1	C215	1	C126	0.999998
2	C200	1	C82	0.999982	C82	0.999986
3	C245	1	C109	0.999945	C109	0.999969
4	C257	1	C126	0.99987	C29	0.921038
5	C126	0.999943	C103	0.946761	C74	0.849573
6	C109	0.999904	C243	0.901224	C1	0.708506
7	C254	0.965766	C189	0.899372	C182	0.449864
8	C240	0.825212	C125	0.878054	C154	0.348776
9	C189	0.802198	C166	0.869728	C129	0.339294
10	C221	0.796194	C200	0.865065	C116	0.310735
11	C82	0.720603	C266	0.854854	C4	0.271633
12	C218	0.6813	C257	0.849746	C77	0.269761
13	C241	0.647347	C36	0.848707	C165	0.26034
14	C100	0.645153	C241	0.846258	C51	0.228743
15	C89	0.61284	C41	0.840655	C81	0.205467
16	C119	0.612024	C156	0.838495	C120	0.195113
17	C163	0.587946	C258	0.812499	C30	0.191293
18	C28	0.583725	C245	0.801865	C64	0.170891
19	C67	0.58065	C67	0.789542	C114	0.169548
20	C230	0.57143	C65	0.779124	C38	0.160722
21	C215	0.55698	C66	0.777729	C194	0.143725
22	C122	0.556527	C213	0.77274	C220	0.137059
23	C192	0.54872	C221	0.771428	C106	0.136669
24	C188	0.547834	C207	0.766454	C243	0.12538
25	C158	0.545135	C232	0.75664	C250	0.115764

Source: authors' own

Table 5: Pearson correlation coefficients and p-value

	DIV1	Div2	Div3	Overall	Private	Public
DIV1	1.0000 0.0000					
Div2	0.5386* 0.0000	1.0000 0.0000				
Div3	0.1154** 0.0709	0.0332 0.6042	1.0000 0.0000			
Overall	-0.0402 0.5303	0.0035 0.9563	0.0652 0.3082	1.0000 0.0000		
Private	-0.0589 0.3575	0.0164 0.7979	0.0766 0.2312	0.8878* 0.0000	1.0000 0.0000	
Public	-0.1046 0.1017	-0.0153 0.8117	0.0247 0.6999	0.5896* 0.0000	0.6552* 0.0000	1.0000 0.0000

*Significant at 1%; ** Significant at 10%

Table A1: Correlation matrix of missing variables

	FUNDEXP	CONTOT	TASSETS	VOLUNT	SEATS	DIFEVENT	PARTOT	SMFOLL	WEBV
FUNDEXP	1.000								
CONTOT	-0.017	1.000							
TASSETS	0.122	-0.018	1.000						
VOLUNT	0.159	-0.040	0.045	1.000					
SEATS	0.079	-0.038	0.089	0.077	1.000				
DIFEVENT	-0.025	-0.005	-0.026	-0.056	0.140	1.000			
PARTOT	0.105	-0.007	0.097	0.009	0.172	0.815	1.000		
SMFOLL	0.079	-0.022	0.066	0.108	0.045	-0.031	0.075	1.000	
WEBV	0.104	0.088	0.022	0.158	0.190	0.032	0.077	0.357	1.000

Source: authors' own

Table A2: Correlation matrix between observed variables and variables with missing data

	FUNDEXP	CONTOT	TASSETS	VOLUNT	SEATS	DIFEVENT	PARTOT	SMFOLL	WEBV
MANG	-0.059	-0.014	-0.057	0.073	-0.082	-0.020	-0.025	-0.027	-0.100
FUNDEXP	NA	-0.014	-0.058	0.047	-0.080	-0.019	-0.019	-0.028	-0.116
CONTOT	-0.066	NA	-0.069	0.060	-0.081	-0.020	-0.025	-0.027	-0.124
TASSETS	-0.041	-0.010	NA	0.019	-0.076	-0.014	-0.014	-0.022	-0.087
PERS	-0.053	-0.012	-0.057	0.043	-0.083	-0.017	-0.021	-0.033	-0.107
VOLUNT	-0.051	0.018	0.067	NA	0.012	-0.014	-0.014	0.068	0.128
SEATS	-0.067	-0.020	-0.074	0.078	NA	NA	NA	0.006	-0.102
DIFEVENT	-0.035	-0.037	-0.071	-0.033	-0.016	NA	-0.035	-0.084	-0.030
PARTOT	-0.070	-0.020	-0.064	0.042	-0.060	NA	NA	-0.027	-0.125
SMFOLL	-0.031	-0.013	-0.045	0.050	-0.079	-0.019	-0.019	NA	-0.101
WEBV	-0.054	NA	-0.056	0.073	-0.071	-0.018	-0.018	-0.002	NA

Source: authors' own

[1] This is the margin for for-profits in performing arts, since it refers to works that are popular enough to offer a number of performances, such that the high fixed costs may be offset over time. Nevertheless, interest in attracting and creating new audiences is a strategy also currently being adopted by non-profits due to the stagnant attendance numbers at this kind of performance (Ostrower and Calabrese, 2019)

[2] SMU DataArts is a non-profit organization that provides high-quality, in-depth data, analysis, and proven resources for the arts and culture sector. See www.culturaldata.org

[3] It should be remembered that certain dance sectors, such as classical ballet and some ethnic styles (flamenco, for example), might be considered a kind of cultural heritage. Public funding would therefore be justified in order to preserve or provide such a merit good (Heilbrun and Gray, 1997)

[4] Once again, the differentiated weight between stages must be well justified. Dance companies might prioritize the cultural production stage whereas venues and policymakers might focus more on attracting audiences. We thus follow the most common practice in Network DEA models (Avkiran and Tone, 2016), which is equal weighting between stages.

[5] Classification of activities established by the National Endowment for the Arts and the National Assembly of State Arts Agencies, and which considers for dance sector entities of Performing Groups, Arts Service Organization, Arts Center, School of the Arts, Arts Camp/Institute, etc. Our analysis is confined to activities strictly involving artistic creation and performances; in other words, those in the first section. We have also ruled out very small companies, namely, those who had gross receipts and total assets below $200,000 and $500,000, respectively.

[6] We thus consider the number of performances and the possible repetitions thereof during different sessions as well as the size of the venue where the show is performed. See similar applications for estimating cultural supply in Zieba (2011) and Last and Wetzel (2010)

[7] The results of all the efficiency ranges are presented blindly in the name of the dance companies, since the goal of the work is primarily academic, and seeks to demonstrate the usefulness of the method applied and the results concerning dance company performance in the USA. Nevertheless, the specific efficiency ratio results can be provided by the authors upon request.