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Ifo Working Paper No. 188

September 2014

An electronic version of the paper may be downloaded from the Ifo website
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This paper has been accepted for publication in Papers in Regional Science

Abstract

During the 1960s and 1970s, the German state governments reduced the number of municipalities. Many independent municipalities in the outskirts of a city became a district of the respective city. Using propensity score matching, I examine how the reforms influenced population growth in these incorporated units. The results show that the population of small incorporated municipalities grew by about 47 percentage points faster than the population of small municipalities that remained independent. The results do not show that large incorporated municipalities grew faster than large municipalities that remained independent. Population growth was stronger in municipalities that were incorporated later.

JEL Code: H11, H77, R23.
Keywords: Municipality reform, administrative structure, population growth, propensity score matching.

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* I would like to thank Marie-Estelle Binet, Thiess Buettner, Garett Jones, Niklas Potrafke, Janina Reinkowski, Marcel Thum, Manuel Wiegand, and seminar/conference participants for their helpful comments. I am also grateful to Nina Czernich for providing me with data on municipalities' centroids. Stefan Frank, Matthias Müller, Tina Schaller, Margret Schneider, Christian Simon, and Leonard Thielmann provided excellent research assistance.

1 Introduction

Experts investigate the optimal (spatial) administrative structure of jurisdictions, reasons for why reforms of administrative structures occur, and effects of reforms. Large jurisdictions may benefit from economies of scale in the production of public goods and services, internalized externalities, and insurance against fiscal shocks. In small jurisdictions, by contrast, citizens have more political influence. Politicians may also satisfy citizens' preferences for public goods more precisely.[1]

To explain why reforms of administrative structures occur, experts examine what influences mergers or secessions at the municipality level. In Sweden, within-municipality imbalances of wealth increased the support for splitting-up in wealthy parts (Brink, 2004).[2] Consolidations are less likely because, for example, grants to merged municipalities are lower than the sum of grants to unmerged municipalities, high-revenue municipalities will have to share their revenues when consolidated with a poorer neighbor, and because political preferences influence the policies implemented. In Norway, consolidations were more likely when efficiency gains were expected to be large and differences in revenues and political preferences were small (Sørensen, 2006).[3] In Japan, consolidations were more likely when economies of scale were expected and less likely when municipalities received grants from the central government (Miyazaki, in press). In the United States, income differences between cities and counties explain approval in consolidation referenda (due to tax-base motives), but economies of scale did not seem to be relevant (Filer and Kenny, 1980).[4] "Unfavorable" migration between city and surrounding area influenced incorporations, of which some could have realized on the city's own right: By expanding city boundaries, politicians may manipulate the composition of voters. Expropriating tax bases by incorporation, on the contrary, was not shown to be relevant (Austin, 1999).

Experts also examine how incorporations influence economic indicators. In France, consolidations

[1] See, for example, Alesina et al. (1995). Experts examine the trade-off between efficiency and heterogeneous populations (Alesina and Spolaore, 1997; Bolton and Roland, 1997).

[2] On secessions of wealthy districts, see also Garasky and Haurin (1997) and Kenny and Reinke (2011).

[3] See Brasington (1999) and Gordon and Knight (2009) on the determinants of school district consolidation.

[4] On the incentives to vote for consolidation, see also Dur and Staal (2008).

of municipalities reduced local tax competition (Charlot et al., in press). In Israel, consolidations reduced municipal expenditures, suggesting that economies of scale are present (Reingewertz, 2012).[5] In Sweden, only small municipalities reduced expenditure growth after consolidation, while large municipalities increased expenditure growth (Nelson, 1992). Small municipalities also experienced higher population growth due to consolidation; consolidations did, however, not influence income growth (Hanes and Wikström, 2008).[6] In Germany, the reforms implemented in the 1960s and 1970s influenced how regions and cities performed: First, counties with an incorporated core had less debt as compared to regions with an independent core city. Second, cities grew faster (in terms of gross value added) the more intensely they incorporated (Blume, 2009).

I also elaborate on the German reforms of the 1960s and 1970s. I focus, however, on how consolidation influenced the municipalities that were incorporated, instead of examining the core city that was expanded. I investigate the changes in population as a measure of the increased or decreased attractiveness of a community. A community is attractive to citizens for reasons such as wealth or political influence. The reforms that reduced the number of municipalities in Germany from 24,300 to 8,500 occurred between 1968 and 1978. A quite long time has passed to evaluate the effects on a rather persistent factor such as the population. I compare municipalities that remained independent with municipalities that became a city district and employ pre-reform population data from 1961 and population data at the municipality and city-district level from 2008.

I use propensity score matching to link incorporated and independent municipalities with similar incorporation probabilities. The location, population, area, and state affiliation predict incorporation probabilities. The results show that the population of small incorporated municipalities grew faster than the population of small municipalities that remained independent. The results do not show that large incorporated municipalities grew faster than large municipalities that remained independent. Population growth was stronger in municipalities that were incorporated later.

[5] On school district consolidation and economies of scale, see Ratcliffe et al. (1990) and Duncombe et al. (1995).

[6] Carruthers (2003) portrays the nexus between political fragmentation and population growth; Grassmueck and Shields (2010) portray the nexus between government fragmentation and economic growth.

2 Institutional Background

The number of municipalities in the current German territory declined from 45,000 in 1900 to 11,200 in 2013. In 1968, the number (in West Germany) was 24,300, with about 95% of the municipalities having less than 5,000 inhabitants. Between 1968 and 1978, the state governments implemented large reforms in the administrative structure of municipalities, which reduced the number of municipalities to 8,500.[7] Initially, governments planned even more reductions; some municipalities, however, successfully resisted merger, both before and after the merger took place.

The reforms occurred in a period where "planning" became increasingly popular. The federal law of regional planning ("Raumordnungsgesetz") from 1965 asked the states to prepare structural improvements of their municipalities. The individual states formed commissions of experts making proposals about how to reform the structure of municipalities. The reforms were less intense when advocates and opponents of the reforms met in the state parliament and more intense when they met only at the municipal level (Mecking and Oebbecke, 2009). The reforms had five aims: promoting equal conditions of life in both urban and rural areas, strengthening the efficiency of municipalities in rural areas, ensuring a well-arranged development and function of urban areas, restructuring areas with respect to aspects of spatial planning and infrastructure, and improving general-interest services (Wagener, 1969). The change from historically established units to units focused on efficient public structures characterizes the reforms.

Some municipalities merged voluntarily, other municipalities were forced to merge. In the state of Baden-Wuerttemberg, for instance, the number of municipalities decreased from 3,379 to 1,111. Municipalities that merged voluntarily received funds. The reforms in Bavaria were similarly intense and reduced the number of municipalities from 7,077 to 2,052. Table 1 shows that even more reforms occurred in the Saarland, Hesse, North Rhine-Westphalia, and Lower Saxony. In all these states, the number of municipalities declined by more than 75%. In Rhineland-Palatinate and Schleswig-Holstein, the number of municipalities declined by only about 20%. After the end of the reform period in 1978, the number of municipalities remained almost constant (see last column).

[7]The number of 11,200 municipalities in 2013 is explained solely by the 1990 reunification of Germany.

Table 1: Reforms in the Administrative Structure

State	No. Municipal. Before Reforms (1968)	No. Municipal. After Reforms (1978)	Reduction in %	No. Municipal. in 2013
Saarland	347	50	85.6	52
Hesse	2684	432	83.9	426
North Rhine-Westphalia	2277	396	82.6	396
Lower Saxony	4231	1030	75.7	1007
Bavaria	7077	2052	71.0	2056
Baden-Wuerttemberg	3379	1111	67.1	1101
Rhineland-Palatinate	2905	2320	20.1	2306
Schleswig-Holstein	1378	1132	17.9	1115
Total	24278	8514	64.9	8459

Number of municipalities before and after the reforms according to Mecking and Oebbecke (2009).

3 Identification Strategy and Data

I investigate whether incorporating a municipality into a core city influences population growth in the incorporated unit. Using a propensity score matching approach, I compare municipalities that merged with a core city with municipalities that remained independent. I estimate the counterfactual outcome, which shows how fast an incorporated municipality would have grown if it had not been incorporated. Comparing these counterfactuals with the actual growth rates shows how incorporations influence population growth.

The sample includes all cities in former West Germany that were county-independent in 1961 and remained county-independent until 2008 ("Kreisfreie Städte").[8] I distinguish two groups of (surrounding) municipalities of these core cities. The first group includes municipalities that were incorporated into a city in the course of the reforms (the treatment group). I compare the population of the incorporated municipalities from when they were still independent in 1961 with the population as a city district in 2008. Suitable data are not available for all cities, especially when a city district is not identical to the former municipality. The group of incorporated municipalities includes 124

[8]County-independent cities are not associated with a county, but are directly subordinate to their state. A county-*dependent* city, by contrast, is part of a county, which is at an intermediate stage between city and state.

observations. The second group includes those municipalities in the surrounding area of a core city that remained independent until 2008 (the control group). I restrict the surrounding area to a circle of 12.5 km around the center of the core city. I consider only those (in 1961 *and* 2008 county-*dependent*) surrounding municipalities that did not experience any mergers or break-ups. The group of still independent municipalities includes 447 observations.

Individual characteristics are likely to have influenced the probability of being incorporated. For example, given that small surrounding municipalities were more likely to be incorporated, population may have grown faster not because of the incorporation, but because of an increased preference of the population for small communities. I thus compare treated and untreated municipalities that have similar (pre-treatment) characteristics. Optimally, municipalities should differ only with respect to whether they were treated, all other characteristics being equal. As it is hardly possible to match on every covariate, however, I condense the individual covariates into one number. I use the propensity score matching approach suggested by Rosenbaum and Rubin (1983), which calculates a probability of incorporation in a first step. A probit regression includes covariates X that are likely to influence the incorporation probability; a binary variable (treated: $T = 1$, untreated: $T = 0$) describes the dependent variable:

$$Prob(T = 1|X) = \phi(X'\beta).$$

For matching, propensity scores for both members of the treatment group and the control group have to overlap (common support). The matching procedure is intended to make the groups comparable by possibly omitting such observations that are causing the groups to be different. In an OLS framework, by contrast, identification would be based also on observations outside the common support, which would give rise to a bias. Moreover, the functional form of the conditional expectation $E(Y_0|X)$ may be misspecified in an OLS framework. I employ four different versions of propensity score matching: one-to-one, k-nearest-neighbors, radius, and kernel matching (description in the appendix).

Successful matching requires treatment and control group to be similar. To ensure this “balancing property” I examine every variable used to explain the propensity score (see, for example, Gadd et al., 2008). The groups are comparable if the average values of each variable in the treatment and the control group do not differ significantly. Valid results also require that "systematic differences in outcomes between treated and comparison individuals [municipalities] with the same values for covariates are attributable to treatment" ("unconfoundedness"; Caliendo and Kopeinig, 2008). With T as treatment, Y_0 and Y_1 as potential outcomes, X as pre-treatment characteristics, and $p(X)$ as propensity score, assignment to the treatment has to fulfill $T \perp Y_0, Y_1 | X$, which can be shown to imply $T \perp Y_0, Y_1 | p(X)$. As it is not possible to test unconfoundedness directly, I only assume the condition to hold. The same holds for the Stable Unit Treatment Value Assumption (SUTVA). The SUTVA requires that potential outcomes of a municipality depend only on the municipality's own treatment status and not on the treatment status of other municipalities.[9]

Given a successful matching of observations and the resulting appraisals for counterfactual outcomes, I compute the average treatment effect on the treated (ATT). The ATT describes how population growth of comparable incorporated (i) and independent municipalities (j) differs:[10]

$$ATT = \frac{1}{n}\left(\sum_{i=1}^{n} \frac{Pop\_2008_i - Pop\_1961_i}{Pop\_1961_i} - \sum_{j=1}^{m} \alpha_j \frac{Pop\_2008_j - Pop\_1961_j}{Pop\_1961_j}\right).$$

The data set contains information on the population from two points of time: pre-reform data from the 1961 population census, and 2008 data from the local statistics of the German Federal Statistical Office and from publications of the individual cities.[11] To explain the incorporation probabilities of municipalities, I only use variables from the pre-reform period and time-invariant variables, since the conditions prevailing in the period prior to the reforms drive the incorporation probabilities.[12] I include the distance of the municipality to the respective core city. The farther away from the center of a core city a municipality is located, the more likely the municipality may be to remain independent.[13] I include the population and area of the surrounding municipality, because a

[9] On unconfoundedness, see Rosenbaum and Rubin (1983). On the SUTVA, see Angrist et al. (1996).

[10] The number of (exploited) observations in the treatment group is denoted n, the number of (exploited) observations in the control group is denoted m, and α_j indicates the different weights for the untreated observations that can follow from all matching methods. I employ the user-written Stata command *psmatch2* in the entire analysis (Leuven and Sianesi, 2003).

[11] As publication practices differ, the population figures of some cities' districts are from the adjacent years.

[12] Variables must also be unaffected by a possible anticipation of the reforms.

[13] In the case of overlapping surrounding areas, I relate a non-incorporated municipality to the nearest core city. I use official central points as coordinates of core cities (which are typically very central places in the centers of the

surrounding municipality should be more likely to lose its independent status the smaller population and area are. Also the population and area of the core city may influence the incorporation probability. Large cities may well incorporate more or less intensely than small cities.

It is conceivable that debt levels and political preferences influence whether a municipality remains independent. I thus include the 1966 per-capita debt level for both the core city and the surrounding municipality. I also include the percentage difference between the conservative (CDU/CSU) and the social-democratic party (SPD) in the county elections of the mid-1960s, and the same for the city council elections in the core cities.[14] As data on debt and elections are not available at the municipality level, I attribute county figures to the municipalities.[15] I include state dummies, since some states reduced the number of municipalities to a greater extent than other states (see Section 2). I also include a dummy variable indicating whether the respective core city is a state capital. Table 2 shows descriptive statistics: from 1961 to 2008, the average incorporated municipality grew by 109%; the average municipality that remained independent grew by only 65%.

4 Empirical Results

The left part of Table 3 shows the results of a probit model to explain the incorporation probabilities (propensity scores; marginal effects in the right part). The farther from the core city's center a municipality is, the less likely the municipality is to be incorporated. Also the larger the municipality's population, the less likely the municipality is to be incorporated. By contrast, a larger area is associated with a higher propensity score. The effects of population and area together indicate that being incorporated is more likely the lower the population density is. The nexus between population density and incorporation probability corroborates the argument that incorporation is done to strengthen the efficiency of administrations, because municipalities with low population density are hardly able to exploit economies of scale in the provision of public goods and services. For the

cities), while the coordinates of surrounding municipalities are based on centroids.

[14]The elections were held between 1964 and 1966. On ideology-induced policy-making in Germany see, for example, Potrafke (2011, 2012, 2013).

[15]Debt at the county level comprises both the debt of the county itself and of the respective municipalities.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Standard Dev.	Min	Max
Incorporated					
Population Growth Rate (in %)	124	109.02	97.70	-36.31	475.99
Pop. Growth Rate, State-Corr. (in %)	124	84.80	97.05	-55.98	456.31
Absolute Population Growth	124	2055.08	4186.46	-126	43100
Year of Incorporation	124	1972.15	2.17	1969	1978
Distance to Core City	124	6.05	2.18	1.76	11.76
Population 1961 Surr. Munic.	124	2332.35	4819.44	111	50906
Population 1961 Core City	124	134209.40	117982.60	29801	809247
Area 1961 Surr. Munic.	124	9.01	8.36	0.99	73.89
Area 1961 Core City	124	63.90	43.28	15.89	251.14
Debt 1966 Surr. Munic. (per capita)	124	187.11	61.59	101.24	440.73
Debt 1966 Core City (per capita)	124	503.20	251.41	114.77	1161.14
Political Diff. Surr. Munic. (in pp)	124	2.52	18.93	-32.50	46.00
Political Diff. Core City (in pp)	124	-11.38	9.59	-27.50	17.20
State Capital	124	0.09	0.29	0	1
Still Independent					
Population Growth Rate (in %)	447	65.23	85.94	-33.89	999.63
Pop. Growth Rate, State-Corr. (in %)	447	41.32	83.77	-51.78	968.05
Absolute Population Growth	447	1308.33	2502.40	-1236	26764
Distance to Core City	447	9.08	2.29	2.49	12.48
Population 1961 Surr. Munic.	447	2232.15	3583.95	91	33290
Population 1961 Core City	447	114883.50	172478.20	28725	1832346
Area 1961 Surr. Munic.	447	10.93	9.80	0.97	118.58
Area 1961 Core City	447	61.48	57.52	9.65	747.23
Debt 1966 Surr. Munic. (per capita)	447	199.85	65.71	116.55	440.73
Debt 1966 Core City (per capita)	447	522.33	210.27	114.77	1271.07
Political Diff. Surr. Munic. (in pp)	447	6.26	16.99	-51.80	49.10
Political Diff. Core City (in pp)	447	-9.64	10.73	-65.00	20.70
State Capital	447	0.11	0.31	0	1

Population growth describes total population growth from 1961 to 2008. The number of core cities in these data sets amounts to 30 and 60. Distance in kilometers, area in square kilometers, debt in Euro.

core city, it is conceivable that a higher population and a smaller area increase the probability of incorporating surrounding municipalities to provide space for further population development. The effects of the core city's size do, however, not turn out to be statistically significant.

The per-capita debt level and political difference of both the surrounding municipality and the core city also lack statistical significance. North Rhine-Westphalia, Lower Saxony, Baden-Wuerttemberg,

Table 3: Treatment Probability

Variable	Probit Coeff.	Probit Std.E.	Probit Signif.	Marginal Effects Coeff.	Marginal Effects Std.E.	Marginal Effects Signif.
log(Distance to Core City)	-2.763	0.324	***	-0.443	0.038	***
log(Pop. 1961 Surr. Munic.)	-0.504	0.156	***	-0.081	0.027	***
log(Pop. 1961 Core City)	0.361	0.384		0.058	0.060	
log(Area 1961 Surr. Munic.)	0.290	0.164	*	0.046	0.027	*
log(Area 1961 Core City)	0.008	0.399		0.001	0.064	
log(Debt 1966 Surr. Munic. (per capita))	0.147	0.389		0.024	0.062	
log(Debt 1966 Core City (per capita))	0.417	0.287		0.067	0.047	
Political Diff. Surr. Munic.	-0.003	0.007		0.000	0.001	
Political Diff. Core City	0.002	0.011		0.000	0.002	
Dummy Lower Saxony	2.602	0.324	***	0.418	0.058	***
Dummy North Rhine-Westphalia	3.313	0.627	***	0.531	0.104	***
Dummy Hesse	1.260	0.634	**	0.202	0.101	**
Dummy Rhineland-Palatinate	0.536	0.402		0.086	0.065	
Dummy Baden-Wuerttemberg	1.445	0.328	***	0.232	0.052	***
Dummy Bavaria	0.570	0.432		0.092	0.072	
Dummy State Capital	0.311	0.342		0.050	0.055	
Constant	-0.786	3.667				
Pseudo R^2		0.445				
Log pseudolikelihood		-166				

Number of observations: 571 (treated: 124, untreated: 447). Dependent variable: dummy variable indicating merger (1 = treated, 0 = untreated). Standard errors clustered on the level of the core city. */**/*** significant at the 10/5/1% level. Distance in kilometers, area in square kilometers, debt in Euro. The Saarland is missing due to a lack of observations; reference category: Schleswig-Holstein.

and Hesse consolidated municipalities more intensely than Schleswig-Holstein (reference category). The effects of Rhineland-Palatinate and Bavaria do not turn out to be statistically significant. Also the coefficient of the state-capital dummy lacks statistical significance.

I use the estimated coefficients of the probit model to predict the propensity scores and to perform the matching. Table 4 shows the balancing property for 10-nearest-neighbors matching. After matching, there is no statistically significant difference between the treatment and the control group for any individual variable (see the last two columns).[16]

[16] The tables are similar for one-to-one, radius, and kernel matching, as well as for different sizes of municipalities and different time periods (see below).

Table 4: Balancing Property (10-Nearest-Neighbors Matching)

Variable	Mean Treated	Mean Control	% Bias	% Bias Reduct.	t	$p > \|t\|$
log(Distance to Core City)	1.773	1.714	17.4	86.4	1.02	0.310
log(Pop. 1961 Surr. Munic.)	7.257	7.321	-6.6	44.5	-0.45	0.653
log(Pop. 1961 Core City)	11.413	11.338	9.7	73.1	0.74	0.461
log(Area 1961 Surr. Munic.)	2.008	1.937	10.3	59.2	0.70	0.486
log(Area 1961 Core City)	3.927	3.921	1.0	87.1	0.07	0.943
log(Debt 1966 Surr. Munic. (per capita))	5.225	5.255	-9.9	54.8	-0.72	0.470
log(Debt 1966 Core City (per capita))	6.104	6.119	-3.0	84.4	-0.19	0.850
Political Diff. Surr. Munic.	5.818	6.660	-4.7	77.5	-0.32	0.751
Political Diff. Core City	-10.628	-10.315	-3.1	82.0	-0.23	0.820
Dummy Schleswig-Holstein	0.062	0.044	6.1	80.6	0.54	0.588
Dummy Lower Saxony	0.155	0.096	18.6	71.3	1.23	0.221
Dummy North Rhine-Westphalia	0.052	0.033	7.7	82.6	0.62	0.535
Dummy Hesse	0.031	0.023	5.5	-101.8	0.35	0.726
Dummy Rhineland-Palatinate	0.299	0.244	11.6	78.1	0.85	0.396
Dummy Baden-Wuerttemberg	0.247	0.325	-20.4	-16.8	-1.19	0.234
Dummy Bavaria	0.155	0.234	-22.2	-104.3	-1.39	0.165
Dummy State Capital	0.103	0.073	10.1	-81.6	0.73	0.466

Distance in kilometers, area in square kilometers, debt in Euro. The Saarland is missing due to a lack of observations.

4.1 Incorporation Effect

The left part of Table 5 shows the results for the average treatment effect on the treated. Two out of four methods estimate a positive effect of incorporation on population growth, which is statistically significant at the 10% level. A municipality that became a city district grows (over the period 1961 to 2008) by 24 to 27 percentage points more than the municipality would have grown if it had not been merged with the core city. Municipalities that were incorporated grew by about 108%; municipalities that remained independent grew by only 81% to 85% (not shown). When I use bootstrapped standard errors, which attempt to take into account that the propensity score is estimated, three out of four methods show a statistically significant effect.[17]

[17] On bootstrapped standard errors and propensity score matching, see Abadie and Imbens (2008). Inferences do not change when I use standard errors as suggested by Abadie and Imbens (2012).

Table 5: Average Treatment Effect on the Treated (in Percentage Points)

	Diff. of Population Growth Rates	
		State-Corrected
Matching Method	Coeff. (Std.E.)	Coeff. (Std.E.)
One-to-one *(Caliper: 5%)*	23.462 (19.338)	26.577 (19.023)
(Bootstrapped Standard Errors)	(18.556)	(18.400)
10-Nearest-Neighbors *(Caliper: 5%)*	27.067 (17.208)	29.599 (16.964)*
(Bootstrapped Standard Errors)	(15.922)*	(15.806)*
Radius *(Caliper: 5%)*	26.754 (14.895)*	29.354 (14.601)**
(Bootstrapped Standard Errors)	(13.150)**	(13.166)**
Kernel *(Epanechnikov, Bandwidth: 5%)*	26.473 (14.998)*	28.987 (14.701)**
(Bootstrapped Standard Errors)	(14.175)*	(14.344)**

Number of observations: 544 (treated: 97, untreated: 447). Outcome variable: difference of average population growth rates between incorporated and independent municipalities. The right column is based on growth rates that take differences in state growth rates into account. */** significant at the 10/5% level.

The treatment effects are based on comparisons of incorporated and independent municipalities that may be located in different states. Population growth rates of states differed from 12.8% in North Rhine-Westphalia to 38.5% in Baden-Wuerttemberg. I adjust the treatment effect for the different state growth rates by subtracting the difference of state growth rates in the calculation of the figures of every individual match. I thus consider no longer the population growth rate of a municipality itself, but the extent to which the population growth rate exceeds that of the state in which the municipality is located. The right part of Table 5 shows the results. The treatment effect amounts to 27 to 30 percentage points and attains statistical significance at the 5% or 10% level in three out of four methods. Municipalities that were incorporated grew 83 percentage points more than their state; municipalities that remained independent grew only 53 to 56 percentage points more than their state.

4.2 Incorporation Effect: Different Sizes

Because large municipalities might be more efficient than small municipalities (economies of scale), large municipalities are less likely to benefit from incorporation. To investigate if the treatment effect of large municipalities is smaller, I estimate subsamples for small and large municipalities. The first subsample contains municipalities with less than or exactly 1,500 inhabitants in 1961, and the second subsample municipalities with more than 1,500 inhabitants (descriptive statistics in the appendix). Table 6 shows the results. The treatment effect is much larger for small municipalities than for large municipalities. The treatment increases the population growth rate by 46 to 48 percentage points in small municipalities, which is significant at the 5% or 10% level; the effect is –11 to +4 percentage points in the group of large municipalities and lacks statistical significance. The difference of about 42 to 59 percentage points is statistically significant at the 1% level.[18] In terms of population growth, small municipalities thus benefit more from incorporation than large municipalities. The results corroborate evidence from Sweden, where mergers increased population growth only in small municipalities (Hanes and Wikström, 2008).

Why does the population in small incorporated municipalities grow faster than in small municipalities that remained independent? It is conceivable that improvements in the provision of public goods and infrastructure influenced population growth. The city will probably be more willing to extend the streetcar network to a city district than to a municipality that is the same distance as the district from the city's core. But other public goods and services may also make an incorporated unit more attractive; for example, when the public sector becomes more efficient by exploiting economies of scale and is consequently able to increase the provision of goods and services. Public good provision may also increase when local governments failed to coordinate before consolidation. Firms that use public goods as inputs may benefit from increased public good provision, attracting further population. Mergers of municipalities may also reduce the volatility in the provision of public goods by absorbing fiscal shocks because of an insurance effect. If these effects caused higher

[18]The effect of 46 to 48 (–11 to +4) percentage points results from a growth rate that exceeds the respective state growth rate by 110 (43) percentage points in the incorporated, and 62 to 65 (39 to 54) percentage points in the independent municipalities. The standard error of the difference follows from $se(x - y) = \sqrt{(var(x)/n_x) + (var(y)/n_y)}$, with n indicating the respective number of observations, and is based on the assumption of two independent samples (see Kendall 1952, p. 226).

Table 6: Average Treatment Effect on the Treated (Different Sizes; in Percentage Points)

Matching Method	Diff. of Population Growth Rates *Pop. <= 1500* Coeff. (Std.E.)	*Pop. > 1500* Coeff. (Std.E.)	*Difference* Coeff. (Std.E.)
One-to-one *(Caliper: 5%)*	48.089 (25.081)*	-10.968 (45.761)	59.056 (9.248)***
(Bootstrapped Standard Errors)	(22.697)**	(25.478)	(5.875)***
10-Nearest-Neighbors *(Caliper: 5%)*	46.058 (22.614)**	-2.475 (28.022)	48.533 (6.242)***
(Bootstrapped Standard Errors)	(18.309)**	(16.884)	(4.229)***
Radius *(Caliper: 5%)*	45.537 (20.752)**	3.819 (21.489)	41.718 (5.115)***
(Bootstrapped Standard Errors)	(18.009)**	(14.682)	(3.911)***
Kernel *(Epanechnikov, Bandwidth: 5%)*	47.808 (21.183)**	4.157 (22.146)	43.651 (5.250)***
(Bootstrapped Standard Errors)	(17.618)***	(17.456)	(4.233)***

Number of observations: 338 / 204 (treated: 51 / 44, untreated: 287 / 160). Outcome variable: difference of average population growth rates between incorporated and independent municipalities. Growth rates corrected for state differences (see above). */**/*** significant at the 10/5/1% level.

population growth rates, the incorporation policy was successful. Then municipalities would have been incorporated that actually had potential for increasing efficiency.

The time span between announcing and realizing mergers gives rise to an alternative explanation. Local governments may behave opportunistically by increasing expenditures and debt before a merger. The respective neighborhood benefits from new public goods, while the costs are largely shifted to the newly formed city (common pool problem).[19] The improved public good provision gives rise to population growth. As the common pool problem increases in the size of the city relative to the incorporated municipality, this explanation fits particularly well for small municipalities.

Also the location of housing programs may explain different population growth rates. In the 1960s and 1970s, commuter towns were built within cities' borders to relieve pressure on the cities' cores. Commuter towns were constructed mostly in the outlying city districts, which may very well have included some newly incorporated districts. As these commuter towns were built in previously sparsely populated areas, population growth may have increased.

[19] On evidence for the common pool problem, see Hinnerich (2009), Jordahl and Liang (2010), and Hansen (2014).

Table 7: Average Treatment Effect on the Treated (Different Time Periods; in Percentage Points)

Matching Method	Diff. of Population Growth Rates *Incorp. '69-'72* Coeff. (Std.E.)	*Incorp. '73-'78* Coeff. (Std.E.)	*Difference* Coeff. (Std.E.)
One-to-one *(Caliper: 5%)*	11.773 (21.143)	58.096 (25.095) **	-46.323 (5.772)***
(Bootstrapped Standard Errors)	(17.094)	(35.335) *	(7.433)***
10-Nearest-Neighbors *(Caliper: 5%)*	16.051 (14.564)	58.442 (27.222) **	-42.392 (5.788)***
(Bootstrapped Standard Errors)	(14.443)	(24.895) **	(5.346)***
Radius *(Caliper: 5%)*	15.557 (14.384)	58.727 (25.234) **	-43.170 (5.407)***
(Bootstrapped Standard Errors)	(14.067)	(19.882)***	(4.406)***
Kernel *(Epanechnikov, Bandwidth: 5%)*	15.358 (14.412)	58.004 (25.349) **	-42.646 (5.430)***
(Bootstrapped Standard Errors)	(10.993)	(21.567)***	(4.561)***

Number of observations: 513 / 478 (treated: 66 / 31, untreated: 447 / 447). Outcome variable: difference of average population growth rates between incorporated and independent municipalities. Growth rates corrected for state differences (see above). */**/*** significant at the 10/5/1% level.

4.3 Incorporation Effect: Different Time Periods

Some of the mergers were voluntary, but others were not (see Section 2). Having voluntary and involuntary mergers gives rise to the question of whether the two ways of merging resulted in different outcomes. Distinguishing between voluntary and involuntary mergers is, however, not clear-cut in many cases. Some mergers may have been passed off as if they were voluntary, even though they were the result of negotiations involving concessions offered to the municipality as an inducement to incorporation. To overcome the problem of different (unobservable) degrees of voluntariness, I distinguish between two subsamples: incorporations from 1969 to 1972 and incorporations from 1973 to 1978.[20] It is conceivable that mergers realized earlier were more voluntary than mergers realized later. The voluntariness in turn might be based on individual characteristics such as the economic performance that may result in different population growth effects.

[20]The reforms started in 1968, but there are no incorporations earlier than 1969 in my data set. I provide descriptive statistics on the two subsamples in the appendix.

Table 7 shows the results for earlier and later incorporations.[21] Early incorporations result in weaker population growth effects than later incorporations do. The effect of the early incorporations amounts to 12 to 16 percentage points and lacks statistical significance. The late incorporations show an effect of 58 to 59 percentage points, which is statistically significant at the 5% level. The difference between late and early incorporations of 42 to 46 percentage points is statistically significant at the 1% level.[22] It is conceivable that municipalities that were incorporated earlier, and hence more voluntarily, were weaker. Municipalities that were incorporated later and hence less voluntarily, by contrast, should have done better before. The smaller treatment effect for early incorporated municipalities is thus a product of two aspects: First, early incorporated municipalities were initially poorer; second, I always compare with all municipalities that remained independent, and not with only those municipalities that were in a poor or strong position before the reforms. The effect of the early incorporated municipalities is thus underestimated, and the effect of the later incorporated municipalities overestimated. If I could compare, however, incorporated with initially poor or strong remained-independent municipalities, effects were possibly similar for both groups. Although the different magnitudes of the treatment effects do not necessarily imply different effects for the two groups, they indicate that weak municipalities were incorporated earlier.[23]

4.4 Robustness Tests

I tested the robustness of the results in several ways. I tested whether the results change with using a logit model rather than a probit model. Using a logit model renders the effect of incorporation to lack statistical significance in one out of five cases in Table 5, and in one out of four cases in each of the Tables 6 (different municipality sizes) and 7 (different time periods).

[21] Note that Tables 6 and 7 do not show mirror-image results. On the one hand, the early incorporated municipalities are even smaller than the late incorporated municipalities, and on the other hand, the timing of incorporations of small and large municipalities is very similar (see the descriptive statistics in the appendix).

[22] The effect of 12 to 16 (58 to 59) percentage points results from a growth rate that exceeds the respective state growth rate by 71 (108) percentage points in the incorporated, and 55 to 59 (49 to 50) percentage points in the independent municipalities.

[23] If both weak and strong municipalities had been incorporated to the same extent at all points in time, one would expect similar effects of early and late incorporations, or even a stronger effect for early incorporations, because they benefitted for a longer time from the positive effects of incorporation. That the early incorporations show a weaker effect can thus only be explained by the fact that early incorporated municipalities have always been weaker.

I tested whether the results change when I exclude all variables with z-values below 1 from the probit regression.[24] Replicating Table 5, excluding variables with z-values below 1 renders all coefficients to be statistically significant. Replicating Table 6 (different municipality sizes), excluding variables with z-values below 1 does not change the results. Replicating Table 7 (different time periods), excluding variables with z-values below 1 renders all coefficients to be statistically significant. The coefficients for late incorporations are, however, about twice as large as for early incorporations.

I use a caliper of 5% to restrict matches to those matches having a sufficiently small difference in propensity scores between the treated and untreated case (see appendix). I tested whether using different calipers changes the results. Replicating Table 5, using a caliper of 1% (2.5%) renders the effect of incorporation to lack statistical significance in four (two) out of five cases. Using a caliper of 10% does not change the results. Replicating Table 6 (different municipality sizes), using a caliper of 1% or 2.5% does not change the results. Using a caliper of 10% renders the effect of incorporation to lack statistical significance in one out of four cases. Replicating Table 7 (different time periods), using a caliper of 1% renders the effect of incorporation to lack statistical significance in two out of four cases. Using a caliper of 2.5% or 10% does not change the results.

I tested whether using different thresholds in separating small and large municipalities changes the results. Replicating Table 6, using a threshold of 1000 or 1250 inhabitants does not change the results. Using a threshold of 1750 (2000) inhabitants renders the effect of incorporation to lack statistical significance in one (four) out of four cases. The declining effect with larger thresholds confirms that small municipalities show larger effects of incorporation.

I tested whether using different thresholds in separating early and late incorporations changes the results. Replicating Table 7, using the year 1970 or 1971 as threshold does not change the results. Using the year 1973 as threshold renders the effect of incorporation in the early period to be statistically significant in three out of four cases, and in the late period to lack statistical significance in all four cases. Using the year 1974 as threshold renders the effect of incorporation in the early period to be statistically significant in two out of four cases, and in the late period to lack statistical significance in three out of four cases. The changing results when shifting the threshold to 1973 or

[24] On the specification of propensity score models, see Caliendo and Kopeinig (2008).

1974 indicate that incorporations in 1973 show particularly strong population growth effects.

5 Conclusions

I examine how incorporations of cities' surrounding municipalities influence population growth in these incorporated units. The data set includes the large reforms in Germany during the 1960s and 1970s. Using propensity score matching, I compare municipalities in the surrounding area of cities that remained independent with municipalities that merged with the core city. The population of small incorporated municipalities grew faster than the population of small municipalities that remained independent, corroborating evidence from Sweden (Hanes and Wikström, 2008).

Since experts investigating voting behavior find that the population opposes mergers *e.g.* because of political and fiscal reasons (see above), citizens already residing in that place may be worse off because of the reform. Political and fiscal aspects could have also kept away new residents. The revealed preferences of the new citizens show, however, that they benefit from the incorporation policy. The connection between city and incorporated municipality (infrastructure) may have improved or the provision of public goods may have become more efficient – aspects that also benefit the citizens already residing in that place. In particular for small municipalities such efficiency gains should be a relevant explanation for the increased population growth. Then the incorporation policy was successful and highly-segmented regions should consider to further consolidate municipalities. The interpretation differs when the location of housing programs played a decisive role. Given that a housing program would have been realized in any event, the incorporation would have influenced only the location of the program, without causing further economic effects. Assuming, however, that incorporations increased the number of housing programs gives rise to ambiguous implications. The view on the reforms is pessimistic when a common pool problem increased population growth.

Future research may well examine how incorporations influence economic indicators, such as real estate prices. In particular, location decisions of businesses may be influenced by whether a location was incorporated or not. Experts may also investigate how consolidations influence election outcomes (due to a different composition of voters) and political commitment.

Appendix

Matching methods

One-to-one matching: I match every treated municipality with the untreated neighbor (in the probability space) that has the closest propensity score. Several treated municipalities can be matched with the same untreated municipality (with replacement). To avoid imprecise matches, I introduce a caliper. The caliper restricts matches to those matches having a sufficiently small difference in propensity scores between treated and untreated case.

K-nearest-neighbors matching: I match each treated case with an unweighted average of k nearest neighbors. I run k-nearest-neighbors matching with 10 neighbors. As I use a caliper also here, I conduct matching with less than 10 neighbors when there is not a sufficient number of neighbors available within the caliper. A higher number of neighbors to compare with provides the advantage of exploiting more information and being less subject to outliers (smaller variance). Comparing with a higher number of neighbors is done, however, at the expense of a less precise matching (larger bias). The one-to-one matching is a special case of k-nearest-neighbors matching; that is, one-to-one matching uses only one neighbor.

Radius matching: I match the treated observation to an unweighted average of those untreated observations with a propensity score within a certain radius, *e.g.*, all untreated cases that have a propensity score up to 5 percentage points higher or lower than the treated case. Radius matching captures all neighbors within a certain radius, no matter how many there are. K-nearest-neighbors matching with a caliper, by contrast, captures a certain number of neighbors, no matter how many there are available within the caliper. Only if k is greater than the number of observations within the caliper, and hence all neighbors within the caliper are captured, radius and k-nearest-neighbors matching can produce identical matches (given $radius = caliper$).

Kernel matching: Resembles radius matching, but compares the treated case with a *weighted* average of untreated cases given a certain bandwidth. The weights depend on the difference in propensity scores. The farther away the matching partner in terms of propensity scores, the smaller the weight the matching is given. The kernel matching approach thus puts more weight on near neighbors than on neighbors farther away in the probability space. Kernel matching with a uniform kernel function is the same as radius matching. I use, however, the common Epanechnikov kernel with decreasing weights.

I use calipers – or a bandwidth in the case of kernel matching – of 5% in all matching approaches. The propensity scores of the treated and the matched untreated case(s) are thus not allowed to differ by more than 5 percentage points. Using calipers is done at the expense of a smaller number of observations exploited (larger variance), but does ensure against comparing treated and untreated municipalities that are too different from one another in terms of propensity score (smaller bias), which increases the quality of the matching approach. Without calipers one would have to use a different method of ensuring that the matching procedure uses only those observations in the control group that are similar to the treated observations. As robustness tests, I also use calipers of 1%, 2.5%, and 10%.

Table A1: Descriptive Statistics (Different Sizes)

Variable	Obs.	Mean	Standard Dev.	Min	Max
Population <= 1500					
Population Growth Rate (in %)	356	78.48	92.52	-36.31	636.50
Pop. Growth Rate, State-Corr. (in %)	356	55.53	89.77	-55.98	604.92
Absolute Population Growth	356	657.65	874.70	-467	5193
Treatment	356	0.19	0.40	0	1
Year of Incorporation	69	1972.30	2.10	1969	1978
Distance to Core City	356	8.68	2.49	2.68	12.48
Population 1961 Surr. Munic.	356	787.17	378.24	91	1496
Population 1961 Core City	356	96027.47	92032.25	28725	1085014
Area 1961 Surr. Munic.	356	7.54	4.97	0.97	34.03
Area 1961 Core City	356	54.31	37.46	9.65	309.84
Debt 1966 Surr. Munic. (per capita)	356	200.77	68.07	108.88	440.73
Debt 1966 Core City (per capita)	356	500.41	213.10	114.77	1271.07
Political Diff. Surr. Munic. (in pp)	356	6.25	17.27	-51.80	46.00
Political Diff. Core City (in pp)	356	-10.11	10.02	-65.00	20.70
State Capital	356	0.10	0.30	0	1
Population > 1500					
Population Growth Rate (in %)	215	68.55	86.54	-25.06	999.63
Pop. Growth Rate, State-Corr. (in %)	215	42.87	86.17	-42.95	968.05
Absolute Population Growth	215	2816.41	4380.52	-1236	43100
Treatment	215	0.26	0.44	0	1
Year of Incorporation	55	1971.96	2.27	1969	1977
Distance to Core City	215	7.99	2.69	1.76	12.37
Population 1961 Surr. Munic.	215	4682.56	5512.02	1509	50906
Population 1961 Core City	215	157251.70	231886.30	28725	1832346
Area 1961 Surr. Munic.	215	15.43	12.73	2.33	118.58
Area 1961 Core City	215	74.74	73.39	12.56	747.23
Debt 1966 Surr. Munic. (per capita)	215	190.98	59.23	101.24	440.73
Debt 1966 Core City (per capita)	215	547.61	227.85	114.77	1271.07
Political Diff. Surr. Munic. (in pp)	215	4.12	17.80	-39.20	49.10
Political Diff. Core City (in pp)	215	-9.87	11.29	-32.30	18.30
State Capital	215	0.10	0.30	0	1

The number of core cities in these data sets amounts to 50 and 54. Distance in kilometers, area in square kilometers, debt in Euro.

Table A2: Descriptive Statistics (Different Time Periods)

Variable	Obs.	Mean	Standard Dev.	Min	Max
Incorporation <= 1972					
Population Growth Rate (in %)	521	69.89	87.39	-33.89	999.63
Pop. Growth Rate, State-Corr. (in %)	521	46.01	85.55	-51.78	968.05
Absolute Population Growth	521	1336.97	2450.47	-1236	26764
Treatment	521	0.14	0.35	0	1
Year of Incorporation	74	1970.73	1.38	1969	1972
Distance to Core City	521	8.59	2.59	1.76	12.48
Population 1961 Surr. Munic.	521	2164.01	3374.43	91	33290
Population 1961 Core City	521	111031.40	161739.50	28725	1832346
Area 1961 Surr. Munic.	521	10.55	9.32	0.97	118.58
Area 1961 Core City	521	59.58	54.47	9.65	747.23
Debt 1966 Surr. Munic. (per capita)	521	198.32	63.76	116.55	440.73
Debt 1966 Core City (per capita)	521	520.03	218.85	114.77	1271.07
Political Diff. Surr. Munic. (in pp)	521	6.02	17.14	-51.80	49.10
Political Diff. Core City (in pp)	521	-9.74	10.42	-65.00	20.70
State Capital	521	0.11	0.31	0	1
Incorporation > 1972					
Population Growth Rate (in %)	497	71.27	89.79	-36.31	999.63
Pop. Growth Rate, State-Corr. (in %)	497	47.26	87.73	-55.98	968.05
Absolute Population Growth	497	1464.62	3070.25	-1236	43100
Treatment	497	0.10	0.30	0	1
Year of Incorporation	50	1974.26	1.19	1973	1978
Distance to Core City	497	8.84	2.36	2.49	12.48
Population 1961 Surr. Munic.	497	2328.58	4112.21	91	50906
Population 1961 Core City	497	123743.50	171829.30	28725	1832346
Area 1961 Surr. Munic.	497	10.85	9.99	0.97	118.58
Area 1961 Core City	497	64.07	57.41	9.65	747.23
Debt 1966 Surr. Munic. (per capita)	497	198.28	66.94	101.24	440.73
Debt 1966 Core City (per capita)	497	519.98	212.27	114.77	1271.07
Political Diff. Surr. Munic. (in pp)	497	5.58	17.41	-51.80	49.10
Political Diff. Core City (in pp)	497	-9.98	10.80	-65.00	20.70
State Capital	497	0.10	0.30	0	1

Table shows also municipalities that remained independent. The number of core cities in these data sets amounts to 62 and 66. Distance in kilometers, area in square kilometers, debt in Euro.

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