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The toll of voting in a pandemic: Municipal elections and the spread of COVID-19 in Bavaria*

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Abstract

Elections may take place in precarious environments that even pose health risks. I consider the case of Bavaria, where close to ten million people were asked to vote in the municipal elections on March 15 of 2020, to quantify the toll of elections in a pandemic. Despite declaring a state of emergency on the very next day, two weeks later, Bavaria had left behind any other German state in terms of COVID-19 infections and deaths per capita. Using district-level health, demographic, and economic data, I find that at least 3,700 or 15% of the cumulative increase in positive test results between March 15 and April 4 are explained by a dummy variable for Bavaria. Across Bavarian districts, a 1% increase in voter participation is associated with an additional 13.6 positive tests and 1.2 deaths per 100,000 inhabitants over the following three weeks.

Keywords: COVID-19, municipal elections, pandemic, synthetic control method

JEL classification: H11, H12, I12, I18

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1 Introduction

Elections are the backbone of democracy. When they take place in precarious environments, however, voting may come along with nontrivial health risks. While such risks are commonly attributed to developing countries, the COVID-19 pandemic spread them across the globe. As a consequence, many countries deferred national and subnational elections or switched to postal ballots.[1] In contrast, the German state of Bavaria held municipal elections with only a few precautionary measures in place on March 15, 2020, calling close to ten million voters to the polls while declaring a state-wide emergency on the very next day. Two weeks later, Bavaria had left behind any other German state in terms of COVID-19 infections and deaths both in absolute figures and per capita.

Given that a state-wide lockdown took effect on March 21, the Bavarian municipal elections provide an almost perfect setting for quantifying the toll of voting in a pandemic. Using a synthetic control state matched on demographic, economic, and weather characteristics, I show that Bavaria observed an unexpectedly large increase in COVID-19 infections and deaths relative to other German states after March 15. Due to the multifaceted heterogeneity of Germany's 401 districts even within state, I continue by running regressions at the district level, subsequently controlling for demographic, economic, health and child care variables. In the most conservative specification, where only Bavaria's neighboring states are considered as the control group, a dummy for Bavarian districts still explains about 3,700 infections or about 15% of the cumulative increase in positive test results between March 15 and April 4. This finding is qualitatively and quantitatively robust to adding a strong-beer-festival dummy for Bavarian municipalities, where at least one such event took place in early March. Finally, I focus on explaining the variation in cumulated COVID-19 infections and deaths across Bavaria's 96 districts, all of which were treated by the municipal elections. Using the official voter participation as a measure of the treatment's intensity and controlling for other characteristics, I find that a 1% increase in voter participation is associated with an additional 13.6 positive test results and 1.2 deaths per 100,000 inhabitants, translating to 1,780 infections and 160 deaths at the state level between March 15 and April 4.

[1] The International Institute for Democratic and Electoral Assistance (IDEA) provides a global overview of the impact of COVID-19 on national and subnational elections.

The motives for sticking to the scheduled date of the municipal elections and in-person voting are unclear but likely diverse, ranging from practical considerations to concerns about disgruntled voters. In the psychological literature, the source model of group threat predicts that groups confronted with external threat respond by tightening in-group ties (Greenaway and Cruwys, 2019). Consistent with this, Skitka (2005) documents that Americans responded to the 9/11 terrorist attacks with heightened feelings of patriotism, while Toya and Skidmore (2014) show that societal trust increases following natural disasters. On the other hand, there is evidence that, in precarious situations, people become more suspicious and susceptible for conspiracy theories (Dussaillant and Guzmán, 2014; van Prooijen and van Dijk, 2014). For the current COVID-19 pandemic, Sibley et al. (2020) find that participants of a representative survey in New Zealand report higher trust in science, politicians, and policy, higher levels of patriotism, and higher rates of mental distress during the pandemic and lockdown compared to matched individuals surveyed prior to the pandemic and lockdown.

Regarding the outcome of elections, the political economy literature argues that crises provide voters with a rare opportunity to evaluate the performance of the incumbent government (Ashworth et al., 2018). According to this view, voters may punish the government for being ill-prepared or taking inadequate measures (Arceneaux and Stein, 2006; Cole et al., 2012) or reward the government for performing well (Bechtel and Hainmueller, 2011; Gasper and Reeves, 2011). Bol et al. (2020) use a representative web-based survey fielded in March and April 2020 in Western Europe to compare the political support for incumbent governments of participants taking the survey right before and after the start of a lockdown, finding that lockdowns enhanced intentions to vote for the party of the Prime Minister or President, trust in government, and satisfaction with democracy. For the Bavarian municipal elections, Frank et al. (2020) show that declaring a state of emergency between the first and second ballot led to a 10 percentage point increase in electoral turnout relative to the first and second ballots in previous elections. Controlling for party affiliations and other factors, incumbents tend to profit from higher turnout due to the state of emergency. Leininger and Schaub (2020) assess the causal effect of COVID-19 infections on electoral outcomes across Bavarian districts and find that the pandemic consistently benefitted the dominant regional party, center-right Christian Social Union (CSU), and its candidates.

Since the start of the pandemic, a host of contributions has investigated the relationship between social factors, political measures, and the spread of COVID-19 infections and deaths (see, e.g., Ahammer et al., 2020; Allcott et al., 2020; Andersen, 2020; Mangrum and Niekamp, 2020). In contrast, there is little empirical evidence on the health risks of holding elections in a pandemic. Cotti et al. (2020) find a statistically significant relationship between in-person voting and the spread of COVID-19 two to three weeks after the Wisconsin primary on April 7, 2020, where a 10% difference in average in-person voters per polling location is associated with a 17.7% increase in the positive test rate across counties, suggesting that the primary was related to about 700 additional infections in Wisconsin. Bach et al. (2020) find no effect of the French town hall elections held on March 15, 2020, on the excess mortality of 170,000 male candidates aged above 60 relative to the general population, regardless of the intensity of the election race and how candidates fared in the 2014 elections.

The effects in the present paper are an order of magnitude larger than in the previous two studies and statistically significant for at least two reasons. The Wisconsin primary election took place during a "Safer at Home" order (Cotti et al., 2020), when extensive precautionary measures were already in place and public awareness of contagiousness was likely high, whereas the Bavarian municipal elections were held on the eve of a state-wide emergency. To investigate the effect of the French town hall elections on candidate mortality, Bach et al. (2020) use the general population as a control group. Given that the incidence of COVID-19 in the general population represents the main risk factor for contagion of socially active candidates, the control group seems ill-suited to answer the question at hand.

The rest of the paper is structured as follows. Section 2 gives information on the Bavarian municipal elections and the timing of events. Sections 3 and 4 describe the data and empirical methodology, respectively. Section 5 presents the estimation results. Section 6 concludes.

2 Background

The first known German case of COVID-19 occurred in Bavarian district Starnberg, where a 33-year-old male employee of automotive supplier Webasto was infected by a mildly symptomatic Chinese colleague, who was tested positively after returning to China. Subsequently, 13 colleagues or their relatives were tested positively. Unrelated to the Webasto outbreak, a German women was infected, while staying at the Dortmunder Hütte, an alpine cottage in Tirol, Austria, during January 24–26. In both cases, the infectious individuals were isolated and the outbreaks seemed to be under control. By March 1, the cumulated number of proven COVID-19 cases in Bavaria had increased to a mere 25, and the potential health risks were widely considered as minor.[2]

Starting in 1946, after the end of the Second World War, Bavaria held municipal elections in intervals of two to four years. In 1960, the election period was extended to six years and has not been modified since. The last seven municipal elections took place in March of an election year, indicating that the polls on March 15 did not deviate from the regular schedule. In contrast to prior polls, however, the municipal elections in 2020 took place "at the dawn of a global pandemic" (Leininger and Schaub, 2020).

In predominantly catholic Bavaria, the period of Lent between Ash Wednesday and Easter is also a high season for the state's famous strong-beer festivals. Several such events took place in early March, mainly in the administrative regions of Oberbayern, Niederbayern, and Oberpfalz, while others were canceled due to increasing COVID-19 concerns. Two large and now infamous festivals took place in the municipalities Tirschenreuth and Rosenheim, with 1,400 and 1,500 visitors, respectively.[3] Another 1,500 visitors attended a festival in Straubing on March 7. It did not go unnoticed by the media that these and their neighboring districts were also most strongly affected by COVID-19 infections and deaths afterwards (Lill, 2020). Given that an earlier outbreak in North Rhine-Westphalian district Heinsberg had been traced back unambiguously to an indoor event with a mere 300 visitors on February 15, the health risks of mass gatherings were already known by the beginning of March.[4]

First signs of rising COVID-19 infections induced the Bavarian government to send an email to district and community offices on March 4, urging poll clerks to "adhere to standard

[2]Bavaria's public broadcasting service (BR) interviewed "patient zero" after quarantine on February 28, who argued that "Although it is a new virus, it is not as bad as the flue."

[3]The festival in Mitterteich (Tirschenreuth) took place on Saturday, March 7. The festival in Rosenheim was discontinued after three days on March 9. Table A.1 in the appendix lists Bavarian municipalities, where at least one strong-beer festival took place in early March, as well as the estimated number of visitors.

[4]Through August 2020, eight of the nine districts with the highest number of COVID-19 infections per 100,000 inhabitants had either hosted a strong-beer festival or are directly adjacent to one that did, the only non-Bavarian district in the top-nine being Heinsberg (Robert Koch Institute: COVID-19-Dashboard).

practices for protection against infectious diseases such as hand hygiene, keeping physical distance as well as cough and sneeze hygiene" (StMI, 2020a, p. 2). A second email on March 11 pointed out the procedures for recruiting poll clerks and the possibility of consolidating polling locations in the event of excess absenteeism on short notice (StMI, 2020b, pp. 2–3). While the first email leaves the provision of disinfectants at the discretion of the local health authorities, facial masks or other protective gear are not mentioned in either email.

On March 11, the World Health Organization (WHO) publicly assessed that "COVID-19 can be characterized as a pandemic" (WHO, 2020). At the same time, an exceptionally close race for mayor's offices in many Bavarian city and town halls spurred voters' interest ahead of the elections.[5] Rather than shying away from the polls on March 15, voter participation in the municipal elections therefore increased for the first time since 1990, from 54.7% in 2014 to 58.8% in 2020.

One might argue that neither the strong-beer festivals nor the municipal elections seemed particularly risky at the time. While the first COVID-19 victim in Bavaria, an 80-year-old resident of a nursing home in Würzburg, Unterfranken, died on March 12 (StMGP, 2020a), deaths in Rosenheim, Straubing, and Tirschenreuth did not start to cluster until after the elections.[6] Following election day, however, public life in Bavaria was restricted immediately. On March 16, the Bavarian government declared a state-wide emergency, which eventually lasted for three months until June 16, prohibiting public gatherings and events and closing all non-essential shops and amenities (Bayerische Staatsregierung, 2020). Two days later, Mitterteich was subjected to the first German curfew under the Infection Prevention Law, anticipating a state-wide lockdown, which came into effect on March 21 and was initially foreseen to last for only two weeks until April 3 (StMGP, 2020b).[7]

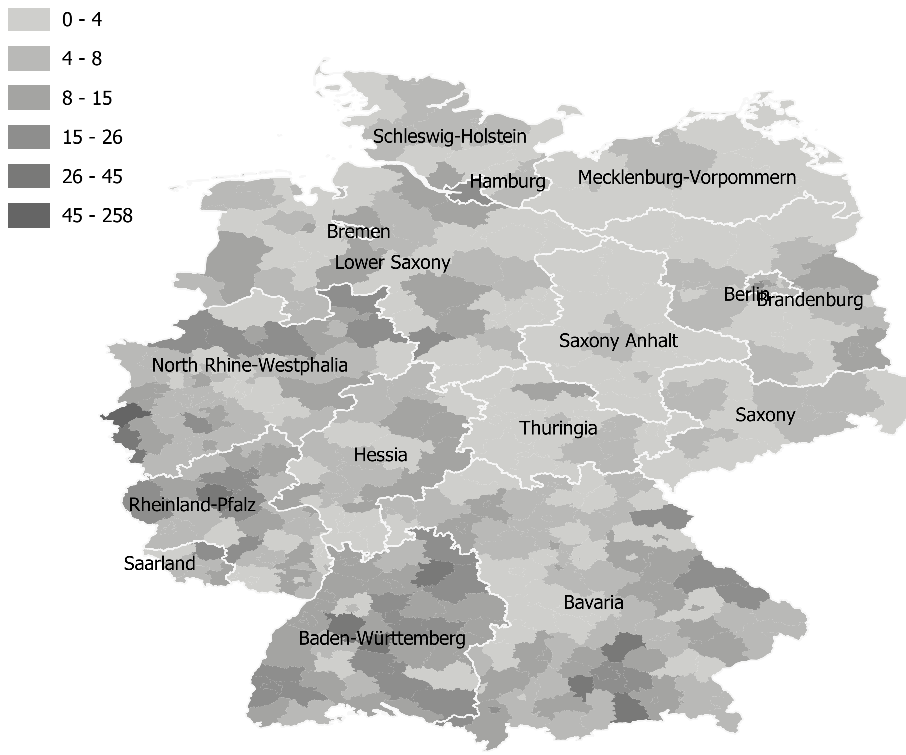
[5] According to a survey published by BR on March 14, 2020, 79% of survey participants displayed "strong or very strong interest" in the elections, an increase of 9 percentage points relative to the elections in 2014 (BR, 2020). Indeed, 16 out of 24 races for city halls, among them the five most populous Bavarian cities, and 46% of the races for town halls were only decided in a run-off ballot on March 29, 2020.

[6] By March 15, the Robert Koch Institute had documented zero COVID-19-related deaths in Rosenheim (urban and rural district) and Straubing, 2 in Tirschenreuth, and a maximum of 7 in Würzburg.

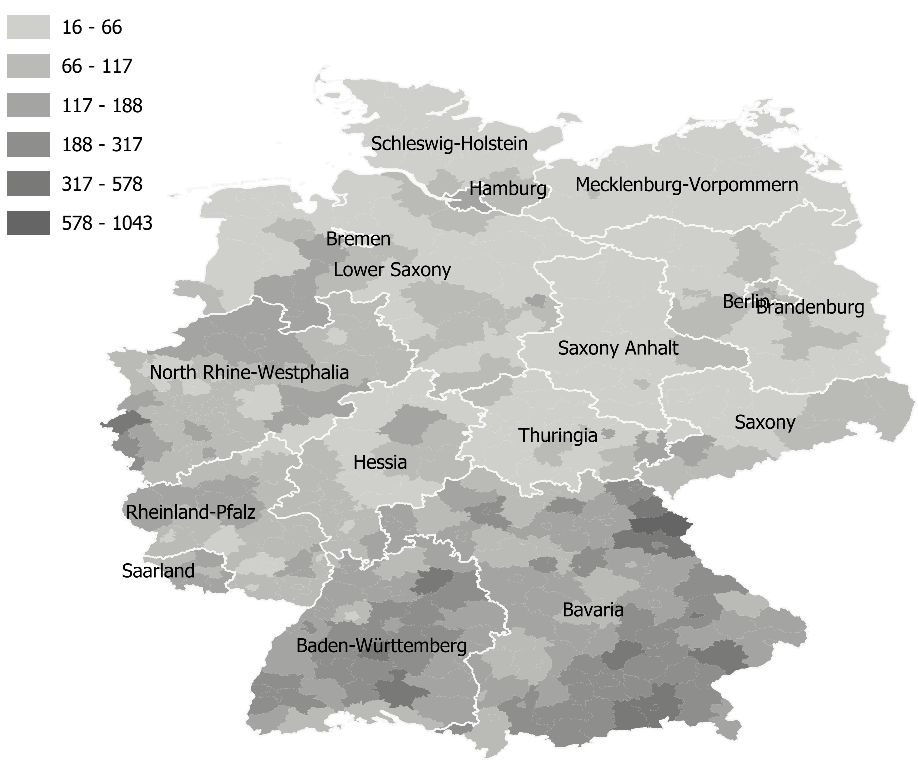
[7] The state-wide lockdown restricted leaving home to absolute necessities such as going to work, shopping groceries, visiting pharmacies, doctors and partners as well as elderly, sick or people in need outside of hospitals and nursing homes. The general decree also granted the right to spend time outside for the sake of physical exercise, albeit only with pets or people of the same household. Violations could be sanctioned according to the Infection Prevention Law up to a maximum fine of €25,000 (Stroh, 2020).

Figure 1: Occurrence of COVID-19 infections by German district

(a) Cumulated infections on March 15, 2020



(b) Cumulated infections on April 4, 2020



3 Data

Since reunification with the former German Democratic Republic (GDR) in 1990, the Federal Republic of Germany comprises 16 states and 401 districts, of which 294 are rural and 107 are urban districts. The Free State of Bavaria comprises 96 districts, of which 71 are rural and 25 are urban districts, including the state capital Munich.

Official data on COVID-19 infections and deaths at the Bundesland (state) and Landkreis (district) level for January 28 through July 2 were retrieved from the COVID-19-Dashboard of the Robert Koch Institute (RKI) on July 3, 2020.[8] For each positive test result reported to the RKI, the data carry information on the state, district, age group, sex, reporting date, and whether the person tested has recovered or deceased in the meantime. Panels (a) and (b) in Figure 1 illustrate the occurrence of COVID-19 infections by German district on March 15, the day of the municipal elections, and on April 4, exactly two weeks after the state-wide lockdown came into effect in Bavaria.

Data on German demographic, economic, and health and child care characteristics at the state and district level were retrieved from the Federal Statistical Office on July 10, 2020. Summary statistics for the full list of control variables by category are reported in Table 1. Data on the number of eligible and actual voters, the official voter participation, and the change in voter participation relative to the municipal elections in 2014 were retrieved from the Bavarian State Office for Statistics on July 10, 2020. Weather data on precipitation and temperature in spring 2020 at the state level were obtained from Statista (2020).[9]

4 Econometric Methodology

Figure 2 plots the cumulated number of COVID-19 infections and deaths by German state per 100.000 inhabitants for January 28 through July 2 and illustrates that, by the beginning of April 2020, Bavaria (BY) had left behind any other German state in terms of infections

[8] The most recent data on COVID-19 infections and deaths in Germany reported to the RKI are available at NPGEO Corona. Due to different sources, these data deviate from those reported by Center for Systems Science and Engineering (CSSE) at Johns Hopkins University.

[9] These data are not available at the district level, and matching recordings from weather stations operated by the German Meteorological Service (DWD) with district data is often impeded by missing observations.

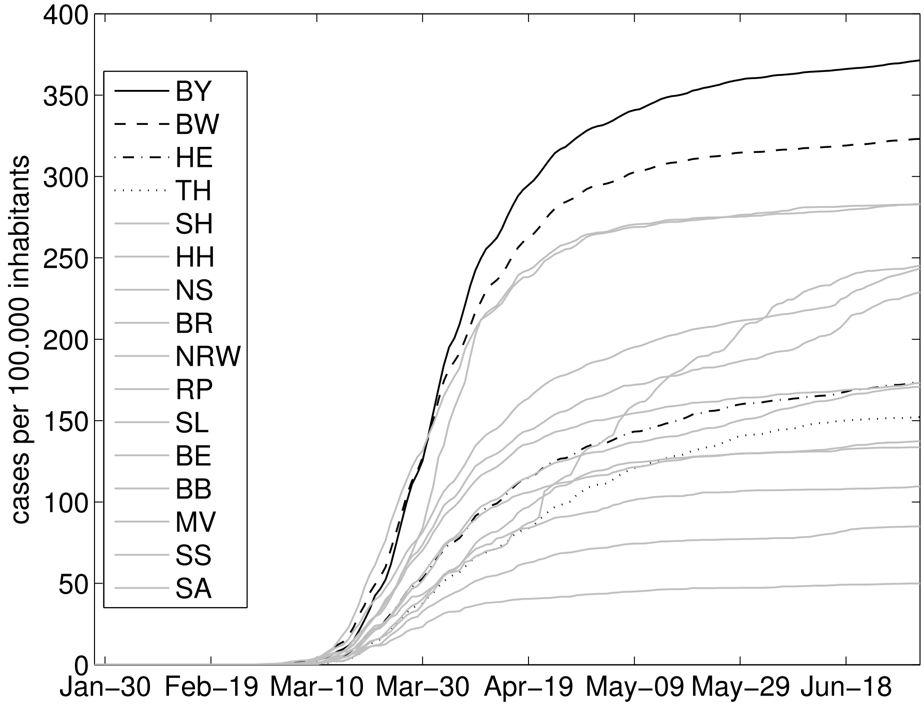
Table 1: Summary statistics for dependent and control variables at the district level

	Variable	Districts in BY	Districts in BW, HE, TH	Districts in all but BY
COVID-19	Infections until March 15†	13.14 (27.76)	20.69 (25.25)	20.35 (50.68)
	Infections until April 4†	265.8 (403.4)	278.7 (260.8)	236.1 (350.9)
	Deaths until March 15†	.1979 (.8159)	.3656 (.9867)	.2459 (1.185)
	Deaths until April 4†	12.65 (16.32)	12.37 (14.93)	9.315 (14.57)
Demographic	Population density per km^2	465.2 (694.3)	503.7 (635.4)	555.4 (705.1)
	Age structure of population			
	% aged 18–24	8.115 (1.103)	7.531 (1.899)	7.309 (1.785)
	% aged 25–44	24.55 (2.570)	24.29 (3.083)	23.46 (2.824)
	% aged 45–64	30.17 (2.131)	30.05 (2.449)	30.62 (2.427)
	% aged ≥65	20.89 (1.958)	21.81 (3.099)	22.47 (2.850)
	Population determinants†			
	Live births	93.60 (9.249)	92.70 (11.53)	90.31 (11.16)
	Deaths	109.8 (15.60)	113.3 (20.62)	120.8 (18.77)
	Net migration	761.9 (435.5)	497.4 (407.4)	433.3 (396.9)
	Female share of population	50.37 (0.719)	50.43 (0.622)	50.65 (0.590)
	Foreign share of population	10.65 (4.614)	12.03 (6.393)	9.840 (5.299)
Economic	Unemployment rates			
	% unemployed	2.864 (0.998)	4.036 (1.422)	5.268 (2.027)
	% unemployed aged 55–64	26.39 (4.119)	23.71 (4.578)	23.15 (4.480)
	Employment rate	64.29 (2.914)	63.20 (4.291)	61.45 (4.263)
	Disposable income♮	24.26 (2.486)	22.92 (2.846)	21.95 (2.402)
Health and child care	Hospital bed density†	663.9 (555.4)	621.9 (347.3)	622.9 (323.6)
	Child care participation rates			
	% aged 0–2 years	27.46 (7.216)	35.92 (12.22)	36.61 (12.34)
	% aged 3–5 years	92.96 (3.057)	94.20 (2.644)	93.57 (3.623)
	Geriatric demand and supply‡			
	Elderly in need of care	160.37 (32.69)	199.0 (31.04)	202.9 (31.07)
	Nursing home places	55.60 (12.83)	52.61 (9.218)	55.48 (10.23)

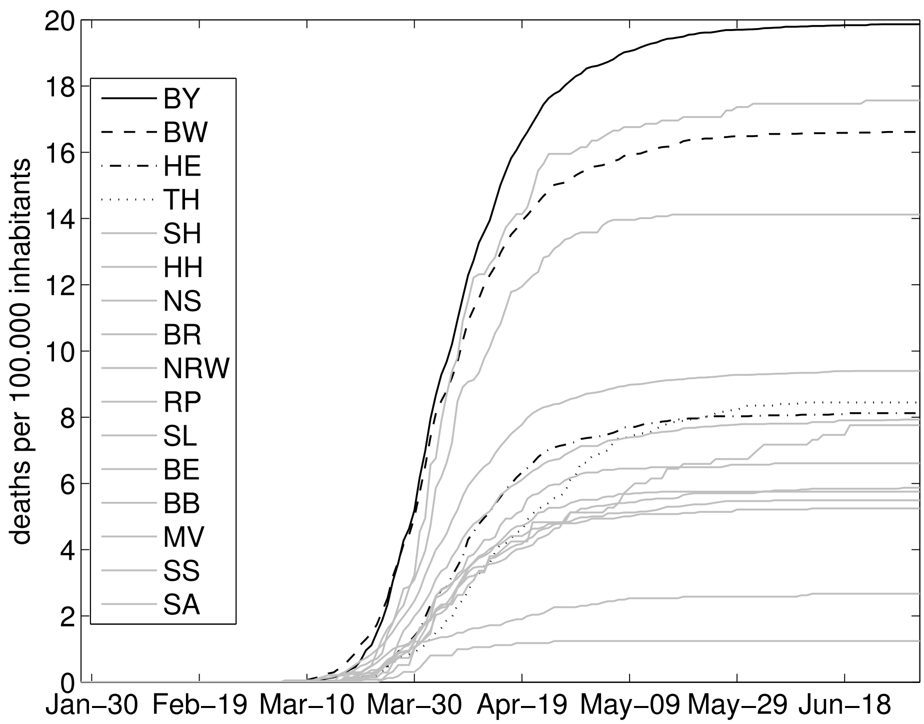
Note: Unweighted sample means with standard deviation in parentheses.
† per 100,000 inhabitants
♮ EUR 10,000 per person
‡ per 1,000 inhabitants aged ≥ 65

Figure 2: Cumulated COVID-19 infections and deaths by German state

(a) Cumulated infections



(b) Cumulated deaths



and deaths. In what follows, I investigate whether this can be explained by differences in the state's demographic, economic, health and child care disposition, or whether the seemingly disproportionate spread of COVID-19 in Bavaria is associated with the municipal elections on March 15, 2020. The econometric analysis proceeds in three steps.

4.1 Synthetic Control Method

As a first step, I consider state-level data on COVID-19 infections and deaths and employ the synthetic control method for causal inference in comparative case studies with aggregate data as developed in Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010). In particular, I construct a synthetic control state from Germany's other 15 states that matches best a selection of time-invariant Bavarian demographic and economic characteristics as well as the evolution of cumulated COVID-19 infections and deaths, respectively, in the 30 days prior to the election according to the loss function proposed by Abadie, Diamond and Hainmueller (2010).[10] I also condition on average precipitation and temperature in spring 2020 in order to account for possible weather effects on the spread of COVID-19.

4.2 Across-State Regression Analysis

In the main analysis, I consider district-level data on COVID-19 infections and deaths across Germany. I am mainly interested in whether the Bavarian municipal elections on March 15 had an effect on the subsequent spread of COVID-19. Given that few restrictions on public life were in place prior to and a state-wide lockdown was effected less than a week after the elections, the case of Bavaria provides a natural experiment for addressing this question.

Accordingly, the dependent variable is the cumulated increase in COVID-19 infections and deaths, respectively, between Sunday, March 15 and Saturday, April 4, two weeks after a state-wide lockdown came into effect on March 21. Since the entire Free State but no other German state held municipal elections in March 2020, their potential effect is captured by the coefficient on a dummy variable that equals unity for Bavarian districts and zero otherwise. To address the fact that different German districts were in different phases of the pandemic

[10]MATLAB code to implement the synthetic control method is available on Jens Hainmueller's webpage.

when the lockdown occurred, I control for the total number of COVID-19 infections per 100,000 inhabitants on March 15 in all specifications, sequentially adding control variables to account for differences in demographic, economic, health and child care characteristics across districts. This setup translates into the following regression model for the cumulated increase in infections per 100,000 inhabitants for district i:

$$\Delta Cases_{i,\text{April 4–March 15}} = \alpha + \beta \cdot Bavaria_i + \gamma \cdot Cases_{i,\text{March 15}} + \mathbf{X}_i \cdot \delta + \eta \cdot Beer_i + \varepsilon_i, \qquad (1)$$

where α denotes a common intercept, β the coefficient of interest, γ the coefficient on known infections in district i on March 15, and δ a vector of coefficients pertaining to the district-level control variables in the matrix $\mathbf{X}_i$. In some specifications, I further control for strong-beer festivals in several Bavarian districts in early March by adding the count variable $Beer$.[11]

Equation 1 is estimated by ordinary least squares. In the baseline regressions, I consider all 305 non-Bavarian districts as the control group, which was not treated by the Bavarian municipal elections on March 15. In a narrow version of the interstate regression analysis, I focus on the 84 districts of Bavaria's neighboring states Baden-Württemberg, Hessia, and Thuringia, which also obtain non-zero weights in the synthetic control state.

4.3 Within-State Regression Analysis

Although time-invariant controls help isolate the unpredictable component in COVID-19 infections and deaths after the municipal elections, the dummy variable in Equation (1) might absorb *any* observable or unobservable differences between Bavarian and other German districts. To identify the effects of the municipal elections, I focus on Bavaria's 96 districts and replace the state dummy by voter participation as a measure of treatment intensity.[12]

As before, I control for the total number of COVID-19 infections per 100,000 inhabitants on March 15 as well as district-level demographic, economic, health and child care variables. The final specification contains a count dummy for strong-beer festivals held in early March.

[11] Table 1 and A.1 reports summary statistics for the control variables used in the regression analysis and the Bavarian municipalities hosting strong-beer festivals in March 2020, respectively.

[12] Given that both the state dummy and voter participation in the municipal elections are zero for all non-Bavarian districts, the two variables display a correlation of 0.987 across all 401 districts. Including them in a regression together therefore blurs the interpretation and statistical significance of either coefficient.

This yields the following regression model for the cumulated increase in infections between March 15 and April 4 per 100,000 inhabitants for Bavarian district j:

$$\Delta Cases_{j,\text{April 4–March 15}} = \alpha + \beta \cdot Voter_j + \gamma \cdot Cases_{j,\text{March 15}} + \mathbf{X}_j \cdot \delta + \eta \cdot Beer_j + \varepsilon_j, \qquad (2)$$

where β denotes the coefficient on voter participation in the Bavarian municipal elections, while the interpretation of all other coefficients and variables is as in Equation (1).

5 Empirical Results

This section presents the main estimation results based on the three econometric approaches discussed above.

5.1 A Synthetic Control State

As a starting point, I investigate whether the evolution of Bavarian COVID-19 infections and deaths in Figure 2 can be explained by state-level demographic, economic, and weather characteristics, or the evolution of infections and deaths prior to the municipal elections.[13] For this purpose, I construct a synthetic control state of Bavaria as a weighted average of Germany's remaining states using the method in Abadie, Diamond and Hainmueller (2010).

Note that only a subset of German states is marked individually in Figure 2. The reason is that the synthetic control method assigns non-zero weights only to Bavaria's neighboring states Baden-Württemberg (BW), Hessia (HE), and Thuringia (TH).[14] The corresponding weights are 58.1%, 38.8%, and 3.1% for COVID-19 infections and 47.2%, 40.9%, and 11.9% for COVID-19-related deaths. Accordingly, these three states are considered as the control group in a narrow version of the across-state regression analysis below.

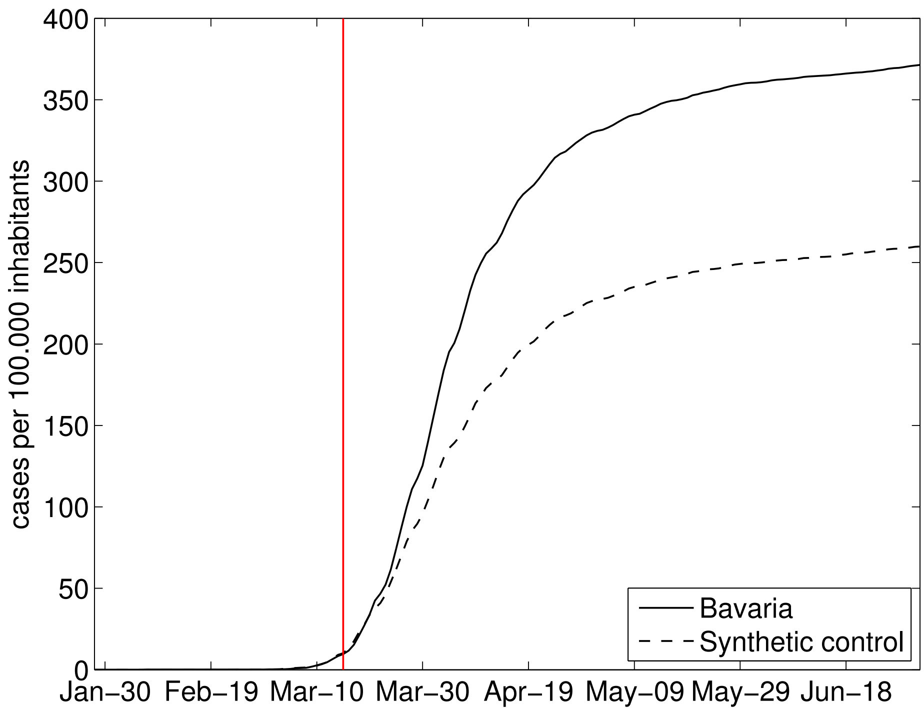
Figure 3 plots the hypothetical evolution of COVID-19-related infections and deaths for the synthetic control state against the actual evolution for Bavaria. The vertical line indicates

[13] In order to ensure convergence of the numerical algorithm for both COVID-19 infections and deaths, I control for a subset of the economic characteristics in Table 1, i.e. unemployment and employment rates, in addition to the demographic and weather characteristics.

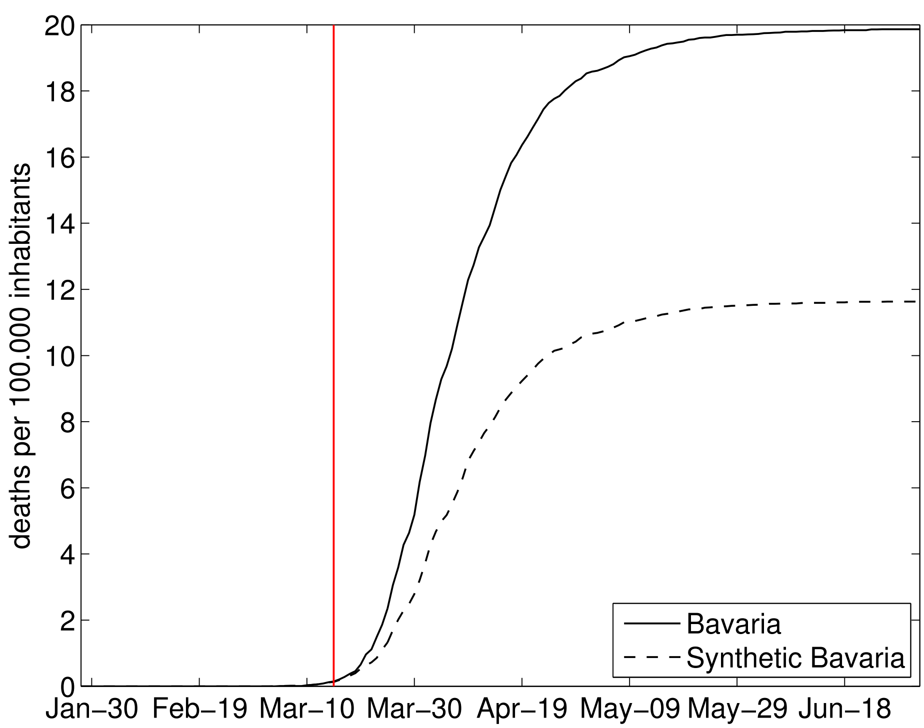
[14] Bavaria's rural district Hof also shares a segment of its across-state border with Saxony's Vogtlandkreis. Nevertheless, the synthetic control method assigns zero weight to the Free State of Saxony.

Figure 3: Cumulated COVID-19 infections and deaths for Bavaria and a synthetic control state

(a) Cumulated infections



(b) Cumulated deaths



the date of the municipal elections. By the end of June 2020, the hypothetical falls short of the actual number of infections and deaths per 100,000 inhabitants by about 111.5 (30%) and 8.2 (41%), respectively. Accordingly, there is clear evidence of a differential evolution of infections and deaths after March 15. At the same time, the difference seems to stabilize in early April, about two weeks after the state-wide lockdown took effect on March 21.

5.2 Across-state Estimation Results

Given that Germany's 401 rural and urban districts differ among many dimensions even within state, the previous state-level analysis is unlikely to do justice to this heterogeneity. This is especially true for Bavaria, which comprises relatively younger and wealthier regions in Oberbayern, including the state capital Munich, as well as relatively older and more remote regions in Oberfranken and the Oberpfalz. In this section, I therefore isolate the effect of a dummy variable for Bavarian districts on the cumulated increase in COVID-19 infections and deaths between March 15 and April 4, subsequently controlling for demographic, economic, health and child care variables. Table 2 and 3 reports the estimation results for ten different specifications of the regression in Equation 1 for infections and deaths, respectively.

Specifications (1) through (5) consider all 305 non-Bavarian districts as the control group, against which I compare the cumulated increase in infections and deaths in Bavaria. Note that the coefficient of main interest is on the *Bavaria* dummy in the second line. Although the point estimate in Table 2 decreases from 94.2 to 53.5 infections per 100,000 inhabitants, when including all demographic, economic, and health and child care controls from Table 1, the coefficient estimate remains highly statistically significant across all specifications. This finding is robust to adding a count dummy for strong-beer festivals held in several Bavarian municipalities in early March (see Table A.1). The same holds for Table 3, where the point estimate decreases from 6.3 to 4.4 deaths per 100,000 inhabitants while adding controls, yet remains statistically significant.

The most comprehensive setup in (5), which includes all controls and the *Beer* dummy, implies an unexplained cumulated increase in Bavarian districts by 40.8 infections and 3.3 deaths per 100,000 inhabitants, translating to 5,350 additional infections and 432 additional deaths at the state level or about 21.6% and 36.1% of the cumulated increase in infections and

Table 2: Regression of cumulative increase in COVID-19 infections on explanatory variables

Dependent variable: $\Delta Cases_{\text{April 4–March 15}}$

	All German Districts					Districts in BY, BW, HE, TH					Districts in BY	
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	70.89***	−179.0	−286.1	−597.6	−273.2	68.05***	242.8	312.8	380.4	1272	−1,065	671.9
	(6.209)	(533.0)	(588.5)	(544.0)	(510.6)	(12.51)	(1,399)	(1,650)	(1,528)	(1,292)	(2,311)	(1,963)
Bavaria	94.21***	83.46***	59.33***	53.51***	40.83***	61.55***	71.57***	55.63***	33.22*	28.26*		
	(12.63)	(15.57)	(14.28)	(16.61)	(12.64)	(13.93)	(17.70)	(20.59)	(19.87)	(16.89)		
Voter											15.53***	13.60***
											(2.042)	(3.577)
$Cases_{\text{March 15}}$	2.021**	1.746**	1.689***	1.663***	1.676***	6.315***	6.772***	6.256***	5.728***	5.558***	3.564*	3.699**
	(.8887)	(.7564)	(.6690)	(.6459)	(.6341)	(1.274)	(1.669)	(1.739)	(1.463)	(1.227)	(1.872)	(1.589)
Beer					135.5***					130.4***		117.0***
					(43.12)					(32.71)		(24.99)
Demographic	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Economic	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y
H&C Care	N	N	N	Y	Y	N	N	N	Y	Y	Y	Y
Observations	401	401	401	401	401	178	178	178	178	178	96	96
R^2	0.307	0.362	0.392	0.414	0.540	0.282	0.330	0.354	0.401	0.568	0.406	0.585

Notes: Coefficient estimates with robust standard errors in parentheses. ***/**/* indicates statistical significance at the 1/5/10% level. *Bavaria* = 1 for Bavarian districts and zero otherwise. $Cases_x$ denotes the cumulative number of COVID-19 infections up to date x. *Beer* measures the number of confirmed strong-beer festivals held in a given district in March 2020 (see Table A.1). *Voter* denotes the official voter participation in the Bavarian municipal elections on March 15, 2020. *Demographic*, *Economic*, and *H&C Care* denote demographic, economic, health and child care controls at the district level. The complete set of control variables is listed in Table 1.

Table 3: Regression of cumulative increase in COVID-19 deaths on explanatory variables

Dependent variable: $\Delta Deaths_{\text{April 4–March 15}}$

	All German Districts					Districts in BY, BW, HE, TH					Districts in BY	
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	2.726***	−9.813	24.32	−2.834	24.71	2.728*	42.07	161.2	208.3	281.2*	38.32	184.6
	(.3893)	(55.73)	(62.32)	(59.00)	(57.18)	(1.465)	(152.4)	(177.8)	(172.4)	(165.2)	(266.4)	(255.7)
Bavaria	6.328***	5.836***	4.721***	4.372***	3.295**	4.238***	4.188**	4.110*	.9995	.5937		
	(1.372)	(1.711)	(1.525)	(1.694)	(1.349)	(1.541)	(2.073)	(2.321)	(2.193)	(1.990)		
Voter											1.385***	1.223***
											(.5028)	(.4472)
$Cases_{\text{March 15}}$	.1251***	.1188***	.1163***	.1111***	0.1122***	.3776**	.4681**	.4729**	.4098**	.3959**	.2467	.2581
	(.0476)	(.0480)	(.0454)	(.0431)	(.0417)	(.1521)	(.2019)	(.2106)	(.1773)	(.1567)	(.2366)	(.2150)
Beer					11.51**					10.66***		9.846***
					(4.635)					(3.502)		(2.607)
Demographic	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Economic	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y
H&C Care	N	N	N	Y	Y	N	N	N	Y	Y	Y	Y
Observations	401	401	401	401	401	178	178	178	178	178	96	96
R^2	0.158	0.177	0.188	0.210	0.320	0.112	0.182	0.201	0.276	0.391	0.337	0.445

Notes: Coefficient estimates with robust standard errors in parentheses. ***/**/* indicates statistical significance at the 1/5/10% level. *Bavaria* = 1 for Bavarian districts and zero otherwise. $Cases_x$ denotes the cumulative number of COVID-19 infections up to date x. *Beer* measures the number of confirmed strong-beer festivals held in a given district in March 2020 (see Table A.1). *Voter* denotes the official voter participation in the Bavarian municipal elections on March 15, 2020. *Demographic*, *Economic*, and *H&C Care* denote demographic, economic, health and child care controls at the district level. The complete set of control variables is listed in Table 1.

deaths, respectively, between March 15 and April 4. Note also that the coefficient estimate on the *Beer* dummy is about three times larger and highly statistically significant.

However, districts in Bavaria likely differ from districts in the rest of Germany in terms of other observable or unobservable characteristics. Accordingly, I replicate the regression in Equation (1), considering only districts in Bavaria's neigboring states Baden-Württemberg, Hessia, and Thuringia as the control group, which are arguably more similar and were also assigned non-zero weights by the synthetic control method. Specifications (6) through (10) in Tables 2 and 3 report the estimation results for this narrow control group.

Relative to the broad control group, the coefficient estimates on the *Bavaria* dummy are somewhat lower, albeit statistically significant for the first three specifications. Adding district-level health and child care controls in specification (9), however, the point estimate for infections in Table 2 decreases by about 40% and statistical significance falls to the 10% level. While including the *Beer* dummy reduces the point estimate of the *Bavaria* dummy further, it barely affects its statistical significance. The corresponding point estimate for deaths in Table 3 is close to zero and no longer statistically significant. This seems to be mostly due to the inclusion of geriatric care variables, suggesting that the predisposition of Bavarian districts, with fewer elderly in need of care but more nursing home places per 1,000 inhabitants aged 65 and above relative to the narrow control group, may explain the cumulated increase in COVID-19-related fatalities.[15]

The most conservative specification in (10) implies an unexplained cumulated increase by 28.3 infections per 100,000 inhabitants in Table 2, translating to about 3,700 additional cases at the state level or 15.3% of the cumulated increase in infections between March 15 and April 4. At the same time, there is no clear evidence of unexplained COVID-19-related deaths in Bavaria relative to the narrow control group in Table 3. Given that the *Bavaria* dummy absorbs any observable or unobservable differences between districts in Bavaria and the rest of Germany not accounted for by the controls, however, it represents a noisy proxy for the municipal elections, at best.

[15] An alternative explanation is that Bavaria tested more mildly or asymptomatic persons than the narrow control group, thus detecting a larger share of non-lethal COVID-19 infections per 100,000 inhabitants. Given that data on the total number of tests and the fraction of positive test results by German state are available from the SARS-CoV2-Surveillance report only since April 24, this hypothesis cannot be tested.

5.3 Within-State Estimation Results

In this section, I therefore present the results for the within-state regression in Equation (2), which focuses on Bavaria's 96 rural and urban districts and uses official voter participation in the municipal elections as a measure of their treatment intensity across districts. One might argue that voters in districts with relatively high infection numbers *before* the elections shied away from the polls due to health concerns. If this was the case, the effect on the cumulated increase in COVID-19 infections and deaths *after* the elections would be attenuated. Yet, the number of known infections and deaths for Bavarian districts on March 15 was low, especially for those districts facing the steepest increase afterwards (see Footnote 6). Consistently, Figure A.1 in the appendix reveals no statistically significant relationship between cumulated COVID-19 infections and deaths in the first half of March 2020 and voter participation in the municipal elections across all Bavarian districts as well as for rural and urban districts separately.

If health concerns induced voters in the high-risk group to disproportionately use postal ballots, this is an endogenous response to the pandemic and thus part of the overall effect. Under relatively general assumptions, this kind of behavioral adaption leads to attenuation bias in the coefficient estimate on voter participation. If and only if eligible voters in districts affected more severely by COVID-19 *after* the elections were more likely to use postal ballots and cast their vote at the same time, the coefficient estimate could be upward-biased.[16]

Specifications (11) and (12) in Tables 2 and 3 report the coefficient estimates for the regression in Equation (2) for COVID-19 infections and deaths, respectively, where I include the full set of district-level controls from Table 1. Regardless of whether I also include the count dummy for strong-beer festivals in early March, voter participation is associated with a statistically significant increase in infections and deaths. Specification (12), for example, which includes all district-level controls and the *Beer* dummy, implies that a 1% increase in official voter participation is associated with an additional 13.6 positive test results and 1.2 deaths per 100,000 inhabitants, translating to 1,780 infections and 160 deaths at the state level between March 15 and April 4. In light of an increase in voter participation by 4.1%

[16] Data on the number of postal ballots are not available at the district level. The number of ballot papers issued as a proxy for postal ballots and the final election results will be available only in September 2020.

relative to the municipal elections in 2014, voters' greater interest in the elections may thus account for 7,300 COVID-19 infections and 657 deaths in Bavaria during the same period.[17]

6 Conclusion

This paper quantifies the toll of voting in a pandemic by considering the case of the Bavarian municipal elections on March 15, 2020. In contrast to the subsequent run-off ballots, which were held on March 29 using only postal ballots, close to ten million citizens were called to the polls in the main elections, while public life was severely restricted on the very next day. Accordingly, this provides an almost perfect setting for identifying the causal effect of the municipal elections on the spread of COVID-19 in Bavaria.

Using a synthetic control state matched on demographic, economic, and weather characteristics, I show that Bavaria observed an unexpectedly large increase in COVID-19 infections and deaths relative to other German states after March 15. Controlling for demographic, economic, health and child care variables at the district level and considering only municipalities in Bavaria's neighboring states as the control group, a dummy variable for Bavaria still explains about 3,700 infections or 15% of the cumulative increase in positive test results between March 15 and April 4. This finding is qualitatively and quantitatively robust to adding a strong-beer-festival dummy for Bavarian districts, where at least one such event took place in early March. Given that the Bavarian government was a front-runner in taking measures in order to contain the pandemic, the results are unlikely to be driven by differences in social-distancing measures across German states.

When focusing on explaining the variation in cumulated COVID-19 infections and deaths across Bavarian districts, all of which were treated by the municipal elections, and using official voter participation as a measure of the treatment intensity, I find that a 1% increase in voter participation is associated with an additional 13.6 positive test results and 1.2 deaths per 100,000 inhabitants, translating to 1,780 infections and 160 deaths at the state level in the three weeks following the elections.

[17] These conclusions are quantitatively valid, if and only if the increase in voter participation was not due to increased use of postal ballots.

I conclude that the combination of an unaware population and an unfortunate timing of the municipal elections "at the dawn of a global pandemic" (Leininger and Schaub, 2020) contributed to the spread of COVID-19 in Bavaria, which might have been contained by the exclusive use of postal ballots, as in the run-off elections on March 29. At the same time, the state-wide lockdown effected by the Bavarian government on March 21 likely prevented even higher numbers of infections and deaths.

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Appendix

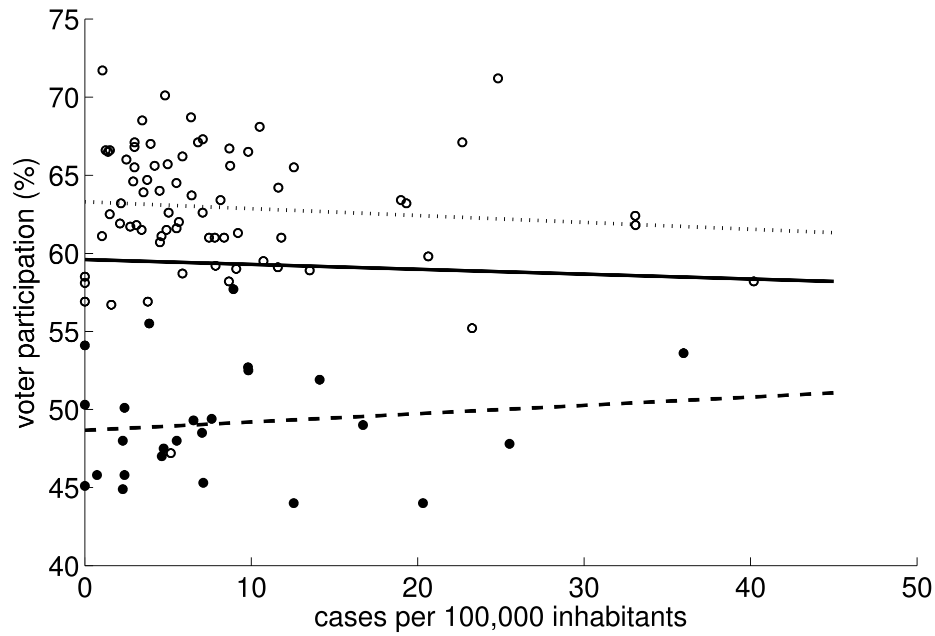
Table A.1: Bavarian municipalities hosting strong-beer festivals in March 2020

Municipality	Type	Venue	Date	Visitors
Neustadt a. d. Waldnaab	Landkreis	Flossenbürg	March 7	—
Neustadt a. d. Waldnaab	Landkreis	Pressath	March 7	—
Mühldorf a. Inn	Landkreis	Neumarkt-Sankt Veit	March 7	—
Rosenheim	Kreisfreie Stadt	Rosenheim	March 6–8	1,500/day
Rosenheim	Landkreis	Rosenheim	March 6–8	1,500/day
Rottal-Inn	Landkreis	Pfarrkirch	March 7	—
Schwandorf	Landkreis	Wackersdorf	March 7	—
Straubing	Kreisfreie Stadt	Straubing	March 7	1,500
Tirschenreuth	Landkreis	Mitterteich	March 7	1,400
Wunsiedel i. Fichtelgebirge	Landkreis	Niederlamitz	March 7	—

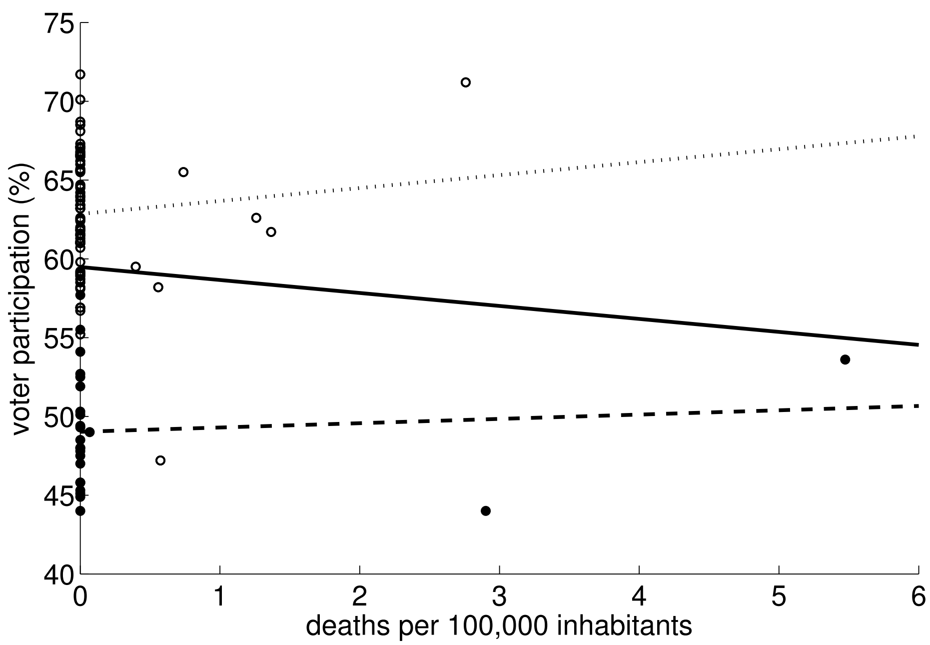
Notes: — indicates no information on the estimated number of visitors, which is likely small. The strong-beer festival in Rosenheim was discontinued by the organizers after three days. A team of German-French broadcaster ARTE attended the festival in Niederlamitz (Theodor, 2020).

Figure A.1: Cumulated COVID-19 infections and deaths between March 1 and March 15 and voter participation in the Bavarian municipal elections

(a) Cumulated infections and voter participation by district



(b) Cumulated deaths and voter participation by district



Note: Empty circles pertain to rural and filled circles to urban districts. —/···/- - represents the fitted least squares line for all Bavarian districts/only rural districts/only urban districts.