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ORIGINAL PAPER

How to stop the race to the bottom

Empirical evidence from North Rhine-Westphalia

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Abstract Standard tax multipliers are a widespread feature of fiscal equalization systems. A simple theoretical model shows that actual tax multipliers respond positively to changes in standard tax multipliers. This theoretical prediction is tested empirically using data on municipalities in Germany. A quasi-experiment in the state of North Rhine-Westphalia is exploited to identify the incentive effect. The empirical results confirm that local business tax policy is shaped by standard tax multipliers. They provide a straightforward practical tool to avoid a race to the bottom in local business tax rates.

Keywords Fiscal equalization · Quasi-experiment · Local taxation · Business tax · Fiscal competition

JEL Classification H25 · H71 · H77 · R51

1 Introduction

It is a well-known normative principle among public economists that business taxation should not be decentralized to subnational levels of government. Otherwise, so the argument goes, local governments would engage in a harmful "race to the bottom" where they constantly try to undercut their neighbors' business tax rates. Resulting tax rates would be inefficiently low (Oates 1972). A similarly widespread insight is that

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problems of overspending and reduced tax effort arise whenever budgeting involves a common pool of resources (see Raudla 2010 for a review on the use of the "budgetary commons" metaphor in existing literature).

Germany's institutional setting involves business tax autonomy for local governments and a common pool of fiscal equalization transfers from the state to the local level. As a result, conventional wisdom points to overly low business tax rates as a likely outcome: Competition for mobile capital presumably pushes tax rates downwards. At the same time, one might suspect that the common pool of equalization transfers further reduces tax effort. Indeed, Köthenbürger (2002) shows that equalization schemes that rely on revenue equalization tend to reinforce tax competition. In contrast, fiscal equalization in the form of tax base or capacity equalization increases subnational tax rates and thus attenuates competitive forces, which may be efficiency-enhancing when competition effects are strong enough (Köthenbürger 2002; Bucovetsky and Smart 2006; Smart 2007). Municipal fiscal equalization in Germany adheres to the capacity equalization principle, which is also employed in the transfer systems of countries such as Canada and Australia. In such systems, jurisdictions' tax bases are evaluated at a standard tax rate and compared to a benchmark level of spending or revenue to determine the size of the transfer.[1] The transfer to each jurisdiction decreases in its "fiscal capacity."

In this paper, we argue that the so-called standard tax multipliers (*fiktive Hebesätze* or *Nivellierungshebesätze*) help to prevent both the race to the bottom and the raiding of the commons. Standard tax multipliers are employed in fiscal equalization schemes to calculate the fiscal capacity from taxes for which subnational governments enjoy tax autonomy. In the case of German municipalities, business tax is one of the most important components of fiscal capacity. The use of standard tax multipliers has the following effect: If the municipality's actual business tax multiplier is smaller than the standard tax multiplier, the accounted standardized business tax revenue is greater than actual business tax revenue (and vice versa). While the effects of most mechanisms within the equalization system are unknown to the municipalities, the municipalities are well aware of the impact of the standard tax multiplier (i.e., the "overestimation" of tax revenue if the standard tax multiplier exceeds their business tax multiplier). Standard tax multipliers prevent municipalities from neglecting their own tax sources. They provide a signal for an "appropriate" tax rate level, which municipalities are incentivized to follow in order to maximize their revenue. Thus, practitioners at the state level have devised a clever mechanism to circumvent common pitfalls of local tax policy. Consistent with this argument, local business tax rates in Germany hardly appear to have been driven by a race to the bottom. Instead, they exhibited a steady upward trend over the past three decades.[2]

A growing body of empirical literature investigates the incentive effects of equalization systems on tax policy and demonstrates the positive impact of capacity

[1] In contrast to most such systems, German municipal fiscal equalization schemes rely on a comparison between "fiscal need" and "fiscal capacity." Moreover, the sum of all equalization transfers is typically fixed by the state level and not endogenous.

[2] Weighted average business tax multipliers in Germany increased from 330 in 1980 and 364 in 1990 to 390 in 2010 (Federal Statistical Office 2014c).

equalization on local tax rates. Egger et al. (2010) exploit a change of the equalization formula in the state of Lower Saxony and show that this reform had a significant impact on municipalities' business tax rates for four consecutive years. Büttner (2006) provides evidence that there is a positive relationship between the marginal contribution rate, defined as the rate at which an increase in the tax base reduces equalization transfers, and local business tax rates in the state of Baden-Württemberg. Smart (2007) investigates the effect of equalization among Canadian provinces, showing that an expansion of transfers leads to higher provincial tax rates.

This paper presents further evidence of the upward pressure that fiscal equalization exerts on local tax rates. We add to the literature by focusing the analysis on standard tax multipliers and using an innovative identification strategy with a new dataset. Standard tax multipliers are an institutional feature of any equalization scheme that relies on so-called representative tax systems, as well as being present in municipal fiscal equalization in all thirteen German territorial states.[3] The hypothesis of standard tax multipliers as a driver of local tax policy has long been discussed in the applied literature on the evaluation of and reform options for fiscal equalization systems (e.g., Büttner et al. 2008; Parsche and Steinherr 1995; Goerl et al. 2013). Baskaran (2014) even takes this hypothesis as a given in his analysis of local tax mimicking by municipalities in Germany. He views a reform of standard tax multipliers in the state of North Rhine-Westphalia in 2003 as the cause of observable adjustments in actual tax multipliers. This is despite the fact that, to the best of our knowledge, an explicit test of this hypothesis is absent from the academic literature to date. We adapt the theoretical models used in Smart (2007) and Egger et al. (2010) to illustrate the interaction of local taxation and fiscal equalization. This allows us to derive the optimal business tax multiplier as well as the incentive effect of a change in the standard business tax multiplier. Beyond the mechanics exposed in the model, we believe that standard tax multipliers provide an easy-to-read signal to local policymakers. They view standard tax multipliers as a reference for an appropriate and politically feasible tax multiplier. In contrast to changes in eligibility criteria, adjustment levels, or marginal contributions rates, which may also influence local tax multipliers as shown in the previous literature, standard tax multipliers have the same magnitude as actual multipliers. As a result, changes in standard tax multipliers are easily translated into perceived necessary adjustments of local multipliers. As stated by Baskaran (2015) , hikes in standard tax multipliers also provide a window of opportunity for local officials to raise tax multipliers while deflecting the blame to the state level. Thus, we argue that changes in standard tax multipliers are more obvious and potentially more powerful trigger of local tax responses than previously analyzed fiscal equalization parameters.

Standard tax multipliers are often equal, or at least related, to the average of actual tax multipliers, creating an endogeneity problem in empirical analysis. A quasi-experiment in North Rhine-Westphalia allows us to solve this problem. Until 1995, North Rhine-Westphalia's equalization scheme featured standard tax multipliers that were differentiated according to municipal population size. In 1993, the state consti-

[3] Moreover, fiscal equalization between federal states in Germany also employs standard tax rates to standardize property transfer tax revenue since the introduction of state tax rate autonomy for this tax in 2006.

tutional court ruled that this arbitrary differentiation was not permissible. As a result, North Rhine-Westphalia's state legislature had to adjust its municipal fiscal equalization scheme. The court ruling thus led to exogenous variation in the standard tax multiplier for small municipalities. The strict exogeneity of this reform is in contrast to other reforms where standard tax multipliers are adjusted to better reflect actual average tax multipliers.

Our empirical analysis is based on a balanced panel dataset of annual administrative data for all 396 municipalities of North Rhine-Westphalia. The dataset covers the time period from 1987 to 2002, thereby containing information on the pre-reform, reform and post-reform periods. It draws on a variety of official statistics data sources. The rich and unique dataset includes a number of municipal- and county-level control variables.

Our research design combines a municipal-level fixed effects model with a difference-in-differences approach, where local business tax multipliers are regressed on interaction terms between treatment groups and treatment points. Our identification strategy exploits the exogenous (quasi-experimental) variation of the standard tax multiplier for "small" municipalities induced by the reform of the North Rhine-Westphalian municipal fiscal equalization system in the mid-1990s. We find a positive effect of the standard business tax multiplier on local business tax multipliers, as predicted by theoretical considerations. The findings are robust to a number of alternative specifications.

Section 2 clarifies the institutional features of the German business tax and municipal fiscal equalization. Section 3 introduces the theoretical model. Section 4 explains our empirical approach and data. Section 5 presents the results of the empirical analysis. Section 6 concludes.

2 Institutional background

Germany's federal structure is a key determining factor of the country's fiscal landscape. The federal level, the three city-states and 13 territorial states, and the more than 11,000 municipalities each have differing degrees of tax autonomy over different taxes. For German municipalities, the business tax (*Gewerbesteuer*) and the equalization transfers (*Schlüsselzuweisungen*) provided to them by their federal state are two of the most important income sources.[4] In 2013, municipal net revenue from the business tax and fiscal equalization transfers accounted for 15.8 and 14.3 % of aggregate municipal income, respectively (Federal Statistical Office 2014b).

2.1 Business taxation

It is a particularity of the German tax system that municipalities enjoy business tax autonomy. Each municipality sets its own local business tax multiplier (*Gewerbesteuerhebesatz*). In contrast, the business tax base and the basic tax rate

[4] Other relevant sources are the local property tax, the municipal shares of VAT and income tax, as well as duties and charges.

(*Steuermesszahl*)[5] are defined at the federal level. The resulting tax rate is determined by multiplying the local business tax multiplier with the basic federal tax rate. The business tax is charged on operating profits of corporate and non-corporate firms. In 2013, gross business tax revenue amounted to 43 bn EUR, making it Germany's third most revenue-generating tax (Federal Statistical Office 2014a).

2.2 Municipal fiscal equalization

In 2013, municipal fiscal equalization transfers in Germany totaled 29.4 bn EUR (Federal Statistical Office 2014b). These transfers serve a double purpose. First, most German municipalities lack sufficient own revenue sources to fund their tasks. The transfers they receive from their respective federal state via its municipal fiscal equalization system thus serve a fundamental financing function. Second, the transfers are designed to reduce differences in municipalities' capacities to provide public goods.

Municipal fiscal equalization systems function similarly in all German states. All of them employ the same basic mechanism of comparing a fictitious measure of "fiscal need" with a standardized measure of "fiscal capacity." Total fiscal equalization transfers $\sum_{i=1}^{I} T_i$ (*Schlüsselmasse*, i.e., the sum of all equalization transfers paid out in one year in the state in question) are predetermined. The fiscal equalization transfer T_i of municipality i equals

$$T_i = \alpha(\beta N_i - C_i) \quad \forall i \quad \text{with } \beta N_i > C_i. \tag{1}$$

T_i depends on the combined effect of the following factors: adjustment level α, i.e., the degree to which the difference between fiscal need and fiscal capacity is equalized; fictitious measure of fiscal need, which is calculated by multiplying a fiscal need number N_i by the basic amount β; standardized measure of fiscal capacity C_i.[6]

Municipalities whose fiscal capacity exceeds their fiscal need are called "abundant" and do not benefit from fiscal equalization transfers. The basic amount is determined via an iterative process and equals[7]

$$\beta = \frac{\sum_{i=1}^{I} T_i + \alpha \sum_{i=1}^{I} C_i}{\alpha \sum_{i=1}^{I} N_i} \forall\, i \quad \text{with } \beta N_i > C_i. \tag{2}$$

While the derivation of the fictitious measure of fiscal need is negligible with respect to the focus of this paper, the derivation of the standardized measure of fiscal capacity is not. Fiscal capacity is the sum of standardized business and property tax revenue and the (unstandardized) municipal share of VAT and income tax revenue. To assure

[5] The basic federal tax rate was set at 5 % (with lower rates for operating profits below 48.000 euros) during our sample period. It was reduced to a uniform rate of 3.5 % in 2007.

[6] In addition to such "common" fiscal equalization transfers, some states employ special transfers to municipalities suffering from a very low standardized tax revenue to ensure that they achieve a pre-defined level of fiscal resources. However, this is not the case in North Rhine-Westphalia.

[7] Due to the endogeneity of the basic amount, the comparative statics of municipal fiscal equalization are not straightforward and unknown to municipalities.

local tax multiplier autonomy, municipal fiscal equalization systems employ so-called standard tax multipliers to evaluate tax revenue from taxes for which the municipalities set tax multipliers (business and property tax). Standard tax multipliers are set by the respective federal states. Standardized business tax revenue R_i^{std} equals

$$R_i^{\text{std}} = s \times \frac{R_i}{m_i} \tag{3}$$

with $R_i :=$ business tax revenue, $m_i :=$ business tax multiplier and $s :=$ standard tax multiplier.[8]

If the actual business tax multiplier is smaller than the standard tax multiplier, the accounted standardized tax revenue is greater than the actual business tax revenue (and vice versa). While the effects of most mechanisms within the equalization system are unknown to the municipalities, they are well aware of the impact of the standard tax multiplier (i.e., the "overestimation" of tax revenue if the standard tax multiplier exceeds their business tax multiplier).

3 A simple theoretical model

To understand the incentive effect of standard tax multipliers, we develop a simple theoretical model of local taxation and fiscal equalization with two revenue-maximizing local jurisdictions. It is a version of the models employed by Egger et al. (2010) and Smart (2007), which we extend to include the standard tax multiplier as well as the basic amount. It allows us to derive the optimal business tax multiplier and the incentive effect of a change in the standard business tax multiplier. Suppose there are two municipalities i and j whose sole income sources are business taxation and fiscal equalization transfers. The business tax base B_i of municipality i does depend not only on its own business tax rate m_i, but also on the one of municipality j, m_j:

$$B_i = B_i^0 + \gamma m_j - \delta m_i \tag{4}$$

where $B_i^0 \geq 0$ and $\delta > \gamma \geq 0$. Tax revenue R_i thus becomes

$$R_i = m_i \left(B_i^0 + \gamma m_j - \delta m_i \right). \tag{5}$$

Fiscal capacity C_i is

$$C_i = \frac{s R_i}{m_i} = s \left(B_i^0 + \gamma m_j - \delta m_i \right) \tag{6}$$

where s again denotes the standard tax multiplier.

[8] Standardized property tax revenue is determined equivalently.

Assuming that both municipalities are non-abundant, the respective fiscal equalization transfers T_i are derived by inserting Eq. (2)[9] into Eq. (1):

$$T_i = \alpha \left[\frac{\sum T_{i,j} + \alpha s \left(B_i^0 + \gamma m_j - \delta m_i + B_j^0 + \gamma m_i - \delta m_j \right)}{\alpha \left(N_i + N_j \right)} N_i - s \left(B_i^0 + \gamma m_j - \delta m_i \right) \right] \tag{7}$$

As an auxiliary assumption, suppose that both municipalities seek to maximize their revenue from taxes and transfers:

$$\max_{m_i} R_i + T_i \tag{8}$$

The reduced-form equation for the optimal tax rate of municipality i then becomes:

$$m_i* = \frac{1}{4\delta^2 - \gamma^2} \left[2\delta B_i^0 + \gamma B_j^0 + \alpha s \left\{ \gamma\delta + 2\delta^2 + \frac{1}{N_i + N_j} \left(\gamma N_j (\gamma - \delta) + 2\delta N_i (\gamma - \delta) \right) \right\} \right] \tag{9}$$

This leads to the following first derivative with respect to the standard tax multiplier s:

$$\frac{\partial m_i^*}{\partial s} = \frac{1}{4\delta^2 - \gamma^2} \left[3\delta\gamma N_i + N_j \left(2\delta^2 + \gamma^2 \right) \right] > 0 \tag{10}$$

Proposition *An increase in the standard tax multiplier increases the optimal tax multiplier chosen by the municipalities.*

Given this relationship, the use of standard tax multipliers prevents municipalities from neglecting their own revenue sources and provides a clever way to circumvent the common pool problem. What is more, many municipalities consider the standard tax multiplier as a signal for their own tax policy. Even if—as is likely the case—local policymakers do not fully understand the intricacies of fiscal equalization and the effect of the basic amount, they recognize intuitively that they should respond to changes in the standard tax multiplier to avoid transfer losses. In contrast to changes in the adjustment level α, which also induces tax multiplier reactions, changes in s are easily translated into appropriate adjustments of the local tax multiplier, as both have the same magnitude. Therefore, a race to the bottom in local business tax rates does not occur when standard tax multipliers are used in equalization.

[9] The first-round basic amount becomes:

$$\beta_1 = \frac{\sum_{i=1}^{I} T_i + \alpha s \left(B_i^0 + \gamma m_j - \delta m_i + B_j^0 + \gamma m_i - \delta m_j \right)}{\alpha (N_i + N_j)}.$$

4 Empirical approach

4.1 Quasi-experiment

We exploit a quasi-experiment in the state of North Rhine-Westphalia for an empirical test of our proposition. North Rhine-Westphalia offers a promising case to study given that it is the most populous German state with over 17 million inhabitants. Moreover, it stands out as a state where municipalities' business tax multipliers are high relative to those found elsewhere in Germany. The same applies to its standard tax multipliers.

Like those in the other 12 territorial states, the 396 North Rhine-Westphalian municipalities receive state transfers through a municipal fiscal equalization system. Each year, several billion euros (8 bn in 2014) are paid out as equalization transfers. North Rhine-Westphalia currently sets a single standard tax multiplier with respect to the business tax. Until 1995, the equalization scheme featured standard tax multipliers that were differentiated according to population size. The fiscal capacity of municipalities with up to 150,000 inhabitants ("small" municipalities) was calculated using a standard tax multiplier of 350. The fiscal capacity of municipalities whose population size exceeded this threshold ("big" municipalities) was evaluated with a standard tax multiplier of 380. In 1993, the state constitutional court ruled that this arbitrary differentiation was not permissible (VerfGH 9/92, 22/92).[10] As a result, North Rhine-Westphalia's state legislature was required to adjust its municipal fiscal equalization scheme. Standard tax multipliers for municipalities with less than 150,000 inhabitants were increased in three equal steps between 1996 and 1998 to reach the larger cities' multiplier. This 30-points change amounted to an increase of 8.5 % in the standardized tax multiplier. The court ruling thus led to sizeable exogenous variation in the standard tax multiplier for small municipalities. To the best of our knowledge, this quasi-experiment has not been used in the literature to date.

4.2 Data sources

Our empirical analysis is based on a balanced panel dataset of annual administrative data for all 396 municipalities of North Rhine-Westphalia. The dataset covers the time period from 1987 to 2002, thereby containing information on the pre-reform, reform, and post-reform periods. It draws on a variety of official statistics data sources, namely North Rhine-Westphalia's statistical office (*IT.NRW*), the Regional Database Germany (*Regionaldatenbank Deutschland*) and the Federal Employment Agency (*Bundesagentur für Arbeit*). The rich and unique dataset includes municipal business tax multipliers, inhabitants, income tax and VAT shares, employees at place of employment, GDP (at county level), disposable income of private households (at county level), municipal debt, tax bases and revenues from property and business tax, commuters and municipal surface area. There are 375 "small" and 21 "big" municipalities up until 1999. From 2000 onwards, one additional city has more than 150,000 inhabitants.

[10] The differentiation was found to be arbitrary as long as the legislator had not established why it was warranted for objective reasons.

Table 1 Summary statistics, 1987–2002

Variable	Mean	Std. Dev.	Min.	Max.	N
Business tax multiplier (in %)	373.284	35.652	250	490	6336
Income tax share p.c. (1000 EUR)	0.286	0.05	0.17	0.484	4356
GDP p.c. (1000 EUR)	20.732	4.013	13.066	62.922	3960
Inc. of priv. households p.c. (1000 EUR)	16.645	1.642	13.136	21.456	3168
Employees p.c.	0.259	0.093	0.048	0.625	3960
Surface area p.c. (ha)	0.429	0.345	0.028	2.36	4356

Business tax multiplier, surface area p.c., income tax share p.c., employees p.c. (municipal level) and income of private households p.c., GDP p.c. (county level); number of observations: 396 municipalities p.a

Table 1 provides summary statistics for the most important variables, which are reported in per capita terms with the exception of business tax multipliers. Between 1987 and 2002, business tax multipliers in North Rhine-Westphalia varied between 250 and 490, with an unweighted average of 373.28. Table 1 also illustrates some data availability issues. None of the tabulated control variables are available for all years. Municipal income tax shares, GDP and surface area have only been reported since 1992.[11] There are no data on the disposable income of private households before 1995 or on the number of employees before 1993. More detailed summary statistics are provided in Tables 6, 8 and 7 in Appendix.

Figure 1 depicts the difference between average business tax multipliers of "big" and "small" municipalities between 1992 and 2002.[12] The three dashed vertical lines mark the three reform years where standard business tax multipliers for small municipalities were raised. As shown, the average business tax multiplier of big municipalities was more than 70 % points higher than that of small municipalities at the outset. During the three reform years, the difference in averages dropped sharply, to a level of 60 % points and below.

4.3 Empirical model

Our research design combines a municipal-level fixed effects model with a difference-in-differences approach. The dependent variable is the business tax multiplier $m_{i,t}$ of municipality i in year t. Our independent variables of interest are the interaction terms $\mathrm{TG}_i \times \mathrm{TP}_t,\ t = 1996, \ldots, 1998$ between treatment groups ($\mathrm{TG}_i = 1$ if population $\leq$ 150, 000 and 0 otherwise)[13] and treatment points ($\mathrm{TP}_{1996} = 1$ if $t = 1996, \mathrm{TP}_{1997} = 1$ if $t = 1997, \mathrm{TP}_{1998} = 1$ if $t = 1998$ and 0 otherwise).

We include two types of control variables to adjust for observable time-variant differences between municipalities: $\mathbf{X_{i,t}}$ and $\mathbf{Z_{c,t}}$ represent column vectors of

[11] GDP is also missing in 1993.

[12] In 2003, the standard tax multiplier was increased to 403 for all North Rhine-Westphalian communities.

[13] Population size in 1995 determines assignment to treatment groups for the one municipality that grows beyond 150,000 inhabitants in 2000.

Fig. 1 Difference in average business tax multipliers between "big" and "small" municipalities, 1992–2002. *Source*: IT.NRW, own calculations

municipal-level variables (debt p.c., share of income tax etc.) and county-level variables (GDP p.c. etc.), respectively. Furthermore, we control for municipal and year fixed effects (λ_i, Φ_t). The municipal fixed effects account for unobserved but time-invariant omitted municipal-level factors that may influence business tax multipliers. By adding year fixed effects to the regression equation, we are able to control for common shocks affecting tax rates across all municipalities in a given year. We use the following regression model with $t = 1995, \ldots, 1998$:

$$m_{i,t} = \alpha \mathrm{TG}_i + \delta_{1996}\,\mathrm{TG}_i \times \mathrm{TP}_{1996} + \delta_{1997}\mathrm{TG}_i \times \mathrm{TP}_{1997} + \delta_{1998}\mathrm{TG}_i \times \mathrm{TP}_{1998} + \beta \mathbf{X_{i,t}} + \theta \mathbf{Z_{c,t}} + \lambda_i + \Phi_t + \varepsilon_{i,t} \quad (11)$$

where the error term $\varepsilon_{i,t}$ is clustered at the county level.

Our coefficients of interest δ_{1996}, δ_{1997} and δ_{1998} measure how the business tax multiplier differential between "small" municipalities (treatment group) and "big" municipalities (control group) changed c.p. between the reference year 1995 and 1996, and 1997 and 1998, respectively.

4.4 Discussion of identification

Our identification strategy exploits the exogenous (quasi-experimental) variation of the standard tax multiplier for "small" municipalities induced by the reform of the North Rhine-Westphalian municipal fiscal equalization system in the mid-1990s. In contrast to later changes to standard business tax multipliers, this reform was prompted by a court ruling and is therefore truly exogenous. The chosen identification strategy thus circumvents typical endogeneity concerns.[14] The validity of identification hinges on the assumption of a common trend between treat-

[14] Standard tax multipliers were not set exogenously in later reforms (2003, 2011).

ment and control groups.[15] We assume that business tax multipliers would have evolved in parallel in the absence of treatment (conditional on other included independent variables). Without treatment, δ_{1996}, δ_{1997} and δ_{1998} would have to be zero.

Differences in administrative status between the treatment and the control groups might pose a potential concern regarding this identifying assumption. All 21 cities in the control groups are cities with county status. Of the 375 municipalities in the treatment group, only two have county status, while the remaining 373 belong to a county. If there had been systematic differences in or changes to the financing structure or spending responsibilities of municipalities with as opposed to without county status during our sample period, this might constitute a violation of the common trend assumption. We know of no such major shifts during the period of interest. Moreover, the revenue sources of cities with county status are equivalent to those of municipalities belonging to a county: Both rely on the same types of taxes, fees and charges, transfers, etc. In contrast, counties are financed solely through state transfers and the *Kreisumlage*, a financial contribution levied from municipalities within the county. Through this levy, municipalities belonging to a county share the responsibility for financing county-level spending. Given this administrative and fiscal setup, we believe that our treatment and control groups are sufficiently comparable.

Systematic differences in the degree to which both groups suffer from fiscal distress and find themselves under the supervision of regulatory authorities might also bias our estimation results. In recent years, regulatory authorities have been bound by official decrees to ensure that local tax multipliers of municipalities operating under budget consolidation plans are higher or at least equal to average state-wide tax multipliers of municipalities in their population size range. This might induce upward movements in tax multipliers which are unrelated to standard tax multipliers. There are unfortunately no official records on municipalities with budget consolidation plans in the mid-1990s. However, according to the Ministry of the Interior, the practice of actively influencing tax multipliers is a relatively new phenomenon. To the best of their knowledge, no official decrees existed during our sample period that would have mandated regulatory authorities to make higher tax rates a precondition for the approval of budget consolidation plans. What is more, budget consolidation plans were much less widespread during our sample period than they are today. Thus, we are confident in the validity of the common trend assumption.

We investigate the common trend by plotting the development of the average business tax multipliers of "small" municipalities (treatment group) and "big" municipalities (control group) between 1987 and 2010 (Fig. 2). The former is represented by the gray dashed and the latter by the black dotted line. The corresponding standard tax multipliers are shown in gray ("small" municipalities) and black ("big" municipalities/ all municipalities). Figure 2 supports the common trend assumption. Both groups have seen a gradual upward trend since 1987. The development of their business tax

[15] Although we distinguish "treated" and "untreated" municipalities, it is important to note that transfer payments to all municipalities were affected by the reform: The sum of all transfers is fixed and the change in the standard tax multiplier affects how this sum is distributed among all municipalities.

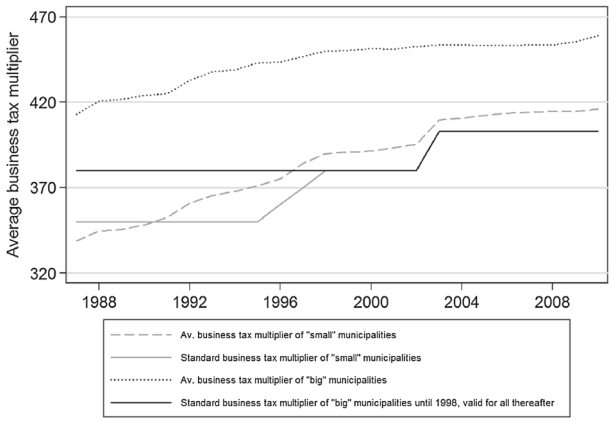

Fig. 2 Development of average business tax multipliers and standard business tax multipliers, 1987–2010. *Source*: IT.NRW, own calculations

multipliers has been similar for most of the time period. Visible exceptions with some convergence of averages occurred during the reform years 1996–1998 and 2003 (see also Fig. 1).[16]

5 Results

5.1 Main results

Table 2 shows results for two regressions where $t = 1995, \ldots, 1998$. We restrict our main analysis to the reform period as we expect municipalities to react instantaneously to changes in applicable standard tax multipliers. Specification *I* contains baseline results for a regression without any control variables apart from the usual municipal and year fixed effects. The regression displayed in specification *II* includes income tax shares, GDP and disposable income of private households, surface area and the number of employees at place of work (each per capita) as additional controls. In line with our expectations, the interaction terms $\mathrm{TG}_i \times \mathrm{TP}_t$, $t = 1996, \ldots, 1998$, between treatment group and treatment point dummies are highly significant with positive estimated coefficients in both regression specifications. According to the baseline specification, business tax multipliers of small municipalities were about 3.7 % points higher in 1996 than in 1995 ($\delta_{1996} = 3.694$), c.p. They rose by another 5.7 percentage points in the following year ($\delta_{1997} - \delta_{1996} = 5.712$). A smaller adjustment of about 2.6 % points took place in 1998, the final year of the reform ($\delta_{1998} - \delta_{1997} = 2.641$). Given the annual increase of the standard tax multiplier of 10 % points, the degree of adjustment of small municipalities' tax multipliers is remarkable.

Adding time-variant controls slightly affects the coefficients of interest (specification *II*). Per capita income tax shares and GDP each turn out to be individually

[16] As mentioned above, there was another reform in 2003. The incentive effect was stronger for the group of "small" municipalities due to their lower business tax multipliers.

Table 2 Regression results

	I Baseline	II With controls
Treatment group ×1996	3.694***	3.527***
	(0.755)	(1.077)
Treatment group ×1997	9.406***	6.772***
	(1.974)	(2.296)
Treatment group ×1998	12.047***	8.471***
	(2.321)	(2.883)
Income tax share p.c. (1000 EUR)		92.080**
		(41.175)
GDP p.c. (1000 EUR)		−1.479*
		(0.765)
Inc. of priv. households p.c. (1000 EUR)		4.056
		(3.661)
Surface area p.c. (ha)		−54.038
		(44.459)
Employees p.c.		48.119
		(33.958)
N	1584	1584
R^2	0.498	0.512

Fixed effects estimates based on Eq. (11). Balanced panel of all 396 municipalities for the period 1995–1998. Dependent variable: business tax multiplier (municipal level). Independent variables of interest: interaction terms between treatment group and treatment points. Treatment group: "small" municipalities, whose standard tax multiplier was increased in three equal steps between 1996 and 1998. Control group: "big" municipalities, whose standard tax multiplier was not affected by the reform. Treatment points: 1996, 1997 and 1998. Base year: 1995. Base group: control group. Both specifications control for municipal and year fixed effects. Specification *II* additionally controls for income of private households p.c., GDP p.c. (county level) and surface area p.c., income tax share p.c., employees p.c. (municipal level). Standard errors in parentheses are clustered by county. Significance levels: * 0.10; ** 0.05; *** 0.01

significant covariates. Per capita disposable income of private households, surface area and employees at place of employment are jointly significant with the remaining controls and further improve the goodness of fit as measured by the R^2. The results of specification *II* support the general magnitude and the direction of the reform effect. However, they also suggest that the development of business tax multipliers is affected by time-variant factors aside from the reform. We expect the common trend between treatment and control groups to hold conditional on these time-varying factors. Our results are stable across all tested model specifications.[17]

[17] Further potential controls were tested (e.g., debt p.c. and employees p.c.), but were not significant and did not improve goodness of fit.

5.2 Robustness checks

To validate our results, we perform equivalent regressions using the full dataset where t runs from 1987 to 2002 and corresponding interactions terms $\mathrm{TG}_i \times \mathrm{TP}_t$, $t = 1987, \ldots, 1994, 1996, \ldots, 2002$ and year fixed effects are added. Specification *III* of Table 3 shows the results of such a regression without any further control variables.

The coefficients of interest, δ_t, belonging to this regression are also illustrated in Fig. 3. Importantly, the interaction terms $\mathrm{TG}_i \times \mathrm{TP}_t$, $t = 1987, \ldots, 1994$ belonging to the pre-reform period are all individually and jointly statistically insignificant. In contrast, the interaction terms $\mathrm{TG}_i \times \mathrm{TP}_t$, $t = 1996, \ldots, 2002$ of the reform and post-reform period are all highly significant with positive coefficients, indicating an upward shift of business tax multipliers triggered by the reform. The estimated adjustment during the reform years 1996 to 1998 is exactly the same as in specification *I* of Table 2. In the years following the reform, estimated coefficients δ_{1999} to δ_{2002} remain fairly stable. This lends support to the notion of an immediate response to each annual change of the standard tax multiplier.[18] Due to limitations in data availability (see Sect. 4.2), a regression using pre-reform data and a set of control variables is not possible. However, the analysis can be extended to post-reform years. This is done in specification *IV* of Table 3 where t runs from 1995 to 2002 and per capita income tax shares, GDP, disposable income, surface area and employees again have been included as control variables. Again, the reform effects are significant and their magnitude and direction are in line with our expectations.

As an additional robustness check, we rerun specifications *I* and *II* of Table 2, this time excluding municipalities that were abundant, i.e., did not receive any equalization transfers, at any point between 1995 and 1998. This reduces the number of municipalities in the treatment group to 316. There are 19 municipalities left in the control group. Municipalities that did not benefit from equalization transfers presumably faced weaker incentives to raise their tax multipliers following the increase in their standard tax multiplier. Some incentive effect remains as it is very hard, if not impossible, for most municipalities to predict whether their fiscal capacity might exceed their fiscal need in a given year. Nonetheless, we expect the estimated treatment effect to be stronger than in our baseline specification.

Table 4 shows the corresponding regression results. The estimated treatment effect is very similar and slightly more pronounced than in our baseline specifications, confirming our expectations.

5.3 Extension

Lastly, we adapt our model to test if "small" muncipalities' reactions to the reform differed systematically depending on their pre-reform business tax multipliers. We expect

[18] The slightly higher coefficients in 2001 and in 2002 might be due to anticipating reactions to the 2003 reform.

Table 3 Regressions results (extended time period)

	III Pre- and post-reform	IV Post-reform
Treatment group × 1987	−1.927	
	(5.167)	
Treatment group × 1988	−3.782	
	(3.762)	
Treatment group × 1989	−4.001	
	(3.457)	
Treatment group × 1990	−3.808	
	(3.081)	
Treatment group × 1991	−0.347	
	(2.955)	
Treatment group × 1992	0.089	
	(2.343)	
Treatment group × 1993	−0.402	
	(2.138)	
Treatment group × 1994	0.888	
	(1.715)	
Treatment group × 1996	3.694***	3.533***
	(0.755)	(0.879)
Treatment group × 1997	9.406***	7.578***
	(1.975)	(1.940)
Treatment group × 1998	12.047***	10.291***
	(2.323)	(2.298)
Treatment group × 1999	12.387***	11.092***
	(2.383)	(2.457)
Treatment group × 2000	12.035***	9.824***
	(2.398)	(2.611)
Treatment group × 2001	14.203***	11.754***
	(2.416)	(2.777)
Treatment group × 2002	14.916***	12.554***
	(2.562)	(2.927)
Income tax share p.c. (1000 EUR)		100.505***
		(31.279)
GDP p.c. (1000 EUR)		−0.418
		(0.409)
Inc. of priv. households p.c. (1000 EUR)		1.269
		(1.755)
Surface area p.c. (ha)		−15.049
		(24.808)

Table 3 continued

	III Pre- and post-reform	IV Post-reform
Employees p.c.		25.773*
		(15.359)
N	6336	3168
R^2	0.760	0.551

Specification *III* and *IV* are based on a balanced panel of all 396 municipalities for the period 1987–2002 and 1995–2002, respectively. Dependent variable: business tax multiplier (municipal level). Independent variables of interest: interaction terms between treatment group and treatment points. Treatment group: "small" municipalities, whose standard tax multiplier was increased in three equal steps between 1996 and 1998. Control group: "big" municipalities, whose standard tax multiplier was not affected by the reform. Treatment points: 1987–1994 (only specification *III*), 1996–2002. Base year: 1995. Base group: control group. Both specifications control for municipal and year fixed effects. Specification *IV* additionally controls for income of private households p.c., GDP p.c. (county level) and surface area p.c., income tax share p.c., employees p.c. (municipal level). Standard errors in parentheses are clustered by county. Significance levels: * 0.10; ** 0.05; *** 0.01

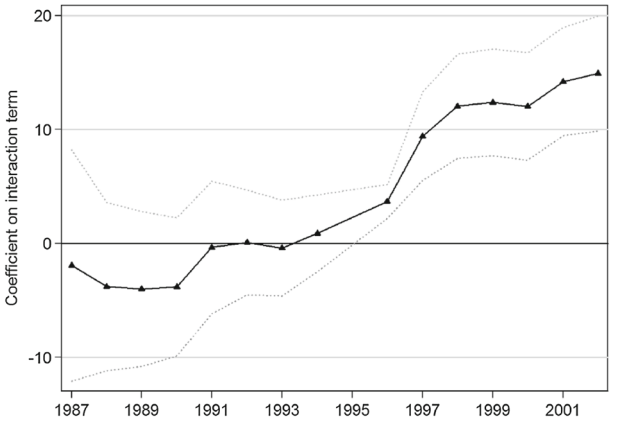

Fig. 3 Coefficients on interaction terms. *Notes Dotted lines mark* 95 % confidence intervals around point estimates.
Source: IT.NRW, own calculations

to find a more pronounced effect for "small" municipalities with a "low" pre-reform business tax multiplier. We operationalize these considerations by distinguishing two groups within our original treatment group: Treatment group 1 consists of the 217 "small" municipalities whose business tax multiplier was smaller than 380 in 1995 ($TG1_i = 1$ if population $\leq 150{,}000$ and $m_{i,1995} < 380$ and 0 otherwise). Treatment group 2 refers to the 158 "small" municipalities with business tax multipliers greater than or equal to 380 in 1995 ($TG2_i = 1$ if population $\leq 150{,}000$ and $m_{1995} \geq 380$ and 0 otherwise). The corresponding interaction terms are defined as $TG1_i \times TP_t$ and $TG2_i \times TP_t$, $t = 1996, \ldots, 1998$. We estimate the following regression equation with

Table 4 Regression results (excluding abundant municipalities)

	V Baseline	VI With controls
Treatment group × 1996	3.695***	3.386***
	(0.847)	(1.179)
Treatment group × 1997	10.227***	7.325***
	(2.151)	(2.361)
Treatment group × 1998	12.921***	9.024***
	(2.526)	(2.872)
Income tax share p.c. (1000 EUR)		85.131*
		(49.956)
GDP p.c. (1000 EUR)		−1.337
		(0.824)
Inc. of priv. households p.c. (1000 EUR)		6.250*
		(3.517)
Surface area p.c. (ha)		−36.957
		(39.868)
Employees p.c.		47.738
		(33.627)
N	1340	1340
R^2	0.535	0.553

Fixed effects estimates based on Eq. (11). Balanced panel of 335 municipalities which received transfers in all years from 1995 to 1998, for the period 1995 to 1998. Dependent variable: business tax multiplier (municipal level). Independent variables of interest: interaction terms between treatment group and treatment points. Treatment group: "small" municipalities, whose standard tax multiplier was increased in three equal steps between 1996 and 1998. Control group: "big" municipalities, whose standard tax multiplier was not affected by the reform. Treatment points: 1996, 1997 and 1998. Base year: 1995. Base group: control group. Both specifications control for municipal and year fixed effects. Specification *VI* additionally controls for income of private households p.c., GDP p.c. (county level) and surface area p.c., income tax share p.c., employees p.c. (municipal level). Standard errors in parentheses are clustered by county. Significance levels: * 0.10; ** 0.05; *** 0.01

$t = 1995, \ldots, 1998$:

$$m_{i,t} = \alpha_1 \mathrm{TG1}_i + \alpha_2 \mathrm{TG2}_i + \sum_{t=1996}^{1998} \delta_{1,t}\, \mathrm{TG1}_i \times \mathrm{TP}_t + \sum_{t=1996}^{1998} \delta_{2,t}\, \mathrm{TG2}_i \times \mathrm{TP}_t + \beta \mathbf{X_{i,t}} + \theta \mathbf{Z_{c,t}} + \lambda_i + \Phi_t + \varepsilon_{i,t} \quad (12)$$

Table 5 shows the results for differentiated treatment groups, with specification *V* displaying the regression without controls (except for the usual municipal and year fixed effects) and specification *VI* including the same time-variant controls as specifications *II* and *IV*.

In line with our expectations, we find a much stronger reform effect on the business tax multipliers of treatment group 1 than on those of treatment group 2.

Table 5 Regression results (two treatment groups)

	V Two treatment groups	VI With controls
Treatment group (1) × 1996	4.095***	4.782***
	(1.046)	(1.339)
Treatment group (2) × 1996	3.144***	3.360***
	(0.897)	(0.961)
Treatment group (1) × 1997	13.375***	14.279***
	(2.113)	(2.588)
Treatment group (2) × 1997	3.956*	3.945*
	(2.080)	(2.282)
Treatment group (1) × 1998	17.284***	16.836***
	(2.209)	(2.815)
Treatment group (2) × 1998	4.855*	3.811
	(2.525)	(2.844)
Employees p.c.		43.035
		(28.682)
Income tax share p.c. (1000 EUR)		−56.122
		(42.267)
GDP p.c. (1000 EUR)		−1.436**
		(0.606)
Inc. of priv. households p.c. (1000 EUR)		2.603
		(2.663)
Surface area p.c. (ha)		20.049
		(42.173)
N	1584	1584
R^2	0.560	0.565

Fixed effects estimates based on Eq. (12). Balanced panel of all 396 municipalities for the period 1995 to 1998. Dependent variable: business tax multiplier (municipal level). Independent variables of interest: interaction terms between treatment groups and treatment points. Treatment group 1: "small" municipalities whose business tax multiplier was smaller than 380 in 1995 and whose standard tax multiplier was increased in three equal steps between 1996 and 1998. Treatment group 2: "small" municipalities whose business tax multiplier was greater than or equal to 380 in 1995 and whose standard tax multiplier was increased in three equal steps between 1996 and 1998. Control group: "big" municipalities, whose standard tax multiplier was not affected by the reform. Treatment points: 1996, 1997 and 1998. Base year: 1995. Base group: control group. Both specifications control for municipal and year fixed effects. Specification *VI* additionally controls for income of private households p.c., GDP p.c. (county level) and surface area p.c., income tax share p.c., employees p.c. (municipal level). Standard errors in parentheses are clustered by county. Significance levels: * 0.10; ** 0.05; *** 0.01

All interaction terms between treatment group 1 and treatment point dummies are highly statistically significant with positive estimated coefficients $\delta_{1,t}$. The magnitude of the total effect for treatment group 1 pinpoints the strength of the effect triggered by the reform (specification V: $\delta_{1,996} + \delta_{1,1997} + \delta_{1,1998} = 47.943$). Apparently, municipalities in treatment group 1 used the reform as an opportunity

to raise business tax multipliers even beyond the 30 percentage point increase of the reform.

The size of the estimated coefficient on the interaction term between treatment group 1 and treatment point 1996 is rather low and close to the one of treatment group 2 (specification V: $\delta_{1,1996} - \delta_{2,1996} = 0.951$). This is not the case in 1997 and 1998: According to specification V, the business tax multipliers of treatment group 1 were about 13.4 % points higher in 1997 than in 1995 ($\delta_{1,1997} = 13.375$) and continued rising in 1998 ($\delta_{1,1998} = 17.284$).

In contrast, the estimated effects of the interaction terms between treatment group 2 and the treatment point dummies are rather stable ($\delta_{2,1996} = 3.144$, $\delta_{2,1997} = 3.956$ and $\delta_{2,1998} = 4.855$). Moreover, statistical significance of treatment group 2's interaction terms is low compared with those of treatment group 1 and in case of $\delta_{2,1998}$ depends on the specification used.

In summary, we find that the rise of the standard business tax multiplier had an effect on the business tax multipliers of all "small" municipalities, but this effect was particularly strong for municipalities with a "low" pre-reform business tax multiplier (i.e., pre-reform business tax multiplier below post-reform standard tax multiplier).

6 Conclusion

Conventional economic wisdom suggests that decentralized business taxation and a common pool of equalization transfers among local jurisdictions should lead to a race to the bottom in local business tax rates. In practice, however, a simple institutional device, standard tax multipliers, is used to counteract downward pressure on municipal tax rates and tax effort. Standard tax multipliers are employed in fiscal equalization schemes in all German territorial states to assess a municipality's fiscal capacity independently of its actual tax multiplier.

Using the case of North Rhine-Westphalia in the mid-1990s, this paper empirically analyzes the impact of standard business tax multipliers on municipal business tax policy. The results show that upward shifts in standard business tax multipliers lead to immediate upward adjustments in actual business tax multipliers. This is true for all affected municipalities. The reaction is more pronounced for municipalities whose business tax multipliers are below post-reform standard tax multipliers. The findings are robust to a number of alternative specifications. They also reflect the positive incentive effect derived from theoretical considerations.

Our results have important implications for the practical design of fiscal equalization schemes. They highlight the importance of the parameters of equalization systems for shaping local tax policy. Through its choice of the standard tax multiplier, a state can influence the level of municipal tax rates and the weight of competitive downward forces. Some states choose to set standard tax multipliers that are so low that they have virtually no signaling effect while others induce a race to the top in local taxation through regular adjustments of standard multipliers. This partially explains why there is far greater heterogeneity in business tax multipliers across federal states than within states in Germany.

By consequence, standard tax multipliers should be regarded as a tool for governments to shape lower-level tax policy, with important consequences for their own competitiveness.

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7 Appendix

See Tables 6, 7 and 8.

Table 6 Summary statistics (means) by year, 1987–2002

Year	Business tax multiplier (in %)	Inc. tax share p.c. (1000 EUR)	GDP p.c. (1000 EUR)	Inc. of priv. households p.c. (1000 EUR)	Employees p.c.	Surface area p.c. (ha)
1987	342.737	–	–	–	–	–
1988	348.838	–	–	–	–	–
1989	349.583	–	–	–	–	–
1990	352.146	–	–	–	–	–
1991	356.376	–	–	–	–	–
1992	364.646	0.294	18.849	–	–	0.450
1993	369.182	0.294	–	–	0.266	0.445
1994	371.593	0.296	19.471	–	0.261	0.440
1995	374.801	0.294	20.066	15.480	0.261	0.434
1996	378.775	0.268	20.288	15.686	0.257	0.430
1997	387.518	0.270	20.603	16.018	0.253	0.426
1998	393.114	0.282	20.992	16.339	0.254	0.423
1999	393.912	0.294	21.287	16.647	0.257	0.420
2000	394.530	0.296	21.699	17.204	0.260	0.418
2001	396.346	0.281	21.884	17.923	0.261	0.416
2002	398.449	0.278	22.181	17.866	0.259	0.414
Total	373.284	0.286	20.732	16.645	0.259	0.429

Business tax multiplier, surface area p.c., income tax share p.c., employees p.c. (municipal level) and income of private households p.c., GDP p.c. (county level); number of observations: 396 municipalities p.a

Table 7 Summary statistics (means) for treatment group by year, 1987–2002

Year	Business tax multiplier (in %)	Inc. tax share p.c. (1000 EUR)	GDP p.c. (1000 EUR)	Inc. of priv. households p.c. (1000 EUR)	Employees p.c.	Surface area p.c. (ha)
1987	338.811	–	–	–	–	–
1988	344.813	–	–	–	–	–
1989	345.547	–	–	–	–	–
1990	348.120	–	–	–	–	–
1991	352.533	–	–	–	–	–
1992	360.827	0.291	18.505	–	–	0.472
1993	365.336	0.291	–	–	0.259	0.466
1994	367.816	0.294	19.124	–	0.255	0.461
1995	370.976	0.292	19.690	15.482	0.255	0.455
1996	375.147	0.266	19.935	15.693	0.251	0.451
1997	384.192	0.269	20.239	16.036	0.247	0.447
1998	389.928	0.281	20.604	16.363	0.248	0.444
1999	390.744	0.292	20.899	16.673	0.250	0.440
2000	391.344	0.294	21.289	17.233	0.254	0.438
2001	393.275	0.279	21.471	17.960	0.254	0.436
2002	395.416	0.276	21.755	17.895	0.253	0.435
Total	369.676	0.284	20.351	16.667	0.253	0.450

Business tax multiplier, surface area p.c., income tax share p.c., employees p.c. (municipal level) and income of private households p.c., GDP p.c. (county level); number of observations: 375 “small” municipalities p.a

Table 8 Summary statistics (means) for control group by year, 1987–2002

Year	Business tax multiplier (in %)	Inc. tax share p.c. (1000 EUR)	GDP p.c. (1000 EUR)	Inc. of priv. households p.c. (1000 EUR)	Employees p.c.	Surface area p.c. (ha)
1987	412.857	–	–	–	–	–
1988	420.714	–	–	–	–	–
1989	421.667	–	–	–	–	–
1990	424.048	–	–	–	–	–
1991	425.000	–	–	–	–	–
1992	432.857	0.338	24.986	–	–	0.055
1993	437.857	0.342	–	–	0.382	0.055
1994	439.048	0.334	25.658	–	0.373	0.055
1995	443.095	0.335	26.778	15.444	0.368	0.055
1996	443.571	0.308	26.597	15.554	0.363	0.055
1997	446.905	0.298	27.105	15.704	0.360	0.056
1998	450.000	0.315	27.930	15.915	0.360	0.056
1999	450.476	0.331	28.205	16.189	0.366	0.056
2000	451.429	0.326	29.037	16.692	0.372	0.056
2001	451.190	0.311	29.245	17.260	0.373	0.056
2002	452.619	0.308	29.786	17.344	0.370	0.056
Total	437.708	0.323	27.533	16.263	0.369	0.056

Business tax multiplier, surface area p.c., income tax share p.c., employees p.c. (municipal level) and income of private households p.c., GDP p.c. (county level); number of observations: 21 “big” municipalities p.a

References

Baskaran, T. (2014). Identifying local tax mimicking with administrative borders and a policy reform. *Journal of Public Economics*, *118*, 41–51.

Baskaran, T. (2015). *The revenue and base effects of local tax hikes: Evidence from a quasi-experiment*. Center for European, Governance and Economic Development Research Discussion Papers (257).

Bucovetsky, S., & Smart, M. (2006). The efficiency consequences of local revenue equalization: Tax competition and tax distortions. *Journal of Public Economic Theory*, *8*(1), 119–144.

Büttner, T. (2006). The incentive effect of fiscal equalization transfers on tax policy. *Journal of Public Economics*, *90*(3), 477–497.

Büttner, T., Holm-Hadulla, F., Parsche, R., & Starbatty, C. (2008). Analyse und Weiterentwicklung des Kommunalen Finanzausgleichs in Nordrhein-Westfalen: Gutachten im Auftrag des Innenministeriums des Landes Nordrhein-Westfalen.

Egger, P., Köthenbürger, M., & Smart, M. (2010). Do fiscal transfers alleviate business tax competition? Evidence from Germany. *Journal of Public Economics*, *94*(3–4), 235–246.

Federal Statistical Office. (2014a). Fachserie 14 Reihe 4: Finanzen und Steuern 2013.

Federal Statistical Office. (2014b). Pressemitteilung 109/14 (21.03.2014): Kommunen erzielten im Jahr 2013 einen Überschuss von 1,1 Milliarden Euro.

Federal Statistical Office. (2014c). Realsteueraufkommen und gewogene Durchschnittshebesätze ab 1949 (F 310/37123100).

Goerl, C.-A., Rauch, A., & Thöne, M. (2013). Weiterentwicklung des kommunalen Finanzausgleichs in Nordrhein-Westfalen.

Köthenbürger, M. (2002). Tax competition and fiscal equalization. *International Tax and Public Finance*, *9*, 391–408.

Oates, W. E. (1972). *Fiscal federalism*. New York: Harcourt Brace Jovanovich.

Parsche, R., & Steinherr, M. (1995). Der kommunale Finanzausgleich des Landes Nordrhein-Westfalen: Gutachten im Auftrag des Innenministeriums des Landes Nordrhein-Westfalen.

Raudla, R. (2010). Governing budgetary commons: What can we learn from Elinor Ostrom? *European Journal of Law and Economics*, *30*(3), 201–221.

Smart, M. (2007). Raising taxes through equalization. *Canadian Journal of Economics*, *40*(4), 1188–1212.