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The Impact of Intergovernmental Grants on Cost Efficiency: Theory and Evidence from German Municipalities

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Abstract: In this paper we use a simple bureaucracy model of fiscal illusion to analyse the impact of intergovernmental grants on the cost efficiency of local jurisdictions. We find that a higher degree of redistribution within a system of fiscal equalisation or an increase in the amount of grants received by a local jurisdiction leads to an extension of organisational slack or X-inefficiency in that jurisdiction. This theoretical prediction is tested by conducting an empirical analysis using a broad panel of German municipalities. The results of the empirical analysis are consistent with the theoretical findings and therefore support the existence of a negative incentive effect of intergovernmental grants on local authorities' cost efficiency.

I. INTRODUCTION

A key issue in the theoretical and empirical literature of public finance is how intergovernmental grants influence the level of local public spending of the recipient government. Researchers have been particularly interested in whether grants from the federal government stimulate higher levels of overall spending by local governments, or rather substitute for local tax revenue. The first effect is called the "flypaper effect" (Courant, Gramlich and Rubinfeld 1979) following Arthur Okun's observation that "money sticks where it hits". This is because grants entering the public sector also stay there, rather than being distributed to the private sector in the form of lower tax payments. There is a large empirical literature trying to estimate the extent to which intergovernmental grants to state and local governments are associated with higher government spending (for a review, see e.g. Hines and Thaler 1995). Some of these studies attempt to explain the flypaper effect by specification errors in the econometric estimation (for

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a recent study, see e.g. Knight 2002), other studies suggest that the individuals underly a kind of fiscal illusion which leads to a misperception of the "true" tax price (Courant, Gramlich and Rubinfeld 1979, Oates 1979).

An aspect which has attracted far less attention in the flypaper literature is concerned with the question whether observed changes in expenditures are associated with analogous changes in the actual level of public goods or services or whether increases in expenditures lead (at least to some extent) to a waste of resources (or X-inefficiency, Leibenstein 1966) and losses in productive efficiency. In fact, to the best of our knowledge, only one study has so far attempted to assess the impact of intergovernmental aid on technical efficiency or X-efficiency (Silkman and Young 1982). This empirical study investigates the technical efficiency of two public services (school bus transportation and public libraries) in the United States using cross section data. Silkman and Young (1982) show that the non-local proportion of total revenues (that is the proportion of intergovernmental grants) have a strong negative impact on the productive efficiency of local government's services. In further studies, Athanassopoulos and Triantis (1998), Balaguer-Coll et al. (2007), De Borger and Kerstens (1996), and Loikkanen and Susiluoto (2005) analyse the general determinants of local governments' cost efficiency in Greece, Spain, Belgium, and Finland – using different parametric and non-parametric estimation techniques. They all come to the conclusion that (intergovernmental) grants stimulate technical or cost inefficiency.[1] Finally, in a recent theoretical analysis, Kotsogiannis and Schwager (2006) show that fiscal equalisation programmes foster the incentives of the incumbents towards more rent extraction by reducing the intensity of political competition.

Given this background the aim of this paper is to add to the existing literature by studying the causal effects of intergovernmental grants on local technical efficiency in Germany. For this purpose we use a simple bureaucracy model of Niskanen (1975) and introduce the possibility that the federal government is able to give (lump sum) grants to the local government (as a substitute for local tax revenues). Moreover we assume, similar to Moesen and van Cauwenberge (2000), that the citizens of the local jurisdiction are susceptible to a misperception of the true tax price of the local public goods or services due to fiscal illusion. In fact, it is assumed that a higher amount of intergovernmental grants leads to an underestimation of the true tax price by the citizens and therefore to a higher demand of public output. Using this framework we analyse how a higher degree of redistribution, that is an increase in the amount of grants to the local government, affects the technical efficiency in the provision of public goods and services in this local jurisdiction. We find that a higher degree of redistribution has a negative impact on the technical efficiency in the local jurisdiction.

Finally, the results derived in the theoretical analysis are tested in an empirical framework using a broad panel of German municipalities. Germany is an interesting case to study, since grants received from higher levels of governments make up a considerable share of local governments' revenue. To figure out the impact of intergovernmental aid on technical

[1] In contrast to the above mentioned studies, Geys and Moesen (2009) find a positive relationship between grants and cost efficiency for a sample of Flemish municipalities. According to the authors, however, this result could be due to the fact that grants from higher level governments in Flanders are linked to strict supervision on expenditures. In addition, Worthington (2000) finds no significant relationship between grants and technical efficiency for a sample of Australian local governments.

efficiency we apply the stochastic frontier estimation approach proposed by Battese and Coelli (1995) which allows us to make use of panel data. The results of the empirical analysis are consistent with our theoretical findings and support the existence of a negative incentive effect of intergovernmental grants on local authorities' cost efficiency. We find that an increase in the amount of grants received by the local government indeed leads to a reduction in technical efficiency or to an increase in X-inefficiency in that local jurisdiction.

The remainder of the paper is structured as follows. In section 2 we conduct the theoretical analysis where we also give a brief review of the original Niskanen (1971) bureaucracy model, and derive a testable proposition. Section 3 describes the empirical analysis including an introduction to the institutional setting of the German local governments. Final conclusions are drawn in section 4.

II. THEORETICAL ANALYSIS

2.1 The Bureaucracy Model of Niskanen

In the original bureaucracy model of Niskanen (1971) the relationship between a bureau and its sponsor or funding agency is that of a bilateral monopoly. In our case we could assume, for instance, that the sponsor is represented by the local government of a municipality which approves a certain budget for a public bureau (e.g. the Road Construction Office) in order to "buy" services and goods from this bureau (e.g. the construction of new highways). We further assume that the electoral process in the municipality is dominated by the median voter and that the local government wants to meet the wishes of the median voter.

The total budget, TB^N, which the sponsor is willing to approve, is assumed to be a quadratic function of the public output, Q:

$$TB^N = aQ - bQ^2, \tag{1}$$

that is, the total budget is a concave function of Q, reflecting diminishing marginal utility of public output. Moreover, the minimum total production costs for producing the public output, TC, are given by:

$$TC = cQ + dQ^2. \tag{2}$$

As can be seen from equation (2), total costs are assumed to rise at an increasing rate like a competitive firm's cost schedule. This cost function is only known by the bureaucrat. Finally the bureaucrat faces the constraint that the total budget must be equal or greater than the minimum total costs:

$$TB^N \geq TC. \tag{3}$$

Now, Niskanen (1971) assumes that the bureaucrat seeks to maximise the size of the budget, TB^N, that is the bureaucrat maximises the budget-output function (1) over Q under the constraint that (in)equality (3) is fulfilled. However, as pointed out by Migué and Belanger (1974), one implication of budget-maximisation is that the production of public output is allocatively inefficient (since the total budget is too large) but it is indeed technically efficient. This, in turn, implies that there remains no surplus revenue for the bureaucrat which can be devoted to his/her own ends since this would compete with output. The bureaucrat, however, has preferences for things like income, prestige, expansion of personnel, leisure time, etc. Therefore, in a later version of his model, Niskanen (1975) extended the original model by assuming that the bureaucrat has access to the "fiscal residuum" (Orzechowski 1977; also called "discretionary profit", Migué and Belanger, 1974 or "organisational slack", Cyert and March, 1963), which is defined as the difference between the total budget and the minimum production costs,

$$FR = TB^{N} - TC. \quad (4)$$

The fiscal residuum measures the degree of production inefficiency or X-inefficiency (Leibenstein 1966) at each possible production level.

Under the assumption that the bureaucrat has access to the fiscal residuum both the production inefficiency and the output enter the utility function of the bureaucrat. That is, the bureaucrat (indirectly) is able to use parts of the budget for his/her own ends. One could imagine for instance, that the fiscal residuum or X-inefficiency generates utility for the bureaucrat in terms of leisure, long breaks, large expense accounts, political appointments and so on. Therefore, if the choice variables of the bureaucrat are public output and technical inefficiency, government production is allocatively as well as technically inefficient.

2.2 A Bureaucracy Model of Fiscal Illusion

Following Niskanen (1975) we assume that the utility function of the bureaucrat is given by:

$$U = \alpha_1 Y^{\beta 1} N^{\gamma 1}, \quad (5)$$

where Y represents the present value of the bureaucrat's monetary income and N the set of nonmonetary perquisites of his/her position like leisure time, expensive lunches, reputation, and so on. Moreover, Y and N are related to the public output and the fiscal residuum (or maximum level of production inefficiency) as follows:

$$\mathrm{Y} = \alpha_2 Q^{\beta 2} FR^{\gamma 2} \quad (6)$$

$$\mathrm{N} = \alpha_3 Q^{\beta 3} FR^{\gamma 3}. \quad (7)$$

Equations (6) and (7) can be interpreted as the reward structure of the bureaucrat which is established by the sponsor. The main difference between the reward structure of a manager in a profit-seeking firm and a typical bureaucrat is that γ_2 is relatively high for the manager and relatively low for the bureaucrat. In contrast to the manager, the bureaucrat is not able to appropriate directly any of the fiscal residuum as personal income. On the other hand, the bureaucrat is characterized by relatively high values of β_2, β_3 and γ_3.

Substituting Y and N in (5) yields an expression of the utility function in terms of the public output, Q, and the fiscal residuum, FR:

$$U = \alpha Q^{\beta} FR^{\gamma}, \quad (8)$$

where

$$\alpha = \alpha_1 \alpha_2^{\beta 1} \alpha_3^{\gamma 1}$$

$$\beta = \beta_1 \beta_2 + \gamma_1 \beta_3$$

$$\gamma = \beta_1 \gamma_2 + \gamma_1 \gamma_3.$$

Now, the available combinations of public output and technical inefficiency determine the choice constraint of the bureaucrat.

In a next step, we want to derive the demand function of the voter. As pointed out by Niskanen (1975) the budget function (1) is the integral of the demand function facing the bureaucrat over the whole range of output, or in other words the monetary reflection of the voter's preferences. Since Niskanen assumes a quadratic budget function the demand function for public output has to be linear (in prices). In order to derive this demand function we first assume that the utility of the voter is given by:

$$U^V = X - \frac{(Q-\rho)^2}{2\theta}, \text{ with } \rho, \theta > 0\,, \tag{9}$$

where X is the amount of the private good, which has by assumption a price of unity, and ρ and θ are some parameters. Furthermore the budget constraint of the voter is given by:

$$Y^V = Y + \bar{\tau} g = X + \tau(g) PQ, \tag{10}$$

where Y^V denotes the voter's total income, Y the voter's private income, and P the production price of the public output presented to the voter in the form of tax payments. Moreover, besides tax revenue from service recipients, the sponsor (or local government) receive lump-sum grants, g, from higher levels of government or other local governments (due to limited autonomy in raising own revenues) in order to finance parts of the public output. In addition, the tax share, τ, accruing to the voter is assumed to depend on the amount of grants received by the local government. Similar to Moesen and Van Cauwenberge (2000), we assume that the tax share the voter will take into account in his/her consumption decision is a negative function of the amount of grants due to fiscal illusion ($\frac{\partial \tau}{\partial g} < 0$), that is, the higher the grants received by the local government, the lower the perceived tax price of the public output (by the voter). Therefore, the function $\tau(g)$ captures the voter's degree of fiscal illusion.[2] If the local government does not receive any grants, $\tau(g)$ is equal to the real tax share $\bar{\tau}$. If, on the other hand, the local government does receive a positive amount of grants, then $\tau(g)$ falls until it reaches a lower bound $\underline{\tau}$ depending on the amount of grants received. Of course, if the voter is completely free of fiscal illusion, $\tau(g)$ equals the real tax share, $\bar{\tau}$. But for the rest of the paper we will assume that the voter underlies at least a certain degree of fiscal illusion. As can be seen from equation (10), an increase in g then has two effects on the budget constraint: on the one hand voter's total income, Y^V, will increase since $\bar{\tau} g$ rises (usual income effect),

2 The difference between this analysis and the study of Moesen and Van Cauwenberge (2000) is that the latter introduces the fiscal illusion in a different context. More specifically, the authors investigate how governmental borrowing affects the demand for public goods and services when the taxpayers are not confronted with the "true" costs of providing the public goods and services due to a certain degree of myopia.

but on the other hand there will also be a reduction in the tax price of the public output due to fiscal illusion (price effect).

Given the utility function and the budget constraint of the (median) voter, we can easily derive the demand function for the public output:

$$Q = \rho - \theta\tau(g)P, \text{ with } \rho, \theta > 0, \tag{11}$$

which, because of the quasilinearity of the utility function (9) does not depend on the voter's wealth. Now, as can be seen from equation (11), an increase in the amount of grants leads to an increase in the demand for public output ($\frac{\partial Q}{\partial g} > 0$) since the perceived tax price for the voter decreases due to fiscal illusion.[3]

In order to investigate the effects of an increase in grants on technical inefficiency, we first have to derive the budget function, *TB*:

$$TB = P * Q = \frac{1}{\tau(g)}\left(aQ - bQ^2\right) = \frac{1}{\tau(g)}TB^N, \tag{12}$$

where we have used the fact that the total budget is given by *P* times *Q*. To be in line with the original Niskanen (1971) model, we replaced $\frac{\rho}{\theta}$ by a, $\frac{1}{\theta}$ by b and $(aQ - bQ^2)$ by TB^N, the budget function (1) where fiscal illusion is absent, that is TB^N represents the "true" monetary reflection of the sponsor's preferences. Since $\tau(g)$ ranges between the real tax share ($\bar{\tau}$) and a lower bound ($\underline{\tau}$), *TB* is either equal or bigger than the "true" budget, TB^N. Moreover, substituting the total budget, *TB*, and the minimum total costs from equation (2), *TC*, in (4), yields an expression for the fiscal residuum:

$$FR = TB - TC = \left(\frac{a}{\tau(g)} - c\right)Q - \left(\frac{b}{\tau(g)} + d\right)Q^2. \tag{13}$$

As a next step, we can replace (13) in the utility function of the bureaucrat (8):

$$U = \alpha Q^\beta \left[\left(\frac{a}{\tau(g)} - c\right)Q - \left(\frac{b}{\tau(g)} + d\right)Q^2\right]^\gamma, \tag{14}$$

which yields an expression of the utility function depending solely on public output. Finally, maximising (14) with respect to *Q* then leads to the level of output that maximises the utility of the bureaucrat:

$$Q^* = \frac{\beta + \gamma}{\beta + 2\gamma} \frac{\left(\frac{a}{\tau(g)} - c\right)}{\left(\frac{b}{\tau(g)} + d\right)}. \tag{15}$$

If we differentiate Q^* with respect to the amount of grants received by higher levels of government, g, we can see that g is an increasing function in Q^*:

[3] For the sake of simplicity we assume that the (median) voter has quasi-linear preferences which means that income effects do not matter. The results, however, do not change if we use an utility function which does not exclude income effects. The difference between an equivalent increase in voter's private income, then, would be that the latter only causes an income effect, while in our case higher grants additionally lower the price of public output and therefore also produce a substitution (or price) effect.

$$\frac{\partial Q^*}{\partial g} = -\left(\frac{\beta+\gamma}{\beta+2\gamma}\right)\left(\frac{ad+bc}{(b+\tau(g)d)^2}\right)\frac{\partial\tau}{\partial g} > 0. \tag{16}$$

In other words, if fiscal illusion is present, the demand for public output will rise as long as the amount of grants increase. This is due to the fact that the voter systematically underestimates the true tax price of public output ($\frac{\partial\tau}{\partial g} < 0$) and therefore substitutes private for public good consumption.

To find out the desired effect of an increase in g on the fiscal residuum or technical inefficiency we finally have to plug in the level of output that maximizes the utility of the bureaucrat, Q^* in the definition of the fiscal residuum (13) and differentiate this expression with respect to g:

$$\frac{\partial FR^*}{\partial g} = -\frac{\partial\tau}{\partial g}\frac{1}{\tau(g)^2}\left(aQ^* - bQ^{*2}\right) + \frac{\partial Q^*}{\partial g}\left(\frac{1}{\tau(g)}\left(a - 2bQ^*\right) - \left(c + 2dQ^*\right)\right) \tag{17}$$

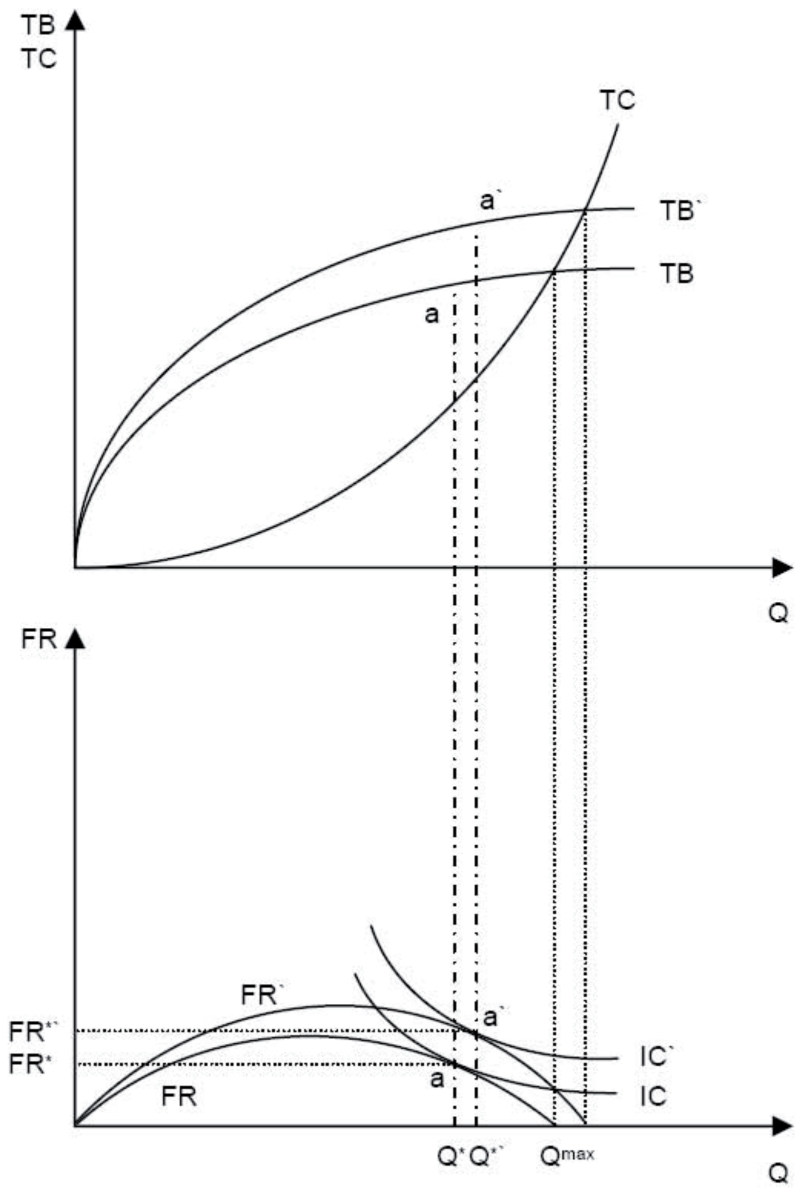
$$= -\frac{\partial\tau}{\partial g}\frac{1}{\tau(g)^2} TB^{N*} + \frac{\partial Q^*}{\partial g}\left(\frac{\partial TB^*}{\partial Q^*} - \frac{\partial TC^*}{\partial Q^*}\right),$$

where the asterisks denote the values that maximise the bureaucrat's utility. The sign of the partial derivative of technical inefficiency with respect to the amount of grants now depends on the signs of the two summands in equation (17). First, if the budget is positive (that is, if Q ranges between zero and $\frac{a}{b}$) and if we assume the presence of fiscal illusion ($\frac{\partial\tau}{\partial g} < 0$) the sign of the first summand is positive. Concerning the second summand, we have shown in equation (16) that grants are an increasing function of Q^*, that is the first term of the second summand is bigger than zero. If a marginal increase in Q^* causes total budget to increase more than total costs ($\frac{\partial TB^*}{\partial Q^*} > \frac{\partial TC^*}{\partial Q^*}$), the second summand in equation (17) will be positive, too. If, on the other hand, both effects are of equal size ($\frac{\partial TB^*}{\partial Q^*} = \frac{\partial TC^*}{\partial Q^*}$), this term will be zero. The last two statements simply say that the increase in the fiscal residuum (due to the increase of grants) must lie within the budget constraint (3). Nevertheless, in both cases the overall effect of a marginal change in grants on technical inefficiency would be positive, which proves our intended point that there is a negative incentive effect of intergovernmental grants on technical efficiency. We can summarise these findings by the following proposition:

Proposition**:** *In the presence of fiscal illusion ($\frac{\partial\tau}{\partial g} < 0$), an increase in grants from higher levels of government or other local governments leads to an increase in the technical inefficiency of the recipient government, if: (i) the budget is positive ($0 < Q < \frac{a}{b}$) and (ii) a marginal increase in output causes the total budget to increase more or as much as total costs ($\frac{\partial TB^*}{\partial Q^*} \geq \frac{\partial TC^*}{\partial Q^*}$).*

Similar to Moesen and Van Cauwenberge (2000), the above-mentioned mechanism can be illustrated as presented in Figure 1. The upper panel of Figure 1 shows the budget function, TB, and the minimum cost function for producing the public output, TC, whereas the lower panel outlines the corresponding fiscal residuum, FR, as well as the bureaucrat's utility maximising combination of output and technical inefficiency represented by the tangency point of his/her indifference curve, IC, and the fiscal residuum (point a). Now, an increase in the amount of grants received by the local government causes the voter to assume that there has been a reduction in his/her tax price due to fiscal illusion. As a consequence, the voter demands a higher amount of public output, and the local government (which wants to meet the wishes of the median voter) approves a higher budget, which is shown in the upper panel by the upward shift of the budget curve from *TB* to *TB´*. The higher budget, in turn, leads to an upward shift of the fiscal residuum from *FR* to *FR´* (lower panel of Figure 1), and, finally to the new tangency point *a´* at which both output and technical inefficiency has risen. In other

Figure 1: Effects of an increase in the amount of grants



words, the bureaucrat uses parts of the new budget for the increase in public output, but he/she also diverts parts for his/her own ends.[4]

III. EMPIRICAL ANALYSIS

The proposition derived above provides a testable relationship between the amount of grants received by the municipalities and the degree of technical inefficiency (or X-inefficiency). In the German case this is of particular interest, since grants received from higher levels of government or other local governments constitute a considerable share of local government revenues (as will be seen in the following subsection).

However, before presenting the results along with the underlying estimation approach and data set, the institutional setting of the German local governments as well as the main features of the German municipal system of fiscal equalisation will be provided. This is necessary in order to clarify the context of local public decision-making in Germany.

3.1 Institutional Background

Germany's fiscal constitution is characterised by a differentiated federal structure, where municipalities constitute the lowest level of government. Nevertheless, local governments exhibit considerable autonomy with regard to their revenue as well as expenditure side. With respect to revenues, local governments have three main income sources: tax revenue (41% of total revenue in 2004), grants (from fiscal equalisation schemes; 31% of total revenue in 2004) and revenue from user charges (9% of total revenue in 2004). In the German state Baden-Württemberg, which will be considered here, local governments can decide independently on five different types of taxes: trade tax (*Gewerbesteuer*), property tax (*Grundsteuer*) and three bagatelle taxes which are not raised by all municipalities. As can be seen from Table 1, only the trade tax yields significant revenues (41.33%); in contrast, the revenue from the property tax accounted for only 15.04% of total tax revenue in 2004. Apart from these own tax revenues, municipalities also receive tax revenue from higher levels of government ("tax sharing"). On the one hand, they get a share of the revenue accruing from the federal income tax (15% of revenue raised in the state Baden-Württemberg) and interest income tax (12% raised in the state Baden-Württemberg), on the other hand, they also obtain 2.2% of the value added tax revenue raised in Germany as a whole.[5] While the

4 An alternative explanation of the inefficiency enhancing effect of intergovernmental grants could be *pork barrel politics*. According to Weingast, Shepsle and Johnsen (1981), the larger the number of special interest groups as well as their appointed representatives (in a representative legislature), the smaller the degree to which they internalise the cost of public spending. In this context, intergovernmental grants can reduce the degree to which an individual taxpayer and its representative internalise the costs of their policy decisions (for special programmes), since both benefit from specific programmes and the cost of these special programmes are distributed over all taxpayers. Therefore, both perceive only a fraction of the initiated costs which, in turn, can lead to increasing public expenditures as well as inefficiency levels. We are grateful to an anonymous referee for pointing this out.

5 Note that the participation of the municipalities in the value added tax revenue was introduced in 1998 when the trade tax on capital (*Gewerbekapitalsteuer*) (in the western German states) was abolished (see Ministry of Finance of Baden-Württemberg 2006).

share of the income tax accounted for 38.25% of total tax revenue in 2004, the share of the value added tax made up only 4.51%.

Table 1: Composition of the Tax Revenue of Baden-Württemberg's Local Governments in 2004

Type of tax	Mrd. €	per capita	% of total tax revenue
Trade tax	3.59	335.54	41.33
Property tax	1.31	122.14	15.04
Share of income tax	3.32	310.52	38.25
Share of value added tax	0.39	36.58	4.51
Other taxes	0.08	7.11	0.88

Source: Statistical Office of Baden-Württemberg, own calculations

With respect to the allocation of funds, the German municipal system of fiscal equalisation incorporates both vertical and horizontal elements, whereas all transfers within this equalisation system are regulated by law (*Finanzausgleichsgesetz* – FAG). The vertical equalisation is concerned with the financial relationships between the state (of Baden-Württemberg) and its municipalities. The state has to ensure that the communities are able to perform their tasks. In contrast, the horizontal equalisation serves to balance differences in the financial power among the municipalities. This is necessary since (own) tax revenues of the communities can vary substantially among each other. [6]

Table 2: Intergovernmental grants of Baden-Württemberg's municipalities in 2004

Type of grant	Mio. €	Per capita
Key grants	2110.04	197.47
Grants for current expenditures	1372.82	128.48
Grants for investments and investment assistance	649.14	60.75
Grants for municipalities with special financial requirements	1.09	0.10
Other general grants	454.19	42.15
Sum	4587.28	429.31

Source: Statistical Office of Baden-Württemberg, own calculations

The most important element of the fiscal equalisation system, however, constitutes the so called fiscal equalisation mass (*Finanzausgleichsmasse*) which is financed by both the

6 For more details see Ministry of Finance of Baden-Württemberg (2006). For more details on the municipal fiscal equalisation schemes of other German states or other countries, see e.g. Broer (2001) or Shah (2006).

state and the municipalities.[7] Within a formula based system this fiscal equalisation mass is distributed to the local governments whereas jurisdictions with lower fiscal capacity receive more grants from the fiscal equalisation mass. The different types of grants received by the local governments of the state Baden-Württemberg in the fiscal year 2004 are shown in Table 2. As can be seen from this Table, roughly 50% of the fiscal equalisation mass are distributed via so-called key grants (*Schlüsselzuweisungen*), which are lump-sum transfers established according to a predetermined formula ("key").

As mentioned above the tax revenue of the local governments strongly depends on the municipalities' fiscal capacity. Therefore, one fundamental idea of the key grants is to equate these differences by comparing the fiscal capacity (*Finanzkraft*) with the fiscal needs (*Finanzbedarf*) of the municipalities. Thereby, fiscal capacity is calculated by the municipalities' sum of the different tax revenues and parts of the grants received two years ago. Note that the calculation of the fiscal capacity in case of the trade and property tax is based on a standardised rather than the real tax revenue.[8] Moreover, only 80% of the revenue accruing from the value added tax is used for the calculation of the municipalities' fiscal capacity. The fiscal needs of the municipalities are, in contrast, established by the product of a predetermined per capita sum (*Kopfbetrag*) and the number of inhabitants (of each municipality). The per capita sum, in turn, depends on the number of the municipality's inhabitants, since a rising number of inhabitants is assumed to increase fiscal needs above average. This is due to the fact that larger municipalities are assumed to perform more tasks and to provide qualitatively higher public goods and services (see Ministry of Finance of Baden-Württemberg 2006, p. 35). More specifically, the per capita sum is calculated by multiplying a certain (base) amount (*Grundkopfbetrag*), which is determined annually by the ministry of finance (based on certain criteria), with a multiplier increasing with the number of inhabitants.[9]

On the basis of this comparison, the system of fiscal equalisation distinguishes three types of municipalities: Firstly, if fiscal capacity exceeds fiscal needs, the jurisdiction is said to be *abundant* and obtains no (key) grants. In case fiscal capacity lies between 60% and 100% of fiscal needs, the municipality is called *financially weak*, and, finally, municipalities with a fiscal capacity of less than 60% of fiscal needs are said to be *financially very weak*. Of course the (key) grants are highest for the last category.[10] The distribution of the municipalities' financial

[7] In most of the other German states (exceptions: Lower Saxony, Rhineland-Palatinate and Schleswig-Holstein), the fiscal equalisation mass is financed only by the states (see e.g. Lenk 2003). In Baden-Württemberg, however, the fiscal equalisation mass is additionally supplied by payments of the municipalities (*Finanzausgleichsumlage*). Therefore, and in contrast to the other states, the fiscal equalisation scheme in Baden-Württemberg contains - apart from the vertical component - a pure horizontal component whereas the equalisation schemes of (most of) the other states are based on a pure vertical system with a horizontal effect (for more details, see e.g. Birke 2000).

[8] The respective standardised collection rates (*Anrechnungshebesätze*) amount to 290% in case of the trade tax, and 195% as well as 185% in case of the two types of the property tax in Baden-Württemberg.

[9] For more details on the calculation of the per capita sum, see Appendix B. Note that the usage of this multiplier implies that larger municipalities receive compared to smaller ones higher amounts of grants. In terms of the proposition derived in subsection 2.2, this implies that the degree of fiscal illusion caused by intergovernmental grants should be higher in larger municipalities.

[10] Note that the deficit in terms of the ratio fiscal capacity/fiscal needs for financially (very) weak municipalities is fully compensated for up to a ratio of 60%; deficits lying between 60% and 100% are balanced out only up to a predetermined quota (currently approximately 70% of the difference between the fiscal needs and the fiscal capacity).

power in 2004 is depicted in Table 3. There it is shown, that most municipalities fall under the category financially weak whereas only a small fraction of the communities is abundant.

Table 3: Baden-Württemberg's Municipalities According to their Financial Power in 2004

Type of municipality	Number	% of all municipalities
Abundant	104	9.36
Financially weak	737	66.34
Financially very weak	270	24.30
Total	1111	

Source: Statistical Office of Baden-Württemberg, own calculations

Turning to the expenditure side, the revenue obtained by local governments basically serves to finance three types of tasks: (1) voluntary tasks (e.g. museum), (2) duties without instructions of higher-level governments (e.g. cleaning of public avenues), and (3) duties with instructions of higher-level governments (e.g. running of local police authorities).[11] Table 4 gives a detailed overview of the amount of money spent for the different types of tasks the local governments face as well as the corresponding share of total expenditures for the year 2004 – using the classification of functions as given in Baden-Württemberg's administrative regulation on the municipalities' budgets (*Verwaltungsvorschrift über die Gliederung und Gruppierung der Haushalte der Gemeinden*). As can be seen from the Table, expenditures on general financial management like interest and amortization repayments account for the bulk of total expenditures (approximately one third). A major part of the budget is also spent on social security (like kindergartens and youth welfare services) as well as public facilities and business development (roughly 11%, respectively). Other posts on the budget are generally somewhat smaller, whereas public safety constitutes the smallest part of the budget (approximately 3% of total expenditures).

3.2 Estimation Approach

To measure the (relative) efficiency of the local governments it is first necessary to select an adequate set of input and output combinations that helps to identify the most efficient local government(s) in the sample. In other words, we have to determine a *best practice frontier*. In a second step, the (relative) efficiency of the other, less efficient municipalities can then be determined by measuring the deviations from this best practice frontier. Basically there are two methods of measuring decision-making units' technical efficiency in the literature (for an introduction see e.g. Lovell 1993, Blank 2000): non-parametric and parametric approaches. In *non-parametric* approaches such as Data Envelopment Analysis (DEA, Farrell 1957, Charnes, Cooper and Rhodes 1978) or Free Disposable Hull (FDH, Deprins, Simar and Tulkens 1984), the best practice frontier envelopes the data as tightly as possible, whereas this envelopment is achieved by solving a sequence of linear programs, one for each decision-making unit. *Parametric* approaches, on the other hand, establish the best practice frontier on the basis of

[11] For more details see Gern (2005).

Table 4: Apportionment of the Total Expenditures According to the Administrative Regulation on the Classification of the Municipalities in 2004

Classification number	Scope of functions	Expenditure (in € per capita)	Share of total expenditure (in %)
0	General Administration	191.85	7.85
1	Public Safety	75.99	3.11
2	Schools	161.90	6.61
3	Science, Research, Culture	89.66	3.67
4	Social Security	280.76	11.49
5	Health, Sport, Recovery	127.28	5.20
6	Architecture, Housing, Traffic	241.45	9.89
7	Public Facilities, Business Development	277.95	11.36
8	Commercial Companies, General Basic and Separate Assets	153.48	6.28
9	General Financial Management	844.14	34.55
	Sum	2442.59	100

Source: Statistical Office of Baden-Württemberg, own calculations

a specific functional form using econometric estimation methods. Moreover, the deviations from the best practice frontier derived from parametric methods can be interpreted in two different ways. Firstly, deterministic approaches interpret the whole deviation from the best practice frontier as inefficiency. In contrast to these approaches, stochastic frontier models (Aigner, Lovell and Schmidt 1977, Battese and Cora 1977, Meeusen and van den Broeck 1977) decompose the deviation of the best practice frontier in an inefficiency part, on the one hand, and in a part arising from other stochastic influences or measurement errors, on the other hand. Since stochastic frontier models are more precise in the definition of the deviation from the best practice frontier the present analysis uses this approach for determining the technical efficiency of German local governments.

Furthermore, as pointed out by Kumbhakar and Lovell (2000), the analysis of technical or productive efficiency consists of two components: The first is the estimation of a (stochastic) best practice frontier whereas the second component concerns the incorporation of *exogenous* or *non-discretionary* variables which may influence the performance of the decision making units (local governments). More precisely, we can distinguish two kinds of such external influences: "production preconditions" and determinants of technical efficiency. The former can be interpreted as characteristics of municipalities that might affect both its individual production possibilities and its level of efficiency. Examples for such production preconditions are the socio-economic make-up of the population or structural factors like the level of the unemployment rate or the population density. The determinants of efficiency, like for example, the political colour of the local government, in contrast influence only the level of technical efficiency but not its best practice frontier. The grants received by the local government, of course, fall into the second category.

Exogenous variables have been incorporated into efficiency analyses in a variety of ways (for an overview see Kumbhakar and Lovell 2000). In a two-step approach (e.g. Pitt and Lee 1981, Berger and Mester 1997, Worthington 1999) the (in)efficiency scores are first determined by estimating a (stochastic) frontier and then these (in)efficiency scores are regressed (e.g. with a Tobit censored regression model) on the exogenous variables. However, as pointed out by Kumbhakar, Gosh and McGuckin (1991) and Reifenschneider and Stevenson (1991) there are serious econometric problems with this approach. First, it must be assumed that the (in) efficiencies scores obtained in the first stage are independently and identically distributed, but if this is the case, the assumption that the (in)efficiency scores exhibit a functional relationship with the exogenous variables in the second stage is contradicted. Second, it must further be assumed that the output (or input) variables used for estimating the best practice frontier in the first stage are uncorrelated with the exogenous variables. In case they are correlated, the adequate maximum likelihood estimators are biased. If a large set of output (or input) as well as exogenous variables is used this assumption is very likely to be violated.

To avoid (at least one of) theses inconsistencies Kumbhakar et al. (1991), Reifenschneider and Stevenson (1991) and Huang and Liu (1994) developed models for the technical inefficiency effects involved in stochastic frontier functions. In such one-step approaches the parameters of the stochastic frontier as well as the parameters of the exogenous variables are estimated simultaneously. The model proposed by Battese and Coelli (1995) which will be used here extended these approaches to accommodate panel data. Employing a translogarithmic specification (Christensen, Jorgenson and Lawrence 1973) the basic estimation equation used in the present analysis to identify (among other things) the impact of grants on German municipalities' technical or cost efficiency[12] is:

$$lnC_{i,t} = \beta_0 + \sum_{r=1}^{S} \beta_r lny_{r,i,t} + \frac{1}{2}\sum_{r=1}^{S}\sum_{q=1}^{S} \beta_{r,q} lny_{r,i,t} lny_{q,i,t} + \psi_t + \underbrace{v_{i,t} + u_{i,t}}_{=\varepsilon_{i,t}} \qquad (18)$$

$$u_{i,t} = \delta_0 + \sum_{j=1}^{J} \delta_j z_{j,i,t} + \psi_t + w_{i,t}, \qquad (19)$$

where i is the subscript for the decision-making units and t the time subscript. S and J designates the number of output and exogenous variables included in the model, respectively. Furthermore, the dependent variable of equation (18), C, denotes the input indicator, whereas y represents the various output indicators. The composed error term of equation (18), ε, consists of a symmetric component, v, which is usually assumed to be independently and identically normally distributed $N(0, \sigma_v^2)$, and a one-sided non-negative component, $u \geq 0$, representing

12 Here, the terms "technical" and "cost" efficiency are used synonymously. In fact, the usage of the right term depends on the interpretation of equation (18). If, on the one hand, equation (18) is regarded as a cost function (with input prices being equal to all municipalities) the term cost efficiency would be appropriate. But if, on the other hand, the left hand side of equation (18) is interpreted as an aggregate input indicator (of the municipalties), the term technical efficiency would be more suitable. The difference between the two concepts is, that the cost efficiency contains besides the "technical" component additionally an "allocative" component.

inefficiency. Both error terms are assumed to be independent. Moreover, the u's are assumed to be independently distributed, such that u is obtained by truncation (at zero) of the normal distribution $N(\sum_{j=1}^{J} \delta_j z_{j,i,t}, \sigma_u^2)$. z represents the various exogenous variables and w a random variable which is defined by the truncation of the normal distribution with zero mean and variance σ_w^2 (see Batesse and Coelli 1995). The latter assumption ensures that the inefficiency component, u, can only take on values bigger than or equal to zero. Finally, the time trends are included to control for both technical change (in the stochastic frontier) and time-varying inefficiency effects (see also Battese and Coelli 1995, Audibert 1997).[13]

3.3 Data

The empirical analysis is based on an annual database of 1111 municipalities in the German state of Baden-Württemberg for the period of 1990 to 2004. For the estimation, however, we restrict our attention to municipalities with more than 10000 inhabitants to get a more homogeneous setting with regard to the different types of tasks performed by the municipalities. Especially the provision of public goods which are carried out on a voluntary basis (e.g. libraries, public swimming pools, etc.) is more common in larger municipalities. The descriptive statistics of the input variable as well as the various output and exogenous variables for the reduced sample are provided in Table 5.

Similar to Geys, Heinemann and Kalb (2007) the input for providing the public services is approximated by total current (net) primary expenditures of the single local governments. These include all spending on the current budget less the difference between debt service and income from interest. Spending on the capital budget is not considered, since large investments (e.g. in infrastructure projects) are infrequent events which inflate total spending in the year they emerge. The empirical analysis uses net primary expenditures per capita as dependent variables. As can be seen from Table 5, both absolute and per capita expenditures show substantial variation within the state (of Baden-Württemberg).

Furthermore, the output of the local governments is approximated by five variables: (1) the number of students in public schools (*Grund- und Hauptschulen*), (2) the total population, (3) the share of population older than 65, (4) the number of employees covered by social security (at place of work), and (5) the surface of public recovery areas. All these variables represent approximations of important responsibilities of the municipalities with regard to educational, infrastructural, social, economic and recreational services. In terms of the categories listed in Table 4 of subsection 3.1, the first variable relates to the "Schools" function of the local governments, variable (2) to "General Administration" and "Architecture, Housing, Traffic", variable (3) to "Social Security", variable (4) to "Business Development", and variable (5) to "Health, Sport, Recovery" and "Public Facilities". Note, however, that these measures should be considered as rather crude proxies for the level of public goods provision (see also De Borger

13 Note that we do not include municipality fixed-effects into the estimation system. This is due to the fact that (1) time series variation in some of the explanatory variables is very limited, so that the fixed effects estimates will be imprecise, and (2) the fixed effects estimator for stochastic frontier models recently developed by Greene (2005) ("true fixed effects estimator", p. 277) would not allow us to assess the effects of the explanatory variables in the way explained above. However, as mentioned above, a two-step procedure (with efficiency scores obtained by the true fixed effects estimator in the first stage) leads to biased inferences.

Table 5: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Input variable:				
Net current primary expenditures (in € per capita)	1660.09	486.79	956.38	9644.19
Output variables:				
Students in public schools	1691.08	2293.22	417	27625
Total population	28483.86	49050.06	8203	598470
Share of population older than 65	15.618	2.394	8.611	27.800
Social insured employees (at place of work)	12338.65	28713.05	663	385197
Recovery area (in are)	6115.54	10242.25	376	110841
Fiscal control variables:				
Grants (in € per capita)	354.59	132.71	33.48	1898.35
Abundant municipalities	0.084	0.277	0	1
Financially weak municipalities	0.712	0.453	0	1
Financially very weak municipalities	0.204	0.403	0	1
Other control variables:				
Unemployment rate (in %)	6.216	1.807	1.775	13.3
Population density (inhabitants per hectare)	5.718	4.563	0.682	28.86
Students at university	870.40	4160.85	0	35152
Accommodation facilities	12.883	18.028	0	155
Herfindahl index	0.339	0.069	0.211	1
Share of left	29.318	10.478	0	55.556
Year	8	4.321	1	15

Sample size: 3675 observations; 245 municipalities over 15 years (1990-2004).

and Kerstens 1996, Geys 2006). Table 5 shows that the variation of the output indicators is very high among the communities indicating that there are substantial differences with regard to the (population) size of the municipalities.

As exogenous fiscal variables we first include the per capita values of the sum of all types of grants listed in Table 2 to the model. According to the proposition derived in section 2.2, we expect a negative relationship between the *grants per capita* and the technical efficiency of the local governments. In this context the question arises whether there could be a problem of endogeneity when trying to identify the effects of grants received by the local governments on cost efficiency. With regard to this question it can be argued that the amount of grants received by the municipalities mainly depend on the fiscal capacity, that is on the sum of the different tax revenues of the local governments. Hence, there is no direct relationship between (cost) efficiency and the amount of grants received, since higher inefficiencies primarily lead to increases in expenditures.[14]

Moreover, to control for the financial power of a community which serves as a basis in the municipal fiscal equalisation system (see section 3.1), dummy variables for *abundant* and *financially weak* municipalities were created and incorporated into the estimation equation (19). Since abundant municipalities exhibit the highest fiscal capacity (fiscal capacity > fiscal needs), it is expected that these municipalities have – in comparison to the other two types of municipalties – more money to spend and therefore can afford more or qualitatively higher public goods and services.

In addition, as mentioned in section 3.2, it is very important to control for other characteristics of the municipalities which might influence their individual production possibilities as well as their level of inefficiency. First, *population density* is included because it approximates the rural and urban divide among the different municipalities. Moreover, it can be regarded as a proxy for the heterogeneity of property prices which tend to differ substantially between rural and urban communities. While a high population density points to cost advantages due to regional concentration of services (see e.g. De Borger and Kerstens 1996), higher property prices in urban areas may render production more costly. Therefore the effect of the population density on the level of municipalities' spending is ambiguous. Second, as pointed out by Geys, Heinemann and Kalb (2007), the level of the local authorities' unemployment rate may also affect the costs of providing a given bundle of public services in opposed directions. On the one hand, a higher *unemployment rate* implies higher spending on unemployment and housing benefits ("cost effect") and, on the other hand, a higher unemployment rate can also entail lower demand for high quality public services (and therefore lower spending), since people living in communities with high unemployment rates typically have less money to spend ("preference effect").

Third, it is hypothesised that municipalities which are more dependent on tourism (e.g. the black forest, the region around Lake Constance) have to spend relatively more money on public services, since tourists typically have a greater demand for high-cost or high-quality services like adventure pools, an excellent net of hiking trails, and so on. Therefore, the variable *accommodation facilities*, which captures the municipalities' number of guesthouses (hotels, boarding houses, youth hostels, etc.) was added to the specification. Fourth, the number of *students enrolled at universities* (of the university cities) were incorporated to the estimation equation (19). Similar

14 Of course, there can be doubts whether the variable intergovernmental grants is really exogenous in this context. For example, it could be argued that there are incentives for the local governments to lure additional grants in order to reduce the pressure to increase efficiency generated by additional expenditures which otherwise have to be financed by own tax revenues. In this case, reverse causality would be an issue and instrumental variable (IV) estimation should be considered. However, the Battese and Coelli (1995) model does not allow for the introduction of instrumental variables. Since the "traditional" two-step approaches lead to biased inferences (see subsection 3.2), the one-step approach used here is, in our opinion, nonetheless preferable.

to municipalities which are more dependent on tourism, it is hypothesised that university cities have to spend relatively more money for infrastructure services like, for example, a bus line network, student hostels or administrative things being associated with students.

Moreover, political control variables were included in the specification. The *Herfindahl index* measures the political concentration or monopolisation of the local council. It is calculated out of the important parties' share of seats (from "right" to "left": CDU, FDP, SPD, GRÜNE) and the share of seats of the so called "free voter unions"[15]. It is expected that high political concentration points to low political competition and thus should reduce efficiency (see e.g. Besley, Persson and Sturm 2005). As a measure of political preferences, the share of seats of left-wing parties (i.e. SPD and GRÜNE) in the local council (*share of left*) was incorporated to estimation equation (19). This variable measures the impact of ideology on technical efficiency. The ideological effect, however, is not easy to determine a priori (Geys, Heinemann and Kalb 2010), since left-wing parties indeed are often assumed to have preferences for a larger government size. However, a larger government size not necessarily implies less efficient governments. Therefore the effect of the share of left-wing parties in the local council on technical efficiency is ambiguous.[16]

Finally, to control for time effects in the stochastic frontier as well as in the inefficiency model a time trend (year) was included in equation (18) and (19).

3.4 Results

The results of the estimation are shown in Table 6.[17] As can be seen from this table we estimated two types of cost functions, a translogarithmic cost function as introduced in section 3.2 and a simple Cobb-Douglas cost function to check for the robustness of the results.

First of all, note that the variance parameter γ is close to one in both specifications and highly significant. This parameter (lying between 0 and 1) indicates how much of the variation in the composed error term is due to the inefficiency term, $u_{i,t}$, in equation (18). A value close to zero indicates that the vast majority of residual variation is due to the normal disturbance error, $v_{i,t}$, whereas a value close to one indicates that much of the variation is explained by the inefficiency component, $u_{i,t}$. Therefore, in our case, much of the variation in the composed error term is due to the inefficiency term, $u_{i,t}$. Moreover, we carried out (generalised) likelihood ratio tests. Firstly, we tested the null hypothesis that all covariates of the inefficiency model (19) are jointly equal to zero. This resulted in a test statistic of about 1167 in the translogarithmic and 1328 in the Cobb-Douglas case indicating that in both cases the null hypothesis can strongly be rejected. Secondly, a test of the Cobb-Douglas (restricted model) against the translogarithmic (unrestricted model) cost function yielded a test statistic

15 Free voter unions are loose federations of persons not belonging to special parties. In Germany such federations only exist on the local level. One recent exception is the German state Bavaria, where the free voter unions entered the state parliament in 2008.

16 Note that information about the party affiliation of the mayor which is also member of the local council, was not available. Though the mayor has agenda-setting power, she/he is only a usual member of the local council with a simple vote. Therefore, the missing party affiliation of the mayor distorts the results of the two political variables only marginally (at least in municipalities with a relatively large council).

17 For space constraints only the coefficients of the inefficiency model (19) are shown. The coefficients of the full model, however, are reported in Table A1 of the Appendix.

of about 210 which means that we can reject the null hypothesis of the restricted model at the one percent level. This indicates that the non-linearities captured by the translogarithmic cost function (quadratic and cross-product terms of the output measures) are highly significant and that the translogarithmic function represents the cost structure of the municipalities better than the Cobb-Douglas function. Nevertheless, as mentioned above, the Cobb-Douglas cost function can serve to check the robustness of the results.

Table 6: Determinants of Baden-Württemberg Local Governments' Cost Efficiency

Variable	Translog (1)	Cobb-Douglas (2)
Fiscal Variables		
Grants	0.0014** (9.5057)	0.0014** (7.4171)
Abundant municipality	2.6919** (14.7291)	2.8225** (6.9300)
Financially weak municipality	0.8019** (7.1502)	0.8565** (6.0858)
Production environment and political constraints		
Unemployment Rate	-0.0271** (-5.3756)	-0.0131* (-2.5538)
Population Density	-0.0104** (-2.9481)	-0.0054* (-2.2538)
Students at university, log	-0.0362** (-3.5782)	0.0083* (2.2066)
Accommodation Facilities	0.0096** (7.5573)	0.0105** (7.3697)
Herfindahl index	2.4637** (11.0895)	2.4308** (8.0659)
Share of left	0.0135** (10.2378)	0.0136** (5.8140)
Year2	0.0379** (7.0673)	0.0356** (7.5478)
Sigma-squared ($\hat{\sigma}^2$)	0.1628** (13.3290)	0.1648** (8.0811)
Gamma (γ)	0.9352** (143.6191)	0.9316** (113.7242)
Log-likelihood	2279.94	2174.78

Note: N = 3675. Dependent variable: net current primary expenditures per capita. t-values are given in parentheses. ** (*) denotes significance at 5% (10%) level. Coefficients of the output indicators (and their quadratic and cross product terms) as well as the constant terms of the frontier and the inefficiency model are not reported (see Table A1 of the Appendix).

The results in Table 6 support the negative incentive effect of intergovernmental grants on local authorities' cost efficiency as stated in the proposition of section 2.2. The coefficient of the variable "grants" is in the translogarithmic as well as in the Cobb-Douglas case highly significant and has the expected positive sign indicating that an increase in the amount of grants received by the local government leads (through an increase of the expenditures) to a rise in technical inefficiency. As can be seen from the Table, however, the effect is with a coefficient of 0.0014 both in the translogarithimic and in the Cobb-Douglas case very small. Table 6 also shows that the dummy variables for abundant and financially weak municipalities are both positive and highly statistically significant. This supports our hypothesis of section 3.3 where we argued that abundant or financially weak municipalities have (in relation to financially very weak communities, respectively) more money to spend which, in turn, enable these municipalities to afford more or qualitatively higher public goods and services.

Concerning the other control variables a closer look at Table 6 reveals that the unemployment rate has a negative sign with robust significance in both the translogarithmic and the Cobb-Douglas case. Hence, the preference effect mentioned in section 3.3 seems to outweigh the cost effect. Secondly, population density significantly decreases costs suggesting that densely populated communities have cost advantages due to agglomeration economies. Moreover, the variable "students at university" has, contrary to our prediction in section 3.3, a negative sign in the translogarithmic case. In the Cobb-Douglas case, however, the sign is positive. Hence, the effect of this variable on the best practice frontier is ambigious. Finally, the variable "accommodation facilities" is in both cases positive and highly statistically significant. This is in accordance with our statement in section 3.3 where we hypothesised that touristic regions have (relatively) higher expenditures due to greater demand for high-cost or high-quality services.

The political variables included in the estimation equation also attain statistical significance. As expected, the Herfindahl index, as an indicator for political concentration and monopolisation, significantly reduces efficiency in both specifications, or in other words, low political competition in the local governments seems to increase inefficiency. Moreover, local governments with a high share of left-wing parties seem to be involved with higher inefficiency.

Finally, the time trend included in the inefficiency model ("year2") is positive and highly significant, too. This indicates that cost inefficiencies in the provision of public goods and services tended to increase throughout the 15-year period.

IV. CONCLUSIONS

This paper investigates the causal effect of intergovernmental grants on local jurisdictions' cost efficiency or X-efficiency. For this purpose we use the simple bureaucracy model of Niskanen (1975) and introduce the possibility that the federal government is able to give grants to the local jurisdictions in order to substitute for (missing) local tax revenues due to limited autonomy in raising own revenues. Similar to Moesen and van Cauwenberge (2000) we assume that the voter underlies a kind of illusion with respect to the true tax price of the public goods and services provided by the local government. In fact, we assume that the existence of intergovernmental grants causes the voter to underestimate the true tax price of the public goods due to fiscal illusion. Using this theoretical framework we show that a higher degree of redistribution or an increase in the amount of grants received by the local government leads to an increase in technical inefficiency in that local jurisdiction. Our empirical analysis support the existence of such an (positive) incentive effect of fiscal equalisation on local jurisdictions' cost inefficiency. In line with the findings of Silkman and Young (1982) and De Borger and Kerstens (1996) we show (using a broad panel of German municipalities) that an increase in the amount of grants received by the local governments indeed results in an increase in the cost (or technical) inefficiency in that local jurisdiction.

With regard to efficiency considerations, one implication of the above derived result is that, in order to reduce the degree of inefficiency (or to eliminate the fiscal illusion), the federal government should give more autonomy to the local jurisdictions in raising their own revenue, since, in this case, the fiscal illusion stemming from the intergovernmental grants would diminish. In this context it would be interesting to analyse whether non-matching grants stimulate technical inefficiency or X-inefficiency more than matching grants, since then the fiscal equalisation scheme can be organised in such a way that technical inefficiency will be minimised. But this is left for further research. Furthermore, the negative relationship between the grants and the local governments' efficiency could be reduced by including explicit performance incentives (for the incumbents) in the formulas for intergovernmental grants (Silkman and Young 1982).

Finally, it should be noted that the empirical results have been derived by using a very limited and rough set of indicators representing the whole outputs (and inputs) of a municipality. Here, of course, a more detailed reproduction of the tasks accomplished by the municipalities would be desirable. Unfortunately, this has not been possible so far due to missing data (availability). Nevertheless, a further step could be to investigate the effect of intergovernmental grants on technical inefficiency for a particular area of public goods provision (e.g. waste collection, public libraries and so on), since in that case the definition of outputs is much easier and more obvious.

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APPENDIX A

Table A1: Complete results of the multi-output frontier estimation

Variable	Translog (1)	Cobb-Douglas (2)
Stochastic frontier		
Constant (β_0)	8.3308** (7.6637)	6.3365** (92.8964)
A: Students in public schools	0.6218 (1.5662)	-0.1042** (-6.9166)
B: Total Population	-0.7061 (-1.4636)	0.0286* (1.8029)
C: Share of population older than 65	0.2981 (0.6275)	-0.0152 (-0.8436)
D: Social insured employees	-0.4393* (-2.2049)	0.1500** (21.6474)
E: Recovery Area	0.3238** (2.6256)	0.0047 (1.0680)
A^2	0.0801 (1.2610)	–
B^2	0.0044 (0.0592)	–
C^2	-0.1026 (-1.3724)	–
D^2	0.0477** (3.8634)	–
E^2	0.0254** (4.6239)	–
A*B	0.0096 (0.0797)	–
A*C	-0.2153* (-2.0287)	–
A*D	-0.0563 (-1.3021)	–
A*E	-0.1048** (-3.4756)	–
B*C	0.1958* (1.8423)	–
B*D	-0.0112 (-0.2224)	–
B*E	0.0091 (0.2899)	–

C*D	0.0625 (1.4124)	–
C*E	-0.0829** (-2.7055)	–
D*E	0.0154 (1.3177)	–
Year1	0.0141** (21.2349)	0.0135** (24.4005)
Inefficiency model		
Constant (δ_0)	-4.4927** (-15.7318)	-4.6840** (-6.6462)
Grants	0.0014** (9.5057)	0.0014** (7.4171)
Abundant municipality	2.6919** (14.7291)	2.8225** (6.9300)
Financially weak municipality	0.8019** (7.1502)	0.8563** (6.0858)
Unemployment Rate	-0.0271** (-5.3756)	-0.0131* (-2.5538)
Population Density	-0.0104** (-2.9481)	-0.0054* (-2.2538)
Students at university	-0.0362** (-3.5782)	0.0083* (2.2066)
Accommodation Facilities	0.0096** (7.5573)	0.0105** (7.3697)
Herfindahl index	2.4637** (11.0895)	2.4308** (8.0659)
Share of left	0.0135** (10.2378)	0.0136** (5.8140)
Year2	0.0379** (7.0673)	0.0356** (7.5478)
Sigma-squared ($\hat{\sigma}^2$)	0.1628** (13.3290)	0.1648** (8.0811)
Gamma (γ)	0.9352** (143.6191)	0.9316** (113.7242)
Log-likelihood	2279.94	2174.78

Note: N = 3675. Dependent variable: net current primary expenditures per capita. The dependent and output variables as well as the variable students at university are in natural logs. t-values are given in parentheses. ** (*) denotes significance at 5% (10%) level. The variables “year1” and “year2” account for both technical change in the stochastic frontier and time-varying inefficiency effects. The results were obtained by using FRONTIER 4.1 (Coelli, 1996).

APPENDIX B: PER CAPITA SUM OF THE MUNICIPALITIES

Under art. 7, para. 2 FAG, the per capita sum (*Kopfbetrag*) of the municipalities is determined by multiplying the base amount (*Grundbetrag*), which is determined annually by the ministry of finance (of Baden-Württemberg) according to certain criteria, with the following multipliers:

(1) 100% for municipalities with less than 3,000 inhabitants

(2) 110% for municipalities with 10,000 inhabitants

(3) 117% for municipalities with 20,000 inhabitants

(4) 125% for municipalities with 50,000 inhabitants

(5) 135% for municipalities with 100,000 inhabitants

(6) 155% for municipalities with 200,000 inhabitants

(7) 179% for municipalities with 500,000 inhabitants

(8) 186% for municipalities with more than 600,000 inhabitants.

In case the number of inhabitants is lying between two of the above mentioned figures, a proportionate multiplier is used. In 2004, the base amount was 690 €.