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**THE REVENUE AND BASE EFFECT OF
LOCAL TAX HIKES:
EVIDENCE FROM A QUASI-
EXPERIMENT**

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The revenue and base effects of local tax hikes:

Evidence from a quasi-experiment

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Abstract

This paper studies the revenue and base effects of local property and business tax hikes using a natural experiment in the German state of North Rhine-Westphalia (NRW). Due to a reform of the local equalization scheme in 2003, a set of municipalities in NRW increased their local tax rates by one to two percentage points while the remaining municipalities kept their rates constant. Using this variation across municipalities and over time to implement a difference-in-differences design covering the period 1995-2010, I find that property tax hikes have a revenue elasticity of unity and no adverse base effects. Business tax hikes have no discernible base effects but also no statistically significant effect on revenues. Furthermore, the results suggest that the tax hikes have no effect on broader economic outcomes such as local employment, firms' wage bill, and property prices. Overall, increasing local tax rates by one to two percentage points does not seem to affect the local economy adversely.

Keywords: Tax hikes, Tax base effects, Local business taxes, Local property taxes

JEL codes: H20, H71, H77

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1 Introduction

It is often argued that a hike in local tax rates may not increase revenues proportionally because of adverse base effects. There are indeed many reasons why bases may decline after a tax hike. First, mobile firms may respond to tax hikes by moving to jurisdictions where the tax burden is lower (Wilson, 1986; Zodrow and Mieszkowski, 1986). Similarly, high property taxes may lead to outmigration of residents, depressing property values and consequently the property tax base. Further reasons for adverse base effects are increased tax avoidance, outright tax evasion, and a general reduction in productive activity (Piketty et al., 2014).

It is, however, unclear how important such adverse tax base effects are in reality. If local officials use tax revenues primarily to improve local services and expand infrastructure, tax hikes may even be associated with increasing bases due to in-migration of firms and residents and higher productivity.¹ Thus, the tax revenue and tax base elasticities with respect to local taxes are ambiguous ex-ante and need to be determined empirically. Estimating these elasticities accurately, however, is difficult as changes in tax rates are usually not random and thus potentially endogenous. It is, for example, plausible that local governments would raise tax rates to keep their budgets balanced if they anticipate revenue shortfalls or additional expenditure needs in the near future. Simply correlating tax rates and revenues or bases may thus lead to a biased estimates of the revenue and base effects of local taxes.

In this paper, I address such endogeneity issues by relying on a natural experiment in the German state of North Rhine-Westphalia (NRW). The experiment involves a change in the formula according to which rule-based transfers are paid from the state government to municipalities. This change concerned the so called hypothetical property and business

¹ Brueckner (1979, 1982), for example, shows that property tax rate hikes should not affect property prices if municipalities provide local public goods efficiently.

tax multipliers. The hypothetical multipliers are mainly used by the state government to rescale tax bases during fiscal equalization. That is, they are the same for all municipalities in the sample and their specific values have almost no substantive effects on transfer payments. However, municipalities ostensibly perceive the hypothetical multipliers as “reference values” and set their actual municipality-specific tax multipliers accordingly. The actual multipliers, in turn, determine the final tax burden faced by firms and inhabitants in a given municipality.

In 2003, the state government of NRW substantially increased the hypothetical multipliers for the property and the business tax. In response, municipalities with actual multipliers below the new hypothetical multipliers immediately raised their actual multipliers. These multiplier hikes were equivalent to an increase in tax rates of about one to two percentage points. In contrast, those municipalities that had actual multipliers above the new hypothetical multipliers kept their actual tax multipliers constant. The relative gap in tax multipliers between the two sets of municipalities that opened up in 2003 remained until 2010, the end of the sample period. Thus, there are well defined treatment and control groups and pre- and post-treatment periods, making it possible to analyze the revenue and base elasticities of the tax hikes in a transparent difference-in-differences framework.

The results are as follows. Regarding property taxes, I find that the revenue elasticity is essentially unity both in the short- and the long-run. Correspondingly, the base effects of tax hikes are zero. Second, I also find no significant tax base effects for business taxes. Yet, in contrast to the property tax hikes, I do not observe higher revenues following the reform either. Standard errors for the business tax estimates are large, however, which suggests, consistent with anecdotal evidence, that firm earnings are highly volatile and that even relatively large tax hikes have no discernible effects on tax revenues.

I complement these findings for the revenue and base effects with evidence for broader economic outcomes. First, I find that the number of social-security covered employees in

a municipality does not decline after the tax hikes. Second, I analyze the effect of the tax hikes on property prices and on firms' wage bill with data available at the county-level. These regressions, too, indicate that the tax hikes had no negative effects.

This paper primarily contributes to the relatively small literature on the revenue and base effects of local taxes. The most closely related previous contribution is Büttner (2003), who finds that business tax hikes have substantial base effects in the German state of Baden-Württemberg. His instrumental variables identification strategy is problematic, however, as it relies on instruments whose validity is questionable.² While not specifically focusing on revenue and base effects, Becker et al. (2012) find for Germany that business tax rates and multinational enterprise activity are negatively correlated. For property taxes, Bradbury et al. (2001) analyze the effect of property tax limits in the US on house prices. The results suggest that tax cuts due to the limits reduce house prices, presumably because of inefficient reductions in local services.³

A related literature studies the base and revenue effects of corporate taxes. Devereux et al. (2014), for example, analyze the effect of corporate taxes on corporate taxable income with tax records data from the UK. Focusing on bunching at kinks in the corporate tax schedule, they find a significant negative elasticity. However, they do not focus on tax differentials across political jurisdictions. A noticeably larger literature studies the effect of corporate taxes with cross-country samples (Clausing, 2007; Devereux, 2007; Brill and Hassett, 2007; Katsimi and Sarantides, 2012; Kawano and Slemrod, 2012). However, one crucial difficulty that cross-country studies face is that tax burdens are hard to compare across countries given different base definitions (Kawano and Slemrod, 2012). The advantage of studying local business and property taxes in Germany is that the definition of the tax bases is the same across localities.

²He uses lags of fiscal variables, e. g. the lagged level of debt, the lagged deficit, the lag of the local tax rates etc.

³Lang and Jian (2004) offer similar evidence.

Another related strand of literature analyzes the role of income taxes for individuals' behavior, notably labor supply and tax avoidance decisions. Several studies in this literature find that tax rates can have significant effects on behavior and thus on the relevant tax bases. For the US, for example, Gruber and Saez (2002) document that taxable income responds to tax rates. Eissa et al. (2008) show furthermore that reducing the tax burden on low-income taxpayers increases the likelihood that they participate in the labor market. Kleven and Esben (2014) find significant taxable income responses to tax reforms in Denmark. However, there are also several studies that find only minor labor market responses to tax rate differentials. For example, Chetty et al. (2011) find that labor supply responds only weakly to tax differentials in marginal tax rates in the Danish income tax schedule.⁴

Finally, this paper also contributes to the literature on local tax competition. This literature relies on the premise that if tax hikes have significant base effects, local governments should strategically adjust their tax rates to attract mobile bases. The studies in this literature employ various methodologies to identify such strategic interactions. The traditional methodology is spatial lag regressions, i. e. regressions that relate the tax rate of neighboring municipalities to the tax rate of a given municipality, using neighbors' economic or demographic characteristics as instruments for their tax rates (Brueckner and Saavedra, 2001). This approach has recently been criticized because the instruments used for neighbors' tax rates, i. e. neighbors' characteristics, are likely endogenous (Gibbons and Overman, 2012). More recent research of local tax competition relies on various other methodologies, such as difference-in-differences (Lyytikäinen, 2012; Baskaran, 2014), standard regression discontinuity designs (Isen, 2014), or border regression discontinuity designs (Eugster and Parchet, 2011). Except for Eugster and Parchet (2011), the quasi-experimental studies do not find evidence for local tax competition. In particular, Baskaran (2014) uses the tax hikes of 2003 in NRW analyzed in this paper to study whether border

⁴See Saez et al. (2009) for a survey of the literature.

municipalities in the neighboring state of Lower-Saxony respond strategically and finds no evidence for systematic interactions. The results in the present paper, i. e. that there are no base effects in NRW following the 2003 tax hikes, is consistent with the absence of tax competition across municipalities.

The remainder of this paper is structured as follows. The next section provides some institutional background. Section 3 describes the data. Section 4 introduces the main empirical model and collects the baseline results for the tax revenues and base effects. Section 5 presents some robustness tests. Section 6 relates the tax hikes to border economic outcomes. Finally, Section 7 concludes.

2 Background

2.1 Local taxation in NRW

NRW is the most populous state in Germany and had in 2014 about 17.6 million inhabitants. The state was divided into 396 municipalities during the entire sample period. Municipalities in NRW, as in all other German states, levy in terms of revenues two important local taxes: the property tax B and the business tax.⁵ The property tax is a tax on non-agricultural properties, essentially a combined tax on land and buildings, and has to be paid by both regular residents and by firms. The tax base is the value of a property as assessed by the tax authorities. In 2010, gross property tax revenues in NRW were about 2.7 billion Euros, i. e. about 5% of total current local revenues.

The business tax is paid by firms to the municipality where they are located. While there are some adjustments to account for e. g. interest rate payments, the tax base is basically firm profits. Hence, the business tax is essentially a corporate tax that is levied

⁵Municipalities also levy a local tax on agricultural properties, the property tax A. However, revenues from this tax are negligible (e. g. only 37 million Euros in 2010 in all of NRW). I therefore ignore this tax in the following and refer in the following to the property tax B simply as property tax.

at the local level.⁶ Gross business tax revenues in NRW were about 8.9 billion in 2010, i. e. about 17% of total current local revenues.

Municipalities do not set the tax rate as such for the local taxes, but rather choose a so called multiplier (*Hebesatz*). The multiplier, however, is deterministically related to the tax burden faced by residents and firms, and thus to the tax rate. Specifically, the property tax burden on a particular property is determined according to the following formula:

$$T_{property} = V_{property} \cdot S_{property} \cdot M_{property}, \quad (1)$$

where $T_{property}$ is the property tax to be paid, $V_{property}$ is the value of the property as assessed by the tax authorities⁷, $S_{property}$ is the so called *Steuermesszahl* (basic tax rate), which is a factor determined by federal law and which therefore is the same across municipalities. The *Steuermesszahl* varies according to the type of property in question.⁸ Generic properties face a factor of 3,5%. $M_{property}$ is the municipality-specific property tax multiplier that is individually chosen by each municipality. By choosing an appropriate multiplier, municipalities can scale the property tax burden to basically any level. For example, assuming $S_{property} = 3,5\%$, a multiplier of 300 would imply a tax rate of about 10.5% according to the above formula. A multiplier of 400 would imply a tax rate of about 14%.

The business tax levied on a particular firm is given by a similar formula:

$$T_{business} = V_{business} \cdot S_{business} \cdot M_{business}, \quad (2)$$

⁶Firms must also pay a federal corporate tax whose rates do not vary across municipalities.

⁷The process by which the value of a property is assessed is codified by federal law and takes into account the age of a building, its location etc.

⁸For example, one-family dwellings have a different value than two-family dwellings.

where $T_{business}$ is the assessed business tax, $V_{business}$ is the profit of a firm in a given year (after some adjustments), $S_{business}$ is the *Steuermesszahl* for the business tax. The value of the *Steuermesszahl* is determined by federal legislation and thus does not vary across municipalities. Until 2008, the $S_{business}$ was 5% for incorporated and most non-incorporated firms.⁹ $M_{business}$ is the business tax multiplier in a given municipality. As for the property tax, the multiplier determines the tax rate faced by a given firm in a municipality.

2.2 Hypothetical multipliers

The identification strategy in this paper relies on a reform of the local equalization scheme in NRW that took place in 2003. I thus describe in this section the main features of the equalization scheme. The primary goal of the scheme is to reduce the difference between the “fiscal capacity” and the “fiscal need” of a municipality by providing rules-based state transfers. These transfers have a substantial volume. For example, the state government allocated about 5 bn. Euros in 2010 for this transfer program.¹⁰

Fiscal capacity has a precise meaning according to the law regulating municipal transfers. It is defined as follows:

$$c_{i,t} = \sum_m r_{i,t-1,m} \frac{\bar{d}_{t,m}}{d_{i,t-1,m}} + r_{other,t-1}, \quad (3)$$

where $c_{i,t}$ is the assessed fiscal capacity of a municipality in year t , $r_{i,t-1,m}$ are the revenues raised by municipality i from the local tax m in the previous year, with m =(business tax, property tax)¹¹ and $r_{other,t-1}$ are other types of tax revenues.¹² The revenues from each local

⁹For non-incorporated firms, the *Steuermesszahl* varied according to the earnings. The highest rate was 5% and was applied to firms with earnings above 48,000 Euro.

¹⁰Source: NRW municipal financing law 2010 (*GFG 2010*).

¹¹Note that the property tax A revenues also enter the formula for fiscal capacity.

¹²The most important of the other taxes is the income tax. Income tax rates are set at the federal level and do not vary across municipalities, but municipalities are entitled to a fraction of the revenues raised from their inhabitants. As municipalities have no autonomy over the income tax, I ignore it in the

tax are divided in the formula by the respective actual tax multiplier of a municipality i in the previous year, $d_{i,t-1,m}$, and then multiplied by a factor called “hypothetical multiplier”, $\bar{d}_{t,m}$, which is the same for all municipalities and set by the state government.

The purpose of the division by the actual multiplier is to account for the fact that revenues may be higher in a municipality either because its tax base is large or because it has chosen a high multiplier. As the intention underlying the transfer scheme is that municipalities should receive higher transfers only if they have low own revenues for structural reasons, i. e. because they have small tax bases, and not because they choose to levy low tax rates, the division with the actual multipliers ensures that only differences in tax bases matter for transfer payments. The multiplication with the hypothetical multipliers scales the bases back to the level of revenues.

The other element of the transfer formula is the “fiscal need” of a municipality. This measure is defined as follows

$$n_{i,t} = \theta_t x_{i,t}, \tag{4}$$

where $n_{i,t}$ is the fiscal need of municipality i in year t , θ_t is a measure called *Grundbetrag*, which is a factor set by the state government and which does not vary across municipalities. The purpose of this factor is to ensure that total transfer payments equal the volume of fiscal resources the state government has ex-ante allocated to the equalization scheme. Thus, the fiscal capacity and fiscal need measures calculated for the municipalities only affect the relative distribution of transfers across municipalities, not the total amount of transfers paid to the municipalities as a whole. The specific fiscal need of a municipality is determined by the factor $x_{i,t}$ whose value depends on the certain municipal characteristics, such as total number of inhabitants, the number of school children, the number of unemployed etc.

following. I also ignore any other tax revenues that enter the formula as they are not important in terms of revenues.

Finally, the transfers allocated to a municipality are then determined according to this formula:

$$g_{i,t} = \begin{cases} 0.9(n_{i,t} - c_{i,t}) & \text{if } n_{i,t} > c_{i,t} \\ 0 & \text{else.} \end{cases} \quad (5)$$

That is, municipalities that have a fiscal capacity below their fiscal need receive 90% of the difference. Municipalities that have a fiscal capacity above their fiscal need receive zero transfers.

The hypothetical multipliers, $\bar{d}_{t,m}$, enter the transfer formula through their effect on fiscal capacity as defined in Equation 3. However, as mentioned above they primarily serve only to scale the bases back to the level of revenues. That is, while they have minor substantive effects, they mostly serve as a normalization of bases and should therefore have negligible effects on transfer payments and thus on actual multipliers.¹³ Yet, any intention of the state government to change hypothetical multipliers evokes significant opposition from local stakeholders. Corresponding to these acrimonious debates, actual tax multipliers, as I show below, respond strongly to changes in hypothetical multipliers.

¹³Changes in hypothetical multipliers affect the difference between fiscal need and fiscal capacity of all municipalities and may therefore have a substantive effect on the relative distribution of transfers (recall that hypothetical multipliers cannot affect total transfer payments - total transfer payments are set ex-ante by the state government and do not depend on assessed fiscal capacities or needs). To see this, differentiate the expression in Equation 5 for positive transfers with respect to $\bar{d}_{t,m}$, i. e.

$$\frac{\partial g_{i,t}}{\partial \bar{d}_{t,m}} = -0.9 \frac{r_{i,t-1,m}}{d_{i,t-1,m}}. \quad (6)$$

Thus, an increase in the hypothetical multiplier of tax m increases the assessed fiscal capacity of all municipalities. For a given municipality, the size of the increase is proportional to the value of its tax base for the tax m (since $r_{i,t-1,m} = \text{base}_{i,t-1,m} \times d_{i,t-1,m}$). Thus, richer municipalities are assessed with a relatively higher fiscal capacity if hypothetical multipliers increase, causing a reallocation of transfers from richer to poorer municipalities. However, these reallocations should generally be small as other and arguably more important components of the transfer formula, such as fiscal need or the actual value of the various tax bases, remain unaffected by a change in hypothetical multipliers. Also, note that the value of $d_{i,t-1,m}$ does not matter for how a change in hypothetical multipliers affects transfers to a given municipality as this parameter cancels out. Thus, municipalities should have no strong nor systematic incentive to change actual multipliers in response to an increase in hypothetical multipliers.

One reason why hypothetical multipliers may have a strong effect actual multipliers even if they have only negligible effects on transfer payments is that considerable confusion prevails about the actual purpose of the hypothetical multipliers. There is the widespread believe, presumably because local politicians and the local media make often statements to this effect, that if a municipality chooses an actual multiplier below the relevant hypothetical multiplier, it will receive fewer transfers. While it is unlikely that municipal officials, especial those responsible for municipal finances, are unaware that the value of the hypothetical multipliers has almost no direct effect on transfers, it is possible that many voters are misinformed of such details. Thus, any increase in hypothetical multipliers would allow local officials to increase actual tax multipliers while deflecting the blame for the tax hike to the state government. In other words, a hike in the hypothetical multipliers gives local officials a window of opportunity to increase actual multipliers while minimizing the political costs associated with a tax increase.

Even if hypothetical multipliers are not important for transfer receipts, German state governments do not set them randomly. Typically, they are supposed to reflect the weighted average multipliers in a state.¹⁴ Thus, developments in the large municipalities have a substantial effect on the hypothetical multipliers set by the state governments. In most states, the adjustments take place continuously and in small steps. In NRW, in contrast, the adjustments take place every few years, and consequently in larger steps. The last adjustments before 2003 took place in 1996 and 1997. After the 2003 hikes, the next hikes happened in 2011. As the adjustments in hypothetical multipliers tend to happen irregularly and without little prior notice, anticipation effects regarding revenues or bases are unlikely and, as I show below, also not observable in the data.

¹⁴The weights reflect the population size of a municipality. Specifically, the “weighted average” is determined by dividing gross revenues in the state with the gross value of the bases. Consequently, as large municipalities have large bases, the multipliers they choose will have a disproportionate effect on the weighted average.

3 Data

I use data on local taxation (multipliers, revenues, and bases) from the Statistical Office of NRW. The data covers all 396 municipalities in NRW over the period 1995-2010. Thus, there are eight pre-treatment and eight post-treatment years.

Using the data on local tax rates, I define treatment and control groups for the property and the business tax regressions as follows. The treatment group for the property tax consists of all municipalities that had in 2002 an actual property tax multiplier lower than 381, the hypothetical property tax multiplier as of 2003. For the business tax, I define the treatment group as consisting of all municipalities that had in 2002 an actual business tax multiplier of less than 403, the hypothetical business tax multiplier as of 2003.

Figure 1 shows a map of NRW showing the location of treatment and control municipalities for both taxes. Subfigure (a) pertains to the property tax. It is clear that most municipalities are classified as treated. Geographically, the control group is clustered in the center of the state while the treatment group is spread out more evenly. Subfigure (b) shows the corresponding map for the business tax. In general, this exhibits a similar pattern as the one for the property tax. The main difference is that the control group is slightly larger for the business tax, indicating that more municipalities levied tax multipliers higher than the hypothetical multiplier in 2002 for the business than for property tax.

The increase in hypothetical tax multipliers, while imposed by the state government, did not affect municipalities randomly. First, as mentioned above there is clearly a geographical clustering in the maps. According to Table 1, treatment and control municipalities are also different with respect to their fiscal characteristics. In particular, while control municipalities have by definition higher tax multipliers in the pre-treatment period, they also have higher revenues for both taxes. Table 2 indicates that treatment and control mu-

municipalities also differed in their socio-economic characteristics. In particular, treatment municipalities tend to be considerably smaller than control municipalities. In the regressions, I control for any time-invariant municipal characteristics with fixed effects. Thus, the crucial question regarding identification, as is usual in difference-in-differences designs, is whether treatment and control groups were subject to similar trends in the outcome variables. I verify this parallel trends assumption graphically when discussing the results.

With respect to the tax multipliers, Figure 2 shows how they have evolved in the treatment and control groups during the sample period. First, pre-treatment trends for the tax rates are similar despite the non-randomness of the treatment. It is also obvious from the figure that in 2003, the year in which the state government raised the hypothetical multipliers, those municipalities that had been classified into the treatment group indeed witness a steep and discontinuous increase in their local property and business tax rates. Those municipalities classified into the control group do not witness a similar rise, average tax rates develop smoothly in this set of municipalities.

Specifically, while the hypothetical multipliers for the property tax rates increased in the control group by less than 3 points in 2003, average tax rates increased in the treatment group by 42 points. For the business tax rates, the increase in average tax rates in the control group was less than 4 points while that in treatment group was about 19 points. That is, property tax multipliers increase by 12 percent and business tax multipliers by about 5 percent in the treatment group. For the control group, the corresponding figures are less than one percent for both taxes. These numbers translate into tax rate hikes of about 1.5 percentage points for the property tax and 1 percentage point for the business tax in 2003 in the control group based on the formulas in Equations 1 and 2. For the control group, in contrast, the tax rate hikes in 2003 are practically zero. Thus, the hikes represent a noticeable increases in the relative tax burden on firms and inhabitants in the treatment group.

4 Baseline results

4.1 Empirical model

To evaluate the revenue and base effects of the tax hikes, I estimate difference-in-differences models of the following form:

$$y_{i,t} = \alpha_i + \gamma_t + \text{Treatment}_{i,t} + \epsilon_{i,t}, \quad (7)$$

where in the baseline regressions $y_{i,t}$ is log tax revenues per capita or log tax bases per capita for the property and business tax in municipality i in year t , respectively. Revenues are simply the gross revenues collected by a municipality in a given year. Tax bases as reported by the statistical office are defined as gross revenues divided by the actual multiplier of a municipality.

The α_i are municipality fixed effects and the γ_t are year fixed effects. $\text{Treatment}_{i,t}$ is a dummy for those municipalities that were treated in 2003. As described above, this dummy is defined differently for property and the business taxes, depending on whether a municipality had in 2002 a lower actual tax multiplier than the state-wide hypothetical multiplier in 2003.

I estimate the treatment effect specified in Equation 7 for four post-treatment years: 2003, 2006, 2008, and 2010. Specifically, I restricted the sample such that it covers 2002 and one of the four years listed above. Consequently, the diff-in-diff models assess how tax revenues and bases evolve in the treatment group relative to 2002, the last pre-treatment year, compared to the development in the control group. I collect the estimates together with 95% confidence intervals in figures reported further below. The confidence intervals are based on heteroscedasticity- and cluster-robust standard errors. As treatment varies at the municipality-level, I cluster at that level.

To assess the common trends assumption and to provide for a graphical assessment of the treatment effect, I also plot the evolution of the dependent variable over the entire 1995-2010 period. To focus on trends, I normalize the series by subtracting in each year the relevant value in 2002.

4.2 Property tax hikes

Subfigure (a) of Figure 3 collects the diff-in-diff results for property tax revenues. First, the log of revenues per capita in the treatment and control groups display basically identical trends in the pre-treatment period. In 2003, when the property tax hikes take place, log revenues per capita increase noticeably in the treatment group but not in the control group. The relative gap that emerges in 2003 remains until 2010. Corresponding to this graphical evidence, the diff-in-diff estimates also suggest significant short- and long-run treatment effects. Revenues increase by about 9% in 2003 in the treatment group. By 2010, they are about 12% higher. As mentioned above, the percentage increase in the property tax multiplier (and consequently in the tax rate) was about 12%, thus the elasticity of revenues with respect to the tax rate is about unity, suggesting no negative base effects.

To study the base effects explicitly, I collect in Subfigure (b) the results for the property tax bases. Pre-treatment trends in the treatment and control groups are again similar. Consistent with the results for revenues, there is no treatment effect, neither in the short- nor in the long-run according to the plots. The diff-in-diff regressions also do not suggest significant treatment effects. The estimated coefficients are close to zero and insignificant both in the short- and the long-run.

4.3 Business tax hikes

Subfigure (a) of Figure 4 collect the results for business tax revenues. First, business tax revenues display similar pre-treatment trends. However, unlike for the property tax, the tax hikes of 2003 did not lead to an increase in business tax revenues. The series in both the treatment and control groups evolve similarly in the post-treatment period. Corresponding to this graphical evidence, the diff-in-diff estimates are insignificant both in the short- and the long-run. However, note that the confidence intervals of the estimates are large, suggesting that there is substantial variability in business tax revenues. This large variability arguably reflects that firm earnings are inherently volatile. Moreover, in most municipalities the lion's share of business tax revenues is paid by only a few large firms, which tends to increase revenue volatility even further. Thus, even relatively large tax hikes do not seem to have a discernable effect on business tax revenues.

Subfigure (b) reports the results for business tax base. First, as above, pre-treatment trends are similar. In the post-treatment period, there is a relative drop in the business tax base in the treatment relative to the control group in the first few years, but it is difficult to visually assess whether this decline is statistically significant. This issue can be clarified with the the diff-in-diff regressions, which suggest that the tax hikes had no significant effects. First, the estimated treatment effects vary substantially over time. In 2003, the estimated effect is 1%, in 2006 it is -11%, but in 2008 it is -5%, while again being -11% in 2010. The estimated coefficients are also never significant and display large confidence intervals. Overall, while not as conclusive as the results for the property tax base, these estimates indicate that the tax hikes had no significant treatment effects on the business tax base. This conclusion is further supported by the robustness tests reported below.

5 Robustness

5.1 Neighbor sample

The treatment group has substantially more municipalities than the control group as shown in Figure 1. The control municipalities also tend to be geographically clustered. While trends with respect to revenues and bases are arguably parallel, municipalities that are geographically far away from the treatment group may not be sufficiently comparable with the control municipalities, which could lead for example to relatively large standard errors. Therefore, I restrict in a robustness test the set of treatment municipalities to those that are contiguous to at least one control municipality.

Subfigure (a) of Figure 5 confirms that the reform had a significant effect on the property tax multipliers in the restricted sample used in this section. The property tax multipliers in the treatment group increase significantly in 2003. They also continue to be higher until the end of the sample period.

Subfigure (b) collects the results for property tax revenues. The results are similar to the baseline estimates. Trends in property tax revenues are parallel in the pre-treatment period. In 2003 there is a steep increase in treated municipalities but not in untreated neighboring municipalities. The increase in property tax revenues in the treatment group persists until the end of the sample period. Subfigure (c) presents the results for the bases. The pre-treatment trends are again reasonably similar. For the post-treatment period, I find no significant treatment effects, neither in the short- nor in the long-run.

Subfigure (d) confirms for the business tax that the reform had a significant effect on the tax multipliers in the treatment group in this restricted sample. Subfigure (e) collects the results for the business tax revenues. As in the baseline regressions, there are no significant treatment effects on revenues. The estimates also continue to display relatively large confidence intervals. Subfigure (f) collects the corresponding results for the business

tax base. As before, there is no significant effect. The estimated treatment effects are insignificant and, except in 2006, close to 0. The confidence intervals also continue to be relatively wide.

5.2 Control municipalities from Lower-Saxony

In this section, I deal with the fact that the reform potentially affected all NRW municipalities, even if those municipalities with tax multipliers above the hypothetical ones were ostensibly not affected according to the evidence discussed above. Therefore, I report in Figure 6 results where all untreated NRW municipalities are dropped from the sample. Instead, I use the municipalities located in the neighboring state of Lower Saxony (NDS) as control group.¹⁵ Otherwise, the specification follows the baseline models.

Subfigure (a) show how property tax multipliers evolved in the treatment and control groups. First, as above there is a noticeable hike in the tax multipliers in treated NRW municipalities. No such hikes are observable in NDS municipalities, suggesting, *inter alia*, that NDS municipalities did not systematically react to the tax hikes in NRW. The gap in the property tax multiplier that opened up between treated NRW and untreated NDS municipalities remains until 2010 but declines slightly over time.

Subfigure (b) shows the results for the property tax revenues. Trends are similar in the pre-treatment period. In 2003, there is, as above, a clear discontinuity in the series for treated municipalities but not for the control municipalities in NDS. The diff-in-diff estimates are significantly positive and thus suggest that the tax hikes led to higher property tax revenues. Consistent with the decline in the difference in tax rates between treatment and control groups, the estimated treatment effects for revenues also decline over time. Subfigure (c) reports the results for the property tax base. These results are also consistent with the baseline findings. The pre-treatment trends in the series are almost identical.

¹⁵Data source: State Statistical Office of Lower Saxony.

They continue to be similar in the post-treatment period. Correspondingly, the estimated treatment effects are numerically close to 0, even if statistically significant in some years.

Subfigure (d) shows the evolution of the business tax multipliers in the treatment and control groups. As above, a discontinuous increase in business tax multipliers is observable in 2003. The gap between treatment and control groups closes somewhat faster than the gap that emerged for the property tax multipliers. By 2010, the gap has completely vanished. Thus, realistically any treatment effects for the business tax should be observable only in the first few years after the tax hikes. Subfigure (e) collects the results for the business tax revenues. As above, trends in the pre-treatment period are parallel. They continue to be parallel in the post-treatment period. Correspondingly, the diff-in-diff estimates are also consistently insignificant. Finally, Subfigure (f) collects the results for the business tax base. Again as before, there is no evidence for a significant treatment effect. The post-treatment trends evolve similarly and the diff-in-diff estimates are insignificant.

5.3 Control municipalities from Hesse

To establish the robustness of the results further, I use municipalities from another state neighboring NRW, Hesse, as control group.¹⁶ The results are collected in Figure 7. As previously, I first report how tax multipliers have evolved in treatment and control groups. Subfigure (a) shows the development of average property tax multipliers. In 2003, property tax multipliers increase discontinuously in treated NRW municipalities but not in Hessian municipalities. The gap narrows until the end of the sample period, but less so than in the regressions with the control municipalities from NDS.

Subfigure (b) shows the results for property tax revenues. The plots suggest similar pre-treatment trends but a significant and persistent bump in treated municipalities in 2003. The diff-in-diff estimates, too, are positive and significant for all years. Subfigure (c) shows

¹⁶Data source: State Statistical Office of Hesse.

the results for the property tax base. As previously, I do not observe a sizable treatment effect. That is, while the coefficient is statistically significant in 2003, it is numerically small. For the subsequent years, I obtain precisely estimated zeros.

Subfigure (d) shows the development of the average business taxes multipliers. Again there is a observable bump in treated NRW municipalities but not in control Hessian municipalities. Unlike in the NDS regressions, the gap in business tax multipliers does not close. Subfigure (e) presents the results for the business tax. I do not observe a significant effect of the treatment on revenues. Similarly, the results for tax bases in Subfigure (f) also show no significant effect of the treatment.

6 Economic effects of the tax hikes

Given that there are no significant effects on tax bases, one should expect that the tax hikes did not affect broader economic outcomes either. I therefore study such broader effects in this section. First, I focus on municipal employment. Second, I study the effect of the hikes on property prices and on firms' wage bill with county-level data.

6.1 Local employment

If the tax hikes had led to outmigration of firms, there should be adverse employment effects. In fact, adverse employment effects are often cited in Germany as the main reason why municipalities should avoid local tax hikes. I therefore explore how property and business tax hikes affect the number of employees covered by social security (the default form of employment in Germany) as share of the total municipal population.¹⁷ It is clear that there may be a direct link between business taxes and the number of employees. The

¹⁷Data source: State Statistical Office of NRW.

link between property taxes and employees may be less obvious, but recall that firms, too, must pay property taxes in Germany.

Subfigure (a) explores the effect of the property tax hikes on the number of employees covered by social security as share of the total municipal population. First, I find that the pre-treatment trends are similar. Second, I find no negative effects of the treatment. In fact, the share of social security covered employees increase slightly in the treatment group in the long-run.

Subfigure (b) pertains to the business tax. This subfigure shows, first, that pre-treatment trends in treatment and control groups with respect to the share of social security covered employees are again similar. Second, the business tax hikes had no negative effect on the share of social security covered employees. I again obtain a small positive and significant treatment effect.

6.2 Property prices

One issue with the property tax bases is that the value of a property is assessed by the tax office. These assessments may not accurately reflect the actual change in the value of properties following tax hikes. That is, while assessed property tax bases would thus not be affected by the hikes, property owners may still witness a reduction in their wealth following property tax hikes. To explore this issue, I study the effect of the property tax hikes on property prices. If property owners internalize the costs of the higher taxes, property prices should decline.

The data on property prices¹⁸, however, is only available at the county level. Treatment and control groups must consequently be defined based on counties rather than municipalities. I therefore calculate the average tax rate in a county and define treatment and control groups accordingly. That is, counties with average tax multipliers in 2002 below 381 points

¹⁸Data source: State Statistical Office of NRW.

are classified as belonging to the treatment group while counties with multipliers above 381 are classified as members of the control group.¹⁹

The results are collected in Figure 9. First, I confirm in Subfigure (a) that the classification of counties in treatment and control groups is reasonable. Indeed, the average property tax multipliers increase significantly in 2003 in the treatment counties but not in the control counties. Subfigure (b) collects the results for the effect of the property tax hikes on average property prices.²⁰ The diff-in-diff estimates also vary significantly over time. The treatment effect is about 13% in 2003 but -13% in 2010. In both cases, as well as in the other years, the estimates are insignificant. One plausible interpretation is that property prices vary significantly over time, especially after the outbreak of the financial crisis, and that tax rates are thus not a particularly important determinant of property prices. That property prices do not fall significantly after property tax hikes suggest that the owners of the properties do not bear the burden of property taxation. This conclusion is plausible if the higher revenues are used by local governments to improve local services (Bradbury et al., 2001) or to reduce fiscal deficits and thereby future tax rates (Stadelmann and Eichenberger, 2014).

6.3 Wage bill

As for property taxes, it is possible that there are no significant base effects of business taxation because firms can shift some of the costs of higher tax rates to their employees. Fuest et al. (2013) find with fixed effects regressions using a sample of German municipalities that business tax hikes lower employees' wages. In contrast to Fuest et al. (2013),

¹⁹For county-free cities, which do not have any subordinate municipalities, I use their actual tax multipliers.

²⁰Note that the data on property prices exhibits missing values. To avoid over-time variability in the series merely due to a change in the sample (as some municipalities would in some years drop out of the calculated averages, I interpolate missing values for a county with five-year averages (using two years before and two years after the missing observation).

who have access to confidential social security data on employee compensation, I cannot explore the incidence of the tax hikes on wages at the municipal level. However, I have county-level data on wage bill of firms from 2000 to 2010.²¹

I therefore explore in Figure 10 whether the business tax hikes affected the wage bill. As before, I define treatment and control groups based on the county-level average of the municipal business tax multiplier. Specifically, treatment counties are those with an average multiplier below 403 points in 2002. Subfigure (a) of Figure 10 confirms that the classification in treatment and control counties is reasonable. Treatment counties experience a discontinuous increase in average tax multipliers while control counties do not. Subfigure (b) then collects the results on the wage bill per employee. I find no significant treatment effect. The diff-in-diff estimates are precisely estimated zeros.

7 Conclusion

This paper studies the revenue and base effects of increasing local tax property and business taxes using a natural experiment in the German state of NRW. The findings indicate that while property tax hikes have significant revenue effects, the base effects of both property and business tax hikes are negligible. Tax hikes also have no discernible effect on broader economic variables, such as employment, property prices, or firms' wage bills. Overall, the results suggest that tax rate increases in the range of one to two percentage points do not have negative effects on the local economy.

One potential shortcoming of the analysis is that it is unclear whether the findings hold for other settings. However, an increase in tax rates by one to two percentage points represents a significant transfer of resources from firms and residents to local governments and is clearly noticeable by tax payers. Local tax hikes, both in Germany and elsewhere,

²¹Data source: State Statistical Office of NRW.

are typically smaller than those studied in this paper. Thus, it seems likely that the results obtained in this paper have general relevance. That is, given that even tax hikes as large as in NRW have no negative effect on bases, it is a plausible conjecture that the more moderate tax increases typically observed in other settings would have no negative base effects as well.

This absence of adverse base effects after local tax hikes is remarkable given the various studies showing that individuals respond to personal income tax differentials. Thus, personal and local taxes have ostensibly a different effect on their respective bases. One explanation for these potentially contradictory findings is that there is a more direct link between costs and benefits for local taxes than for personal income taxes. Residents and firms may benefit from an increase in local tax rates by receiving better services or a decrease in municipal debts and thus lower expected future taxes. Another possibility is that responding to property or business tax hikes is more costly than responding to personal income tax hikes. While it may be relatively easy for individuals to reduce work hours²² or invest more time in tax avoidance activities, firms may be unwilling to scale back production or to risk any disruptions by moving to other jurisdictions. They may also be scrutinized more strictly by tax officials, making avoidance activities more difficult. Similarly, for residents, the transaction costs involved with the sale of properties and the social costs of moving to some other jurisdiction may outweigh the costs of paying higher taxes. Tax hikes, as long as they are not extremely large, may also not significantly dissuade new investments or curtail demand for residential property if firms and households are more concerned about the location of a property due to agglomeration rents or residential amenities than about the level of local tax rates.

From a policy perspective, the results in this paper suggest that concerns about negative base effects should not be the main reason to avoid local tax hikes. Yet, this observation

²²However, the findings in Chetty et al. (2011) suggest that frictions are an important reason why only large tax differentials may evoke labor supply responses.

does not imply that tax hikes have no costs. In particular, tax hikes may lead to discontent in the electorate, causing political costs for local officials. It would be interesting to explore in future research what forms these political costs can assume. In the US, for example, the famous property tax revolutions, which led to the imposition of maximum ceilings, may have been a consequence of the inability or unwillingness to avoid high property tax burdens by moving to other jurisdictions. In other settings, high local tax rates may lead to electoral losses for incumbent municipal officials. Analyzing such political consequences would help us to gain a more comprehensive understanding of the determinants and consequences of local tax policy.

Acknowledgements

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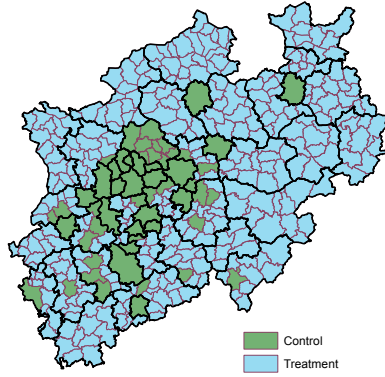
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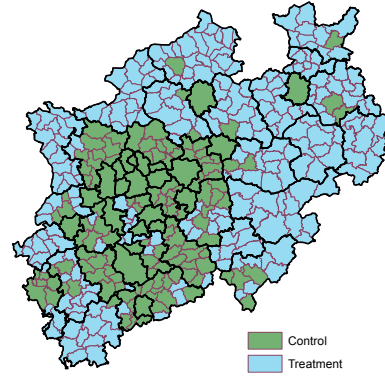
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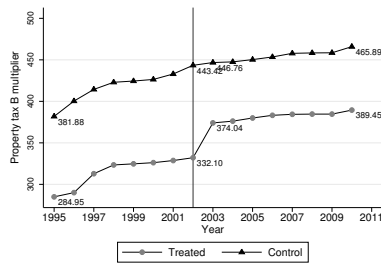


(a) PROPERTY TAX B

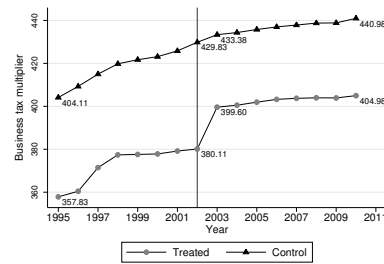


(b) BUSINESS TAX

Figure 1: Treatment and control groups among NRW municipalities. These maps present the municipalities that had actual tax multipliers below (treatment group) and above (control group) the 2003 state-wide hypothetical multipliers for the property and the business tax in 2002. The state-wide hypothetical multiplier was 381 points for the property tax and 403 points for the business tax in 2003. Subfigure (a) pertains to the property tax B (340 treatment and 56 control municipalities) and Subfigure (b) to the business tax (250 treatment and 146 control municipalities).

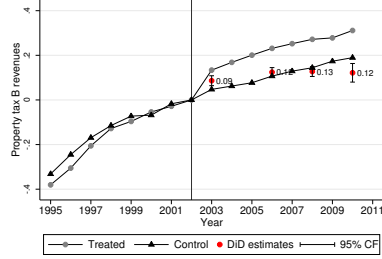


(a) PROPERTY TAX B

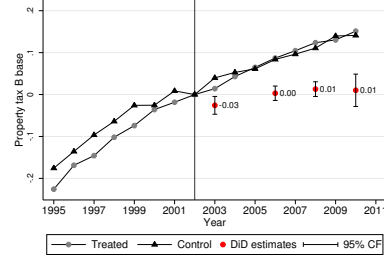


(b) BUSINESS TAX

Figure 2: Tax multipliers in treatment and control groups among NRW municipalities. This figure presents the evolution of the average property and business tax multipliers in the period 1995-2010 for the treatment and control groups. Subfigure (a) pertains to the property tax B (340 treatment and 56 control municipalities) and Subfigure (b) to the business tax (250 treatment and 146 control municipalities).

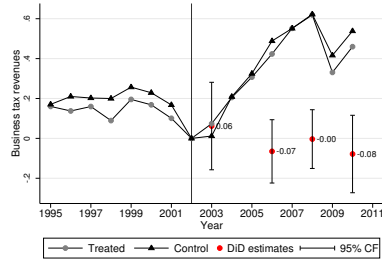


(a) TAX REVENUES

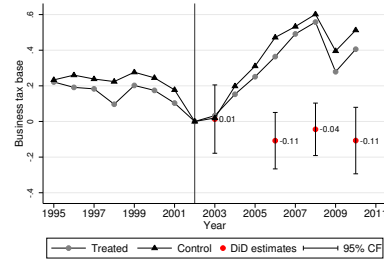


(b) TAX BASE

Figure 3: Property tax revenues and bases in NRW treatment and control municipalities. This figure shows plots of how property tax revenues per capita (in logs) and tax base per capita (in logs) have evolved over the period 1998-2010 in treated and untreated NRW municipalities. Treated municipalities in all three subfigures are those located in NRW with a property tax multiplier ≤ 381 points in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.



(a) TAX REVENUES



(b) TAX BASE

Figure 4: Business tax revenues and bases in NRW treatment and control municipalities. This figure shows how business tax revenues per capita (in logs) and tax base per capita (in logs) have evolved over the period 1998-2010 in treated and untreated NRW municipalities. Treated municipalities in all three subfigures are those located in NRW with a business tax multiplier ≤ 403 points in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.

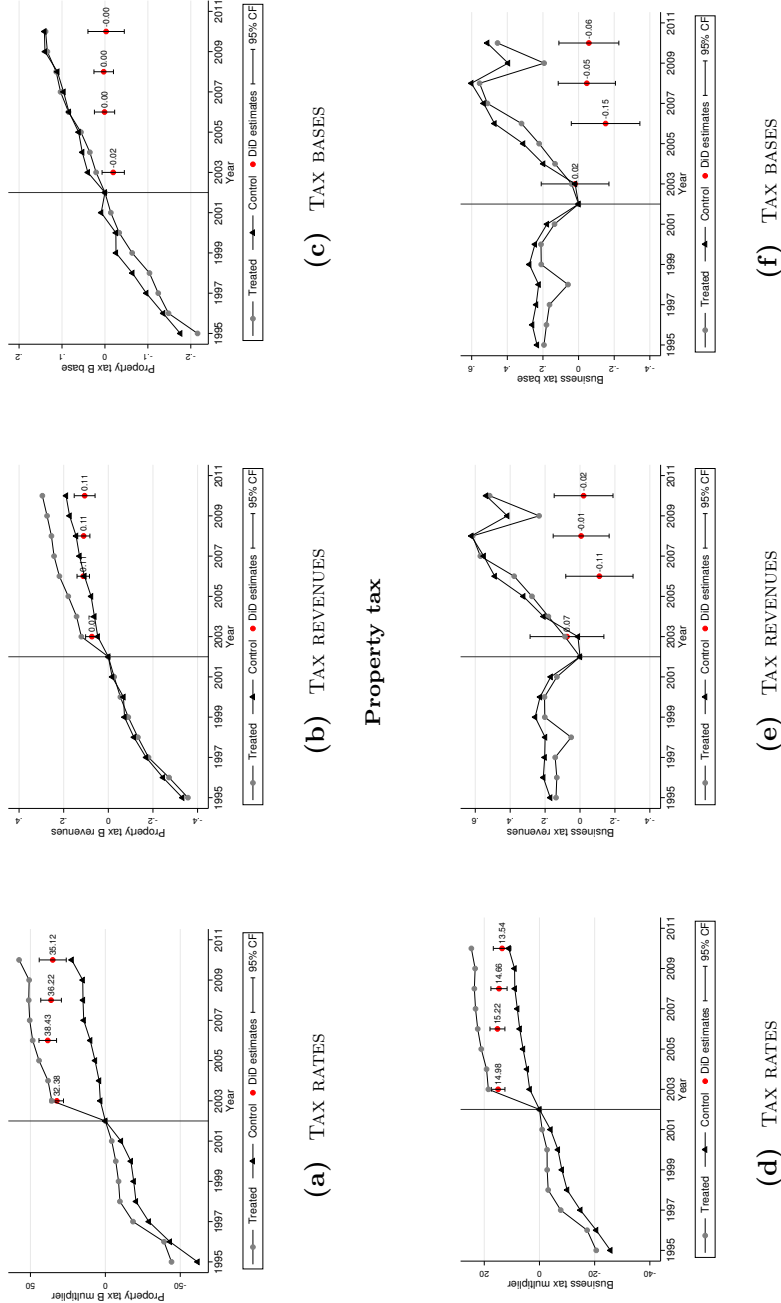


Figure 5: Tax hikes in NRW and effects on untreated municipalities and their treated neighbors. This figure shows how business and property tax multipliers, revenues per capita (in logs), and tax base per capita (in logs) have evolved over the period 1998-2010 in untreated NRW municipalities and all treated NRW municipalities that are contiguous to untreated NRW municipalities. Treated municipalities for the property tax graphs are those located in NRW with a property tax multiplier ≤ 381 and for the business tax graphs those municipalities with a business tax multiplier ≤ 403 in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.

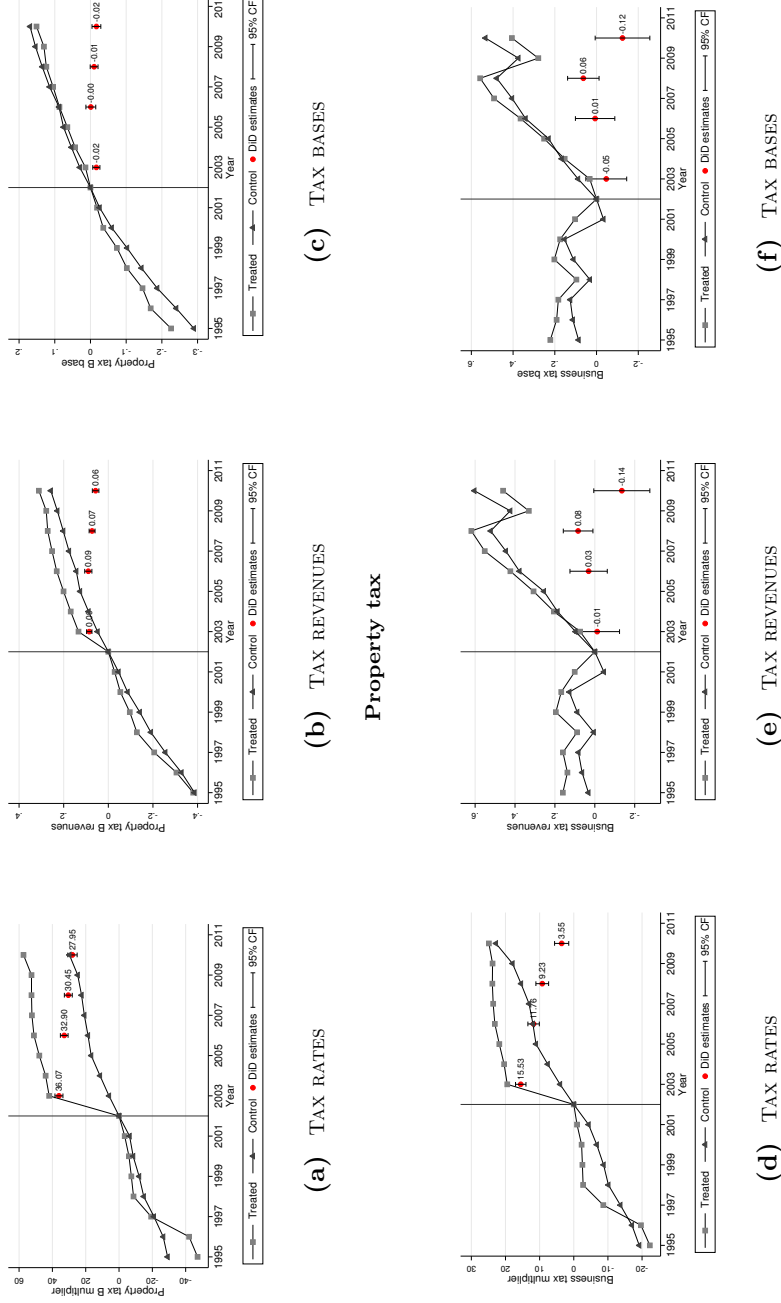


Figure 6: Business and property tax multipliers, revenues and bases in NRW treatment and NDS control municipalities. This figure shows how business and property tax multipliers, revenues per capita (in logs), and tax base per capita (in logs) have evolved over the period 1998–2010 in treated NRW municipalities and all municipalities in the neighboring state of Lower Saxony (NDS). Treated municipalities for the property tax graphs are those located in NRW with a property tax multiplier ≤ 381 and for the business tax graphs those municipalities with a business tax multiplier ≤ 403 in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.

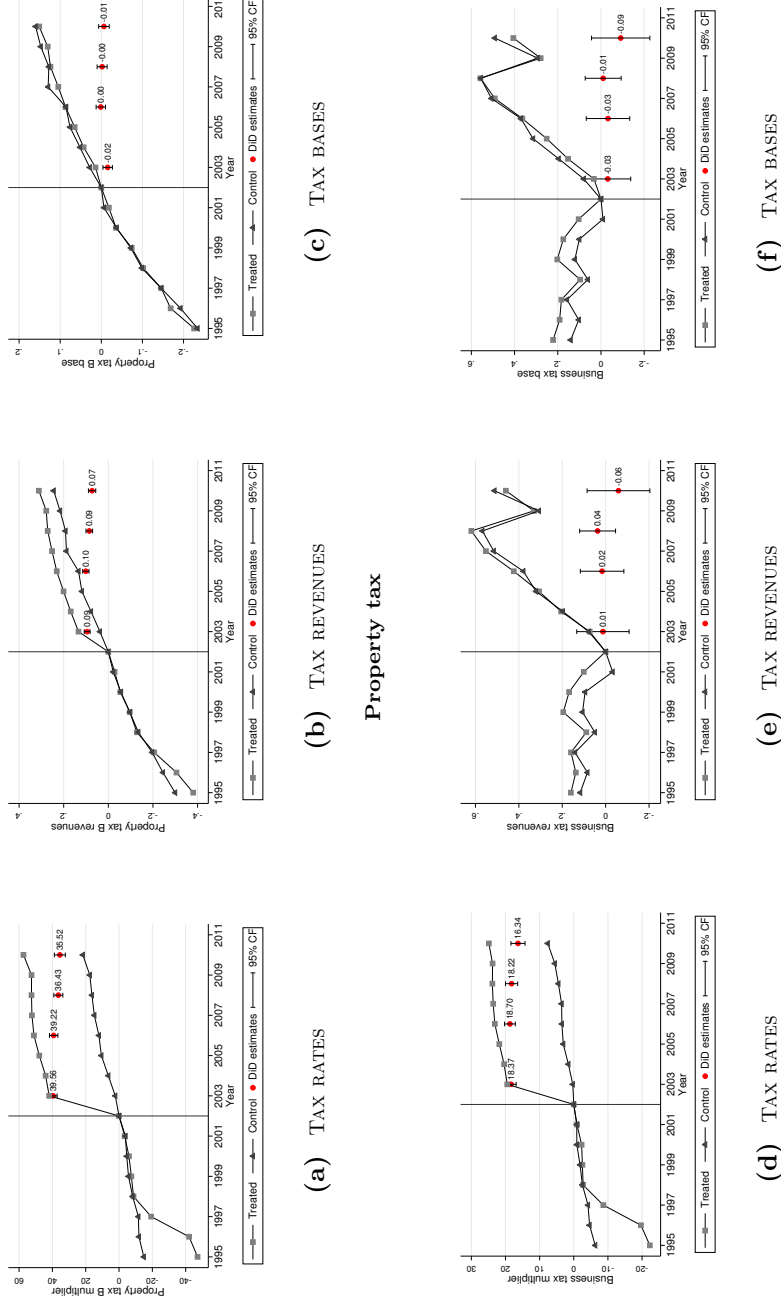
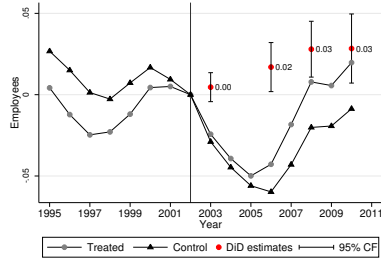
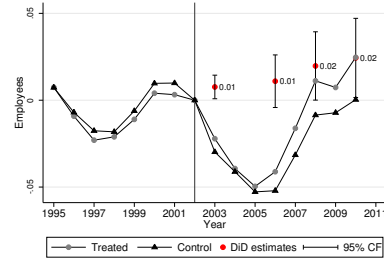


Figure 7: Business and property tax multipliers, revenues and bases in NRW treatment and HE control municipalities. This figure shows how business and property tax multipliers, revenues per capita (in logs), and tax base per capita (in logs) have evolved over the period 1998-2010 in treated NRW municipalities and all municipalities in the neighboring state of Hesse (HE). Treated municipalities for the property tax graphs are those located in NRW with a property tax multiplier ≤ 381 and for the business tax graphs those municipalities with a business tax multiplier ≤ 403 in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.

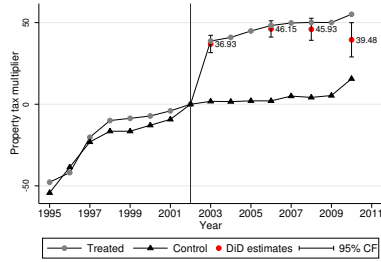


(a) PROPERTY TAX

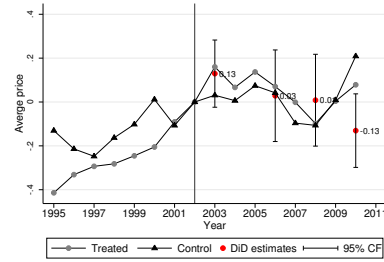


(b) BUSINESS TAX

Figure 8: Tax hikes in NRW and employment effects. This figure shows how the share of employed covered by the social security insurance scheme to total inhabitants have evolved over the period 1998-2010 in treated and untreated NRW municipalities. Treated municipalities for the property tax graphs are those located in NRW with a property tax multiplier ≤ 381 and for the business tax graphs those municipalities with a business tax multiplier ≤ 403 in 2002. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the municipality.

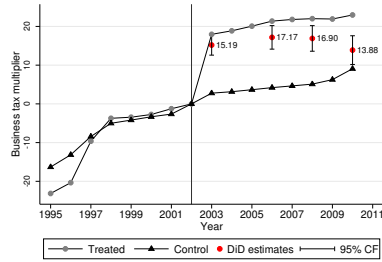


(a) PROPERTY TAX RATE

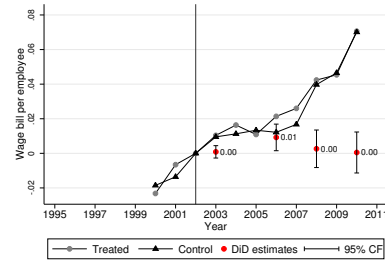


(b) AVERAGE PROPERTY PRICES

Figure 9: Effect of property tax hikes on number of sales and property prices, county-level regressions. This figure shows how average property tax multipliers, the number of property sales, and average property sale prices have evolved over the period 1998-2010 in treated and untreated NRW counties. Treated counties in all three subfigures are counties located in NRW where average property tax multipliers of municipalities are ≤ 381 points in 2002. There are 30 treated and 23 control counties or county-free cities. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the county. Missing observations for individual years are replaced with moving averages.



(a) BUSINESS TAX RATE



(b) WAGE BILL PER EMPLOYEE

Figure 10: Effect of business tax hikes on the wage bill, county-level regressions. This figure shows how average business tax multipliers, the wage bill per employee, and the total wage bill have evolved over the period 2000-2010 in treated and untreated NRW counties. Treated counties in all three subfigures are counties located in NRW where average business tax multipliers of municipalities are ≤ 403 points in 2002. There are 20 treated and 33 control counties or county-free cities. The plots also include coefficient estimates and 95% confidence intervals of difference-in-differences regressions. Confidence intervals are based on heteroscedasticity and cluster-robust standard errors. The unit of clustering is the county.

Table 1: SUMMARY STATISTICS FOR FISCAL VARIABLES

Variable	Obs	Mean	SD	Min	Max
Property tax					
2002					
<i>Treated</i>					
Multiplier	340	332.106	27.422	230.000	380.000
Revenues	340	89.900	15.777	51.054	159.862
Base	340	27.031	3.898	16.787	42.069
<i>Control</i>					
Multiplier	56	443.429	41.517	385.000	530.000
Revenues	56	124.879	27.906	75.080	222.338
Base	56	28.121	5.330	17.068	46.808
1995-2001					
<i>Treated</i>					
Multiplier	2380	312.974	31.424	200.000	400.000
Revenues	2380	76.749	18.532	17.866	326.147
Base	2380	24.408	4.797	6.851	98.834
<i>Control</i>					
Multiplier	392	414.781	56.238	290.000	530.000
Revenues	392	109.459	30.158	30.533	226.861
Base	392	26.272	5.564	8.855	46.205
2003-2010					
<i>Treated</i>					
Multiplier	2720	382.061	26.762	230.000	495.000
Revenues	2720	113.196	19.566	14.306	246.870
Base	2720	29.617	4.575	3.832	64.772
<i>Control</i>					
Multiplier	448	454.844	41.280	390.000	590.000
Revenues	448	140.008	29.545	89.837	310.468
Base	448	30.777	5.769	19.942	62.087
Business tax					
2002					
<i>Treated</i>					
Multiplier	250	380.120	15.971	300.000	400.000
Revenues	250	244.883	163.868	7.235	1199.013
Base	250	64.802	45.460	1.809	386.793
<i>Control</i>					
Multiplier	146	429.836	17.793	405.000	490.000
Revenues	146	259.951	149.668	0.051	954.722
Base	146	60.365	34.588	0.012	235.740
1995-2001					
<i>Treated</i>					
Multiplier	1750	371.675	19.964	260.000	420.000
Revenues	1750	281.252	185.276	0.097	1589.701
Base	1750	76.060	51.850	0.026	512.824
<i>Control</i>					
Multiplier	1022	416.982	23.348	350.000	475.000
Revenues	1022	293.588	151.152	0.032	1229.470
Base	1022	70.328	35.675	0.008	267.275
2003-2010					
<i>Treated</i>					
Multiplier	2000	402.738	15.151	310.000	450.000
Revenues	2000	363.550	260.435	0.007	2071.517
Base	2000	91.029	68.607	0.009	658.004
<i>Control</i>					
Multiplier	1168	437.122	17.883	403.000	490.000
Revenues	1168	372.251	231.485	0.003	1945.204
Base	1168	85.072	53.180	0.006	480.318

Figures for revenues and bases are per capita values in levels.

Table 2: SUMMARY STATISTICS FOR SOCIO-DEMOGRAPHIC CHARACTERISTICS

Variable	Obs	Mean	SD	Min	Max
Property tax					
2002					
<i>Treated</i>					
Population	340	24657.110	18323.990	4303.000	141534.000
Social security employment	340	25.103	8.938	5.245	50.396
<i>Control</i>					
Population	56	173088.100	181351.400	17158.000	968639.000
Social security employment	56	30.570	10.027	14.145	61.608
Business tax					
2002					
<i>Treated</i>					
Population	250	21713.050	17105.450	4303.000	141534.000
Social security employment	250	25.138	9.159	5.245	50.396
<i>Control</i>					
Population	146	86630.770	131848.700	9229.000	968639.000
Social security employment	146	27.140	9.393	10.340	61.608