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ABSTRACT

The Political Effects of the 1918 Influenza Pandemic in Weimar Germany*

How do health crises affect election results? We combine a panel of election results from 1893–1933 with spatial heterogeneity in excess mortality due to the 1918 Influenza to assess the pandemic's effect on voting behavior across German constituencies. Applying a dynamic differences-in-differences approach, we find that areas with higher influenza mortality saw a lasting shift towards left-wing parties. We argue that pandemic intensity increased the salience of public health policy, prompting voters to reward parties signaling competence in health issues. Alternative explanations such as pandemic-induced economic hardship, punishment of incumbents for inadequate policy responses, or polarization of the electorate towards more extremist parties are not supported by our findings.

JEL Classification: D72, I18, N34, H51

Keywords: pandemics, elections, health, voting behavior, issue salience, issue ownership, Weimar Republic

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I. Introduction

The COVID-19 pandemic raised the attention for public health topics worldwide. Given the ongoing likelihood of intense epidemics, it is crucial to gain a comprehensive understanding of their long-term impact on politics. Much of the existing literature focuses on the consequences for incumbent governments but neglects how pandemics affect vote switching and political competition more broadly and beyond the short-run.[1] A large body of work in the literature on voting behavior suggests that voters attach more importance to issues most salient to them and, consequentially, vote for those parties most congruent with their view on these issues (for an overview, see Dennison, 2019). Pandemics, by increasing the salience of health topics, should thus have differential effects on the popularity of parties depending on their engagement with such issues.

In this paper, we study how the salience of a public health issue affects electoral outcomes in the context of the 1918 influenza pandemic – one of deadliest in recent human history. Specifically, we focus on the case of Germany and analyze the political consequences of the health crisis unfolding as a result of the pandemic. The so-called Spanish flu arrived amidst World War I (1914-1918) in Germany for a deadly second wave in October 1918, adding a health emergency to the list of issues policy makers were confronted with at the time. Contrary to other countries like the U.S., however, the policy response was negligible: schools, theaters, and public transport largely remained open for the public and newspapers downplayed the topic to keep up morale in the trenches and at home.[2] Nevertheless, since the pandemic killed around 0.5% of the population, its local intensity was arguably salient to voters whose neighborhoods came down with the flu, whose relatives and friends died, and whose engagement with public life was altered due to widespread sick leaves.[3] When elections were held in January 1919, just a month after the second wave flattened, the flu was most likely still fresh on the voters' minds.

To assess the empirical relationship between pandemic intensity and election results, we exploit a panel of voting results containing 14 elections during the period 1893 to 1933 across all 362 constituencies of the German Empire and the Weimar Republic in a difference-in-differences design. We combine this panel dataset with a measure of Spanish flu mortality in 1918. The measure of Spanish flu mortality is econometrically derived by purging excess mortality in 1918 of World War I deaths, taking into account the unique circumstances in Germany at the end of the war. Evidence from detailed causes-of-death data available at the district level confirms that the remaining variation in excess mortality can indeed be ascribed to the influenza pandemic.

The key result of our analysis is that constituencies which suffered higher excess mortality due to the Spanish flu shifted electoral support towards left-wing parties. Quantitatively, our results imply that moving from a constituency at the 25th percentile of mortality to a constituency at the 75th percentile increased the left-wing vote share by 2.4 percentage points or 8.1 percent relative to the last election prior to the Spanish flu. We show that these votes were diverted

[1] Recent work on retrospective voting in response to pandemics includes, e.g. Arroyo Abad and Maurer (2021); Baccini et al. (2021); Daniele et al. (2020); Giommoni and Loumeau (2022), and Herrera et al. (2020).

[2] Despite the lack of government intervention, there were substantial disturbances in public services and industrial production when countless workers needed to take sick leave (Michels, 2010, p. 21).

[3] This is amplified by the fact that, especially in autocracies, voters should give greater weight to local information as it is more directly observable and less prone to government manipulation (Rosenfeld, 2018).

largely from right-wing parties.

Using event-study specifications, we can investigate pre-treatment dynamics and track the impact of Spanish flu mortality over time. We find that high and low mortality regions followed similar trends in voting patterns from 1893 until 1912, the last election prior to the pandemic, which corroborates the validity of the parallel trends assumption. Moreover, the post-treatment dynamics reveal a permanent shift in electoral support for left-wing parties which started immediately in January 1919 and lasted until the end of the Weimar Republic in 1933.

Several pieces of evidence substantiate that our findings can indeed be ascribed to the influenza pandemic. Firstly, we use novel city-level data on causes of deaths to show that our results are entirely driven by excess mortality due to respiratory diseases, the cause-of-death category that includes influenza. On the contrary, excess mortality resulting from non-respiratory diseases and external causes, the category that includes military deaths, does not exhibit any correlation with voting outcomes. Secondly, acknowledging that diseases may spread easier under poor living conditions, we demonstrate that our baseline results are robust to controlling for several pre-WWI measures of poverty and inequality. Lastly, we show that there is no correlation between Spanish flu mortality and levels of deprivation resulting from World War I, which we approximate using infant mortality.

We also address concerns about the comparability of elections results before and after WWI. While the fundamental changes in Germany's political, electoral, and party system before the elections of 1919 will be captured econometrically by election fixed effects, threats to identification could arise if the impact of these changes was correlated with flu mortality.[4] We undertake several measures to alleviate such concerns: first, we hold constituency borders fixed at the beginning of the observational period to rule out any impact of changes in administrative borders. Second, to address volatility in the party landscape, we aggregate votes into three broad party camps (left wing, centre, right wing) that are highly comparable over the entire study period. Finally, we account for changes in the electorate through the introduction of female suffrage and a lowering of voting age after WWI by directly controlling for the size of these two newly enfranchised population groups.

Mechanism and theoretical considerations We consider several potential mechanisms which may explain why voters from constituencies with higher flu mortality changed their voting behavior. The most plausible explanation, in our view, is the idea that voters reward competence in times of crisis, which was pioneered by Budge and Farlie (1983) and Petrocik (1996) in the so-called 'issue ownership' theory. More recently, Bélanger and Meguid (2008) have refined this theory by arguing that issue ownership is mediated by perceived issue salience, i.e., it will only affect voting decisions of those who think the issue is important.[5]

To analyze the merits of this mechanism in our context, we inspect more detailed groups of parties instead of broad camps. Crucially, we find that the boost in salience of public health due to pandemic intensity did not benefit all left-wing party groups but only socialists. Furthermore,

[4] See the discussion in Section II for further details.

[5] While there was a recent increase in research on issue ownership and its interaction with issue salience, empirical evidence on effects for voting outcomes is still mixed (Singer, 2011; Lefevere et al., 2015; Dennison, 2019; McAllister and bin Oslan, 2021; Sipma and Berning, 2021).

when breaking down the centrist camp, we find benefits only for the liberal parties. In line with issue ownership theory, we provide historical evidence that these were in fact the two groups which include the only parties that had a reputation for competence in the field of public health before the pandemic. Voters likely associated Social Democrats with public health due to their involvement with the health insurance, whereas they associated National Liberals with their endorsement of the social hygiene movement. Since the pandemic was followed by a politicization of health, it effectively made health irreversibly a public issue instead of a private affair. This could explain the permanent shift in voting patterns observed in our results. While our preferred explanation is along the lines of the issue ownership argument, we acknowledge that our findings are also consistent with a public choice perspective, whereby voters have fixed preferences for health policies but update their voting behavior considering the perceived utility gained from these policies.

A competing mechanism which we can confidently exclude is that our results are a mere by-product of changes in (socio-)economic conditions. More precisely, the pandemic may have altered the geography of poverty with lasting consequences for the (socio-)economic composition of constituencies and in this way affected voting outcomes. However, we find that correlates of poverty, such as infant mortality and welfare rates, do not display a systematic relationship with excess flu mortality.

We also look into other political-economy mechanisms which could rationalize our main findings. For one, voters may have chosen to hold incumbents accountable for the policy response during the pandemic as predicted by standard models of retrospective voting.[6] However, we do not find that excess flu mortality is related to voting for incumbents.[7] Alternatively, the economic hardship which may have accompanied the pandemic could have polarized the electorate and shifted votes towards more populist and extremist parties. This would be in line with recent evidence on the electoral success of populist movements among discontent voters after e.g. financial crises, globalization, structural changes, and automation (see, e.g. Mian et al., 2014; Inglehart and Norris, 2016; Algan et al., 2017; Colantone and Stanig, 2018; Dorn et al., 2020). In our analysis, however, we do not observe an increase in support for either extreme left-wing or extreme right-wing parties in constituencies with higher rates of flu mortality.

Contribution to the literature This paper adds to existing research on the political consequences of health crises and pandemics. Broadly speaking, this literature predominantly relies on retrospective voting mechanisms and finds countervailing effects of crisis intensity on attitudes towards incumbents. Crises either lead to disappointment with the government or a 'rally around the flag' effect uniting voters and governments confronted with a common threat. Which effect dominates is likely driven by the quality of the political response by the government. Analyzing major worldwide epidemics since the 1970s, Aksoy et al. (2020) find that trust in government de-

[6] For prominent examples see, e.g. Kramer (1971); Fiorina (1978); Ferejohn (1986); Malhotra and Kuo (2008); Healy et al. (2010); Bechtel and Hainmueller (2011); Healy and Malhotra (2013); Lewis-Beck and Stegmaier (2018)

[7] Interestingly, this echoes findings by Achen and Bartels (2004) who analyzes the impact of mortality during the 1918 influenza pandemic in the U.S. on voting for the incumbent party during the midterm elections of 1918. Acknowledging their small sample, they tentatively conclude that the pandemic had little or no political effects. The authors argue that the flu is therefore an example of an event in which voters did not expect the government to control the spread of the pandemic or its consequences and that the null results are reasonable.

clines when policy interventions are weak and that this effect was particularly persistent among individuals exposed to an epidemic during their impressionable years (18–25).[8]

For the COVID-19 pandemic, Daniele et al. (2020) find evidence for a 'rally around the flag' effect for European governments if they relied on scientific expertise instead of populist policies. Herrera et al. (2020) find that the initial 'rally around the flag' effect drops if governments fail to implement policies to control the pandemic.[9] Giommoni and Loumeau (2022) find similar effects in 2020 French municipal elections, where incumbent politicians gained votes in localities under stricter lock-down measures.[10] Conversely, the incumbent of the 2020 U.S. presidential election lost more votes in regions with a higher amount of COVID-19 cases, especially in states without stay-at-home orders (Baccini et al., 2021). Different from these papers, we find no evidence for retrospective voting but for issue ownership which rewards overall perceived competence in a particular policy domain, also of non-incumbents, rather than punishing bad political performance of the past. In addition, contrary to the literature inspecting the COVID-19 pandemic, our historical setting allows us to inspect political effects in the medium run.

We also contribute to the small literature on the political consequences of the 1918 Influenza pandemic. In a related paper, Blickle (2020) examines the consequences of the Spanish flu for elections in Weimar Germany. Using variation in influenza mortality across 25 regions, he finds that cities in regions with higher influenza mortality in 1918 exhibited higher vote shares for the Nazi party (NSDAP) in the 1932 and 1933 elections. This finding is explained by lower public spending, especially on schooling, in cities more affected by the Flu. In comparison, our paper uses more granular measures of pandemic intensity and shows a sizable and lasting positive effect of on voting for left-wing parties, induced by a shift in support towards parties with expertise in health issues. This shift occurs immediately after the pandemic and is well identified using an event-study design. Inspecting U.S. congressional and presidential elections, Arroyo Abad and Maurer (2021) find evidence for retrospective voting after the 1918 pandemic. In this case, voters seem to have punished incumbents for their poor response, albeit in relatively small magnitudes. Different from Germany, U.S. voters were well aware of the pandemic and local politicians successfully curbed its spread using non-pharmaceutical interventions (Bootsma and Ferguson, 2007; Correia et al., 2022).[11] Esteves et al. (2022) show that higher influenza mortality

[8] Gutiérrez et al. (2022) relate higher incidence of the H1N1 virus during the 2009 epidemic in Mexico to voting for the incumbent PAN party, finding small but persistent negative effects. Mansour and Reeves (forthcoming) show that higher HIV/AIDS mortality in the U.S. is associated with an increased vote share for the Democrats starting from the 1994 election. Campante et al. (forthcoming), on the other hand, find that the Democrats lost votes, when Republicans strategically incited fear of a domestic Ebola outbreak mentioning the virus in connection with immigration and terrorism. These findings indicate that voting decisions are based on the 'perceived' government response which may be framed by political opponents. Flückiger et al. (2019) show that trust in government increased more strongly in African regions with a more intensive Ebola outbreak indicating that voters rewarded the adoption of public health measures. Aassve et al. (2021) inspect long-run consequences of the Spanish flu and show that descendants of survivors generally had lower social trust.

[9] Abad Cisneros et al. (2021) show that candidates in the 2021 Ecuadorian elections used topics related to COVID-19 to mobilize voters during the campaign.

[10] Sircar (2021) finds no correlation between infection rates and votes for the ruling party in the 2020 Croatian parliamentary election. De Vries et al. (2021) find evidence for cross-border spill-overs of political effects, i.e. Italy's early lockdown measures increased support for incumbents in other European countries.

[11] These interventions were enacted by incumbents from more competitive elections (Walden and Zhukov, 2021). The short-run negative mortality effects of these interventions may have been offset by higher mortality in the medium run (Chapelle, 2022). However, Ager et al. (forthcoming) show that there were no long-run consequences of school closures for children's educational attainment and adult labor market outcomes.

was, in fact, associated with the expansion of the health sector across U.S. cities. However, the expansion was driven by private and not public provision. In Germany the government did not take actions to prevent the spread of the pandemic and withheld information about it from the general public to keep up morale during wartime. This setting allows us to sidestep issues arising from voters with different party affiliations having different perceptions regarding the risk of contracting the Flu and therefore differentially complying with NPIs as, e.g. in recent U.S. elections (Allcott et al., 2020; Baccini et al., 2021). Furthermore, until the end of the pandemic, Germany was a constitutional monarchy with a chancellor appointed by the emperor. Instead of blaming the now resigned government, voters may have rationally decided to reward expertise in the new Weimar Republic.

The literature has also established that the Spanish flu pandemic had various economic consequences which may constitute competing mechanisms in our context. Beach et al. (2022) summarize the literature and argue that its findings are consistent with a negative labor supply shock because the pandemic largely affected working-age adults. The pandemic had negative consequences for GDP growth (Barro et al., 2020; Carillo and Jappelli, 2022) which were mostly short-lived (Velde, 2022; Dahl et al., 2022). Negative employment and income effects are typically found especially at the lower end of the income distribution, leading to increases in inequality in Italy, Spain, and Sweden (Karlsson et al., 2014; Basco et al., 2021; Galletta and Giommoni, 2022). However, high mortality rates also resulted in labor shortages that increased wages in the medium-run (Garrett, 2009) and female labor force participation in the short-run (Fenske et al., 2022). Hence, whether or not the Spanish flu affected inequality in all countries is unclear.[12] We know relatively little about the consequences of the 1918 influenza pandemic in Germany (see Michels, 2010, for a historical overview). The German historical literature has hitherto largely neglected the pandemic, partly due to the difficulties in distinguishing between the consequences of the war in general and the Flu in particular. Recently, Franke (2022) showed that poverty and air pollution are among the main drivers of Influenza mortality in 1918 in the German state of Württemberg.

Finally, we contribute to a growing body of work discussing explanations for the rise of fascism in Weimar Germany before WWII (see, e.g. King et al., 2008; De Bromhead et al., 2013; Adena et al., 2015; Satyanath et al., 2017; Galofré-Vilà et al., 2021; Koenig, 2023; Voth and Voigtländer, forthcoming). Our paper demonstrates that the influenza pandemic 1918 triggered a persistent shift in electoral support from right to left after WWI and thus provides rare evidence on the factors which stabilized the nascent, fragile democracy of Weimar Germany rather than those leading to its downfall.[13]

The remainder of this paper is organized as follows. In Section II, we provide key information on the Spanish flu pandemic in Germany and give an overview of the historical and political context. Section III introduces the main data sets, while Section IV details out how we estimate

[12] Health shocks differ from other types of shocks such as wars because they have little impact on physical capital (Jordà et al., 2022) and thus do not affect the wealth distribution. It is therefore unlikely that the influenza pandemic affected voting behavior via changes in wealth inequality similar to the way WWII increased votes for the Labour party in England, as found by Heldring et al. (2022). Nevertheless, if the pandemic led to sorting, it may have had an effect on the geography of poverty, wealth, and voting patterns (Ambrus et al., 2020).

[13] Acemoglu et al. (2022) provide evidence that a perceived threat of Socialism, as measured by Socialist party vote shares in 1919, contributed to the subsequent rise of Fascism in Italy.

excess mortality arising from the Spanish flu in 1918. Section V introduces our estimation strategy whereas Section VI presents the main estimation results as well as robustness and validity checks. In Section VII we discuss and present evidence on the mechanisms behind our main findings. Section VIII concludes.

II. Historical background

1918 was the final year of WWI. Germany was heavily involved in fighting against the Allied powers and the German government was focused on military efforts and mobilization to sustain the war effort. The German spring offensive began in late March but largely failed to deliver a decisive victory. It was followed by the Hundred Days Offensive of the Allied powers which started in early August and ended with the Armistice of Compiègne in November 1918. The war had taken a toll on the German population and there was widespread war weariness, economic hardships, and food shortages, leading to growing discontent.

II.1. The 1918 influenza pandemic in Germany

The 1918 Influenza pandemic was one of the deadliest pandemics in human history. Case fatality ratio and reproductive numbers were higher than for other pandemics of the twentieth century.[14] The virus, originating in the United States, spread to Europe through military troops. In March 1918, over 100 US soldiers fell ill at Fort Riley, Kansas, marking the initial outbreak. The virus then gradually spread through the US and reached France in April 1918 via US soldiers, eventually reaching all other countries (Crosby, 2003; Barry, 2004). In Germany, it entered through soldiers on leave and prisoners of war in camps. The influenza spread from west to east starting in mid-June 1918 (Michels, 2010, p.10).

The Spanish flu in Germany occurred in multiple waves. The first wave hit in spring and peaked in early July, about three weeks later than among the Entente troops (Johnson, 2001, p.111). The second wave peaked between mid-October and mid-November. While those infected in the first wave only developed relatively mild symptoms, the virus had possibly undergone genetic mutation and caused more severe symptoms in the second wave. Mortality was several times higher and death often occurred soon after the first onset of symptoms (Michels, 2010, p.16). Unlike in other countries, the third wave that occurred between late January and March 1919 does not show a significant impact in the German mortality statistics (Buchholz et al., 2016, p. 530).

The sick experienced high fever, severe headaches, and limb pain. Those with a severe form of the disease often suffered from bleeding from the nose and ears, as well as spitting blood. Their faces turned blue due to oxygen deprivation. Autopsies revealed extensive lung damage, with lungs filled with blood and fluid (Michels, 2010, p.6). Unlike many other pandemics, the Spanish flu shows a unique W-shaped relationship between mortality and age with the highest death rates among young adults (Shanks and Brundage, 2012). This was attributed to a cytokine storm, an immune system response that caused organ failure.

[14] The World Health Organisation estimates that the 'Spanish flu' caused between 20 million and 50 million deaths globally, with some estimates ranging up to 100 million casualties. The influenza subtype H1N1 that emerged in 1918 was more infectious and deadly than other sub-types.

According to a survey by Buchholz et al. (2016, p. 527), estimates of excess mortality caused by the Spanish flu in Germany in 1918 vary between approximately 240,000 and 442,300 deaths in a population of 62 million. This translates to an excess death rate ranging from 3.9 to 7.2 per 1,000 individuals, which aligns with the 6.5 estimate used in Barro et al. (2020).[15]

II.2. The policy and media response

German authorities did little to limit the spread of the influenza. The second wave of infections hit the German army during the Hundred Days Offensive, the crucial final phase of WWI, and authorities downplayed the threat to keep up morale (Michels, 2010). Restricting mobilization and supplies to limit the spread of an infectious disease was not an option. Non-pharmaceutical interventions (NPI) such as bans on meetings, cultural events and religious services were rejected because authorities did not want to raise concerns of the people.

The Imperial Health Council (*Reichsgesundheitsrat*), an advisory body to the health department, did not recommend school closures because they prevented mothers from going to work and deprived children from receiving a meal (Michels, 2010, p.21). The council rather recommended instructing the people with some basic codes of conduct to limit infections emphasizing personal hygiene and cleanliness, especially when preparing food (Michels, 2010, p.21). The national government delayed informing the federal states about these recommendation for two weeks until the end of October.

Neither imperial nor state governments issued any binding instructions, but left decisions to local authorities. Similarly, the Prussian Ministry of Culture delegated the decision to close schools to local governments and public health officers. While some cities indeed decided to close schools for a few days, even fewer closed theaters and cinemas and suspended court hearings.

Press censorship remained effective during the first wave of the pandemic. General rules implied that the press should not report on the state of the military and news should not agitate the reader. German media, during this period, aligned with the government's communication strategy to maintain a positive image and not undermine Germany's position on the Western front before the arrival of US troops (Michels, 2010, p.12). Despite rumors attributing the spread of influenza to food and supply shortages, the media refrained from discussing such matters.

During the second wave, mainstream newspapers in Germany began to report more openly about the disruptions caused by influenza and the impact of the disease on public life. However, the health department, concerned about the tone and content of the media coverage, requested the ministry of interior to instruct the press to avoid alarming the public. As a result, even at the peak of the second wave in October and November 1918, the coverage of the pandemic remained minimal in German newspapers. Articles were limited to brief reports and did not discuss the government or political parties as being responsible for the outbreak or its consequences.

Moreover, the topic disappeared from the press by the end of October, long before the epidemic had subsided because peace negotiations with the Allies, rising food prices, and other war-related topics were predominant in October and early November (Michels, 2010, p.23). In contrast to mainstream media, newspapers issued by social democratic parties or related insti-

[15] Another recent study by Franke (2022) indicates excess mortality between 5.4 and 6.1 per 1,000 for the period 1918–1920.

tutions were more critical and discussed concerns of the working class. The flagship newspaper *Vorwärts* increasingly reported more openly as the flu progressed (Müller, 2020).[16]

II.3. Changes in the political system by 1919

The German Empire, existing from 1871 to November 1918, was a constitutional monarchy where power was held by the German emperor who appointed a chancellor with executive authority. Following the end of the German Empire, the Weimar Republic emerged as a parliamentary republic in 1919. In this new system, the government was appointed by an elected president and relied on parliamentary support from a majority.

In this paper, we analyze voting results for the Reichstag, the lower house of Germany's parliament. From 1871 to 1912, the last elections before the Spanish flu, members of parliament were elected according to a majoritarian representation system by men at least 25 years old.[17] There were 397 single-member constituencies, each consisting of 2–4 counties. From 1919 to 1933, members of parliament were elected according to a proportional representation system by men and women at least 20 years old.[18] The population that was entitled to vote increased from approximately 14 million in 1912 to 37 million in 1919. There were now only 38 large electoral constituencies each of which sent candidates according to a party's electoral lists. Since voting results for elections during the Weimar Republic are reported at the county level, they can be aggregated up to the level of 362 constituencies existing already during the German Empire, making them directly comparable.[19]

From October 3 until November 9, 1918, the German Empire was effectively governed by a cabinet under the chancellor Max von Baden, who, like most of his cabinet members, had no party affiliation. After a change in the constitution, this was the first government that was in fact accountable to parliament. As a consequence, it was also the first cabinet to ever include Social Democrats.[20] The ministry of the interior, responsible for health issues, was held by a member of the Centre party.

In the aftermath of the November Revolution of 1918 in Germany, the country was governed by the Council of the People's Deputies which ruled by decree and bypassed parliament. Their rule lasted from November 10 to February 13 and thus had minor overlaps with the second wave of the Spanish flu. The council consisted exclusively of social democrats and was predominantly occupied with negotiating and signing the peace terms and preparing federal elections for the National Assembly (*Nationalversammlung*) on 19 January 1919.[21] The National Assembly was elected with the purpose of drafting the new constitution of the Weimar Republic and was

[16]Editors started using the term 'epidemic' on July 5. On October 11, the *Vorwärts* reported that influenza had "not only greatly increased in extent" but that "the number of severe and fatal cases increased compared with the first wave" (Vorwärts, 11 October. 1918, p. 3). On October 20, the *Vorwärts* reported that the disease extended "over the entire Reich" and was also "associated with more severe courses of disease".

[17]Excluding soldiers, convicts, and those on welfare.

[18]Excluding soldiers again from 1920.

[19]See Section III for more details.

[20]In the last federal elections of the German Empire in 1912, Social Democrats had received 34.8% of votes, resulting in 110 seats (199 were needed for a majority in the house). The elections of 1917 were postponed until after the end of the war.

[21]The council included three members from the Social Democratic Party (SPD) and three members from the Independent Social Democratic Party (USPD), a group that had split from the SPD due to their firm anti-war stance.

replaced after the elections of June 1920.[22]

The elections of 1919 brought some further changes to Germany's party landscape. New parties emerged and established parties operated under new party names. We will not cover these transitions in detail here but deal with them empirically by combining parties into broader political camps to maintain comparability over time. This practice follows Koenig (2023) and allows us to condition on pre-existing political leanings before the Spanish flu.

II.4. Health and politics

The period immediately following the war marked a politicization of health (Woelk and Vögele, 2002, p. 21). While until 1914, the state mainly assumed the policing of health-related issues, after 1918 it became increasingly involved in health care and the establishment of a public health system (Woelk and Vögele, 2002, p. 22). As per constitution, public health became a responsibility of the government instead of the individual. This change was rooted in the perception that the poor state of popular health after the war was attributed to political decisions rather than being attributed to individual decisions or behaviors (Sachße and Tennstedt, 1988, p. 117). From the perspective of administration, however, an existing dualism between social insurance and medical practice continued.

With the exception of the SPD and its predecessors, parties did not address health policy in their programs. The main goal of socialist parties in Germany was improving the conditions of the working class and the social aspects of health were part of this. Since their earliest party platform, the Gothaer Program of 1875, the Socialist Workers' Party (SAP) advocated policies explicitly protecting the health of workers in Germany (Kettler, 1978). Furthermore, they demanded self-administration of all workers' insurances. In their 1891 Erfurter Program, the SPD demanded free medical treatment for all and nationalization of health care. Subsequent party conventions discussed compulsory vaccination, combating widespread diseases such as Tuberculosis, and the expansion and improvement of health insurance benefits.

It was largely through the insurance system that the SPD and its predecessors assumed a leading role in health. Many insurances were governed by an elected board of workers, oftentimes party officials, thus deepening the ties between the party and the local insurances (Tennstedt, 1983; Müller, 2020).[23] In fact, during the Anti-Socialist Laws, which banned meetings and assemblies that spread social-democratic principles from 1878 to 1890, health insurance meetings were used to disguise official party assemblies. After mandatory health insurance for blue collar workers was implemented under Bismarck in 1884, socialists rather than conservatives reaped the political benefits by successfully claiming the responsibility for this policy (Kersting, 2022). It was also through the insurances that social democracy was confronted with political reality

[22] In the elections to the National Assembly, Social Democrats received 45.5% of votes, resulting in 185 of 423 seats. In the elections of 1920, they received 39.5% of votes and 186 of 459 seats. (These numbers add up results for the SPD and the USPD.) This allowed them to form a centre-left coalition with the Christian democratic Centre party, subsequently called the 'Weimar Coalition' to govern. The Centre party attained 19.7% of votes and 91 seats in 1919. From 1920, they remained relatively stable with approximately 13% of votes.

[23] Physician and Reichstag MP Otto Mugdan (Left Liberals) argued in 1904 that it had become impossible to gain employment in a health insurance fund for anyone who was not a Social Democrat (cited after Tennstedt, 1983, p. 436). Out of 1,277 local insurance funds (*Ortskrankenkassen*) that were contacted, 166 funds responded to a survey stating that they had Social Democrats on their board, while 181 funds reported that they did not (Tennstedt, 1983, p. 430).

(Labisch, 1976, p. 363).

While the SPD established their leadership in health topics through administration of workers' insurances, the National Liberals were the party for medical practitioners. Because they largely came from the wealthy and educated middle class in Germany, physicians were among the typical constituents of the party. As liberals they opposed the idea of nationalized health care and promoted the free choice of medical doctors. Liberals also supported the social hygiene movement that promoted health through prevention of illness, e.g. through building public health infrastructure (Fehlemann, 2002; Hüntelmann, 2021). This movement was initially leaning left-liberal but soon came to be dominated by national-liberal physicians (Labisch and Tennstedt, 1991, p. 14). Private and public health clinics and nursing homes became the primary policy tool for liberal physicians in the early 1900s (Kott, 2014, p. 181).

III. Data

III.1. Voting data

The voting data used in this paper is a panel of election results for German constituencies (*Wahlkreise*) from 1893 to 1933 constructed by Koenig (2023). The data harmonizes two existing datasets on elections before and after WWI by ICPSR (1991) and Falter and Hänisch (1990) and expands it with returns for the election of the National Assembly in January 1919. To assure comparability over time, all parties are classified into one of three political *camps*: left-wing, centre, and right-wing.[24] We compute their vote shares by dividing the number of votes for a political camp by the total number of valid votes. For analyses inspecting mechanisms, we further classify them into one of six party *groups* (Communist, Socialist, Liberal, Catholic-Minority, Conservative, Antisemitic).

Prior to 1920, parliamentary seats were allocated via single-member constituencies and election results were not published at a lower level of aggregation. Each constituency consisted of 2–4 counties (*Kreise*) and their borders remained constant until the end of WWI. Starting with the 1920 election, voting data were consistently published at the county level, which allows calculating election results at the constituency-level data also for this period.[25] To assure comparability across space, we aggregate post-1920 election results and other county-level variables up to the level of the 362 constituencies in the German Empire contained within the borders of Weimar Germany.[26]

Starting in 1898, voting data was also published for the 226 cities with more than 10,000 inhabitants. This data allows us to construct a city-level panel dataset that includes cause-specific mortality rates along with the corresponding variables that are present in our constituency-level panel. This dataset will be used in our analyses of cause-specific mortality in Section VI.3.2.

[24] See Table D.1 in the Appendix for details.

[25] For details on handling changes in administrative boundaries of counties, we follow Koenig (2023).

[26] Some regions of the German Empire were ceded after the Treaty of Versailles, including Alsace–Lorraine, parts of Silesia and Poznan.

III.2. Spanish flu mortality

Optimally, we would have liked to use administrative data on influenza deaths reported at the same level of observation as our voting data. Since such data do not exist, we rely on a variety of official vital statistics. In particular, we use newly-digitized all-cause numbers of deaths for each county-year between 1904 and 1933 from publications by the statistical offices of Imperial and Weimar Germany and scale these by the 1910 population count, which was the last census unaffected by the influenza pandemic and WWI. For most analyses, we collapse the data to the constituency-level to match the panel of election results. For further details on the construction of excess mortality, see Section IV below.

Moreover, we were able to obtain data on influenza deaths at a higher level of aggregation, specifically for the 37 districts (*Regierungsbezirke*) of Prussia, from the Prussian statistical office.[27] We also obtained yearly numbers of soldiers killed in World War I at the same level of aggregation. These data are used to assess the accuracy of our predictions for excess mortality when applied at a more detailed level of observation.

For our analyses at the city-level, we obtained similar vital statistics as well as cause-specific numbers of deaths from publications by the Imperial Health Office between 1904 and 1913. We extend the administrative data into the years 1914 to 1918 by digitizing hitherto unpublished city-level mortality reports submitted to the Imperial Health Office, which we resurrected from hand-written archival sources. Within the 13 cause-of-death categories listed in the city-level records, influenza deaths are recorded in the category 'respiratory diseases'.[28] This category includes any death caused by diseases of the respiratory system apart from the separately listed diphtheria & croup and tuberculosis.[29] We aggregate the remaining categories into deaths from 'external' forces such as suicide, violence and accidents and those from 'non-respiratory' diseases. This will allow us to run placebo checks to ensure that it was not just any type of mortality that influenced the voting results.

III.3. Other outcomes

To inspect potential channels of transmission, we use four additional panel variables to capture potential changes in local economic conditions emerging after the pandemic. In particular, we use population size, taken from the census of the years 1895, 1900, 1905, 1910, 1916, 1917, 1919, 1925 and 1933. Changes in population size may reflect natural changes due to births and deaths, but also net migration, all responding to local economic and health conditions. Second, we use infant mortality for the years 1904 to 1933, calculated from the same vital statistics discussed above as the ratio of stillbirths and deaths below the age of one over the total number of births in a given year. Changes in infant mortality are arguably a very good proxy for the local nutritional status and general health environment. Third, we also use general mortality from the same vital statistics for similar reasons. Last, we collected data from statistical yearbooks on the share

[27] For a map, see Figure B.1 in the Appendix.

[28] Using such a broad category for our analysis also avoids issues related to potential miss-classification of influenza deaths by the officials.

[29] We also added pertussis deaths which were not listed separately until 1905. The remaining categories are as follows: childbed fever, scarlet fever, measles & rubella, typhoid, intestinal diseases, suicide, violence, accidents and all other or unknown diseases.

of individuals and households receiving welfare benefits in approximately 60 cities. The data covers the years 1910 to 1912 and 1926 to 1929, enabling us to approximate the changes in the population eligible for financial support during this period.

III.4. Control variables

In our baseline regressions, we incorporate two sets of control variables: demographic and war-related controls. Two of the demographic variables address concerns related to the combination of election results from Imperial Germany and the Weimar Republic, specifically the expansion of the electorate in 1918. The new constitution of the Weimar Republic introduced women's suffrage and lowered the voting age to 20. Although these changes significantly increased the electorate, significant shifts in electoral patterns only emerged several years after WWI (Koenig, 2023). Moreover, women tended to vote either in accordance with their spouses or social class (Sneeringer, 2002). Nevertheless, to address these concerns empirically, we include two demographic controls: the population share of newly enfranchised females (born before 1899) and males (born between 1893 and 1898), based on data from the 1910 census. The other two demographic controls are the logarithm of population in 1910 and population growth between 1910 and 1917.

Regarding war-related control variables, we account for the population share employed in blue-collar occupations, obtained from the 1907 occupation census, and the share of World War I veterans as estimated by Koenig (2023).We also include infant mortality in 1917 as a proxy for poor living conditions during the war preceding the pandemic. Finally, we utilized digitized maps to calculate the proximity of each constituency and city to the Eastern and Western front lines in 1918. Further details on all variables and their sources are provided in Appendix Section C. Table A.1 in the Appendix provides a descriptive statistics for all variables used.

IV. Estimating Spanish flu mortality

Figure 1 shows mortality rates for the period 1904–1918. The box plots give a sense of excess mortality during the years 1914-1918. In the absence of WWI and the Spanish flu, one would expect mortality rates to remain relatively stable at around 11-12 deaths per 1,000 inhabitants, as observed from 1904 to 1913. However, the mortality rates for the years 1914–1918 are higher due to military deaths resulting from the war. The box plot for 1918 shows an even higher and more dispersed mortality rate resulting from the additional impact of the Spanish flu. It is estimated that the Spanish flu claimed between 240,000 and 442,300 lives in 1918, while around 380,000 people died as a result of WWI (Buchholz et al., 2016; Roesle, 1925). These figures are comparable to the mortality rates during earlier war years.[30]

In the absence of fine-grained data on Spanish flu mortality in 1918, we construct such a measure using county-level vital statistics aggregated to the constituency level.[31] In a first step, we run the following regression to obtain estimates for constituency-specific mortality levels and trends:[32]

[30] According to Roesle (1925), about 234,000 German WWI soldiers died in 1914, 424,000 in 1915, 335,000 in 1916 and 282,000 in 1917.

[31] See Appendix Section C for further details.

[32] See Clay et al. (2019) for a similar approach.

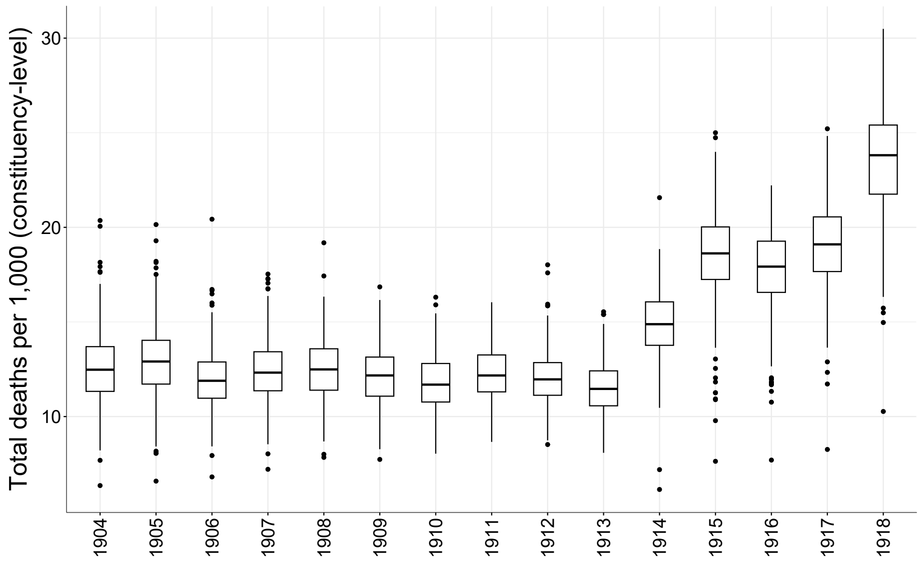


Figure 1 — Mortality rates 1904–1918

Notes: The graph shows box plots of constituency-level mortality rates (crude death rates) from 1904 to 1918 per 1,000 inhabitants in 1910.

$$Mort_{it} = \mu_i + \theta_i \times t + \epsilon_{it} \tag{1}$$

$Mort_{it}$ is the number of deaths in constituency i in year $t \in 1904-1913$ per 1,000 individuals in 1910, the last pre-war census year. μ_i are constituency fixed effects that capture time-invariant unobserved heterogeneity in mortality rates across constituencies. To flexibly account for regional mortality dynamics, we include constituency specific linear time trends. We do not include the years 1914–1917 to avoid that the estimated coefficients are affected by WWI. The estimated μ_i and θ_i coefficients are used to predict mortality in 1918. Predicted 1918 mortality is subtracted from actual 1918 mortality to obtain a measure of excess mortality as described in Equation 2. We compute excess mortality for the years 1914 to 1917 in an analogous way and use these variables in plausibility and validity checks.

$$ExcMort_{1918} = Mort_{i1918} - \widehat{Mort}_{i1918} \tag{2}$$

We expect that the 1918 excess mortality calculated from Equation 2 includes both military deaths and influenza deaths. To confirm this, we make use of the fact that data on military deaths and influenza deaths is available at a higher level of administration, namely the district level.[33] We aggregate excess mortality in a given year $t \in 1914 - 1918$ to the district level and regress it on military deaths per 1,000 capita in the respective year. The results of this analysis are depicted in columns 1-5 of Table 1. We find highly significant positive correlations between excess mortality and military deaths per 1,000 capita for the years 1914 to 1917. Indeed, excess mortality increases almost one-by-one with every military death. In 1918, the correlation is still positive and economically meaningful, although it does not reach conventional significance

[33]On average, a district consists of roughly 7 constituencies.

levels. This analysis confirms that excess mortality in 1918 is not exclusively driven by military deaths but most likely also by the Spanish flu.

TABLE 1 — Creating Spanish flu exess mortality

	Excess mortality in ...						Flu Mortality 1918		
	1914	1915	1916	1917	1918				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Military deaths 1914 per 1,000	1.019***					0.058			
	(0.190)					(0.210)			
Military deaths 1915 per 1,000		0.820***				0.252**			
		(0.193)				(0.101)			
Military deaths 1916 per 1,000			0.988***			−0.125			
			(0.191)			(0.143)			
Military deaths 1917 per 1,000				0.787***		0.723***			
				(0.250)		(0.213)			
Military deaths 1918 per 1,000					0.404		0.051		−0.260
					(0.307)		(0.266)		(0.227)
Influenza deaths 1918 per 1,000								1.059***	1.136***
								(0.208)	(0.218)
Districts	37	37	37	37	37	37	37	37	37
Observations	37	37	37	37	37	37	37	37	37
Mean DV	3.18	7.71	6	8.12	12.8	6.36	0	0	0
R^2	0.464	0.397	0.584	0.259	0.051	0.563	0.001	0.426	0.451

Notes: This table presents bivariate regressions between predicted measures of excess mortality and reported deaths due to war and Spanish flu at the district level. Robust standard errors in parentheses: *p<0.1; **p<0.05; ***p<0.01.

The above analysis shows that we need to further refine our measure to isolate excess mortality due to the Influenza. We do so by purging excess mortality in 1918 of excess mortality in the earlier war years 1914–1917, i.e., we deduct estimated military deaths. To purge constituency-level excess mortality in 1918 from military deaths, we estimate Equation 3:

$$ExcMort_{i1918} = \sum_{t=1914}^{1917} \beta_t ExcMort_{it} + \epsilon_{i1918} \tag{3}$$

We expect the residual of this regression to capture Spanish flu mortality of constiuency i in 1918, $FluMort_{i1918}$. The R-squared in column 6 confirms that military deaths from previous war years explain more than 50% of the variation in excess mortality 1918 for the district-level. Our interpretation of this finding is that excess mortality in 1914–1917 are meaningful predictors of excess mortality due to the war in 1918. Under the assumption that spatial variation in military deaths between 1914 and 1917 is highly correlated with spatial variation in military deaths in 1918, the residual variation in 1918 excess mortality resulting from estimating equation 3 should capture excess mortality due to the Spanish flu.

To empirically validate this assumption, we use our district-level data and regress residual excess mortality in 1918 on military deaths and influenza deaths. As column 7 of Table 1 shows, residual excess mortality is no longer correlated with military deaths. Column 8 of Table 1 confirms that residual excess mortality in 1918 is strongly correlated with influenza deaths. The highly significant coefficient is slightly larger than one, which could be interpreted as under-reporting of Spanish flu mortality in the administrative data. In column 9 of Table 1, we regress estimated residual excess mortality on reported military and influenza deaths, which leaves our findings unaffected. Therefore, in the remainder of the paper, we will use residual excess mortality in 1918 as our variable of interest and label it Spanish flu mortality ($FluMort_{i1918}$) for ease of interpretation. Figure 2 shows a map of the spatial distribution of this variable across the 362 constituencies in the German Empire.

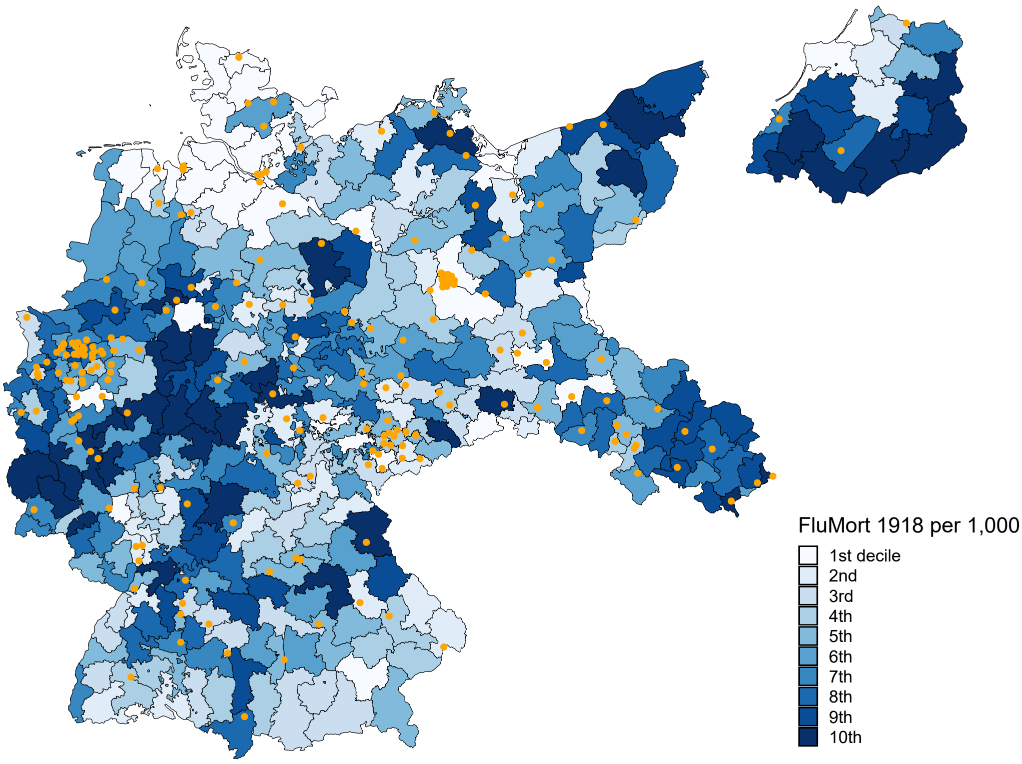


FIGURE 2 — Estimated Spanish flu mortality across constituencies

Notes: The map depicts Spanish flu mortality in 1918 across constituencies. Spanish flu mortality in 1918 is excess mortality in 1918 purged of military deaths in 1918 per 1,000 individuals in 1910. Yellow dots indicate the location of the cities included in the city-level analysis. For further details see Section IV.

V. Estimation strategy

To identify the impact of Spanish flu mortality on election results, we estimate the following difference-in-differences model:

$$Vote_{it} = \gamma_i + \tau_t + \delta(FluMort_{i1918} \times PostFlu_t) + \lambda_t(X_i' \times Year_t) + \epsilon_{it}. \quad (4)$$

$Vote_{it}$ is the vote share for a particular political camp or party group in constituency i in election year t. γ_i are constituency-fixed effects that account for time-constant heterogeneity across constituencies. τ_t are election-fixed effects that flexibly capture common trends in the election system as well as general time trends in voting patterns. $FluMort_{i1918}$ is residualized excess mortality in constituency i in year 1918 per 1,000 individuals in 1910 and as such measures mortality from the Spanish flu. $PostFlu_t$ is an indicator variable that takes the value of one for all elections in years t after 1918, and is zero otherwise. X' is a vector of time-invariant constituency specific covariates determined prior to the Spanish flu. This vector of covariates includes demographic variables such as log population in 1910, population growth from 1910 to 1917, the population share of females born before 1899, and the population share of males born 1893-1898. Further, it includes our set of war-related variables: the population share of blue-collar workers, the population share of WWI veterans, infant mortality 1917 which we use as a proxy for dismal living conditions, as well as the proximities to the Western and Eastern front. We interact this vector with election dummies $Year_t$ to allow for differential effects of the regional covariates over time. Standard errors ϵ_{it} are clustered at the constituency level to account for serial correlation within constituencies.

The coefficient δ in front of the interaction of Spanish flu mortality $FluMort_{i1918}$ and the post pandemic indicator $PostFlu_t$ yields the causal effect of Spanish flu mortality on vote shares under the assumption that, conditional on the set of controls, constituencies with higher Spanish flu mortality in 1918 would have followed the same voting trend as constituencies with lower Spanish flu mortality in absence of the Spanish flu.

To provide econometric evidence for the validity of this key identifying assumption, we estimate a dynamic difference-in-differences specification with multiple pre- and post-periods. In particular, we modify Equation 4 by interacting Spanish flu mortality in 1918 with a full set of election-fixed effects instead of a single post-pandemic indicator. This results in an event-study specification with four leads and six lags, where the last pre-pandemic election in 1912 is the reference point:

$$Vote_{it} = \gamma_i + \tau_t + \sum_{t=1893}^{1933} \delta_t (FluMort_{i1918} \times Year_t) + \lambda_t (X_i' \times Year_t) + \epsilon_{it} \qquad (5)$$

This dynamic specification allows us to investigate the voting trends across regions prior to the Spanish flu. In particular, if $\delta_t = 0$ for all pre-pandemic elections, this would provide evidence for the validity of the common trends assumption. Moreover, we can inspect how the Spanish flu effects change over time; in particular, we would like to understand whether it is transitory or permanent. In further analyses, we test the validity of our findings by accounting for linear constituency-specific pre-trends in the outcome and including excess mortality from pre-pandemic war years as additional controls.

VI. Results

VI.1. Main results

Static difference-in-differences analysis We start by estimating a stripped-down version of the static difference-in-differences model from Equation 4, where we only control for key demographic variables in addition to constituency and election fixed effects. These demographic variables include the logarithm of population density, population growth from 1910 to 1917, the population share of females born before 1899, and the population share of males born 1893-1898. Column 1 of Table 2 shows that Spanish flu mortality significantly increases the left-wing vote share. Adding the set of war-related control variables slightly reduces the size of the point estimate without changing the overall picture (see column 2 of Table 2). The positive effect of Spanish flu mortality on the left-wing vote share remains statistically highly significant and economically meaningful.

Table 2 — The impact of Spanish flu mortality on vote-shares

	Leftwing			Centre			Rightwing		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FluMort1918×PostFlu	0.014***	0.012***	0.013***	0.004	0.008	0.006	−0.019***	−0.020***	−0.018***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
Constituency FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
War-related controls	N	Y	Y	N	Y	Y	N	Y	Y
Constituency pre-trends	N	N	Y	N	N	Y	N	N	Y
Constituencies	362	362	362	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068
Mean DV	0.3	0.3	0.3	0.41	0.41	0.41	0.29	0.29	0.29
R^2	0.920	0.933	0.940	0.870	0.883	0.892	0.809	0.833	0.846

Notes: The table reports results from estimating equation 4. The dependent variables measure vote shares of the party camp indicated in the column head at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Demographic controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), and Pop. growth 1910-1917. War-related controls: % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

The coefficient of 0.012 suggests that moving from a constituency at the 25th percentile of Spanish flu mortality to a constituency at the 75th percentile of Spanish flu mortality increases the left-wing vote share by 2.4 percentage points or 8.1 percent relative to the last election prior to the Spanish flu (29.1 percent). In other words, a standard deviation increase in flu mortality is associated with an increase in the left-wing vote share by 10%. Adding linear constituency-specific pre-trends in the outcome leaves our estimates virtually unaffected (see column 3 of Table 2).[34] Columns 4–6 repeat the exercise using the centre's vote share as the outcome variable. The results point to small and insignificant increases in vote shares. Columns 7–9 use the right-wing vote share as the outcome variable. The estimates are consistently negative and significant suggesting that the increase in vote shares for left-wing parties came at the expense of right-wing parties.

The evidence on mechanisms that we discuss below point toward the idea that voters rewarded left-wing parties for their perceived competence in health issues. Hence, our analyses will examine left-wing vote shares as outcome from here but we will return to comparing vote shares of other party groups in the mechanism section.

Dynamic difference-in-differences analysis To provide prima facie evidence for the key identifying assumption that constituencies with different levels of Spanish flu mortality would have

[34] Constituency pre-trends are generated from estimating linear trends in left-wing vote shares for the period 1893–1912 and extrapolating them for the period 1919–1933.

followed similar trends in the absence of the pandemic, we present descriptive graphs in Figures B.2–B.4 in the Appendix. The figures plot the average vote shares of left-wing, center, and right-wing party camps for constituencies categorized as either above or below the median of Spanish flu mortality from 1893 to 1933. Focusing on Figure B.2, we observe that the trends in the left-wing vote shares before the Spanish flu were nearly identical in both groups, which visually supports the notion of common pre-treatment trends. After the Spanish flu, the left-wing vote share increased much more in constituencies with higher mortality rates than in those with lower mortality rates, starting immediately with the 1919 election. As a result, the initial gap between the two groups was reduced by half, and this reduced difference persisted in subsequent elections until the end of the observation period.[35]

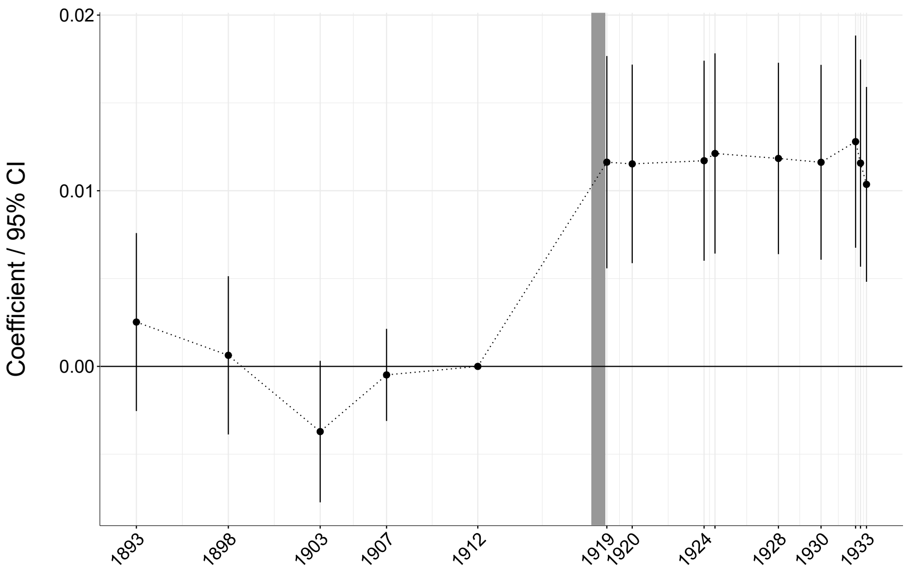


FIGURE 3 — Event study graph for left-wing vote share

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. The dependent variable measures left-wing vote shares at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with election-fixed effects. Demographic controls and war-related, controls interacted with time-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

We proceed to present results from the dynamic difference-in-differences specification of Equation 5 that allows us to more thoroughly inspect pre-treatment trends and post-treatment dynamics in Figure 3. The results confirm that there is no differential trend in left-wing vote shares across constituencies with varying levels of Flu mortality in elections from 1893 to 1912. This finding supports the validity of the difference-in-differences approach. Immediately after the Spanish flu, we observe a significant increase in the left-wing vote share that remains of similar size in subsequent elections. One possible explanation for this permanent shift could be that voters changed their perception of health from being a private matter to a public issue due to the pandemic. We also conclude from the results that the absence of pre-treatment trends

[35]To ensure the validity of our findings, we also compare constituencies below and above the 25th and 75th percentiles of the Spanish flu mortality distribution in a robustness check. The results are qualitatively similar (see Figure B.5 of the Appendix).

allows us to focus on the static model for the remainder of the empirical analysis.[36]

VI.2. Robustness checks

Spill-overs In case of spatial spill-over across constituency borders, restricting the Spanish flu effect to a constituency might yield a conservative estimate of the pandemic effect. In particular, if Spanish flu mortality in a constituency affects left-wing vote shares in neighboring constituencies, we would not capture the full extent of the Spanish flu effect. To address this issue, we add the population-weighted mean of Spanish flu mortality in adjacent constituencies as an alternative treatment variable to Equation 4. Table A.2 in the Appendix shows that a treatment effect that adjusts for spatial spill-overs predicts changes in left-wing votes better and yields stronger effects than a treatment which only considers local Flu mortality. We interpret this result as evidence for inter-constituency spill-overs and that our main results should be considered conservative estimates.

Outliers and linearity To rule out that outliers drive our results, we regress both changes in the left-wing vote share from 1912 to 1919 and Spanish flu mortality in 1918 on our full set of covariates. Figure 4 plots the residuals against each other. This boils down to a graphical depiction of the difference-in-differences approach of Equation 4 with only two time periods. The scatter plot allows us to inspect whether the positive relation between Spanish flu mortality and the left-wing vote share is observable over the entire distribution of Spanish flu mortality, or whether the positive relation is driven by specific data points at the lower or upper end of the distribution. Figure 4 shows that the positive relation between Spanish flu mortality and the left-wing vote share is indeed linear and not driven by any particular outliers.

In a related exercise, we leave out provinces one-by-one, thereby testing whether our results are driven by particular areas of Weimar Germany (see Figure B.8 in the Appendix). Finally, we also test whether the results are robust to weighing constituencies according to their 1910 or 1919 population size (see Table A.3 in the Appendix). Both tests yield findings consistent with earlier results.

VI.3. Validity checks

Below we present evidence for the validity of our Spanish flu measure using cause of death data available at the city level and consider the possibility of confounding factors related to poverty and inequality that may be picked up by Spanish flu mortality and potentially explain the observed changes in voting patterns.

VI.3.1. Controlling for excess mortality due to WWI

We investigate the relationship between excess mortality from earlier war years, i.e. from 1914 to 1917, and left-wing voting outcomes. To this end, we sequentially add interaction terms of the Post-Flu indicator and excess mortality from 1914 to 1917 as controls in Table A.4 in the

[36] In the Appendix, we provide analogous event-study graphs for the vote shares of the centre (Figure B.6) and the right-wing (Figure B.7). The results suggest that over the entire post-pandemic period, left-wing parties gain at the expense of right-wing parties while vote shares of centre parties are barely affected.

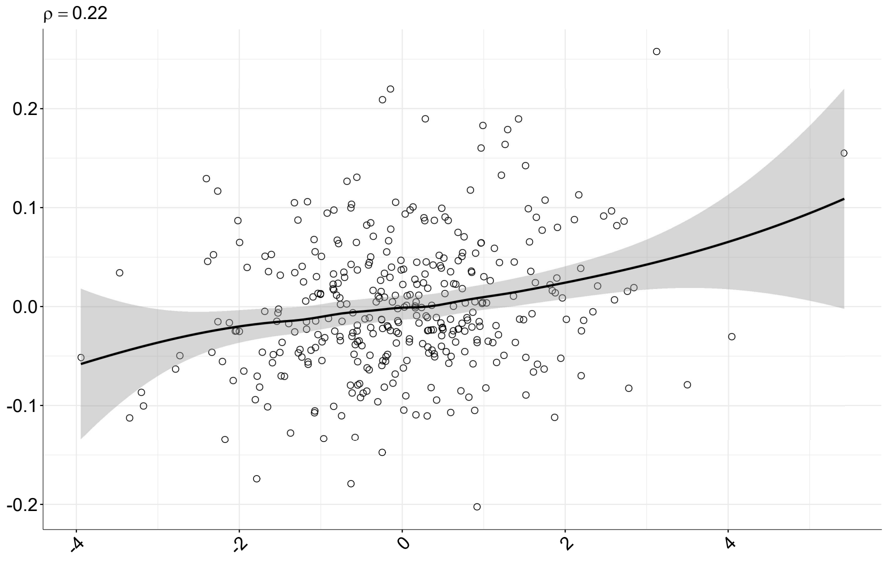


FIGURE 4 — Spanish flu mortality and Δ left-wing vote share 1912-1919

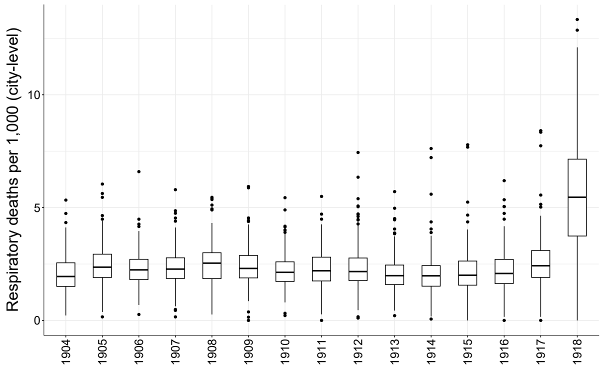
Notes: Figure shows a scatter plot of the change in left-wing votes shares between 1912 and 1919 against Spanish flu mortality across constituencies. The black line is the corresponding LOESS estimate of the residual change in left-wing votes share, drawn from a regression on demographic controls and war-related controls, and residual Spanish flu mortality. Gray area shows 95% confidence band.

Appendix. The coefficient on Spanish flu mortality remains largely unaltered due to the fact that this measure is the residual of excess mortality in 1918 from a regression on excess mortality in 1914 to 1917. Most importantly, we find that none of the excess mortality measures from 1914 to 1917 produces a similarly strong and positive correlation with the left-wing vote share as Spanish flu mortality. Rather, we find both small and positive but also small and negative coefficients for excess mortality from previous years. This suggests that we indeed pick up the effect of the Spanish flu and that this Spanish flu effect is systematically different from excess mortality effects in earlier war years. Even 1918 military deaths, i.e., 1918 excess mortality predicted by 1914–17 excess mortality as estimated in Section IV, do not correlate with changes in left-wing vote shares, as displayed in column 6. This finding provides further evidence that we indeed identify an effect of the Spanish flu that is not confounded by conditions resulting from the war.

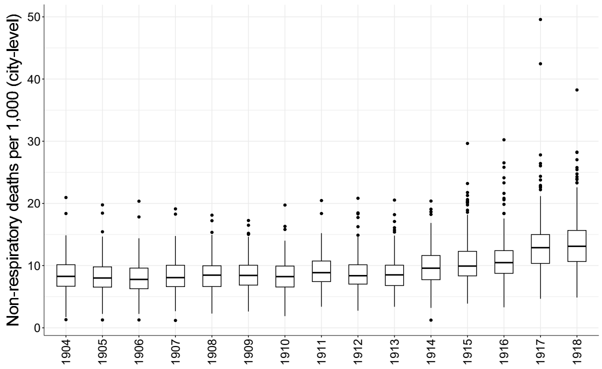
VI.3.2. Placebo checks on city-level causes of death

While we have adjusted for excess mortality caused by war deaths, it is possible that the remaining variation in excess mortality in 1918 is still driven by other factors besides the Spanish flu. Therefore, the effects observed in our study may not entirely reflect the impact of the Spanish flu, but rather the impact of other regional mortality phenomena in 1918.

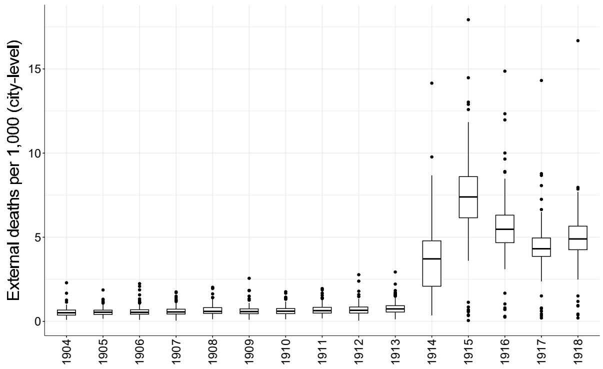
To alleviate this concern, we use data on causes of death across the 226 German cities with more than 15,000 inhabitants for placebo checks. For this purpose, we classify deaths into three categories: deaths caused by respiratory diseases, deaths caused by non-respiratory diseases, and deaths resulting from external causes. We compute annual mortality rates by calculating



A. Respiratory diseases (city-level)



B. Non-Respiratory diseases (city-level)



C. External causes (city-level)

FIGURE 5 — Box plots of cause-specific excess mortality from 1912 to 1918

Notes: The graph shows box plots of cause-specific excess mortality in 1914, 1915, 1916, 1917, and 1918. See Section III.2 for details.

the number of deaths in each category per 1,000 city inhabitants in 1910. Figure 5 shows that mortality caused by respiratory diseases, the category in which Spanish flu deaths should be recorded if they are correctly identified by physicians, is remarkably higher in 1918 than in all other years. We do not find such conspicuous changes in mortality caused by non-respiratory diseases over the years. Looking at mortality resulting from external causes, the category that includes casualties of war, we observe higher numbers during the war years from 1914 to 1918 than in previous years.

In Table 3 we show results from estimating a static difference-in-differences model similar to Equation 4 using the city-level data. In column 1, we replicate our baseline specification from Table 2 using a Spanish flu mortality rate constructed in the same way as in Section IV for the city level. Similar to the constituency-level results, we find that a one standard deviation increase in flu mortality is associated with an increase of the left-wing vote share by 10% of a standard deviation. In column 2, we find a strong and statistically highly significant positive effect of mortality from respiratory diseases in 1918 on the left-wing vote share, which is in line with a Spanish flu effect. The effect of mortality from non-respiratory diseases in 1918 (column 3) and mortality resulting from external causes in 1918 (column 4) are both small and insignificant. This pattern is reinforced if we simultaneously include all three cause-specific mortality variables as covariates in column 5: mortality from respiratory diseases drives our

Table 3 — Cause-specific mortality rates and vote shares

	Leftwing					
						Z-score
	(1)	(2)	(3)	(4)	(5)	(6)
FluMort1918	0.005***					
	(0.002)					
... - Respiratory×PostFlu		0.007***			0.007***	0.125***
		(0.002)			(0.002)	(0.045)
... - Non-Respiratory×PostFlu			−0.000		0.001	0.019
			(0.001)		(0.001)	(0.037)
... - External×PostFlu				−0.001	0.001	0.007
				(0.003)	(0.003)	(0.035)
City FE	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Cities	213	213	213	213	213	213
Observations	2,173	2,173	2,173	2,173	2,173	2,173
Mean DV	0.4	0.4	0.4	0.4	0.4	0
R^2	0.900	0.901	0.898	0.898	0.901	0.901

The table reports results from estimating equation 4. The dependent variable measures left-wing vote shares at the city level for 12 elections between 1898 and 1933. The main explanatory variable is: in column 1 predicted Spanish flu in 1918 mortality as described in Section IV; in column 2 deaths from respiratory diseases per 1,000 capita, in column 3 deaths from non-respiratory diseases per 1,000 capita, in column 4 deaths from non-respiratory diseases per 1,000 capita, each interacted with an indicator variable that is one for each election after 1918. Controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), Pop. growth 1910-1917, % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the city level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

main effect. Normalizing the three cause-specific mortality measures to a mean of zero and a standard deviation of one to make them comparable, we confirm our findings (column 6). Thus, this exercise provides further evidence that it is indeed Spanish flu mortality that caused the increase in the left-wing share.

VI.3.3. Controlling for poverty, inequality, and malnutrition

A related concern is that the impact of the Spanish flu on the left-wing vote share is confounded by pre-existing poverty and inequality. To address this concern, we show in Appendix Table A.5 that our results are robust to adding interaction terms of the Post-Flu indicator and four indicators of pre-existing poverty and inequality: the poverty rate in 1907, the infant mortality in 1914, and the household-level Gini coefficients for income and wealth in 1914 for Prussia.

Furthermore, one may be concerned that poor living conditions and malnutrition emerging during WWI confounds our estimates. The civilian population increasingly struggled with shortages of food and coal since the early stages of WWI. These conditions may lead to high Spanish flu mortality and affect people's voting decisions at the same time. As shown in the literature, in-utero exposure to malnutrition increases infant mortality (see, e.g. Hernández-Julián et al., 2014). Infants are particularly vulnerable and quickly react to changes in living conditions. We consider infant mortality a suitable proxy for poor living conditions and have thus included its 1917 value as one of our war-related controls in all regressions. However, this may not be sufficient to exclude confounding effects for two reasons. Firstly, we may not capture possible non-linearity and heterogeneity in other years. Secondly, if infant mortality is just a poorly measured proxy of what we really want to capture, we should include this variable as dependent variable instead of control variable in the regression (see Pei et al., 2019).

Figure B.9 in the Appendix shows results from the dynamic difference-in-differences specification of equation 5 using infant mortality as an outcome variable instead.[37] We do not find any economically meaningful or statistically significant correlations between Spanish flu mortality and infant mortality during pre-pandemic years. This suggests that, conditional on constituency fixed effects, regions that were strongly affected by the Spanish flu are not the same regions that experienced high infant mortality due to dismal living conditions during WWI. This finding indicates that the impact of dismal living conditions during the war does not distort the effects of the Spanish flu on the left-wing vote share in our model.

VII. Studying the Mechanisms

The results presented so far are in line with our hypothesis that the local intensity and salience of the pandemic induced voters to transfer their votes to left-wing parties based on their perceived competence handling public health issues. In this section, we provide evidence to further support our hypothesis and exclude other competing hypotheses.

VII.1. Economic mechanisms

As mentioned in the introduction, existing research suggests that the Spanish flu pandemic had economic consequences in other countries that may also work as mechanisms in our context. The Spanish flu is especially associated with changes in labor income. Given that the pandemic particularly affected the working-age population, it is conceivable that entire families became vulnerable to falling into poverty. These families, in turn, might have become inclined to support left-wing parties that promoted social policy.

We inspect this and related mechanisms using several correlates of poverty as outcome variables in our difference-in-differences approach established in equation 4.[38] Columns 1 and 2 in Table 4 show null results for changes in population size.[39] Accordingly, we interpret this finding to imply that regions more affected by the pandemic did not suffer from a significant population decline. Columns 3 and 4 show results for infant mortality. While we already documented the absence of differential trends in infant mortality before the war in Section VI, we confirm here that there is little evidence for systematic changes in infant mortality after the war that could reflect an increase in poverty due to the pandemic. Columns 5 and 6 show similar results for overall mortality.

[37]To compute infant mortality, we divide the number of deaths of infants under one year old by the number of births in the corresponding year.

[38]We also present results from event-study specifications based on equation 5 in Figures B.10–B.14 of the Appendix.

[39]In this table, even-numbered columns add pre-trends that are generated from estimating linear trends in left-wing vote shares for the period 1893–1912 and extrapolating them for the period 1919–1933 for constituencies or cities respectively.

Table 4 — The impact of Spanish flu mortality on demography and poverty

Unit	Constituencies						Cities	
	Log(population)		Infant mortality		Deaths p.c.		Share of Ind.s on welfare	Share of HHs on welfare
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FluMort1918×PostFlu	0.001	0.002	0.029*	0.015	−0.006	0.000	−0.110	0.012
	(0.005)	(0.005)	(0.017)	(0.015)	(0.014)	(0.013)	(0.083)	(0.080)
Unit FE	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Unit pre-trends	N	Y	N	Y	N	Y	N	N
Units	362	362	362	362	362	362	59	59
Observations	3,258	3,258	10,860	10,860	10,860	10,860	193	314
Mean DV	0	0	0	0	0	0	0	0
R^2	0.988	0.988	0.930	0.937	0.905	0.906	0.893	0.853

Notes: The table reports results from estimating equation 4 at the constituency level in columns 1–6 and the city level in column 7–8. Dependent and explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable in columns 1–2 is population size in logs, observed in 1895, 1900, 1905, 1910, 1916, 1917, 1919, 1925, and 1933. The dependent variable in columns 3–4 is the ratio of stillbirths and deaths below the age of one over 1,000 births in a given year, observed annually from 1904 to 1933. The dependent variable in columns 5–6 is deaths per 1,000 individuals, observed annually from 1904 to 1933. The dependent variable in column 7 is number of individuals receiving welfare payments divided by the total population in 1910, observed in the years 1910, 1911, 1912, 1926, 1927. In column 8, welfare recipients are counted at the household level and the data is additionally available for 1928 and 1929. The treatment variable in all columns is predicted Spanish flu mortality as described in Section IV, interacted with an indicator variable that is one for time period after 1918. Controls: % Veterans, Proximity to Western front, Proximity to Eastern front, % Males born 1893-1898, % Females born before 1899, Infant mortality 1917, Log(pop. density), Pop. growth 1910-1917 and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency- or city level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Columns 1–6 present outcomes that are only indirectly connected to poverty. Unfortunately, these are the only available data in the panel of constituencies used for our estimation strategy. However, we were able to collect measures specifically measuring poverty in several cross sections from the 61 largest cities in Germany before and after the war that can be used for our DiD approach. In columns 7 and 8, we observe a *decline* in the share of individuals and households receiving welfare payments in cities with higher Spanish flu mortality, although only the former is statistically significant at conventional levels. In sum, we find no evidence that regions subject to a higher Spanish flu mortality experienced worsening economic conditions that could explain changes in voting behavior.

VII.2. Politico-economic mechanisms

After excluding that purely economic changes are the main driving force behind our results, we focus on politico-economic channels in this subsection. For the purpose of this analysis, we move from inspecting outcomes for three broad party camps to six more narrow party groups that better reflect political competition but still provide sufficient consistency in comparing vote shares from before and after the inception of the Weimar Republic. The six groups consist of communist, socialist, liberal, catholic-minority, conservative, and antisemitic parties. For further details on the party classification, see Appendix D.

VII.2.1. Retrospective voting

As discussed in the introduction, existing research predominantly explains voter's responses to changes in (socio-)economic conditions with a retrospective voting mechanism. In our case voters could be punishing incumbent parties for their failed response to improve health conditions during the pandemic. To empirically test this mechanism, we run a difference-in-differences model along the lines of equation 4, but use the vote share of the local incumbent party group as outcome variable. We define the incumbent as belonging to the party group that gained the largest share of votes in the election(s) preceding the pandemic in the respective constituency. The underlying idea is that voters hold their local representative in the national parliament accountable for national policies.

TABLE 5 — The impact of Spanish flu mortality on incumbent vote shares

	Incumbent vote share					
Classification	Party groups (5)			Party groups w/o Left (4)		
Incumbent = Winner in?	1907	1912	1907–1912	1907	1912	1907–1912
	(1)	(2)	(3)	(4)	(5)	(6)
FluMort1918×PostFlu	−0.000	−0.001	0.000	−0.004	−0.000	−0.002
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Constituency FE	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Constituencies	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068
Mean DV	0.39	0.41	0.41	0.35	0.34	0.35
R^2	0.817	0.806	0.813	0.829	0.845	0.837

Notes: The table reports results from estimating equation 4 at the constituency level for 14 elections between 1893 and 1933. The dependent variables measure vote shares of the incumbent, i.e. the party group with the highest vote share in the pre-pandemic election year indicated in the column head. The treatment variable is predicted Spanish flu mortality as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Controls: % Veterans, Proximity to Western front, Proximity to Eastern front, % Males born 1893-1898, % Females born before 1899, Infant mortality 1917, Log(pop. density), Pop. growth 1910-1917 and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Table 5 shows no evidence that heterogeneity in Spanish flu intensity is associated with the punishment of incumbents. In column 1, we define the party group with the highest vote share in the 1907 elections as the incumbent. In column 2, it is the party group with the highest vote share in the 1912 elections. In column 3, it is the party group with the highest average vote share across both the 1907 and 1912 elections. For none of the three alternatives we find evidence that Spanish flu mortality decreased the vote share of the last winner. Indeed, the estimated coefficients are far from conventional significance levels. In columns 4 to 6, we account for the fact that left-wing parties may not have been considered incumbents due to their lack of involvement with the governments prior to WWI. We thus exclude them from the potential pool of incumbents and re-run the estimations from columns 1 to 3. Again, we do not find any evidence for voters punishing incumbents.

A potential explanation for the lack of evidence for a retrospective voting channel is that voters did not associate local representatives in parliament with the incumbent government. In the German Empire, the chancellor and members of his government were typically not affiliated with any of the parties and not elected by parliament.[40] Hence, voters may not have tried to punish local incumbents because they did not associate them with the government that they actually would have liked to hold accountable.

VII.2.2. Issue ownership

As also discussed in the introduction, the most plausible explanation for our main results is that voters shifted their votes in favor of parties with a reputation for addressing public health issues. In constituencies with a higher Spanish flu mortality, indicating a greater salience of public health concerns, we expect a larger shift of votes towards parties with established expertise in this domain. As summarized in Section II.4, the SPD was strongly associated with public health due to their involvement in the health insurance, while the National Liberals were also perceived as a party concerned with health issues, supported by their affiliation with the medical profession and their endorsement of the social hygiene movement.

TABLE 6 — The impact of Spanish flu mortality on party-group vote shares

	Left-wing	Com-munist	Socia-list	**Centre**	Catholic-Minority	Liberal	**Right-wing**	Conser-vative	Anti-semitic	**Turn-out**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FluMort1918×PostFlu	0.012***	−0.004**	0.016***	0.008	−0.011**	0.020***	−0.020***	−0.011**	−0.009	0.001
	(0.003)	(0.002)	(0.003)	(0.005)	(0.004)	(0.006)	(0.006)	(0.005)	(0.006)	(0.002)
Constituency FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Constituencies	362	362	362	362	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068	4,706	4,706
Mean DV	0.3	0.07	0.23	0.41	0.25	0.16	0.29	0.16	0.14	0.79
R^2	0.933	0.813	0.872	0.883	0.914	0.696	0.833	0.745	0.839	0.783

Notes: The table reports results from estimating equation 4 at the constituency level for 14 elections between 1893 and 1933. The dependent variables measure vote shares of the party group indicated in the column head. The treatment variable is predicted Spanish flu mortality as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Controls: % Veterans, Proximity to Western front, Proximity to Eastern front, % Males born 1893-1898, % Females born before 1899, Infant mortality 1917, Log(pop. density), Pop. growth 1910-1917 and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Table 6 presents the results regarding the relationship between Spanish flu mortality and changes in votes shares by decomposing the three party camps (left wing, centre, right wing) into the six party groups (communist, socialist, catholic-minority, liberal, conservative, antisemitic).

[40] The chancellors would typically build issue-by-issue coalitions, predominantly relying on votes from the Conservative and Liberal parties but also the Catholic centre party for their policies (Davis, 2000, p. 6).

The estimated coefficients show a significant increase in vote shares specifically for the socialist and liberal party groups, i.e., exactly those groups that encompass SPD and National Liberals, the parties associated with public health policies. Conversely, there is a significant decline in vote shares for the conservative and catholic-minority party groups, which include parties that lacked a demonstrated competence in public health prior to the pandemic. Given the absence of evidence for retrospective voting, we argue that issue ownership is the most plausible explanation for these findings. It is reasonable to assume that voters rewarded parties with expertise in health matters and punished those without it in the aftermath of the Spanish flu.

An alternative interpretation of the results for the socialist parties group is that health issues became more salient specifically to their potential voters, possibly due to the more open reporting on the Spanish flu by newspapers affiliated with the SPD and related institutions. However, we rule out this hypothesis in two ways. Firstly, we have included the blue-collar worker share, which reflects the voter potential of the SPD, as one of our baseline controls in the analysis. Secondly, we examine the relationship between Spanish flu mortality and voter turnout. If the pandemic activated potential voters for the SPD but did not change mobilization for other parties, we would expect an aggregate increase in turnout in regions with higher Spanish flu mortality. However, column 10 of Table 6 shows that there is no significant relationship between Spanish flu mortality and turnout.[41] Hence, we conclude that the salience of the health issues did not significantly impact voter mobilization or attract previously abstaining SPD voters to the polls.

VII.2.3. Identity politics and polarization

The additional results presented in Table 6 provide insights into the potential role of identity politics and polarization as alternative mechanisms. The findings in columns 2 and 9 show that neither communist nor antisemitic parties experienced an increase in votes in constituencies with higher Spanish flu mortality. This suggests that the results do not reflect a surge in support for extremist parties.[42]

VIII. Conclusions

The Spanish flu pandemic in Germany has received little attention in history textbooks, most likely because it coincided and was overshadowed by other major international events like the Germany's November Revolution 1918, the final weeks of WWI and the end of the German Empire. With a death toll of about 0.5% of the population in 1918, it must still have been dramatic for those who were affected. We analyze the consequences of this experience on political outcomes. Using a measure of excess mortality purged from casualties of war, we estimate the effects on vote shares in 14 elections before and after the pandemic in a difference-in-differences design. Starting with the very first elections immediately after the flu in 1919, left-wing parties saw an increase in vote shares by 2.4 percentage points when moving from a region in the 25th

[41] Figure B.15 in the Appendix confirms that there is no significant change in turnout immediately after the Spanish flu.

[42] It is worth noting that communist parties did not run for elections prior to WWI. The estimated coefficient thus implies that regions with higher Spanish flu mortality did not become more radical once the party became an option.

percentile to a region in the 75th percentile of the mortality distribution. This relative change of approximately 8% remained relatively stable until the end of the Weimar Republic and the last free elections in 1933.

Our evidence precludes the idea that changes in economic conditions related to the pandemic are responsible for the observed voting patterns. Furthermore, voters do not seem to have punished incumbents for misguided policy responses to the pandemic. Rather, voters appear to have rewarded parties they perceived as commanding sufficient competence in public health policy. Because of their historical ties with the health insurances, the SPD was clearly on the minds of voters when public health became a national issue after the end of the Spanish flu pandemic. In regions ravaged by the pandemic, the perception that health was a private matter effectively changed to a public issue.

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Appendix

This Web Appendix (not for publication) provides additional material discussed in the unpublished manuscript *The Political Effects of the 1918 influenza pandemic in Germany* by Stefan Bauernschuster, Matthias Blum, Erik Hornung, and Christoph Koenig.

Table of Contents

A. Tables

Table A.1 — Summary statistics

	Obs	Mean	Std.Dev.	Min	Max
Voting (constituency)					
% Vote Leftwing	5,068	0.30	0.16	0.00	0.82
% Vote Socialist	5,068	0.23	0.15	0.00	0.82
% Vote Communist	5,068	0.07	0.08	0.00	0.63
% Vote Centre	5,068	0.41	0.26	0.00	1.00
% Vote Catholic-Minority	5,068	0.25	0.27	0.00	1.00
% Vote Liberal	5,068	0.16	0.16	0.00	0.93
% Vote Rightwing	5,068	0.29	0.22	0.00	0.98
% Vote Conservative	5,068	0.16	0.17	0.00	0.95
% Vote Antisemite	4,706	0.14	0.18	0.00	0.79
% Turnout	4,706	0.79	0.09	0.33	0.95
% Vote Winner 1907	5,068	0.39	0.24	0.00	1.00
% Vote Winner 1912	5,068	0.41	0.22	0.00	1.00
% Vote Winner 1907-1912	5,068	0.41	0.22	0.00	1.00
% Vote Winner 1907 (w/o Left)	5,068	0.35	0.26	0.00	1.00
% Vote Winner 1912 (w/o Left)	5,068	0.34	0.26	0.00	1.00
% Vote Winner 1907-1912 (w/o Left)	5,068	0.35	0.25	0.00	1.00
Treatment (constituency)					
FluMort 1918 per 1,000	362	0.00	1.48	−3.84	5.21
FluMort 1918 per 1,000 adjacent	362	−0.07	0.99	−3.27	2.43
ExcMort 1914 per 1,000	362	3.24	1.41	−4.43	7.92
ExcMort 1915 per 1,000	362	7.01	2.02	−2.94	13.33
ExcMort 1916 per 1,000	362	6.29	1.64	−2.87	13.17
ExcMort 1917 per 1,000	362	7.72	2.08	−2.30	15.90
ExcMort 1918 per 1,000	362	12.23	2.47	−0.29	19.24
Estimated military deaths 1918 per 1,000	362	12.23	1.98	1.46	20.06
Controls (constituency)					
% Males born 1893-1898	362	0.06	0.01	0.04	0.08
% Females born before 1899	362	0.37	0.02	0.28	0.43
Log (pop. density)	362	−1.89	1.49	−3.54	5.16
Pop. growth 1910-1917	362	−0.04	0.07	−0.29	0.21
% Veterans	362	0.14	0.02	0.06	0.20
Proximity to Western front	362	−4.85	2.74	−12.75	−0.41
Proximity to Eastern front	362	−12.03	2.79	−16.21	−4.17
Infant mortality 1917	362	0.18	0.04	0.10	0.30
% Blue-collar empl.	362	0.22	0.08	0.07	0.40
Population 1910 in 1,000	362	159.73	112.88	1.33	1,319.43
Population 1919 in 1,000	362	163.55	122.84	0.61	1,492.05
% Poor 1907	362	0.00	0.00	0.00	0.02
Infant mortality 1914	362	0.19	0.05	0.09	0.35
Gini 1914 income (Prussia only)	216	0.62	0.12	0.32	0.86
Gini 1914 wealth (Prussia only)	216	0.85	0.05	0.66	0.96
Other outcomes (constituency)					
Log(population)	3,258	11.79	0.62	6.42	14.22
Infant mortality	10,860	0.16	0.05	0.03	0.40
Deaths per 1,000	10,860	12.91	3.50	2.14	30.49
Treatment (district)					
Influenza deaths 1918 per 1,000	37	3.24	0.68	1.54	4.75
FluMort 1918 per 1,000	37	0.00	1.10	−2.31	2.18
ExcMort 1914 per 1,000	37	3.18	0.78	1.81	5.36
ExcMort 1915 per 1,000	37	7.71	1.10	5.10	10.54
ExcMort 1916 per 1,000	37	6.00	1.26	3.20	10.16
ExcMort 1917 per 1,000	37	8.12	0.95	5.77	9.74
ExcMort 1918 per 1,000	37	12.80	1.25	10.17	15.37
Military deaths 1914 per 1,000	37	3.69	0.52	2.38	4.62
Military deaths 1915 per 1,000	37	7.22	0.85	5.46	8.82
Military deaths 1916 per 1,000	37	4.98	0.97	3.15	6.93
Military deaths 1917 per 1,000	37	4.60	0.62	3.75	5.89
Military deaths 1918 per 1,000	37	6.36	0.70	4.74	8.06

Notes: Observations are at the **constituency-level**. Panel and cross-sectional variables are reported according to their time-dimension. Note that % Turnout is not available for the 1919 election and % WWI deaths only for Bavaria and a few states or districts which perfectly coincide with particular constituencies.

Summary statistics (continued)

	Obs	Mean	Std.Dev.	Min	Max
Voting (city)					
% Vote Leftwing	2,173	0.40	0.14	0.00	0.84
% Vote Centre	2,173	0.38	0.21	0.00	0.99
% Vote Rightwing	2,173	0.22	0.18	0.00	0.73
Other outcomes (city)					
Mortality Respiratory per 1,000	1,875	2.60	1.62	0.00	13.34
Mortality Non-Respiratory per 1,000	1,875	10.45	4.09	1.23	49.57
Mortality External per 1,000	1,875	3.25	2.77	0.04	17.93
Share of ind.'s on welfare	193	0.04	0.03	0.00	0.15
Share of HHs on welfare	314	0.17	0.16	0.01	0.99
Treatment (city)					
FluMort 1918 per 1,000	213	−0.24	2.67	−14.98	10.01
ExcMort Respiratory 1918 per 1,000	213	3.33	2.59	−4.38	12.76
ExcMort Non-Respiratory 1918 per 1,000	213	4.13	4.20	−12.96	22.43
ExcMort External 1918 per 1,000	213	4.04	1.64	−1.80	15.72
Controls (city)					
% Males born 1893-1898	213	0.06	0.01	0.04	0.07
% Females born before 1899	213	0.37	0.03	0.28	0.43
Log (pop. density)	213	−1.30	1.35	−3.25	4.60
Pop. growth 1910-1917	213	−0.08	0.13	−0.37	0.54
% Veterans	213	0.14	0.03	0.06	0.19
Proximity to Western front	213	−4.58	2.14	−12.61	−0.97
Proximity to Eastern front	213	−12.46	2.35	−15.98	−4.39
Infant mortality 1917	213	0.17	0.05	0.05	0.40
% Blue-collar empl.	213	0.27	0.07	0.10	0.40

Notes: Observations are at the **constituency-level**. Panel and cross-sectional variables are reported according to their time-dimension. Note that % Turnout is not available for the 1919 election and % WWI deaths only for Bavaria and a few states or districts which perfectly coincide with particular constituencies.

Table A.2 — Accounting for spatial spill-overs

	Leftwing			Centre			Rightwing		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FluMort1918×PostFlu (own)	0.012***		0.004	0.008		0.019***	−0.020***		−0.023***
	(0.003)		(0.003)	(0.005)		(0.006)	(0.006)		(0.007)
FluMort1918×PostFlu (adj)		0.026***	0.022***		−0.011	−0.029***		−0.014	0.007
		(0.004)	(0.005)		(0.010)	(0.011)		(0.010)	(0.011)
Constituency FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Constituencies	362	362	362	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068
Mean DV	0.3	0.3	0.3	0.41	0.41	0.41	0.29	0.29	0.29
R^2	0.933	0.935	0.935	0.883	0.883	0.884	0.833	0.830	0.833

Notes: The table reports results from estimating equation 4. The dependent variables measure vote shares of the party camp indicated in the column head at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is population-weighted mean Spanish flu mortality in 1918 in the own and all adjacent constituencies as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Demographic controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), and Pop. growth 1910-1917. War-related controls: % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Table A.3 — Weighted regressions

	Leftwing			Centre			Rightwing		
Pop. weights	None	1910	1919	None	1910	1919	None	1910	1919
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FluMort1918×PostFlu	0.012***	0.013***	0.013***	0.008	0.004	0.004	−0.020***	−0.017***	−0.016***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Constituency FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Constituencies	362	362	362	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068	5,068
Mean DV	0.3	0.34	0.34	0.41	0.39	0.4	0.29	0.26	0.26
R^2	0.933	0.932	0.933	0.883	0.883	0.884	0.833	0.832	0.834

Notes: The table reports weighted regression results from estimating equation 4. Population weights as indicated in column heads. The dependent variables measure vote shares of the party camp indicated in the column head at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 in the own and all adjacent constituencies as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Demographic controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), and Pop. growth 1910-1917. War-related controls: % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Table A.4 — World War I mortality and vote shares

	Leftwing					
	(1)	(2)	(3)	(4)	(5)	(6)
FluMort1918×PostFlu	0.012***	0.012***	0.012***	0.012***	0.012***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ExcMort1914×PostFlu		−0.001				
		(0.002)				
ExcMort1915×PostFlu			0.003**			
			(0.002)			
ExcMort1916×PostFlu				−0.004**		
				(0.002)		
ExcMort1917×PostFlu					0.002	
					(0.002)	
Est'd Mil.Deaths 1918 per 1,000×PostFlu						0.003
						(0.002)
Constituency FE	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Constituencies	362	362	362	362	362	362
Observations	5,068	5,068	5,068	5,068	5,068	5,068
Mean DV	0.3	0.3	0.3	0.3	0.3	0.3
R^2	0.933	0.933	0.933	0.933	0.933	0.933

The table reports results from estimating equation 4. The dependent variable measures left-wing vote shares at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), Pop. growth 1910-1917, % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

Table A.5 — Conditioning on measures of poverty

	Leftwing							
Factor =	% Poor 1907		Infant mortality 1914		Gini 1914 income (Prussia)		Gini 1914 wealth (Prussia)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FluMort1918×PostFlu	0.012***	0.012***	0.012***	0.012***	0.010***	0.010***	0.013***	0.013***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Factor×PostFlu	−1.628		−0.124		0.220**		0.443***	
	(1.283)		(0.173)		(0.111)		(0.145)	
Constituency FE	Y	Y	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y	Y	Y	Y	Y
Factor×Election FE	N	Y	N	Y	N	Y	N	Y
Constituencies	362	362	362	362	216	216	216	216
Observations	5,068	5,068	5,068	5,068	3,024	3,024	3,024	3,024
Mean DV	0.3	0.3	0.3	0.3	0.29	0.29	0.29	0.29
R^2	0.933	0.933	0.933	0.933	0.930	0.931	0.931	0.931

Notes: The table reports results from estimating equation 4. The dependent variables measure vote shares of Leftwing parties at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Controls for measures of poverty as indicated in column heads are either interacted with postFlu dummy (odd-numbered columns) or with election dummies (even-numbered columns). Demographic controls: % Males born 1893-1898, % Females born before 1899, Log(pop. density), and Pop. growth 1910-1917. War-related controls: % Veterans, Proximity to Western front, Proximity to Eastern front, Infant mortality 1917, and % blue-collar employment. All controls are time invariant and interacted with election fixed effects. Standard errors, clustered at the constituency level, in parentheses: *p<0.1; **p<0.05; ***p<0.01.

B. Figures

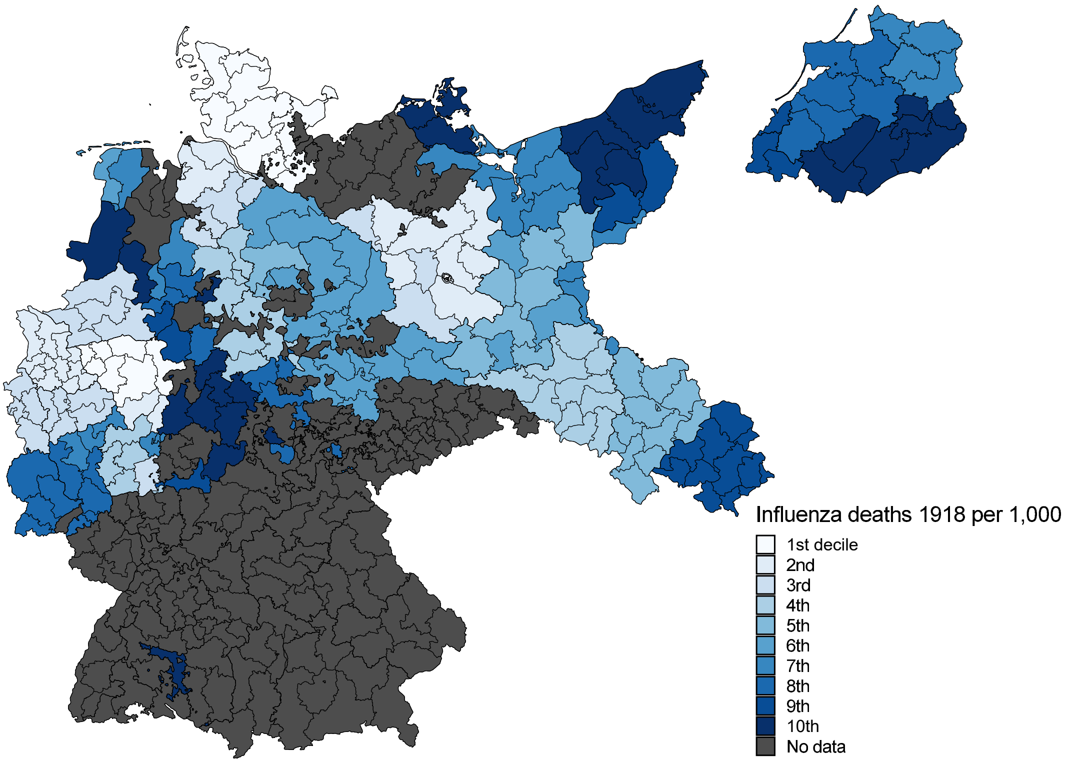

Figure B.1 — Reported Spanish flu mortality across districts

Notes: The map depicts Spanish flu mortality in 1918 as reported in administrative data by the Prussian statistical office. The map plots district-level (37 units) data on a constituency-level (216 units) map for Prussia. If a constituency consists of counties located in different districts, the population weighted mean mortality is plotted.

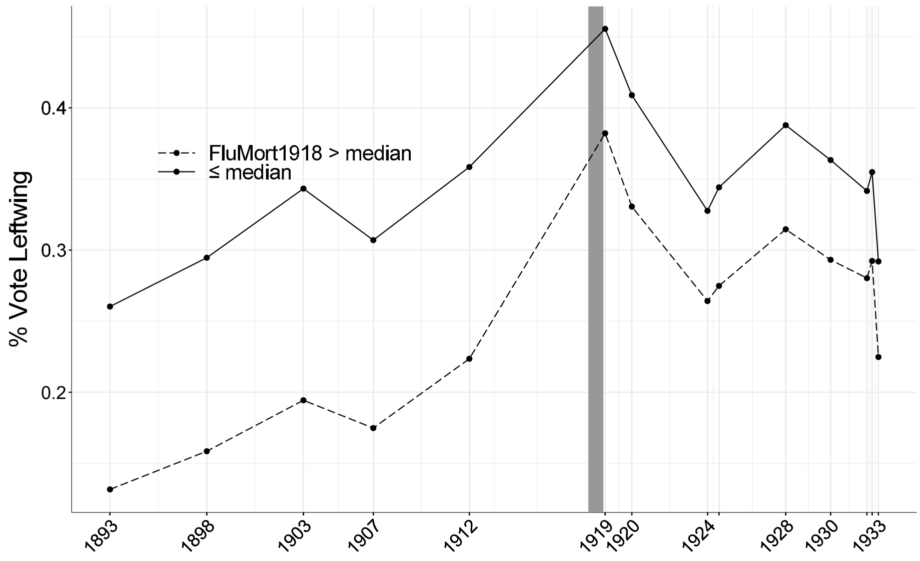

FIGURE B.2 — Left-wing vote share pre/post-flu and residualized excess mortality 1918

Notes: Plot of the mean left-wing vote share for constituencies below (solid line) and above (dashed line) the median of Spanish flu mortality in 1918 over time. The gray-shaded area marks the pandemic.

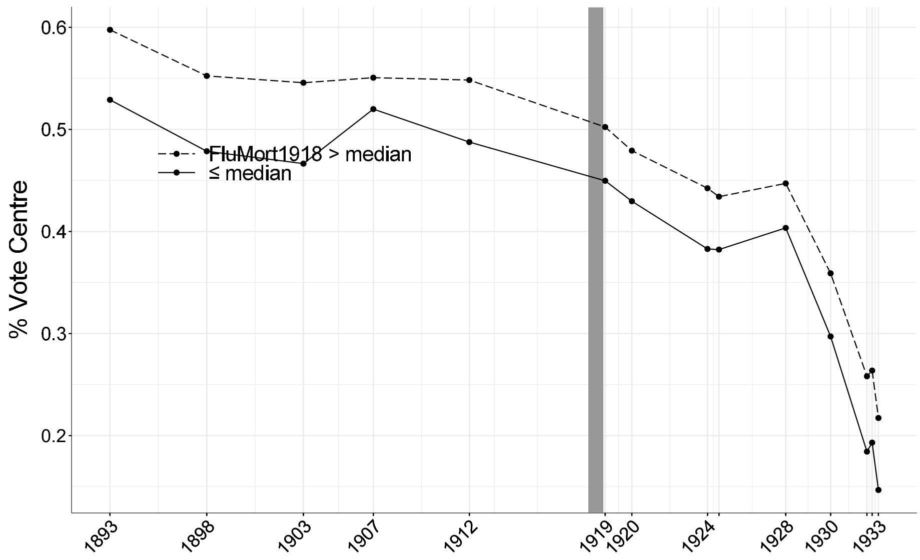

FIGURE B.3 — Centre vote share pre/post-flu and residualized excess mortality 1918

Notes: Plot of the mean centre vote share for constituencies below (solid line) and above (dashed line) the median of Spanish flu mortality in 1918 over time. The gray-shaded area marks the pandemic.

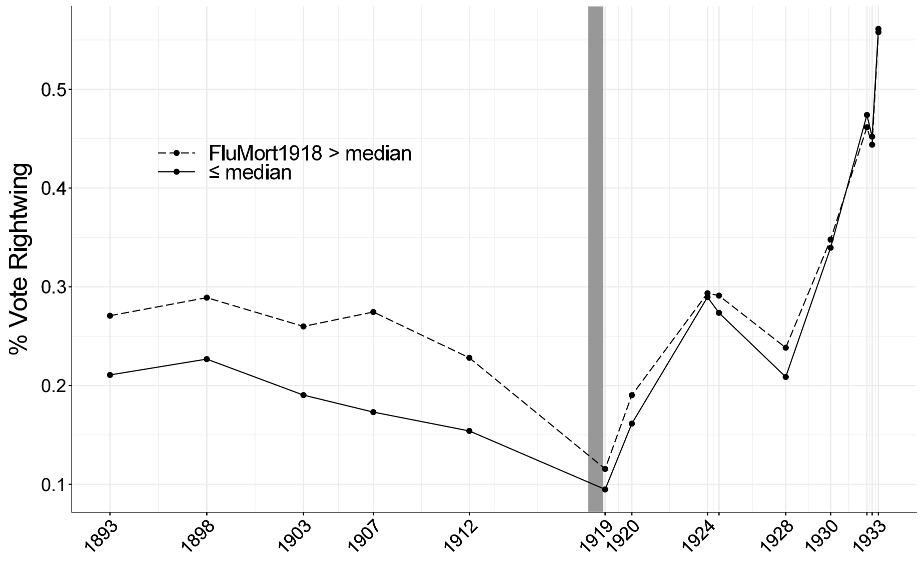

Figure B.4 — Right-wing vote share pre/post-flu and residualized excess mortality 1918

Notes: Plot of the mean right-wing vote share for constituencies below (solid line) and above (dashed line) the median of Spanish flu mortality in 1918 over time. The gray-shaded area marks the pandemic.

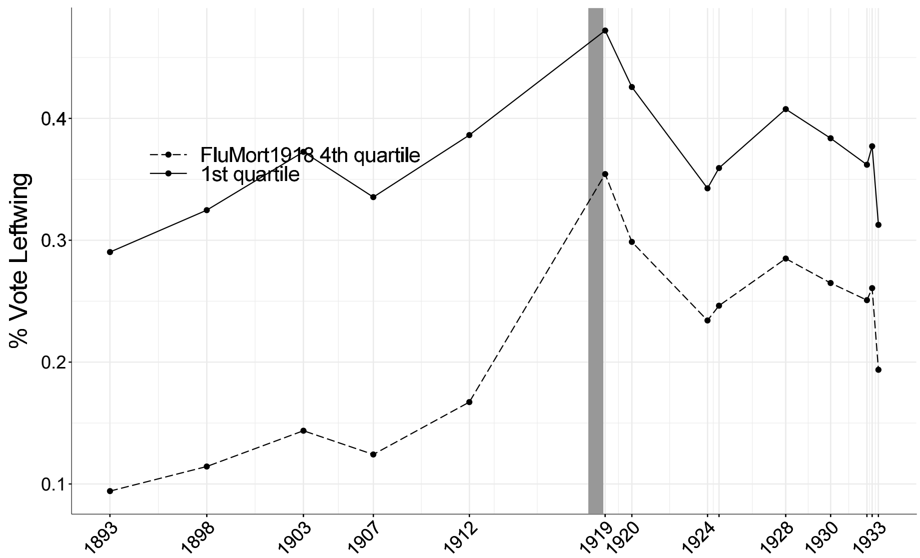

Figure B.5 — Left-wing vote share pre/post-flu and residual excess mortality 1918

Notes: Plot of the mean left-wing vote share for constituencies below the 25th percentile (solid line) and above the 75th percentile (dashed line) of Spanish flu mortality in 1918 over time. The gray-shaded area marks the pandemic.

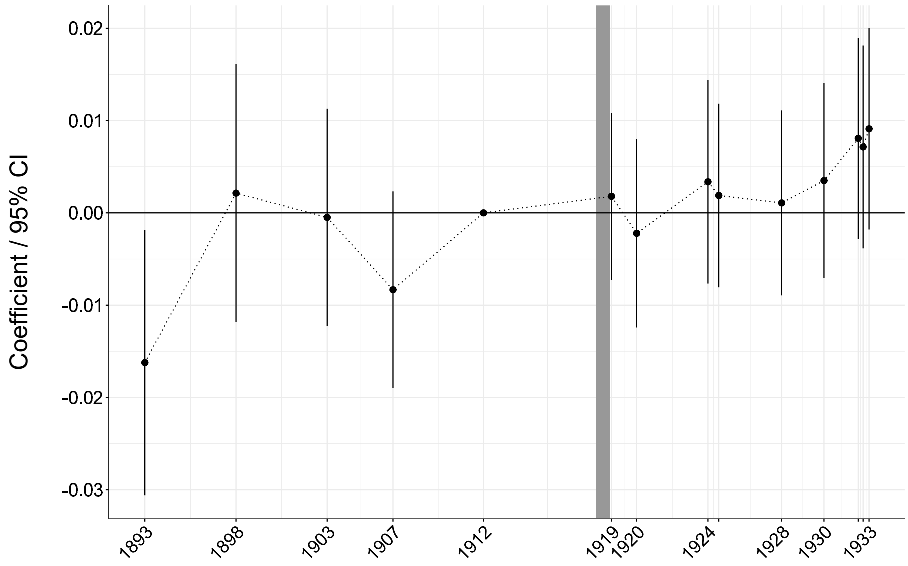

FIGURE B.6 — Event study graph for centre vote share

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. The dependent variable measures centre vote shares at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with election-fixed effects. Demographic controls and war-related controls, interacted with election-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

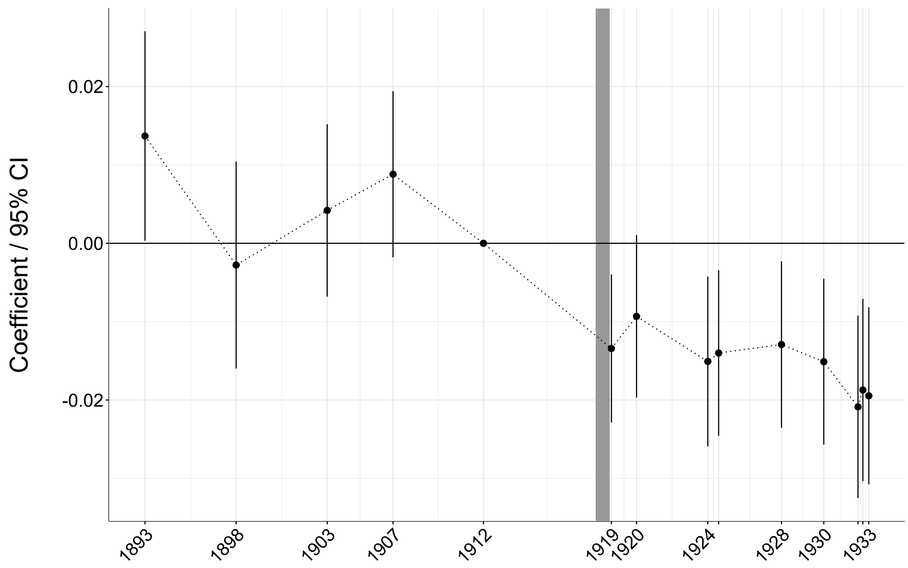

FIGURE B.7 — Event study graph for right-wing vote share

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. The dependent variable measures right-wing vote shares at the constituency level for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with election-fixed effects. Demographic controls and war-related controls, interacted with election-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

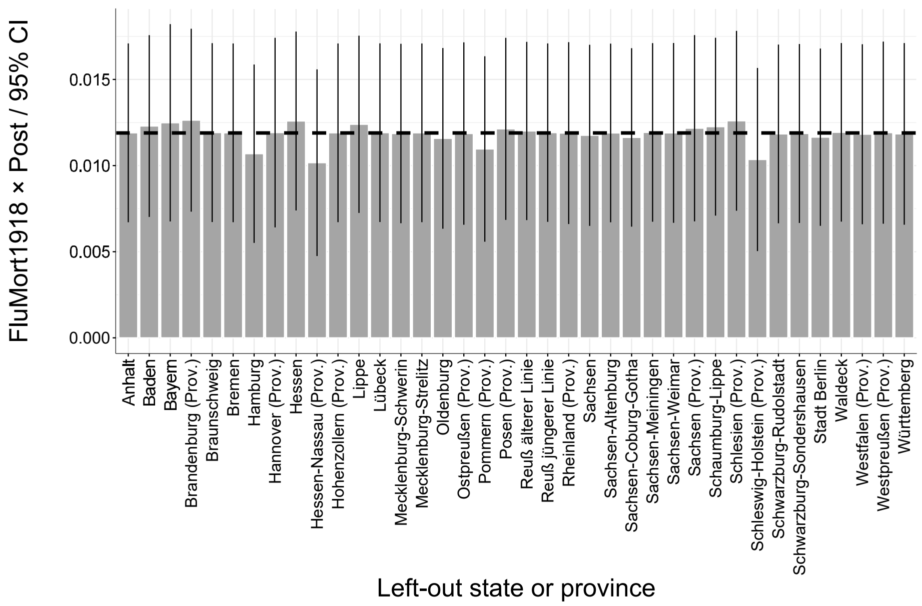

FIGURE B.8 — Leaving out provinces one-by-one

Notes: The figure reports δ coefficients from estimating equation 4 with 95% confidence intervals, dropping one province at the time from the sample. The dependent variables measure vote shares of left-wing parties for 14 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with an indicator variable that is one for each election after 1918. Demographic controls and war-related controls, interacted with election-fixed effects included. Standard errors are clustered at the constituency level.

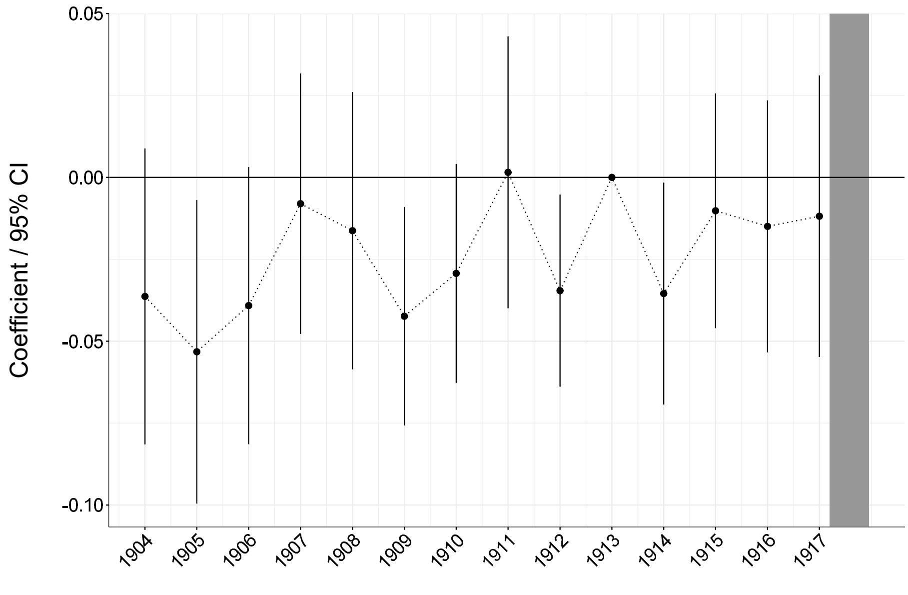

FIGURE B.9 — Spanish flu mortality and infant mortality

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is infant mortality per 1,000 births at the constituency level between 1904 and 1917. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1913. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

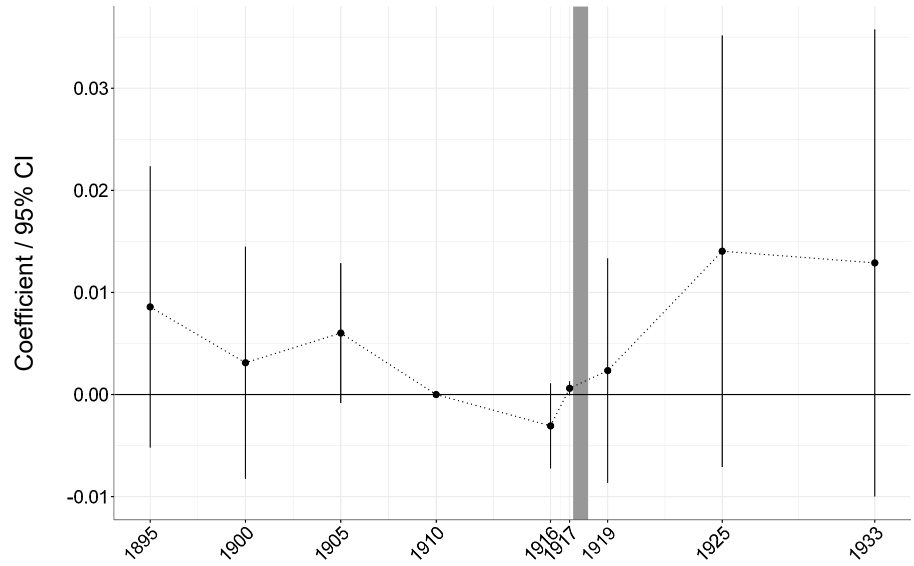

Figure B.10 — Event study graph for total population

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is log total population at the constituency level from 9 censuses between 1895 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1910. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

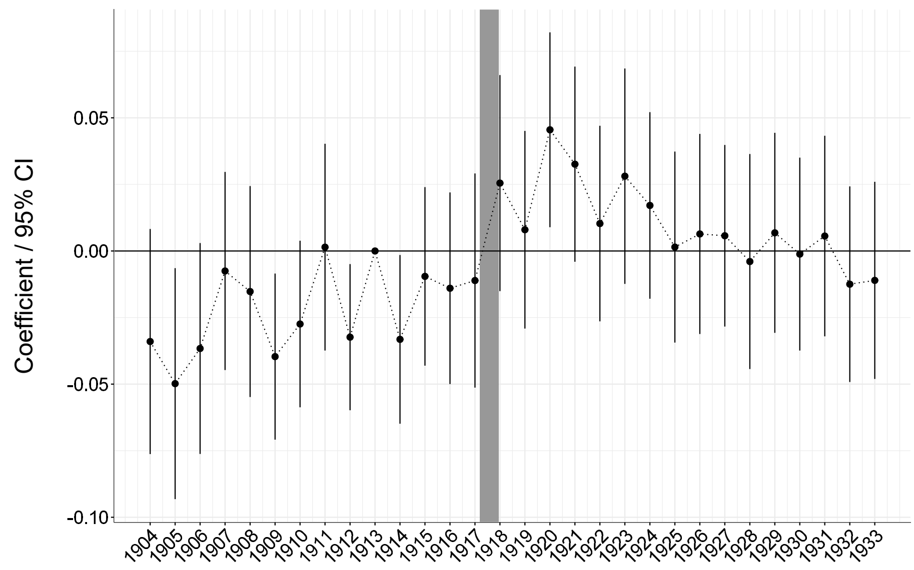

Figure B.11 — Event study graph for infant mortality

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is infant mortality per 1,000 births at the constituency level between 1904 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1913. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

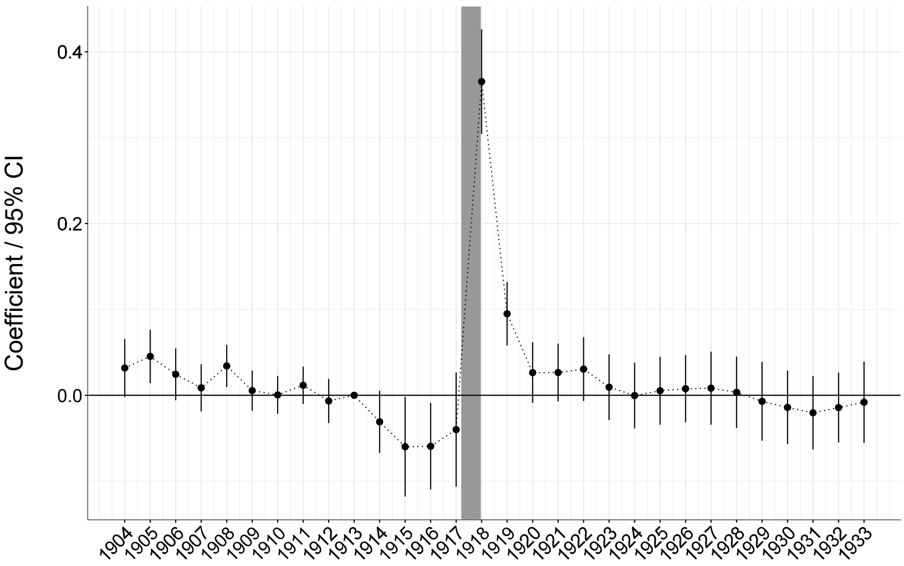

FIGURE B.12 — Event study graph for general mortality

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is all-cause mortality per 1,000 individuals at the constituency level between 1904 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 as described in Section IV, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1913. Standard errors are clustered at the constituency level. The gray-shaded area marks the pandemic.

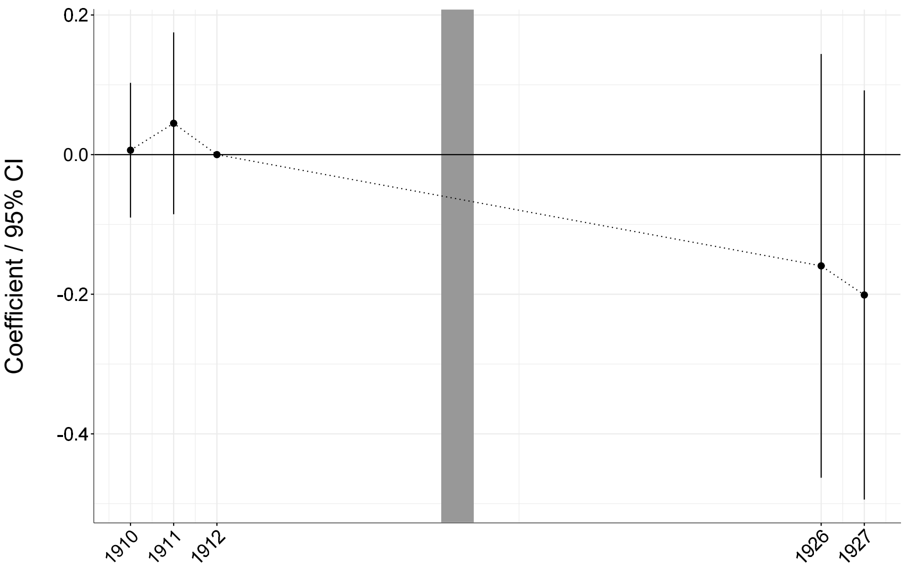

FIGURE B.13 — Event study graph for welfare recipients (individuals)

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is welfare recipients (individuals) per capita at the city level. The main explanatory variable is predicted Spanish flu mortality in 1918 at the city level as described in Section VI.3.2, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the city level. The gray-shaded area marks the pandemic.

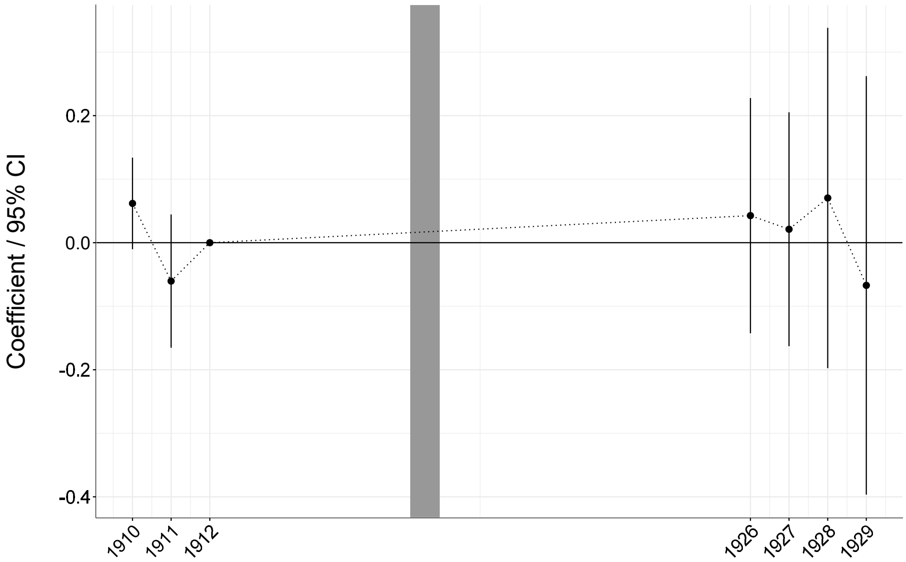

Figure B.14 — Event study graph for welfare recipients (households)

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. Dependent and main explanatory variables are standardized with mean zero and unit standard deviation. The dependent variable is welfare recipients (households) per capita at the city level. The main explanatory variable is predicted Spanish flu mortality in 1918 at the city level as described in Section VI.3.2, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the city level. The gray-shaded area marks the pandemic.

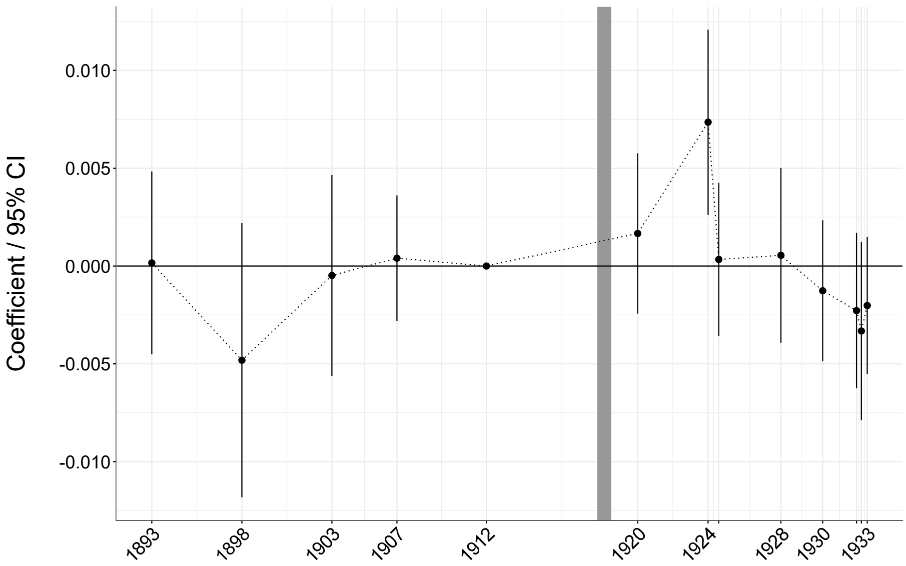

Figure B.15 — Event study graph for turnout

Notes: The figure plots δ_t coefficients estimated from equation 5 with 95% confidence intervals. The dependent variable measures turnout at the constituency level for 13 elections between 1893 and 1933. The main explanatory variable is predicted Spanish flu mortality in 1918 at the city level as described in Section VI.3.2, interacted with year-fixed effects. Demographic controls and war-related controls, interacted with time-fixed effects included. The omitted reference year is 1912. Standard errors are clustered at the city level. The gray-shaded area marks the pandemic.

C. Data sources

Election data

Parliamentary elections Information on election results comes from three sources. For the period of the German Empire 1871 to 1912, we rely on ICPSR (1991) which reports election results already at the constituency-level. Data on the 1919 election is reported at the same level and taken from Statistisches Reichsamt (1919). For elections 1920 until 1933, we used county-level results in the dataset compiled by Falter and Hänisch (1990).

Parliamentary elections (city-level) Election results for cities above 10,000 inhabitants was released for the last four parliamentary elections 1898 (Kaiserliches Statistisches Amt, 1899), 1903 (Kaiserliches Statistisches Amt, 1904), 1907 (Kaiserliches Statistisches Amt, 1907) and 1912 (Kaiserliches Statistisches Amt, 1913a). For elections 1920 until 1933, we used municipality-level results in the dataset compiled by Falter and Hänisch (1990).

Vote shares Individual parties or candidates are classified into party groups as presented in Table D.1. Votes are then aggregated for each party group by election and constituency or city, respectively. Vote shares (incl. those for referenda) are calculated by dividing votes through the number of valid votes.

Turnout Turnout is calculated by dividing the sum of valid and invalid votes by the number of eligible voters. Size of electorate and invalid votes were not reported in 1919 which prohibits calculating turnout for this election.

New male voters Formed as the sum of the male cohorts born 1893-1898 in the 1910 census described below.

New female voters Formed as the sum of the female cohorts born before 1899 in the 1910 census described below.

Population data

Census 1895 Reported in Kaiserliches Statistisches Amt (1897). Data used: Total population counts.

Census 1900 Reported in Kaiserliches Statistisches Amt (1903). Data used: Total population counts.

Census 1905 Reported in Kaiserliches Statistisches Amt (1907). Data used: Total population counts.

Census 1910 Reported in Kaiserliches Statistisches Amt (1915). Data used: Number of women and men by age cohorts <1893, 1893-1894, 1895-1896, 1897-1898, >1898. Number of Catholics, Protestants and military personnel.

Census 1910 (city-level) Reported in Volkswirtschaftliche Abteilung des Kriegsernährungsamtes (1917a). Data used: Total population counts.

Census 1916 Reported in Volkswirtschaftliche Abteilung des Kriegsernährungsamtes (1917b). Data used: Total population counts.

Census 1916 (city-level) Reported in Reichsgesundheitsamt (1919). Data used: Total population counts.

Census 1917 Reported in Statistisches Reichsamt (1918). Data used: Total population counts, foreign prisoners of war, domestic military personnel.

Census 1917 (city-level) Reported in Reichsgesundheitsamt (1919). Data used: Total population counts.

Census 1919 Reported in Statistisches Reichsamt (1920). Data used: Total population counts.

Census 1925 Reported in Falter and Hänisch (1990). Data used: Total population counts.

Census 1933 Reported in Falter and Hänisch (1990). Data used: Total population counts.

Normalization All data are aggregated at the constituency-level, if not stated otherwise, and normalized by the 1910 population.

District-level vitality data

Influenza deaths (Prussia) Reported in Preußisches Statistisches Landesamt (1921). Data used: Number of influenza deaths in 1918.

Military deaths 1914-1919 (Prussia) Reported in Preußisches Statistisches Landesamt (1922). Data used: Number of killed soldiers in WWI for each year 1914 to 1919.

Normalization All data are normalized by the 1910 population.

County-level vitality data

Vital statistics 1904-1906 Reported in Kaiserliches Statistisches Amt (1909). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.

Vital statistics 1907 Reported in Kaiserliches Statistisches Amt (1910). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1908 Reported in Kaiserliches Statistisches Amt (1911). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1909 Reported in Kaiserliches Statistisches Amt (1913b). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1910 Reported in Kaiserliches Statistisches Amt (1913c). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1911 Reported in Kaiserliches Statistisches Amt (1916). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1912-1913 Reported in Statistisches Reichsamt (1918). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1914-1919 Reported in Statistisches Reichsamt (1922). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1920-1921 Reported in Statistisches Reichsamt (1924). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1922-1923 Reported in Statistisches Reichsamt (1926). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1924-1927 Reported in Statistisches Reichsamt (1930). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1928 Reported in Statistisches Reichsamt (1931). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1929-1930 Reported in Statistisches Reichsamt (1933). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1931 Reported in Statistisches Reichsamt (1934). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Vital statistics 1932-1933 Reported in Statistisches Reichsamt (1938). Data used: Number of live births, stillbirths, total deaths and deaths below age 1.
Normalization All data are aggregated at the constituency-level and normalized by the 1910 population.

City-level data

Vital statistics 1904 Reported in Kaiserliches Gesundheitsamt (1905). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1905 Reported in Kaiserliches Gesundheitsamt (1906). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1906 Reported in Kaiserliches Gesundheitsamt (1907). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1907 Reported in Kaiserliches Gesundheitsamt (1908). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1908 Reported in Kaiserliches Gesundheitsamt (1909). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1909 Reported in Kaiserliches Gesundheitsamt (1910). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1910 Reported in Kaiserliches Gesundheitsamt (1911). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1911 Reported in Kaiserliches Gesundheitsamt (1912). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1912 Reported in Kaiserliches Gesundheitsamt (1913). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1913 Reported in Kaiserliches Gesundheitsamt (1914). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause.
Vital statistics 1914-1918 Reported in Reichsgesundheitsamt (1919). Data used: Number of live births, stillbirths, deaths below age 1 and deaths by cause, gender and military status.
Welfare recipients 1910 Reported in Landsberg (1913). Data used: Number of households and individuals receiving continuous financial support.
Welfare recipients 1911 Reported in Landsberg (1914). Data used: Number of households and individuals receiving continuous financial support.

Welfare recipients 1912 Reported in Landsberg (1916). Data used: Number of households and individuals receiving continuous financial support.

Welfare recipients 1926 Reported in Helbling (1927). Data used: Number of households and individuals receiving continuous financial support.

Welfare recipients 1927 Reported in Helbling (1928). Data used: Number of households and individuals receiving continuous financial support.

Welfare recipients 1928 Reported in Helbling (1930). Data used: Number of households receiving continuous financial support.

Welfare recipients 1929 Reported in Helbling (1931). Data used: Number of households receiving continuous financial support.

Normalization All data are normalized by the 1910 population or number of households, respectively.

Occupation data

Source All data comes from the occupational census 1907 reported in Kaiserliches Statistisches Amt (1910).

Agricultural Number of women and men with primary occupation in agriculture (codes A1-A6) and their dependants.

Working class Number of women and men with primary occupation in mining and manufacturing (codes B1-B166) and their dependants.

Health Number of women and men with primary occupation in health sector (code E5).

Normalization All data are aggregated at the constituency-level and normalized by the 1907 population reported in this source.

Other data

Proximity to frontlines We obtained and geocoded maps of exact frontline locations around the pandemic onset provided in Stamps and Esposito (1950) from the website `www.firstworldwar.com`. The exact dates are August 30th 1918 for the Western front, March 3rd (Treaty of Brest-Litovsk) for the Eastern front, June 15th for the Souther (Italian) front and September 14th for the Balkan front. Based on the geocoded maps, we calculated the distance of each city or constituency centroid to the nearest point on each of the four frontlines.

Proximity to garrisons Pre-WWI locations of all garrisons within the German Empire are reported in the map provided by Ruhl (1914). We assigned each location a longitude-latitude coordinate and calculated the distance of each city or constituency centroid to the nearest listed garrison.

WWI casualties Taken from Verein für Computergenealogie (2014). Only records with longitude-latitude coordinates of the casualty's birthplace are kept. Using constituency-shapefiles, each record can be assigned to a constituency and aggregated up to that level. Coordinates were corrected by the author for the cities of Berlin, Hamburg and Breslau. For large cities containing several constituencies but only a unique casualty coordinate (Berlin, Breslau, Dresden, Hamburg, Munich), casualty counts are distributed proportionately according to the 1910 population split.

Normalization All data are aggregated at the constituency-level, if not stated otherwise, and normalized by the 1910 population.

D. Party classification

Table D.1 — Party coding

Election/Party group	Party names (English)	Party names (German)
1893-06-15		
Communist	*Not running*	*Not running*
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Poles; Other parties; Unaffiliated candidates; Splinter parties	Zentrum; Polen; Andere Parteien; Unbestimmt; Zersplittert
Liberal	National-Liberals; South German People's Party; Free-thinking People's Party; Free Thinkers' Union	Nationalliberale Partei; Süddeutsche Volkspartei; Freisinnige Volkspartei; Freisinnige Vereinigung
Conservative	German Conservatives; German Empire Party	Deutschkonservative Partei; Deutsche Reichspartei
Antisemitic	German Reform Party and Antisemites	Deutsche Reformpartei und Antisemiten
1898-06-16		
Communist	*Not running*	*Not running*
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Poles; Other parties; Unaffiliated candidates; Splinter parties	Zentrum; Polen; Andere Parteien; Unbestimmt; Zersplittert
Liberal	National-Liberals; German People's Party; Free-thinking People's Party; Free Thinkers' Union	Nationalliberale Partei; Deutsche Volkspartei; Freisinnige Volkspartei; Freisinnige Vereinigung
Conservative	German Conservatives; German Empire Party	Deutschkonservative Partei; Deutsche Reichspartei
Antisemitic	Antisemites; Farmers Union; Peasants Union	Antisemiten; Bund der Landwirte; Bauernbund
1903-06-16		
Communist	*Not running*	*Not running*
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Poles; Other parties; Unaffiliated candidates; Splinter parties	Zentrum; Polen; Andere Parteien; Unbestimmt; Zersplittert
Liberal	National-Liberals; German People's Party; Free-thinking People's Party; Free Thinkers' Union	Nationalliberale Partei; Deutsche Volkspartei; Freisinnige Volkspartei; Freisinnige Vereinigung
Conservative	German Conservatives; German Empire Party	Deutschkonservative Partei; Deutsche Reichspartei
Antisemitic	Antisemites; Farmers Union; Peasants Union	Antisemiten; Bund der Landwirte; Bauernbund
1907-01-25		
Communist	*Not running*	*Not running*
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Poles; Other parties; Unaffiliated candidates; Splinter parties	Zentrum; Polen; Andere Parteien; Unbestimmt; Zersplittert
Liberal	National-Liberals; German People's Party; Free-thinking People's Party; Free Thinkers' Union	Nationalliberale Partei; Deutsche Volkspartei; Freisinnige Volkspartei; Freisinnige Vereinigung
Conservative	German Conservatives; German Empire Party	Deutschkonservative Partei; Deutsche Reichspartei
Antisemitic	Federation of Farmers and Economic Union; German Reform Party, Antisemites and German Social Party	Bund der Landwirte und Wirtschaftliche Vereiningung; Deutsche Reformpartei, Antisemiten und Deutschsoziale Partei

Table D.1: Party coding (continued)

1912-01-12		
Communist	*Not running*	*Not running*
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Poles; Other parties; Unaffiliated candidates; Splinter parties	Zentrum; Polen; Andere Parteien; Unbestimmt; Zersplittert
Liberal	National-Liberals; Progressive People's Party	Nationalliberale Partei; Fortschrittliche Volkspartei
Conservative	German Conservatives; German Empire Party	Deutschkonservative Partei; Deutsche Reichspartei
Antisemitic	German Reform Party; Economic Union	Deutsche Reformpartei; Wirtschaftliche Vereiningung
1919-01-19		
Communist	Independent Social Democratic Party	Unabhängige Sozialdemokratische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Other parties	Zentrum; Andere Parteien
Liberal	German People's Party; German Democratic Party	Deutsche Volkspartei; Deutsche Demokratische Partei
Conservative	German National People's Party	Deutschnationale Volkspartei
Antisemitic	*Not running*	*Not running*
1920-06-06		
Communist	Communist Party of Germany; Independent Social Democratic Party	Kommunistische Partei Deutschlands; Unabhängige Sozialdemokratische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Bavarian People's Party; Bavarian Peasants' League; Polish Catholic Party of Upper Silesia, Lusatian People's Party and National Democratic People's Party; Other parties	Zentrum; Bayrische Volkspartei; Bayerischer Bauernbund; Polnisch-Katholische Partei Oberschlesiens, Lausitzer Volkspartei und Nationaldemokratische Volkspartei; Andere Parteien
Liberal	German People's Party; German Democratic Party	Deutsche Volkspartei; Deutsche Demokratische Partei
Conservative	German National People's Party	Deutschnationale Volkspartei
Antisemitic	German Middle Class Party	Deutsche Mittelstandspartei
1924-05-04		
Communist	Communist Party of Germany; Independent Social Democratic Party	Kommunistische Partei Deutschlands; Unabhängige Sozialdemokratische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Bavarian People's Party; Economic Party of the German Middle Class; Other parties	Zentrum; Bayrische Volkspartei; Wirtschaftspartei des deutschen Mittelstandes; Andere Parteien
Liberal	German People's Party; German Democratic Party	Deutsche Volkspartei; Deutsche Demokratische Partei
Conservative	German National People's Party	Deutschnationale Volkspartei
Antisemitic	German Social Party; German Völkisch Freedom Party	Deutschsoziale Partei; Deutschvölkische Freiheits-Partei

Table D.1: Party coding (continued)

1924-12-07		
Communist	Communist Party of Germany; Independent Social Democratic Party	Kommunistische Partei Deutschlands; Unabhängige Sozialdemokratische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party; Bavarian People's Party; Economic Party of the German Middle Class; Other parties	Zentrum; Bayrische Volkspartei; Wirtschaftspartei des deutschen Mittelstandes; Andere Parteien
Liberal	German People's Party; German Democratic Party	Deutsche Volkspartei; Deutsche Demokratische Partei
Conservative	German National People's Party	Deutschnationale Volkspartei
Antisemitic	German Social Party; National Socialist Freedom Movement	Deutschsoziale Partei; Nationalsozialistische Freiheitsbewegung
1928-05-20		
Communist	Communist Party of Germany	Kommunistische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party and Bavarian People's Party; German Farmers' Party; Reich Party of the German Middle Class; Reich Party for Civil Rights and Deflation; Other parties	Zentrum und Bayrische Volkspartei; Deutsche Bauernpartei; Wirtschaftspartei; Volksrechtpartei; Andere Parteien
Liberal	German People's Party; German Democratic Party	Deutsche Volkspartei; Deutsche Demokratische Partei
Conservative	German National People's Party; Christian-National Peasants' and Farmers' Party	Deutschnationale Volkspartei; Christlichnationale Bauern- und Landvolkpartei
Antisemitic	National Socialist German Workers' Party	Nationalsozialistische Deutsche Arbeiterpartei
1930-09-14		
Communist	Communist Party of Germany	Kommunistische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party and Bavarian People's Party; Reich Party of the German Middle Class; Other parties	Zentrum und Bayrische Volkspartei; Wirtschaftspartei; Andere Parteien
Liberal	German People's Party; German State Party	Deutsche Volkspartei; Deutsche Staatspartei
Conservative	German National People's Party; Christian-National Peasants' and Farmers' Party; Christian Social People's Service; Conservative People's Party	Deutschnationale Volkspartei; Christlichnationale Bauern- und Landvolkpartei; Christlich-Sozialer Volksdienst; Konservative Volkspartei
Antisemitic	National Socialist German Workers' Party	Nationalsozialistische Deutsche Arbeiterpartei
1932-07-31		
Communist	Communist Party of Germany	Kommunistische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party and Bavarian People's Party; Reich Party of the German Middle Class; Other parties	Zentrum und Bayrische Volkspartei; Wirtschaftspartei; Andere Parteien
Liberal	German People's Party; German State Party	Deutsche Volkspartei; Deutsche Staatspartei
Conservative	German National People's Party; Christian-National Peasants' and Farmers' Party; Christian Social People's Service	Deutschnationale Volkspartei; Christlichnationale Bauern- und Landvolkpartei; Christlich-Sozialer Volksdienst
Antisemitic	National Socialist German Workers' Party	Nationalsozialistische Deutsche Arbeiterpartei

Table D.1: Party coding (continued)

1932-11-06		
Communist	Communist Party of Germany	Kommunistische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party and Bavarian People's Party; German Farmers' Party; Reich Party of the German Middle Class; Other parties	Zentrum und Bayrische Volkspartei; Deutsche Bauernpartei; Wirtschaftspartei; Andere Parteien
Liberal	German People's Party; German State Party	Deutsche Volkspartei; Deutsche Staatspartei
Conservative	German National People's Party; Christian Social People's Service	Deutschnationale Volkspartei; Christlich-Sozialer Volksdienst
Antisemitic	National Socialist German Workers' Party	Nationalsozialistische Deutsche Arbeiterpartei
1933-03-05		
Communist	Communist Party of Germany	Kommunistische Partei Deutschlands
Socialist	Social Democratic Party	Sozialdemokratische Partei Deutschlands
Catholic-Minority	Centre Party and Bavarian People's Party; German Farmers' Party; German-Hanoverian Party; Other parties	Zentrum und Bayrische Volkspartei; Deutsche Bauernpartei; Deutsch-Hannoversche Partei; Andere Parteien
Liberal	German People's Party; German State Party	Deutsche Volkspartei; Deutsche Staatspartei
Conservative	Black-White-Red Struggle Front; Christian Social People's Service	Kampffront Schwarz-Weiß-Rot; Christlich-Sozialer Volksdienst
Antisemitic	National Socialist German Workers' Party	Nationalsozialistische Deutsche Arbeiterpartei

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