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The Effect of Inter-municipal Cooperation on Local Business Development in German Municipalities

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Abstract

Does inter-municipal cooperation (IMC) enhance municipal economic performance? This study employs marginal structural models to address selection into treatment and time-dependent confounding to estimate the effectiveness of IMC in the field of local business development. I use data on municipalities in four West-German states, Lower Saxony, Hesse, Rhineland Palatinate, and Bavaria during the years 2008-2015. I find that, over time, IMC has a positive effect on local economic performance and local business development resources are spent more productively in cooperating municipalities.

Key words: Inter-municipal cooperation, economic development, marginal structural models, Germany

JEL: H77, O10, O22, D78

1. Introduction

Given the widening urban-rural gap in many European countries, municipalities are eager to attract businesses and people, and to provide public services efficiently. Inter-municipal cooperation (IMC) in local business development presents an instrument to share local capabilities and risks that come with development investments (e.g., Chen et al., 2016). Motivation for engaging in cooperation in general stems from the expectation of economies of scale or scope, a benefit that would also be attainable by merging jurisdictions. The somewhat loser and more flexible alternative of IMC is expected to be less taxing on the electorate and, therefore, an attractive alternative instrument to improve public service delivery (cf. Blesse and Rösel, 2017). Moreover, joint provision of public goods and services via IMC can be tailored to fit specific strengths and weaknesses of the participating municipalities.

While a framework for institutional collective action (ICA) has been developed (cf. Feiock, 2007) and factors determining the formation of cooperative agreements have been studied extensively (e.g., Morgan et al., 1988; Bel et al., 2013b; Bergholz, 2018)[1], the analysis of the impact of such agreements remains a challenge. On the one hand, IMC has been proven to grant size benefits through the joint delivery of some mandatory public services (e.g., Bel and Costas, 2006; Dijkgraaf and Gradus, 2013; Niaounakis and Blank, 2017). On the other hand, IMC has been related to extensive transaction costs that inhibit cost advantages generated by IMC (e.g, Sørensen, 2007; Blåka, 2017).

The existing literature suffers from two shortcomings: 1) Only a narrow range of public services has been analysed. 2) The methodological approaches do not adequately address the problem of selection into treatment, and time-varying confounding. Few studies employ quasi-experimental designs to make causal inferences about IMC (e.g., Ferraresi et al., 2018).

[1] For a comprehensive overview see Bel and Warner (2016).

This study applies a new method for causal inference and focusses on cooperation in a voluntary public service: local business development.

Many German states support IMC and over the course of the last decade, German municipalities have increasingly engaged in cooperation. This is why I analyse municipalities in four West-German states, Lower Saxony, Hesse, Rhineland Palatinate, and Bavaria. Using two-way fixed-effect (FE) models in addition to marginal structural models (MSMs), I find that cooperating municipalities are more successful in their local business development efforts and that, over time, cooperations are more effective.

The paper is structured as follows: In section 2, I will review the relevant literature concerning inter-municipal cooperation. In section 3, I will present the hypotheses regarding IMC effects, before introducing the institutional background of German municipalities and the data in section 4. Section 5 presents the empirical analysis, and section 6 the results, which are discussed in section 7. Concluding remarks follow in section 8.

2. Related Literature

The joint provision of public goods and services relates to a central problem discussed in the literature on fiscal federalism: The optimal size of jurisdictions. While large jurisdictions can benefit from economies of scale and internalize external effects, the distance between governments and their constituents is also increased (cf. Oates, 1972). Via IMC, local governments agree to provide certain services jointly while other services are left to the single municipalities' discretion. Thus, size benefits can be attained without centralizing local authority. Compared to blanket amalgamations, this approach suggests a more precise focus on areas with room for improvement or urgency for relief. The question of the optimal size is reformulated: Who should cooperate to provide which service?

Empirical findings on the effectiveness of IMC are mixed. Numerous studies find a negative correlation between the cost of provision and IMC. Bel and Costas (2006) look at municipal costs for waste collection in Spanish municipalities and find that costs are decreased in cooperating municipalities with a population smaller than 20,000. Bel et al. (2013a) explicitly study small (on average 5,000 inhabitants) Spanish municipalities and test whether cooperation in solid waste services can reduce municipal costs. They find that cooperating municipalities have lower costs in solid waste services. Niaounakis and Blank (2017) investigate whether IMC enhances efficiency in Dutch tax departments. They find that municipalities can increase cost efficiency through economies of scale. Expanding on IMC in the Netherlands, Allers and Greef (2017) confirm that cooperation in the field of tax collection is associated with lower costs; however, they do not find cost savings in cooperations in the fields of welfare provision, sheltered work, and waste collection, leaving municipal spending overall unchanged by IMC.

On the other hand, there are studies that find a positive correlation between costs and IMC. Blaeschke and Haug (2017) focus on German municipalities cooperating in the wastewater sector. They find lower technical efficiency when it comes to cooperating municipalities compared to non-cooperating ones, attributing this finding to agency and coordination costs. Sørensen (2007) looks at user fees and costs in the provision of waste collection in Norwegian municipalities. His findings show higher fees and costs in municipalities that share ownership of waste collection companies. He argues that the dispersion in ownership leads to agency costs and subsequently to losses in efficiency. In another study on Norwegian municipalities, Holum and Jakobsen (2016) examine citizens' satisfaction under IMC. They consider cooperation in fire services and waste services. While they find a positive effect of IMC on citizens' satisfaction when it comes to waste services, they find a negative effect in the field of fire services. They argue the effect of IMC depended on the characteristics of the services provided cooperatively. Waste collection services was a field in

which transaction costs are low and therefore, cost advantages through IMC are expected. Holum and Jakobsen (2016) further point out that citizens would frequently come into contact with waste collection services and could, to a certain extent, gage increases in quality. Whereas fire services suffered a loss of accountability under IMC because of the increased distance to the citizens.

A meta-study by Bel and Sebő (2019) on 18 IMC-effects studies confirms the frequent finding that small municipalities can benefit from cost advantages through IMC. They also find that studies with more recent databases and/or panel data point to greater reductions in costs, concluding that over time municipalities learn to cooperate more effectively. They further test for the impact of service related transaction costs and do not find a significant effect of the ease of measurement or asset specificity on the efficacy of IMC.

When it comes to the methodological approach, a majority of studies estimate cost functions in order to investigate the effect of IMC on municipal costs (e.g. Bel and Costas, 2006; Zafra-Gómez et al., 2013; Dijkgraaf and Gradus, 2013) but only a few employ quasi-experimental designs (e.g. Ferraresi et al., 2018).

There are two important empirical aspects concerning the analysis of IMC. First, the decision to cooperate is endogenous. Only a few studies account for the fact that municipalities select into cooperation. Frère et al. (2014) as well as Baba and Asami (2019) utilize instrumental-variable approaches to model municipal spending under IMC in France and Japan, respectively. While Frère et al. (2014) look at spatial effects of cooperation and find no significant effect of IMC on municipal spending, Baba and Asami (2019) study cooperation in health and fire services and find reduced spending in cooperating municipalities for both fields. Ferraresi et al. (2018) use a difference-in-difference estimator in combination with propensity score matching to analyse the effect of IMC on expenditures in Italian municipalities and find a negative effect of cooperation on expenditures.

While an instrumental-variable approach, as well as propensity score matching, can control for selection into treatment, they cannot account for the second important empirical aspect of IMC-analysis: time-varying confounding. The decision to cooperate and resulting outcomes are dependent on time-varying factors that themselves are influenced by previous decisions on cooperation (see Figure 1). Time-varying confounding challenges the estimation of effects and effect sizes and, so far, has not been addressed in the IMC literature.

[Figure 1 here]

This study focusses on two shortcomings of the existing literature. The first concerns the method. Methodological approaches prevalent in IMC-research do not account for a selection into treatment bias, or for time-varying confounding. Other disciplines that rely on observational data make use of marginal structural models (MSMs) to deal with time-varying confounding. The seminal paper by Robins et al. (2000) introduces MSMs in the field of epidemiology. In sociology, Sharkey and Elwert (2011) as well as Wodtke et al. (2011) utilize MSMs to look at how neighborhood characteristics affect cognitive ability and high school performance in children, respectively. Furthermore, Sampson et al. (2006) investigate the effect of marriage on crime, while Bacak and Kennedy (2015) look at the effect of incarceration on the probability to get married. In the political sciences, Blackwell (2013) studies the effect of negative campaigning on democratic vote share in the US using MSMs.

The second research gap pertains to the jointly provided service. Analyses concentrate on mandatory tasks such as waste services, fire services, tax collection, and health services (e.g. Holum and Jakobsen, 2016; Niaounakis and Blank, 2017; Baba and Asami, 2019). However, IMC is not limited to these services. The case of German municipalities shows cooperation in voluntary tasks like providing cultural and recreational facilities, tourism marketing, as well as local business development (cf. Schmidt, 2005). While cooperation in mandatory tasks, like waste services, is often induced by cost pressure, cooperation in voluntary tasks stands apart: If

service delivery in these tasks is too expensive, the municipality can choose not to deliver at all. Engaging in cooperation in voluntary tasks signals ambition to make the municipality more attractive for inhabitants, tourists, and especially businesses. Local business development is foremost a regional matter, since it produces extensive external effects. This is why research on local business development focusses on the regional level. Chen et al. (2016) study the formation as well as the impact of regional economic development partnerships in urban areas. They find that in areas where government is more fragmented partnerships have a positive effect on personal income, employment, and the number of firms. Their study comes closest to this paper, as they model the emergence of cooperation before estimating outcome models for regional economic outcomes.

This paper addresses the shortcomings in the existing IMC literature by focussing on cooperation in the field of local business development and applying MSMs to control for selection into treatment as well as time-varying confounding.

3. Hypotheses

I am investigating direct as well as indirect effects of IMC on local economic performance. First, local business development projects produce external effects, which dissuades municipalities to engage in those projects in the first place. Through joint projects, they can internalize benefits from services that would otherwise spill over to neighboring municipalities. Thus, cooperating municipalities may have a higher economic performance than non-cooperating municipalities because they are more likely to engage in local business development (cf. Park and Feiock, 2006; Chen et al., 2016).

H_1: *Engaging in IMC has a positive effect on local economic performance for cooperating municipalities.*

Second, IMC can increase the productivity of local business development efforts. A municipality, that spends resources on local business development cooperatively, may profit from broadened capacities in infrastructure and expertise (cf. Chen et al., 2016). Thus, cooperation can increase the productivity of each Euro spent on local business development.

H_2: *Engaging in IMC increases the productivity of local business development expenditures.*

Third, the effect of IMC may change over the course of the cooperation. Coordination between the cooperation partners may be more difficult in the beginning and they may learn how to cooperate more effectively over the duration of IMC (cf. Bel and Sebő, 2019).

H_3: *Engaging in long-term IMC has a positive effect on local economic performance for cooperating municipalities.*

Lastly, local business development produces substantial spillovers. Thus, the effect of IMC in local business development is not limited to one municipality either. Attracting and promoting businesses influences neighboring municipalities even if they are not part of a cooperation. IMC, therefore, has an effect on neighborhood economic performance (cf. Frère et al., 2014; Chen et al., 2016).

H_4: *Neighbors of municipalities that engage in IMC have higher local economic activity than neighbors of municipalities that do not engage in IMC.*

4. Institutional Background and Data

I use data on German municipalities in order to test hypotheses H_1-H_4. The German setting is suitable because IMC is common practice. German municipalities act self-governing and decisions about local business development projects, business and land tax rates, are at their discretion. Furthermore, data is available not only on a number of municipal characteristics but on their cooperation activity as well.

4.1 Municipalities and Cooperation in Germany

Municipalities constitute the smallest jurisdictional unit in Germany and have the right of self-government. In 2017, municipal expenditures accounted for around 25 percent of all government spending (Statistisches Bundesamt, 2018). Higher tier governments delegate tasks to the municipal level, such as running elections and registry offices. Beyond that, municipalities provide local amenities, social security, elementary schools, as well as cultural and recreational services and have extensive discretion when it comes to fulfilling these tasks.

A mayor is head of the municipal council, which local citizens elect every five or six years, depending on the state. The council allocates the municipal budget and sets the tax rates for the business and property tax, which are the most important endogenous municipal revenues. Municipalities also receive a share from federal income tax and value added tax revenues as well as grants through a fiscal equalization system.

Following the principle of subsidiarity German municipalities, are performing three types of tasks: Delegated tasks from higher levels of government, mandatory self-government tasks, and voluntary self-government tasks (Scherf, 2011: 502-503). The latter kind of tasks are at the discretion of the municipality, whereas the former two types are not. Municipalities can decide if and how they want to approach voluntary self-government tasks which comprise 1) providing cultural goods, like museums, theatres, and musical schools, 2) providing recreational facilities, like public pools, parks, and sport facilities, 3) engaging in spatial or land-use planning, 4) promoting economic development and tourism.

Municipalities can cooperate in different forms subject to public law and there are three prevalent forms with varying degrees of intensity. They can form working groups with other local actors (private and public), they can sign agreements with such actors, and they can form

special purpose associations, called Zweckverbände (cf. Schmidt, 2005; Oebbecke, 2007). The latter has the capacity to be subject of legal rights and duties, and serves as a rather binding form of cooperation[2]. In this study, my focus lies on this strong form of IMC, which presents an opportunity for thorough analysis because of complete public information on special purpose associations and their members. Especially the joint provision of local business development takes place via special purpose associations. Given the risk of division costs and defection costs, credible commitment via a binding form of cooperation is important in local business development projects (cf. Carr and Hawkins, 2013; Hawkins, 2017).

Special purpose associations can serve a single purpose, e.g. waste collection; however, associations can also be committed to provide multiple services, and a municipality can be part in more than one association (cf. Schmidt, 2005). The municipal council can make the decision to become a member in a special purpose association or to terminate membership.

A majority of special purpose cooperations is concerned with the provision of local amenities, specifically waste management, which is costly for small municipalities to deliver on their own. Other associations manage graveyards, hospitals or fire and rescue services. This study focusses on local business development, which comprises the development of local business parks, promotion of local businesses and tourism spots.

4.2 Data

Data on special purpose associations was gathered from the statistical offices of Lower Saxony, Hesse, Rhineland Palatinate and Bavaria. It comprises all special purpose associations existing during the years 2005 to 2016 and their respective associated municipalities. The data contains

2 Special purpose associations are also the oldest form of institutionalized cooperation in Germany (apart from the league of towns, already present in the Middle Ages), dating back to the first half of the 19th century (cf. Oebbecke, 2007).

additional information on the field or the purpose of the association, whether it was formed, e.g., to jointly run a public pool or to manage wastewater collection. In order to explain the decision to cooperate and the subsequent effect of cooperation I lag variables up to three years. The earliest available data on special purpose associations dates back to 2005, the first year of the observation period is 2008.

Of the overall 5726 municipalities of Lower Saxony, Hesse, Rhineland Palatinate and Bavaria, a majority of 3945 municipalities did join special purpose associations before 2008. Many of those cooperations are concerned with local amenities and waste/water disposal, and some of them have existed for decades[3]. With respect to local business development, 220 municipalities started cooperations after 2007, forming 35 special purpose associations (see Figure 2). These associations are concerned with promoting local businesses, tourism projects and business parks. In favour of brevity, I will refer to cooperation in the field of local business development plainly as cooperation, from here on.

[Figure 2 here]

I draw on the Regional Data Base Germany for data on demographic and economic characteristics, such as population size, area, and municipal revenues (see Table 1 for variable description). Information on whether a state is in general supporting IMC projects financially and in which capacity was gathered from the respective states' ministries.[4] The final sample includes all municipalities in the four states that never cooperated during the years 2008-2015, the control group, and municipalities that started cooperation during 2008-2015, the treatment group. I exclude municipalities that cooperated before the observation period. In the baseline

[3] In Bavaria, a law instituted in the 1970s established regional planning associations that are in principle considered as special purpose associations. Every municipality in Bavaria belongs to such a planning association.

[4] For more detailed information on IMC-support policies see Table 2.

year 2007, municipalities in the treatment group are smaller in population size and are shrinking at a higher rate than the municipalities in the control group (see Table 3).

[Table 3 here]

They also have lower tax revenues per capita, which comprise revenues from property tax, value added tax, income tax, and business tax. The unemployment rate is higher in the treatment group and the expenditures on local business development are on average more than twice as high as in the control group.

[Figure 3 here]

5 Empirical Strategy

The challenge in analyzing the effect of IMC on local economic performance is twofold: 1) IMC is by definition a voluntary measure any municipality can choose to engage in. It is, as a treatment, not exogenous. 2) The factors confounding treatment and outcome are time-varying. I employ a two-way fixed-effects model, as well as a marginal structural model to address unobserved heterogeneity and endogeneity.

5.1 The FE-model

Although information on municipal characteristics is plentiful, I cannot claim to control for every source of heterogeneity. Therefore, I utilize FE-models to control for time-invariant unobserved heterogeneity. The FE-model for local economic performance (LEP) of municipality m in time t is

$$LEP_{mt} = \beta_0 + \beta_1 IMC_{mt-1} + \beta_2 X_{mt-1} + \alpha_m + \delta_t + \varepsilon_{mt} \quad (1)$$

LEP is measured by two outcome variables: m´s unemployment rate, and m´s own tax revenues per capita. If cooperation is successful, this success should manifest in higher property

value, a higher tax base, thus, higher tax revenues, and a higher demand for labor. To test hypothesis H_1, I introduce the treatment dummy, IMC, indicating whether municipality m cooperated in t-1. X_{mt-1} is a vector of control variables, lagged by one year to circumvent simultaneity. X_{mt-1} comprises population size and population growth, to account for potential economies of scale, as is standard in the IMC literature (e.g., Bel and Mur, 2009; Holum and Jakobsen, 2016; Ferraresi et al., 2018). To capture m's state of business development, X_{mt-1} also includes m's local business development expenditures (LBD exp.), the sum of m's neighbors' local business development expenditures (LBD neighbors), and the share of small and large firms on county level. I also control for existing freeway access points within m's borders, an indicator for accessibility (cf. Bischoff et al., 2019), and the number of existing cooperations of m as control for pre-existing local networks (cf. Hawkins et al., 2016). Furthermore, I control for state-level support for IMC (see Table 2). α_m is the individual time-invariant unobserved effect, δ_t is a vector of period dummies controlling for exogenous shocks shared by all municipalities in period t, and ε_{mt} is the error term.

The second hypothesis, H_2, refers to the mediating effect of IMC on the productivity of LBD efforts. To test for this effect, I include the sum of LBD expenditures, spent by m and m's neighboring cooperation partners (LBD. exp. IMC) in a specification of the baseline model (1). If m is not engaging in IMC it means that LBD exp. IMC is zero, as no LBD expenditures made by m are affected by an extension of capacities or infrastructure.

In order to investigate the effect of IMC duration on LEP, stated in hypothesis H_3, I estimate model (1) using a series of duration dummies, indicating the years a cooperation lasted.

The fourth hypothesis, H_4, suggests possible spillovers generated by IMC. To analyze the effect of IMC on neighboring municipalities, I run the baseline model (1) and the

specifications for H_2 and H_3, with the neighborhood median values of the dependent variable as outcome measure.

The model described in (1) may produce biased results. As studies on time-varying treatment and covariates highlight (e.g., Robins et al., 2000; Blackwell, 2013; Imai and Ratkovic, 2015), controlling for time-varying covariates when modelling outcome can induce post-treatment bias, also termed the "bad control problem" (cf. Angrist and Pischke, 2009). In the case of IMC, the treatment (cooperation) and the outcome (economic performance) may both be dependent on time-varying factors, such as population size. For example, smaller municipalities have higher incentives to cooperate because they can benefit from economies of scale (Bel and Costas, 2006; Bel et al., 2013a; Bel and Sebő, 2019). If a municipality successfully cooperates it may attract more inhabitants, thus, the population may increase after cooperation. At the same time, economic activity depends on both cooperation activity as well as population size in past periods (see Figure 1). The FE-model cannot capture such a dynamic process and excluding time-varying confounders will induce omitted variable bias (see e.g. Angrist and Pischke, 2009). Therefore, I introduce a method, new to the field of IMC, for dynamic causal inference: MSMs.

5.2 The MSM

In their seminal paper on MSMs, Robins et al. (2000) suggest a two-step process: First, they model treatment assignment for each point in time as a function of covariate and treatment history. The predicted propensity scores are used to construct inverse probability of treatment weights (IPTW). Weighting the sample via IPTW creates a pseudo-population in which treatment is no longer confounded (Robins et al., 2000). Thus, observational data is reweighted to resemble a randomized treatment assignment. In the second step, a weighted linear outcome model is estimated. Inferences via MSMs are, therefore, inferences about potential outcomes

rather than about a subset of observed outcomes. This argument follows the lines of the Heckman selection models. Blackwell (2013) points out, however, that MSMs are not restricted to use instrumental variables in the first stage as selection is on observable rather than unobservable factors.

The limitation of this approach lies in the assumption of sequential ignorability (Robins, 2000). It means that treatment is assumed to be random given that we controlled for *all* common causes of treatment and outcome. In other words, we assume no unobserved heterogeneity.

5.2.1 Constructing IPTW: Determinants of Cooperation

I will build on previous findings on determining factors for IMC to model treatment assignment. Since the IPTWs depend on the specification of the treatment model, it is crucial to build this model on a firm basis. Bel and Warner (2016) give a thorough overview of the existing literature on IMC emergence and point out that emergence factors pertain to the categories of fiscal constraints, economies of scale, organizational form, service level transaction costs, community wealth, spatial effects, racial homogeneity, and politics. As Blaeschke (2014) shows, it is important to reflect on these categories in light of the set-up of cooperation. He argues that a municipality alone cannot enforce IMC without having suitable cooperation partners. As municipalities are most likely to cooperate with direct neighbors, the direct neighborhood forms the pool of potential cooperation partners (Bischoff and Wolfschütz, 2019; see also Bischoff et al., 2019). Therefore, in modelling IMC emergence, one has to refer to measures of fiscal constraints, economies of scale, etc., on both, the side of the observed municipality m, and m's potential cooperation partners, m's neighbors. This is why I include spatial lags in the following model to estimate the decision to cooperate, i.e. the treatment assignment via pooled logistic regression.

$$IMC_{mt} = \beta_0 + \beta_1 \overline{IMC}_{mt-1} + \beta_2 \overline{X}_{mt-1} + \beta_3 X_0 + \delta_t + \varepsilon_{mt} \quad (2)$$

IMC_{mt} is a dummy variable taking the value of one if municipality m is cooperating in year t, and zero otherwise. $\overline{IMC}_{mt-1}$ represents m's treatment history for the last three years. $\overline{X}_{mt-1}$ is a vector of the three year variable histories of all control variables included in the FE-model from (1) and their spatial lags (m's neighborhood median without m). Additionally, three year histories of the outcome measures, own tax revenues and unemployment rate, are included here. X_0 includes baseline values of the time-varying variables included in $\overline{X}_{mt-1}$ in addition to time-invariant variables. The latter include dummy variables indicating whether m is a city with county rights, whether m is located in a metropolitan area[5], the number of m's direct neighbors and m's area. δ_t is a vector of period dummies and ε_{mt} is the error term.

[Table 4 here]

Results from the pooled logit estimation show that IMC is rather persistent, as IMC in the previous year is a good predictor for IMC in year t. Cities with county rights are more likely to cooperate, while municipalities with strong commuter flows towards large cities are less likely to engage in IMC. Area and freeway access have a positive effect on the probability to cooperate, as does state support for IMC. The unemployment rate, own tax revenues, as well as the amount of expenditures on LBD by m and m's neighbors have a positive effect on the probability to cooperate. Furthermore, I find municipalities are more

[5] Cities with more than 100,000 inhabitants are regarded as metropolitan city centres and their direct neighbors with a daytime population density bigger than 500 and/ or more than 50 percent of commuters commuting to a city centre are regarded as suburban areas. A municipality is categorized as non-metropolitan if less than 25 percent of its outbound commuters commute to a city bigger than 100,000 or such a city's suburban areas. Guidelines following the Federal Institute for Research on Building, Urban Affairs and Spatial Development, https://www.bbsr.bund.de/

likely to cooperate in local election years and the share of large firms (>250 employees) on county level shows a negative effect.

In the next step, I predict the probability to start IMC for municipality m in period t, conditional on previous treatment, outcome and covariate histories, as well as, baseline covariates $\Pr(IMC_{mt} \mid \overline{IMC}_{mt-1}, \overline{X}_{mt-1}, X_0)$ [6]. Multiplying the inverse of this propensity score over the observation periods gives us the inverse probability of treatment weights for each observation, $\widehat{SW_m}$. These weights are stabilized weights, in that the numerator is not equal to one, but equal to the marginal probability of treatment, conditional on treatment history and baseline covariates, which I estimate in a separate numerator model.

$$\widehat{SW_m} = \prod_{t=1}^{T} \frac{\Pr(IMC_{mt} \mid \overline{IMC}_{mt-1}, X_0)}{\Pr(IMC_{mt} \mid \overline{IMC}_{mt-1}, \overline{X}_{mt-1}, X_0)} \qquad (3)$$

5.2.2 Estimating the MSM: The Effect of Cooperation

Having determined the treatment assignment, I am estimating a weighted linear MSM of the form

$$LEP_m = \beta_0 + \beta_1 IMC_m + \beta_2 X_0 + \varepsilon_m \qquad (4)$$

LEP is dependent on the treatment dummy, IMC, taking the value of one if m cooperated during the observation period, and on baseline variables, X_0. ε_m is the error term. Baseline variables are the same as in the numerator-model of the IPTW so that in the weighted model

[6] The latest studies on IMC emergence in Germany employ hazard models to explain the switch from non-cooperation to cooperation (Bergholz, 2018; Bischoff et al., 2019; Bischoff and Wolfschütz, 2019). Since municipalities in my sample also terminate cooperation, IMC in local business development is less permanent than in other fields studied. Therefore, I use a pooled logistic model to explain a municipality's binary choice between cooperation and non-cooperation for each point in time.

confounding factors are controlled for by 1) the weighting itself and 2) the baseline variables. Local economic performance is measured at the end of the observation period, in 2015, by m´s unemployment rate and m´s own tax revenues per capita.

As in the FE-model, I use two specifications of the model presented in equation (4). In the first specification, I include the sum of LBD expenditures, spent by m and m's neighboring cooperation partners (LBD. exp. IMC) to test hypothesis H_2. The second specification includes duration dummies, indicating the length of cooperation, to test hypotheses H_3. To test hypothesis H_4 I estimate model (4) and its specifications using neighborhood median values of the unemployment rate and own tax revenues.

6 Results

Table 5 reports the results of the FE-model and the MSM. The models test for the direct effect of IMC (hypothesis H_1) and the mediating effect of IMC on the productivity of LBD expenditures (hypothesis H_2) on local economic performance.[7] The MSM shows a significant positive effect of LBD expenditures by m and its neighboring cooperation partners on m's tax revenues. The FE-model shows a significant negative effect of IMC, as well as a negative effect of LBD expenditures on the municipal unemployment rate. These results support hypotheses H_1.and H_2.

[Table 5 & 6 here]

Table 6 reports the results of the FE-model and the MSM with respect to the effect of IMC duration (hypothesis H_3) and spillovers (hypothesis H_4). The FE-model shows an increasing (in significance and size) negative effect of IMC duration on m's unemployment rate, while the MSM shows a positive effect on m's tax revenues in cooperations that last six

[7] Results for all control variables are available upon request.

to eight years (also see Figure 4). Both models show a negative long term effect of IMC on the neighborhood median unemployment rate, as well as a positive long term effect on neighborhood median tax revenues. The MSM further reports a negative effect on neighborhood median unemployment in the first year of cooperation, and a positive effect in cooperations that last four to five years (see Figure 5). H_3 and H_4 are supported by the results.

[Figure 4 & 5 here]

I further test hypothesis H_4 by estimating the direct effect of IMC and the effect of LBD resources spent by m and m's cooperating neighbors on m's neighborhood median unemployment rate and tax revenues. Table 7 shows a negative effect of IMC and LBD expenditures spent by m and m's cooperating neighbors on the neighborhood median unemployment rate, found in the MSM. The FE-model shows a positive effect for IMC as well as for LBD expenditures on neighborhood median tax revenues, while the MSM confirms the positive effect on tax revenues for LBD expenditures.

[Table 7 here]

As a robustness check, I truncate the IPTWs at the 1st and 99th percentile. Truncating weights is referred to as efficiency trade-off between bias reduction and variance (cf. Austin and Stuart, 2015; Thoemmes and Ong, 2016). Table 8 shows the non- truncated and truncated weights.

[Table 8 here]

Although the mean is close to one in the original weights, there are rather low/high minimum/maximum values that can justify truncation in favor of efficiency. Results from the MSMs using truncated weights confirm a positive effect of LBD expenditures spent by m and m's cooperating neighbors on both, m's tax revenues and m's neighborhood's median tax revenues (see Table 9). With respect to the effect of IMC duration, a short term negative effect

of IMC on the neighborhood median unemployment rate and a positive effect of long-lasting cooperation on m's neighborhood's tax revenues is robust to truncation (see Table 10).

[Table 9 & 10 here]

Overall MSM and FE produce significant results in the models predicting neighborhood median measures rather than outcomes of the single municipality m, which is likely to be due to the nature of IMC. Cooperation, by design, affects a group of partners and not a single municipality exclusively.

7 Discussion

The results produced by the FE-models and the MSMs show significant differences due to the different approaches in bias reduction. FE-models control for time-invariant unobserved factors that may drive selection into treatment, like persisting political networks between neighboring municipalities. MSMs control for time-varying factors that themselves are depending on previous cooperation activities. State support for IMC, e.g. may be more prominent in regions where municipalities previously were hesitant to initiate cooperation. Therefore, IMC may be dependent on IMC support, which is in turn dependent on previous IMC activities. While the FE-model shows a direct (and over time, increasing) effect of IMC on municipality m's unemployment rate, the MSM only reports positive effects of LBD expenditures that were spent by m and neighboring cooperation partners on m's tax revenues.

While the results from the FE-model and the MSM differ in the specifications that predict municipality m's own performance, they are very similar (in effect direction and size) in the specifications where the neighborhood's performance is the dependent variable. In both models the LBD expenditures have a positive effect on neighborhood median tax revenue. This may be attributable to fuzzy model design. Cooperation happens between neighboring municipalities so that the treatment is not limited to m but involves some of m's neighbors. If

this were the case, however, the effect should be detectable within municipality m itself. Therefore, m's cooperation must produce spillovers affecting also non-cooperating neighbors. This makes sense, especially if a mobile factor like labor is the basis for a measure of local economic performance, like the unemployment rate.

The fact that both models produce remarkably similar effect sizes could have two reasons: Either, both approaches correct for discretely different biases of the same size, or they correct for a bias that has its origin in a mix of time-invariant unobserved and time-varying confounders. For example, the combination of neighborhoods with strong political networks and IMC support over time. Neither model can control for both sources, however, each can control for one of the two. Observing an effect on the neighborhood's performance rather than on municipality m's performance

With respect to the duration of IMC both methods show similar trends (see Figures 4 and 5). The FE-model shows a significantly negative long-term effect on unemployment (both municipal and neighborhood median unemployment), while the MSM shows a negative first-year and long term effect (only in the neighborhood specification). The neighborhood's own tax revenues are positively affected by long-term cooperation in both models, indicating that cooperative local business development projects may take a few years until completion. Land for a joint business park might need developing before businesses can settle, for example.

8 Conclusion

This contribution analyses the effect of IMC in the field of local business development. To my knowledge, it is the first study to focus on IMC in the field of local business development utilizing a method that allows for causal inference. I draw on the extensive literature on IMC emergence to explain the decision to cooperate and control for selection into treatment and post-treatment bias. In addition to a FE-model, I use MSMs to estimate the average treatment effect

of IMC on own tax revenues per capita and the municipal unemployment rate. I find that cooperation has a mediating effect on the productivity of local business development efforts, in that with increasing expenditures on local business development neighborhoods with cooperating municipalities have a lower unemployment rate compared to those that do not cooperate. Furthermore, long-term cooperations, lasting at least six years, show increased own tax revenues.

This study is not without shortcomings. First, MSMs address the bad control problem encountered in the FE-model; however, the sequential ignorability assumption for MSMs is hard to test. It is reasonable to assume that I cannot measure every common cause of treatment and outcome, as I am relying on observational data. Therefore, the MSM may not produce completely unbiased results. Nonetheless, the quality of information on German municipalities is good and the treatment-predicting model builds on a very rich empirical literature. Accordingly, the potential for bias should be small.

Second, while unemployment rate and tax revenues show an impact of cooperation, the effects of IMC may manifest in different outcome measures. It remains a challenge to devise a more detailed, informative measure; one that is meaningful given the different contexts of cooperation with respect to the field of cooperation and the kind of potential cooperating parties.

Third, in focusing on special purpose associations I neglect less formalized forms of IMC, like working groups or agreements. However, as there is no official data on the latter forms, complete if narrow information makes it possible to utilize panel data and to control for unobserved heterogeneity via the FE-approach.

More research is called for in order to identify the drivers of successful cooperation in different environments and to develop methodological approaches that can deal with the dynamic setting of cooperation over time.

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Figures and Tables

Figure 1: Time-varying treatment and covariates. Adapted from Bacak and Kennedy (2015)

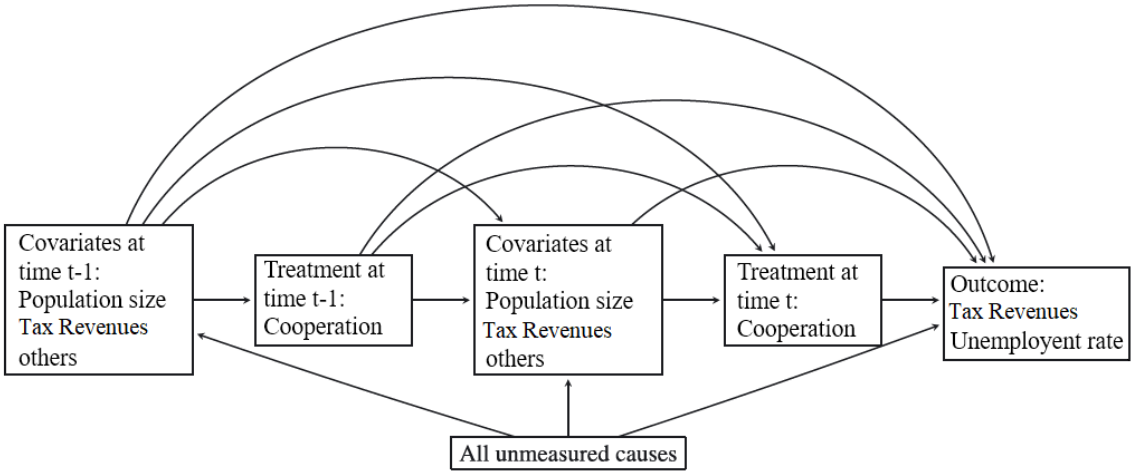


Figure 2: Municipalities cooperating in local business development in the four states

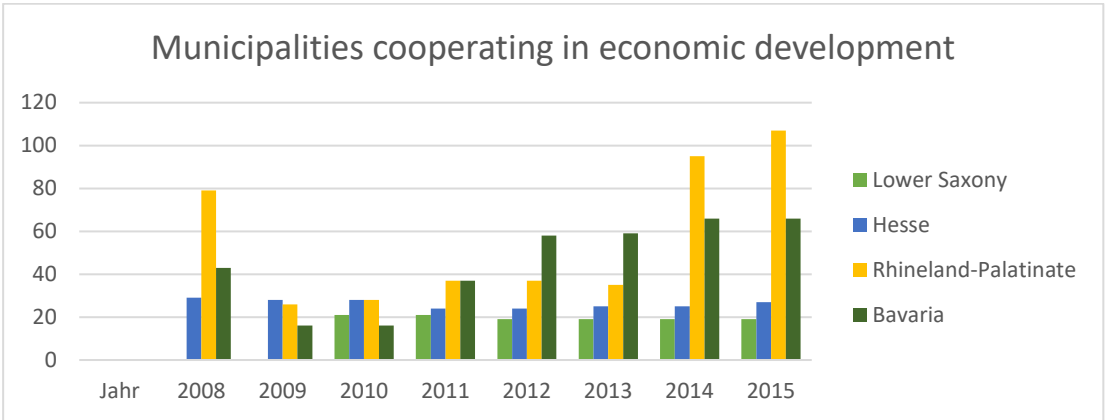


Figure 3: Cooperating municipalities (dark) and non-cooperating municipalities (light)

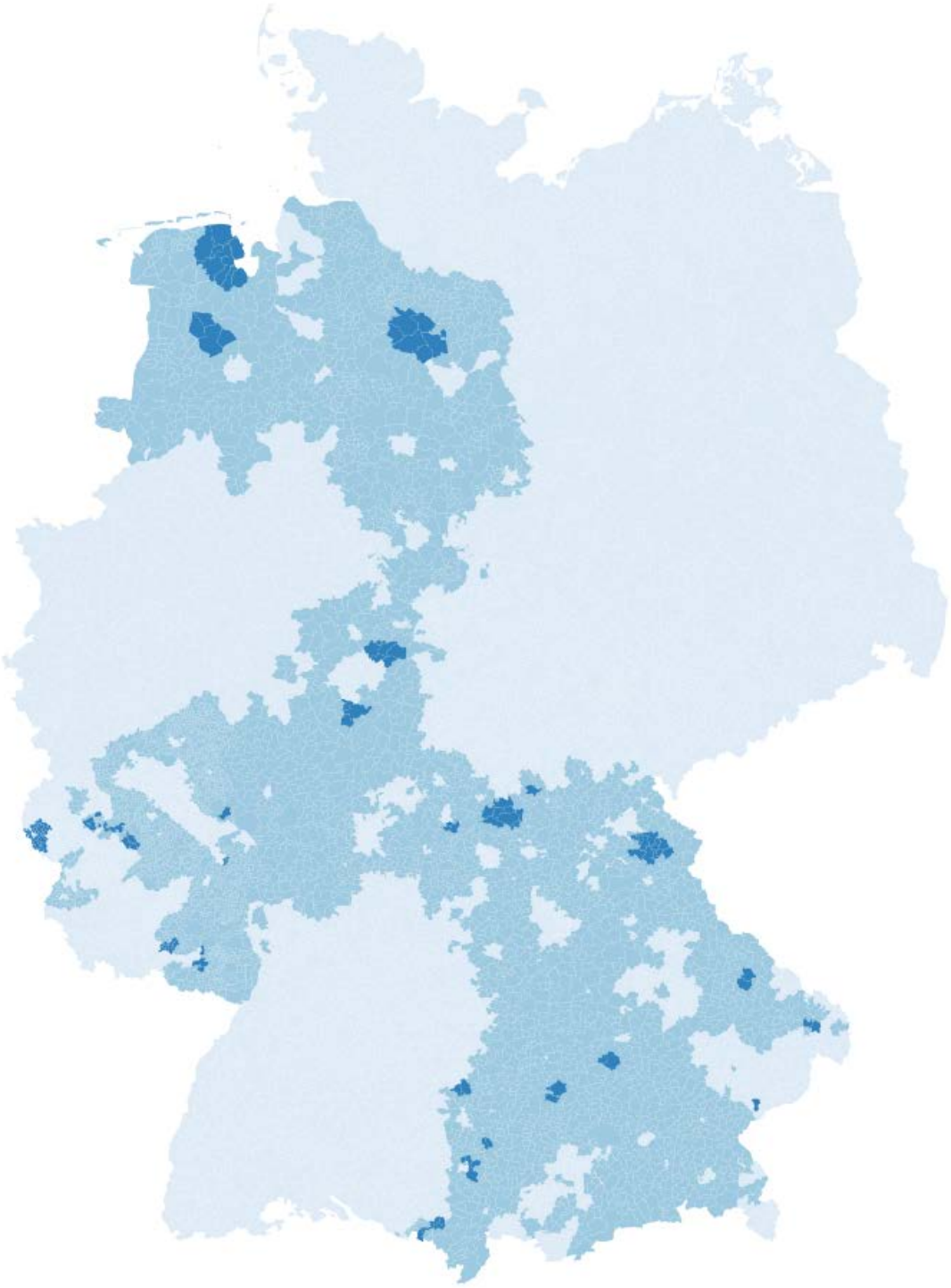
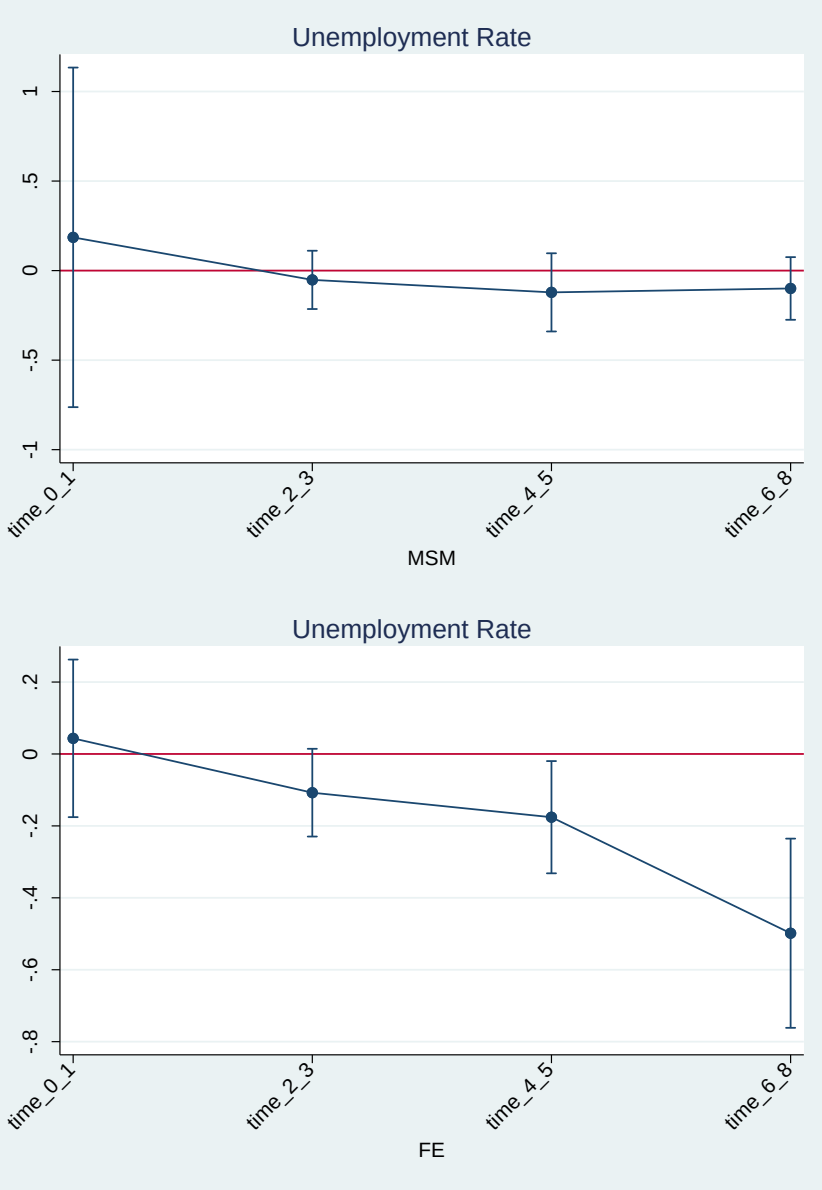


Figure 4: Effect of IMC duration on the unemployment rate and own tax revenues, MSM and FE-models



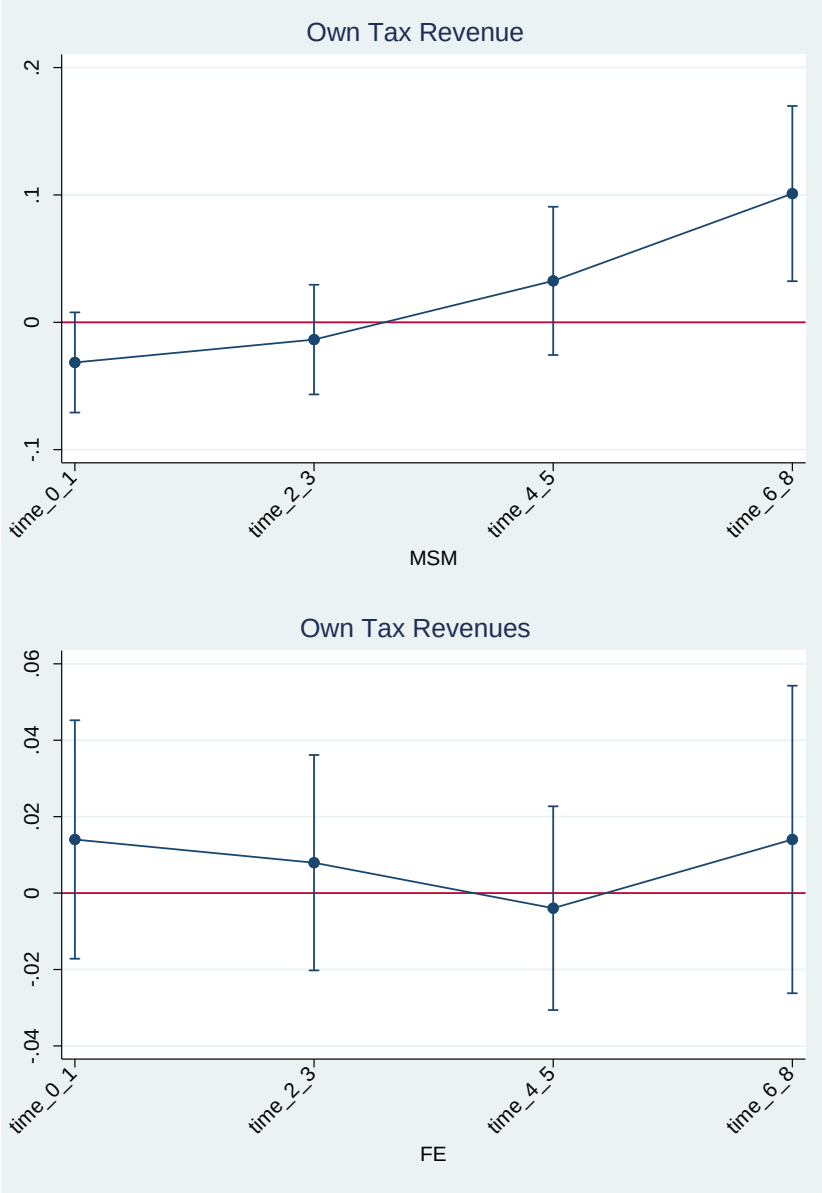


Figure 5: Effect of IMC duration on the neighborhood unemployment rate and neighborhood own tax revenues, MSM and FE-models

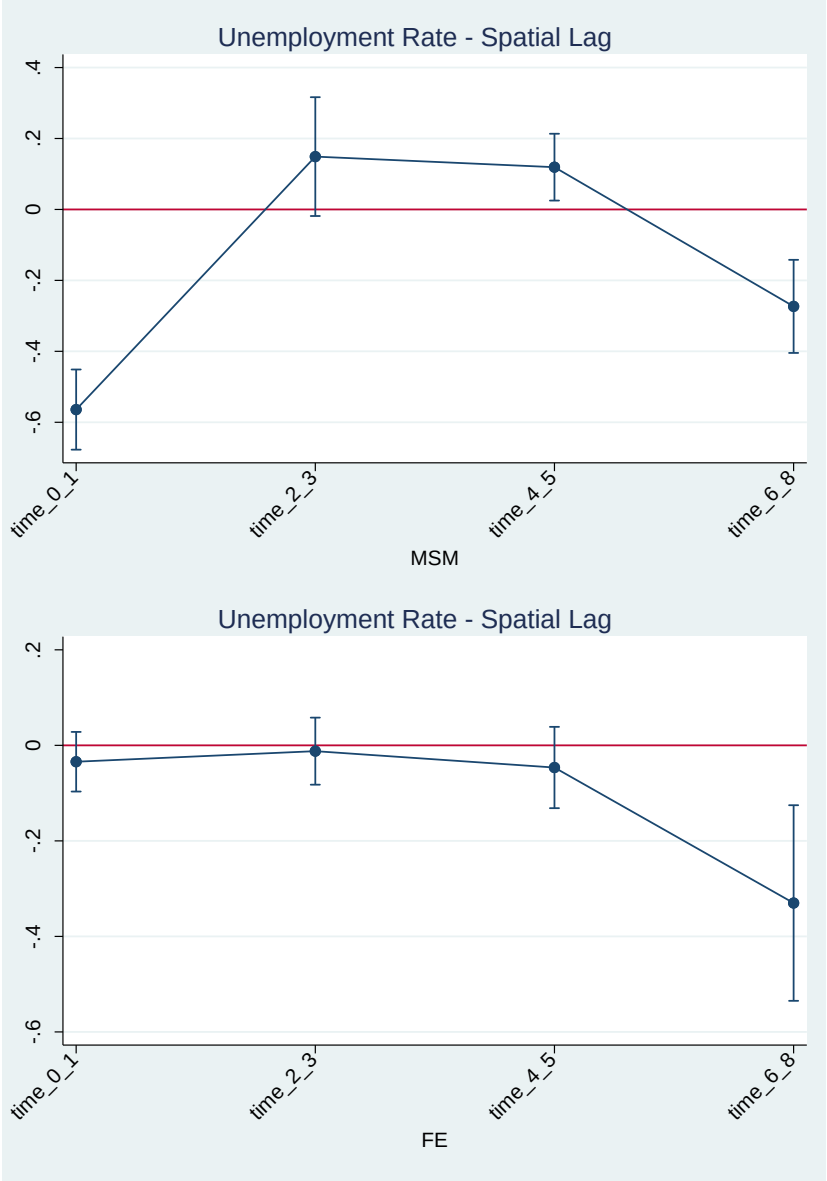


Table 1: Variables and their description

Variable	Measure
Time invariant variables	
City with county rights	Dummy=1 if the municipality is a city with county rights
Metro area	Dummy=1 if the municipality is located in a metropolitan area
Area	Municipal area in square kilometers
Num. neighbors	Total number of neighbors
Border county	Dummy=1 if the municipality is located at a county border
Border state	Dummy=1 if the municipality is located at a state border
State dummies	Dummy=1 if municipality m is located in state LS,HE,RP,or BA
Time varying variables	
Population size	Natural log of the total number of citizens
Population growth	One year growth rate of the municipal population
Unemployment rate	Reported unemployed/population between 15 and 65 y/o
Own tax revenue	Business, property, income, and value added tax revenues per capita
LBD exp.	Municipal expenditures on local business development per capita
LBD neighbors	Sum of expenditures on local business development per capita spent by m's direct neighbors
IMC support	Dummy=1 in year and state where the state government supports IMC projects
Other cooperations	Number of other unions municipality m is part of in year t
Election year	Dummy=1 in year of municipal council election
Freeway access	Dummy=1 if municipality m is located near a freeway access
Share small firms	Share of firms with less than 10 employees (on county level)
Share large firms	Share of firms with more than 250 employees (on county level)
IMC	Dummy=1 if municipality m engages in IMC in year t
LBD. exp. IMC	Expenditures on local business development per capita spent by m and m's neighboring cooperation partners

Table 2: State support for IMC

State	Form of Support	Year
Lower Saxony	Directive for the promotion of inter-municipal mergers and inter-municipal cooperation	2007 - 2010
Hesse	Funding for IMC for - municipalities < 18k inhabitants - municipalities < 30k inhabitants - all municipalities	 2004 – 2007 2008 – 2010 since 2011
Rhineland Palatinate	No explicit Funding	
Bavaria	Funding for IMC in - economically underdeveloped areas adjacent to East German states - all municipalities	 2012 since 2015

Table 3: Sample baseline means for cooperating and non-cooperating municipalities

	Non-cooperating				Cooperating			
VARIABLES	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Unemployment rate	4.11	1.79	0.79	18.18	5.72	5.48	1.03	50
Own tax revenue	678.66	483.21	-442.53	16342.23	588.66	348.89	54.56	2380.94
Population size	5583	25399.03	29	1311573	4842.46	9616.31	9	82192
Population growth	-0.25	1.65	-11.3	16.76	-1.04	4.49	-42.86	10.39
LBD exp.	0.65	3.57	0	65.43	1.77	4.6	0	24.36
IMC support	0.28	0.45	0	1	0.2	0.4	0	1
Freeway access	0.11	0.31	0	1	0.14	0.35	0	1
City with county rights	0.01	0.09	0	1	0.02	0.14	0	1
Metro area	0.46	0.5	0	1	0.13	0.33	0	1
Area	28.09	30.8	0.39	357.5	35.31	47.62	1.39	247.15
Num. neighbors	6.03	2.05	0	29	6.08	2.02	2	12
Number of municipalities	4395				160			

Table 4: Pooled logistic regression predicting cooperation, odds ratios

	OR	SE		OR	SE
Time invariant and time-varying variables at baseline			*Time varying variables continued*		
City with county rights	4.885**	(3.360)	LBD exp.		
Metro area	0.180***	(0.0505)	At t-1	0.999	(0.00237)
Area	1.013***	(0.00302)	At t-2	1.001	(0.00131)
Num. neighbors	0.934	(0.0454)	At t-3	1.002***	(0.000772)
Other cooperations	1.032	(0.0232)	Population size (SL)		
IMC support	1.626e+07***	(1.986e+07)	At t-1	3.113**	(1.750)
Freeway access	2.425***	(0.674)	At t-2	0.799	(0.454)
Population size	14.19	(48.69)	At t-3	0.225*	(0.203)
Population size (sl)	2.375	(1.427)	Population growth (SL)		
Population growth	0.969	(0.0393)	At t-1	1.050	(0.0765)
Population growth (sl)	0.950	(0.0873)	At t-2	0.855**	(0.0659)
Unemployment rate	1.062	(0.0784)	At t-3	1.371***	(0.105)
Unemployment rate (sl)	1.322***	(0.103)	Unemployment rate (SL)		
Own tax revenue	1.607	(0.641)	At t-1	0.680**	(0.117)
Own tax revenue (sl)	4.045*	(2.992)	At t-2	1.051	(0.174)
LBD exp.	1.057***	(0.0123)	At t-3	0.695**	(0.104)
LBD neighbors	1.033***	(0.00546)	Own tax revenue (SL)		
Share small firms	0.839	(0.121)	At t-1	0.595	(0.667)
Share large firms	0.864**	(0.0503)	At t-2	0.152*	(0.171)
			At t-3	0.112**	(0.0971)
Time varying variables			LBD neighbors		
			At t-1	0.996*	(0.00191)
IMC			At t-2	1.002*	(0.00128)
At t-1	5.853e+10***	(3.474e+10)	At t-3	0.999	(0.00128)
At t-2	4.28e-07***	(4.41e-07)	IMC support		
At t-3	1.931	(2.419)	At t-1	7.010***	(2.669)
Population size			At t-2	0.125***	(0.0580)
At t-1	0	(0)	At t-3	4.204***	(2.078)
At t-2	3.199e+143	(6.884e+145)	Share small firms		
At t-3	0***	(0)	At t-1	0.507***	(0.115)
Population growth			At t-2	1.831**	(0.458)
At t-1	19.32	(41.31)	At t-3	1.557	(0.436)
At t-2	0.711***	(0.0829)	Share large firms		
At t-3	1.086*	(0.0497)	At t-1	0.661***	(0.0647)
Unemployment rate			At t-2	1.106	(0.0905)
At t-1	0.819	(0.103)	At t-3	1.667***	(0.182)
At t-2	1.298**	(0.162)		0.507***	(0.115)
At t-3	0.933	(0.0817)	Election year	3.608***	(1.144)
Own tax revenue					
At t-1	0.807	(0.303)	Constant	660.0**	(2,129)
At t-2	0.693	(0.303)			
At t-3	0.877	(0.402)	Observations	40,180	

Also included: state and county border dummies, state dummies, and year dummies. Robust seEform, clustered on municipal level, in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5: The effect of IMC on unemployment rate and own tax revenues, MSM and FE

Model	Variables	Unemployment	Unemployment	Tax Revenue	Tax Revenue
MSM	IMC	-0.0202		0.0222	
		(0.122)		(0.0187)	
	LBD. exp. IMC		-0.000224		0.000272***
			(0.000210)		(9.65e-05)
	Observations	4,448	4,388	4,452	4,384
	R-squared	0.657	0.660	0.694	0.693
FE	IMC	-0.152**		0.00282	
		(0.0605)		(0.0116)	
	LBD. exp. IMC		-0.000838**		0.000186
			(0.000413)		(0.000115)
	Observations	40,487	40,409	40,591	40,505
	R-squared	0.207	0.207	0.210	0.210

Control variables in the FE: Population size, population growth, LBD Exp., LBD neighbors, other cooperations, IMC support, share small firms, share large firms, year dummies.
Control variables in the MSM are the FE-controls, outcome variables, and their respective spatial lags at baseline, as well as, city with county rights, metro area, area, num. neighbors, border county, border state, state dummies.
Robust standard errors in parentheses, clustered on municipal level *** p<0.01, ** p<0.05, * p<0.1. N=4552

Table 6: The effect of IMC duration on the (neighborhood) unemployment rate and (neighborhood) own tax revenues, MSM and FE

Model	Years of IMC	Unemployment	Tax Revenue	Unemployment (neighborhood)	Tax Revenue (neighborhood)
MSM	1	0.186	-0.0315	-0.564***	-0.00922
		(0.484)	(0.0201)	(0.0576)	(0.0293)
	2-3	-0.0518	-0.0136	0.149*	-0.0221
		(0.0830)	(0.0220)	(0.0854)	(0.0166)
	4-5	-0.122	0.0325	0.119**	-0.0116
		(0.111)	(0.0297)	(0.0480)	(0.0260)
	6-8	-0.0998	0.101***	-0.273***	0.117***
		(0.0892)	(0.0351)	(0.0670)	(0.0165)
FE	0-1	0.0434	0.0140	-0.0343	0.000458
		(0.112)	(0.0159)	(0.0319)	(0.00817)
	2-3	-0.108*	0.00795	-0.0121	0.0143*
		(0.0622)	(0.0144)	(0.0358)	(0.00744)
	4-5	-0.176**	-0.00395	-0.0464	0.00948
		(0.0796)	(0.0136)	(0.0434)	(0.00857)
	6-8	-0.498***	0.0140	-0.330***	0.0410***
		(0.134)	(0.0205)	(0.104)	(0.0120)

Control variables in the FE: Population size, population growth, LBD Exp., LBD neighbors, other cooperations, IMC support, share small firms, share large firms, year dummies.
Control variables in the MSM are the FE-controls, outcome variables, and their respective spatial lags at baseline, as well as, city with county rights, metro area, area, num. neighbors, border county, border state, state dummies.
Robust standard errors in parentheses, clustered on municipal level *** p<0.01, ** p<0.05, * p<0.1.

Table 7: The effect of IMC on neighborhood unemployment and neighborhood tax capacity, truncated weights

Model	Variables	Unemployment (neighborhood)	Unemployment (neighborhood)	Tax Revenue (neighborhood)	Tax Revenue (neighborhood)
MSM	IMC	-0.149*		0.0200	
		(0.0815)		(0.0222)	
	LBD. exp. IMC		-0.000776***		0.000301***
			(0.000118)		(2.66e-05)
	Observations	4,445	4,388	4,452	4,384
	R-squared	0.758	0.761	0.831	0.833
FE	IMC	-0.0272		0.0152**	
		(0.0320)		(0.00605)	
	LBD. exp. IMC		-0.000156		0.000197***
			(0.000230)		(5.68e-05)
	Observations	40,454	40,379	40,604	40,518
	R-squared	0.416	0.416	0.505	0.504

Control variables in the FE: Other cooperations, IMC support, share small firms, share large firms, year dummies, as well as neighborhood median values of population size, population growth, and LBD Exp.
Control variables in the MSM are the FE-controls, outcome variables, and their respective spatial lags at baseline, as well as, city with county rights, metro area, area, num. neighbors, border county, border state, state dummies.
Robust standard errors in parentheses, clustered on municipal level *** p<0.01, ** p<0.05, * p<0.1. N=4552

Table 8: Summary statistics on inverse probability of treatment weights

	Min.	1st Quartile	Median	Mean	3rd Quartile	Max
Not-Truncated	0. 013	0.992	0.999	0.999	1.001	25.009
Truncated at 1st and 99th Percentile	0.127	0.992	0.999	0.978	1.001	1.121

Table 9: The effect of IMC on (neighborhood) unemployment rate and (neighborhood) own tax revenues, MSM with truncated weights

Model	Variables	Unemployment	Unemployment	Tax Revenue	Tax Revenue
	IMC	-0.111		0.00262	
		(0.0928)		(0.0176)	
	LBD. exp. IMC		2.73e-05		0.000278**
MSM			(0.000374)		(0.000124)
	Observations	4,448	4,388	4,452	4,384
	R-squared	0.641	0.647	0.692	0.691
		Unemployment (neighborhood)	Unemployment (neighborhood)	Tax Revenue (neighborhood)	Tax Revenue (neighborhood)
	IMC	-0.0576		-0.00698	
		(0.0581)		(0.0107)	
	LBD. exp. IMC		-0.000108		0.000149*
MSM			(0.000332)		(8.98e-05)
	Observations	4,445	4,388	4,452	4,384
	R-squared	0.755	0.760	0.831	0.831

Control variables are population size, population growth, LBD Exp., LBD neighbors, outcome variables, and their respective spatial lags at baseline, other cooperations, IMC support, share small firms, share large firms at baseline, as well as, city with county rights, metro area, area, num. neighbors, border county, border state, state dummies.
Robust standard errors in parentheses, clustered on municipal level *** p<0.01, ** p<0.05, * p<0.1.

Table 10: The effect of IMC duration on (neighborhood) unemployment and (neighborhood) tax capacity, MSM with truncated weights

Years of IMC	Unemployment	Tax Revenue	Unemployment (neighborhood)	Tax Revenue (neighborhood)
1	0.414	-0.0277	-0.500***	-0.000298
	(0.649)	(0.0227)	(0.0752)	(0.0394)
2-3	-0.348*	-0.0295	-0.213	-0.0345**
	(0.180)	(0.0279)	(0.145)	(0.0150)
4-5	-0.0768	0.0219	0.142***	-0.00202
	(0.0896)	(0.0283)	(0.0549)	(0.0167)
6-8	0.0859	0.0484	-0.0222	0.0492*
	(0.177)	(0.0440)	(0.104)	(0.0282)
Observations	4,448	4,452	4,445	4,452
R-squared	0.642	0.693	0.755	0.831

Control variables are population size, population growth, LBD Exp., LBD neighbors, outcome variables, and their respective spatial lags at baseline, other cooperations, IMC support, share small firms, share large firms at baseline, as well as, city with county rights, metro area, area, num. neighbors, border county, border state, state dummies.
Robust standard errors in parentheses, clustered on municipal level *** p<0.01, ** p<0.05, * p<0.1.