Does inter-municipal cooperation reduce the intensity of tax competition?

Evidence on inter-local industrial parks in Germany

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Abstract

We ask whether inter-municipal cooperation serves as a platform by which municipalities coordinate tax policies and reduce the intensity of tax competition. Specifically, we focus on inter-municipal cooperation in form of inter-local industrial parks. We apply the case study-oriented synthetic control method (SCM) to analyze the causal impact of 12 inter-local industrial parks on municipal tax-setting behavior using data on municipalities from West-German states of Hesse and North Rhine Westphalia between 2000 and 2018. We find evidence that inter-local industrial parks lead to tax coordination in some occasions but not in others. Our ex post analysis suggests that tax coordination only takes place in specific political constellations.

Key-words: Inter-local industrial parks, inter-municipal cooperation, tax coordination, counterfactual analysis, synthetic control method

JEL: H25, H77, H71, R58

1. Introduction

Inter-municipal cooperation (hereafter IMC) has become increasingly widespread in the industrialized world (e.g., Hulst and van Montfort 2007; Rosenfeld et al. 2016). IMC refers to the voluntary cooperation of municipalities in a distinctly defined set of one or more tasks while it preserves local autonomy in the other tasks. In practice, IMC-arrangements cover a wide spectrum of municipal tasks (Hulst et al., 2009; LeRoux et al., 2010). IMC enables local governments to internalize spillovers and allows especially smaller jurisdictions to exploit economies of scale and scope in the jointly performed tasks (Banaszewska et al.; e.g., Feiock et al., 2009). There are numerous studies assessing the impact of IMC – asking whether existing IMC-arrangements reduce costs and/or increase efficiency in public service production (for a recent survey, Bel and Sebő (2019).

Less attention has been paid to a possible side-effect of IMC: IMC creates a platform that facilitates the coordination of local policies among union-members. This platform can be used for collusive purposes. In particular, it can be used to coordinate local tax policies and thereby reduce the intensity of inter-local competition (e.g., Bischoff et al. (2021).

So far, this side-effect of IMC has received little attention in the empirical literature on IMC.[1] This is where the current paper comes in. We provide an empirical study of the impact of IMC using data from two West-German states in the period 2000 – 2018. We focus on a specific field of inter-municipal cooperation – namely inter-local industrial parks and investigate whether they are used as platforms to reduce inter-local competition. Inter-local industrial parks are a very good testing ground for a number of reasons. First, they require

[1] Three empirical studies on the impact of the French "Establishments for inter-municipal cooperation" are an exception. They will be discussed in detail in section 2.

substantial joint investments and thus represent a strong commitment for long-term cooperation (e.g. Bischoff et al. (2021). Second, they are especially suitable for organizing tax coordination because they control important dimensions of the inter-local competition for mobile capital – namely the quality of new local business land and the timing of its development (e.g. (Taylor, 1992); Bischoff et al. (2021). This makes it easier to enforce coordination (see Feuerstein, 2005). If IMC is used as a tool to reduce inter-local competition, we expect to observe it for inter-local industrial parks. Finally, local business tax rates provide a clear-cut indicator for the intensity of inter-local competition.

We employ the case study-oriented approach of the synthetic control method (SCM) to establish specific impacts of interlocal industrial parks (Abadie et al. 2010; Abadie 2021). It is especially suitable for cases where the treatment group is small and thus constructing an appropriate control group is challenging. Our analysis covers 12 inter-local industrial parks founded between 2005 and 2014 involving 30 municipalities in the West-German states of Hesse and North Rhine Westphalia. At the 5% level we find a significant increase in tax multipliers and/or a reduction in the spread of inter-municipal tax rates emerges in three out of twelve cases. In another five cases, the effects are weakly significant. These results indicate that inter-local industrial parks are used as a platform for tax coordination in some occasions. Our ex-post analysis suggests that these occasions are characterized by specific political constellations.

The paper proceeds as follows. Section 2 reviews the relevant literature. Section 3 presents the main hypothesis and data. Section 4 describes our empirical strategy before section 5 presents the results of this analysis. Section 6 discusses the results and section 7 concludes.

2. Review of literature

Local tax-setting behavior

Economic theory takes it that local governments compete for mobile businesses and firms (e.g., Oates & Schwab, 1988). The most widely studied instruments are local tax rates. A large number of theoretical papers building on them (Wilson, 1999) show that the mobility of capital forces governments to set low tax rates for mobile factors – especially capital. These models assume governments to be benevolent and thus conclude that tax competition leads to welfare losses.

Besley and Case (1995) show that essentially the same behavioral pattern can be rationalized by a model that assumes opportunistic incumbents whose aim is to extract rents. Accordingly, citizens (and firms) compare the bundle of tax rates and public services in their home municipality with the bundle offered in neighboring municipalities. This yardstick competition limits the leeway of incumbents to extract rents through high tax rates and thereby increases efficiency in local government. Finally, the empirical patterns in tax-setting behavior may be the as a result of social learning (e.g. Baskaran (2014). In this case, the welfare interpretation is unclear.

All three interpretations predict the tax-setting behavior to be spatially correlated – a pattern reported in many empirical studies (e.g. Revelli (2001); Allers and Elhorst (2005). Hereafter, we use the term (inter-local) tax interdependence whenever we refer to the empirical phenomenon but continue to refer the theoretical concepts – in particular inter-local tax competition – whenever the underlying mechanism is meant.

While most studies on inter-local interdependence look at tax-setting behavior, Taylor (1992) turns to the interdependence in infrastructure investments. He argues that time is the main strategic variable: Municipalities can increase the chance of attracting firms if they are faster in providing the necessary infrastructure than their competitors. Jayet and Paty (2006)

build a two-stage model of inter-local competition. In stage 1, the municipalities build infrastructure before they compete using tax rates in stage 2. Their model explains why we often see an overprovision of land devoted to business purposes (see also Dembour & Wauthy, 2009). This implies that municipalities set inefficiently low tax rates and provide too much business-related infrastructure (Jayet & Paty, 2006; Taylor, 1992). This notion is supported by Büttner (2006). Using data from Germany , he finds that municipalities exposed to more intense tax competition provide a higher amount of commercial land.

Policy coordination and IMC

Local governments can increase their freedom of maneuver and fight inefficiencies from overly intense inter-local competition by coordinating their (tax) policies. However, the literature on tax coordination (e.g., Keen & Konrad, 2013) points at severe limits in the enforceability of tax agreements (see also Kehoe (1989)). In particular, enforceability is limited by the fact that tax rates are just one among many instruments in the competition for mobile capital. The literature also shows that coordination is more difficult among heterogeneous jurisdictions. For instance, the outsider position is found to be particularly interesting for small jurisdictions with large neighbors (e.g., Keen & Konrad, 2013). Drawing analogies from the literature on cartels (e.g., Levenstein & Suslow, 2006), the likelihood of successful coordination can be increased if jurisdictions are organized in associations because these facilitate surveillance and side-payments and provide a platform to punish defectors (see Feuerstein, 2005).

The critical role of inter-local platforms in the coordination of tax policies provides a link to the literature on IMC). Bischoff et al. (2021) provide an empirical analysis on the question whether intra-regional competition fosters inter-municipal cooperation. They apply a hazard model to a panel of more than 6 000 West-German municipalities between 2000 and 2015 and find inter-local industrial parks more likely to emerge among municipalities that –

other things equal – have low business tax rates and high land tax rates. The current paper builds on Bischoff et al. (2021) and ask whether the foundation of inter-local industrial parks change local tax-setting behavior in a way consistent with a reduction of inter-local tax competition.

Inter-local competition and IMC

Very few papers address the relationship between IMC and inter-local competition. Di Liddo and Giuranno (2016) analyze the impact of IMC on yardstick competition in a theoretical model. They argue that governments interested in extracting rents make use of IMC because this increases the amount of extractable rents without reducing the probability of re-election. While rent extraction is unlikely to play a major role in industrial parks, the main logic of Di Liddo and Giuranno (2016) still applies: Inter-local industrial parks may serve as a means to take the bite out of intra-regional competition for mobile capital.

Three empirical papers on the French "Establishments for inter-municipal cooperation" (EIMC) are closely related to the current study. Charlot et al. (2015) analyze the impact of EIMC in urban French municipalities on local business taxes. Using spatial panel models, they find EIMC-membership to lead to higher business tax rates. Breuillé et al. (2018) analyze the impact of EIMC on the rates of four major local taxes using a difference-in-difference approach as well as instrumental variable techniques. They show that the membership in an EIMC increases the overall burden from municipal tax rates considerably while the tax rates imposed by member municipalities themselves decrease. Agrawal et al. (2020) apply a spatial econometrics approach and use historical unions as an instrument for the EIMC formed recently. They find the policy interaction of municipalities within the same EIMCs to be more intense than the interaction with outside municipalities. In sum, these studies support the notion that EIMC reduce the intensity of inter-local tax competition.

EIMC are multi-purpose institutions in charge of a wide range of important municipal tasks. The underlying legislation allows municipalities to share the local tax base with the EIMC or to transfer the right to raise local taxes to it. Since, 2014, the EIMC council is elected by the citizens in the member municipalities. Moreover, the central government ultimately required every municipality to be part of an EIMC. Given these characteristics, EIMC are a very special case that is by no means representative for IMC-arrangements found elsewhere. Instead, they more resemble the fully-fledged jurisdictions – similar to the German "Verbandsgemeinde" (see also Breuillé et al. (2018).

We are not aware of any study on inter-local tax interdependence and IMC in Germany. However, there are studies that indirectly relate to this topic. Büttner and Schwerin (2016) argue that the strikingly large number of German municipalities apply exactly the same tax rate is an indication of partial tax coordination, but they do not test this notion. Blesse and Martin (2015) analyze municipal tax setting behavior in the German state North Rhine-Westphalia and find more intense tax interaction among municipalities located in the same county or administrative district (Regierungsbezirk) or covered by the same local newspaper. While these studies indicate that tax coordination takes place where there are networks or organizations of inter-local interaction, they do not empirically test for this the relationship. This is where our paper comes in.

3. Main Hypothesis and data

3.1 Main hypothesis

Consider a certain municipality located in a competitive environment. If tax competition is intense, both citizens and a benevolent local government share the objective to reduce the intensity of tax competition because this increases welfare along with their budgetary room of maneuver. If governments are opportunistic, the main logic of Di Liddo and Giuranno (2016)

applies: Inter-local industrial parks can serve as a means by which local governments can take the bite out of yardstick competition and thereby facilitate rent-extraction without diminishing their re-election prospects.

By establishing an inter-local industrial park, municipalities create an institutional platform that facilitates inter-local coordination in the future. If we combine the main logic of the theory of tax coordination with Taylor (1992)'s theory on competition in infrastructure investments, we see that inter-local industrial parks are a particularly promising instrument in tax coordination: Municipalities that agree on a joint industrial park automatically also agree on a common quality of infrastructure and timing of land development. This implies a commitment not to circumvent a possible agreement on tax policy by shifting the competition to the field of infrastructure quality or the time of finalizing it. Thus, we hypothesize:

Main Hypothesis:

Inter-local industrial parks constitute a platform that is used to reduce the intensity of intra-regional tax competition.

Following the literature on tax interdependence (see section 2), we use the multiplier of the local business tax as the main indicator. The above hypothesis implies that municipalities connected by a joint industrial park set higher business tax rates – other things equal. In addition, we use the average bandwidth of tax rates among cooperating municipalities. Here, tax coordination implies a reduction in bandwidth.

German municipalities are a suitable testing ground. They provide important public services like local roads, industrial parks or pre-school childcare and have leeway when choosing quality and quantity of many public services. More than 50 percent of municipal revenues come from unconditional grants distributed through a formula-based fiscal equalization system and from vertical tax sharing (e.g., Büttner, 2006). The local business tax

is the most important endogenous source of municipal revenues accounting for 18 percent of revenues in West-Germany in 2015. Municipalities set the effective rate on profits of local business establishments by fixing the so-called tax multiplier (applied to a unified tax base). Similarly, they determine the tax multipliers and receive the revenues from local land taxes (e.g., Bischoff & Krabel, 2017). The land tax A levied on land used in agriculture and forestry raises negligible revenues while the land tax B levied on the ratable value of real estate contributes some 5 percent to the budget of West-German municipalities on average (in 2015).[2]

German local governments can regulate the use of land within its borders. Similar to the system of land zoning in the US, German land-use regulation follows the principle of functional zoning. Accordingly, municipalities develop plans of land-usage in which they legally dedicate land to specific purposes (Hirt, 2012). Firms are only allowed to operate on land dedicated to business activities. Changes in the plans for land-usage must pass the municipal council and need approval by an upper-tier administration. In most cases, German municipalities play an active role in the developing and marketing and managing business land (e.g. Bischoff et al, 2021). When industrial parks are developed jointly, the details of the cooperation is often settled in formal contracts. In many cases, special inter-municipal unions (Zweckverbände) are formed for these purposes (e.g. Bischoff et al. 2021).

3.2 Data

Given the lack of official data, we collect data on joint industrial parks from 1) from an extensive study on German joint industrial parks by Wuschansky and König (2006), 2) official data on municipality owned enterprises, 3) official data on administrative unions, 4) federal commercial estate databases. 5) finally, we conduct supplementary internet searches to have a

[2] Data on revenue shares from Bundesministerium der Finanzen (2021) and own calculations.

complete data set of joint industrial parks in Germany (see also Bischoff et al. 2021).[3] For every joint industrial park, we know which municipalities participate and the year in which the contractual agreement underlying the joint industrial park was signed. Less than 8 percent of the German municipalities participate in a joint industrial park. Cooperation is more frequent in Western and South-Western states. Some parks date back to the 1970s. Most inter-local industrial parks encompass two cooperating municipalities while parks with four or more partners are rare (e.g. Bischoff et al. 2021).

We use a panel data set of municipalities of the two German states Hesse and North Rhine Westphalia between 2000 and 2018. We focus on these two states because their municipalities did not go through fundamental regional reforms like the East-German states, nor are many of their municipalities are organized in multi-purpose organizations (so-called Verbandsgemeinden, Samtgemeinden, Ämter, Verwaltungsgemeinschaften). The latter restrictions were imposed because this organization perform municipal tasks on their behalf and thus may serve as a platform to organize tax policy coordination. In many cases, joint industrial parks are organized within these organizations. This makes it difficult to define an adequate control group.

Restricting the sample to Hesse and North Rhine Westphalia leaves us with a balanced panel covering 837 municipalities 2000 to 2018. 103 of them are organized in a total of 49 inter-local industrial parks. Roughly 70 percent of them have only two members and parks covering more than three members are rare. More than two thirds of them were founded before 2005 (see

[3] The data on joint industrial parks is complemented by a wide range of official municipal level data provided by the Regional Database of the German Federal Statistical Office and the statistical Offices of the Länder. Further data on the German highway network was kindly provided by Leibniz Institute of Ecological Urban and Regional Development (http://autobahn.ioer.info/).

figure 1). In the upcoming analysis, we will focus on those inter-local industrial parks founded between 2005 and 2014 and encompassing municipalities of only one state.

[Figure 1]

4. Empirical strategy

The synthetic control method (SCM) generalizes the usual difference-in-differences (DiD) model by allowing for uncontrolled confounders that vary over time (Abadie et al. (2010) ; Abadie (2021)). The DiD model is prone to a violation of the parallel trend assumption when data no longer support the pre-treatment trends. The SCM method enables a carefully construction of counterfactuals. While the DiD approach only establishes the overall effect of inter-local industrial parks on tax coordination, the synthetic control method provides detailed insights on the impacts of individual cooperations. The practical problem of multiple treated units is settled by aggregation (Abadie 2021).

In obtaining the SCM estimator of effects of a inter-local industrial park in a state for year t, t= T_0+1, T_0+2, ..., T, we rely on a donor pool of n municipalities r, r=1,2,...,n, within that state, where no joint industrial park exist. In order to control for spillover effects, communities adjacent to the treated area are excluded. The treated area 0 consists of two or more municipalities in which an inter-local industrial park is founded in year T_0.[4]

Let Y_{rt} be the indicator of tax coordination as the outcome of interest that is observed for all regions r at any year t in the sample period. The effect α_{0t} is given by the difference between the values of coordination variable with and without a joint industrial park, Y_{0t}^{F} and Y_{0t}^{N}, in the treated area 0:

[4] As inter-local industrial parks can be founded at any time in year T_0, we mainly assess the initial change in business taxes starting in year T_0+1.

(1) $\alpha_{0t} = Y_{0t}^{F} - Y_{0t}^{N}$, $t=T_0+1, T_0+2, ...T.$

While the outcome variable Y_{0t}^{F} is observed for $t > T_0$, $Y_{0t} = Y_{0t}^{F}$, the potential extent of tax coordination, Y_{0t}^{N}, is unobservable in the post-treatment period. In the SCM approach, the counterfactual Y_{0t}^{N} is estimated by constructing a synthetic control unit that resembles the treated area in its characteristics and outcome in the pre-treatment period as close as possible. The best match determines the optimal weights $w_1^*, w_2^*, ..., w_n^*$, with $0 \leq w_r^* \leq 1$ and $\sum_r w_r^* = 1$ for r=1,2,...,n, of the control communities in the synthetic municipality.

The synthetic control method uses the optimal weights $w_1^*, w_2^*, ..., w_n^*$ to estimate the counterfactual tax multiplier Y_{0t}^{N} as a linear combination of observed outcomes Y_{rt} in a set of control municipalities:

(2) $\hat{Y}_{0t}^{N} = \sum_{r=1}^{n} w_r^* \cdot Y_{rt}$.

For a feasible implementation of SCM, we randomly select n=100 control units from the donor pool. With (2), the synthetic control estimator of the effect of inter-local industrial parks α_{0t} is given by

(3) $\hat{\alpha}_{0t} = Y_{0t} - \sum_{r=1}^{n} w_r^* \cdot Y_{rt}$, $t=T_0+1, T_0+2, ...T.$

Abadie (2021) examines the properties of the SCM estimator $\hat{\alpha}_{0t}$ for an underlying linear factor model that does not impose parallel output trends (see also Abadie et al. (2010)). Multiple unobserved components are allowed to exert varying effects over time. $\hat{\alpha}_{0t}$ is an unbiased estimator of the effect if the synthetic control reproduces the observed and unobserved characteristics of the treated area. With regard to the unobserved features the match is favorable when transitory shocks are small. Although the bias bound inversely depends on T_0, a bad match

between the characteristics of the treated area and the synthetic control unit cannot be compensated by an increased pre-treatment period. In particular, the ability of the synthetic control $\hat{Y}_{0t}^{N}$ to reproduce the path of the tax multiplier Y_{0t} in the pre-treatment period t=1, 2, ..., T_0, is deemed as an indication for a low bias.

Statistical inference of the tax effect of inter-local industrial parks $\hat{\alpha}_{0t}$ can be based on placebo tests as a special variant of permutation tests (Abadie and Gardeazabal (2003); Abadie et al. (2010); Abadie (2021)). In our approach, the treatment is successively assigned to all randomly selected control municipalities of the donor pool. By estimating the placebo effect in the control regions, a permutation distribution of tax effects of interlocal industrial parks $\hat{\alpha}_{rt}^{PL}$, r=1,2,,,,,n, is generated. According to our main hypothesis of rising business tax rates or catching-up following the agreement of a joint industrial park, one-sided placebo tests are conducted.[5] In order to obtain valid inference, control municipalities with a bad pre-treatment match are excluded from testing.[6] As in a classical permutation test, lead-specific actual significance levels (p-values) can be computed by establishing the rank of the real effect $\hat{\alpha}_{0t}$ in the distribution of the placebo effects (Cavallo et al. 2013). The adjusted p-value at lead h is obtained from the reduced sample of m control municipalities (m≤n) with an acceptable pre-treatment fit (Galiani and Quistorff (2017):

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5 The one-sided inference can substantially increase the power of the test (Abadie (2021)).

6 Abadie et al. ((2011) gauge a bad pre-treatment fit by means of the ratio between the pre-treatment MSPEs of a placebo and the treated unit. Per default a ratio of 20 is used to discard the placebo. However, robustness checks show that our testing results hold for a wide range of MSPE ratios.

We apply the synthetic control method to estimate the treatment effects of joint industrial parks formed in the period from 2005 to 2014 on tax coordination in five sub-sequent years in the four German states Hesse and North Rhine-Westphalia. Between 2005 and 2014, these states saw 12 new agreements on joint industrial parks involving a total of 29 participating municipalities (see Table 1) Seven agreements involved two municipalities while the others consists of three municipalities.

[Table 1]

Municipalities that started cooperating before 2005 or after 2014 were excluded from the donor pool – leaving us with 734 untreated municipalities. Figure 2 shows the municipalities in the treatment group (dark blue) and the municipalities with joint industrial parks that were excluded from the sample because they were founded before or after the above-mentioned period (light blue). The latter were excluded from the donor pool. In addition, we exclude all neighbors of municipalities with joint industrial parks from the donor pool to rule out spillover effects. This leaves us with 495 municipalities in the final donor pool. Figure 3 shows the distribution of business tax multipliers in donor pool and treatment group for selected years.

[Figure 2+3]

When generating the synthetic control group, we restrict the relevant donor pool to municipalities from the same state as the treated municipalities to avoid any biases resulting from differences in state regulation or changes in the latter. In each case, 100 randomly selected municipalities from the relevant part of the donor pool are used to construct synthetic controls with respect to essential municipal characteristics. We recurred to random sampling because of the size of the donor pools (Hesse: 298; North Rhine-Westphalia 161). Moreover, a random selection of control units tends to be favorable for a bias bound of the SCM estimator (Abadie et al. 2010; Abadie 2021)).

Table 2 provides the descriptive statistics for municipalities in the treatment group and in the donor pool. We use the per capita tax revenues from vertical tax sharing generated by the observed municipality. We control for the seat share of Christian democrats as well as local associations in the municipal council to account for partisan effects and differences in local preferences. Next to these time-variant confounders, we use a number of other variables that are indirectly related to local tax-setting behavior and potentially drive the emergence of interlocal industrial parks (e.g. Bischoff et al. (2021). Two variables account for the availability of suitable land in municipality m and its neighbors. The dummy variable "land_scarce" takes on the value 1 if the share of land available for development (captured by land currently used in farming and forestry) in a certain municipality m is below the median of all municipalities (0 else). In addition, we introduce the number of neighboring municipalities for which the corresponding share is larger than the median. The availability of a good transport connection is captured by a dummy variable that takes on the value 1 if there is a motorway junction within the jurisdictional borders of municipality m (0 else) and a separate variable equal to the number of neighboring municipalities with a motorway junction.

We use the (logarithm of the) total number of citizens, the share of inhabitants younger than 18. In addition, we include the corresponding median values among municipality m's neighbors as well as the median for the fiscal capacity among neighboring municipalities. We include the number of neighboring municipalities that have the same strongest party in the local council as municipality m to capture expected political transaction costs associated with tax coordination without formal municipal agreement. Finally, we use time-invariant confounders. Urban clusters are marked using a dummy that takes the value 1 in all cases where municipality m or one of its neighboring municipalities has more than 100.000 inhabitants (0 else) or has the status of a city with county rights. We use the number of neighboring municipalities in total and the number of neighbors belonging to the same county (e.g. Bischoff et al. (2021). Separate

dummies mark municipalities located at state borders and all years with an active IMC-promotion policy at state level.

[Table 2]

To construct synthetic controls for the treated areas, optimal weights of the selected control municipalities, $w_1^*, w_2^*, ..., w_n^*$, and the regional characteristics and pre-treatment outcome, $v_1^*, v_2^*, ..., v_{k+1}^*$, have to be determined for all inter-local industrial parks.[7] As a result, we obtain synthetic control regions that resemble the treated areas much more closely than a simple average of the control municipalities. While the similarity is very close for some variables, a nearly perfect match cannot be obtained for all variables (Abadie et al. (2011); Cavallo et al. 2013). However, variables with larger deviations usually have low v-weights and thus only play a subordinate role in the construction of the synthetic controls. This construction process accounts for time-variant uncontrolled confounders.

5. Results

In Hesse, the inter-local industrial parks in our sample were founded in 2005, 2006 and 2011. In one case (H3) we find significant differences in the tax multiplier of the cooperating municipality and the synthetic control unit at the 5% level (Fig. 4). In the two other cases (H1 and H4), the differences in tax multipliers prove to be weakly significant (10% level).

[Figure 4]

For North Rhine-Westphalia, we analyze seven industrial parks founded between 2007 and 2014. Figure 5 shows significant differences at the 5% level in the business tax multiplier

[7] The optimal weight is chosen such as to minimize the mean squared prediction error (MSPE) of the synthetic control with respect to Y_{0t}^N in the pre-treatment period.

for the two parks founded in 2010 (N3 and N4) and weakly significant effects for two parks founded in 2013 and 2014 (N6, and N7).

[Figure 5]

In sum, we find evidence that inter-local industrial parks serve as a platform to coordinate tax policies and reduce the intensity of inter-local tax competition in one quarter of the cases. If we include those cases where the effect is significant at the 10 percent level, the share rises to more than half ~~of the~~ of the cases. At both levels of significance the rise of the tax multipliers appears to be sizeable.

In the analysis underlying figure 4 and 5, we use the business tax rate to measure the intensity of tax competition a municipality is exposed to. In the underlying logic, tax coordination implies an increase in business tax rates in the treated units – as compared to the counterfactual. However, tax coordination could also imply a reduced bandwidth of tax rates among cooperating municipalities. This can be achieved without an increase in tax rates. To capture this second form of tax coordination, we calculated the following new indicator:

$$Y_{rt} = \frac{n}{n-1}\left(\max\{t_{it}\} - \text{av}\{t_{it}\}\right)$$

For a municipality within the treatment group, it calculates the average deviation in the tax rate t_{it} of all partners in the joint industrial parks to the highest tax rate in the consortium. Here, n is the number of partners. For the non-treated municipalities, the same indicator was calculated for a fictitious inter-local industrial park consisting of the municipality and random selection of n direct neighbors. We keep the constellation of municipalities for which the measure is calculated constant across the entire period.

[Figure 6 + 7]

Using this measure, we reran the analyses above. The results are presented in figure 6 and 7. For Hesse, we only find weakly significant effects for two of the five inter-local industrial parks (H2 and H4). In North Rhine Westphalia, a significant effect in the second form of tax coordination appears in two cases (N3 and N4) at the 5% level and a weakly significant effects is reported for a third industrial park (N6).

[Table 3]

Table 3 contrasts the results of SCM analyses for our two indicators of tax coordination. Overall, significant effects are more frequent for the first indicator. This holds for both levels of significance. Only the cases H3 in Hesse and N3 and N4 in North Rhine Westphalia support our main hypotheses at the 5-percent level of significance. In the latter two cases, support is found for both our indicators while the Hessian case only finds an increase in average tax multipliers but no change in the bandwidth of tax multipliers. At the 10 percent level of significance, we find another four cases where inter-local industrial parks lead to an increase in the tax multiplier and one case with a reduction in bandwidth of tax multipliers and one case with an effect on both indicators.

6. Discussion

In sum, we find evidence that joint industrial parks are used to coordinate tax policies among their members. However, this effect only occurs in a limited number of cases. Thus, we find only partial support for our main hypothesis. This raises the question whether the cases for which there is evidence for tax coordination differ from those cases that are not. This question is addressed in an ex post analysis. The comparison refers to characteristics of the joint industrial parks (e.g. number of members and the number of situs members) as well as to characteristics of the cooperating municipalities. Next to population size, we focus on variables that are closely related to the incentives to increases taxes (e.g. due to low fiscal capacity or low

business tax rates in the pre-treatment phase). The vote share of Christian Democrats (CDU) and local initiatives in the local council are included to characterize the political constellations in which the decisions to cooperate are made. Finally, a descriptive statistical analysis of the involved industrial parks lead us to include variables capturing land scarcity, the access to a motorway and the number of neighbors with abundant land.

In our ex post analysis, we test for differences in the average value of the variables within the consortia as well as for differences in the standard deviation within the consortia. The higher the latter, the more heterogeneous the interests are – other things equal – and thus the more difficult it is to coordinate. For most characteristics, we restrict the comparison to the time before the industrial park is founded. For the parties' seat shares, however, the comparison extends to the post-treatment period because political constellation in this period co-determines the ability to coordinate taxes within the newly founded consortium.

We run univariate Wilcoxon rank-sum tests to compare the characteristics inductively. The results are reported in Table 4a and 4b. Table 4a compares the three cases with a significant increase in business tax multipliers (H3, N3, N4) to the other cases. Table 4b provides the analogous comparison for the bandwidth in tax multipliers – thus comparing N3 and N4 to the rest.

[Table 4a/b]

Neither the characteristics of the industrial parks, nor the non-political characteristics of the municipalities are found to differ. However, significant differences are found for the seat shares in the local council held by CDU and local initiatives. The joint industrial parks for which we find evidence for successful tax coordination are characterized by a higher seat share of CDU and a lower seat share of local initiatives in the local council. Qualitatively the same pattern emerges if we run the tests comparing the cases significant at the 10 percent level to the

~~in~~nonsignificant cases.[8] It is important to note that these results cannot be interpreted in a causal way. Yet they provide a hint that tax coordination may be more likely in certain political constellations than in others.

Summing up, our results provide evidence that inter-local industrial parks are used to undermine intra-regional tax competition in favor higher business tax rates. However, this effect only emerges in a limited number of cases.

Our findings are partly in line with the studies by Charlot et al. (2015), Breuillé et al. (2018) and (Agrawal et al., 2020) on the role of the French EIMC. They find the formation of EIMC to lead to a systematic increase in local tax rates. The difference in results can be explained by the fundamental differences between EIMC and the inter-local industrial parks analyzed in this paper. While the latter represent inter-municipal cooperation in a narrow and clearly defined field of government activity, EIMC are formed to provide a wide array of different services. They have their own, directly elected council and the right to raise their own taxes. Furthermore, every French municipality has to join an EIMC. This is why Breuillé et al. (2018) call them "… in practice, an additional level of sub-national jurisdictions…". They are not representative for the phenomenon IMC – defined as the voluntary cooperation of municipalities in a distinctly defined set of one or more tasks that preserves local autonomy in the other tasks (e.g. Bel and Warner (2016). The inter-local industrial parks analyzed in our paper clearly belong to this category.

Our results are also partly in line with the study by Banaszewska et al. (2022). They analyze the impact of inter-municipal unions founded to promote local business development on local economic performance in Poland. Many inter-municipal unions included in their

[8] Results are available upon request.

sample are involved in developing industrial parks. They find a positive impact on local employment rates while there is no indication that the number of resident firms is reduced. Their results stand against the notion that IMC generally facilitates collusive behavior at the expense of local firms. While our study does not generally challenge this implication, it shows that collusive behavior is present in some cases.

What are the political implications? When it comes to the joint industrial parks, our results do not nourish the fear that they are a general threat to inter-local (tax) competition. Thus, our results to not call for additional regulation of local autonomy.

To assess the effect for other forms of IMC, it is necessary to account for the fact that inter-local industrial parks represent a particularly suitable form of IMC for tax coordination. In other fields, collusive behavior with respect to tax policy is much more difficult to organize. Thus, our results suggest that IMC is unlikely to go along with a systematic reduction inter-local competition. This is good news for those who want to promote IMC as a means of exploiting economies of scale and internalizing inter-regional spillovers. Our results do not support the fear that IMC reduces the intensity of inter-local competition on a large scale and thus systematically mitigates the efficiency gains from decentralization (e.g. Di Liddo and Giuranno (2016). On the other hand, our results are bad news for those who believe that inter-local competition leads to welfare losses and were hoping for IMC to dampen competition and increase welfare systematically.

Our ex post analysis provides little insights that help differentiate between constellations in which IMC is likely to lead to tax coordination and thus increased tax rates and constellations in which this is unlikely to happen. This question must be left for future research. At the same time, our results add to the growing body of evidence showing that similar treatments have quite heterogeneous effects across seemingly similar treatment cases. Our analysis shows that the case study-oriented synthetic control method (SCM) provides valuable additional insights

that standard DiD-regressions cannot give. This holds especially in studies like ours where the number of treated cases is limited.

Our study is not without limitations. Most importantly, we focus on year in which the agreement about launching an inter-local industrial park is reached rather than the year when the first firms actually settle therein. One may argue that this is a rather early stage because coordination needs time. On the other hand, we do not find the difference in tax multipliers between treated municipalities and synthetic control groups to increase over time. Moreover, the platform "joint industrial park" is established once the inter-local agreement is reached and the interaction among local government officials are likely to be more intense in the early phase of the cooperation when essential decisions are made.

7. Conclusion

Using data on municipalities in two West-German states between 2000 and 2018, we test whether inter-local industrial parks reduce the intensity of tax competition the cooperating municipalities face. We apply the synthetic control method to 12 inter-local industrial parks founded in two German states between 2005 and 2014. We find evidence for successful tax coordination in some interlocal industrial parks but not in others. The ex post analysis does not provide much insight into the conditions under which inter-local industrial parks facilitates tax coordination. This question must be left for further research.

Our study is the first to use the SCM analysis in the context of IMC or local tax-setting behavior before. Its main advantage lies in the carefully targeted construction of counterfactuals and the control for unobserved confounders that vary over time. In contrast to the DiD approach the synthetic control method provides detailed insights on the impacts of inter-local industrial parks on tax coordination. This enables researchers to identify the drivers of tax rate effects and tax coordination.

In addition, our study adds to the literature on the impact of IMC on local economic performance. More empirical studies are needed using data from other regions with different institutional settings and different fields of cooperation. Beyond testing for an overall IMC-effect on tax rates, these studies should pay more attention to the heterogeneity of effects – trying to identify conditions under which IMC does lead to tax coordination and thus increased business tax rates. In addition, other indicators have to be analyzed. The model by Di Liddo and Giuranno (2016) suggests that budgetary measures capturing managerial slack are promising in this respect. Such measures can be used to capture the impact of IMC on the intensity of yardstick competition in numerous fields of local government activity.

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Figure 1: Municipalities forming a new inter-local industry parks (1990 -2017)

1a. Hesse

1b. North Rhine Westphalia

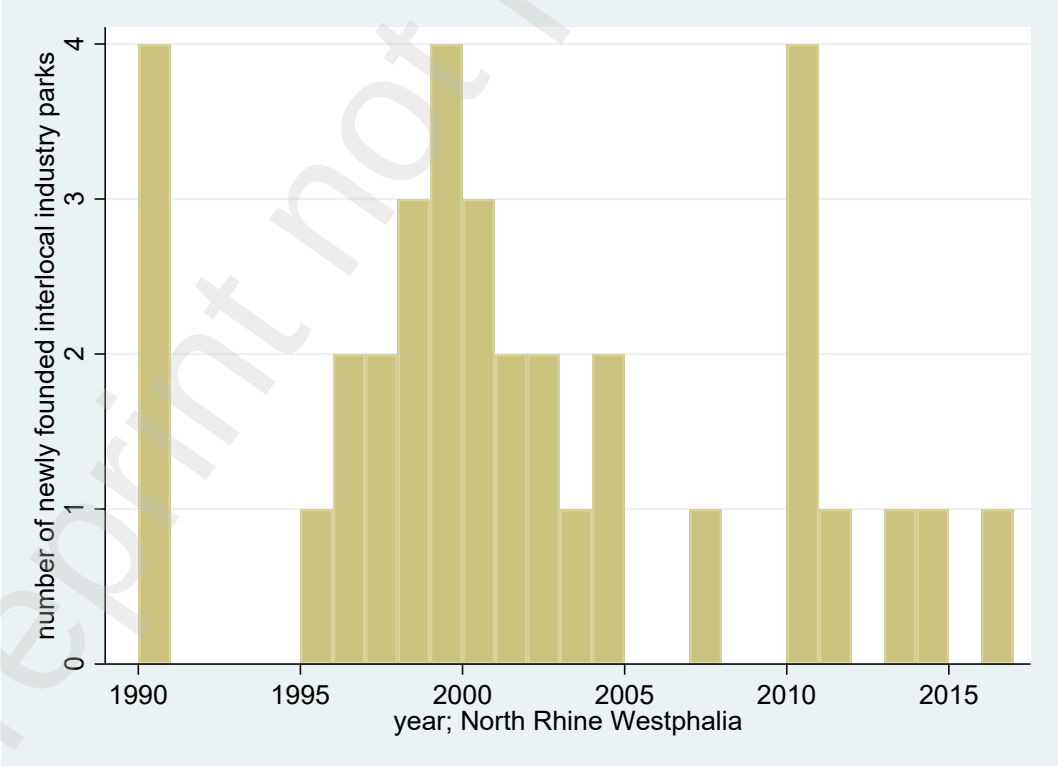


Figure 2: Map of municipalities with joint industrial park

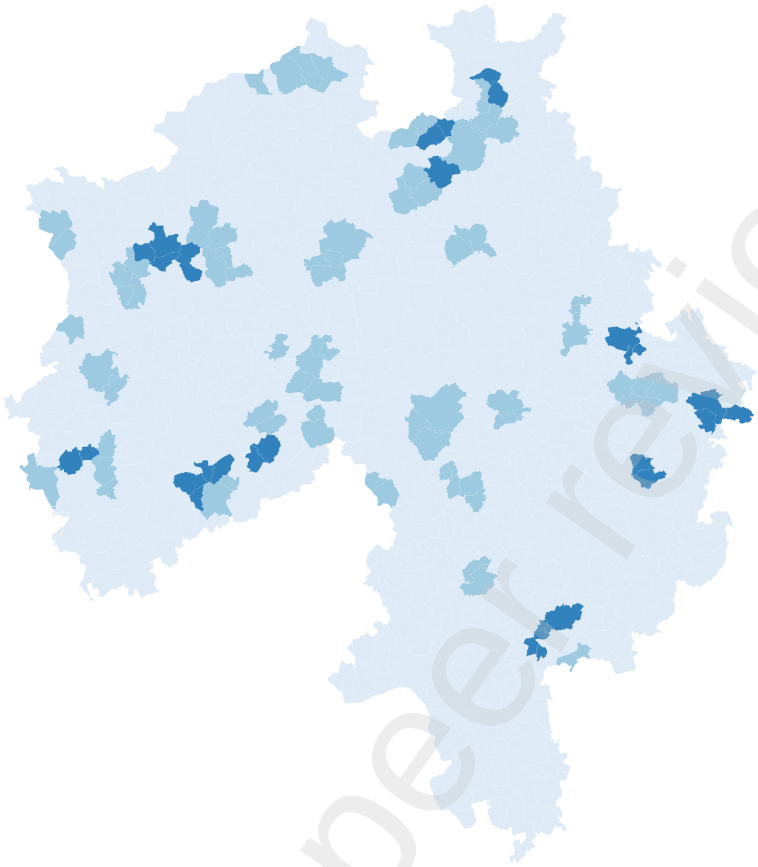
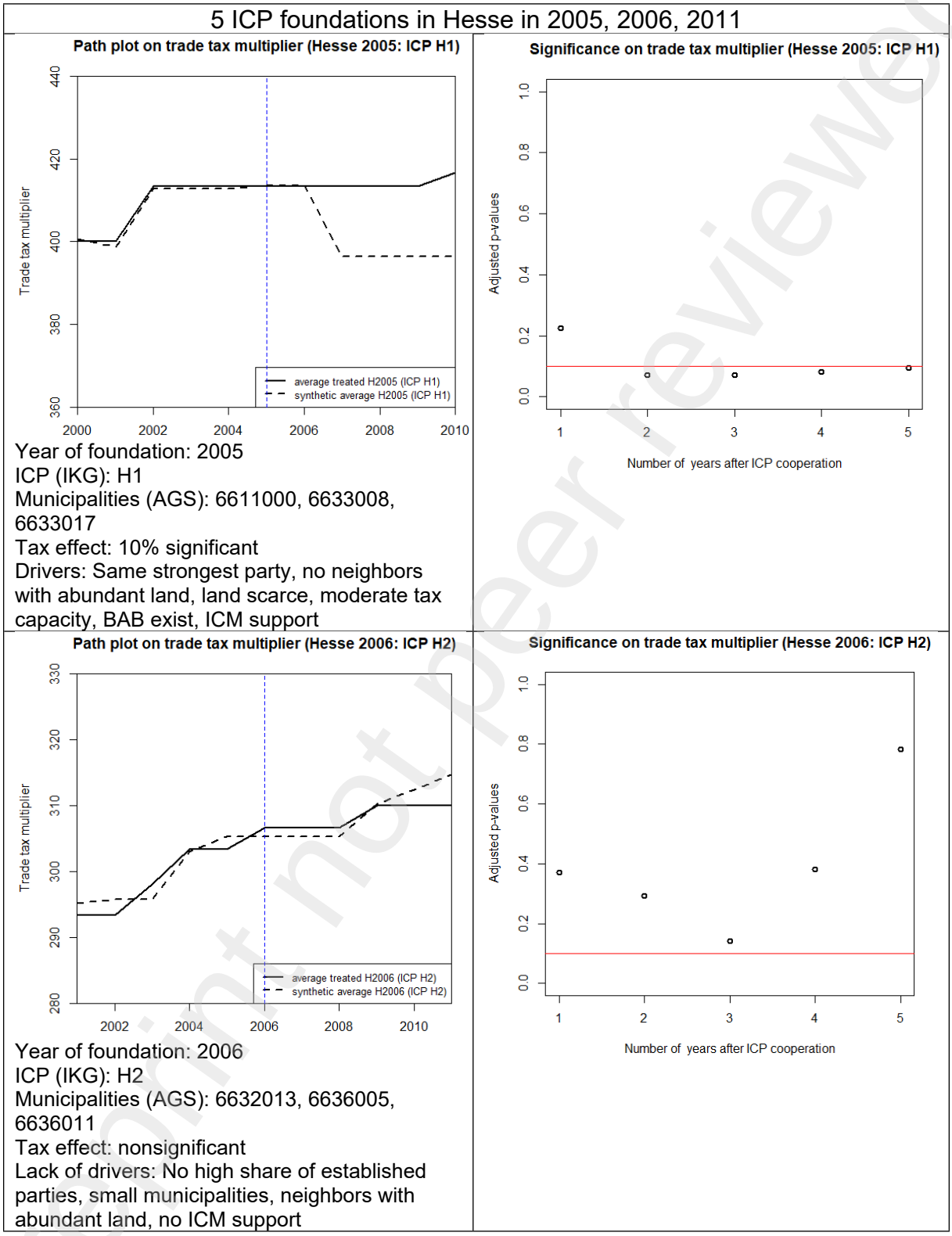
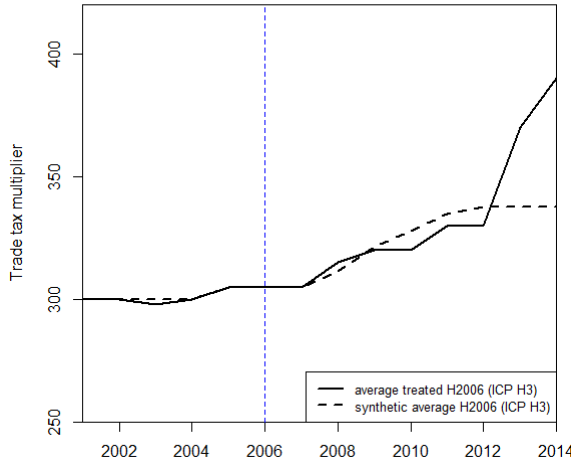
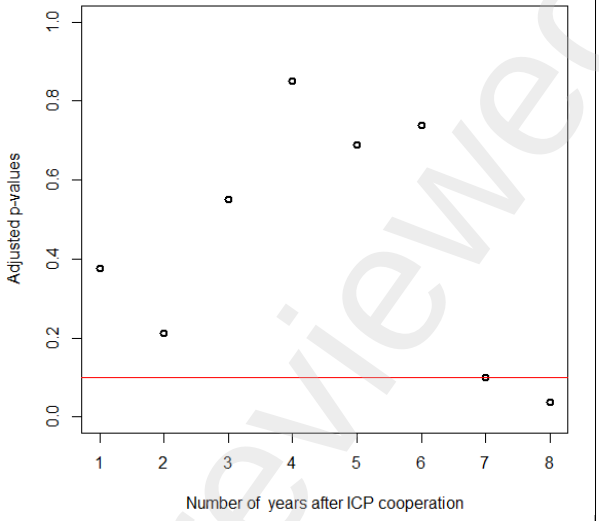


Figure 3: Business tax multiplier in treatment group and donor pool (selected years)

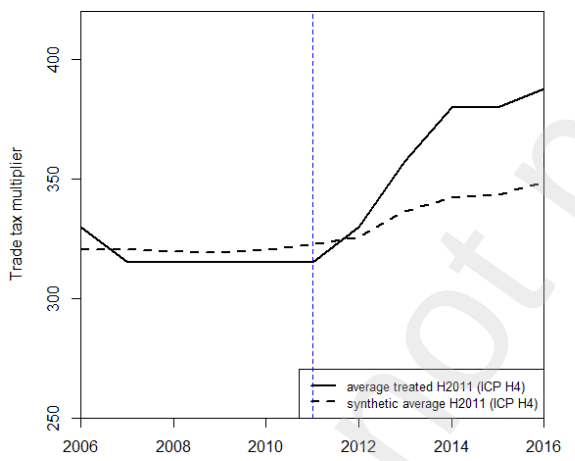
Figure 4: Real and synthetic business tax multiplier for inter-local industrial parks in Hesse

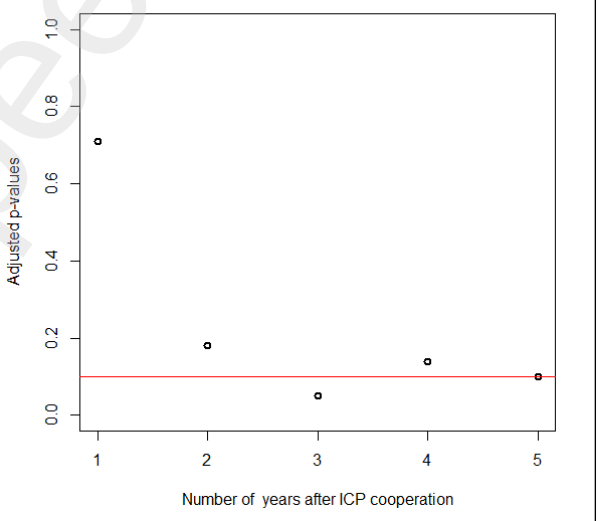




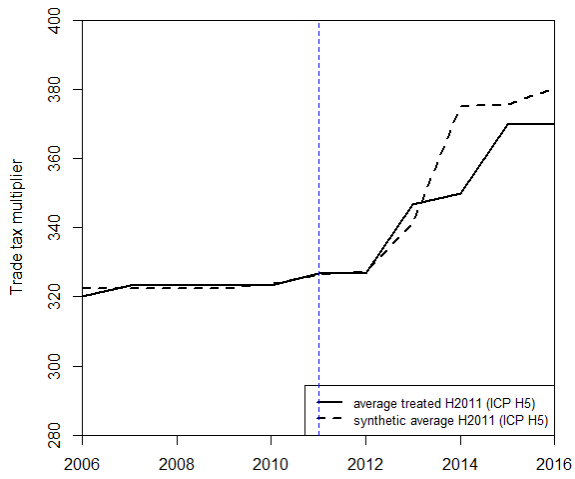


Year of foundation: 2006
ICP (IKG): H3
Municipalities (AGS): 6632011, 6632015
Tax effect: 5% significant
Drivers: High CDU share, same strongest party, land scarce, low tax capacity, BAB exist, ICM support





Year of foundation: 2011
ICP (IKG): H4
Municipalities (AGS): 6435006, 6435007
Tax effect: 10% significant
Drivers: High CDU share, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist, ICM support



Year of foundation: 2011
ICP (IKG): H5
Municipalities (AGS): 6435013, 6440004, 6440014
Tax effect: nonsignificant
Lack of drivers: No high share of established parties, relevance of local initiatives, changing strong party, low share of neighbors with abundant land

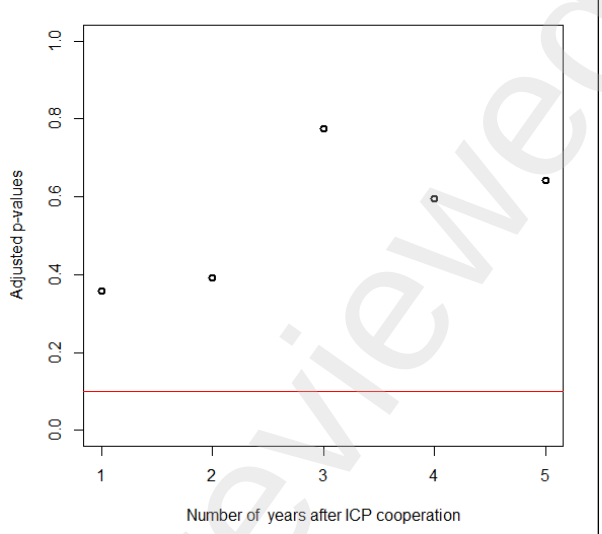
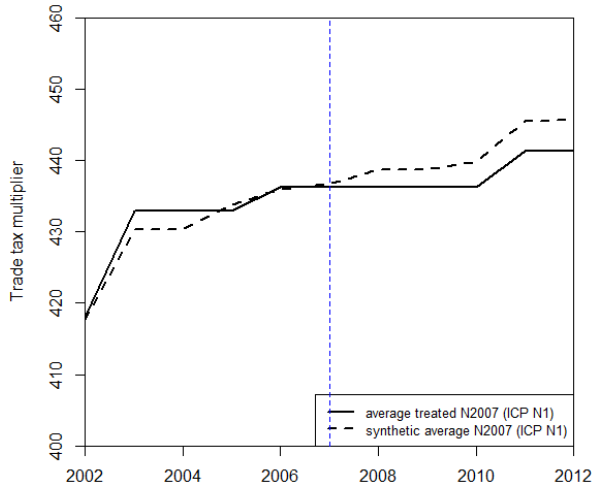
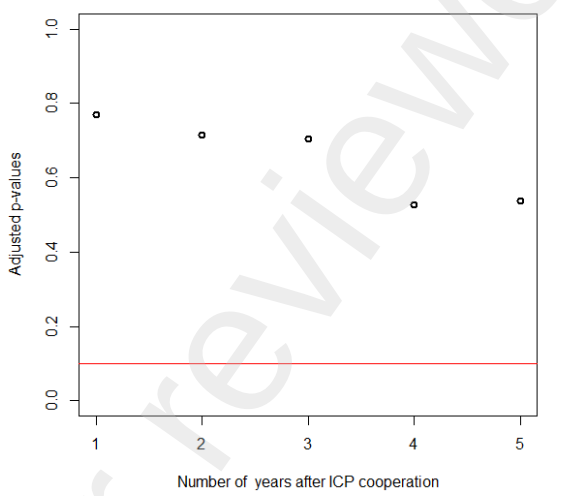


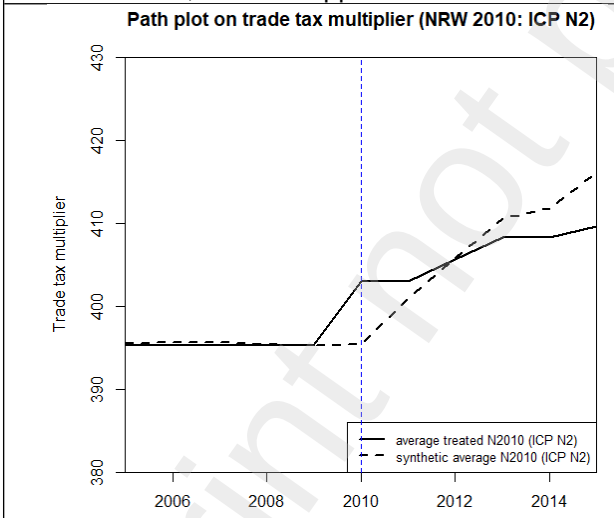
Figure 5: Real and synthetic business tax multiplier for inter-local industrial parks in North Rhine-Westphalia

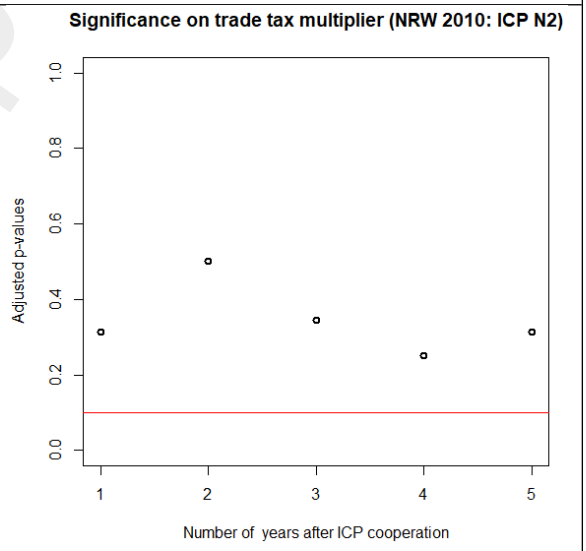
7 ICP foundations in
North-Rhine Westfalia in 2007, 2010, 2011, 2013, 2014



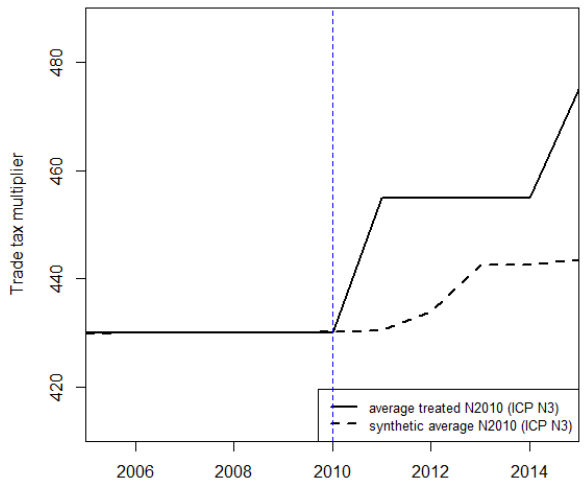


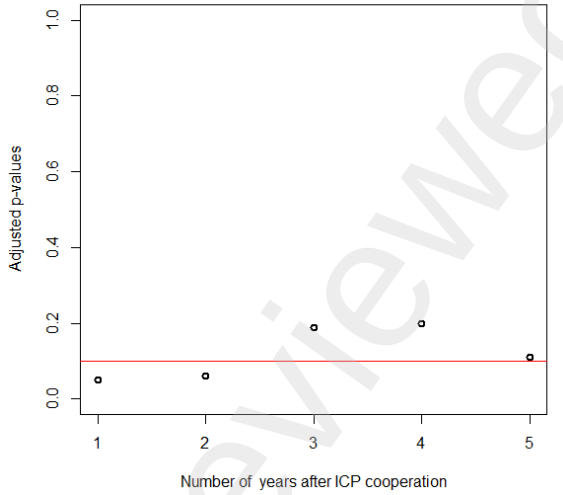
Year of foundation: 2007
ICP (IKG): N1
Municipalities (AGS): 5170008, 5170016, 5170044
Tax effect: nonsignificant
Lack of drivers: No high share of established parties, changing strongest party, neighbors with abundant land, no ICM support



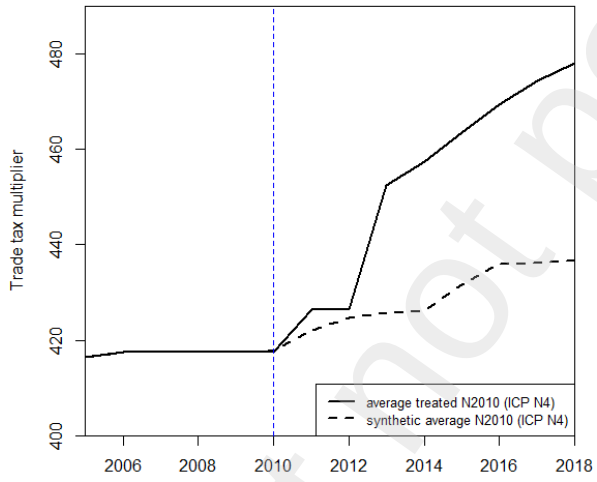


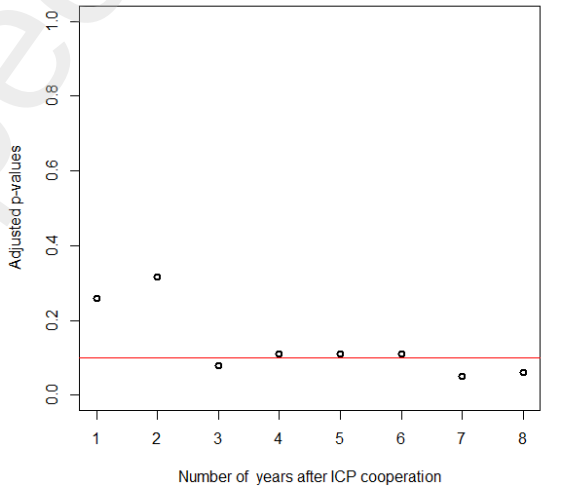
Year of foundation: 2010
ICP (IKG): N2
Municipalities (AGS): 5754008, 5754012, 5754052
Tax effect: nonsignificant
Lack of drivers: no high share of established parties, already high tax capacity, no ICM support



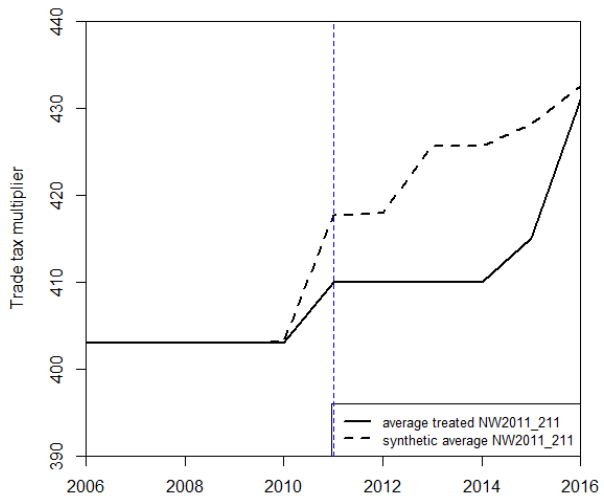


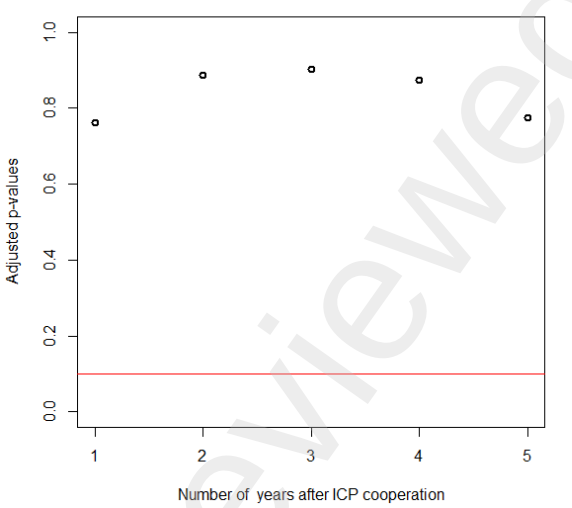
Year of foundation: 2010
ICP (IKG): N3
Municipalities (AGS): 5382044, 5382068
Tax effect: 5% significant
Drivers: High CDU share (outright majority), same strongest party, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist



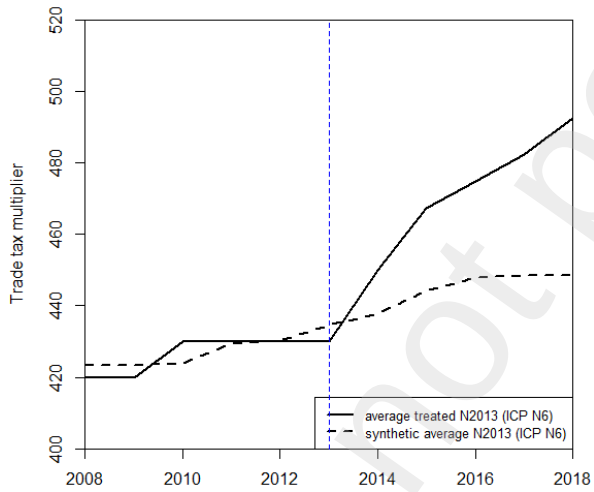


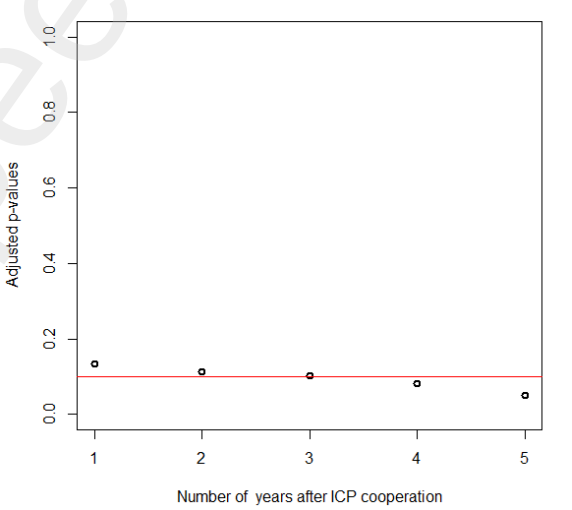
Year of foundation: 2010
ICP (IKG): N4
Municipalities (AGS): 5382036, 5382040
Tax effect: 5% significant
Drivers: High CDU share (outright majority), same strongest party, no neighbors with abundant land, land scarce, low tax capacity



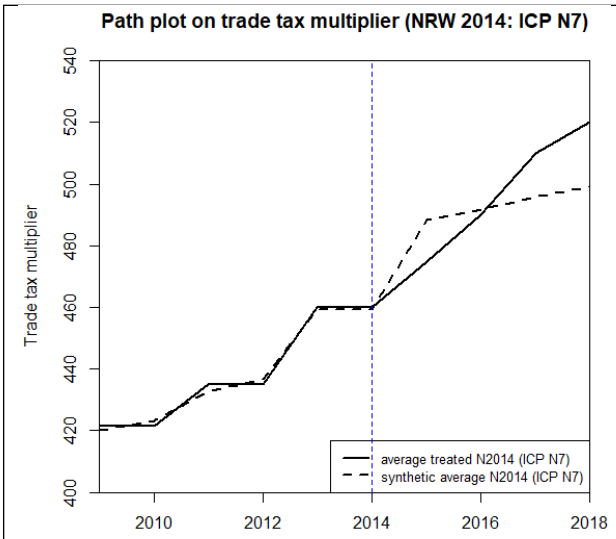


Year of foundation: 2011
ICP (IKG): N5
Municipalities (AGS): 5758024, 5770016
Tax effect: nonsignificant
Lack of drivers: changing strongest party, no ICM support





Year of foundation: 2013
ICP (IKG): N6
Municipalities (AGS): 5382004, 5382012
Tax effect: 10% significant
Drivers: Same strongest party, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist



Year of foundation: 2014
ICP (IKG): N7
Municipalities (AGS): Inden (5358020), Eschweiler (5334012)
Tax effect: 10% significant
Drivers: High CDU share, same strongest party, land scarce

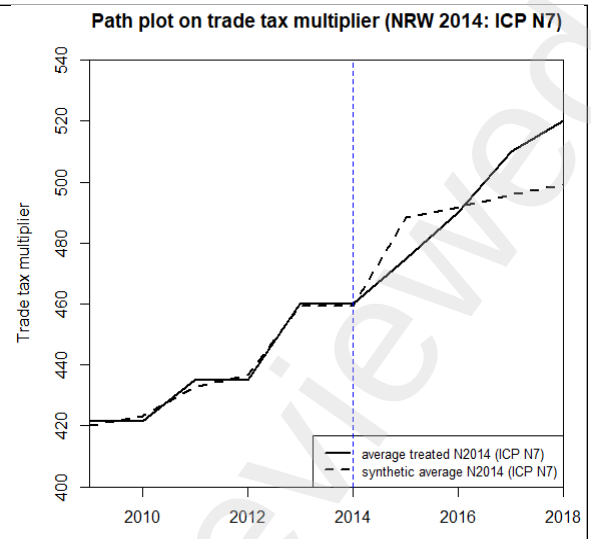
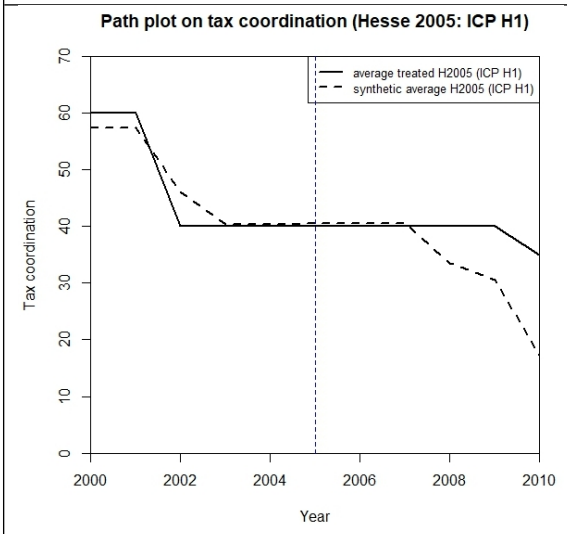
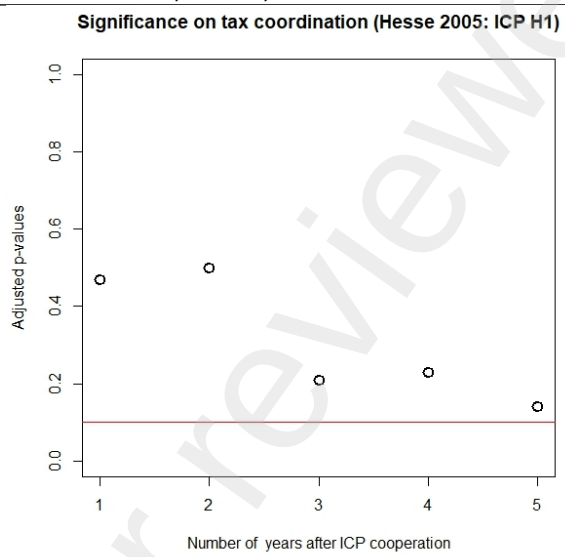


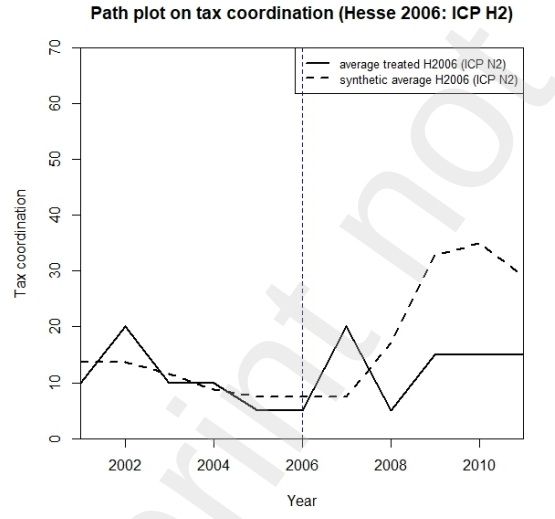
Figure 6: Real and synthetic average deviation in business tax multiplier for inter-local industrial parks in Hesse

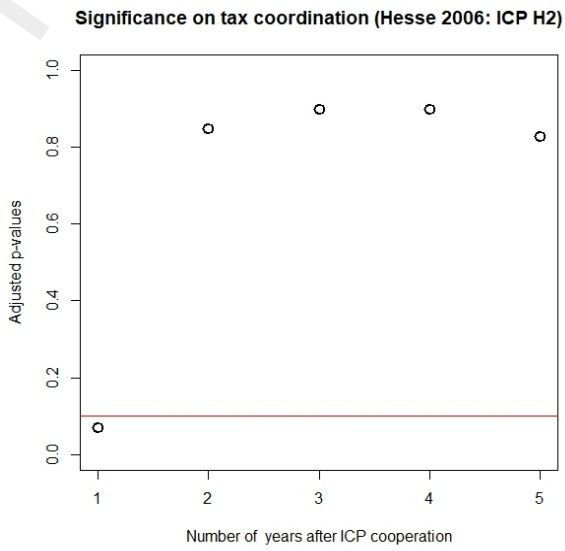
5 ICP foundations in Hesse in 2005, 2006, 2011



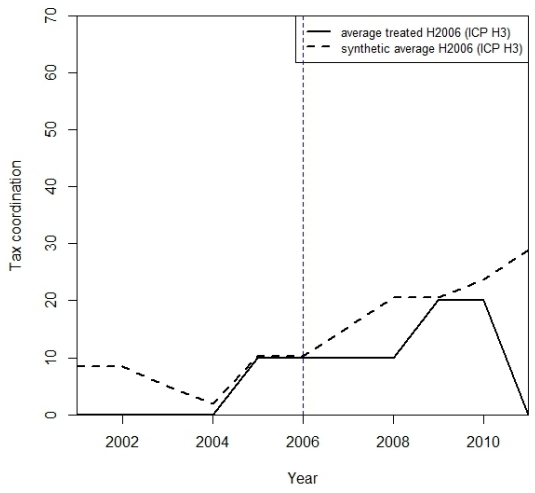


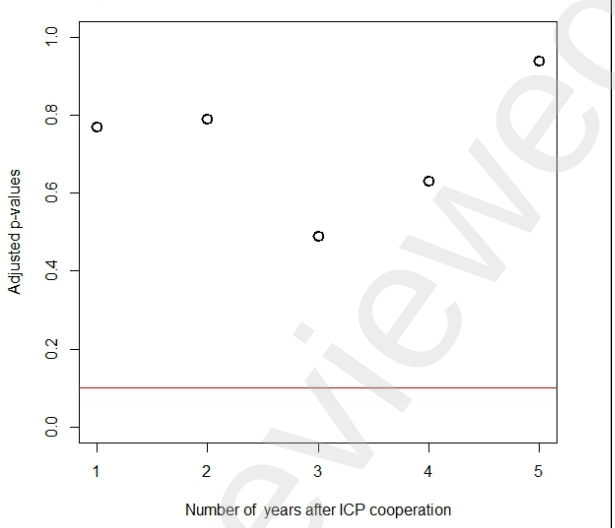
Year of foundation: 2005
ICP (IKG): H1
Municipalities (AGS): 6611000, 6633008, 6633017
Average deviation effect: nonsignificant
Drivers: Same strongest party, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist, ICM support



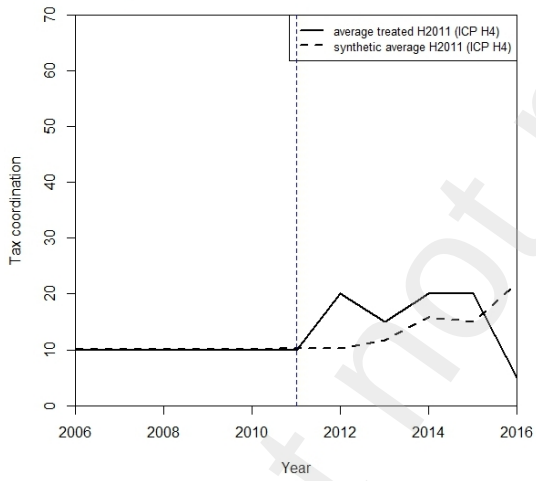


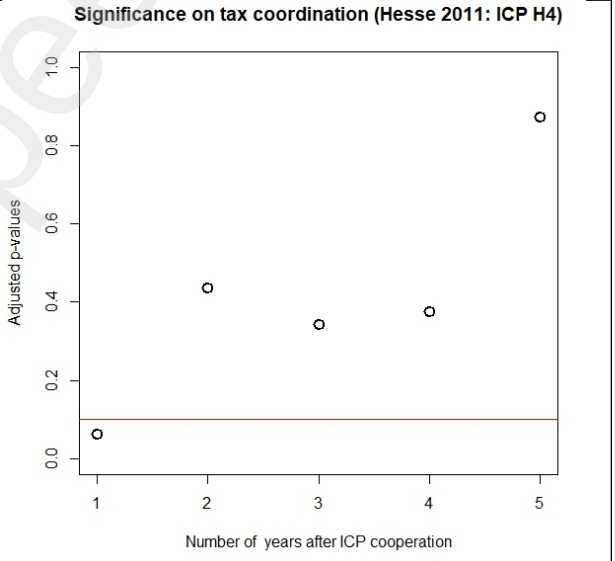
Year of foundation: 2006
ICP (IKG): H2
Municipalities (AGS): 6632013, 6636005, 6636011
Average deviation effect: 10% significant
Lack of drivers: No high share of established parties, small municipalities, neighbors with abundant land, no ICM support



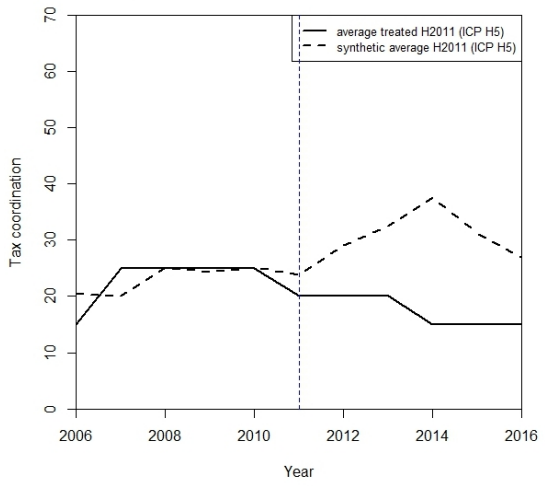


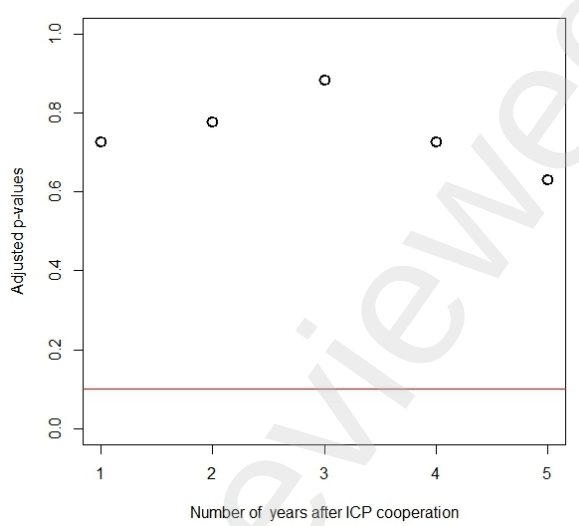
Year of foundation: 2006
ICP (IKG): H3
Municipalities (AGS): 6632011, 6632015
Average deviation effect: nonsignificant
Drivers: High CDU share, same strongest party, land scarce, low tax capacity, BAB exist, ICM support





Year of foundation: 2011
ICP (IKG): H4
Municipalities (AGS): 6435006, 6435007
Average deviation effect: 10% significant
Drivers: High CDU share, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist, ICM support

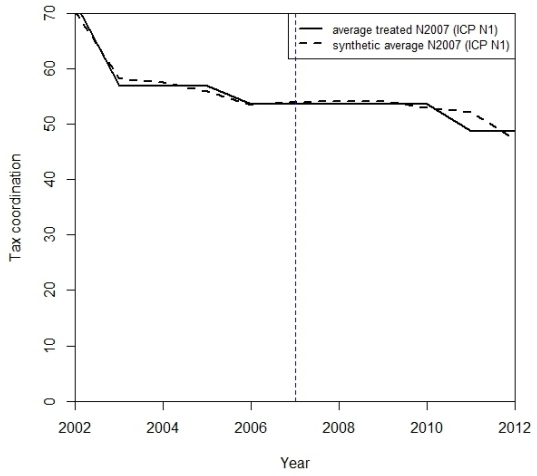


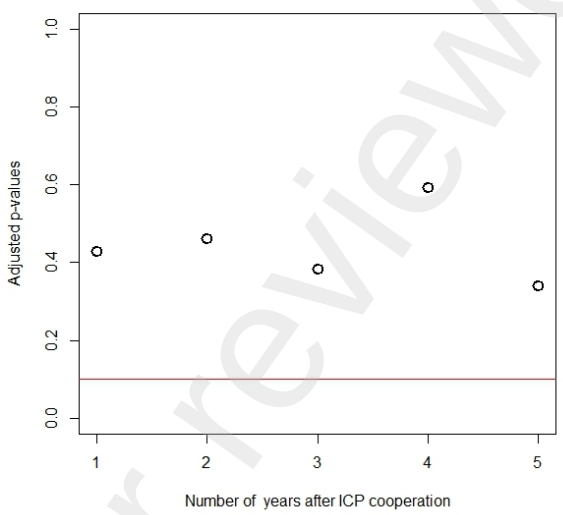


Year of foundation: 2011
ICP (IKG): H5
Municipalities (AGS): 6435013, 6440004, 6440014
Average deviation effect: nonsignificant
Lack of drivers: No high share of established parties, relevance of local initiatives, changing strong party, low share of neighbors with abundant land

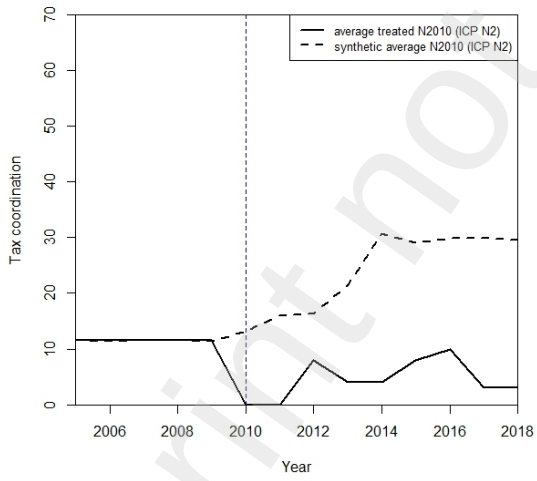
Figure 7: Real and synthetic average deviation in business tax multiplier for inter-local industrial parks in North Rhine-Westphalia

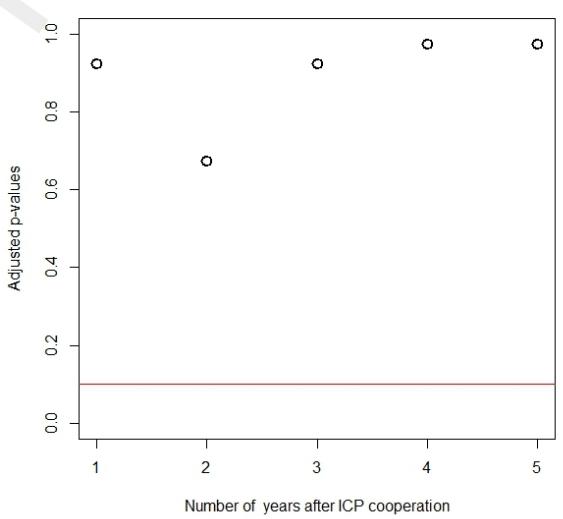
7 ICP foundations in
North-Rhine Westfalia in 2007, 2010, 2011, 2013, 2014



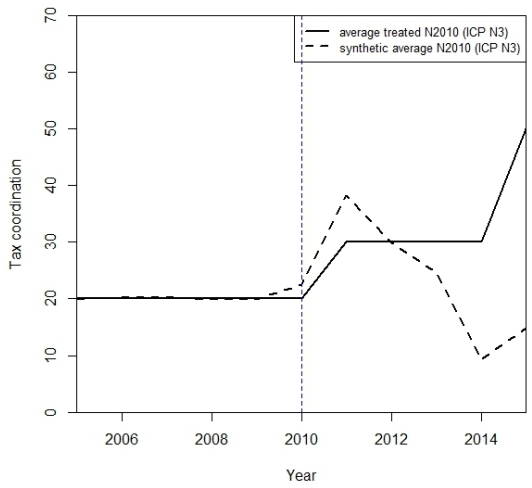


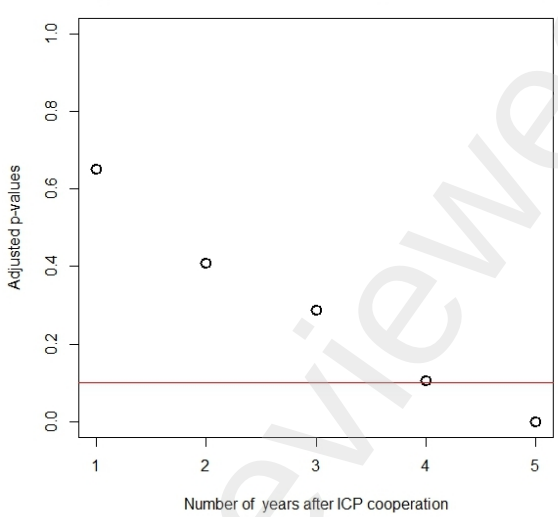
Year of foundation: 2007
ICP (IKG): N1
Municipalities (AGS): 5170008, 5170016, 5170044
Average deviation effect: nonsignificant
Lack of drivers: No high share of established parties, changing strongest party, neighbors with abundant land, no ICM support



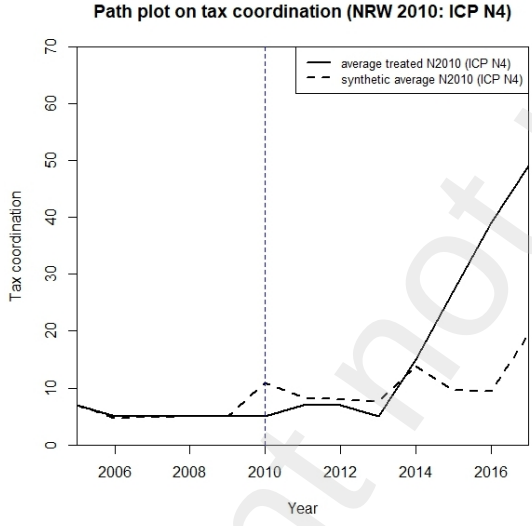


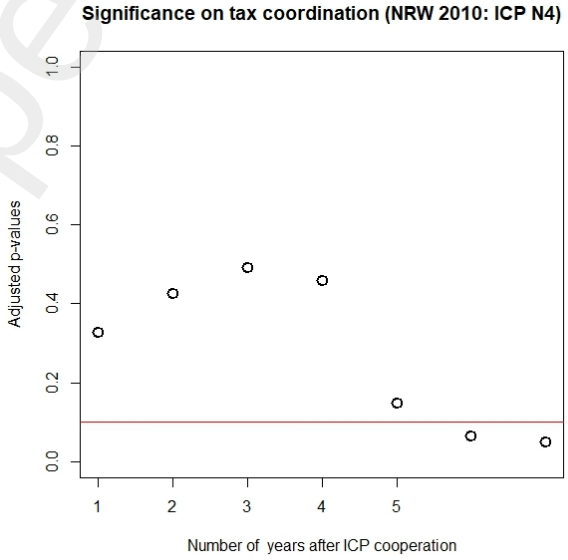
Year of foundation: 2010
ICP (IKG): N2
Municipalities (AGS): 5754008, 5754012, 5754052
Average deviation effect: nonsignificant
Lack of drivers: no high share of established parties, already high tax capacity, no ICM support



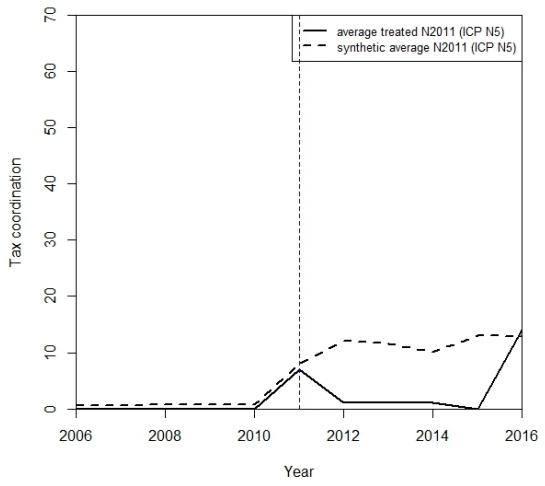


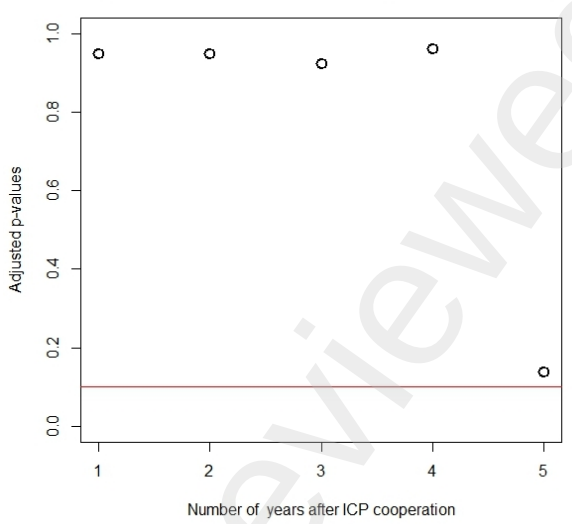
Year of foundation: 2010
ICP (IKG): N3
Municipalities (AGS): 5382044, 5382068
Average deviation effect: 1% significant
Drivers: High CDU share (outright majority), same strongest party, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist



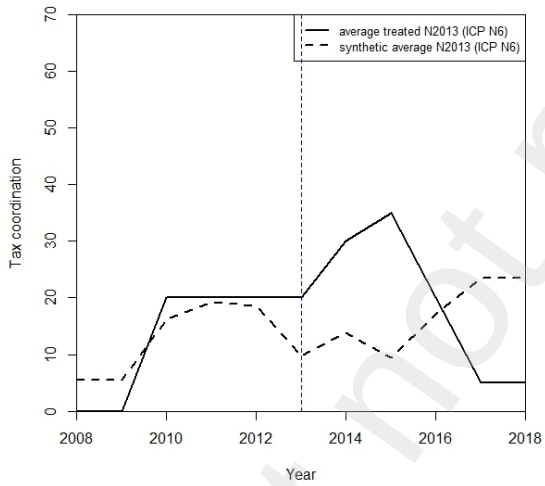


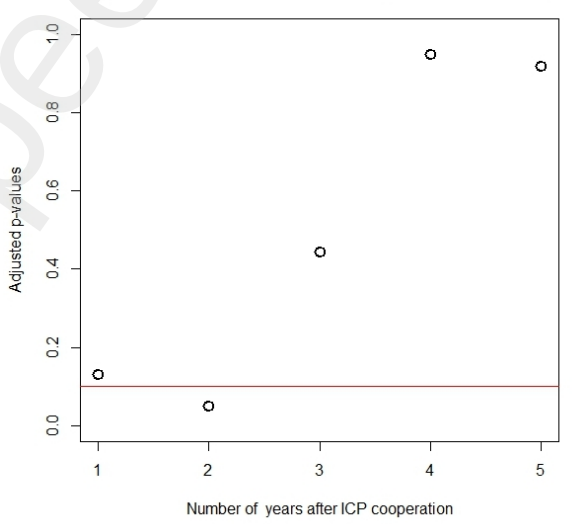
Year of foundation: 2010
ICP (IKG): N4
Municipalities (AGS): 5382036, 5382040
Average deviation effect: nonsignificant (significant, if treatment period is extended 6th and 7th treatment period)
Drivers: High CDU share (outright majority), same strongest party, no neighbors with abundant land, land scarce, low tax capacity



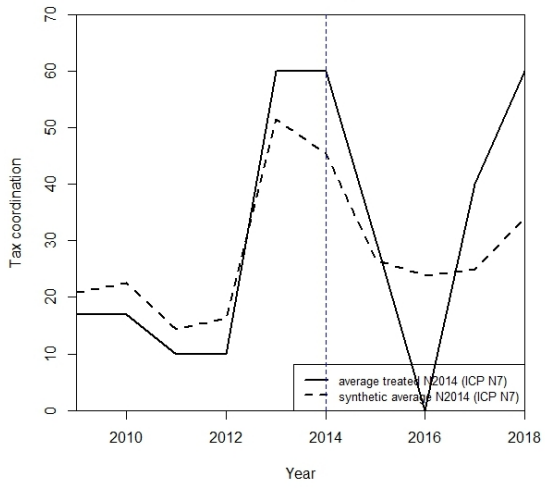


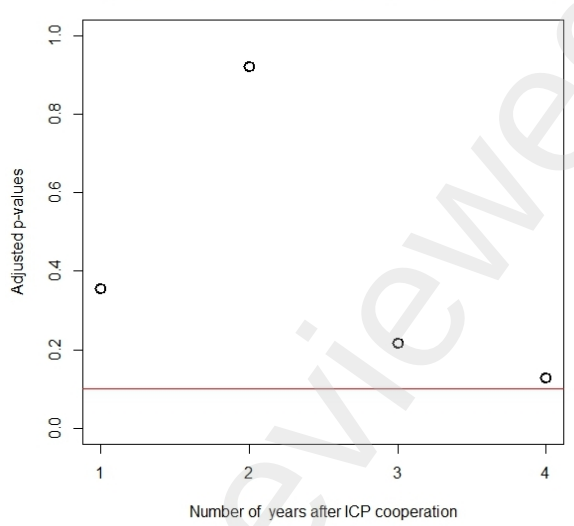
Year of foundation: 2011
ICP (IKG): N5
Municipalities (AGS): 5758024, 5770016
Average deviation effect: nonsignificant
Lack of drivers: changing strongest party, no ICM support





Year of foundation: 2013
ICP (IKG): N6
Municipalities (AGS): 5382004, 5382012
Average deviation effect: 10% significant
Drivers: Same strongest party, no neighbors with abundant land, land scarce, moderate tax capacity, BAB exist





Year of foundation: 2014
ICP (IKG): N7
Municipalities (AGS): Inden (5358020), Eschweiler (5334012)
Average deviation effect: nonsignificant
Drivers: High CDU share, same strongest party, land scarce

Table 1: Inter-local industrial parks included in the analysis

state	Nr.	Name of the industrial park	Founded in	Municipalities involved
Hesse	H1/63	Netzwerk Industriepark Kassel	2005	Kassel, Fuldabrück, Lohfelden
Hesse	H2/70	Gewerbegebiet ehem. Husarenkaserne	2006	Nentershausen, Herleshausen, Sontra
Hesse	H3/66	Interkommunales Gewerbegebiet „Friedrichsfeld“	2006	Kirchheim, Niederaula
Hesse	H4/64	Fliegerhorst Langendiebach	2011	Bruchköbel, Erlensee
Hesse	H5/67	Gewerbegebiet Limes	2011	Hammersbach, Büdingen, Limeshain
NRW	N1/78	Interkommunales Gewerbegebiet Air-Park Schwarze Heide	2007	Dinslaken, Hünxe, Voerde (Niederrhein)
NRW	N2/102	Interkommunales Gewerbegebiet "Ravenna Park"	2010	Gütersloh, Halle (Westf.), Werther (Westf.)
NRW	N3/91	Gemeinsames Gewerbegebiet Niederkassel-Troisdorf	2010	Alfter, Troisdorf
NRW	N4/212	Gewerbegebiet Much - Neunkirchen-Seelscheid AöR	2010	Much, Neunkirchen-Seelscheid
NRW	N5/211	Gewerbepark Am Wiehen	2011	Löhne, Hüllhorst
NRW	N6/100	Interkommunaler Gewerbepark Vorgebirge Bornheim-Süd / Alfter-Nord	2013	Alfter, Bornheim (Rheinland)
NRW	N7/210	Interkommunales Gewerbegebiet "Inden/Eschweiler - Am Grachtweg"	2014	Inden, Eschweiler

Table 2: Descriptive statistics for treatment group and donor pool in year 2004

Variable	treatement group					donor pool				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
population	29	33078	42601	3101	194464	495	23550	50419	0	646889
share of pop < 18 years [%]	29	19.36	1.51	16.20	22.77	491	19.59	2.06	14.21	28.40
land scarce	29	0.93	0.26	0	1	494	0.75	0.44	0	1
motorway access	29	0.45	0.51	0	1	495	0.25	0.43	0	1
urban cluster	29	0.41	0.50	0	1	495	0.23	0.42	0	1
tax capacity	29	661	157	367	1010	491	677	289	77	2687
business tax multiplier	29	382	55	300	490	495	354	58	0	490
share Christian democrats [%]	28	39	9	22	57	483	41	13	0	74
share local initiatives [%]	28	8	8	0	26	483	14	13	0	100
Neighbors' population (median)	29	24973	21798	3389	79286	493	18837	27698	533	361856
Neighbors' share of pop < 18 (median)	29	0.19	0.01	0.17	0.22	492	0.20	0.02	0.16	0.24
Neigbhors with abundant land	29	0.95	0.20	0	1	493	0.79	0.39	0	1
Neigbhors with motorway access	29	2.90	1.47	1	6	494	1.64	1.57	0	11
Neighbors' tax capacity (median)	29	683	165	377	1004	492	643	211	168	2257
Neighbors' business tax multiplier (median)	29	379	55	300	460	493	355	45	190	470
Neigbhors with same strongest party	26	3.92	2.40	0	11	455	3.45	2.08	0	13
Neighbors in the same county	29	3.88	1.37	0	6	495	3.72	1.58	0	8

Table 3: Overview of case-based SCM results

state	Nr.	founded in	Effect on tax rate	Effect on average deviation in tax rates
Hesse	H1	2005	10% sign.	not sign.
Hesse	H2	2006	not sign.	10% sign.
Hesse	H3	2006	5% sign.	not sign.
Hesse	H4	2011	10% sign.	10% sign.
Hesse	H5	2011	not sign.	not sign.
NRW	N1	2007	not sign.	not sign.
NRW	N2	2010	not sign.	not sign.
NRW	N3	2010	5% sign.	1 % sign
NRW	N4	2010	5% sign	5% sign.
NRW	N5	2011	not sign.	not sign.
NRW	N6	2013	10% sign	10% sign.
NRW	N7	2014	10% sign.	not sign.

Table 4: Ex post comparison of inter-local industrial parks with and without significant effect
4a. Three cases with significant effect on tax multiplier vs. nine cases without significant effect

	not significant		significant	
Variable	Mean	Std. dev.	Mean	Std. dev.
pre-treatment period (4 years)				
population (average)	31165	20221	25444	26211
population (st. dev.)	29633	31761	10222	13365
population (max.)	61266	56613	32672	35595
CDU seats (%, average)**	33.60	4.45	43.34	4.74
CDU seats (%, st. dev.)	4.16	3.10	6.45	2.40
seats local initiative (%, average)**	10.29	4.37	1.80	1.56
seats local initiative (%, st. dev.)	7.18	4.74	1.87	1.64
tax capacity (average)	953	284	861	183
tax capacity (st. dev.)	150	191	128	171
business tax mulitiplier (average)	406	60	404	77
business tax mulitiplier (st. dev.)	12.16	7.77	12.61	7.80
scarce land (%, average)	0.89	0.24	1.00	0.00
neighbors w. scarce land (average)	1.06	1.83	0.83	1.44
post-treatment period (4 years)				
CDU seats (%, average)*	36.87	4.78	47.49	6.51
CDU seats (% st. dev.)	5.96	2.96	7.14	3.87
seats local initiative (%, average)*	9.10	6.28	0.67	1.15
seats local initiative (%, st. dev.)**	7.82	4.67	0.94	1.63
time-invariant variables				
motorway access (average)	0.44	0.12	0.50	0.50
number of neighbors (average)	6.22	0.56	5.83	0.29
members of joint industry parks	2.56	0.53	2.00	0.00
number of situs municipalities	1.89	0.78	1.33	0.58

** Wilcoxon rank-sum test, significant at the 5 percent level
* Wilcoxon rank-sum test, significant at the 10 percent level

4b. Two cases with significant effect on average deviation in business tax multiplier vs. nine cases without significant effect

	not significant		significant	
Variable	Mean	Std. dev.	Mean	Std. dev.
pre-treatment period (4 years)				
population (average)	28509	20833	35864	26880
population (st. dev.)	26794	31261	14714	15370
population (max.)	55688	56215	46269	37747
CDU seats (%, average)**	34.03	4.41	46.08	0.14
CDU seats (%, st.dev.)	4.54	3.15	5.71	2.87
seats local initiative (%, average)	9.26	5.25	2.71	0.12
seats local initiative (%, st. dev.)	6.46	5.01	2.81	0.29
tax capacity (average)	927	280	949	145
tax capacity (st. dev.)	139	184	174	213
business tax mulitiplier (average)	397	63	448	10
business tax mulitiplier (st. dev.)	12.00	7.35	13.61	10.75
scarce land (%, average)	0.90	0.22	1.00	0.00
neighbors w. scarce land (average)	1.20	1.78	0.00	0.00
post-treatment period (4 years)				
CDU seats (%, average)**	37.19	4.62	51.21	1.26
CDU seats (%, st. dev)	6.52	3.24	5.20	2.73
seats local initiative (%, average)	8.19	6.58	1.00	1.41
seats local initiative (%, st. dev.)	6.95	5.08	1.41	2.00
time-invariant variables				
motorway access (average)	0.50	0.21	0.25	0.35
number of neighbors (average)	6.15	0.57	6.00	0.00
members of joint industrial parks	2.50	0.53	2.00	0.00
number of situs municipalities	1.80	0.79	1.50	0.71

** Wilcoxon rank-sum test, significant at the 5 percent level
* Wilcoxon rank-sum test, significant at the 10 percent level