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## The Impact of Fiscal Equalization on Local Expenditure Policies: Theory and Evidence from Germany

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on Local Expenditure Policies –  
Theory and Evidence from Germany**

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## Non-Technical Summary

The literature on fiscal competition among local governments has so far mainly focussed on the aspect of tax competition. The standard argument states that competing governments lower their tax rates in order to attract a mobile tax base, thereby neglecting negative externalities which arise for other jurisdictions. The bottom line is an inefficiently low level of taxation and a relative underprovision of public goods. Recent theoretical literature suggests that fiscal externalities resulting from tax competition tend to be internalised by redistributive grant systems, thereby raising efficiency of local public finances. Empirical research supports the view that revenue sharing exerts a strong impact on jurisdictions' tax policy.

An aspect which has attracted lesser attention in the literature on fiscal competition is that local governments may also compete for mobile tax bases via the provision of productivity-enhancing public goods. Theoretical research suggests that fiscal competition in the presence of a public input to production leads to a bias in the local spending mix, i.e. a relative overprovision of this public input compared to purely consumptive public goods.

In this paper we use a simple model of bi-dimensional fiscal competition in taxes and public inputs. We then introduce a redistributive grant scheme to analyze the incentive effects of fiscal equalization transfers on local tax and spending decisions. As already shown in the literature we find that fiscal capacity equalization induces local jurisdictions to increase distortionary taxation of a mobile tax base. In addition, increasing the degree of redistribution - while compensating for budgetary effects - induces local governments to rebalance their budget towards a lower budgetary share of the publicly provided input. Therefore, in our analysis the implementation of a system of fiscal equalization alleviates both, tax as well as expenditure competition. Moreover, in the case of full equalization of tax bases, compositional inefficiencies in local spending vanish when assuming inelastic supply of capital.

While recent studies have already analyzed the incentive effects of fiscal equalization grants on local tax policy in Germany, the empirical analysis presented in this paper - to the best

of our knowledge - is the first focusing on local public spending. The estimations are based on a panel of German municipalities in the state of Baden-Wuerttemberg. As municipalities within their self-administration responsibilities decide on infrastructure spending on the local street network as well as spending on local schools, Germany is an interesting case to study in our context. Moreover, municipal tax bases are equalized to a large extent via the municipal system of fiscal equalization. We make use of non-linearities in this grant scheme and implement a regression discontinuity estimator to identify the incentive effect of fiscal equalization transfers. The results suggest that in line with the theoretical predictions jurisdictions that are facing higher marginal contribution rates to the municipal system of fiscal equalization are not only characterized by a higher local business tax rate but also by a lower budgetary shares of public investment in the fields of street infrastructure and education.

# The Impact of Fiscal Equalization on Local Expenditure Policies - Theory and Evidence from Germany

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**Abstract:** This paper uses a simple model of fiscal competition in taxes and public inputs among local jurisdictions to analyze the incentive effects of fiscal equalization transfers. We find that a budget-compensated increase in the contribution rate to a system of fiscal equalization not only induces higher local tax rates (e.g., Koethenbueger, 2002; Bucovetsky and Smart, 2006) but also lower budgetary shares of the public input to production. The subsequent empirical analysis is based on a rich data set of German municipalities and provides strong evidence for the existence of an incentive of fiscal equalization transfers on local expenditure policies.

**Key Words:** Fiscal competition; Fiscal equalization; Public inputs; Regression discontinuity approach; Germany

**JEL Classification:** H72, H77

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# 1 Introduction

This paper analyzes the incentive effect of fiscal equalization transfers on local expenditure policies and thereby extends the literature on the internalizing impact of redistributive grant systems which has so far focused on local tax policy. Among others, Koethenbueger (2002) and Bucovetsky and Smart (2006) bring forward the argument, that in the presence of tax competition for a mobile capital tax base, transfer schemes which inversely relate to the tax base tend to reduce marginal cost of raising public funds and induce local governments to increase their taxing effort. Inefficiencies in local public finances as suggested by the traditional tax competition literature (e.g., Wilson, 1986; Zodrow and Mieszkowski, 1986; Wildasin, 1988;) are thereby - at least partially - corrected for. Previous empirical research by Buettner (2006) and Egger, Koethenbueger, and Smart (2007) supports the view that revenue sharing exerts a significant impact on jurisdictions' tax policy.

An aspect which has attracted lesser attention in the theoretical literature on fiscal competition is that local governments may also compete for the mobile tax base via the provision of a public input to production and that expenditure competition might give rise to an additional source of inefficiency. Extending the seminal contribution by Zodrow and Mieszkowski (1986), Keen and Marchand (1997) present a standard framework of fiscal competition where local jurisdictions have available two policy instruments. They show that in the presence of a productivity-enhancing public good, the composition of local public spending tends to be systematically biased towards a relative overprovision of public inputs compared to public goods which are consumed directly by residents. Hindriks, Peralta, and Weber (2006) present a model of tax and public input competition and, in the presence of a tax revenue sharing scheme, focus on the interaction of the two policy instruments when regions are heterogenous. In their dynamic setting the authors find that local jurisdictions have an incentive to underinvest in stage one of the game in order to alleviate second-stage tax competition. The implementation of a revenue sharing scheme in turn discourages local public investment while exerting only a small impact on local tax policy.

In this paper we follow Keen and Marchand (1997) and use a static model of bi-dimensional

fiscal competition. We then introduce a redistributive grant scheme to analyze the incentive effects of fiscal equalization transfers on local tax and spending decisions. As already shown, e.g., in Bucovetsky and Smart (2006), we find that fiscal capacity equalization induces local jurisdictions to increase distortionary taxation of the mobile tax base. In addition, increasing the degree of redistribution - while compensating for budgetary effects - induces local governments to rebalance their budget towards a lower budgetary share of the publicly provided input. Therefore, in our analysis the implementation of a system of fiscal equalization alleviates both, tax as well as expenditure competition. Moreover, in the case of full equalization of tax bases, the compositional inefficiencies in local spending pointed out by Keen and Marchand (1997) vanish when assuming inelastic supply of capital.

While two recent studies (Buettner, 2006; Egger, Koethenbueger, and Smart, 2007) have analyzed the incentive effects of fiscal equalization grants on local tax policy in Germany, the empirical analysis presented in this paper - to the best of our knowledge - is the first focusing on local public spending. The estimations are based on a panel of German municipalities in the state of Baden-Wuerttemberg. As municipalities within their self-administration responsibilities, decide on infrastructure spending on the local street network as well as spending on local schools Germany is an interesting case to study in our context. Following Buettner (2006) we make use of non-linearities in the grant scheme and implement a regression discontinuity estimator to identify the incentive effect of fiscal equalization transfers. We find that, in line with the theoretical predictions, jurisdictions that are facing higher marginal contribution rates to the municipal system of fiscal equalization are characterized by lower budgetary shares of public investment in the fields of street infrastructure and education.

The paper proceeds as follows. In section 2 we conduct the theoretical analysis and derive testable empirical implications. Section 3 then describes the empirical analysis of local expenditure policies in Germany. Conclusions are drawn in section 4.



## 2 Theoretical Analysis

The model in this paper builds on the theoretical analysis in Hauptmeier (2007). We use a standard framework of fiscal competition (e.g., Zodrow and Mieszkowski, 1986; Keen and Marchand, 1997) and consider a federation with a set of  $n$  local jurisdictions, labelled  $i = 1, \dots, n$ . In each jurisdiction a competitive firm produces a homogenous private good using immobile labor  $L$ , perfectly mobile capital  $K$  and a publicly provided input  $P$ . The common production technology  $F(L, K, P)$  is assumed to be linear homogenous with respect to labor and capital. The public input  $P$  is of the factor-augmenting type and raises marginal productivity of the primary input factors, capital and labor. For analytical convenience labor is normalized to unity and we assume that firms in jurisdiction  $i$  produce according to the following (per labor unit) production technology:

$$f(k_i, P_i) = k_i^\alpha P_i^\beta = k_i^\alpha (\lambda_i b_i)^\beta, \quad \alpha + \beta \leq 1$$

As in Hauptmeier (2007) the impact of public inputs is modelled by introducing a shift-term,  $P_i^\beta$ , into the production function which captures total factor productivity. The public input is substituted by its budgetary share  $\lambda_i$  times the local budget,  $b_i$ . By assumption, the production function exhibits non-increasing returns to scale, i.e.  $\alpha + \beta \leq 1$ .

Each jurisdiction levies a source based tax ( $\tau_i$ ) on locally installed capital. Profit maximization and free capital mobility imply an equal net rate of return to capital  $r$  across jurisdictions which is given by the after tax marginal product of capital

$$r = f_{k_i} - \tau_i.$$

The profit maximisation condition implies per-capita demand for capital  $k_i = \phi(r + \tau_i, \lambda_i)$  and implicit differentiation yields

$$\frac{\partial k_i}{\partial r} = \frac{\partial k_i}{\partial \tau_i} = \frac{1}{f_{k_i k_i}} < 0, \quad \frac{\partial k_i}{\partial \lambda_i} = -\frac{f_{k_i \lambda_i}}{f_{k_i k_i}} > 0.$$

Therefore, a higher net rate of return as well as a higher tax rate reduces capital demand

in jurisdiction  $i$  while a higher budgetary share of the public input raises it.

The representative consumer in jurisdiction  $i$  derives utility from private ( $c_i$ ) and public ( $Z_i$ ) consumption according to a well behaved and quasi linear utility function

$$u_i = c_i + v(Z_i) = c_i + v((1 - \lambda_i)b_i).$$

Note that  $v$  constitutes an increasing and strictly concave function and public consumption is substituted by its budgetary share times the local budget. Per-capita private consumption  $c_i$  is given by

$$c_i = k_i^\alpha (\lambda_i b_i)^\beta - k_i(r + \tau_i) + s_i r,$$

where  $s_i$  labels capital endowment per-capita in jurisdiction  $i$ . The budget of the local government  $i$  which is used to finance public consumption and the public input reads

$$b_i = \tau_i k_i + g_i,$$

where  $g_i$  constitutes grants from the federal government. As in Buettner (2006) the upper level government administrates a system of local fiscal equalization by setting a marginal contribution rate ( $\vartheta_i$ ) such that income from grants ( $g_i$ ) can be represented as a linear function of the tax base

$$g_i = y_i - \vartheta_i k_i. \tag{1}$$

Unconditional transfers<sup>1</sup> from the upper level government are labelled  $y_i$ . In order to close the model we assume that the capital market equilibrium is given by

$$\sum_j k_j = \sum_j s_j,$$

so that total capital demand in the federation is satisfied by total capital endowment.

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<sup>1</sup>These are the transfers a jurisdiction would receive if its tax base were actually zero.

Implicitly differentiating the capital market condition yields

$$\frac{\partial r}{\partial \tau_i} = -\frac{\frac{\partial k_i}{\partial \tau_i}}{\sum_j \frac{\partial k_i}{\partial r}} < 0, \quad \frac{\partial r}{\partial \lambda_i} = -\frac{\frac{\partial k_i}{\partial \lambda_i}}{\sum_j \frac{\partial k_i}{\partial r}} > 0.$$

Similar to Zodrow and Mieszkowski (1986), we assume that the number of jurisdictions  $n$  in the national economy is large and therefore the (net) interest rate effect of variations in either policy instrument is not taken into account by local governments.

Local jurisdictions simultaneously choose their policy instruments  $\tau_i$  and  $\lambda_i$  given the optimal choices of the other jurisdictions while neglecting the external impacts of their policies. The unconstrained maximization problem of jurisdiction  $i$  reads

$$\max_{\tau_i, \lambda_i} u_i(\tau_i, \lambda_i) = k_i^\alpha (\lambda_i b_i)^\beta - k_i (r + \tau_i) + s_i r + v((1 - \lambda_i) b_i) \quad (2)$$

The first order conditions from the perspective of jurisdiction  $i$  are

$$\frac{\partial u_i}{\partial \tau_i} = -k_i + (k_i^\alpha \beta (\lambda_i b_i)^{\beta-1} - v') \left( \lambda_i \frac{\partial b_i}{\partial \tau_i} \right) + v' \frac{\partial b_i}{\partial \tau_i} \stackrel{!}{=} 0, \quad (3)$$

$$\frac{\partial u_i}{\partial \lambda_i} = (k_i^\alpha \beta (\lambda_i b_i)^{\beta-1} - v') \left( b_i + \lambda_i \frac{\partial b_i}{\partial \lambda_i} \right) + v' \frac{\partial b_i}{\partial \lambda_i} \stackrel{!}{=} 0. \quad (4)$$

From (4) one can immediately see that in the local government optimum the marginal product of the publicly provided input to production ( $k_i^\alpha \beta (\lambda_i b_i)^{\beta-1}$ ) falls below the marginal utility of public consumption ( $v'$ ). Compared to a first best situation under policy coordination<sup>2</sup> where governments provide public goods efficiently, i.e.  $k_i^{\alpha-\gamma} \beta (\lambda_i b_i)^{\beta-1} = v' = 1$ , we observe a distortion of the local spending decision due to the productivity effect of public input provision. This finding is in line with Keen and Marchand (1997) who analyse the impact of fiscal competition on the pattern of public spending and come to the conclusion that public inputs are relatively overprovided in an uncoordinated equilibrium.

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<sup>2</sup>Note that one has to assume that national policy coordination does not affect capital supply to the federation.

Solving both first order conditions (3) and (4) for  $(k_i^\alpha \beta (\lambda_i b_i)^{\beta-1} - v')$  and equating them leaves us with

$$\begin{aligned} v' &= \frac{k_i}{\frac{\partial b_i}{\partial \tau_i}} + \lambda_i \frac{k_i}{b_i} \frac{\frac{\partial b_i}{\partial \lambda_i}}{\frac{\partial b_i}{\partial \tau_i}} \\ &= \frac{k_i}{k_i + (\tau_i - \vartheta_i) \frac{\partial k_i}{\partial \tau_i}} (1 + \varepsilon_{b_i, \lambda_i}), \end{aligned} \quad (5)$$

where  $\varepsilon_{b_i, \lambda_i} = \frac{\partial b_i}{\partial \lambda_i} \frac{\lambda_i}{b_i}$  labels the elasticity of the local budget with respect to the share of the public input. One observes the usual optimality condition that the marginal rate of substitution (MRS) between public and private consumption ( $v'$ ) equals the marginal rate of transformation (MRT). The MRT consists of two terms, where  $\frac{k_i}{k_i + (\tau_i - \vartheta_i) \frac{\partial k_i}{\partial \tau_i}}$  captures the marginal cost raising public funds (MCPF) and the multiplicative factor  $(1 + \varepsilon_{b_i, \lambda_i})$  arises due to the self-financing effect of the public input. As the marginal contribution rate  $\vartheta_i$  enters the RHS of equation (5) the redistributive grant system allows the federal government to adjust the local cost of raising public funds (see, among others, Buettner, Hauptmeier, and Schwager, 2006). By implementing full equalization, i.e.  $\tau_i = \vartheta_i$ , the MCPF reduce to one as in this case  $\varepsilon_{b_i, \lambda_i} = 0$  and the first term of the RHS of (5) obviously equals one. This is in line with Bucovetsky and Smart (2006) who - in a pure tax competition setting - show that if saving is inelastic full equalization establishes efficiency of local public finances. Using  $\tau_i = \vartheta_i$  in either of the first order conditions (3) and (4) leads to the fact that the gap between the marginal product of the public input  $(k_i^\alpha \beta (\lambda_i b_i)^{\beta-1})$  and the marginal utility of public consumption ( $v'$ ) vanishes. Therefore, full equalization corrects both, externalities arising from tax as well as expenditure competition in the presence of a publicly provided input to production.

When fiscal equalization is only partial, i.e.  $\tau_i > \vartheta_i$ , underprovision of the public consumption good occurs as MCPF exceed one. This is apparent from equation (5) as the first term on the RHS is greater than one due to the marginal tax base effect of an increase in the tax rate ( $\frac{\partial k_i}{\partial \tau_i} < 0$ ) and the fact that the elasticity of the local budget with respect to the share of the public input ( $\varepsilon_{b_i, \lambda_i}$ ) is positive. Comparing MCPF in a pure tax competition setting (see, e.g., Buettner, 2006) with the RHS of equation (5) shows that when local ju-

jurisdiction have available two instruments, i.e.  $\tau_i$  and  $\lambda_i$ , to compete for the mobile capital tax base fiscal competition becomes fiercer. This results from the self-financing effect of the public input which is captured by the factor  $(1 + \varepsilon_{b_i, \lambda_i}) > 1$ . Therefore, compared to a pure tax competition setting, the presence of the productivity enhancing public input leads to a further increase of the MRS between public and private consumption.

Comparative static analysis of adjustments in the marginal contribution rate  $\vartheta_i$  generates further insights on how the federal government can affect the local MCPF by inducing jurisdictions to adjust their policy parameters  $\tau_i$  and  $\lambda_i$ . Therefore, we rearrange optimality condition (5) to derive an implicit function,

$$\Gamma(\tau_i, \lambda_i, \vartheta_i, y_i) = \frac{k_i}{k_i + (\tau_i - \vartheta_i) \frac{\partial k_i}{\partial \tau_i}} (1 + \varepsilon_{b_i, \lambda_i}) - v' = 0, \quad (6)$$

and apply the implicit function theorem to derive the comparative static effects of a changes in the marginal contribution rate  $\vartheta_i$  on the two policy parameters

$$\frac{d\tau_i}{d\vartheta_i} = - \frac{\frac{\partial \Gamma}{\partial \vartheta_i}}{\frac{\partial \Gamma}{\partial \tau_i}}, \quad (7)$$

$$\frac{d\lambda_i}{d\vartheta_i} = - \frac{\frac{\partial \Gamma}{\partial \vartheta_i}}{\frac{\partial \Gamma}{\partial \lambda_i}}. \quad (8)$$

From the second order conditions of the unconstrained maximization problem (2) we know that  $\frac{\partial \Gamma}{\partial \tau_i} > 0$  and  $\frac{\partial \Gamma}{\partial \lambda_i} < 0$ . Therefore, the signs of the derivative of the implicit function  $\Gamma$  with respect to the marginal contribution rate will determine the signs of the comparative static effects. Differentiating with respect to  $\vartheta_i$  yields

$$\frac{\partial \Gamma}{\partial \vartheta_i} = \frac{k_i}{\frac{\partial b_i}{\partial \tau_i}} \left( \frac{\frac{\partial k_i}{\partial \tau_i}}{\frac{\partial b_i}{\partial \tau_i}} (1 + \varepsilon_{b_i, \lambda_i}) - \frac{\varepsilon_{b_i, \lambda_i}}{(\tau_i - \vartheta_i)} \right) - \frac{\partial b_i}{\partial \vartheta_i} \underbrace{\left( (1 - \lambda_i) v'' + \lambda_i \frac{k_i}{b_i^2} \frac{\frac{\partial b_i}{\partial \lambda_i}}{\frac{\partial b_i}{\partial \tau_i}} \right)}_{\frac{\partial \Gamma}{\partial y_i}}, \quad (9)$$

where  $\frac{\partial b_i}{\partial \tau_i} > 0$  and  $\frac{\partial b_i}{\partial \lambda_i} > 0$ , as increases in the tax rate as well as the share of the public input improve the local budget. In contrast, the increase in the marginal contribution rate

$\vartheta_i$  to the system of fiscal equalization has a negative budgetary effect, i.e.  $\frac{\partial b_i}{\partial \vartheta_i} < 0$ . The overall impact of a marginal increase in  $\vartheta_i$  can be separated into a "substitution" and an "income" effect. The first term on the RHS of (9) captures the pure "substitution effect" which is negative and arises as MCPF are reduced by raising the degree of redistribution within the federation. Negative tax base effects of increases in the local capital tax rate  $\tau_i$  as well as beneficial tax base effects due to an improvement of the budgetary share of public inputs  $\lambda_i$  are now "shared" to a greater extent by all jurisdictions within the system of fiscal equalization. The second term on the RHS of (9) captures the "income effect" induced by the increase in the marginal contribution rate. As indicated, the term in brackets depicts the marginal impact of unconditional federal transfers  $y_i$ , which is multiplied by  $\frac{\partial b_i}{\partial \vartheta_i} < 0$  and cannot be signed unambiguously. *Ceteris paribus*, a decrease in public funds directly reduces public consumption as well as public input provision according to the respective budgetary shares. This in turn leads to an increased marginal utility of  $Z_i$  but also to a higher marginal productivity of  $P_i$ . The adjustment of the endogenous budgetary structure then depends on the specification of the utility function, which is general in our case, and the assumptions concerning production technology.

As we are primarily interested in the incentive effects of fiscal equalization, we will focus on budget-compensated effects of variations in the marginal contribution rate. Therefore, we analyze the comparative static effects of an increase in  $\vartheta_i$  while compensating for budgetary losses by a corresponding increase in unconditional transfers, i.e.  $db_i = -k_i d\vartheta_i + dy_i \stackrel{!}{=} 0$ . This yields the following budget-compensated comparative static effects of an increase in  $\vartheta_i$ :

$$\left. \frac{\partial \tau_i}{\partial \vartheta_i} \right|_{comp.} > 0, \quad \left. \frac{\partial \lambda_i}{\partial \vartheta_i} \right|_{comp.} < 0 \quad (10)$$

We observe that a budget-compensated increase in the marginal contribution rate induces the local jurisdiction to increase its tax rate on mobile capital. This finding is in line with the theoretical literature stating that fiscal capacity based equalization tends to decrease the marginal cost of raising public funds, thereby generating incentives for participating governments to raise distortionary taxation. This helps to enhance efficiency in the presence

of tax competition for a mobile tax base (Koethenbueger, 2002; Bucovetsky and Smart, 2006). While this tax rate effect is well known from the literature we also show that by increasing the marginal contribution rate, the upper-level government is able to affect the composition of local spending as a higher degree of redistribution induces the jurisdiction to lower its budgetary share of the public input. Thereby, compositional inefficiencies in local spending as suggested by Keen and Marchand (1997) are at least reduced.

### **3 Empirical Analysis**

The following empirical analysis aims at testing the theoretical predicted incentive effect of fiscal equalization on local public spending. We exploit a rich data set of municipalities in the major German state of Baden-Wuerttemberg. In our context, Germany is a very interesting case to study as the municipal system of fiscal equalization, which is administrated by the states, is characterized by substantial redistribution of fiscal resources. Moreover, within their self-administration responsibilities, municipalities decide on spending on local streets and schools, two expenditure categories which can be classified as "productive" spending.

In the following we will give a description of the German system of municipal fiscal equalization. Section (3.2) then describes the data set and discusses the estimation approach. In Section (3.3) the results are presented.

#### **3.1 Municipal Fiscal Equalisation in Germany**

The German system of municipal fiscal equalization in principal has two objectives, namely firstly, to provide municipalities with additional revenues in order to fulfill their self-administrated spending responsibilities ("vertical equalization") and secondly, to equalize excessive fiscal capacity differences ("horizontal equalization"). While each state in Germany administrates its own municipal equalization system and therefore institutional differences occur, the basic structure is similar across states. Here, we focus on the system in the state of Baden-Wuerttemberg.

In principle, fiscal capacity equalization is achieved by reducing the difference between what is defined by law as fiscal need<sup>3</sup> and a municipality's fiscal capacity<sup>4</sup>. According to their relative fiscal capacity, i.e. the ratio of fiscal need to fiscal capacity, local jurisdictions are categorized as having "low", "medium" or "high" fiscal capacity. The latter group does not receive any transfers while municipalities with relative fiscal capacity smaller than 100% receive formula-based fiscal equalization grants. In addition, municipalities which are characterized by a "low" fiscal capacity receive transfers to ensure a relative fiscal capacity of at least 60%. The fiscal equalization grants are partly financed by contributions all municipalities have to finance out of their local tax revenues. Contributions to the state and to the county occur in addition.

Buettner (2006) has shown that the municipal system of fiscal equalization can be summarized by a linear function which relates grants to the tax base as depicted in (1). The marginal contribution rate  $\vartheta_i$  can thus be calculated as

$$\vartheta_i \equiv \tau^{rs} + (\tau_0 - \tau^{rs}) \left( \theta_i^{local} + \theta_i^{state} + \theta_i^{equal} (1 - \theta_i^{local} - \theta_i^{state}) \right), \quad (11)$$

where  $\tau^{rs}$  labels a uniform tax rate which determines revenue sharing with the federal and state level and  $\tau_0$  constitutes a standardising tax rate used to determine the taxing capacity of the local business tax. In addition, municipalities have to finance contributions out of their fiscal capacity to the county ( $\theta_i^{local}$ ), the state ( $\theta_i^{state}$ ) as well as formula-based contributions into the system of fiscal equalization ( $\theta_i^{equal}$ ). Note that transfers to the state and county reduce fiscal equalization contributions.

Unconditional grants  $y_i$  from the upper-level government are derived from

$$y_i \equiv x_i + \xi_i n_i (1 - \theta_i^{local} - \theta_i^{state}) - \left( \frac{\vartheta_i - \tau^{rs}}{\tau_0 - \tau^{rs}} \right), \quad (12)$$

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<sup>3</sup>Fiscal need is determined by a basic per-capita allowance which is multiplied by the municipality's population size.

<sup>4</sup>The fiscal capacity of a municipality is determined by the tax base of the local business tax as well as other revenues, in particular the municipal share of income and corporate taxation.



where  $x_i$  labels other revenue and  $n_i$  depicts fiscal need. The parameter  $\xi_i$  captures that municipalities are being treated differently within the fiscal equalization system conditional on whether they are characterized by a low, medium or high fiscal capacity.<sup>5</sup>

Table (1) gives an overview of the fiscal equalization parameters for the fiscal year 2004. While fiscal need does not display substantial cross-sectional variation one observes a high standard deviation in the case of fiscal capacity. Therefore, relative fiscal capacity varies strongly between 32% and 414%. Around 90% of the municipalities in the state of Baden-Wuerttemberg are characterized by low or medium fiscal capacity and receive fiscal equalization transfers. One quarter of the sample displays a relative fiscal capacity below 60% and therefore is eligible for additional equalization transfers. These municipalities are facing particularly high marginal contribution rates. In the last two rows of table (1) descriptive statistics for unconditional transfers ( $y_i$ ) and the marginal contribution rate ( $\vartheta_i$ ) are presented. Both variables show substantial within variation.

Besides fiscal equalization grants, municipalities receive additional grants in order to fulfill their self-administrated spending responsibilities. This also includes two types of specific grants: Firstly, within the so called "traffic and transport burden sharing" ("Verkehrslastenausgleich"), municipalities receive general as well as lump-sum grants depending on the length of the road network and the size of the municipal area respectively. Secondly, in the course of "school burden sharing" ("Schullastenausgleich"), municipalities receive transfers depending on the number of pupils.

## 3.2 Data and Estimation Approach

Our empirical analysis is based on an annual database for the 1111 municipalities in the German state of Baden-Wuerttemberg. It covers the period between 1990 and 2003 as some of the expenditure data is not available for the most recent fiscal year 2004. For our estimations we reduce this sample in two ways. Firstly, we restrict our attention to

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<sup>5</sup>For further details on the formalization of the municipal fiscal equalization system in the German state of Baden-Wuerttemberg see the Appendix in Buettner (2006).

Table 1: Descriptive Statistics for the fiscal equalization system in 2004

Variable		Mean	Std. Dev.	Min	Max
Fiscal need ( $n_i$ )	€ per capita	726	51.6	690	954.5
Fiscal capacity	€ per capita	548	205	187	3292
Relative fiscal capacity	ratio	.7536	.2712	.3260	4.14
Low fiscal capacity	binary	.2414	.4281	0	1
Medium fiscal capacity	binary	.6633	.4728	0	1
High fiscal capacity	binary	.0953	.2937	0	1
Rev. sharing tax rate ( $\tau^{rs}$ )	in %	.041	0	.041	.041
Standardizing tax rate ( $\tau_0$ )	in %	.145	0	.145	.145
County contribution rate ( $\theta^{local}$ )	in %	.3280	.0428	.27	.421
State contribution rate ( $\theta^{state}$ )	in %	.2118	.0101	.2045	.2795
Fiscal equalization contribution rate ( $\theta^{equal}$ )	in %	.7057	.2616	0	1
Unconditional grants ( $y_i$ )	€ per capita	274	46.4	68.4	373.7
Marginal contribution rate ( $\vartheta_i$ )	in %	.1313	.0118	.0922	.145

Sample size consists of 1102 municipalities in the state of Baden-Wuerttemberg.

municipalities with a population of more than 10000. The reason for this is that revenues from the municipal business tax, which states a tax on profits by local firms, are subject to significant fluctuations. The instability of the tax base is apparent especially in small municipalities, which are often characterized by a relatively homogenous economic structure. Secondly, there exist 9 independent cities in the state of Baden-Wuerttemberg, which do not belong to a county and therefore face different incentives within the municipal system of fiscal equalization. We also exclude these observations. Table (2) gives an overview of the underlying data for the reduced sample.

The local expenditure structure ( $\lambda_i$ ) is calculated as the primary expenditure share of spending on basic schools and municipal roads. As in Hauptmeier (2007), we assume that these two spending categories capture local "investment spending". The mean value of the expenditure structure lies around 9.6 %, i.e. about 9.6 % of municipal spending (net of debt service) relates to basic education and street infrastructure.

Table 2: Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max
Expenditure structure ( $\lambda_i$ )	in %	9.632	3.286	1.675	49.33
<i>Fiscal equalization variables:</i>					
Marginal contribution rate ( $\vartheta_i$ )	in %	12.77	1.487	4.445	14.50
Unconditional transfers ( $y_i$ )	€ per capita	296.9	50.00	123.5	373.7
Other grants (general)	€ per capita	4.818	9.258	0	101.3
Specific grants	€ per capita	18.61	31.00	0	252.0
<i>Other control variables:</i>					
Population	in 1000	24.68	16.80	10.24	112.0
Population density	per km <sup>2</sup>	576.1	434.7	68.23	2494

Sample size: 2758 observations - 197 municipalities over 14 years (1990-2003).

The basic estimation equation is given in (13).

$$\lambda_{i,t} = \lambda(\vartheta_{i,t}, y_{i,t}; x_{i,t}, \phi_i, \psi_t) \quad (13)$$

We estimate the determinants of the local expenditure structure  $\lambda_{i,t}$ . The marginal contribution rate to the municipal fiscal equalization system ( $\vartheta_{i,t}$ ) depicts the key variable on the RHS of estimation equation (13). Its coefficient is assumed to capture the incentive effect of fiscal equalization on local expenditure policies. In order to make sure that no "income effects" drive the results we control for unconditional transfers  $y_{i,t}$ .<sup>6</sup> In addition, specific grants as well as other general grants from the state and the federal level are included as control variables in  $x_{i,t}$ . Finally, we also control for population size as well as population density.

We use panel estimation techniques and impose regional fixed effects ( $\phi_i$ ) to avoid an omitted variable bias due to unobserved local heterogeneity. We also control for common time shocks by implementing time fixed effects ( $\psi_t$ ).

<sup>6</sup>See Section 3.1 for details on the composition of unconditional and specific grants.

As already pointed out by Buettner (2006) and Egger, Koethenbueger, and Smart (2007) a problem of endogeneity arises when trying to identify the incentive effects of fiscal equalization because municipalities are able to influence their fiscal conditions - in particular the fiscal capacity - which then determine the incentives faced within the redistributive grant system. Similar to the case of local tax policy addressed in the above mentioned studies, in our case one might expect that via their expenditure policy, municipalities - at least to some extent - might affect their "treatment" within the system of fiscal equalization due to potential tax base effects of investment spending. Conceptually, this corresponds to a problem of self-selection. Egger, Koethenbueger, and Smart (2007) deal with this problem by exploiting a natural experiment in terms of a reform of the fiscal equalization system. Here we follow Buettner (2006) and use as an identification strategy the fact that incentives within the municipal equalization system vary discontinuously with the relative fiscal capacity. Figure (3.2) illustrates these discontinuities. Simulating marginal contribution rates at average revenue sharing and county contribution rates for the year 2003 reveals discontinuous "jumps" at the threshold levels of relative fiscal capacity defined by law.<sup>7</sup> The observed "step function" is separated into three areas according to whether a jurisdiction is characterized as having "low", "medium" or "high" fiscal capacity. Municipalities with a fiscal capacity below 60% of fiscal need, on average, face the highest marginal contribution rates leading to an average equalization rate ( $\frac{\vartheta_i}{\tau_i}$ ) amounting to 85%.<sup>8</sup> The respective values for the "medium" and "high" capacity regime are 77% and 61%.

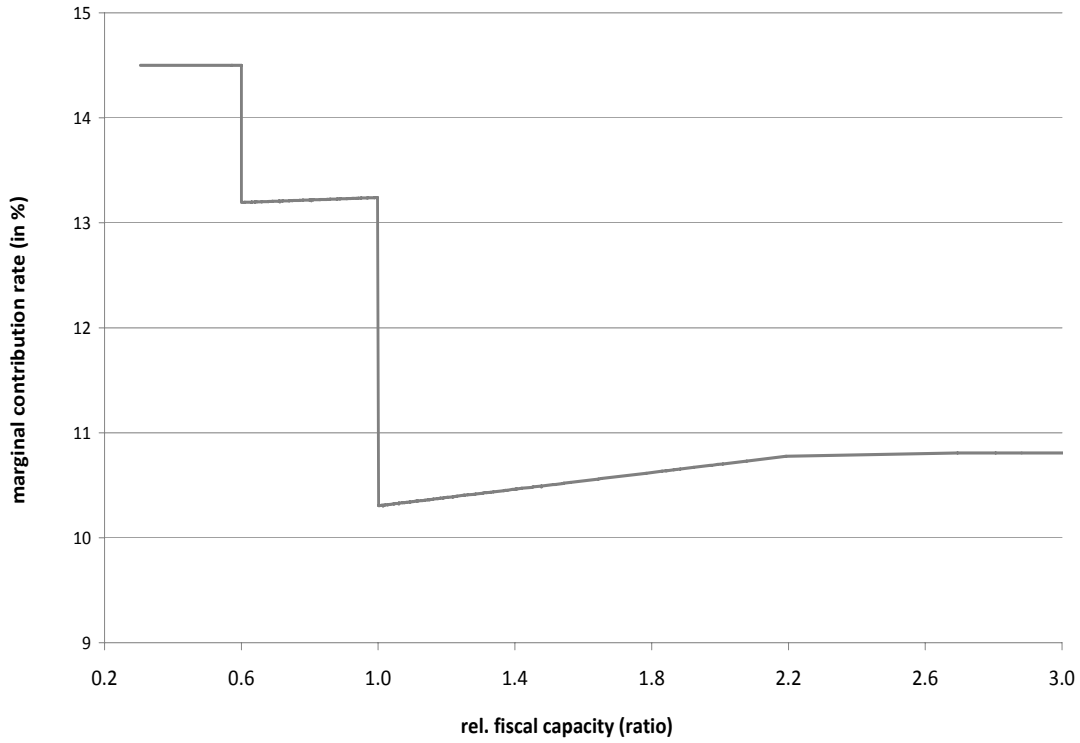
Given the fact that small differences in relative fiscal capacity can lead to significant asymmetries concerning the incentives faced by municipalities allows us to try to identify the incentive effects of fiscal equalization by using a regression discontinuity estimator. The "regression discontinuity approach" was first established by Campbell (1969). The idea behind this approach is to identify the causal effect of a treatment that is assigned as a deterministic function of an observed covariate, which is also related to the outcome of in-

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<sup>7</sup>Note that unconditional transfers  $y_i$  reveal a very similar pattern also characterized by discontinuous "jumps" at the thresholds 0.6 and 1.

<sup>8</sup>Equalization rates are calculated by taking the ratio of the marginal contribution rate  $\vartheta_i$  and the statutory business tax rate  $\tau_i$ .

Figure 1: Discontinuities in municipal fiscal equalization



- marginal contribution rate simulated at average revenue sharing and county contribution rate 2003

terest. Recent applications of the regression discontinuity design include Angrist and Lavy (1999), Van der Klaauw (2002) and Buettner (2006).

In our case the fiscal equalization parameters  $\vartheta_i$  and  $y_i$  depict deterministic functions of the municipal relative fiscal capacity which are defined law. We therefore specify the following estimation equation:

$$\lambda_{i,t} = \beta_1 \vartheta_{i,t} + \beta_2 y_{i,t} + \beta_3 \varphi(\gamma_{i,t}) + \beta_4 x_{i,t} + \phi_i + \psi_t + \epsilon_{i,t} \quad (14)$$

Note that the impact of relative fiscal capacity ( $\gamma_{i,t}$ ) on the local expenditure structure is captured by a function  $\varphi(\gamma_{i,t})$ . By controlling for  $\gamma_{i,t}$  it is ensured that fiscal capacity differences do not drive the results and only discontinuities are exploited to identify the effects of the fiscal equalization parameters. As the specification of  $\varphi(\gamma_{i,t})$  is key to identification, we employ several alternatives in order to capture possible non-linearities in the fiscal equal-

ization system. Besides linear, quadratic as well as cubic specifications in the relative fiscal capacity we therefore also employ a linear spline. This is done by interacting relative fiscal capacity with regime dummies, i.e. "low", "medium" and "high" capacity.

Another important aspect one should consider when analyzing the determinants of the local expenditure structure is that previous decisions might affect contemporary spending policies, i.e. the expenditure structure might follow a partial adjustment process. The inclusion of the lagged dependent variable on the RHS would be a means of capturing this intertemporal policy aspect. However, in the context of a "regression discontinuity approach" estimating a partial adjustment model is not straightforward as conditioning on  $\varphi(\gamma_{i,t})$  implies that only the fiscal equalization parameters necessarily exhibit a behavioral interpretation. Therefore, including lagged values of the covariates and estimating a reduced form equation conceptually constitutes a prudent way to take account for past policy decisions in our framework. Heckman and Robb (1986) suggest this procedure as an alternative to an explicit dynamic specification.

### 3.3 Results

Table (3) gives an overview of the basic regression results. Specifications (1) - (3) include general and specific grants as well as linear and quadratic specifications in the population size and density as conditioning variables. Besides controlling for regional and time fixed effects we impose alternative specifications concerning the relative fiscal capacity.<sup>9</sup>

In all specifications we estimate a significant and negative effect of the marginal contribution rate on the local expenditure structure. This is in line with the theoretical predictions from the model described in Section (2), i.e. a higher marginal contribution rate should be associated with a lower budgetary share of "productive" spending on basic schools and the local street network.

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<sup>9</sup>Note that the linear specification is not reported as results resemble those of specification (1) while featuring a lower  $R^2$ .

Table 3: Basic results (Dep. Var.: Expenditure structure)

Variable / Specification	(1)	(2)	(3)
Marginal contribution rate	-0.2132 *** (0.0695)	-0.1885 *** (0.0707)	-0.2883 *** (0.0931)
Unconditional grants, per capita	0.0614 *** (0.0191)	0.0599 *** (0.0192)	0.0323 (0.0235)
Other grants (general), per capita	0.0955 (0.1591)	0.0990 (0.1612)	0.0908 (0.1577)
Specific grants, per capita	0.3526 *** (0.0333)	0.3523 *** (0.0332)	0.3526 *** (0.0332)
Population, in 1000	0.0047 *** (0.0017)	0.0047 *** (0.0017)	0.0048 *** (0.0017)
Population, squared	-0.0000 ** (0.0000)	-0.0000 ** (0.0000)	-0.0000 ** (0.0000)
Population density	-0.0290 *** (0.0077)	-0.02910 *** (0.0077)	-0.02940 *** (0.0077)
Population density, squared	0.0009 *** (0.0002)	0.0009 *** (0.0002)	0.0009 *** (0.0002)
Relative fiscal capacity	squared	cubic	linear spline
Sample size		2758	
Mean of dep. var.		0.0959	
R-squared (adjusted)	0.5993	0.5998	0.5995

All specifications include regional and time fixed effects as well as controls for relative fiscal capacity as denoted. If significant at 1% (5%) level coefficients are marked with three stars (two stars).

Note that while the fit of the model is more or less unaffected by using alternative specifications of the relative fiscal capacity, the magnitude of the coefficients of the marginal contribution rate varies between specifications (1) - (3). In particular, conditioning on the linear spline and thereby explicitly taking into account the three fiscal capacity regimes defined by law leads to a stronger effect of the marginal contribution rate. Now, a one percentage point increase coincides with a 0.29 percentage point decrease of the local expenditure structure compared to values of -0.21 and -0.19 in specification (1) and (2) respectively. In addition, unconditional transfers which exert a significant and positive impact on the local expenditure structure in the first two specifications turn insignificant when controlling for the linear spline. It is also noteworthy that, when switching to the spline specification, the

significance and the magnitude of the effects of the remaining conditioning variables are basically unaffected. Quite intuitively, specific grants in the field of basic schools and road infrastructure exert a significant and positive effect on the respective budgetary share. In addition, this share increases along with population size and decreases with density.

As already discussed in Section (3.2) intertemporal policy aspects might play a role when analyzing the determinants of the local budgetary structure. Therefore, Table (4) reports results including lags of the covariates as further conditioning variables.

Taking into account dynamic effects marginally improves the  $R^2$  compared to the specifications without lags in time whereas specification (2) reveals a slightly better fit. Most noticeable, the contemporary marginal contribution rate turns insignificant when conditioning on a cubic polynomial in the relative fiscal capacity while we observe a lagged response of the expenditure structure. The positive "income effect" through unconditional transfers is now only weakly significant and, again, relatively small compared to the "incentive effect". Including lags in time in the linear spline specification leaves the contemporary effect of the marginal contribution rate unaffected in terms of magnitude though the coefficient is less precisely estimated. Again contemporary unconditional transfers do not exert a significant impact on the local budgetary structure but we find a weakly significant and positive lagged response.

Overall, the regression analysis confirms the presence of an incentive effects of fiscal equalization grants as suggested by theory. The coefficient of the marginal contribution rate has a negative sign in all reported estimations and the effect is statistical significant with the exception of specification (1) in Table (4). Here we only observe a lagged response. Notwithstanding, it must be highlighted that the magnitude of the incentive effect is sensitive to the specification of relative fiscal capacity, the conditioning variable in the context of the regression discontinuity approach. However, as capturing the nature of discontinuity is key to identification when using discontinuity estimators, implementing the linear spline specification and thereby explicitly taking account of the three fiscal capacity regimes defined by law has a lot to commend it. While differences are small, the dynamic specification combined with a linear spline in fiscal capacity also reveals the best fit.



Table 4: Results with lags in time

Variable	(1)	(2)	
Marginal contribution rate	-0.1531 (0.1063)	-0.2877 (0.1472)	**
Unconditional grants, per capita	0.0502 * (0.0294)	0.0016 (0.0374)	
Other grants (general), per capita	0.0033 (0.1280)	0.0068 (0.1293)	
Specific grants, per capita	0.3376 *** (0.0342)	0.3382 *** (0.0341)	***
Population, in 1000	0.0300 *** (0.0090)	0.0304 *** (0.0084)	***
Population, squared	-0.0000 *** (0.0000)	-0.0000 *** (0.0000)	***
Density	-0.1241 *** (0.0374)	-0.1258 *** (0.0372)	***
Density, squared	0.0027 *** (0.0008)	0.0028 *** (0.0008)	***
Marginal contribution rate, lag	-0.1990 ** (.0910)	-0.1827 (0.1234)	**
Unconditional grants, per capita, lag	0.0270 (0.0275)	0.0609 (0.0370)	*
Relative fiscal capacity	cubic	linear spline	
Sample size		2561	
Mean of dep. var.		0.0969	
R-squared (adjusted)	.60578	.60598	

All specifications include regional and time fixed effects as well as controls for relative fiscal capacity as denoted. Covariates are also employed as lagged values. If significant at 1%, 5% or 10% level coefficients are marked with one star, two and three stars.

Results for the "income effect" of the grant system are mixed. While the theoretical analysis in section (2) did not yield a clear-cut prediction on how a marginal increase in unconditional transfers should affect the local expenditure composition, we observe a highly significant and positive effect of these transfers in specifications (1) - (3) of the static estimations. The significance of this effect completely disappears when conditioning on the linear spline.

Switching to the dynamic specification reduces significance of the "income effect" when controlling for the cubic polynomial while we observe a positive and significant effect of lagged unconditional transfers.

## 4 Conclusions

While the literature on the internalizing impact of redistributive grant systems has so far mainly focused on the aspect of tax competition, we present a model of two-dimensional fiscal competition in taxes and public inputs to analyze the incentive effects of fiscal equalization transfers. Our findings are in line with previous theoretical analyses suggesting that the implementation of capacity based equalization induces local governments to increase distortionary taxation of a mobile capital tax base. In addition, this paper extends the existing literature by pointing out that inefficiencies in local public spending as stated by Keen and Marchand (1997) are reduced while the degree of redistribution within a system of fiscal equalization rises.

This theoretically predicted incentive effect of fiscal equalization transfers on local expenditure policies has then been tested on the basis of a rich data set of German municipalities. Using a regression discontinuity approach which exploits non-linearities in the municipal system of fiscal equalization, we find that a higher marginal contribution rate to the redistributive grant system induces local governments to reduce their budgetary share of infrastructure spending on the local road network and basic school expenditures. The results are robust with respect to dynamic effects as well as various specifications capturing discontinuities in municipal fiscal equalization.

While the theoretical analysis suggests that fiscal equalization tends to increase efficiency of local public finances one must be careful when judging actual welfare effects. Buettner, Hauptmeier, and Schwager (2006) further explore the conditions under which local grant systems enforced by upper-level governments will enhance efficiency. In the context of the German federation where fiscal policies of all levels of state are strongly interlinked by multi-

level fiscal equalization and the sharing of common taxes, the study points to excessive local taxation as a consequence of upper-level government attempts to extract fiscal resources. A recent theoretical analysis by Kotsogiannis and Schwager (2006) puts forward the argument that equalization programs can lead to perverse fiscal incentives if political accountability is reduced. This might well be the case in countries characterized by a pronounced fiscal federalism. Therefore, taking into account political incentives and possible inefficiencies of the public sector when analyzing institutional issues in a fiscal competition context deserves further attention.

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