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Department of Economics, Kemmy Business School
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Department of Economics

Organisational Structure and Managerial Efficiency: A quasi-experimental analysis of German public theatres

Marta Zieba* and Carol Newman**

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Abstract

This paper examines the production technology and managerial efficiency of the performing arts sector in Germany using data on 79 theatres over a 32-year period. We examine how different organisational structures affect the efficiency of public theatres and find that theatres organised under public law are more efficient than theatres organised under private law. Using a difference-in-differences approach we examine the impact on efficiency of the exogenous demand shock experienced by theatres located near the East German border after reunification in 1990. We show that theatres organised under private law react positively to this competition shock as measured by their technical efficiency scores confirming that they respond better to market forces than theatres organised under public law.

Keywords: Organisational structure, managerial efficiency, natural experiment, public theatres, Germany.

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* Department of Economics, University of Limerick, Ireland
** Department of Economics, Trinity College Dublin, Ireland

1. Introduction

This paper explores the relationship between governance structure in publicly funded institutions and managerial efficiency. We use the example of non-profit performing arts organisations in Germany, which differ in terms of their organisational structure, to identify the effect of exposure to market forces on productive efficiency in different types of theatres. We exploit the natural experiment of the reunification of East and West Germany and the exposure of theatres located near the border to increased competition to identify managerial response in terms of efficiency in theatres governed by more or less flexible governance structures.[1] We divide theatre managers into two groups: those that are tightly controlled and monitored by governing public bureaucrats and those that are left free to make production decisions with limited scrutiny by public authorities. We find that the former are more efficient in terms of delivering productive efficiency objectives, while the latter are better capable of reacting to market forces and exploiting new opportunities when exposed to competition. Our findings suggest that an appropriate organisational structure for publicly funded organisations of this kind is a mix between the two systems, that is, one that requires costs and expenditure to be accountable yet does not interfere with the managerial process.

Government funding for the provision of goods which yield private benefits is common, for example, education, health, and in the case of Germany, performing arts organisations. The typical argument for public funding for the provision of these services is the fulfilment of socially desirable (but not necessarily profitable) objectives, such as ensuring an accessible and high-quality service. Collective goods arguments may also motivate government funding. For example, the performing arts generate non-private benefits to the rest of society by contributing to 'social criticism' and 'national prestige' that the community at large enjoys (Throsby and Withers, 1986). However, the justification for *government funding* for these services does not imply that *government provision* of these services is appropriate. Widespread evidence of inefficiencies in public service provision has led to the emergence of a literature concerned with evaluating the productivity of various forms of public sector provision and understanding under what circumstances government provision may be more or less efficient.[2] For example, Hoxby (1999) highlights the fact that improving productivity in the provision of many public services (in her example, schools) requires some resolution between

[1] A small but emerging literature exists which uses the reunification of Germany as a natural experiment. See also Alesina and Fuchs-Schundeln (2007), Frijters et al. (2004) and Uhlig (2006).

[2] One strand of literature focuses on the role of incentives and compensation in public service industries concluding, generally, that weaker incentives are required in public sector organisations due to the existence of public sector motivation leading to higher levels of efficiency than in privately run organisations suggesting that in some cases public provision is the preferred option (Francois, 2000; Besley and Ghatak, 2005).

reducing costs and increasing quality. She finds that with limited information on the quality of service provision a social planner will be less effective in achieving productivity improvements than a local tax-based system. Similarly, Kang and Greene (2002) empirically investigate public school districts facing regulatory pressure to attain both productive efficiency and output quality. In this paper, we also focus on the particular case where information on the quality of the service being provided is unobserved by the public bureaucrat, however, in our case we focus on the relative effectiveness of different financing and organisational rules which invoke different types of managerial behaviour.

Analyses of production technology or productive efficiency within the performing arts sector are common in the cultural economics literature with the most influential work including Gapinski (1980, 1984), Throsby (1977) and more recently Marco-Serrano (2006), Last and Wetzel (2010) and Zieba (2011).[3] While these studies have greatly contributed to our understanding of artistic output and the technology underlying the production of performing arts, they have failed to take account of the institutional setting within which performing arts firms operate. General evidence from the literature suggests that this may be an important component in understanding managerial behaviour and outcomes (see, for example, Good (1992), Kang and Greene (2002)). It is also clear from previous studies that the objectives of performing arts firms in particular will differ depending on their institutional setting (Hansmann, 1981; Krebs and Pommerehne, 1995; Schulze and Rose, 1998). Understanding how efficiency outcomes are influenced by the organisational structure imposed by public bureaucrats is particularly important where substantial public resources are devoted to providing services that, arguably, could be provided by the private sector. Furthermore, exploring how these organisations behave when exposed to competition will provide further insights into the type of organisational structure that might work best.

The rest of the paper is organised as follows. In Section 2 we provide an overview of the institutional setting within which German public theatres operate focusing specifically on how different organisational structures exogenously emerge. In Section 3, we present our empirical strategy for identifying how different governance structures will impact on theatre performance. We develop three hypotheses which we will use to empirically identify a link between organisational structure and efficiency outcomes. Section 4 describes the data used while our findings are presented in Section 5. Section 6 concludes the paper.

[3] A number of other studies have been approached from a cost function perspective only. See, for example, Globerman and Book (1974).

2. Institutional Setting

Extensive public support is provided for numerous state-owned theatres in Germany.[4] German public theatres are owned and directly subordinate to regional government structures which we define, in line with Hoffman (1998), as *licence holders*. These may consist of municipalities, known as *Gemeinden*, federal regions/states, known as *Länder*, and regional (rural) districts known as *Kreise*. Many theatres are also governed by a variety of holdings and unions of several local authorities (consisting mostly of municipalities). In the case of municipalities, the responsible institution of the licence holder is the city council while in the case of theatres owned by the federal region, the responsible institution is the regional parliament.

The licence holder is responsible for financing public theatres in the form of subsidies and sets the goals of the public theatre and monitors how well the theatre performs in relation to these goals.[5] Public funding accounts for 83 percent of the total budget of publicly funded theatres and any deficits incurred by theatres are covered by licence holders which may induce economic inefficiency. The licence holder is represented by politicians and bureaucrats who decide on the governance of public theatres. They decide on the legal form of the theatre, which identifies the relationship between the theatre and the state but also defines the governance rules of the public institutions. In addition, they appoint the theatre director responsible for operating the theatre. Within this institutional setting (which we have simplified here for the purpose of our analysis) we can assume that the most important principal stakeholders of German public theatres are the public bureaucrats representing the licence holder, and the theatre management representing the performing arts institution. These institutional structures, together with the legal form of theatre are discussed in more detail below.

2.1 Public bureaucrats

As indicated above, the elected politicians and bureaucrats represent the responsible institutions of the licence holder. They decide on the legal form of the theatre and are also entitled to appoint a theatre director. While they are eligible to control theatres with regard to their financial and

[4] There are approximately 150 public theatres in existence in Germany today including the addition of approximately 70 East German theatres post-reunification in 1991. In addition, there are 230 large private theatres in Germany, some of which are moderately funded through donations, and 2,000-3,000 small private theatres which are exclusively profit-oriented.

[5] Schulze and Rose (1998) highlight the unique setting within which publicly funded performing arts firms operate in Germany, in particular, in terms of the local organisational structure and decision making power of local bureaucrats in terms of funding levels.

economic goals, in doing so, they are not entitled to interfere with the theatre directors in their pursuit of *artistic* goals according to the Basic Law (Art. 5, Sec. 3) which regulates the relationship between the state and the arts. This structure creates a potential conflict between the objectives of the public authorities and that of the theatre director. This is mainly due to the fact that artistic goals are difficult to define and observe given the information asymmetry and merit good characteristics of artistic output.[6] Nevertheless, the Basic Law mandates that government should support art and culture by ensuring that all citizens have the opportunity to participate in the arts by making culture accessible to wider audiences. This is in part achieved by maintaining ticket prices at a low level thus restricting the market-generated revenue stream available to theatre directors and further complicating the relationship between the bureaucrat/licence holder and the management of the theatre. Since all politicians face a re-election constraint they will impose certain conditions on theatre directors such as a minimum theatre attendance restriction or a minimum level of revenue to be generated from ticket sales.

2.2 Theatre director

The theatre director runs and officially represents the performing arts institution in all respects (both economic and artistic).[7] The director is appointed by the bureaucrat (i.e. licence holder) for a period of three to five years, with the possibility of a one-off extension of the contract (Boerner, 2001).[8] The most important criterion for choosing the theatre director is his recognition and reputation in the world of the arts (Krebs, 1996; Hoffman, 1998). There is much competition in the market for theatre directors. The candidates for a theatre director are usually artists themselves that have already gained experience as theatre directors in other theatres. According to Hoffman (1998), licence holders will seek to recruit a theatre manager who can run the theatre efficiently but who also has an impressive artistic profile.

The contract of employment of a theatre director is prepared by the *German Stage Association* (*Deutscher Bühnenverein*), the association responsible for public theatres. The contract includes the rights of the director to hire and dismiss theatre employers, as well as to compose the artistic

[6] The qualitative goals of theatres are often very broad (Boerner, 2001). The artistic goals of theatres can be thought of, in general terms, as the provision and preservation of art, both classic and modern, and as safeguarding "the freedom of the art" (Greve, 2002).

[7] The structure of the theatre management will depend on the legal form of the theatre (see below Section 2.3), and so may take the form of the chief executive of the board of directors or simply one director.

[8] The choice of artistic director is dependent on different laws and regulations of the federal regions and municipalities. There are neither binding rules nor universal practices but the licence holder makes the final decision (Hofmann, 1998). In a federal region it is the Minister of Education and the Arts and in a municipality it is the cultural subcommittee or the City Council.

programme (Hoffman, 1998). The theatre director has also full control over the quality of the artistic productions. [9] At the same time, the theatre director is also required maintain budgetary discipline while in pursuit of his artistic goals. The artistic goals of the theatre director may be compromised by requirements to meet box-office targets as set by the licence holder to ensure that their services are reaching a wide and diverse audience.[10] However, since budget deficits are covered (albeit to varying degrees) by the licence holder, in this setting there are limited incentives for theatre directors to curtail expenditure. Once box-office targets are met, they may have an incentive to overspend in order to maximise their budget in subsequent years.

In summary, the objectives of the theatre director may conflict with each other given that: first, prices are fixed by the licence holder so that in order to meet box office targets and increase revenues the theatre director must increase theatre attendance; and second, increasing theatre attendance may not always be consistent with achieving artistic goals (Krebs, 1996; Krebs and Pommerehne, 1995).[11] The extent to which the theatre director must cooperate with the objectives of the licence holder will depend on the organisational structure of the theatre which we define here in terms of the legal form of the theatre.

2.3 The legal form of the theatre

The legal form of the theatre defines the organisational structure of the theatre, the rights and the duties of the theatre director, but also the accounting principles and how closely the theatre director should cooperate with the license holder. The legal form also regulates the level of financial reporting that the theatre director must prepare for the licence holder. In other words, the legal form defines the framework for the internal governance mechanisms of the theatres.

Public theatres can be run as many different legal forms depending on the preferences of the public bureaucrats. German public theatres are organised in seven different legal forms (see Appendix 1 for a detailed description of each legal form) which we can generally classify as theatres regulated under

[9] See Werck and Heyndels (2007), O'Hagan and Zieba (2010) and Zieba (2009) for studies concerned with analyzing the demand for theatre attendance from a quality perspective.

[10] For example, licence holders often set box-office targets where between 12 and 15 per cent of the theatre's budget must be brought in through tickets sales (Hofmann, 1998).

[11] Krebs and Pommerehne (1995) divide artistic output into lowbrow quality (which are in demand by the audience) and highbrow quality (which are not in demand but are judged as 'high quality' by the director's peer group) performances.

public law (called also here *public legal form*) and theatres governed under private law (called here *private legal form*), respectively.[12]

INSERT TABLE 1 HERE

Mühlenkamp (2001) highlights the fact that public legal forms are generally less autonomous than private legal forms with regard to the operating of the theatre. For example, the *Regiebetrieb*-theatres, the most common type of public legal form, are most dependent on the licence holder and are run in a similar way to a department of the public administration of the licence holder. Their financial dependence means that their accounting system is "cameral" in form in that all items in the accounts must be separated (Hoffman, 1998).[13] In general, the most important principle of this accounting system is that it should reveal whether the budget has been carried out in line with the original budget plan. The *Regiebetrieb*-theatres are usually run by one theatre director whose financial decisions are monitored by an administrative director who is a bureaucrat employed by the licence holder. Hence, the decision process of theatres run as *Regiebetrieb* is more integrated into the public administration of the licence holder and the theatre director is controlled by the licence holder to a great extent.[14] In contrast, in the case of private legal forms, the most common of which are *GmbH*-theatres, the theatre is run by an independent theatre director (or board of directors). While, there is also a supervisory board of the licence holder which controls the theatre management, it has much less formal influence on the management of the theatre than in the case of public legal forms.

Many German public theatres have been transformed recently from public into private legal forms. As it can be seen in Table 1, the number of theatres organised as public legal forms decreased over time in contrast to theatres governed under private law. According to Mühlenkamp (2001), the main purpose of this formal 'privatisation' with regard to the legal form is to increase the economic efficiency of theatres. A private legal form allows greater flexibility and so the theatre director is better able to react to different market and economic situations. However, as Mühlenkamp (2001) also argues, the greater independence of *GmbH*-theatres may not necessarily guarantee that

[12] It should be noted that the legal form does not affect the ownership structure of the theatre which means that in all cases the only owner of the theatre is the state, i.e. federal region, municipality, district or the holding or cooperation of municipalities.

[13] The cameral system means that expenditure and income are calculated separately. For example, budgets are allocated for specific purposes and surplus returns on a particular activity may not be used to cover losses in other areas of theatre production but must be returned to the subsidiser.

[14] Other types of public legal form such as *Eigenbetrieb*-theatres, *Zweckverband*-theatres and *ÖrA*-theatres follow similar reporting principals with the licence holder although to a lesser extent (see also Appendix 1).

theatres will be more efficiently run: theatre directors have more artistic freedom and may focus solely on the pursuit of artistic goals and so with non-binding budget constraints will be less cost effective.[15]

3. Testable Hypotheses and Empirical Approach

In this section, we set out a basic framework in which to think about the way that different governance structures can impact on managerial efficiency in publicly funded theatres. For this purpose we present a range of testable hypotheses based on what we know about the institutional setting and previous literature on production in the performing arts.

To derive our main hypotheses we first assume that the preferences of the licence holder are exogenously determined. Second, we assume that public bureaucrats expect theatres to produce artistic output efficiently. However, we argue that there is a trade-off between the objectives of public bureaucrats and theatre directors (Krebs and Pommerehne, 1995). Theatre directors may not behave in the interests of the licence holders but will maximise their own personal utility. Their utility might depend not only on their own income but also on the prestige they attract within their own peer or reference group, which consists mainly of the world of arts critics. As argued by DiMaggio and Powell (1983, p. 157), the director of an opera may "be more concerned with noneconomic values like aesthetic quality or social status than with efficiency per se".

However, theatre directors will also face certain constraints on their actions. The differences in these constraints across theatres are institutionally determined. In this study we show that the legal form of the theatre, in other words the way in which theatres are organised, controlled and financed by the state (i.e. licence holder), will have a significant effect on the behaviour of theatre directors. In line with Mühlenkamp (2001), we argue that theatres run as private legal forms and specifically as *GmbH*-theatres are more independent from the licence holder than theatres run as public legal forms or *Regiebetrieb*-theatres. This leads us to our first testable hypothesis:

Hypothesis 1: Theatres operating as private legal forms will be less efficient than theatres operating as public legal forms.

[15] Mühlenkamp (2001) conducted a short empirical analysis of the effects of different legal forms on total costs in German public theatres using 5 years of panel data coming from the same data source as that used in our study. He found that private legal forms do not have lower costs than public legal forms. His empirical analysis was, however, preliminary as his data were much more restrictive in comparison to our study and no efficiency measure was defined.

To test this hypothesis we first establish an efficiency measure for each theatre. We interpret the efficiency of theatres as technical efficiency, i.e. a manager's ability to obtain the maximal output from available resources with the existing production technology (i.e. the given level of inputs). In doing so, we are restricting our analysis to an examination of "managerial" efficiency as opposed to "artistic" efficiency.[16] This is determined by the definition of output that is used in measuring technical efficiency. We use theatre attendance as our output measure as it incorporates a quality dimension given that each actual theatre visit counts as a "cultural experience".[17] The number of visitors, however, may be a function of both supply and demand and so as a robustness check we also consider the number of tickets on offer as an alternative output measure.[18] Both output measures fail to take account of the full dimension of artistic quality. Even, if we interpret artistic output as a "cultural experience", the quality of that experience will be different for each individual attending a given performance; it will depend on tastes and skills of the artistic interpretation (Heilbrun and Gray, 1993). Additionally, there are also subjective aspects of quality which are assessed by the theatre directors themselves that will not be accounted for using these measures. Artistic quality may therefore be related to the unobserved heterogeneity of theatres and this will have implications for the choice of econometric model.

In order to account for the specific nature of performing arts organisations, a flexible functional form is preferred and we apply a translog (logarithmic transcendental) function as proposed by Christensen at al. (1973). However, we also consider the Cobb-Douglas functional form as an alternative specification.[19] Expressing output and inputs in natural log values, the production function for German public theatres can be written as:[20]

[16] It should be noted that pursuing artistic freedom does not inevitably make theatre directors less efficient by spending on costly performances. It may also be the case that technology enables qualitative art production on lower costs (see for details Cowen, 1996).

[17] For example, we could argue that artistic output does not occur until someone experiences it and so actual contact with an audience is an essential ingredient of the output in the performing arts.

[18] The results presented in Section 5 are based on the former while the results for the second measure are available on request. For more discussion on the data and variables see also Sections 4 and 5.

[19] For a detailed discussion of production technology and the different output measures in the performing arts sector see also Zieba and Newman (2007) and Zieba (2011).

[20] German public theatres can be described as *repertory* theatres. This means that each production is performed numerous times during the whole theatre season and many productions are run simultaneously. The theatre season usually lasts 12 months with 10 months of playing and 2 months of preparation for the new theatre season. The production program is prepared and published at the beginning of each season. Hence, it is assumed that all inputs are determined prior to the theatre season beginning. As such, the quantity and quality of the artistic output and the inputs used are not altered during the particular production season.

$$\ln Y_{it} = f(X_{ikt}) = \beta_0 + \sum_{k=1}^{K} \beta_k \ln X_{ikt} + \sum_{k=1}^{K} \sum_{l=1}^{L} \beta_{kl} \ln X_{ikt} \ln X_{ilt} \qquad (1)$$

where Y_{it} is the output of theatre *i* in time period *t* measured as theatre attendance, X_{ikt} and X_{ilt} are the labour (artists and ancillaries) and (primary and secondary) capital inputs used in the artistic production with $k=1,\ldots,K$, $l=1,\ldots,L$.

In order to obtain the technical efficiency scores, the production function given by equation (1) is estimated using a true random effects stochastic frontier approach (SFA) developed by Greene (2004; 2005) and its extension using Mundlak's (1978) adjustment. Both models account for the unobserved heterogeneity of theatres which also controls for the fact that theatres may also operate in different regions with various environmental factors and characteristics that are only partially observed (see also Last and Wetzel (2010)). A full exposition of the SFA approaches used is given in Appendix 2. To test *Hypothesis 1*, we test for statistically significant differences in the computed technical efficiency of theatres operating as private legal forms and those operating as public legal forms.

The objective of this paper is to analyse how the efficiency of publicly funded performing arts firms, operating under different governance structures, is affected by two types of shocks. First, we consider what happens to efficiency when there is a funding shock and second, we consider the effect on efficiency of an increase in competition.

The institutional setting within which German public theatres operate provides us with an ideal opportunity for testing how publicly owned firms operating under different governance structures react when faced with competition for resources (government funding) and markets (audiences). The identification of these effects is made possible by the natural experiment of the reunification of East and West Germany in 1990. After the German-Reunification in October 1990 all theatres in West Germany were exposed to a funding shock connected with the assimilation of the eastern regions and East Berlin into the budget of the Federal Republic of Germany. German public theatres are financed through the lower level budgets of the regions (*Länder*) and municipalities (*Gemeinden*). However, these budgets are aligned according to the federal financial equalisation system which guarantees that all the regions and municipalities receive appropriate levels of funding.[21] In post-unification Germany the entire tax revenue had to be distributed among the

[21] The procedural regulations in this regard can be divided into four phases. First, the entire tax revenue is distributed to the Federation and all the *Länder*, and the municipalities receive a supplementary grant of

western regions and the poorer regions in East Germany. As a result, the regions and municipalities in West Germany experienced significant budget cutbacks and their expenditures on culture also decreased.[22] As we can see from Figure 1, the real level of public funding for West German theatres increased from 1971 until 1989 but it began to decrease from 1990 to 2003. The decline appears small but the financial pressure was felt by many theatres and some theatres were even forced to close or to merge with other theatres.[23] Burns and van der Will (2003) also note that the erosion of cultural budgets since 1990, particularly at the municipal level, was mainly due to the immense costs of unification. Their case studies demonstrate that the budgetary constraints on cultural policy were valid at all levels, from the municipal to the federal.

INSERT FIGURE 1 HERE

A decline in public funding for theatres implies that their budget constraint becomes more binding. In the first scenario (i.e. theatres organised as public legal forms), given that directors are already operating efficiently, the efficiency of these theatres should not be affected by the shock to the level of funding. In the second scenario (i.e. theatres organised as private legal forms), the decline in funding will lead to a decline in any slack in the production process and an increase in efficiency. Directors will improve efficiency levels to ensure that their desire to continue producing reputation-enhancing activities is met. As such we might expect efficiency to improve for these theatres. We will refer to this shock as the 'reunification funding shock'. The specific hypothesis we wish to test is:
Hypothesis 2: The reunification funding shock will lead to increased efficiency levels in theatres operating as private legal forms and unchanged efficiency levels in theatres operating as public legal forms.

To test this hypothesis we estimate the following equation:

$$E_{it} = \gamma_0 + \gamma_L L_{it} + \gamma_s S_{it} + \gamma_{LS} LS_{it} + \gamma_i + \gamma_t + u_{it} \qquad (2)$$

Where E_{it} is the measure of the technical efficiency level of the theatre, γ_i is the vector of theatre fixed effects which control for any other characteristics of theatres that do not change over time, γ_t

revenue. Next, the total *Länder* portion of tax revenue is assigned among the various *Länder*. In a third stage, there is equalisation between poor *Länder* and rich *Länder*. In addition, poor *Länder* also receive funds from the Federation (for more details see Bundesministerium für Finanzen, 2012).

[22] Schulze and Rose (1998) also find that the level of public funding for each performing arts organisation will depend on the size of the overall budget of the municipality.

[23] The financial pressure was also felt by approximately 90 ex-GDR theatres from the eastern regions and East Berlin which are not examined in this study.

is the vector of time-fixed effects, u_{it} is the error term with zero mean and constant variance, L_{it} is a dummy variable capturing whether the theatre is organised as a public legal form [$L_{it} = 0$] or private legal form [$L_{it} = 1$], S_{it} is a dummy variable taking a value of one for each year post-reunification and LS_{it} is an interaction term capturing the differential effect of the reunification funding shock on public and private legal forms. To test *Hypothesis 2* we test for the sign and statistical significance of the parameter γ_{LS}. If positive and significant then our hypothesis holds.

The reunification of Germany also meant that the theatres which were located at the border with Eastern Germany and theatres located in West Berlin (thus neighbouring with the East part of Berlin) were exposed to an exogenous demand shock connected with opening the borders with the Ex-GDR regions of Germany in 1990. The reunification brought both opportunities but also challenges for the theatres located at the border. Firstly, after the reunification the potential audience of theatres located at the border expanded as visitors from neighbouring areas (from the new eastern federal regions or from East Berlin) could easily travel to visit the theatres located in the bordering western regions. However, conversely, visitors from West Germany could easily attend the performances in neighbouring theatres from Eastern Germany and East Berlin.[24] Overall, the level of competition in the market for theatres increased dramatically post-reunification.

Exposed to greater competition, performing arts firms must become flexible in their allocation of inputs to meet market demand. They may need to change the type and quantity of output that they produce and the way in which they produce it. We would expect this increase in competition to affect public and privately organised performing arts firms differently. Theatres organised as public legal forms have very little flexibility in making production decisions and so may lose out on the opportunities presented by the opening up of the market. As such we might expect exposure to competition to have a negative effect on the efficiency of publicly funded theatres. In contrast, the flexibilities afforded to theatre directors operating under private law will allow them to react to changing market forces and re-orientate inputs appropriately. As such we might expect the competition shock to have a positive effect on the efficiency of privately run theatres. The effect,

[24] Furthermore, the theatres located at the border could also easily travel to, and stage guest performances at, the neighbouring theatres in East Germany. All public theatres tour and play guest performances and the average ratio of guest performances to all performances is about 15 per cent (see also Section 4).

however, should only be evident for theatres located at the border. The specific hypothesis we wish to test is:

Hypothesis 3: In the face of a shock exposing theatres to greater competition, theatres operating at the border and organised as private legal forms will increase their efficiency levels while those theatres operating at the border organised as public legal forms will experience a fall in efficiency levels. Theatres in the rest of West Germany will be unaffected.

To test this hypothesis we use the following equation:

$$E_{it} = \gamma_0 + \gamma_L L_{it} + \gamma_s S_{it} + \gamma_{LS} LS_{it} + \gamma_B B_i + \gamma_{LB} LB_{it} + \gamma_{BS} BS_{it} + \gamma_{LBS} LBS_{it} + \gamma_i + \gamma_t + u_{it} \qquad (3)$$

Where E_{it}, γ_i, γ_t, L_{it}, S_{it} and LS_{it} are as before, B_i is an indicator variable which takes on a value of one if the theatre is located near the border, LB_{it} is an interaction term capturing the differential effect on efficiency of the theatre being located near the border and being organised as a private legal form, BS_{it} is an interaction term capturing the differential effect on efficiency of being located near the border and being exposed to the reunification funding shock, and LBS_{it} is an interaction term capturing the differential effect on efficiency of being a theatre organised as a private legal form and located near the border post-reunification. To test *Hypothesis 3* we test for the sign and statistical significance of the parameter γ_{LBS}. If positive and significant then our hypothesis holds.

An important advantage of the difference-in-differences models presented in equations (2) and (3) is that they control for unobserved heterogeneity across theatres using theatre fixed effects γ_i. Time effects, γ_t which are common to all theatres are also included. It should, however, be noted that where technical efficiency is measured using the stochastic frontier approach, the differences-in-differences models presented above can be considered a second-step model where the various treatment variables are regressed on the estimated technical efficiency scores.[25] An alternative to the two-step procedure is a one-step model where the difference-in-differences variables are included in the parameterisation of the mean of inefficiency (see, for example, Battese and Coelli (1995)) or the variance of inefficiency (see, for example, Greene (2007)). However, our preliminary analysis revealed that a numerically feasible estimator was not possible in either case. Therefore, in

[25] This approach is potentially biased given that in the first stage, the efficiency scores are obtained using maximum likelihood estimation assuming that the residual (inefficiency) is independently and identically distributed. However, in the second stage, when the efficiency scores form the dependent variable, this assumption is abandoned.

order to check the robustness of our two-step procedure we estimate the production function presented in equation (1) as a one stage linear fixed effects including the various indicator variables as described in equations (2) and (3). The results using this approach are consistent with our main findings.[26]

It could also be argued that theatre directors self-select into different types of theatres. For example, directors that are more oriented toward the artistic value of the performances might choose publicly organised theatres where they will face less competition. Alternatively, they may select into privately organised theatres where they have greater artistic control. To test whether there is evidence of such selection in our sample we do two robustness checks. First, we estimate an endogenous switching regression model using exogenous selection characteristics (i.e. the population and the income per capita of the city in which the theatre is located, and the type of the licence holder) and find no evidence of sample selection bias.[27] Second, we exclude from the sample nine theatres which changed the legal form over time (see also Section 4) on the basis that these may be cases where theatre directors select into a specific legal form. Our results are robust to the exclusion of these theatres.

4. Data

We construct a panel data of public theatres in Germany using the annual Theatre Report (*Theaterstatistik*) published each year by the *German Stage Association* (*Deutscher Buhnenverein*) since 1965. An unbalanced panel data set of 79 German public theatres that operated between 1972/1973 and 2003/2004 (32 yearly theatre seasons) in West Germany are gathered and prepared for the analysis. A description of all variables and data sources is provided in Appendix 3.

German public theatres are known as *Dreispartentheater* (three branch theatres) meaning that many have drama, music theatre (opera/operetta/musical) and ballet/dance at their disposal. However, in major cities, for example, Berlin, Munich, Dortmund, Hamburg or Magdeburg, theatre branches tend to be separate. Occasionally, puppet and figure theatre and children's and youth theatre are also provided. This implies that a variety of performing arts forms are generally offered by single theatre enterprises. Following this and in line with Throsby (1977), Gapinski (1980) and Zieba (2011), we measure artistic output as the total number of theatre visitors as measured by

[26] In this production function the residual could be thought of as productivity. By including the different dummy and interaction variables from equations (2) and (3) directly in these regressions we can interpret their coefficients as their direct effect on efficiency.

[27] Results of the robustness checks are available on request.

aggregate ticket sales. This includes attendance at all types of performances (drama, opera, ballet, musical, concerts etc.). In addition, preferential and free tickets issued, and theatre attendances at guest performances at other locations, are also included.

All public theatres have a permanently employed theatre ensemble consisting of solo artists, choir, ballet and theatre orchestra members. Support staff consisting of technicians, artistic-technical staff (e.g. stage designers), administrators and house staff are also employed on a full-time or part-time basis.[28] Lastly, German public theatres have their own buildings which often consist of one large and several small auditoriums.

The data for the factor inputs are based on yearly expenses data transformed into real values using numerous price deflators. The price deflators are taken from the *Federal* and *Regional Statistical Offices* in Germany. Information on the capacity of the venue is also utilised. Following Tobias (2003), expenses reported for the fiscal year are transformed into yearly theatre season equivalents. Two separate labour inputs are included in the production function model: *artists* which includes personnel yearly expenses on artistic directors, stage managers, solo artists for operetta and opera, solo artists for drama, ballet members, choir members, guest artists and members of theatre orchestras; and *ancillaries* which represents the expenses for technicians (technical and artistic-technical staff) and administration and house staff. The latter is included as a secondary labour input. Tobias (2003) finds that the marginal returns of artistic expenses are positive in terms of quality, thus it is reasonable to assume that the quality of artists (as judged by such professionals) will be reflected in their salaries.

In the absence of direct information on capital input flows, proxy capital input variables are constructed using data on expenses, costs and commodity usage. Two separate capital inputs are constructed. The *primary capital* input is defined as operative expenses which include administration costs, renting and leasing of facilities, décor and costumes, publications, copy-right costs, materials, expenses for guest performances/sight touring, guest performances by foreign ensembles and other operating expenditures. Prior to aggregation, non-personnel expenses are converted into real values using appropriate capital price deflators for every expense category. The *secondary capital* input is measured using a proxy variable for the value of capital stock which is taken to be the number of

[28] The employment contracts for artists in Germany are regulated by a special contractual agreement called *Normalvertrag Bühnen* which provides a framework for issues such as working hours, minimum salary, etc. (see also Haunschild (2003)). The administrators and house staff of public theatres may also be employed as civil servants protected by public law regulations.

seats for each season, times the number of venues valued at the property value per square meter of building land in West Germany. The value of the capital stock is deflated using an appropriate capital price index.

We also organise theatres by type of legal form. We generate an indicator variable which takes on a value of one for theatres regulated under private law and a value of zero for theatres regulated under public law. As discussed in section 2, we also consider a sub-group of theatres that more specifically represent what we consider private and public legal forms, namely *GmbH*-theatres and *Regiebetrieb*-theatres, respectively.

We consider two different indicator variables for the proximity of theatres to the border. The first is a dummy indicator variable which takes a value of one if the theatre is located within a 50km radius of a theatre located in Eastern Germany (or if theatre is located in West Berlin) and zero otherwise. The second is a dummy indicator which takes a value of one of the theatre is located within a 50km radius of the eastern border (or if theatre is located in West Berlin) and zero otherwise. In line with previous studies on the performing arts, we believe that a distance of about 50km is the maximum average distance that visitors will travel to the nearest theatre and so theatres located more than 50km away are not viable competitors.[29] Finally we generate an indicator variable for the reunification shock which takes a value of one for all theatres for the years from 1990/1991 until 2003/2004 and zero otherwise.

Table 2 provides the basic descriptive statistics for the full sample of 79 theatres (2,404 observations) and also for the reduced sample of 67 theatres which includes the *GmbH*-theatres and the *Regiebetrieb*-theatres only (1,687 observations). Considerable variation exists in all variables across theatres. For the examined period of time, German public theatres receive on average 216,545 visitors for the whole sample and 234,329 visitors for the reduced sample. As expected, the expenses for artists are considerably higher than the personnel expenses for ancillaries (administrators and technicians).

INSERT TABLE 2 HERE

[29] The same distance was used to define the individual theatre markets in various studies on demand for theatres. See Werck and Heyndels (2007) for a similar market definition in the case of Flemish theatres and Zieba (2009) in the case of German public theatres.

The descriptive statistics are also split by the different legal forms (see Table 2). The number of visitors is much greater for public legal forms or *Regiebetrieb*-theatres whereas the level of inputs differs only slightly between the different legal forms. This gives us an indication that theatres organised as private legal forms or *GmbH*-theatres might be less efficient which is consistent with *Hypothesis 1*.

Table 2 also reports the number of observations/theatres for the various legal form indicator variables. Private legal forms account for 31 out of 79 theatres. Within this the number of *GmbH*-theatres is 24. As discussed earlier also, the number of theatres governed under public law (especially the number of *Regiebetrieb*-theatres) decreased between 1972 until 2003 while the number of theatres regulated under private law (especially the *GmbH*-theatres) increased (see Figure 2). This is mainly due to the fact that nine theatres were transformed over the examination period from public into the private legal forms.

INSERT FIGURE 2 HERE

The number of theatres and observations within the various treatment/control groups considered in the differences-in-differences analysis are also presented in Table 2. It should be noted that among the theatres located at the border only 2 theatres (*Theater des Westens* and *Deutsche Oper Berlin*) are located in Berlin. Furthermore, there are between 4 and 7 theatres which are located at the border that are organised as private legal forms or *GmbH*-theatres, depending on the border specification used. These are located in Lübeck, Göttingen, Lüneburg, Berlin (*Theater des Westens*) and Hamburg.[30] The "border effect" we identify is therefore not only a "Berlin effect".[31]

5. Empirical Results

5.1 Measuring and comparing efficiency

Hypothesis 1 posits that theatres operating as private legal forms are less efficient than theatres operating as public legal forms. We expect this to be the case since theatres operating under private law operate under less stringent reporting requirements and as such they focus more on quality enhancing activities. In contrast, theatres operating under public law are more accountable to public bureaucrats in terms of their use of government funding.

[30] Theatres in Hamburg include: *Hamburger Staatsoper*, *Deutsches Schauspielhaus* and *Thalia Theater*.

[31] As an additional robustness check we include a control for the population of the city in which the theatre is located to capture potential size effects. The inclusion of this variable does not have any influence on our main results and so we do not present these results here. They are available on request.

As outlined in Section 3, we measure efficiency using the stochastic production frontier approach applying Greene's (2004, 2005) true random effects model and the true random effects model with Mundlak's (1978) adjustment.[32] Both translog and Cobb-Douglas functional forms are considered. The results for the full sample are presented in Table 3 (Panel A) while the results for the reduced sample including the *GmbH*- and *Regiebetrieb*-theatres only (Panel B) are presented in Table 4. The Hausman test rejects in all cases the hypothesis of no correlation between the inputs and the theatre-specific characteristics which suggests that the true-random effects specification with the Mundlak's adjustment gives unbiased production function coefficients and so is the most appropriate model. Nevertheless, the magnitudes of the production function parameters are very similar across the two models. Furthermore, for the translog specification all variables are normalised at their sample mean prior to the estimation of the production function. Thus, the presented first-order coefficients are directly interpreted as output elasticities which, except the secondary capital input, are statistically significant at the 1 per cent level. For the Cobb-Douglas specification, all output elasticities are also statistically significant at the 1 per cent level (with the exception of secondary capital). Time fixed effects are included in each model but are not significant (not presented) indicating that technological change is not a significant contributor to productivity growth of German public theatres. Summary statistics of the estimated average technical efficiency scores are also presented in Tables 4 and 5. Similar estimates are found across all specifications suggesting that they are robust to the particular type of econometric specification. The average efficiency scores of theatres in each sample are between 84 and 85 percent indicating that on average theatres could increase artistic output (theatre attendance) by 15 to 16 percent without increasing inputs levels.

INSERT TABLES 3 AND 4 HERE

Mean comparison tests of the estimated technical efficiency levels of theatres organised under different legal forms are presented in Table 5. In all cases, the efficiency of theatres organised as private legal forms is lower than that of theatres organised as public legal forms. The difference is statistically significant in all cases. The magnitude of the difference between *GmbH*-theatres and *Regiebetrieb*-theatres is even greater than that of the full sample, as expected given the stricter delineation of these two organisational structures. The percentage differences in efficiency estimates between different legal forms are rather small (i.e. around 1 per cent). However, it should be noted that the applied stochastic frontier efficiency measures are only relative measures (i.e.

[32] See also Appendix 2. Both models are estimated using LIMDEP version 9.0 (Greene, 2007).

based on theatre rankings) and as such the exact magnitude of the efficiency effects cannot be obtained. Nevertheless, these results provide strong evidence to support our hypothesis that theatres organised as public legal forms, where management teams are subject to strict monitoring and reporting requirements, are more efficient than those organised as private legal forms where monitoring and reporting is less stringent. As will be seen below, the results of the difference-in-differences estimations will also confirm these findings.

INSERT TABLE 5 HERE

5.2 The reunification funding shock

The most immediate effect of the reunification of East and West Germany on theatres was the reduced budget that they were faced with. The difference-in-differences model allows us to establish the extent to which the reunification shock had a different effect on theatres organised as private legal forms as compared with those organised as public legal forms. We expect lower levels of funding to have no effect on the efficiency levels of theatres organised as public legal forms given that they are already operating efficiently and the lower funds will be used to cut back on costly quality enhancing activities. In contrast, in the theatres organised as private legal forms, the decline in funding will encourage any theatres experiencing slack in the production process to increase efficiency. As such we might expect efficiency to improve for these theatres. To explore this hypothesis we estimate equation (2) separately for each measure of efficiency. The results are presented in Table 6. The results for the full sample are presented in Panel A while the results for the sample including *GmbH*- and *Regiebetrieb*-theatres only are presented in Panel B. The model controls for theatre and time fixed effects.

INSERT TABLE 6 HERE

Consistent with the mean comparison tests presented in Table 5, we find that the efficiency levels of theatres organised as private legal forms are significantly less than their public counterparts as indicated by the estimated parameters on the L_{it} indicator variables. The shock itself, however, S_{it}, does not have a statistically significant effect, a result that we might expect due to the fact that the actual decline in public funding was rather small (see Figure 1 and discussion in Section 3). The interaction term between the legal form and the reunification shock has no significant effect on efficiency when the full sample is considered. This suggests that, contrary to our proposition given in *Hypothesis 2*, the funding shock resulting from the reunification did not affect the efficiency of

privately and publicly organised theatres differently. When the sub-sample of *GmbH*- and *Regiebetrieb*-theatres are considered in isolation (Panel B) we find that for the translog specification, the funding shock had a negative and significant effect on efficiency for *GmbH*-theatres (as indicated by the coefficient on the variable LS_{it}), but had no significant effect on efficiency for *Regiebetrieb*-theatres (as indicated by the coefficient on the variable S_{it}). The latter is consistent with our theoretical predictions however the former is in contrast to what we expected. This result indicates that in the face of a funding shock, the efficiency levels of the *GmbH*-theatres fall even further. This suggests that even when funding resources become scarce, the objectives of the public bureaucrats remain in conflict with those of the theatre directors, even in the face of funding cuts. It appears that within the *GmbH* organisational structure the lack of control and monitoring allows such inefficiencies to emerge.

5.3 The reunification competition shock

Our final model explores the effect of reunification on the efficiency of the theatres located close enough to the East German border to be affected by the increased level of competition from East German theatres. As discussed in Section 3, we would expect the increase in competition to affect public and privately organised performing arts firms differently. In particular, we expect theatres organised as private legal forms to have the flexibility necessary to react to these market changes and increase efficiency while theatres organised as public legal forms may be more restricted in terms of their ability to react appropriately to the opportunities presented by the opening up of the market. The effect, however, should only affect theatres located at the border. To test *Hypothesis 3* we estimate equation (3). The results are presented in Tables 7 and 8 for the two border specifications, with those for the full sample presented in Panel A and those for the reduced sample of *GmbH*- and *Regiebetrieb*-theatres presented in Panel B. As before we control for theatre fixed and time fixed effects. [33]

INSERT TABLES 7 AND 8 HERE

The coefficient of interest relates to the interaction term LBS_{it} which takes on a value of one if the theatre is organised as a private legal form, is exposed to the reunification shock and is

[33] It should be noted that the variable B_t is time-invariant and hence it is absorbed after applying the within transformation of the data in the fixed-effects specification. Therefore, it is not presented in Tables 6, 7 and 8.

located at the border. The coefficient LBS_{it} is in all cases positive and significant indicating that the reunification effect has a positive effect on the efficiency of privately organised theatres located at the border. The effect of the reunification shock on theatres located at the border and organised as public legal forms is therefore captured by the coefficient on the term BS_{it}. The inclusion of the other indicator variables and interaction effects controls for the fact that: 1) theatres organised as private legal forms are less efficient in general than those organised as public legal forms (coefficient on L_{it}); 2) theatres organised as private legal forms experienced a fall in efficiency as a result of the reunification funding shock while the efficiency levels of theatres organised as public legal forms were unaffected (coefficients on LS_{it} and S_{it}, respectively); 3) theatres located at the border may differ in terms of efficiency (for example, those located in Berlin may be fundamentally different than those located elsewhere) which is picked up in the fixed effect; and 4) theatres organised as private legal forms and located at the border may be different to other theatres (coefficient on LB_{it} which is for the most part positive and significant suggesting that there is a location effect for theatres organised as private legal forms).

Controlling for these factors, in all cases we find that, as hypothesised, the competition shock, LBS_{it}, has a positive and significant effect on theatres organised as private legal forms located at the border while the effect on those organised as public legal forms and located at the border is insignificant. This result holds regardless of the efficiency measure used and regardless of the specification of the border variable. Furthermore, it holds regardless of whether we consider the full sample of public and private theatres or the reduced sample of *GmbH*-theatres and *Regiebetrieb*-theatres. In the latter case, however, we also find a negative and significant effect on *Regiebetrieb*-theatres located at the border (coefficient on BS_{it}) suggesting that in the face of competition the restrictions placed on the managers of *Regiebetrieb*-theatres prevents them from being able to exploit new opportunities presented by increased exposure to competition.

In summary, consistent with our hypotheses, we find that theatres organised as private legal forms are less efficient which results from the fact that those theatres are monitored to a lesser extent by the public bureaucrat than theatres organised as public legal forms. These inefficiencies are exacerbated in the event of a shock to funding resources as evidenced by the deterioration in efficiency levels of theatres organised as private legal forms with the reunification of East and West Germany (in contrast to *Hypothesis 2*). Despite these inefficiencies, we find that the flexibility

afforded by the private legal form within which they operate leaves them better placed to exploit new opportunities (as proposed by *Hypothesis 3*).

6. Conclusion

In this paper we explore the relationship between organisational structure and managerial efficiency within the German public theatre sector. We find strong evidence to suggest that the institutional setting and the governance structure imposed by public bureaucrats has a major impact on managerial performance. Our results overwhelmingly point to the fact that theatres organised as private legal forms have significantly lower efficiency levels than those organised as public legal forms. The former, however, are better placed to react to changes in market conditions, with strong evidence to suggest that exposure to competition results in efficiency improvements for theatres organised as private legal forms but significant declines in efficiency for theatres organised within the more stringent public legal form.

These results provide interesting insights into the role and structure of government supports for performing arts organisations in Germany. These insights are particularly important given the greater demands on public sector resources and the increasing need to evaluate the effectiveness and value-for-money of public sector investments. We find that theatres organised as public legal forms are more efficient in achieving theatre objectives which is the production of artistic output measured as theatre attendance by the given level of inputs. Despite the inefficiencies apparent in theatres organised as private legal forms there is also an argument for this type of organisational structure. We may argue, for example, that these theatres attract theatre directors who produce high-quality artistic output which is more costly and less in demand than lowbrow artistic performances. Consumers may not realise the benefits of this type of collective good and so there is a case for government provision. However, public bureaucrats do not possess the information necessary to evaluate the quality of the output being produced and so inefficiencies inevitably emerge. In other words, there is a case for government funding of these theatres but incomplete information will inevitably lead to inefficient outcomes. We find that the introduction of competition into the mix may help erode some of these inefficiencies. This is due to the fact that these theatres are better placed to exploit new opportunities since they

are more flexible, more dynamic and arguably have a better understanding of the market for their high-quality output.

On the whole, we can conclude for Germany there are pros and cons associated with each type of organisational structure. Our findings suggest that a myriad between the two may be appropriate: tighter controls on the budgets of theatre directors while affording greater flexibility in the production decisions of artistic directors, particularly as the market for artistic performances becomes increasingly competitive.

While the framework applied in this paper is constructed to specifically fit our application to the case of German public theatres it could also be applied to other similarly organised performing arts firms in other countries or other public funded organisations with similar merit good characteristics and which are characterised by a separation of objectives and preferences between those in charge of public funds and managers.[34] Future research may help further explain the story. For example, it would be useful to incorporate a ranking variable for theatres with the highest reputation before the fall of the Berlin wall which might have been known in both parts of Germany. We have also not considered the potential interactions between publicly funded theatres and the large privately run theatre sector in Germany. The extent to which they compete with each other for audiences and artistic directors may affect production decisions and outcomes in the publicly funded sector, particularly for the more market oriented theatres organised as private legal forms. Furthermore, we have not considered how different incentive structures for theatre directors might impact on performance outcomes. Moreover, our results support the argument that the recent transformation of theatres from public into private legal forms does not lead to increased efficiency levels of these theatres. In fact, our findings could be explored in the context of "institutional isomorphism" introduced by DiMaggio and Powell (1983). We may argue that theatres governed under private law follow proven recipes and make approaches borrowed from the publicly organised theatres their own, because "these approaches provide valuable solutions in the face of uncertainty in a changing world" (Roy and Séguin, 2000, p. 450).[35] Exploring these issues will contribute further to our

[34] Examples of sectors producing goods with merit good characteristics other than the arts are education, health, or any other social services.

[35] In the light of this theory public organisations will pursue efficiency objectives to become isomorphic. The institutional isomorphism is "characterized by a strong degree of similarity between organizations and to their environment, because they face similar conditions; thus, isomorphism conditions organizations to adopt emergent, socially defined elements as well as established practices" (Roy and Séguin, 2000, p. 449).

understanding of the link between organisational structure and efficiency for publicly funded non-profit organisations.

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Appendix

A.1 Description of the various types of legal forms of German public theatres

Type of the legal form	Public or private legal form	Short description
Regiebetrieb	Public	*Regiebetrie*b is form of public administration office. Usually, it is run by one theatre director (called *Intendant*) whose financial decisions are monitored by an administrative director who is a bureaucrat employed by the licence holder. *Regiebetrieb* is run in a similar way to a department of the public administration of the licence holder. Their financial dependence means that their accounting system is "cameral" in form in that all items in the accounts must be separated. This is the most common public legal form among theatres.
Eigenbetrieb	Public	*Eigenbetrieb* is a type of legal construct for public firms specific to Germany and is run by a theatre director or a board of directors called *Werkleitung* which is supervised by the elected body consisting of politicians and bureaucrats (called *Werkausschuss*). *Eigenbetriebe* are owned by municipalities only. The accounting system is usually not cameral in form as it is the case of *Regiebetrieb*.
örA	Public	*öffentlich-rechtliche Anstalt* is public corporation or institution directly under federal government control. Thus, it is special construct for public firms and also theatres owned by the federal region. The *örA* is run by the board of directors (*Vorstand*) and is supervised by the elected body of bureaucrats (called *Verwaltungsrat*). The formel influence of the supervisory board on the management is greater in *örA*-theatre than in the *GmbH*-theatre but smaller than in *Regiebetrieb*- or *Eigenbetrieb*-theatre.
ZV	Public	*Zweckverband* is special purpose association or association. It has the same structure as *Eigenbetrieb* with the only difference that the *Zweckverband* is owned by holding or unions of municipalities.
GmbH	Private	*Gesellschaft mit beschränkter Haftung* is limited liability (*Ltd*.) company which is also a common legal form of private enterprises in Germany. In the case of *GmbH*-theatres the only shareholder of the company is the state and the theatre is run by an independent theatre director (or board of directors), called *Vorstand*. There is also a supervisory board (*Aufsichtsrat*) as in the case of public legal form (such as *Eigenbetrieb, Zweckverband* or *ÖrA*-theatres) which controls the theatre management, however, it has much less formal influence on the management of the theatre than the *Werkausschuss* in *Eigenbetrieb*-theatre or the administrative director in a *Regiebetrieb*-theatre. This is the most common private legal form among theatres.
E.V.	Private	*Eingetragener Verein* is a legal status for a registered voluntary association. While any group may be called a *Verein*, registration as *eingetragener Verein* holds many legal benefits because a registered association may legally function as a corporate body rather than just a group of individuals. The *Vorstand* (management body) and the constitution of *E.V.*-theatre is chosen by the members of association (representative politicians and bureacrats of the licence holder) during their general meetings. The constitution of *Eingetragener Verein* defines the rights and the duties of the *Vorstand* and these can be different in each case.
GbR	Private	*Gesellschaft des bürgerlichen Rechts* is civil law association (*Verein*) or partnership under the civil code. With regard to the organisational structure, the *GbR* is similar to the *Eingetragener Verein* but in contrast to the latter, it is not a

registered association and does not have his own legal capacity and all the legal benefits as a corporate body. This is the least common form among public theatres.

A.2 Estimating Efficiency using the Stochastic Production Frontier Approach

In order to integrate the heterogeneity of theatres into the stochastic production frontier model, Greene (2004, 2005) proposes an approach that integrates the random effects approach into the original model of Aigner et al. (1977). Assuming that Y_{it} is an artistic output of theatre *i* in period *t* and $f(X_{ikt})$ is the production function specified in equation (1) of Section 3, the stochastic production frontier model can be written as:

$$Y_{it} = \alpha_i + d_t + f(X_{ikt}) + v_{it} - u_{it} \quad \text{(A1)}$$

where v_{it} is the statistical noise term with zero mean and constant variance; $u_{it} \sim N^{+}(0, \sigma_u^2)$ is a non-negative stochastic term representing inefficiency of theatre *i* in year *t* and $\alpha_i \sim N^{+}(0, \sigma_\alpha^2)$ represents a time-invariant, firm-specific random intercept to capture unobserved heterogeneity of theatres and d_t are the time-fixed effects. Both v_{it} and u_{it} can be expressed as a two-part composite error that is: $\varepsilon_{it} = v_{it} - u_{it}$ which is not normally distributed and the model is estimated by applying a simulated maximum likelihood procedure developed in Greene (2005). The inefficiency term, u_{it}, is computed as the conditional mean of the inefficiency using the formula of Jondrow et al. (1982) so that $E\left[u_{it} \middle| \varepsilon_{it}\right] = \sigma\lambda/(1+\lambda^2)[\phi(a_{it})/(1-\Phi a_{it}) - a_{it}]$ where $\sigma = (\sigma_u^2 + \sigma_v^2)^{1/2}$, $\lambda = \sigma_u / \sigma_v$, $a_{it} = \varepsilon_{it}\lambda/\sigma$, and ϕ and Φ represent the standard normal density and CDF evaluated at a_{it}, respectively. It should be noted that in the True RE model the simulated conditional expectation of inefficiency is computed which is $E[u_{it}|w_{it}]$ where $w_{it} = \alpha_i + \varepsilon_{it}$ and α_i is integrated out of u_{it} using simulations presented in Greene (2005, p. 290). Assuming a logarithmic functional form for the production function, the technical efficiency score of theatre *i* is computed as $TE_{it} = \exp(-u_{it})$ which is bound by zero and one. A score of 1 means full technical efficiency: a theatre cannot increase artistic output unless it increases input usage. A score of less than 1 means that, for the given technology, output can be increased without increasing the level of inputs.

An important advantage of the model specified in equation (A1) is that it differentiates between unobserved time-varying efficiency and the exogenous heterogeneity of theatres through random effects (see, for example, Farsi et al. (2006)). The omission of theatre heterogeneity may lead to biased estimates of the parameters describing the production frontier and also to an overstatement of technical inefficiency, u_{it}, and an understatement of technical efficiency, TE_{it}. The inefficiency of theatres is also time-varying which is an appropriate assumption given the fact it is a dynamic phenomenon (Farsi et al., 2006). This holds especially for our analysis as the number of time periods in the panel is large, and thus, it is difficult to assume a persistent level of inefficiency.

The true-random effects model produces unbiased coefficients of the production function under the assumption that the theatre specific random effects are not correlated with the explanatory variables (inputs). Thus, in line with Farsi et al. (2005), we also extend the True RE model and use an alternative Mundlak's (1978) formulation to reduce the possible bias that results from correlations between the unobserved heterogeneity term (α_i) and the explanatory variables. The correlation of firm-specific effects with explanatory variables is considered in an auxiliary regression given by:

$$\alpha_i = \lambda' \cdot \overline{X_i} + \eta_i, \ \overline{X_i} = \frac{1}{T_i}\sum_{t-1}^{T_i} X_{it}, \ \eta_i \sim N\left(0, \sigma_\eta^2\right) \quad \text{(A2)}$$

where X_{it} is the vector of all explanatory variables, λ_i is the corresponding vector of coefficients to be estimated, T_i is the number of time periods for theatre *i* and $\overline{X_i}$ are theatre specific means. Equation (A2) divides the firm-specific stochastic term into two components: the first explains the relationship between the exogenous variables (with the auxiliary coefficients λ_i) and the firm-specific effect and the second component, η_i which is orthogonal to the explanatory variables. In this way we control for any correlation between the exogenous variables and the heterogeneity component eliminating any bias.

A.3 Variables and Data Sources

Variable Name	Description
Artistic output (Y_{it}):	Total number of visitors during yearly theatre season, aggregate together with guest performances and free attendances
Artists (X_{1it}):	Yearly expenses on artistic directors/management, solo performing personnel in operetta, opera, drama, ballet members, choir members, members of the theatre orchestras.
Ancillaries (X_{2it}):	Yearly expenses on technical, artistic-technical staff, administration and house staff.
Primary capital (X_{3it}):	Operative non-personnel expenses including: administration, rents & leases, décor and costumes, publications, copy right and materials, guest performances, other operating expenditures.
Secondary capital (X_{4it}):	Value of capital stock.
Legal form of theatre (L_{it})	Dummy variable which is equal to 1 if a theatre is run under private law and 0 otherwise; or dummy variable which is equal to 1 if a theatre is run as *GmbH*-theatre and 0 if it is run as *Regiebetrieb*-theatre.
Proximity to the border (B_i)	1st Border Specification: =1 if a theatre is located within 50km radius of a theatre located in Eastern Germany or if a theatre is located in West Berlin 2nd Border specification: =1 if a theatre is located within 50km radius of Eastern border or if a theatre is located in West Berlin
Reunification shock (S_{it})	=1 for each year post-reunification
Data sources	(1) *Theaterstatistik*, Deutscher Bühnenverein 1972/1973-2003/2004, *Tables 1 - 6* (2) *Federal Statistical Office*, *National Accounts* „Volkswirtschaftliche Gesamtrechnungen, Inlandsproduktberechnung Lange Reihen ab 1970“ (3) *Federal Statistical Office*: www.genesis.destatis.de, www-ec.destatis.de, (4) *Regional Statistical Offices*: www.statistik-portal.de

Table 1: Number of theatres in West Germany organised by different legal forms over time

Type of the legal form	1972	1976	1980	1984	1988	1992	1996	2000	2003	Total change
Regiebetrieb	43	42	43	44	43	41	39	34	34	-9
Eigenbetrieb	0	0	0	0	1	3	5	8	6	6
örA	5	5	4	4	4	4	2	2	2	-3
ZV	5	5	6	6	5	4	4	3	2	-3
All public legal forms	53	52	53	54	53	52	50	47	44	-9
GmbH	14	15	17	17	19	20	17	18	22	8
E.V.	5	5	5	5	5	5	5	5	4	-1
GbR	1	1	1	1	1	2	2	2	1	0
All private legal forms	20	21	23	23	25	27	24	25	27	7
All theatres	73	73	76	77	78	79	74	72	71	-1

Source: Theaterstatistik 1972/1973-2003/2004, Deutscher Bühnenverein.

Table 2: Summary Statistics

	(1) Full sample			(2) *GmbH* and *Regiebetrieb*-theatres		
	All theatres	*Public legal forms*	*Private legal forms*	*All theatres*	*Regie-betrieb-*theatres	*GmbH-*theatres
Output and inputs variables		*Mean**			*Mean**	
Y_{it}, attendance	216,545 (134,835)	224519 (139,073)	199062 (123,336)	234,329 (137,577)	242,636 (141,910)	215,026 (124,940)
X_{1it}, artists	8,097 (7,667)	8,810 (8,046)	6,532 (6,495)	9,043 (7,960)	9,686 (8,279)	7,549 (6,943)
X_{2it}, ancillaries	6,093 (5,135)	6,329 (5,205)	5575 (4941)	6,803 (5,299)	6,960 (5,333)	6,439 (5,206)
X_{3it}, primary capital	2,999 (2,812)	3045 (2902)	2898 (2602)	3,303 (2,956)	3,286 (3,029)	3,340 (2,780)
X_{4it}, second. capital	141 (114)	149 (111)	123 (119)	148 (114)	156 (109)	129 (121)
Treatment/control indicators	*No. observations/No. theatres*			*No. observations/No. theatres*		
L_{it}=1		753/31			562/24	
B_i=1						
1st border spec.		306/10			306/10	
2nd border spec.		425/14			425/14	
S_{it}=1		1,045/79			1,045/67	
LB_{it}=1						
1st border spec.		89/4			89/4	
2nd border spec.		208/8			176/7	
LS_{it}=1		347/31			264/24	
BS_{it}=1						
1st border spec.		132/10			132/9	
2nd border spec.		179/14			179/12	
LBS_{it}=1						
1st border spec.		41/4			41/4	
2nd border spec.		88/7			74/7	
Total		2,404/79			1,868/67	

* Standard deviations in parentheses. The data on inputs are appropriately scaled and they are presented in 1,000 EUR for the year 2000. The management salary is presented in EUR also for the year 2000.

Table 3: Stochastic Production Frontier Estimates – Full Sample

	Translog specification		Cobb-Douglas specification	
Dependent variable: lnY_{it}	True RE	True RE with Mundlak	True RE	True RE with Mundlak
Constant	12.91***	12.93**	6.158***	5.812***
	(0.036)	(0.040)	(0.051)	(0.058)
β_1 (artists)	0.468***	0.510***	0.433***	0.471***
	(0.014)	(0.032)	(0.007)	(0.015)
β_2 (ancillaries)	0.141***	0.192***	0.190***	0.204***
	(0.015)	(0.032)	(0.009)	(0.013)
β_3 (prim. capital)	0.086***	0.091**	0.162***	0.142***
	(0.012)	(0.021)	(0.008)	(0.010)
β_4 (second. capital)	0.005	0.007	0.002	0.008
	(0.006)	(0.012)	(0.005)	(0.006)
β_{11}	0.102***	0.104***		
	(0.015)	(0.023)		
β_{22}	0.049***	0.034		
	(0.016)	(0.026)		
β_{33}	0.059**	0.046		
	(0.022)	(0.038)		
β_{44}	0.011	0.010		
	(0.007)	(0.009)		
β_{12}	-0.055*	-0.064		
	(0.032)	(0.049)		
β_{13}	-0.233***	-0.225***		
	(0.018)	(0.027)		
β_{14}	0.031**	0.025		
	(0.014)	(0.018)		
β_{23}	0.044	0.078		
	(0.032)	(0.058)		
β_{24}	-0.044**	-0.029		
	(0.018)	(0.026)		
β_{34}	-0.003	-0.009		
	(0.022)	(0.028)		
d_t (time dummies)	yes	yes	yes	yes
Log-likelihood	829.1	878.3	777.8	797.6
λ	2.518***	2.36***	2.37***	1.693***
	(0.185)	(0.189)	(0.162)	(0.151)
σ_u	0.227	0.221	0.226	0.195
σ_v	0.090	0.094	0.095	0.115
No. observations	2,404	2,404	2,404	2,404
Average E_{ikt} (Std. Dev.)	0.84 (0.09)	0.85 (0.08)	0.84 (0.09)	0.84 (0.08)

Standard errors in parentheses. *** indicate significance at the 1 per cent level. ** and * indicate significance at the 5 and 10 per cent level respectively.

Table 4: Stochastic Production Frontier Estimates – *GmbH*- and *Regiebetrieb*-theatres

	Translog specification		Cobb-Douglas specification	
Dependent variable: lnY_{it}	True RE	True RE with Mundlak	True RE	True RE with Mundlak
Constant	12.83***	12.877***	6.271***	5.716***
	(0.033)	(0.035)	(0.048)	(0.065)
β_1 (artists)	0.313***	0.383***	0.321***	0.326***
	(0.015)	(0.036)	(0.008)	(0.022)
β_2 (ancillaries)	0.208***	0.242***	0.251***	0.288***
	(0.016)	(0.044)	(0.009)	(0.018)
β_3 (prim. capital)	0.139***	0.125***	0.169***	0.156***
	(0.014)	(0.024)	(0.009)	(0.015)
β_4 (second. capital)	0.107	0.017*	0.029***	0.022***
	(0.007)	(0.009)	(0.006)	(0.008)
β_{11}	0.107***	0.112***		
	(0.024)	(0.035)		
β_{22}	0.021	0.042		
	(0.032)	(0.040)		
β_{33}	-0.003	0.025		
	(0.023)	(0.060)		
β_{44}	-0.029**	-0.038**		
	(0.012)	(0.016)		
β_{12}	-0.082	-0.064		
	(0.057)	(0.083)		
β_{13}	-0.171***	-0.171***		
	(0.027)	(0.047)		
β_{14}	-0.012	-0.003		
	(0.019)	(0.029)		
β_{23}	0.082**	0.031		
	(0.036)	(0.088)		
β_{24}	0.010	-0.021		
	(0.029)	(0.056)		
β_{34}	0.011	0.030		
	(0.028)	(0.052)		
d_t (time dummies)	yes	yes	yes	yes
Log-likelihood	785.8	821.7	720.5	726.6
λ	2.781***	2.738***	2.876***	2.713***
	(0.207)	(0.222)	(0.203)	(0.208)
σ_u	0.217	0.216	0.227	0.222
σ_v	0.078	0.079	0.079	0.082
No. observations	1,868	1,868	1,868	1,868
Average E_{ikt} (Std. Dev.)	0.85 (0.09)	0.85 (0.09)	0.85 (0.09)	0.84 (0.09)

Standard errors in parentheses. *** indicate significance at the 1 per cent level. ** and * indicate significance at the 5 and 10 per cent level respectively.

Table 5: Mean comparison tests of the estimated efficiency levels of theatres grouped by legal form

Estimated E_{ikt}	Translog, *True RE*	Translog, *True RE with Mundlak*	C-D, *True RE*	C-D, *True RE with Mundlak*
Public legal forms (L_{1it}=0)	0.845	0.848	0.846	0.846
Private legal forms (L_{1it}=1)	0.837	0.841	0.837	0.837
t-ratio	2.111**	1.861*	2.201**	2.257**
No. observations	2,404	2,404	2,404	2,404
Regiebetrieb-theatres (L_{2it}=0)	0.856	0.857	0.852	0.854
GmbH- theatres (L_{2it}=1)	0.836	0.837	0.827	0.832
t-ratio	4.408***	4.427***	5.293***	4.692***
No. observations	1,868	1,868	1,868	1,868

*** significant difference at the 1 percent level,** significant at the 5 per cent level and * significant different at the 10 per cent level.

Table 6: Identification of the effect of the reunification funding shock

Dependent variable: E_{ikt}	Translog, *True RE*	Translog, *True RE with Mundlak*	C-D, *True RE*	C-D, *True RE with Mundlak*
	Panel A: Private vs Public			
L_{1it}	-0.072***	-0.064***	-0.092***	-0.087***
	(0.014)	(0.013)	(0.014)	(0.013)
S_{it}	0.022	0.022	0.024	0.024
	(0.015)	(0.014)	(0.015)	(0.015)
LS_{it}	-0.004	-0.005	-0.001	-0.001
	(0.008)	(0.007)	(0.008)	(0.008)
Time dummies	yes	yes	yes	Yes
	Panel B: GmbH-theatres vs. Regiebetrieb-theatres			
L_{2it}	-0.076***	-0.065***	-0.099***	-0.091***
	(0.015)	(0.014)	(0.016)	(0.015)
S_{it}	0.019	0.023	0.020	0.020
	(0.017)	(0.017)	(0.018)	(0.017)
LS_{it}	-0.028***	-0.027***	-0.012	-0.015
	(0.009)	(0.009)	(0.010)	(0.009)
Time dummies	yes	yes	yes	yes

Fixed effects estimation with time dummies. Standard errors in parentheses. *** indicate significance at the 1 per cent level, ** indicates significance at the 5 and *indicates significance at the 10 per cent level.

Table 7: Identification of the reunification competition shock – 1st Border Specification

Dependent variable: E_{ikt}	Translog, *True RE*	Translog, *True RE with Mundlak*	C-D, *True RE*	C-D, *True RE with Mundlak*
		Panel A: Private vs Public		
L_{1it}	-0.084***	-0.075***	-0.102***	-0.096***
	(0.015)	(0.014)	(0.014)	(0.014)
S_{it}	0.025	0.024*	0.026*	0.026*
	(0.015)	(0.014)	(0.015)	(0.014)
LS_{it}	-0.012	-0.012	-0.008	-0.007
	(0.009)	(0.008)	(0.008)	(0.008)
BS_{it}	-0.017	-0.016	-0.015	-0.016
	(0.013)	(0.012)	(0.013)	(0.013)
LB_{it}	0.088*	0.086**	0.074*	0.079*
	(0.045)	(0.044)	(0.045)	(0.044)
LBS_{it}	0.054**	0.047**	0.050**	0.045*
	(0.025)	(0.024)	(0.024)	(0.024)
Time dummies	yes	yes	yes	yes
		Panel B: GmbH-theatres vs. Regiebetrieb-theatres		
L_{2it}	-0.087***	-0.078***	-0.110***	-0.102***
	(0.016)	(0.016)	(0.017)	(0.016)
S_{it}	0.027	0.031*	0.030	0.028
	(0.017)	(0.017)	(0.018)	(0.017)
LS_{it}	-0.044***	-0.041***	-0.029***	-0.030***
	(0.010)	(0.010)	(0.010)	(0.010)
BS_{it}	-0.053***	-0.047***	-0.057***	-0.055***
	(0.014)	(0.014)	(0.015)	(0.014)
LB_{it}	0.073	0.081*	0.066	0.066
	(0.045)	(0.045)	(0.047)	(0.046)
LBS_{it}	0.089***	0.074***	0.088***	0.083***
	(0.025)	(0.025)	(0.027)	(0.026)
Time dummies	yes	yes	yes	yes

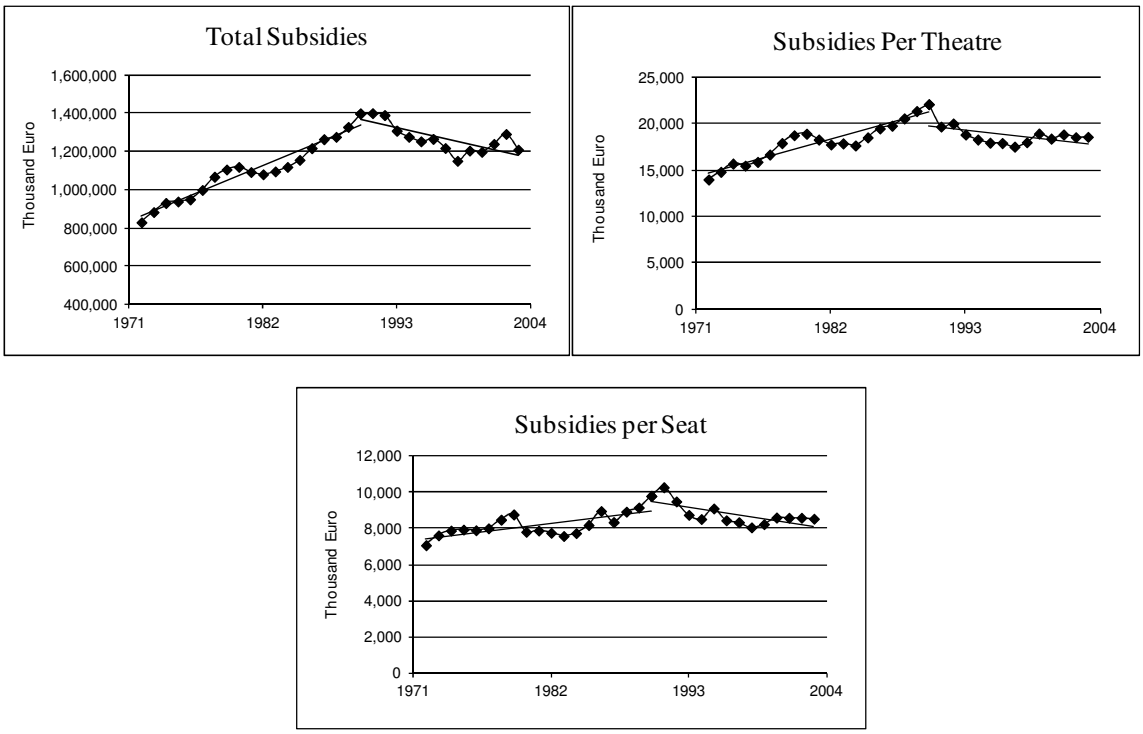
Fixed effects estimation with time dummies. Standard errors in parentheses. *** indicate significance at the 1 per cent level, ** indicates significance at the 5 and *indicates significance at the 10 per cent level.

Table 8: Identification of the reunification competition shock – 2nd Border Specification

Dependent variable: E_{ikt}	Translog, *True RE*	Translog, *True RE with Mundlak*	C-D, *True RE*	C-D, *True RE with Mundlak*
		Panel A: Private vs Public		
L_{1it}	-0.076***	-0.067***	-0.095***	-0.089***
	(0.015)	(0.014)	(0.015)	(0.015)
S_{it}	0.025	0.024*	0.026*	0.026*
	(0.015)	(0.014)	(0.015)	(0.015)
LS_{it}	-0.023**	-0.023***	-0.018**	-0.018*
	(0.009)	(0.008)	(0.009)	(0.009)
BS_{it}	-0.017	-0.016	-0.015	-0.016
	(0.013)	(0.012)	(0.013)	(0.012)
LB_{it}	0.072*	0.067*	0.060	0.062*
	(0.043)	(0.041)	(0.042)	(0.042)
LBS_{it}	0.074***	0.070***	0.067***	0.066***
	(0.020)	(0.019)	(0.019)	(0.019)
Time dummies	yes	yes	yes	yes
		Panel B: GmbH-theatres vs. Regiebetrieb-theatres		
L_{2it}	-0.084***	-0.074***	-0.108***	-0.099***
	(0.017)	(0.016)	(0.017)	(0.016)
S_{it}	0.027	0.031*	0.029	0.028
	(0.017)	(0.017)	(0.018)	(0.017)
LS_{it}	-0.050***	-0.047***	-0.032***	-0.034***
	(0.011)	(0.011)	(0.011)	(0.011)
BS_{it}	-0.053***	-0.047***	-0.057***	-0.055***
	(0.014)	(0.014)	(0.015)	(0.014)
LB_{it}	0.075*	0.077*	0.071	0.068
	(0.043)	(0.043)	(0.045)	(0.044)
LBS_{it}	0.089***	0.079***	0.085***	0.083***
	(0.022)	(0.021)	(0.022)	(0.022)
Time dummies	yes	yes	yes	yes

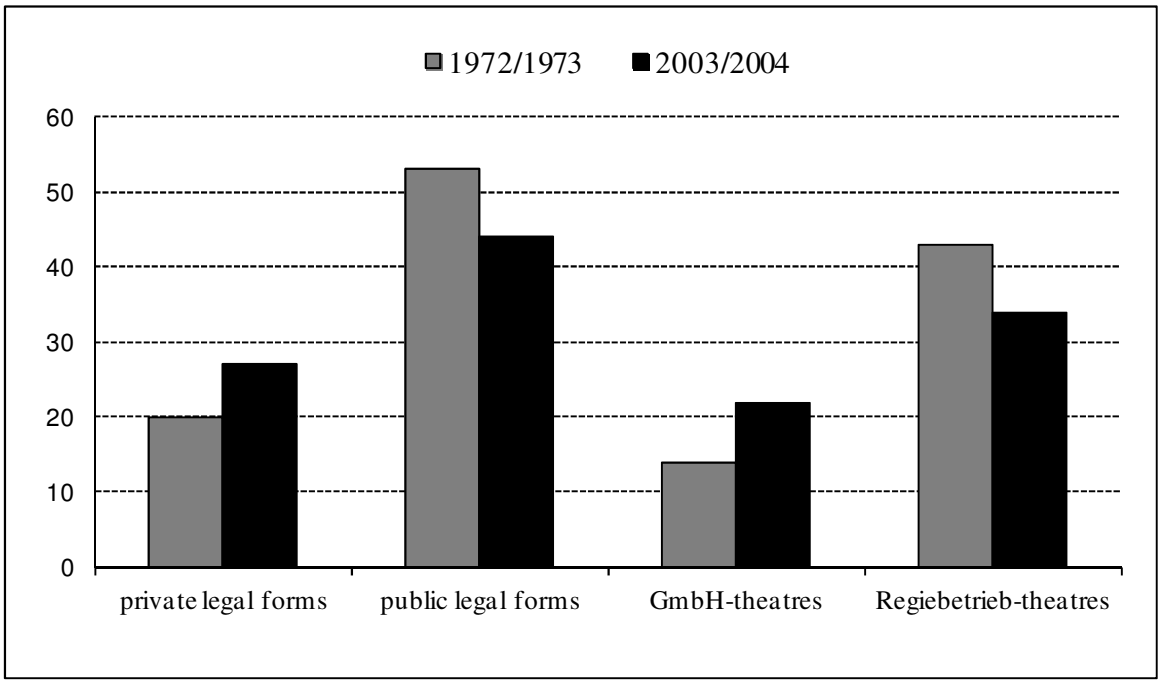
Fixed effects estimation with time dummies. Standard errors in parentheses. *** indicate significance at the 1 per cent level, ** indicates significance at the 5 and *indicates significance at the 10 per cent level.

Figure 1: The real level of public funding for public theatres in Germany (excluding East Germany) between 1965 and 2004.*



Source: Theaterstatistik 1972/1973-2003/2004, Deutscher Bühnenverein

Figure 2: Number of public theatres in West Germany organised in different legal forms at the beginning and end of the examination period.



Source: Theaterstatistik 1972/1973-2003/2004, Deutscher Bühnenverein.