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Fiscal Equalization as a Driver of Tax Increases: Empirical Evidence from Germany

Abstract

This paper exploits a recent devolution of tax setting powers in the German federation to study the effects of fiscal equalization on subnational governments' tax policy. Based on an analysis of the system of fiscal equalization transfers, we argue that the redistribution of revenues provides incentives for states to raise rather than to lower their tax rates. The empirical analysis exploits differences in fiscal redistribution among the states and over time. Using a comprehensive simulation model, the paper computes the tax-policy incentives faced by each state over the years and explores their empirical effects on tax policy. The results support significant and substantial effects. Facing full equalization a state is predicted to set the tax rate from the real estate transfer tax about 1.3 percentage points higher than without. Our analysis also shows that the incentive to raise tax rates is proliferated by the equalization system because the states' decisions to raise their tax rates have intensified fiscal redistribution over time.

JEL-Codes: H770, H240, R380.

Keywords: fiscal equalization, tax autonomy, real estate transfer tax.

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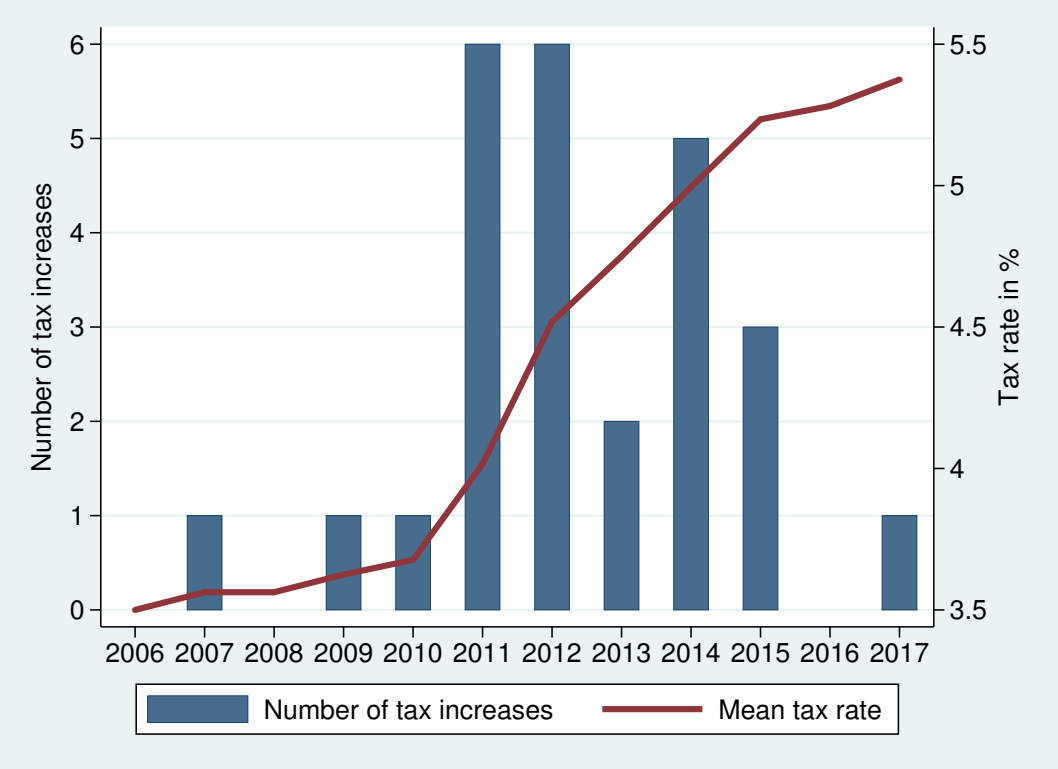
1 Introduction

A key characteristic of federal public finance is the fiscal autonomy of subnational governments. This includes the discretion to decide about expenditures and to impose local taxes. In federations, this autonomy is often combined with equalization transfers ensuring that all subnational governments have sufficient funding to provide a similar level of public good provision. As Boadway (2004, p.212) puts it "...equalization can be seen as necessary counterpart to decentralization, offsetting its tendency to create disparities among regions in the ability to provide public goods and services." However, since fiscal equalization provides jurisdictions with more funds when own revenues decline, fiscal equalization may alter the incentives of subnational governments to raise own source revenues. In particular, receiving states may reduce their own tax effort (*e.g.*, Musgrave, 1961). Yet, depending on how fiscal equalization is designed, it may provide incentives to increase rather than lower taxes (*e.g.*, Smart, 1998).

In a recent reform, the German federation has aimed to strengthen the autonomy of state governments in taxation and assigned the tax rate of the real estate transfer tax (RETT) to the discretion of the states. The system of fiscal equalization was left basically unchanged, however. As depicted in Figure 1, the reform in 2006 had strong effects on tax policy. In the decade following the reform the 16 German states have enacted no less than 26 tax rate increases – no state has lowered its tax rate. Initially, the tax rate was 3.5% on the sales price. In some states, the tax rate has almost doubled; in 2017, the mean tax rate has reached a level of 5.3%.

Figure 1: Real Estate Transfer Tax Rate Increases among the German States



Number of tax rate increases by the 16 German states in the years after the 2006 reform (left axis) and unweighted tax-rate average (right axis) by year. In 2006, all states were required to charge a tax rate of 3.5%. Own calculations.

The economic literature suggests that the RETT is a rather inefficient tax instrument. Because the tax drives a wedge between the buyer's and seller's price, real estate transactions are deterred and matching efficiency on real estate and labor markets is adversely affected (*e.g.*, Lundborg and Skedinger, 1999, Adam *et al.*, 2011, Dachis, Duranton and Turner, 2012). The fact that the states have utilized this distortionary tax instrument so heavily may indicate that they are under substantial revenue stress. As we show in this paper, an alternative explanation is that, rather than simply depressing efforts to raise own source revenues, the combination of tax autonomy and fiscal equalization in

Germany actually provides strong incentives to raise the local tax rates.

The incentives of subnational governments for tax policy are the subject of a large body of economic literature (for surveys see Wilson, 1999, Keen and Konrad, 2013). This literature has emphasized in particular that tax policy of individual governments exerts fiscal externalities on others. If the set of tax instruments is restricted, the resulting tax competition equilibrium is typically characterized by inefficiently low tax rates. The literature has also noted that federal countries have institutions that work in the opposite direction (Keen and Kotsogiannis, 2002). In particular, the literature has pointed to the role of fiscal redistribution (*e.g.*, Smart, 1998, Koethenbuerger, 2002, Bucovetsky and Smart, 2006). The focus is on the incentives of a specific type of fiscal redistribution implemented by the Australian, the Canadian, the German as well as the Swiss federations. These countries feature systems of *fiscal capacity equalization* (FCE), where fiscal transfers are a function of fiscal capacity. The latter is typically defined as a sum of own source revenues, where tax revenues with local discretion are not directly included. Rather revenues from local taxes are standardized to reflect the revenues a state would have collected if the average tax rate were charged on the actual tax base. With fiscal capacity equalization, the adverse impact of a high tax rate on the tax base, which reflects the deadweight loss from taxation, depresses the fiscal capacity of the state. Because this results in higher equalization transfers, states are subject to an incentive to increase the local tax rate and tend to disregard the economic cost of taxation.

The empirical literature on the tax policy incentives of fiscal capacity equalization is relatively scarce. Dahlby and Warren (2003) analyze the effects of fiscal equalization on the incentive of Australian states and territories to raise taxes and note that states that receive more transfers when raising taxes actually tend to impose higher taxes. Evidence for Canada is provided by Smart (2007) who uses an instrumental variable approach to find that tax rates in grant-receiving provinces are higher and more responsive to the tax rate in other provinces. More recently, Ferede (2017) considers the effects of equalization on provincial business and personal income tax rates in Canada. As in Dahlby and Warren (2003), the analysis distinguishes incentives that work through the effects of tax policies on the provincial tax base as well as through the effects on the average (representative) tax rate used to determine fiscal capacity. To identify the effects for grant receiving provinces, Ferede (2017) exploits the discontinuity in the grant allocation formula. The results show that equalization leads to higher tax rates in particular to higher personal income tax rates mainly through its base effects.

Despite the strong fiscal redistribution present in the German federation, there are no papers providing evidence on incentive effects exerted on the German states' tax policy. This is, of course, the consequence of the lack of tax autonomy that characterized German states before the recent reform. Baretti, Huber and Lichtblau (2002) as well as Boenke, Jochimsen and Schroeder (2017) explore effects of fiscal redistribution on tax collection efforts.

Empirical research has also explored effects of redistributive state grants to German mu-

nicipalities (*e.g.*, Buettner, 2006; Egger, Koethenbuerger and Smart, 2010; and Rauch and Hummel, 2016). While this research generally supports causal effects on local tax policy, the mechanism behind the policy response differs from fiscal capacity equalization. As noted by Dahlby and Warren (2003), in systems of fiscal capacity equalization, the degree of redistribution faced by a jurisdiction is endogenous to tax policy. More specifically, the incentive to raise taxes is also determined by the tax policy of other jurisdictions. Therefore, fiscal capacity equalization may exert much stronger effects on tax policy than the grants to municipalities.

This paper contributes to the literature on tax policy effects of fiscal equalization by exploring the tax policy of German states after the recent federal reform. By considering the period following the devolution of tax setting powers, the German case provides ideal conditions to study how the tax policy incentives from equalization affect subnational tax policy and how the incentives are proliferated through the equalization system. In order to measure the specific tax policy incentive faced by each state we implement a detailed simulation model of the equalization system, which comprehensively captures the developments in all states over the observation period. The model provides measures of the degree of fiscal redistribution and the fiscal position of each state over time, which enables us to distinguish income effects associated with equalization from its incentive effects. Since the degree of fiscal redistribution faced by the individual state partly depends on own tax policy and revenues, we employ instrumental variables based on simulations that keep a state's tax rate and its share of the tax base at pre-reform levels.

Controlling for the fiscal position and the associated income effects, the results support a significant and substantial effect of fiscal equalization on a state's tax policy. According to the estimates, with full equalization states set their tax rates from the real estate transfer tax about 1.3 percentage points higher than without. Our analysis also shows that the incentive to raise tax rates is proliferated by the equalization system as each state's decision to raise the tax rate has increased the incentive of other states to raise their taxes as well.

The following section provides an analysis of tax policy under fiscal equalization. Subsequently, in Section 3 the empirical methodology is discussed, and in Section 4 the data is described. Section 5 presents the results. Section 6 concludes.

2 Tax Policy under Fiscal Equalization

This section provides a stylized analysis of optimal tax policy in the presence of fiscal capacity equalization (FCE). For simplicity, the revenues R_i of a state i are assumed to consist of three components

$$R_i = T_i + \tau_i B_i + Z_i.$$

One component is revenue from shared taxes T_i, the second component is revenue from the local tax and the third component is a fiscal transfer.

A capacity based fiscal equalization scheme defines the transfers using a function of the

relative fiscal position S_i of state i

$$Z_i = Z\left(S_i\right), \quad \text{where} \quad Z_i' < 0 \text{ and } \begin{cases} Z_i > 0 & \text{if } S_i < 1 \\ Z_i = 0 & \text{if } S_i = 1 \\ Z_i < 0 & \text{if } S_i > 1. \end{cases}$$

The relative fiscal position is defined as

$$S_i = \frac{C_i}{\frac{1}{n}\sum C_j},$$

which relates the fiscal capacity C_i of state i to the average capacity in all n states. Hence, the transfer is positive if capacity is below ($S_i < 1$) and negative if capacity is above average ($S_i > 1$).

In the German case, fiscal capacity is basically defined as

$$C_i = T_i + \overline{\tau} B_i,$$

where T_i is revenue from shared taxes, and $\overline{\tau} B_i$ is standardized revenue from the local real estate transfer tax with B_i denoting the taxable base and $\overline{\tau}$ denoting the weighted average of tax rates

$$\overline{\tau} = \frac{\sum \tau_j B_j}{\sum B_j}. \tag{1}$$

Function Z_i is strictly decreasing in S_i and has zero value at $S_i = 1$. This implies that a state that receives transfers ($S_i < 1, Z_i > 0$), experiences a decrease in transfers if the relative fiscal position S_i increases.[1]

In a purely redistributive system, the sum of transfers $\sum Z_j$ would be equal to zero. In the terminology of Boadway (2004), such a system would be a "net scheme." However, the German federation runs a "gross scheme", where no such constraint is imposed, because resources are transferred from the federal to the state level in order to fund the equalization scheme.[2]

The effect of an increase in the own tax rate on total revenues is

$$\frac{\partial R_i}{\partial \tau_i} = B_i + \tau_i \frac{\partial B_i}{\partial \tau_i} + Z'(S_i) \frac{\partial S_i}{\partial \overline{\tau}} \left(\frac{B_i}{\sum B_i} \right) + Z'(S_i) \frac{\partial S_i}{\partial B_i} \frac{\partial B_i}{\partial \tau_i},$$

where the first two terms reflect direct and indirect effects on own revenues and the other two terms describe the change in transfers due to changes in fiscal capacity S_i. Denoting the tax-rate elasticity of the taxable base with η_i the equation can be simplified to obtain

$$\frac{\partial R_i}{\partial \tau_i} = B_i (1 + \rho_i) - B_i \eta_i (1 - \beta_i). \tag{2}$$

[1] In the German case, the derivative of the function is discontinuous, *i.e.* there exist threshold levels σ such that $\lim_{S_i \to \sigma^-} Z'(S_i) \neq \lim_{S_i \to \sigma^+} Z'(S_i)$. For the discontinuity in the Canadian system see Ferede, 2017.

[2] Depending on how the federal government is funded, a change in federal transfers also has effects on the tax payers in the state. Ultimately, this may also affect tax policy in state i. However, we abstract from those effects in the theoretical analysis.

The effect of fiscal equalization is captured by two parameters: β_i and ρ_i. β_i is a measure of fiscal redistribution of a change in revenues due a change in the tax base. Formally defined as

$$\beta_i = -\left(Z'\left(S_i\right) \frac{\partial S_i}{\partial B_i} / \tau_i \right) > 0, \tag{3}$$

it captures the fraction of an increase in revenues due to a higher tax base that is compensated through transfers. This effect has been dubbed *equalization base effect* (Dahlby and Warren, 2003). Since the relative fiscal position increases with the tax base, $-Z'\left(S_i\right) \frac{\partial S_i}{\partial B_i}$ determines the loss in transfers given an increase in the tax base. Dividing this loss in transfers by the tax rate relates the change in revenues to the direct revenue effect from an increase in the tax base. If β_i is close to zero, a higher tax base has little impact on transfers and the revenue gain from an increase in the tax base is mainly kept by the state. If β_i is close to unity, a higher tax base results in a strong decline in fiscal transfers. In this case, the net revenue impact of an increase in the tax base is small. If β_i exceeds unity, a higher tax base would result in net-revenue losses. While such heavy redistribution seems hard to justify, it can not be ruled out for practical applications. If the state is net contributor ($Z_i < 0$), an increase in the tax base is associated with a higher contribution. In this case β_i measures the extent to which a revenue increase due to a higher tax base is compensated by higher contributions.

With regard to the revenue effect of a tax rate increase in (2), β_i tends to reduce the revenue implication of the adverse effect of higher taxes on the tax base. As a

consequence, the higher β_i, the larger is the revenue gain from higher taxes.

The second parameter characterizing fiscal equalization, ρ_i, is a measure of fiscal redistribution of a change in revenues due to the tax rate at a given tax base. Dahlby and Warren (2003) call this the *equalization rate effect*. Formally defined as

$$\rho_i = \left(Z'\left(S_i\right) \frac{\partial S_i}{\partial \overline{\tau}} \left(\frac{B_i}{\sum B_j} \right) / B_i \right), \tag{4}$$

it captures the fraction of an increase in revenues due to a higher tax rate at a given tax base that is compensated through transfers. The effect of the local tax rate on the average (representative) tax rate at a given tax base is determined by the share in the total tax base $\left(\frac{B_i}{\sum B_j}\right)$. Hence, any increase in the tax rate raises the average tax rate. However, whether this contributes to an increase in the relative fiscal capacity or not depends on the fraction of the standardized tax revenues in fiscal capacity in the state i relative to all other states.[3] The parameter ρ_i scales the effect on transfers with the actual tax base B_i in order to relate the change in revenues from transfers to the "mechanical" revenue effect of an increase in the tax rate.

If ρ_i is close to zero, a higher tax rate has little direct impact on transfers and the mechanical revenue gain from an increase in the tax rate at a given tax base is mainly

[3]Note that

$$\frac{\partial S_i}{\partial \overline{\tau}} = S_i \left[\frac{B_i}{C_i} - \frac{\sum_j B_j}{\sum_j C_j} \right].$$

If states with low fiscal capacity have also a low share of the tax in total capacity, $\frac{\partial S_i}{\partial \overline{\tau}} < 0$. In this case, a state that receives transfers, would see a decline in its fiscal position when the average tax rate rises $\frac{\partial S_i}{\partial \overline{\tau}} < 0$. As this decline triggers more transfers, ρ_i would be positive.

kept by the state. If ρ_i is positive (negative), the net revenue impact of an increase in the tax rate at a given tax base is larger (smaller) than the mechanical revenue gain. Hence, the revenue effect of a tax increase (2) increases with a positive and decreases with a negative ρ_i.

To discuss the implications of fiscal equalization for tax policy we assume that the incidence of RETT is on the local constituency and consider the marginal cost of public funds[4]

$$MCF_i = B_i \left(\frac{\partial R_i}{\partial \tau_i} \right)^{-1} = \frac{1}{(1+\rho_i) - \eta_i (1-\beta_i)}.$$

In the absence of fiscal redistribution, $\beta_i = 0, \rho_i = 0$, the marginal cost of funds is simply an increasing function of the elasticity of the base. With fiscal redistribution, $\beta_i > 0$ and the marginal cost of funds is reduced. This provides an incentive to expand public consumption and to increase tax rates. With $\beta_i = 1$ and $\rho_i = 0$, the marginal cost of funds would be unity. In this case, the tax would effectively be perceived as a lump-sum tax.[5] If $\beta_i > 1$, the marginal cost of funds may even be smaller than unity. If the equalization rate effect ρ_i is positive, the marginal cost of funds declines. This is intuitive since a tax rate increase would then weaken the fiscal position and more fiscal transfers are obtained.

While we have focused on how the equalization transfers that are received or paid by

[4]Note that we discuss the marginal cost of public funds from the perspective of a state government. The perspective of the federation might be different, see Wildasin (1989).

[5]Bucovetsky and Smart (2006) show that with full equalization $\beta_i = 1$, the incentive to engage in horizontal tax competition is eliminated.

a state are affected by the choice of the local tax rate of this state, the transfers also depend on the tax policy decisions in other states. Even if there are no direct tax externalities, such that the tax base in one state is unaffected by the local tax rate in other states $\frac{\partial B_i}{\partial \tau_j} = 0$, other states' tax policies exert effects: the relative fiscal position and the average tax rate both depend on the tax rates and tax bases in all other states. Hence, the parameters ρ_i and β_i vary with tax policy in other states.

3 Empirical Methodology

In the empirical analysis, we consider the states' tax policies after a federal reform that granted the states the right to set the tax rate of the real estate transfer tax (RETT). The analysis exploits the fact that the degree of fiscal redistribution differs among the states and over time.

The empirical analysis focuses on the choice of the RETT tax rate. Basically, it is concerned with the relationship between the tax rate and precise indicators of fiscal equalization. This includes the degree of fiscal redistribution associated with tax base β_i and tax rate ρ_i. Based on the theoretical discussion, we assume that if the degree of fiscal distribution is high, a state is more likely to increase its tax rate. Since the tax policy is required to set the tax rate in advance, state governments base their tax decisions for the upcoming period on the realization of fiscal capacity and on the realized

degree of fiscal redistribution.[6] This suggests to use the following specification

$$\Delta\tau_{i,t+1} = \alpha_i + b_1\beta_{i,t} + b_2\rho_{i,t} + \sum_{j=1}^{p} b_{3,j} S_{i,t}^{p} + \gamma_t + \varepsilon_{i,t}. \tag{5}$$

where α_i is a fixed state effect and γ_t is a fixed time effect for period t. The latter captures common trends in the German federation. b_1 and b_2 capture the effects of fiscal redistribution. In the light of the above analysis, positive coefficients are expected as the marginal cost of funds is reduced when β_i and ρ_i increase.

The identification strategy utilizes the fact that the equalization transfers are formula based and are determined by a smooth function of relative fiscal capacity. By allowing for arbitrary non-linear effects of the assignment variable $S_{i,t}^{p}$, the estimation approach ensures that only differences in the degree of fiscal redistribution conditional on the fiscal position of a state are used to identify the incentive effects of fiscal equalization. Thereby, we make sure that the variation in the degree of fiscal redistribution is not capturing differences in available resources and in the amount of equalization transfers. This is important, since the fiscal equalization transfers received, or paid, exert income effects on tax policy. Without controls for relative fiscal capacity, empirical responses to the indicators of the degree of fiscal redistribution would capture not only the incentive but also these income effects. To allow for slow adjustment in tax policy, we also provide

[6]The first preliminary account of equalization transfers for a budget year is typically published by the Federal Ministry of Finance in January of the next year. Detailed revenues forecasts for the current budget year are available not before the November when the federal forecast of tax revenues for the current year is issued.

results of specifications that condition on the current tax rate.[7]

As shown above, the degree of fiscal redistribution of RETT revenues is partly determined by local tax policies. To avoid potential biases, we employ instrumental variables. The instruments used are measures of the degree of fiscal redistribution $\widehat{\beta}_{i,t}$ and $\widehat{\rho}_{i,t}$ faced by state i in period t computed by counterfactual simulations, *i.e.* based on simulations that keep a state's tax rate and share of the tax base at pre-reform levels. In other words, as instrumental variables we use indicators of the degree of fiscal redistribution that a state would face if it had not used its newly assigned discretion to set the tax rate and, thus, has kept the tax rate at the pre-reform level. To this end, we fix the state i's tax rate at the pre-reform level. Moreover, to avoid capturing indirect tax policy effects on the tax base we also fix the state's share in the total tax base $B_i / \sum B_j$ at the pre-reform level of the year 2006. Thus, the variation in the indicators used as instrumental variables derives from changes in the fiscal equalization system independent of the tax policy in the respective state. Since we condition on the relative fiscal capacity $S^p_{i,t}$, income effects from fiscal equalization are captured, and the instrumental variable should not exert any separate influence on tax policy, *i.e.* the exclusion restriction is unlikely to be violated.

[7]Since the dimension of the data covers a limited time-period, accurate estimation of the adjustment speed may be difficult due to the Nickell (1981) bias. Since also the cross-sectional dimension is limited, however, we decided against using GMM methods that rely on large n asymptotics.

4 Data

The empirical analysis examines the choice of the tax rate under fiscal capacity equalization. It explores how German states responded with their tax rates after they received the right to set the tax rate of the RETT and, in particular, whether the tax policy response differs depending on the tax policy incentives associated with fiscal capacity equalization as discussed in the Section 2. The analysis explores the tax policy decisions of the states in the period from 2007 to 2017.[8] To identify differences in fiscal equalization we exploit the institutional details of fiscal equalization among German states. Therefore, the next subsection provides a brief discussion of fiscal equalization. Subsequently, descriptive statistics on tax rates and indicators of tax policy incentives are provided.

4.1 Fiscal Equalization in Germany

The German system of fiscal equalization consists of different stages of vertical and horizontal distribution of funds. The first stage involves the distribution of VAT revenue shared between the federal and the state governments. The states' share is distributed mainly according to population size but a fraction is used to provide funds to states with low fiscal capacity, *i.e.* to states with own tax revenues below average. At this stage, fiscal capacity is calculated without VAT revenues. The second stage consists

[8]The observation period covers 26 tax-rate changes. In 2018, no state has changed the tax rate.

of a horizontal redistribution scheme with transfers paid to states with fiscal capacity (including VAT) below fiscal need and contributions made by states with fiscal capacity above fiscal need. The latter is the population-weighted average of fiscal capacity across states. The third stage uses the same measure of fiscal capacity and provides further vertical transfers by the federal government to states with fiscal capacity below fiscal need.

At all stages, real estate transfer taxes are accounted for. Rather than using the revenues directly, the equalization system uses standardized tax revenues for its definition of fiscal capacity. The standardization involves applying the average tax rate, which is the weighted average of actual tax rates (see equation (1)), to the tax base of the real estate transfer tax. Despite the massive tax rate increases, the share of standardized revenues from the RETT in the states' aggregate fiscal capacity amounts to less than 5% (2016).

Using data for 2016, Figure 2 reports the indicator of fiscal capacity relative to fiscal need (S_i) and the resulting level of transfers in per-capita terms. As the figure shows, transfers are a decreasing function of relative fiscal capacity. The relationship between transfers and fiscal capacity is obviously non-linear. Three segments can be distinguished. A first segment shows high transfers and a limited degree of fiscal redistribution. An intermediate segment displays a stronger degree of redistribution and medium level of transfers. States with capacity above average fall in a third segment. It comprises states providing net contributions.

To compute indicators of the degrees of fiscal redistribution, we simulate the fiscal equal-

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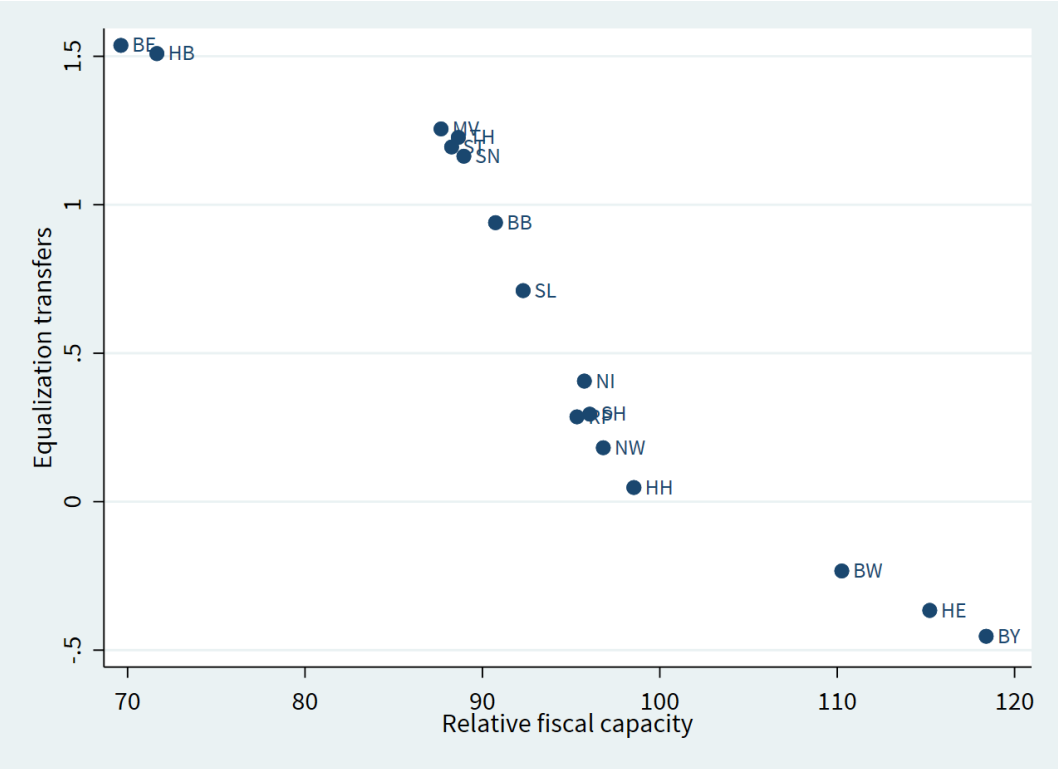
Figure 2: Equalization Transfers and Relative Fiscal Capacity



Equalization transfers in 1,000 Euro per capita. This includes the distribution of the VAT share (*Ergaenzungsanteile*) at the first stage, the horizontal transfer (*Ausgleichszuweisungen/Ausgleichsbeitraege*) at the second stage, as well as the federal transfers (*Allgemeine Bundesergaenzungszuweisungen*) at the third stage of fiscal equalization. Relative fiscal capacity is the fiscal capacity in % of fiscal need according to the second stage of the fiscal equalization system. Own computations based on data for 2016.

BW = Baden-Wuerttemberg, BY = Bavaria, BE = Berlin, BB = Brandenburg, HB = Bremen, HH = Hamburg, HE = Hesse, MV = Mecklenburg-West Pomerania, NI = Lower Saxony, NW = North Rhine-Westphalia, RP = Rhineland-Palatinate, SL = Saarland, SN = Saxony, ST = Saxony-Anhalt, SH = Schleswig-Holstein, TH = Thuringia

ization scheme based on the full account of the various tax revenues collected by each of the states in each year. All three stages of fiscal equalization are taken into account. In terms of the above stylized model of fiscal equalization, the simulations provide us with values for β_i and ρ_i for each state in each year. To compute β_i we consider the effect of a shock to the tax base of a single state i on the transfers received by this state. The shock is scaled such as to generate a tax revenue increase by 1 Million Euro at the average tax rate. ρ_i is obtained by considering the effects of a change in the tax rate of state i by 1 percentage point.

Table 1 provides degrees of fiscal redistribution and other indicators by state in 2006 and 2016, at beginning and end of the observation period, ordered by groups of states and population size. Columns (1) and (2) depict the population share and the relative fiscal capacity in 2016. Columns (3) and (4) show the tax rates in 2006 and 2016 of the respective state. Column (5) reports the degree of fiscal redistribution of a change in revenues due to the tax base (β_i) based on the tax revenues in 2006, *i.e.* before the federal reform. It displays marked variation in several dimensions. The majority of small states (Saxony, Rhineland-Palatinate, Berlin, Schleswig-Holstein, Brandenburg, Saxony-Anhalt, Thuringia, Mecklenburg-West Pomerania, Saarland, Bremen) has also low fiscal capacity. For these states, the degree of fiscal redistribution (β_i) is quite high in 2006. In all these cases, it shows figures above 0.9. This indicates that a shock in the tax base of the real estate transfer tax generating a Euro of additional tax revenues results in an increase of funds net of redistribution by less than 10 cents. 90 cents

Table 1: Fiscal Redistribution by State in 2006 and 2016

					Fiscal Equalization			
	Popul. share	Rel.fiscal capacity (S_i)	Tax rate (τ_i)		Base effect (β_i)		Rate effect (ρ_i)	
Year	2016	2016	2006	2016	2006	2016	2006	2016
State	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Saxony	4.97	88.95	3.5	3.5	0.95	1.40	-0.02	-0.01
Rhineland-Palatinate	4.93	95.33	3.5	5.0	0.95	0.98	-0.01	-0.01
Berlin	4.28	69.62	3.5	6.0	0.94	0.81	0.03	0.02
Schleswig-Holstein	3.48	96.05	3.5	6.5	0.96	0.76	0.01	0.00
Brandenburg	3.02	90.74	3.5	6.5	0.97	0.78	-0.01	-0.01
Saxony-Anhalt	2.73	88.26	3.5	5.0	0.95	1.00	-0.01	-0.01
Thuringia	2.64	88.64	3.5	5.0	0.97	1.00	-0.02	-0.02
Meckl.-West Pomerania	1.96	87.67	3.5	5.0	0.98	1.01	-0.01	-0.00
Saarland	1.21	92.29	3.5	6.5	0.98	0.78	-0.00	-0.00
Bremen	0.82	71.65	3.5	5.0	0.93	1.02	-0.00	-0.00
Bavaria	15.63	118.39	3.5	3.5	0.61	0.86	0.01	0.04
Baden-Wuerttemberg	13.24	110.25	3.5	5.0	0.63	0.63	0.00	0.00
Hesse	7.52	115.21	3.5	6.0	0.68	0.56	0.02	0.01
North Rhine-Westphalia	21.74	96.81	3.5	6.5	0.42	0.62	0.01	-0.02
Lower Saxony	9.65	95.75	3.5	5.0	0.89	0.93	-0.02	-0.02
Hamburg	2.18	98.54	3.5	4.5	0.72	0.99	0.01	0.01

Population share and fiscal position (relative fiscal capacity) in % obtained from the announcements of the fiscal equalization account of the Federal Ministry of Finance. Relative fiscal capacity defined as fiscal capacity (*Finanzkraftmesszahl*) relative to fiscal need (*Ausgleichsmesszahl*) in %. Tax rates obtained from state announcements. Degree of fiscal redistribution β_i for a state-specific shock in the tax base of the RETT (see equation 3) obtained by own simulation analysis. Degree of fiscal redistribution ρ_i for a state-specific shock in the tax rate of the RETT (see equation 4) obtained by own simulation analysis.

are compensated by a reduction in equalization transfers. A second group of states is relatively large and shows high levels of fiscal capacity (Bavaria, Baden-Wuerttemberg, Hesse). For these states the degree of fiscal redistribution is much lower showing figures below 0.7, indicating that a shock in the tax base of the real estate transfer tax generating a Euro of additional tax revenue results in an increase of funds net of redistribution by more than 30 cents. A last group of states either is relatively large or has large fiscal capacity (North Rhine-Westphalia, Lower Saxony, Hamburg). Here the degree of fiscal redistribution varies but is lower than for the first group.

The figures for 2016 look much different (see Column (6)). Though the system of fiscal equalization is the same, for some states β_i has increased, for others it has declined. It seems that the changes are mainly the consequence of changes in tax rates. States that have increased their tax rate the most, such as Berlin, Brandenburg and Saarland, face a decline in fiscal redistribution relative to 2006. The two states that have not increased their tax rate experience an increase in the degree of fiscal redistribution (Saxony and Bavaria). Most notably in Saxony the degree of fiscal redistribution is above 1 in 2016. With a degree of fiscal redistribution of about 1.40, the state loses transfers for each Euro of additional tax revenues in an amount of 1.40 Euro. Hence, at the margin, the state's revenues decline by 40 cents with every additional Euro of revenues from the real estate transfer tax. This extreme level of redistribution[9] is not observed for any other state in 2016. However, Bremen and Mecklenburg-West Pomerania also show degrees of

[9]The fact that there is more than 100% redistribution has been noted in the German debate, see, for instance, Boysen-Hogrefe (2017) and Buettner and Krause (2018).

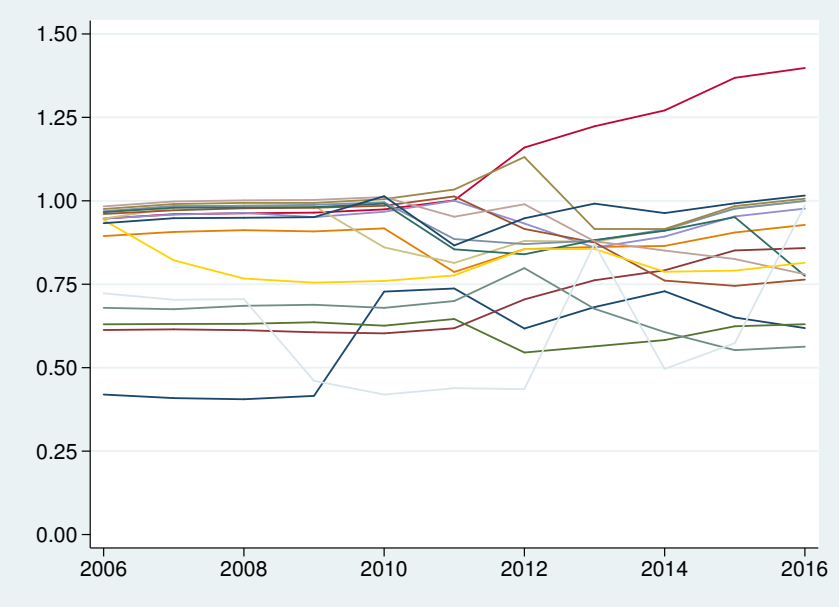
fiscal redistribution above 1.

Columns (7) and (8) report the degree of fiscal redistribution of a change in revenues due to the tax rate (given the tax base) (ρ_i) based on data for 2006 and 2016. It shows little variation and is in most cases very close to zero. This indicates that the fiscal redistribution of the mechanical revenue effects from a tax rate change is very small. Hence, the equalization rate effect is unimportant in the case of the German RETT.

Figure 3 depicts the evolution of the degree of fiscal redistribution of tax base effects over time. The figure reports the actual degree of fiscal redistribution of revenue effects of a shock in the tax base. Accordingly, in 2006 the degree of redistribution of a tax-base shock varies between 0.4 and 1, and the mean and the variance of the degree of fiscal redistribution tend to increase over time.

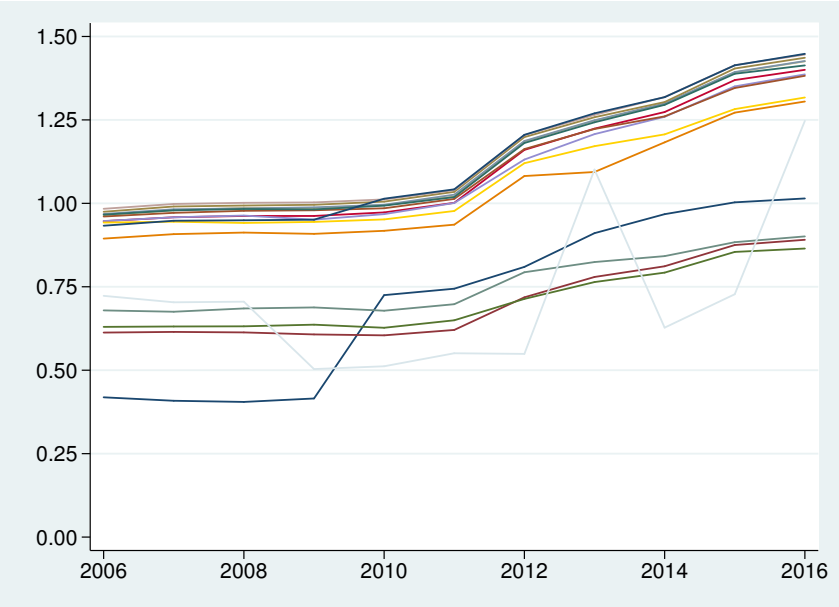
While the actual degree of redistribution is affected by the own choice of the tax rate, Figure 4 reports the development based on the counterfactual simulations. These simulations are based on the assumption that the tax rate and the share in the tax base of the state under consideration have stayed constant at the pre-reform level. The distribution shows less fluctuations, but the degree of fiscal redistribution shows a clear positive trend for all states. During the observation period, if a state had not changed its tax rate, the degree of fiscal redistribution of tax base effects for this state has, on average, grown by about a third.

Figure 3: Degree of Fiscal Redistribution (tax base β)



Degree of fiscal redistribution of changes in revenues due to tax base changes $\beta_{i,t}$ for a state-specific shock in the tax base of the RETT (see equation 3) obtained by own simulation analysis. The data points for 2006 and 2016 are reported in Table 1.

Figure 4: Degree of Fiscal Redistribution (tax base β), counterfactual simulations



Degree of fiscal redistribution of changes in revenues due to tax base changes for a state-specific shock in the tax base of the RETT (see equation 3) obtained by a simulations computed under the counterfactual assumption that tax rate and share of the tax base of the state under consideration have stayed constant at pre-reform levels.

Table 2: Descriptive Statistics

Variables	Obs.	Mean	Std.Dev.	Min	Max
Tax rate	176	4.247	.8900	3.5	6.5
Degree of fiscal redistribution (tax base β)	176	.8450	.1801	.4054	1.398
Counterfactual simulation	176	.9925	.2500	.4050	1.448
Degree of fiscal redistribution (tax rate ρ)	176	-.0009	.0147	-.0247	.0431
Counterfactual simulation	176	-.0006	.0132	-.0211	.0261
Relative fiscal capacity	176	94.07	13.12	67.13	124.3
Relative fiscal capacity (excl.VAT)	176	1.384	.5317	.4986	2.955
Population size (in Mill.)	176	5.10	4.69	0.65	18.03
Public debt (in 1,000 Euro per capita)	176	9.607	6.614	1.587	35.34

Tax rate of the real estate transfer tax across the 16 German states in %. Tax rates obtained from state announcements. Degree of fiscal redistribution β for a state-specific shock in the tax base of the RETT (see equation 3) obtained by own simulation analysis. Degree of fiscal redistribution ρ for a state-specific shock in the tax rate of the RETT (see equation 4) obtained by own simulation analysis. Relative fiscal capacity defined as fiscal capacity (*Finanzkraftmesszahl*) relative to fiscal need (*Ausgleichsmesszahl*) in %.

4.2 Descriptive Statistics

Table 2 provides descriptive statistics for the tax rates and the two key variables of interest, *i.e.* the degrees of fiscal redistribution with regard to the tax base and the tax rate, as well as for control variables. The latter group includes the indicator of relative fiscal capacity and population size. The table also includes indicators for the relative tax capacity excluding VAT, which is used in the first-stage of fiscal equalization. It is included in the subsequent analysis since the first-stage of the equalization scheme exerts separate income effects.

5 Results

Results from a basic set of OLS regressions are provided in Table 3. Given the very small degree of redistribution of revenue effects from tax rate changes (ρ_i), it focuses on the redistribution of the tax base. The first specification includes only the degree of fiscal redistribution (β_i). It shows a significant positive effect. The next three specifications include indicators of the assignment variable, *i.e.* of relative fiscal capacity. Even though the higher-order terms improve the fit of the regression, the degree of fiscal redistribution exerts a similar effect on the tax policy. According to specifications (5) to (7) the positive effect of fiscal redistribution is robust against inclusion of relative fiscal capacity excluding VAT – an indicator that captures assignment in the first-stage of equalization. In order to allow for some adjustment in the tax rate in the first years after the devolution of the right to set the own tax rate, Column (8) adds the current level of the tax rate. Hence, this specification considers tax policy for the upcoming period, conditional on the current choice of the tax rate. With this control added, the degree of fiscal redistribution is still found to exert a significant positive effect, but the effects turns out to be smaller. This supports the view that the effect of the actual degree of fiscal redistribution is confounded by the current tax policy.

Results from IV estimates are provided in Table 4. The estimations employ a measure of the degree of fiscal redistribution ($\widehat{\beta}_i$) as an instrumental variable that is based on counterfactual simulations. It captures the degree of redistribution faced by a state if its tax rate and its share of its tax base had stayed unchanged at pre-reform levels.

Table 3: OLS Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Degree of fiscal redistribution (tax base β)	1.208***	1.211***	1.268***	1.298**	1.207***	1.264**	1.413***	0.935*
	(0.363)	(0.364)	(0.429)	(0.444)	(0.376)	(0.453)	(0.444)	(0.455)
Relative fiscal capacity		-0.002	0.245	-0.997	-0.003	0.242	-1.110	-1.003
		(0.019)	(0.149)	(0.662)	(0.023)	(0.168)	(1.013)	(1.068)
Relative fiscal capacity (sq.)			-0.001*	0.011		-0.001	0.013	0.012
			(0.001)	(0.007)		(0.001)	(0.010)	(0.010)
Relative fiscal capacity (cub.)				-0.000*			-0.000	-0.000
				(0.000)			(0.000)	(0.000)
Relative fiscal capacity (excl.VAT)					0.049	0.073	-1.018	-1.447
					(0.411)	(1.143)	(1.528)	(1.557)
Relative fiscal capacity (excl.VAT) (sq.)						-0.004	0.990*	1.212*
						(0.157)	(0.514)	(0.571)
Relative fiscal capacity (excl.VAT) (cub.)							-0.211**	-0.258**
							(0.095)	(0.108)
Tax-rate								-0.145**
								(0.067)
Observations	176	176	176	176	176	176	176	176
R-squared (overall)	0.233	0.233	0.250	0.262	0.233	0.251	0.274	0.286

Dependent variable: difference in tax rate of the RETT in % between next and current year. OLS regressions. All specifications include state- and year-fixed effects. Robust standard errors (in parentheses) are clustered by state in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

For all specifications, the first-stage F-statistic for the excluded instrument provided at the bottom of the table indicates that the counterfactual simulation provides a strong predictor of the actual degree of fiscal redistribution. Compared with the OLS results, the results point to somewhat smaller effects of fiscal redistribution on tax policy.

Quantitatively, the point estimate provided by Column (7) suggest that in presence of full fiscal redistribution of tax-base shocks ($\beta = 1$) the tax rate is by about 1.3% percentage points higher compared with a hypothetical situation, where fiscal redistribution is absent $\beta = 0$.

The analysis has focused on the redistribution of tax base effects. The appendix provides results of specifications that also include the indicator of the degree of fiscal redistribution associated with the tax rate effect (see Table A-1). While the above findings are confirmed, no significant effect is found for this second indicator.

Since the estimations condition on the fiscal position of a state, the effect found for fiscal redistribution suggest that the remarkable series of tax increases after the reform in 2006 cannot be explained simply with lack of funds but results from the incentive effect of fiscal redistribution. To test whether fiscal distress associated with the level of public debt may partly explain the tax policy, we have conducted robustness checks where the level of public debt per capita is added as a control (see Table A-2). Even though per-capita debt shows a small positive effect, it turns out to be statistically insignificant and the estimates of the effect of fiscal redistribution shows qualitatively similar effects as above.

Table 4: IV Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Degree of fiscal redistribution (tax base β)	0.897***	0.901***	1.040***	1.086***	0.941***	1.075***	1.305***	1.308***
	(0.333)	(0.333)	(0.354)	(0.392)	(0.292)	(0.309)	(0.385)	(0.409)
Relative fiscal capacity		-0.001	0.236*	-0.970	-0.003	0.238	-1.105	-1.052
		(0.019)	(0.133)	(0.657)	(0.021)	(0.161)	(1.009)	(1.048)
Relative fiscal capacity (sq.)			-0.001*	0.011*		-0.001*	0.013	0.012
			(0.001)	(0.007)		(0.001)	(0.010)	(0.010)
Relative fiscal capacity (cub.)				-0.000*			-0.000	-0.000
				(0.000)			(0.000)	(0.000)
Relative fiscal capacity (excl.VAT)					0.105	0.065	-0.914	-1.468
					(0.367)	(1.136)	(1.667)	(1.538)
Relative fiscal capacity (excl.VAT) (sq.)						0.004	0.924	1.245**
						(0.156)	(0.667)	(0.573)
Relative fiscal capacity (excl.VAT) (cub.)							-0.197	-0.265**
							(0.129)	(0.109)
Tax-rate								-0.090
								(0.105)
Observations	176	176	176	176	176	176	176	176
F-statistic (1st.-stage, excl. instr. β)	22.17	19.72	16.63	16.44	86.95	76.56	53.04	50.48

Dependent variable: difference of tax rate of the RETT in % between next and current period. Instrumental variable estimation results based on a counterfactual measure of redistribution obtained under the assumption of unchanged tax policies. All specifications include state- and year-fixed effects. Robust standard errors (in parentheses) are clustered by state in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

6 Summary and Conclusions

This paper has explored the German states' tax policy response to a recent reform, which involves the devolution of tax setting powers to the German states. More specifically, in 2007 German states obtained the right to choose the tax rate of the real estate transfer tax. This reform resulted in an unprecedented wave of tax increases. In the period from 2007 to 2017 among the 16 German states, no less than 26 tax increases occurred. No state has lowered its tax rate. Initially, the tax rate was 3.5% on the sales price. In 2017, the mean tax rate is 5.3%.

As we argue in the paper, due to a system of fiscal capacity equalization, the German states' tax policy is subject to strong incentives to increase the tax rates of the real estate transfer tax. Following Dahlby and Warren (2003), we identify two separate incentives for tax policy. The first incentive is associated with the effect of the tax rate on the tax base. Given the way fiscal capacity is defined, the adverse impact of a high tax rate on the tax base, which reflects the deadweight loss from taxation, contributes to a decline in fiscal capacity. Hence, a state that raises its tax rate receives more rather than less equalization transfers or, if it is a state with high fiscal capacity, needs to make lower transfers to other states. A second incentive effect can arise, since each state's tax policy decision is reflected in the average tax rate that is used by the equalization system to determine fiscal capacity.

To test whether these incentive effects have led the states to increase their tax rate in

the recent years, we use a simulation analysis of the system of fiscal equalization and precisely compute the incentives faced by each state in each period. The identification strategy exploits differences in the degree of fiscal redistribution among the states and over time. To distill the incentive effects empirically, we comprehensively control for income effects of fiscal redistribution by indicators of the relative fiscal capacity. To overcome possible confounding effects of own policies on the incentive effect we use an instrumental variables approach. More specifically, by means of counterfactual simulations we compute indicators of the degree of fiscal redistribution that keep a state's tax rate and its share of the tax base at pre-reform levels, which are used as instrumental variables.

The results support a robust significant effect of fiscal redistribution on tax policy. According to the point estimates, with full equalization of tax revenues, the tax rate for the real estate transfer tax is about 1.3 percentage points higher than without. This sizeable incentive effect is exclusively associated with the fiscal redistribution of the tax base. The equalization rate effect is unimportant in the German context.

Given that the German states were mostly subject to almost full equalization when the reform was implemented, the incentive provided by tax base equalization can explain a substantial part of the recent tax increases by German states. In addition, however, the basic incentive effect to raise the own tax rate has been proliferated by the equalization system. As states responded to the tax policy incentive by setting higher tax rates, the strength of the incentive faced by a state has been increasing over time. Hence, the first

wave of tax increases raised the incentive to increase tax rates and triggered further tax increases.

Our findings point at the importance of a careful design of federal fiscal institutions. Combining a high degree of fiscal redistribution with a decentralized distortionary tax likely results in an inefficient tax structure.

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Fiscal Equalization as a Driver of Tax Increases: Empirical Evidence from Germany: Appendix

Data Sources and Definitions

Population size: the population size is the total amount of population in each state on June 30 of each year. Source: Federal Ministry of Finance (Annual announcements of the fiscal equalization account, (*Zweite Verordnung zur Durchführung des Finanzausgleichsgesetzes*, various years)).

Tax rate of the real estate transfer tax (in %): the tax rate is the rate of the real estate transfer tax in percent applicable to land transactions. In cases where the tax rate has been changed within a year, the annual figure is interpolated based on the exact calendar days. Source: announcements of the 16 German states.

Tax base of the real estate transfer tax (in 1,000 Euro): the tax base of the real estate transfer tax is basically the sale price of the property. Source: Federal Ministry of Finance (Annual announcements of the fiscal equalization account, (*Zweite Verordnung zur Durchführung des Finanzausgleichsgesetzes*, various years)).

Relative fiscal capacity: relative fiscal capacity is defined as fiscal capacity relative to fiscal need for each state. Fiscal capacity is defined as available revenues including state's own tax revenues, the share of income taxes, the VAT share and municipal tax revenues. Fiscal need is the population weighted average of fiscal capacity across states. Source: Federal Ministry of Finance (Annual announcements of the fiscal equalization account, (*Zweite Verordnung zur Durchführung des Finanzausgleichsgesetzes*, various years)) and own calculations.

Relative fiscal capacity (excl.VAT): relative fiscal capacity excluding revenues from VAT as used in the first stage of the equalization system to determine the VAT dis-

tribution. Source: Federal Ministry of Finance (Annual announcements of the fiscal equalization account, (*Zweite Verordnung zur Durchführung des Finanzausgleichsgesetzes*, various years)) and own calculations.

Degree of fiscal redistribution (tax base β): the degree of fiscal redistribution captures the fraction of an increase in revenues due to a higher tax base that is compensated through transfers. The state-specific shock in the tax base of the RETT is scaled such as to generate a tax revenue increase by 1 Million Euro at the average tax rate in all states and periods. Source: own simulation analysis.

Degree of fiscal redistribution (tax rate ρ): the degree of fiscal redistribution captures the fraction of an increase in revenues due to a higher tax rate (at a given tax base) that is compensated through transfers. The state-specific shock in the tax rate of the RETT is an increase by 1 percentage point. Source: own simulation analysis.

Counterfactual degree of fiscal redistribution (tax base $\widehat{\beta}$): the counterfactual degree of fiscal redistribution captures the fraction of an increase in revenues due to a higher tax base that is compensated through transfers. It is calculated under the assumption that the respective state's tax rate and its share of the total tax base have remained at the pre-reform level in the year 2006. The state-specific shock in the tax base of the RETT is scaled such as to generate a tax revenue increase by 1 Million Euro at the average tax rate. Source: own simulation analysis.

Counterfactual degree of fiscal redistribution (tax rate $\widehat{\rho}$): the counterfactual degree of fiscal redistribution captures the fraction of an increase in revenues due to a higher tax rate that is compensated through transfers. It is calculated under the assumption that the respective state's tax rate and its share of the total tax base have remained at the pre-reform level in the year 2006. The state-specific shock in the tax rate of the RETT is an increase in the tax rate of 1 percentage point. Source: own simulation analysis.

Public debt per capita (in 1,000 Euro): Public debt per capita is the total level of state debt held by private and public sectors in 1,000 Euro measured in per-capita terms. Source: Federal statistical office.

Table A-1: IV Estimation Results: Including the Equalization Rate Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Degree of fiscal redistribution (tax base β)	0.962**	0.989**	1.110**	1.116**	1.001**	1.126**	1.389**	1.350**
	(0.422)	(0.489)	(0.533)	(0.524)	(0.414)	(0.452)	(0.594)	(0.634)
Degree of fiscal redistribution (tax rate ρ)	2.637	3.161	2.284	0.986	3.107	2.215	3.243	1.621
	(4.564)	(6.544)	(6.373)	(5.673)	(6.935)	(6.922)	(7.193)	(9.190)
Relative fiscal capacity		-0.004	0.244*	-0.974	-0.005	0.249*	-1.054	-1.033
		(0.024)	(0.131)	(0.657)	(0.024)	(0.151)	(1.053)	(1.084)
Relative fiscal capacity (sq.)			-0.001**	0.011*		-0.001*	0.012	0.012
			(0.001)	(0.007)		(0.001)	(0.010)	(0.011)
Relative fiscal capacity (cub.)				-0.000*			-0.000	-0.000
				(0.000)			(0.000)	(0.000)
Relative fiscal capacity (excl.VAT)					0.037	-0.037	-1.216	-1.549
					(0.430)	(1.132)	(1.911)	(1.684)
Relative fiscal capacity (excl.VAT) (sq.)						0.013	1.027	1.257**
						(0.149)	(0.788)	(0.596)
Relative fiscal capacity (excl.VAT) (cub.)							-0.214	-0.265**
							(0.154)	(0.111)
Tax-rate								-0.079
								(0.145)
Observations	176	176	176	176	176	176	176	176
F-statistic (1st.-stage, excl. instr. β)	17.28	13.13	10.92	11.27	59.07	37.63	66.15	107.10
F-statistic (1st.-stage, excl. instr. ρ)	24.06	27.33	41.12	34.18	30.95	46.83	36.11	35.63

Dependent variable: difference of tax rate of the RETT in % between next and current period. Instrumental variable estimation results based on counterfactual measures of redistribution obtained under the assumption of unchanged tax policies (see text). All specifications include state- and year-fixed effects. Robust standard errors (in parentheses) are clustered by state in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Table A-2: IV Estimation Results: Including State Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Degree of fiscal redistribution (tax base β)	0.897***	0.893***	0.862**	0.957***	0.928***	0.898***	1.130***	1.104***
	(0.333)	(0.321)	(0.339)	(0.368)	(0.285)	(0.315)	(0.356)	(0.400)
State debt (per capita)		0.001	0.024	0.017	0.002	0.031	0.027	0.032
		(0.018)	(0.019)	(0.019)	(0.019)	(0.023)	(0.026)	(0.033)
Relative fiscal capacity		-0.001	0.310**	-0.760	-0.003	0.295*	-0.919	-0.813
		(0.020)	(0.134)	(0.660)	(0.022)	(0.150)	(1.042)	(1.105)
Relative fiscal capacity (sq.)			-0.001**	0.009		-0.001**	0.011	0.010
			(0.001)	(0.007)		(0.001)	(0.010)	(0.011)
Relative fiscal capacity (cub.)				-0.000			-0.000	-0.000
				(0.000)			(0.000)	(0.000)
Relative fiscal capacity (excl.VAT)					0.117	0.714	-0.293	-0.969
					(0.384)	(1.155)	(1.675)	(1.541)
Relative fiscal capacity (excl.VAT) (sq.)						-0.076	0.793	1.226**
						(0.155)	(0.632)	(0.572)
Relative fiscal capacity (excl.VAT) (cub.)							-0.183	-0.278**
							(0.121)	(0.112)
Tax-rate								-0.128
								(0.088)
Observations	176	176	176	176	176	176	176	176
F-statistic (1st.-stage, excl. instr. β)	22.17	24.98	33.13	31.63	66.50	82.40	61.81	43.56

Dependent variable: difference of tax rate of the RETT in % between next and current period. Instrumental variable estimation results based on a counterfactual measure of redistribution obtained under the assumption of unchanged tax policies. All specifications include state- and year-fixed effects. Robust standard errors (in parentheses) are clustered by state in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.