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ABSTRACT

Radio and the Rise of Nazis in Prewar Germany*

How far can the media undermine democratic institutions, and how persuasive can media be in ensuring public support for a dictator's policies? We study this question in the context of Germany between 1929 and 1939. Using quasi-random geographical variation in radio availability, we show that radio had a significant negative effect on the Nazi vote share between 1930 and 1933, when political news had an anti-Nazi slant. In 1933, this negative effect was fully undone in just one month, after the Nazis seized control of the radio and initiated pro-Nazi radio propaganda campaign. Radio also helped the Nazis to enroll new party members and encouraged denunciations of Jews and other open expressions of anti-Semitism after the Nazis fully consolidated power. Nazi radio propaganda was most effective when combined with other propaganda tools, such as Hitler's speeches, and when the message was aligned with listeners' prior beliefs as measured by historical anti-Semitism.

JEL Classification: D7
Keywords: anti-Semitism, dictatorship, media, Nazis, propaganda and unconsolidated democracy

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1. Introduction

Dictators often come to power through a democratic process. When this happens, which essential institutional elements of a consolidated democracy are missing? How do future dictators persuade voters to support them, and how do they maintain popularity during and after consolidation of power? We show that whether future dictators gain control over mass media plays a key role in answering these questions.

The most prominent example of a collapse of democracy without a military coup was the rise of the Third Reich in Germany in the 1930s, which resulted in one of the largest catastrophes in the history of mankind. Did control over mass media help to establish and maintain Adolf Hitler's dictatorial rule? Historians have not reached consensus on this question. Some provide case-study evidence supporting this view (e.g., Shirer 1960 and Somerville 2012).

The Nazis themselves strongly believed in media power. The future Reich minister of propaganda, Joseph Goebbels, noted in his diary right after Hitler was appointed chancellor of Germany and one month before the last democratic election of Weimar Republic: "*Now it will be easy to carry on the fight, for we can call on all the resources of the State. Radio and press are at our disposal. We shall stage a masterpiece of propaganda*" (quoted in Shirer 1960). Later on, during the radio exhibition in Berlin in August 1933, he claimed, *"It would not have been possible for us to take power or to use it in the ways we have without the radio…"*[1] Other historians (e.g., Zimmermann 2006) suggest that propaganda was a lot less effective than Goebbels had claimed.[2] Prior to this paper, there was no systematic empirical analysis of the impact of mass media on political support for Nazis during the collapse of the Weimar Republic and the rise of the Third Reich. Our aim is to fill this gap and shed light on the role of control over mass media for undermining institutions in an unconsolidated democracy and for assuring public support for a dictator's policies.

[1] The full text of the speech in English can be found at http://www.calvin.edu/academic/cas/gpa/goeb56.htm.
[2] For example, Zimmermann (2006) wrote, "However, Goebbels's insistent claims regarding the power of his own propaganda, together with the characteristic methods he used, have misled later generations of historians into believing, likewise, that the propaganda was effective, and into placing primary emphasis on the media as a system of persuasion—a misconception which persists today."

We use detailed geographic variation in radio signal availability combined with the fact that the content of the broadcast changed twice, from having only educational and cultural programs during 1928 to having some political news with a slant against Nazi Party between 1929 and 1932 to heavy pro-Nazi propaganda in 1933. First, we are interested in how this shift in content influenced political support for the Nazi Party, which was gaining popularity during this period. These dynamic effects can be estimated because the government of the Weimar Republic was extremely unstable and, as a result, five parliamentary elections took place between 1928 and 1933. (These elections were held on May 1928, September 1930, July 1932, November 1932, and March 1933.) We predict the strength of radio signal at the time of each of these elections in every locality by combining information on the exact location and the power of radio transmitters with ITM engineering software (Irregular Terrain Model, Hufford, 2002, Olken, 2009). We verify that the signal appears to be idiosyncratic after controlling for a few demographic characteristics (such as flexible polynomial of population), some preexisting political preferences as of 1924 (i.e., before radio expansion), and province fixed effects.

We find no effect of radio availability on voting outcomes in 1928, when radio broadcast content was not yet political. Triggered by the referendum to renounce the Treaty of Versailles initiated by the German nationalists including the Nazi Party (NSDAP)[3] in 1929, the incumbent government altered the mix of programming to include political news slanted against the Nazis. As a result of the change in content, from 1929 to 1932, radio had a significant negative effect on both the referendum vote against the Treaty of Versailles (which was supported by the Nazis) and the share of votes received by the Nazi Party. We also find a significant effect of radio signal on the results of both rounds of presidential election in March and April 1932, which Hitler lost to Paul von Hindenburg: radio had a negative effect on Hitler's vote share and a positive effect on the share of votes cast for von Hindenburg. Broadcast content took another sharp turn after Hitler was named chancellor of Germany and gained complete control over radio, among other executive powers, in January 1933. As a result and in contrast to the effect of radio prior to 1933, in the March elections that year, regions with stronger signal cast a significantly larger share of votes for the Nazi Party,

[3] NSDAP stands for *Nationalsozialistische Deutsche Arbeiterpartei,* the National Socialist German Workers' Party. It was founded in 1920 and dissolved in 1945.

controlling for the Nazi vote share in the previous elections, which took place only five months before. At the same time, without conditioning on previous elections, radio signal stopped being a significant predictor of Nazi vote share in March 1933. This means that in one month, Nazi radio propaganda was able to fully undo the negative effect of the anti-Nazi messages broadcast in the previous three years but did not manage in this month to mobilize more voters than those who were previously persuaded not to vote for the Nazi Party. We calculate persuasion rates for both pro- and anti-Nazi messages and find that in the last few months that Germany remained a democracy, the persuasion power of pro-Nazi propaganda was smaller than that of the anti-Nazi radio broadcasts for the previous three years.

The 1920s and 1930s were a time of rapid expansion of radio in Germany. The number of radio subscriptions was essentially zero in 1924; subscriptions increased to 2 million in 1928, to 3 million in 1930, and to more than 4.5 million in 1933. During the three elections between 1929 and 1932, when radio content did not change, we can also estimate the effect of radio diffusion. Consistent with the cross-sectional results, we find a significant negative effect of radio on votes for the Nazi Party relying only on variation in the change of the signal availability associated with the change in radio transmitters between 1930 and 1932 (i.e., when radio had an anti-Nazi slant) controlling for all unobserved characteristics of localities.

Radio was far from being the only means of political persuasion. In particular, even before taking control over radio, Nazis organized fierce political campaigns using posters, street rallies, and door-to-door campaigning. We find that Nazi radio propaganda was complementary with at least one of the other tools of Nazi political persuasion: Hitler's electoral speeches. The effect of pro-Nazi radio propaganda in 1933 was stronger in places, where Hitler gave a speech at a rally before 1933.

Two counterfactual exercises highlight the role of the radio in the rise of the Third Reich. First, in the absence of the radio in 1930, Nazis could have gained almost as many votes (and seats) as their main competitor, the Social Democratic Party (SPD). Therefore, they could have had larger bargaining power over choosing the candidature for chancellor and ultimately could have gained executive power two-and-a-half years earlier. Second, in the absence of the shift in control over radio to Nazis in January 1933, but with continued use of other tools of propaganda, the subsequent elections would have produced a 5-percentage-

point-lower vote share for the Nazi Party (which constitutes about half of what NSDAP actually gained between the November 1932 and March 1933 elections). Overall, our results confirm that radio propaganda was indeed an important tool in the struggle for power in the late Weimar Republic and was used both by the Nazis (after 1933) and by their opponents (before 1933).

The second question that we pursue in our analysis is whether radio helped the Nazis to maintain political support after they fully consolidated their power. We rely on such manifestations of political support for the regime as Nazi Party membership, denunciations of Jews, and other expressions of anti-Semitism.[4] We find that radio propaganda was important in persuading Germans to support the Nazis. First, radio broadcasts were significantly associated with joining the Nazi Party in 1933, when Nazis had full control over the content of radio broadcasts, but not in 1932, when they had no control over the content. The results imply that without radio propaganda, Nazi Party membership would have been 5,000 people lower in 1933. Furthermore, in localities with larger radio exposure, the number of Jews deported to concentration camps was significantly larger, suggesting that radio influenced local sentiments and increased the rate of denunciations of Jews by ordinary Germans (Voigtländer and Voth 2012). We also consider the following measures of expressions of anti-Semitism: the anti-Jewish letters written by ordinary Germans to the editor of the anti-Semitic national newspaper, *Der Stürmer,* and the attacks on synagogues during *Kristallnacht* (the Night of Broken Glass) in 1938. We find that Nazi radio propaganda had a positive and significant effect on both of these measures of expressions of anti-Semitism. The effect is driven by the places that historically were more anti-Semitic, as measured by the occurrence of anti-Jewish pogroms during the Black Death in 1348-1350 (Voigtländer and Voth 2012).

Overall, the results suggest that, first, mass media can be both an important safeguard against the fall of unconsolidated democracy and an important facilitating factor in such a fall

[4] Even though there were three parliamentary elections in the Nazi Germany—in November 1933, March 1936, and April 1938—voting results are useless in measuring political support for Nazis during this time. As is typically the case in dictatorial regimes, the Nazis banned all opposition parties, and in all of these elections voters were presented with a single list containing only Nazi candidates. As a result, in all three elections the voter turnout and the vote for NSDAP were above 90%.

depending on who exercises control over content and, second, mass media can help dictators gain popular support and persuade people in virtue of their most horrible policies.

Our paper relates to several growing literatures. First, the results contribute to understanding of institutions in unconsolidated democracies and dictatorships (see Acemoglu and Robinson 2006 for a profound and extensive overview of this literature). Our paper is the first to empirically assess the role of mass media in the fall of a democracy and the rise of a dictatorship. Notable theoretical contributions to the theory of media in autocratic states are, for instance, Besley and Prat (2006), Egorov, Guriev, and Sonin (2009), and Gelbach and Sonin (2012).

Second, we also contribute to the literature on power of media in political persuasion. For instance, DellaVigna and Kaplan (2007), Gerber, Karlan, Bergan (2009), and Knight and Chiang (2009) show that mass media can influence voting behavior in developed democracies. Enikolopov, Petrova, Zhuravskaya (2011) and DellaVigna et al. (2012) document effects of media on voting behavior in immature democracies, namely, Russia in 1996 and Croatia in 2007. Enikolopov, Petrova, Zhuravskaya (2011) is more closely related to this paper, as it uses the case of Russia's parliamentary election of 1999 to study how the absence of independent media may help election prospects of the party that controls the media. Our paper differs from the previous studies of media effects on voting behavior in the following important respects. First, our paper is the first to look at panel data with both the content and the extent of the signal coverage changing over time. This allows us to estimate dynamic effects of the change in the media content. In addition, the panel nature of the data helps in estimating persuasion power of a certain message (i.e., anti-Nazi message) taking into account all time-invariant unobserved heterogeneity across localities. Second, this paper is the first to look at how different means of propaganda, e.g., radio propaganda and campaign speeches, interact in their effect on voting behavior. In theory, different propaganda tools can be both substitutes and complements, and we find strong complementary effects.

Our paper is also related to the literature on the effects of media on ethnic hatred and public expression of nationalistic feelings. Yanagizawa (2012) studies the impact of exposure to propaganda on Hutu radio on violence against the Tutsis during the genocide in Rwanda. DellaVigna et al. (2012) study the effect of Serbian nation-building radio on expressions of

anti-Serbian feelings in post-conflict Croatia. Our paper shows that expressions of anti-Semitism by ordinary Germans were triggered by Nazi radio propaganda. Unlike previous papers in this strand of literature, we also show that media have a larger effect on expression of nationalism when the messages are more aligned with the listeners' prior attitude towards a particular ethnic group. In other words, Nazi radio had a stronger effect on anti-Semitic behavior of Germans in places that were historically more anti-Semitic.

We also contribute to the historical literature studying the effects of propaganda in the Weimar Republic and Nazi Germany (e.g., Sinton, Weidenfeld 1943; Ross 2006; and Zimmermann 2006). Our paper, however, is the first to provide systematic, empirical evidence on the causal effect of radio propaganda on support for the Nazis.

The rest of the paper is organized as follows. Section 2 provides background information. Section 3 presents hypotheses. Section 4 describes data. Section 5 discusses empirical strategy and identification issues. Section 6 presents the empirical results. Section 7 concludes.

2. Background

2.1. Political landscape

The Weimar Republic was a parliamentary representative democracy established in Germany in 1919. Until 1932, its government was controlled by a coalition of centrist parties led by the democratically oriented Social Democratic Party of Germany (*Sozialdemokratische Partei Deutschlands*, SPD). Despite numerous economic problems, including hyperinflation in the first half of the 1920s, the coalition had a stable majority until 1930. That year, a severe economic depression weakened the government, triggered by the recall of American short-term loans to Germany following the U.S. stock market crash of 1929 and exacerbated by the heavy burden of reparations. Early elections, held September 14, 1930, were aimed at strengthening the coalition, but they had the opposite result: the centrist parties lost a big share of the vote to opposition parties, and in the two years that followed, the government could function only with the aid of presidential decrees. NSDAP certainly benefited from the economic crisis: it received 18.3% of the vote in 1930, compared with just 2.6% in 1928.

Ongoing economic depression led to further radicalization of the population. In the presidential election of March 1932, Adolf Hitler captured 30.1% of votes in the first round, second only to the incumbent president, Paul von Hindenburg (49.6%). Von Hindenburg won the second round, too, over Hitler, 53% to 36.7%. In the early parliamentary elections held July 31, 1932, the Nazi Party received an astounding 37.3% of votes. The Nazis got electoral support from the growing ranks of the unemployed and financial support from rich industrialists who feared expropriation to pay government debt. Despite Hitler's strong presence on the political scene, von Hindenburg refused to appoint him chancellor. In the November 1932 parliamentary election, Nazis got only 33.1% of the vote (partly because the Nazi Party was beset by its own financial problems). However, as a result of misguided political strategizing during negotiations between von Hindenburg and ex-chancellor Franz von Papen (ironically, aimed at setting constraints on the Nazis while preserving their own power), Hitler was appointed chancellor on January 30, 1933.

Shortly thereafter, the Nazis quickly set about consolidating all political powers, starting with the police and radio stations. After the allegedly staged Reichstag fire in February 1933, most civil liberties were suspended, freedom of press was restricted, the Communist leaders were arrested, terror began spreading over the country, and the Nazis unleashed a widespread campaign of radio propaganda. A month later, in the last competitive pre-WWII elections in Germany, the NSDAP gained 43.9% of votes. By the summer of 1933, all political parties except the NSDAP were outlawed, all independent newspapers were closed, Nazi officials were put in charge of all local governments, and trade unions were abolished and their leadership imprisoned. Germany had become a dictatorship.

2.2. Radio content

In 1923 and 1924, the state postal company (*Reichspost*) together with private investors created nine regional broadcasting companies in Germany. Initially, these companies controlled their own content. Their programming included music (concerts, stage plays, and operas), literary programs (*belles lettres* and poetry), weather, sports, scientific and popular lectures, and advertising. Local news was mostly limited to nonpolitical information about local affairs, such as retail prices and police calls for witnesses.

In their first year of operation, few regional companies experimented with broadcasting political news. However, within several months of operation, the news agency Dradag had centralized the production of all political news programs. During the parliamentary election campaigns in May 1924, when the number of radio subscribers reached 16,000, Dradag allocated 15 minutes of air time to each of the following five parties: Zentrum, the DNVP, the SPD, the DVP, and the DDP.[5] In 1924, the Minister of Home Affairs, Karl Jarres, argued for the regulation of radio, recognizing the risk of abusive uncontrolled political influence on the masses (Dussel 2010). As a result, a majority stake in Dradag was nationalized and the editors were obliged to report in line with official government positions. During the campaigns leading up to the parliamentary election of December 1924, candidates were not given any airtime. By contrast, in the presidential election campaign of 1925, two candidates, von Hindenburg and Wilhelm Marx, were allocated radio time, whereas the Communist candidate, Ernst Thälmann, was not allowed to speak on the air. During this time, the role of politics in radio broadcasts was a subject of ongoing political debate. In 1926, a regulation forbidding any political, especially partisan, content was enacted. Between 1926 and 1928, radio was deliberately apolitical; broadcasts consisted of cultural and entertainment programs. During the parliamentary elections of 1928, no content related to electoral campaigns was aired.

However, in 1929, the policy regarding radio content changed. The Nazi Party, in coalition with other right-wing parties, organized a referendum against respecting reparations required under the Treaty of Versailles (i.e., the so-called Young Plan). In response, the government launched an intensive propaganda campaign to encourage voting "no" in the referendum (Bausch 1956, p. 124).[6] After 1929, radio became increasingly politicized, offering more and more pro-government and pro-democratic content, which included economic and political news, lectures, and speeches. During the parliamentary election campaigns in 1930 and 1932, airtime was given to all major parties with the exception of the Nazis (NSDAP) and the Communists (KPD). During the presidential election campaigns in the spring of 1932, airtime was given exclusively to the incumbent president, von Hindenburg.

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[5] DNVP stands for *Deutschnationale Volkspartei*, the German National People's Party; SPD stands for *Sozialdemokratische Partei Deutschlands*, the Social Democratic Party of Germany; DVP – *Deutsche Volkspartei,* the German People's Party; DDP – *Deutsche Demokratische Partei ,* the German Democratic Party.

[6] The referendum failed due to insufficient turnout.

During the campaigns for the parliamentary election of July 1932, the Nazi Party was given some air time. The government, however, reserved a disproportionate amount of broadcasting time for itself (Pohle 1955).

After the elections of July 1932, the regional broadcasting companies were reformed, becoming more centralized and nationalized. Under Chancellor von Papen, radio was brought under firm state control over the latter half of 1932. *"As part of this restructuring, Interior Minister von Gayl ordered a daily 'Government Hour' for all radio broadcasters, during which ministers could hold supposedly 'unpolitical' speeches in support of government policies,"* (Ross 2006). By November 1932, the centralization and nationalization of all radio broadcasts was completed.

Before Hitler was appointed chancellor, on January 30, 1933, the Nazis had virtually no influence on the content of radio broadcasts and radio content had been slanted against the Nazi Party (Ross 2006). But under Hitler, radio programming changed sharply, and swiftly. Between February 1 and the parliamentary elections of March 5, the Nazis launched an intensive daily radio advertising campaign. The Nazis also minimized airtime for its coalition partner, the DNVP, and blocked access for all other parties (Diller 1980, p. 61). Radio content became dominated by propaganda aimed primarily at uneducated workers (Paul 1990 [1933], p. 39). The broadcasts from demonstrations, marches, and rallies were to transmit the illusion that the Nazi movement was massively popular, which in turn would garner more votes during the upcoming elections. In 1934, Goebbels claimed that radio played a significant role in winning "the war of propaganda" and allowed Nazis to win the March 1933 elections (Weiss 1932, p. 9). The Nazis would continue to use radio as one of their main propaganda tools up until their defeat.

Figure 1 portrays the timeline of the key political events and of the measurement of all variables used as outcomes in this paper.

2.3. Availability of radio

At the end of 1920s and the beginning of the 1930s, the German radio network rapidly expanded. In September 1930, there was just one big transmitter (over 10kW of power); by April 1932, there were three, and by March 1933, there were six (Lerg 1980). In 1927, the transmitters' signal reached just 31.3% of the German population; construction of big

transmitters from 1930 to 1934 extended that reach to 70% of the population. Radio listenership, measured by subscription rates, was expanding fast, from essentially zero in 1924 to almost 5 million by the end of 1933 (see Figure 2). Each year thereafter saw about 1 million additional radio listeners (Vaessen 1938).[7]

Initially, the country was divided into in nine broadcasting districts, each with a diameter of about 200–300 km. To make the signal available to as many people as possible, one transmitter was built in the center of the major city of each broadcasting district. Each transmitter was operated by the corresponding regional broadcasting company. The range and quality of the signal was insufficient to provide uniform radio signal coverage over the country. The twin demands for more localized content from areas with the signal and for radio availability from areas with no signal led to the construction of additional transmitters. The Geneva Frequency Plan, which came into effect in November 1926, reduced the number of available radio frequencies and led to the creation of single-frequency networks in each of the nine broadcasting districts. This resulted in uniform programs within each of the broadcasting districts despite the demand for more local content. The technical upgrades of more powerful transmitters required moving them from the city center to the outskirts (Schütte 1971). A study of population densities was conducted to determine the optimal location for big transmitters.[8] An important rationale for upgrading the power of existing transmitters and building new ones was to reduce signal disturbances from foreign transmitters near the border.[9]

Radio listenership was significantly higher in the big cities with transmitters and suburban area around them, as the signal was sufficiently strong for reception with a relatively cheap crystal radio receiver. Listenership was lower in rural areas, however, because fewer citizens had the more powerful radio sets needed to capture broadcasts. Technical progress led to improvement of radio receivers over time; however, their quality and price varied substantially. The cheapest crystal radio receiver was available for 25 to 30 marks, while more

[7] These figures are a lower bound on the number of radio listeners, because they do not take into account that there were several listeners per subscription. Nor do they account for those who evaded the subscription fee.
[8] Neuordnung des Rundfunks in Deutschland. Der Deutsche Rundfunk, Nr. 49, 6.12.1929, p. 1545f.
[9] For example, the transmitter in Flensburg was constructed in December 1928 as a response to a nearby Danish transmitter. The transmitter in Gleiwitz was built in 1925 because of a Polish transmitter in nearby Kattowitz, and its power was increased to 12 kW in 1927 after the power of the Kattowitz transmitter was increased to 10kW. This upgrade made the "supplementary" transmitter in Gleiwitz the third most powerful in Germany at that time (Schütte 1971).

sophisticated vacuum detectors ranged from 110 to 380 marks. Anecdotal evidence shows that a growing number German houses in the 1920s and 1930s were equipped with homemade radios. During the First World War, 4,000 radio operators were trained to assemble their own receivers, and members of many local radio clubs also made their own receivers. Overall, radio listenership was higher in places with higher population density, better economic conditions, and more favorable terrain (Cebulla 2004, p. 34). Radio listenership was further hindered in rural areas by the widespread lack of electricity; at the time, 96.5% of receivers required power supply.[10] In addition, there was a monthly radio license fee of 2 marks, roughly equivalent to the price of a monthly newspaper subscription, two hours of skilled labor, or four hours of unskilled labor.

From 1933 onward, the Nazis strived to increase the number of radio listeners. An affordable radio receiver, the *Volksempfänger* (people's receiver), was presented August 18, 1933, during the international radio exhibition in Berlin; Goebbels ordered to produce it. Radio was also made available to those who could not afford a private radio receiver: "*The party through its 'wireless wardens' and 'block wardens' in every village and town, help[s] to install communal receiving sets, organizes group listening, lays down rules about the erection of aerials, and reports on illegal listening-in to foreign stations"* (Sington and Weidenfeld 1943).

3. Hypotheses

First, to test whether the radio played a role in dismantling the democratic institutions of the late Weimar Republic, we consider how radio availability affected voting for the Nazi Party during three periods: (1) before 1929, when radio was neutral and apolitical; (2) between 1929 and 1932, when radio slant was anti-Nazi, pro-government, and pro-democracy; and (3) after January 1933, when the Nazis used radio as a propaganda machine. We expect that exposure to radio decreased the vote share of the Nazi Party at the time when radio had an anti-Nazi slant and increased the vote share of the Nazi Party after it got control over the radio. An important falsification test is to verify that radio signal was uncorrelated with the Nazi vote share conditional on observables before radio got political content.

[10] Numbers for July 1933 and July 1934 from Vollmann (1936).

Second, we investigate the effect of radio on the support for Nazi policies after Hitler established dictatorial rule in 1933. We expect radio propaganda to increase the number of new members in the Nazi Party and promote open expressions of anti-Semitic sentiment among ordinary Germans.

Third, we test whether different means of propaganda are substitutes or complements. Theoretically, both are possible and, therefore, if different means of propaganda reinforce each other is an empirical question. We are able to address this issue by measuring the interaction effect between Hitler's speeches at the rallies and radio availability.

Fourth, we test the hypothesis about the difference in persuasion power of the propaganda messages between audiences more and less positively predisposed to the content of the message. We expect that in places with higher initial levels of anti-Semitism, Nazi radio propaganda had a larger effect on the expressions of anti-Semitic sentiments compared to places with lower initial levels of anti-Semitism.

4. Data

Radio availability. We calculate radio availability using information on the radio transmitters. Our primary source of data for transmitter location, frequency, and power is *Mitteilungen der Reichs-Rundfunk-Gesellschaft* (various years). In addition, we use data from *Rundfunk Jahrbuch 1929* for the year 1928. All these sources refer to *Union Internationale de Télécommunications* as the primary source of their data. Based on this information, we calculate predicted radio signal strength in all localities using the Irregular Terrain Model (Huffed 2002, employed also by Olken 2008, Enikolopov et al. 2011, and DellaVigna et al. 2012). For each district (*Kreis*) and each town, we compute signal strength at their geographical centers. The district boundaries come from the map of administrative borders in 1925. Figure 3 presents the map of radio signal strength at four points in time.

Electoral measures. The data on elections come from ICPSR (1999). We use voting results for the five parliamentary (Reichstag) elections between 1928 and 1933, two rounds of presidential elections in March and April 1932, and the referendum on the "Law Against the Enslavement of German People" in December 1929. For the parliamentary elections, we focus mainly on the Nazi vote share, but we also consider the vote shares of other major parties and voter turnout. For the presidential elections, the outcomes are the shares of votes received by

the main candidates: Hitler, von Hindenburg, and Thälmann. We use two referendum outcomes: (1) the number of signatures collected in favor of submitting the law proposal to the parliament as a share of the total number of registered voters, and (2) the number of votes in favor of the proposal during the referendum as a share of registered voters.[11]

Anti-Semitism measures. The measures of anti-Semitism primarily come from Voigtländer and Voth (2012). In particular, we use the information on the number of anti-Semitic letters to *Der Stürmer* from 1935 to 1938, a dummy variable for whether synagogues or Jewish prayer rooms were damaged or destroyed during the *Reichskristallnacht* in 1938, and the information on the number of Jews deported from 1933 to 1942. After 1942, deportations of Jews grew massive and, therefore, stopped being a proxy for local anti-Semitism. This variable comes from the database of Jewish deportees during the Nazi period, which was compiled by the German Federal Archives (Bundesarchiv 2007).

NSDAP membership. The information on NSDAP membership comes from the data set of party membership cards (Burnstein and Falter, 1994). Based on these data, we compute the number of people who joined NSDAP in 1932 and 1933, by city. We restrict the sample to those cities for which there is at least one observation in both 1932 and 1933. The reason for this is that missing data for a particular city-year does not mean that there were no new members from this city joining NSDAP, as the data are a random sample of party membership cards stratified at the city and year level.

Control variables. For sociodemographic variables, our primary source was data from *Zentralarchiv* and German census data from Falter and Hänisch (1990). In particular, we use the following sociodemographic controls from the census data: the share of Jewish and Catholic population, and the share of workers in white- and blue-collar occupations in 1925; the shares of unemployed and partially employed people in 1933. We control for unemployment, as it was an important determinant of pro-Nazi voting (Childers 1983 and

[11] According to the German constitution of that time, if at least ten percent of eligible voters registered their approval of a law proposal, it was sent to the Reichstag for consideration. If the Reichstag rejected this proposal, it was voted on in a referendum. For a proposed law that did not require changes in the constitution to pass referendum, a majority of eligible voters had to turn up to the polls and a majority of those who turned up had to vote in favor of the proposal. Voter turnout at the referendum was extremely low (about 12 percent), so not voting was equivalent to casting the vote against the law. This is why we use the share of those who voted in favor of the law in the total number of eligible (registered) voters rather than as a share of valid votes.

King et al. 2008). However, measures of unemployment are available only from the period after most of the considered elections took place. To make sure that potential reverse causality from election results to employment levels does not affect our results, we report regressions with and without 1933 unemployment controls throughout the paper.

We also use data on property tax payments and the number of participants of World War I, welfare recipients, and pensioners receiving social assistance from the statistical yearbooks (*Statistik des Deutschen Reichs* for various years; see appendix for details). We also construct a variable on the number of speeches that Hitler gave in 1932 in each city based on the information from Domarus (1962). As historical anti-Semitism is an important determinant of pro-Nazi voting and anti-Semitic violence (see Voigtländer and Voth 2012), we include measures of the incidence of pogroms and information on the existence of Jewish settlement in the 14th century from Voigtländer and Voth (2012).

Most of the variables are measured at the district level using the administrative borders in 1925. The district units in election data and sociodemographic data were manually merged to district units in 1925.[12] The exception is data on anti-Semitism from Voigtländerand and Voth (2012) and data on NSDAP membership, which are at the town level. All data sources are described in more detail in the appendix, and the summary statistics for all variables is presented in Table A1 in the appendix.

5. Empirical framework

In this section, we present our main specification and motivate it with a series of reality checks and evidence in favor of the identifying assumptions.

5.1. Specification

We examine the effect of radio exposure on a number of outcomes using the following baseline specification:

$$y_{it} = \beta_0 + \beta_{1t} Radio\_exposure_{it} + \beta_2 X_{it} + \phi_p + \epsilon_{it}, \qquad (1)$$

[12] In cases when the level of election and socioeconomic data did not coincide with 1925 administrative districts (*Kreis*), we used aggregation rule of King et al. (2008). Note that the number of electoral districts is different in different years; this is due to gerrymandering.

where y_{it} is the outcome of interest in district *i* in time *t,* $radio\_exposure_{it}$ is a measure of exposure to radio, X_{it} is a set of controls (to be described below), and ϕ_p is a province fixed effect that takes into account variation between provinces, and therefore, we focus on within-province variation.[13] ϵ_{it} describes unobserved heterogeneity. Most of our results are based on the cross-sectional specifications for a particular time period *t*.

As both radio signal strength and voting for Nazis were strongly correlated with urbanization, it is important to control flexibly for population. In particular, we control for the fifth-degree polynomial of population and a dummy for city status of the district. As a measure of preexisting political preferences, we control for vote shares of the main parties (DNVP, SPD, KPD, and Zentrum) and voter turnout in 1924, the year when radio was not yet available to the general public. We also control for the shares of Jewish and Catholic population in 1925, the shares of blue- and white-collar workers, average property-tax payments, and the population shares of World War I veterans, welfare recipients, and pensioners receiving social assistance. In addition, we control for the historical measure of anti-Semitism, i.e., pogroms in 1349, and the existence of Jewish settlement that year. For each specification, we present the results with and without the measures of unemployment in 1933 (shares of the unemployed and partially employed) as additional covariates.

To account for persistence in political preferences, we also estimate the effect of radio exposure on the first differences in political outcomes:

$$\Delta y_{it} = \beta_0 + \beta_{1t} Radio\_exposure_{it} + \beta_2 X_{it} + \phi_p + \epsilon_{it}, \qquad (2)$$

where Δy_{it} is the change in vote share for the Nazi Party between elections in period t and the previous elections.

In addition, we run several panel specifications with district and time fixed effects to account for all unobserved characteristics of the localities:

$$y_{it} = \beta_0 + \beta_{1t} Nazi\_bias_t * Radio\_exposure_{it} + \beta_2 Z_{it} + \varphi_i + \tau_t + \epsilon_{it}, \qquad (3)$$

where $Nazi\_bias_t$ is an indicator of the radio bias in favor of Nazis at time *t*, which takes value zero if there was no bias, -1 if the bias was anti-Nazi, and 1 if the bias was pro-Nazi. Z_{it}

[13] Previous literature on voting for the Nazi Party focused mostly on regional differences.

stands for the set of baseline control variables interacted with time effects (for those of them that are available as cross-section only).

5.2. Signal strength and listenership

Since our hypotheses link the outcomes to radio exposure, it is important to verify that the predicted signal strength, which we use as the main explanatory variable, is a good proxy for the actual radio listenership. Because owners of radio sets had to pay a monthly subscription fee to listen to the radio, we can use information on the number of subscriptions in each region at different points of time to measure listenership.[14] Table 1 presents the relationship between radio listenership and signal strength for the years 1930 to 1933. Each cross-sectional regression includes the standard set of controls (columns 1 to 4). Column 5 presents results of a panel regression with district and time fixed effects. In all instances, the coefficient on the predicted signal strength is positive and highly significant. A one-standard-deviation increase in the signal strength was associated with a 3.3-percentage-point increase in the share of population with a radio subscription in 1930 (with the mean of 18.7 percent of subscribers in total district population). In 1933, a one-standard-deviation increase in the signal strength was associated with 2.1 additional percentage points in the share of subscribers (with the mean value of 26 percent).

Figures 4A and 4B present the results of a nonparametric estimation of this relationship with and without controls. The plots show that an increase in the signal strength translated into additional listenership only after a certain threshold level of signal strength. This is reasonable, as below this threshold, the quality of the signal was insufficient to listen to the radio (similar-shape relationships have been documented in other contexts, e.g., Olken 2009).[15] Overall, we find a very strong positive relationship between the quality of radio signal in the Weimar Republic and radio listenership.

5.3. Identification assumptions and determinants of radio availability

[14] The number of subscribers is likely to underestimate actual listenership, because it does not take into account that several people could listen to each radio set with a subscription and that some people listened to radio without paying the subscription fee.

[15] The threshold level depends on the quality of receivers, which changes with technological progress. Thus, the level of the threshold cannot be compared across different contexts.

Our main identification assumption in all cross-sectional specifications, and in those panel specifications that focus on the period of a constant slant in radio broadcasts, is that after controlling for observable differences between locations the variation in the predicted signal strength was not correlated with the unobserved characteristics affecting political support for the Nazis and anti-Semitism. As the content of the radio broadcasts changed over time, in some panel specifications, we can relax this assumption and identify the effect of the change in radio propaganda on outcomes under a much weaker assumption that the effect of unobservables is similar before and after the change in the pro-Nazi bias in radio coverage.

Here, we provide information on the determinants of signal strength and provide arguments in favor of the validity of our identifying assumptions. Predicted signal strength in each location depends on the distance to transmitters, their power, and topography in the line of sight between transmitters and the location. Because transmitters are not randomly located, signal strength could be correlated with socioeconomic characteristics of locations that can also affect the outcomes of interest.[16] Table 2A presents the results of cross-sectional regressions, in which the predicted signal strength is related to the set of our control variables. Fifty to 60 percent of variation in the signal strength is explained by socioeconomic and demographic characteristics of the districts. The most important explanatory variables are the fifth-order polynomial of population (with F-statistic of joint significance of its terms varying from 7 to 11), the city status of the district (significant at the 1 percent level), and the share of white-collar workers (in many specifications significant at the 5 percent level). Socioeconomic characteristics, however, are not jointly significant, once population controls are included.

Importantly, voting results (i.e., voter turnout and vote shares for the main political parties) in 1924 are significant correlates of radio signal strength across districts between 1928 and 1933 (with F-statistic of their joint significance varying from 4 to 7), though only the voter turnout is statistically significant individually. The fact that signal strength is significantly correlated with voting outcomes before the appearance of radio is a potential concern for our cross-sectional specifications, since this may indicate that some unobservable characteristics of districts determining political outcomes and anti-Semitism are correlated

[16] We rely on the variation in signal strength coming both from topography and from distance to transmitters, because the variation in topography alone is insufficient for much of the German territory.

with signal strength, which would bias our cross-sectional results. The presence of correlation between unobservables and our main explanatory variable is untestable. However, we perform a series of tests in the spirit of Altonji, Elder, and Taber (2005) to show that such a correlation is not likely to bias results in our favor, under a reasonable assumption that unobservables are positively correlated with observables. In particular, we first predict signal strength in each district with its socioeconomic characteristics and voting outcomes as of 1924 by taking the fitted value from the regressions of signal strength on the full set of controls from Table 2A, with the exception of the polynomial of population and province fixed effects (for which we control directly throughout). And then, we relate this fitted value to the outcomes of interest controlling for the polynomial of population and province fixed effects. Table 2B presents the results of the second stage of this exercise. It indicates how observables that are correlated with radio availability are associated with the outcomes of interest. We find that the index of observables (aggregated into the fitted value for the signal strength) is positively correlated with the vote for Nazis in 1928 and 1930, uncorrelated with the vote for Nazis in 1932, and negatively correlated with the vote for Nazis in 1933. Furthermore, it is negatively correlated with the vote for von Hindenburg in 1932 and uncorrelated with other outcomes. These results suggest that—under the assumption that unobservables are positively correlated with the index of observables—the results of our cross-sectional analysis are likely to be biased *against* finding the negative effect of radio on support for the Nazis before 1933 (when radio was anti-Nazi) and *against* finding the positive effect of radio on support for the Nazis in 1933 (when radio was pro-Nazi). Thus, even if the correlation exists, it is likely to work in the direction of not finding the effect of radio propaganda in cross-sectional specifications, i.e., against the results presented in the paper. Note also that specifications which rely on the change in radio content from anti-Nazi to pro-Nazi control for all unobservable characteristics of the localities with locality fixed effects.

6. Results.

6.1. The effect of radio on support for the Nazis while Germany was still a democracy

6.1.1. Nazi vote share

Table 3 presents results of cross-sectional regressions in which the Nazi vote share is related to the signal strength of German radio for each parliamentary election between March 1928

and March 1933. Specifically, we present estimation results of equation (1) with the vote share for the Nazi Party in district *i* at election *t* as dependent variable and with the signal strength as a proxy for radio exposure separately for each election. We report results with and without unemployment controls. The list of baseline covariates is described in section 5.

The results show that radio availability had different effects on political support for the Nazi Party at different points in time depending on its content. In particular, in 1928, when radio was neutral and apolitical, radio availability did not affect Nazi vote share. During elections of September 1930, July 1932, and November 1932, when radio featured a distinct (though relatively mild) anti-Nazi slant, radio signal strength became a negative significant predictor of Nazi vote share. In contrast, in the last competitive election, in March 1933, which took place less than six weeks after the Nazis took control over radio and initiated heavy propaganda, the negative effect of radio signal strength became much less pronounced and insignificant. The point estimates increase in magnitude three times between 1928 and 1930, stay approximately constant through the end of 1932, and are reduced by one half in 1933. We interpret the magnitude of these results in terms of persuasion power of pro- and anti-Nazi messages in subsection 6.3. Importantly, the effect is not driven by outliers and reflects a shift in the distribution of votes (see Figure A1 in the appendix).

Table A2 in the appendix illustrates how the point estimate of the coefficient on the signal strength is affected by changes in the list of covariates. As an example, we present results for one of the considered elections, namely September 1930. First, the unconditional bivariate relationship is presented and then covariates are added progressively. The point estimate of the coefficient on radio signal strength is almost completely unaffected by changes in the set of controls. It is equal to 0.118 in bivariate relationship, 0.101 when province fixed effects are included as controls, and 0.91 when the full set of controls is added. Note that R-squared increases from 0.03 in a bivariate specification to 0.645 in the baseline specification. The fact that the point estimate does not change much despite such a dramatic increase in explanatory power suggests that it is unlikely that unobservables substantially bias our estimates. The coefficients of interest are stable with changes in the set of covariates for other elections and other specifications as well.

Panel A of Table 4 presents the results of the estimation of equation (2). It reports how radio exposure affected the increase in Nazi Party vote share from the previous elections. The results are consistent with our hypotheses and with the cross-sectional results. There is a negative and significant effect of radio on the change in Nazi vote share between elections of 1930 and 1928, as radio content shifted from neutral to anti-Nazi. There is no effect of radio availability on the gain of votes by the Nazis from the previous election for two consecutive elections in 1932, when radio content was not changing. And there is a positive and significant effect of the signal strength on the gain of votes by the Nazis between elections in March 1933 and November 1932, when content became heavily pro-Nazi. The scatterplots for these regressions indicate that none of the results are driven by outliers (see Figure A2 in the appendix).

To make sure that the differences in the estimated effects of radio content across the three time periods—namely, before content became political, when it became anti-Nazi, and when it turned pro-Nazi—are driven by the differences in content rather than in the over-time changes of radio signal, we re-estimate equations (1) and (2) using leads and lags of signal strength measure. Figure 5 reports the results. We plot point estimates of coefficients on the lags and leads of signal strength along with their confidence intervals for equation (1) in Figure 5A and for equation (2) in Figure 5B. It is apparent from the figure that the differences in results between the three time periods are, indeed, driven by the differences in broadcast content.

To get a better sense of the magnitude of the effect, we also consider listenership—the share of the district population with subscription to the radio—as a measure of radio exposure. We instrument listenership with radio signal strength because it is a choice variable for individuals and, therefore, is endogenous, as individuals can self-select into listening to radio depending on their political preferences. Panel B of Table 4 presents the results of these IV regressions. According to IV results, a 10-percentage-point increase in listenership in a district (equal to 1.2 standard deviations in this variable) led to a decrease in Nazi vote share by 2.9 percentage points in 1930 and an increase in Nazi vote share by 1.7 percentage points in 1933, in comparison to their results in previous elections. For comparison, we also report OLS results, which are smaller in magnitude, possibly, because of a measurement error in listenership variable.

6.1.2. Complementarities between different means of propaganda

Given that the Nazis actively campaigned during all these years, employing various means of propaganda, we hypothesize that the effect of radio after Nazis established control over the content in January 1933 was not uniform across districts that were and were not targeted by other means of propaganda. In particular, we use data on the location of Hitler's speeches in 1932.[17] Table 5 reports the results of regressions with Nazi vote share as the dependent variable and the interaction between the number and the incidence of Hitler's speeches in the district as the main dependent variables, controlling for the direct effect of Hitler's speeches and of radio availability. We find a strong complementarity between Hitler's speeches and radio exposure: coefficients on the interaction are positive and significant at the 1 percent level. The effect of radio propaganda on the Nazi vote share in 1933 is positive but marginally insignificant (p-values 0.11 and 0.15) in districts where Hitler gave at least one speech a year earlier and positive and significant at the 1 percent level in districts where Hitler gave at least two speeches. Thus, in places targeted by other means of propaganda, Nazi radio was more effective in convincing voters to vote for the Nazis in the last competitive elections of 1933.

6.1.3. Panel estimates

During the 1930s, radio was expanding and, therefore, we can also explore the over-time changes in the signal strength to estimate the persuasion power of the radio, controlling for time-invariant unobserved heterogeneity between districts with district fixed effects (i.e., estimate equation (3)). At first, we confine our analysis to the three consecutive elections in which radio was anti-Nazi, in 1930 to 1932. Columns 1 and 2 of Table 6 present the results of estimation of this panel specification. We find that the 1930–1932 expansion of radio led to a significantly smaller Nazi vote share in districts that gained access to the radio during this time (when radio was anti-Nazi), conditional on all observables as well as unobserved

[17] We also have data on the location of Hitler's speeches in 1933. Historical evidence, however, suggests that in 1933 the choice of places for the speeches was driven by the availability of radio in 1933, as Hitler preferred to campaign in places where his speeches could be immediately retranslated on the radio (Somerville 2012). As a result, the number of Hitler's speeches in 1933 is itself a function of the presence of radio in a district, and, therefore, it is impossible to identify the interaction effect cleanly. In 1932, the location of Hitler's speeches was not related to the radio, as the Nazis did not yet control it, which is why we use this variable. Nonetheless, if we re-estimate these regressions using the incidence of speeches in both 1932 and 1933, results are the same.

heterogeneity between districts. The magnitude of the point estimates is 38 percent smaller than that in equation (2) for 1930.

Columns 3 and 4 of Table 6 present panel fixed effects estimation results for the full set of elections (1928–1933), in which signal strength is interacted with time dummies. Consistent with the cross-sectional estimates, we find a negative and significant effect of radio availability on the Nazi vote share in 1930 and a positive and significant effect of radio on voting the Nazi vote share in 1933. Interestingly, with district fixed effects, the magnitude of the effect in 1930 is smaller than in 1933. In columns 5 and 6 of the table, we report estimation of equation (3) with radio availability interacted with the measure of pro-Nazi bias equal to 0 in 1928, -1 in 1930–1932, and 1 in 1933. This specification combines the effects of the change in the radio content with the change in the radio availability due to radio expansion. We find that radio availability has positive and significant effect on the Nazi vote, with the magnitude similar to that in columns 1 and 2.

These panel-data specifications confirm that time-invariant unobserved heterogeneity is not what drives our results in cross-section specifications. The results remain strong and significant when we include location and time fixed effects as well as flexible controls for the observables, irrespective of whether we identify an effect from variation in radio content or from radio expansion.

6.1.4. Robustness to other voting outcomes

In this subsection we show that these radio effects are not confined to voting for the Nazi Party in parliamentary elections. First, we estimate the effect of radio availability on political support for the Nazi-initiated referendum for the "Law against the Enslavement of German People," proposing that Germany exit the Treaty of Versailles. Table 7 reports the results. As authorities used radio to convince the population to withhold support for this proposed law, we find a negative significant effect of radio signal on both the signatures in favor of the proposed law and on the actual vote in favor of the proposed law during the referendum. The results are robust to controlling for the Nazi vote share in the previous election, which took place one-and-a-half years before the referendum.

Second, we consider the effect of radio availability on the results of the presidential election of 1932. Table 8 presents the results. We find that radio signal had a positive and

significant effect on the vote share for von Hindenburg, the incumbent candidate supported by the radio news programs during the campaign, a negative significant effect on the vote for Hitler, who was the main opposition candidate and was negatively covered by the radio, and no effect on the vote for the Communist candidate, Thälmann.

Third, we examine how voter turnout was affected by radio availability. We find a marginally significant negative effect of radio availability both in 1932 (when radio was anti-Nazi) and in 1933 (when radio was pro-Nazi). Table A3 in the appendix presents the results. These effects are consistent with listeners subjected to biased political news being disenchanted with politics. Importantly, voter turnout in all elections we considered was highly positively correlated with voter turnout in 1924. Voter turnout in 1924 is the only political outcome from the period before the spread of the radio that is significantly correlated with signal strength. As the sign of this correlation is positive, the potential concerns about unobserved heterogeneity in political preferences biasing our results are likely to be unfounded, as the bias would have been in favor of finding positive correlation between signal strength and turnout in 1932 and 1933.

Overall, our results are consistent with the hypothesis that radio played an important role in slowing down the Nazis' rise to power before they took control over radio, and that this effect was completely undone in the March 1933 election, after just one month of heavy pro-Nazi radio propaganda.

6.2. Did radio help the Nazis maintain political support after they consolidated power?

Next, we examine whether and how radio helped the Nazis maintain public support for their policies, focusing on nonelectoral outcomes after they came to power in March 1933.

6.2.1. Radio and party membership

First, we consider whether the radio propaganda helped the Nazi recruit new party members. Results are reported in Table 9. The sample consists of 633 (out of 958) districts with nonzero observations for party membership. We find that in 1932, when radio still had an anti-Nazi slant, the number of party members was not significantly related to radio availability (columns 1 and 2). It is not surprising, as the choice whether to join the party concerned the core Nazi supporters, who must have had a negative attitude toward radio broadcasts at that time. In

contrast, in 1933, after the Nazis took over radio, party membership became significantly positively associated with radio signal strength (columns 3 and 4). Columns 5 and 6 show that party membership increased faster from the 1932 level in places where radio was available. The magnitude of the effect implies that approximately 0.3 percent of new NSDAP members—5,000 people—were persuaded by radio propaganda during the first month of the Nazi control over the broadcast.

6.2.2. Radio and anti-Semitism

Second, we examine whether Nazi radio propaganda had an effect on expressions of anti-Semitism proxied by anti-Semitic letters to the official Nazi newspaper, *Der Stürmer*, attacks on synagogues during the Night of Broken Glass (*Reichskristallnacht*), and deportations of Jews between 1933 and 1942. These variables are measured at the city level for 1,216 locations. We estimate equation (1) with these measures of anti-Semitism as dependent variables and radio signal strength in 1935 as the main explanatory variable. In city-level analysis, the set of controls differs from the district-level analysis in two ways. First, we control for log of city population instead of the fifth-order polynomial because the variation in city population is much smaller than between cities and rural areas. Second, in regressions with attacks on synagogues as the dependent variable, we add a dummy for the presence of a synagogue in the city. We provide results both for the full sample of cities, and for the subsample of cities with Jewish settlements in 1349, following Voigtländer and Voth (2012).

Table 10 presents the results. We find that, on average, the exposure to Nazi radio significantly increased the number of letters to *Der Stürmer* and the number of deportations of Jews (although the latter becomes statistically insignificant once we restrict the sample). In contrast, we find no significant average effect of radio on the attacks on synagogues in either of the two samples. Furthermore, we examine whether radio propaganda had a different effect on listeners with different priors with regard to the broadcasted message. To address this question, we estimate an augmented specification where we add the incidence of pogroms in 1349 and its interaction with radio signal strength as additional covariates, where pogroms in 1349 capture a historic predisposition of city population to anti-Semitism. For the full sample of cities, the coefficient on the interaction term between pogroms in 1349 and radio availability in 1935 is positive and statistically significant for the number of letters to *Der*

Stürmer and the number of deportations of Jews (see Table 11), indicating that Nazi radio propaganda had a larger effect on these expressions of anti-Semitism in cities with more anti-Semitic population. Once we restrict the sample to cities with Jewish settlements in 1349, following Voigtländer and Voth (2012), as reported in columns 7 to 12, we find a positive and statistically significant interaction effect between the radio signal and the historical predisposition to anti-Semitism for all three outcomes, including the attacks on synagogues.[18]

Overall, these results confirm that the exposure to Nazi radio propaganda increased the frequency of expressions of anti-Semitism by ordinary Germans and that the propaganda was more effective on listeners who were predisposed to the message.

6.3. Persuasion rates

In order to understand the magnitude of the effects and assess the relative effectiveness of pro-Nazi and anti-Nazi radio propaganda, we compute persuasion rates, i.e., the fraction of the audience of a media outlet (German radio) who were convinced to change their behavior as a result of being exposed to this media. We use the formula for a continuous measure of radio exposure introduced by Enikolopov et al. (2011).[19] This formula yields the effect of an infinitely small change in media exposure taking into account the effect of turnout and controlling for the fraction of people who could potentially be persuaded (i.e., who would not have voted in favor of the message without being exposed to the media). For the 1933 election, we compute the persuasion rate for the positive message—"vote for NSDAP"—using the following formula:

$$f = \frac{1}{1-\nu_0 t_0}\left(t\frac{d\nu}{de} + \nu\frac{dt}{de}\right) = \frac{1}{1-\nu_0 t_0}\cdot\frac{1}{de/_{ds}}\left(t\cdot d\nu/_{ds} + \nu\cdot dt/_{ds}\right), \qquad (4)$$

[18] The results for the subsample of Jewish settlements should be interpreted with caution, as we cannot rule out selection on unobservables in this subsample.

[19] This formula differs from the first formula for persuasion rates derived by DellaVigna and Kaplan (2007) in the following three respects: (1) it focuses on the case of continuous exposure by analyzing the effect of an infinitesimal change in radio exposure; (2) it allows turnout to increase or decrease for voters exposed to radio broadcasts, as some people who would have voted in the absence of the message may decide to abstain from turning up for the election, which is the case in our data; (3) it allows us to compute separately persuasion rates for a positive message (i.e., encouragement to vote for a specific party) or for a negative message (i.e., discouragement to vote for a specific party). Note that the difference between the effects of positive and negative messages is particularly important in a multiparty system such as Germany's.

where v is vote share of NSDAP, t is turnout, v_0 and t_0 are Nazi vote share and turnout in the absence of radio,[20] $dv/_{ds}$ is the effect of the change in radio signal strength on Nazi vote share (column 8 of Table 4), $dt/_{ds}$ is the corresponding effect for turnout (column 10 of Table A3), and $de/_{ds}$ is the effect of the change in radio signal strength on the listenership share (column 4 of Table 1). We evaluate *f* at $t = t_0$ and $v = v_0$. Note that our out best proxy for the listenership measure is the radio subscription rate. Thus, in order to apply this formula, we need to multiply the subscription rate by the average number of adult radio listeners per subscription. Under the assumption that, on average, four people listened to the radio with one subscription, the persuasion rate of the positive message, the pro-Nazi radio propaganda—"vote for NSDAP"—was equal to:

f=[1/(1-0.49*0.91)]*[1/(0.00187*4)]*(0.048*0.91+0.029*0.49)=14.0%.

Voters who could potentially respond to the negative message—"do not vote for the Nazis"—are only those who in the absence of radio would have voted for the Nazis. Thus, the formula for the negative message takes the following form:

$$f = \frac{1}{-v_0 t_0}\left(t\frac{dv}{de} + v\frac{dt}{de}\right) = \frac{1}{-v_0 t_0}\cdot\frac{1}{de/_{ds}}\left(t\cdot dv/_{ds} + v\cdot dt/_{ds}\right), \qquad (5)$$

As in the case of the positive message, we estimate persuasion rate at $t = t_0$ and $\mu = \mu_0$. As $dv/_{ds}$ we take the coefficient on the effect of radio signal strength on change in Nazi vote share from column 2 in Table 4. As the effect of radio signal strength on turnout in 1930 is not significant (see column 4 in Table A3) we take $dt/_{ds} = 0$. Again, assuming that there were, on average, four listeners per subscription, the persuasion rate in 1930 was equal to:

f=-[1/(0.24*0.87)]*[1/(0.00252*4]* (-0.87*0.057)=23.6%.

For each of the last four parliamentary elections in the Weimar Republic, we report calculated persuasion rates in the last row of panel A of Table 4.

[20] The numbers are calculated as the predicted values of the vote share for the NSDAP and turnout from the regressions reported in column 8 of Table 4 and column 10 of Table A3, respectively, calculated at the minimum level of signal strength observed in the sample.

It is interesting to compare persuasion rates of radio in the Weimar Republic to persuasion rates of media in other settings. The persuasion rate of pro-Nazi radio propaganda is comparable to that of Fox news (12%), as reported in DellaVigna and Kaplan (2007), and lower than the persuasion rate of the *Washington Post* (20%), as reported by Gerber, Karlan, and Bergan (2009). Interestingly, the persuasion rate of anti-Nazi radio content, before 1933, is much higher than the one found in DellaVigna and Kaplan (2007) but is smaller than the persuasion rate for an anti-Putin TV channel in Russia (Enikolopov et al. 2011).

6.4. Placebo tests

In this subsection, we provide additional evidence in favor of our identification assumption by showing that German radio availability is not associated with outcomes that it was not supposed to affect. Specifically, we test whether radio signal strength in 1930 (the first year in which we find significant effect of radio on the vote for the NSDAP) was associated with any voting outcomes in 1924 (when radio was used only by the military), with voting in the presidential election of 1925 (when radio listenership was still very small and radio coverage was neutral), and with crime rates from 1900 to 1920 and anti-Jewish pogroms in 1920s. We did not find significant association between radio availability in 1930 and these placebo outcomes (see Table 12), which bolsters our identification assumptions.

7. Conclusions

In the context of the Weimar Republic and the early Third Reich, we study whether mass media played a role in dismantling democratic institutions and in assuring public support for the dictator. We find that relatively mild anti-Nazi slant in radio news programs between 1929 and 1932 was effective in substantially reducing the Nazi Party vote in three consecutive parliamentary elections. In 1933, Nazis took control over radio and began airing heavily pro-Nazi propaganda; in just one month, this fully undid the effect of anti-Nazi radio messages of the previous four years. Second, we examine the impact of the radio after the Nazis fully consolidated power and show that it was instrumental in ensuring public support for the regime. Radio propaganda helped the Nazis enroll new party members and encouraged denunciations of Jews, leading to their deportation to concentration camps and causing open expressions of anti-Semitism, such as burning synagogues and writing anti-Semitic letters to the national newspaper. Third, we find important interaction effects of propaganda through

mass media with other means of propaganda and with listeners' prior attitudes. In particular, radio was a most effective propaganda tool when combined with other tools, such as Hitler's speeches, and when the message was more aligned with listeners' predispositions in particular, a more anti-Semitic audience was more convinced by Nazi propaganda, as measured by historical variation in anti-Semitism several centuries before.

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Figure 1. Timeline of key political events.

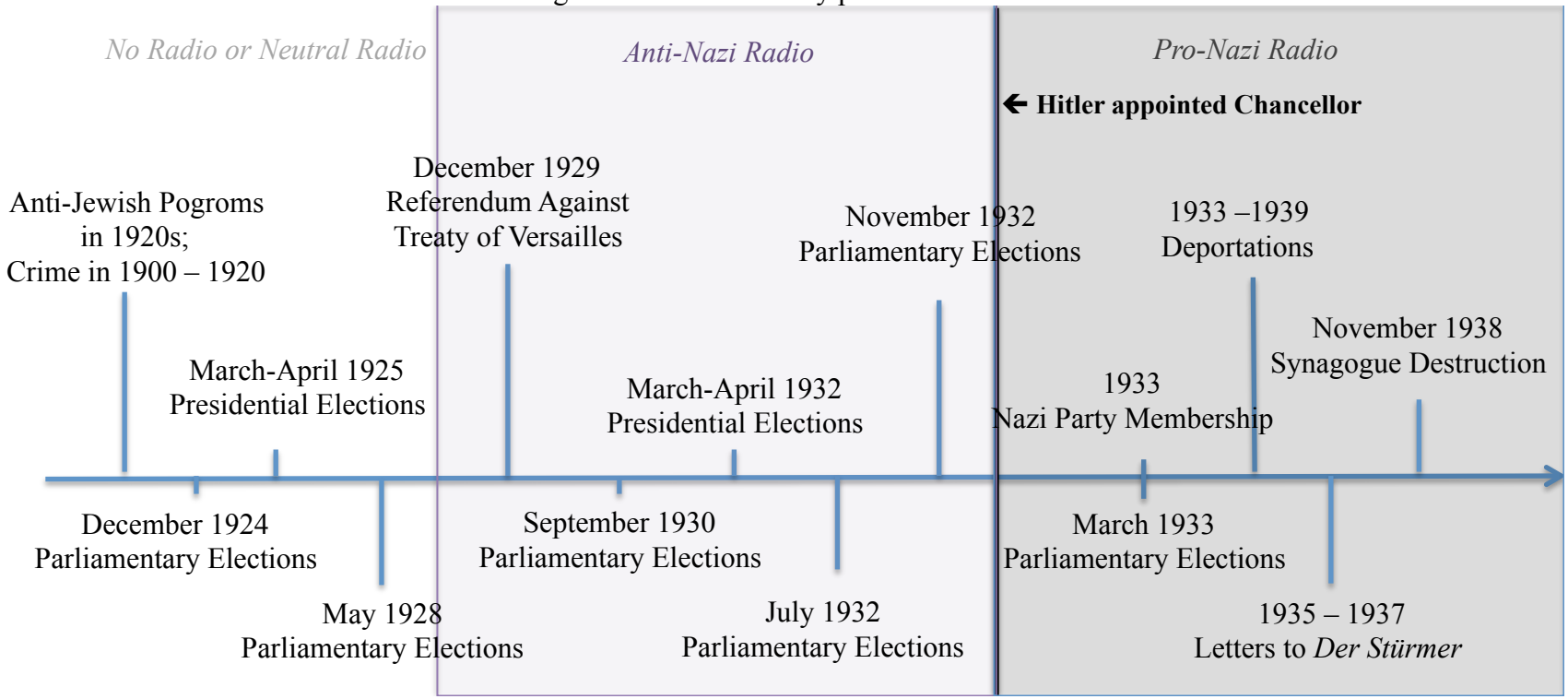


Figure 2. Number of Radio Listeners in Germany, 1924 – 1933.
Green lines – dates of parliamentary elections
Red lines – dates of presidential elections

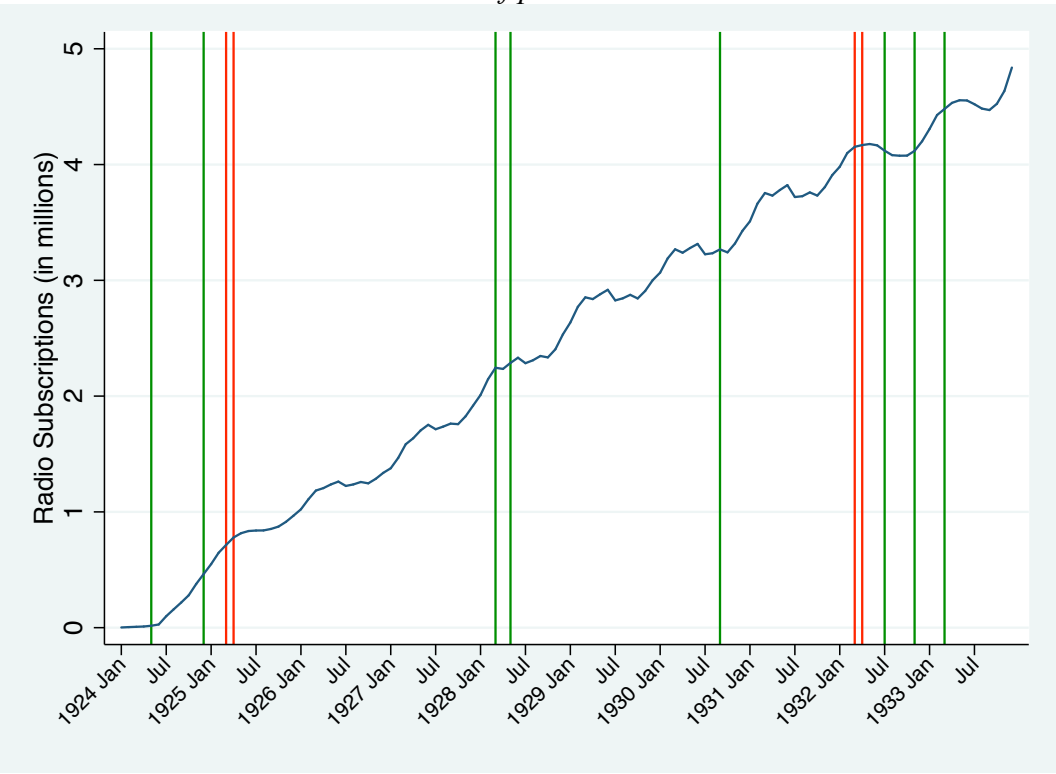
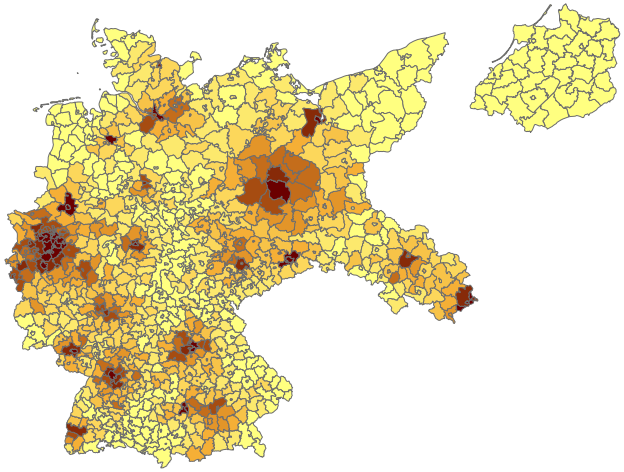
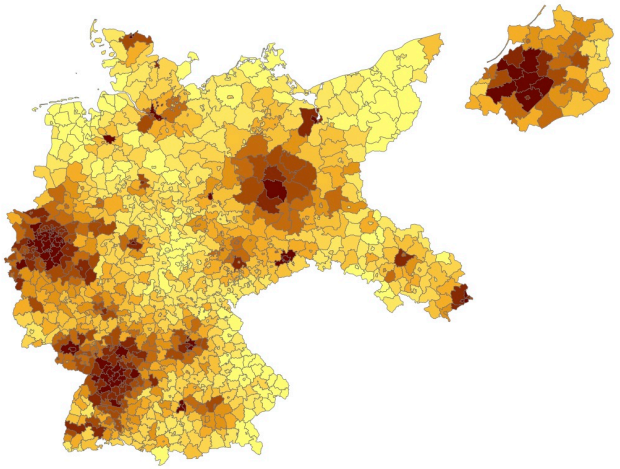


Figure 3. Radio Signal Strength in Germany

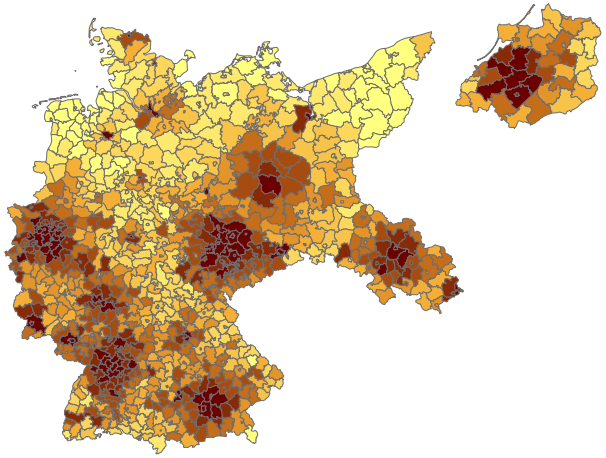
A. May 1928



B. July1932



B. March 1933



D. May 1935

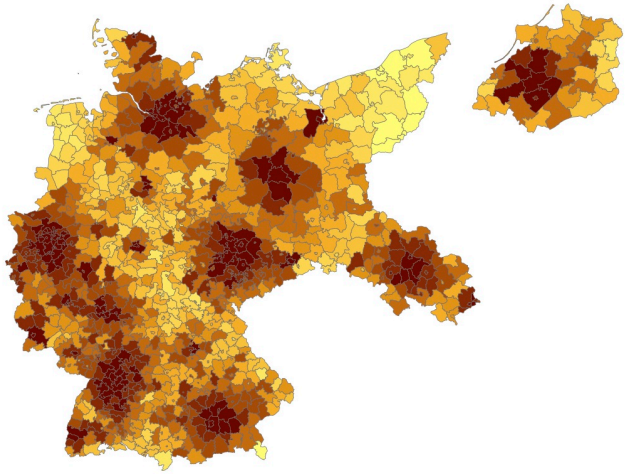


Figure 4A. Radio Listenership and Signal Strength, 1931 (no controls).
t-statistics for bivariate relationship: 11.92

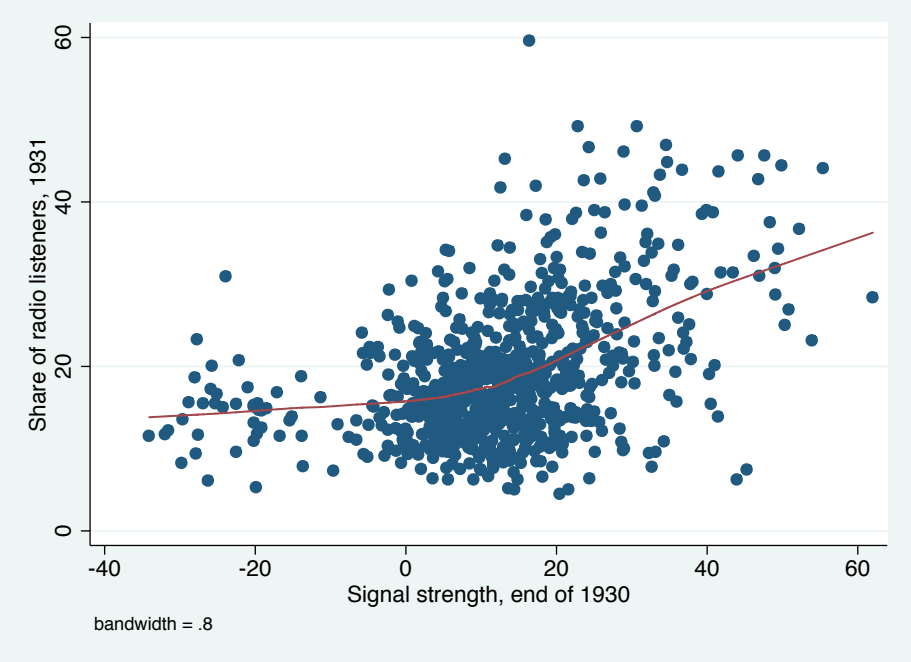


Figure 4B. Radio Listenership and Signal Strength, 1931 (with controls).
t-statistics for signal strength conditional on all controls: 7.45

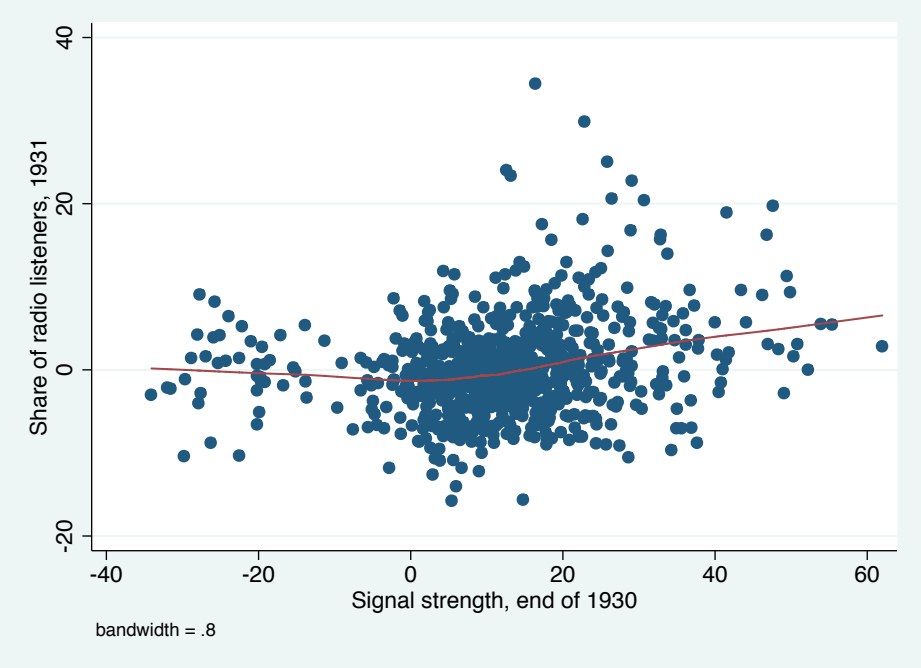
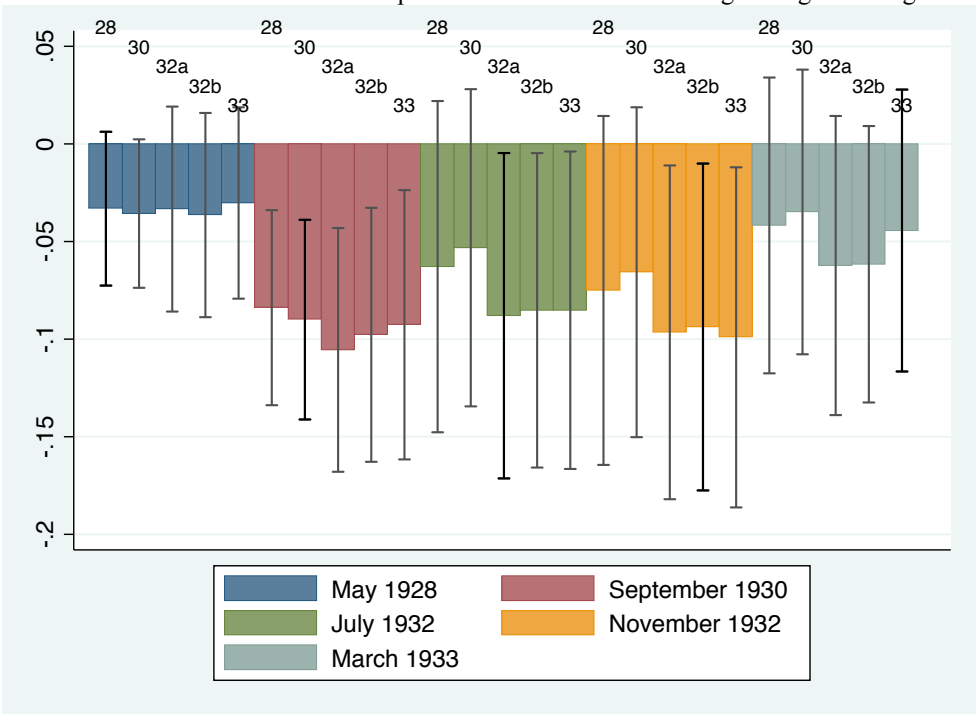


Figure 5. Radio Effect Estimates for Signal Strength and Its Leads and Lags.

A. Dependent variable: vote share for the Nazi Party in corresponding elections. Different colors correspond to different elections; different bars of the same color represent results for leads and lags of signal strength.



B. Dependent variable: change in vote share for the Nazi Party since previous elections. Different colors correspond to different elections; different bars of the same color represent results for leads and lags of signal strength.

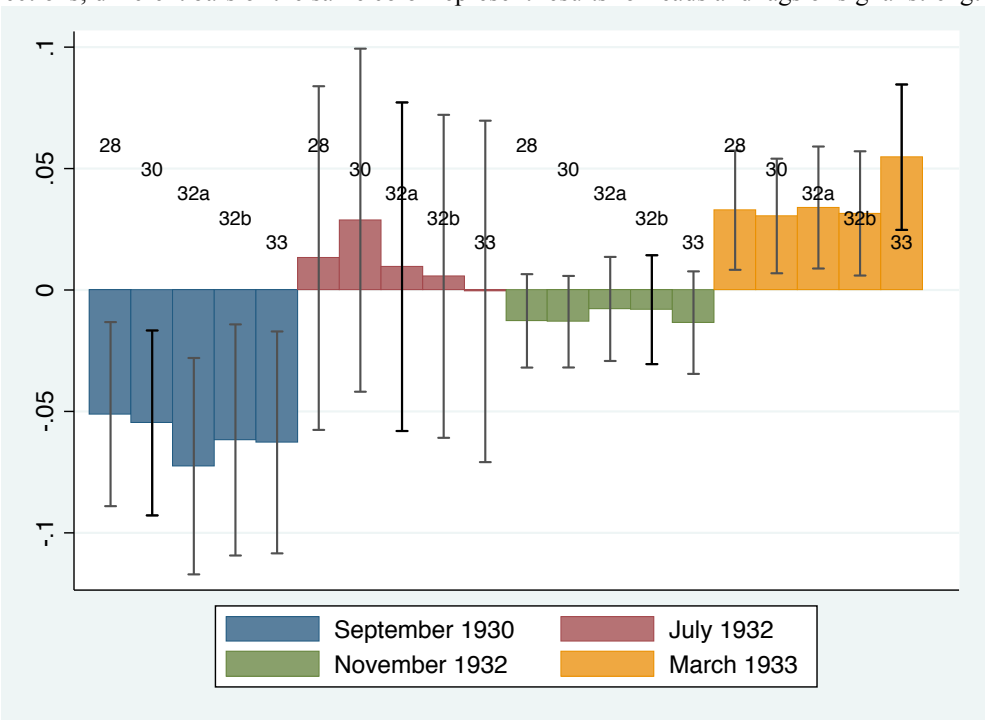


Table 1. Radio Listenership and Radio Availability

	Percentage of population with a license to listen to radio				
	September 1930	*July 1932*	*November 1932*	*March 1933*	*Panel 1930 – 1933*
Radio signal strength	0.252***	0.220***	0.208***	0.187***	0.055***
	[0.033]	[0.028]	[0.031]	[0.039]	[0.020]
Share of Jewish population, 1925	56.437	56.873	56.099	99.05	
	[64.279]	[65.258]	[66.740]	[72.527]	
Share of Catholic population, 1925	-5.338*	-5.184	-5.3	-4.601	
	[2.918]	[3.340]	[3.271]	[3.382]	
Share of blue-collar workers, 1925	-6.017	-9.234**	-8.760**	-8.778**	
	[3.714]	[3.476]	[3.540]	[3.568]	
Share of white-collar workers, 1925	7.079	14.492	12.969	20.596**	
	[8.839]	[9.191]	[9.372]	[9.849]	
City (*Stadtkreis*)	0.515	0.492	0.876	-0.96	
	[1.258]	[1.279]	[1.307]	[1.327]	
War participants per 1,000	0.115	0.129	0.12	0.031	
	[0.106]	[0.101]	[0.103]	[0.124]	
Welfare recipients per 1,000	0.001	0.001	0.001	0	
	[0.001]	[0.001]	[0.001]	[0.001]	
Pensioners with social assistance per 1,000	-0.021	-0.053	-0.054	-0.083	
	[0.055]	[0.053]	[0.053]	[0.057]	
Log of average property tax payment	0.926	1.216*	1.196*	1.698**	
	[0.626]	[0.611]	[0.629]	[0.635]	
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	No
Voting controls, 1924	Yes	Yes	Yes	Yes	No
Province fixed effects	Yes	Yes	Yes	Yes	No
Pogrom controls, 1349	Yes	Yes	Yes	Yes	No
Control variables interacted with period fixed effects	No	No	No	No	Yes
Period fixed effects	No	No	No	No	Yes
District fixed effects	No	No	No	No	Yes
Observations	809	834	834	835	3,312
R-squared	0.58	0.53	0.52	0.50	0.96

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Pogrom controls include dummy for pogroms in 1349 and a dummy for a Jewish settlement in 1349. Pogrom controls are not significant in all specifications. Number of observations varies because of missing data on listenership and because of redistricting.

Table 2A. Determinants of Radio Availability

	Radio Signal Strength									
	March 1928		*September 1930*		*July 1932*		*November 1932*		*March 1933*	
Share of Jewish population, 1925	-90.618	-93.467	-101.994	-105.602	-27.379	-33.019	-25.755	-30.035	-87.042	-93.887
	[119.447]	[123.412]	[114.621]	[118.433]	[138.476]	[142.015]	[127.901]	[130.700]	[99.321]	[101.254]
Share of Catholic population, 1925	0.791	0.689	-1.107	-1.188	-0.361	-0.416	-0.304	-0.321	0.670	0.646
	[3.976]	[3.937]	[3.981]	[3.939]	[3.798]	[3.822]	[3.824]	[3.865]	[3.982]	[3.971]
Share of blue-collar workers, 1925	4.475	3.819	7.265	6.490	9.017*	8.194	7.747	7.150	9.539*	8.727
	[4.751]	[4.605]	[4.497]	[4.375]	[5.288]	[5.263]	[5.227]	[5.238]	[5.409]	[5.417]
Share of white-collar workers, 1925	-15.739**	-17.433**	-13.793*	-15.145**	-21.284**	-21.219**	-16.855**	-16.461*	-15.798*	-14.800
	[6.953]	[6.634]	[6.821]	[6.513]	[8.642]	[8.889]	[8.229]	[8.545]	[8.711]	[8.938]
City (S*tadtkreis*)	4.342***	3.746***	4.455***	3.834***	5.016***	4.515***	4.427***	4.090***	4.768***	4.356***
	[1.271]	[1.216]	[1.415]	[1.349]	[1.473]	[1.380]	[1.484]	[1.392]	[1.638]	[1.561]
War participants per 1,000	-0.110	-0.125	-0.164	-0.179*	-0.127	-0.139	-0.046	-0.054	-0.182	-0.193
	[0.089]	[0.085]	[0.104]	[0.099]	[0.094]	[0.089]	[0.108]	[0.105]	[0.141]	[0.136]
Welfare recipients per 1,000	0.001	0.001	0.001	0.001	-0.000	0.000	0.000	0.001	0.002	0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Pensioners with social assistance per 1,000	-0.105	-0.105	-0.067	-0.065	-0.116	-0.108	-0.112	-0.106	-0.089	-0.077
	[0.108]	[0.107]	[0.105]	[0.105]	[0.093]	[0.095]	[0.095]	[0.098]	[0.089]	[0.092]
Log of average property tax payment	-0.017	0.056	-0.261	-0.179	-0.595	-0.523	-0.608	-0.561	-0.082	-0.023
	[0.704]	[0.703]	[0.691]	[0.687]	[0.581]	[0.571]	[0.575]	[0.560]	[0.690]	[0.683]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pogrom controls, 1349	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	959	959	959	959	959	959	959	959	959	959
R-squared	0.62	0.63	0.63	0.63	0.55	0.55	0.57	0.57	0.53	0.53
F-statistics, population controls	7.684	7.023	8.989	8.096	10.70	9.706	9.736	9.725	10.27	10.18
F-statistics, other socioeconomic controls	2.296	2.807	2.445	3.489	1.994	1.810	1.643	1.510	1.679	1.540
F-statistics, voting controls from 1924	6.549	6.191	7.318	6.697	5.160	4.811	4.736	4.651	4.803	4.612

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Pogrom controls include dummy for pogroms in 1349 and a dummy for a Jewish settlement in 1349. Pogrom controls are not significant in all specifications.

Table 2B. Altonji-Elder-Taber Test

	Nazi Vote Share				
	March 1928	*September 1930*	*July 1932*	*November 1932*	*March 1933*
Prediction of signal strength	0.294*	0.687**	0.181	0.227	-1.280***
(based on all controls)	[0.170]	[0.303]	[0.349]	[0.332]	[0.273]
Population, fifth polynomial	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	960	961	960	920	920
R-squared	0.33	0.36	0.44	0.42	0.36

	Voted "Yes" on the Referendum	Vote share of von Hindenburg in April 1932	Vote share of Hitler in April 1932	Party members of NSDAP in 1933	Log (number of deported) in 1930 – 1939
Prediction of signal strength	-0.135	-0.971***	0.131	0.003	0.004
(based on all controls)	[0.403]	[0.323]	[0.348]	[0.010]	[0.012]
Population, fifth polynomial	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	951	954	954	961	961
R-squared	0.46	0.46	0.40	0.40	0.17

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 3. Radio Availability and Voting for the Nazis: Cross-Sectional Estimates

	Nazi Vote Share									
	March 1928		*September 1930*		*July 1932*		*November 1932*		*March 1933*	
Radio signal strength	-0.028	-0.030	-0.090***	-0.091***	-0.083**	-0.082**	-0.090**	-0.088**	-0.055	-0.050
	[0.018]	[0.019]	[0.027]	[0.027]	[0.038]	[0.038]	[0.039]	[0.039]	[0.034]	[0.034]
Share of Jewish population, 1925	-30.608	-32.148	5.878	3.408	70.184	70.464	140.976***	142.270***	128.796**	133.218***
	[38.878]	[39.781]	[59.504]	[59.836]	[43.902]	[44.583]	[41.075]	[43.248]	[47.502]	[44.512]
Share of Catholic population, 1925	-9.630***	-9.666***	-15.480***	-15.500***	-39.732***	-39.726***	-35.104***	-35.117***	-31.839***	-31.842***
	[2.834]	[2.805]	[4.126]	[4.119]	[4.139]	[4.158]	[3.761]	[3.753]	[4.675]	[4.729]
Share of blue-collar workers, 1925	2.977	2.768	-0.655	-0.937	-1.326	-1.267	-0.767	-0.427	-3.393	-2.616
	[1.811]	[1.667]	[4.613]	[4.571]	[3.873]	[4.081]	[4.530]	[4.862]	[4.955]	[5.054]
Share of white-collar workers, 1925	7.524**	7.332**	13.186**	13.230**	-3.771	-3.654	-8.614	-7.125	-18.077**	-15.166**
	[2.759]	[2.836]	[6.015]	[5.945]	[7.370]	[7.894]	[6.826]	[7.294]	[6.732]	[7.182]
City (*Stadtkreis*)	0.443	0.246	0.825	0.648	-0.247	-0.202	-0.900	-0.584	-0.874	-0.204
	[0.607]	[0.529]	[1.052]	[0.988]	[1.048]	[1.038]	[1.056]	[0.992]	[0.829]	[0.790]
Pogroms in 1349	0.616*	0.630*	0.888*	0.910*	0.164	0.161	0.434	0.405	0.592	0.530
	[0.341]	[0.357]	[0.522]	[0.529]	[0.738]	[0.744]	[0.740]	[0.742]	[0.826]	[0.818]
Jewish settlement in 1349	-0.481*	-0.525*	-0.274	-0.309	-0.206	-0.195	-0.240	-0.177	-1.300*	-1.168
	[0.253]	[0.272]	[0.525]	[0.543]	[0.696]	[0.701]	[0.666]	[0.682]	[0.733]	[0.737]
War participants per 1,000	0.018	0.013	0.033	0.028	0.002	0.003	0.069	0.076	-0.009	0.007
	[0.036]	[0.037]	[0.068]	[0.068]	[0.063]	[0.063]	[0.055]	[0.056]	[0.063]	[0.063]
Welfare recipients per 1,000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.003**	-0.003**	0.001	0.000
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Pensioners with social assistance per 1,000	0.049*	0.050*	0.023	0.026	0.018	0.018	0.029	0.034	-0.029	-0.021
	[0.027]	[0.027]	[0.053]	[0.053]	[0.055]	[0.054]	[0.058]	[0.056]	[0.056]	[0.051]
Log of average property tax payment	0.257	0.280	0.299	0.324	-0.214	-0.220	-0.745*	-0.781*	-0.471	-0.550
	[0.186]	[0.192]	[0.361]	[0.370]	[0.414]	[0.410]	[0.421]	[0.419]	[0.506]	[0.502]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	959	959	960	960	959	959	919	919	919	919
R-squared	0.45	0.46	0.64	0.64	0.87	0.87	0.83	0.83	0.79	0.81

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Observations are weighted by district-level population. Number of observations changes between July and November of 1932 because of redistricting.

Table 4. Radio Availability, Listenership, and an Increase in Nazi Vote Share

Panel A	Change in Vote Share of the Nazi Party Since Previous Elections							
	September 1930		*July 1932*		*November 1932*		*March 1933*	
Radio signal strength	-0.057**	-0.057**	0.022	0.024	-0.007	-0.007	0.044**	0.048**
	[0.024]	[0.024]	[0.038]	[0.039]	[0.013]	[0.013]	[0.019]	[0.018]
Share of Jewish population, 1925	34.907	34.005	59.943	62.710	59.204**	60.207**	-4.808	-1.713
	[43.984]	[43.230]	[61.202]	[60.244]	[22.430]	[22.943]	[48.176]	[44.463]
Share of Catholic population, 1925	-5.852**	-5.846**	-24.295***	-24.267***	4.422***	4.427***	3.320	3.320
	[2.774]	[2.781]	[3.295]	[3.289]	[1.429]	[1.421]	[2.217]	[2.294]
Share of blue-collar workers, 1925	-3.697	-3.742	-0.929	-0.549	0.359	0.480	-2.906	-2.424
	[3.574]	[3.593]	[3.317]	[3.288]	[1.348]	[1.467]	[2.506]	[2.371]
Share of white-collar workers, 1925	5.973	6.331	-15.747***	-15.669***	-4.355*	-4.304	-9.521**	-8.081**
	[4.941]	[4.858]	[3.650]	[4.300]	[2.393]	[2.567]	[3.527]	[3.230]
City (*Stadtkreis*)	0.313	0.316	-1.211	-0.976	-0.359	-0.287	-0.025	0.358
	[0.805]	[0.804]	[0.895]	[0.916]	[0.303]	[0.331]	[0.529]	[0.537]
Pogroms in 1349	0.275	0.282	-0.751	-0.779	0.275	0.263	0.237	0.198
	[0.390]	[0.387]	[0.813]	[0.807]	[0.413]	[0.409]	[0.344]	[0.339]
Jewish settlement in 1349	0.210	0.220	-0.024	0.024	-0.127	-0.114	-1.005***	-0.930***
	[0.417]	[0.421]	[0.502]	[0.509]	[0.288]	[0.289]	[0.302]	[0.283]
War participants per 1,000	0.033	0.032	-0.034	-0.027	0.037	0.039	-0.064	-0.055
	[0.053]	[0.054]	[0.054]	[0.055]	[0.026]	[0.026]	[0.049]	[0.049]
Welfare recipients per 1,000	-0.001	-0.001	-0.000	-0.000	-0.001	-0.001*	0.003**	0.003*
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.002]
Pensioners with social assistance per 1,000	-0.026	-0.024	0.000	-0.003	-0.002	-0.003	-0.059*	-0.057*
	[0.046]	[0.047]	[0.046]	[0.043]	[0.023]	[0.024]	[0.030]	[0.031]
Log of average property tax payment	0.074	0.075	-0.478	-0.512	-0.609***	-0.619***	0.233	0.186
	[0.292]	[0.297]	[0.417]	[0.406]	[0.157]	[0.156]	[0.229]	[0.225]
Other baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes	No	Yes
Observations	958	958	958	958	918	918	917	917
R-squared	0.66	0.66	0.73	0.74	0.52	0.53	0.69	0.70
Persuasion rates, in percentage points	30.5	30.8	0.913	0.7	0.201	-0.208	12.6	13.1

Panel B	Change in Vote Share of the Nazi Party Since Previous Elections							
VARIABLES	*September 1930*		*July 1932*		*November 1932*		*March 1933*	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Radio listenership rate, %	-0.103***	-0.289***	0.027	0.070	-0.023	-0.024	0.044**	0.172**
	[0.037]	[0.105]	[0.028]	[0.171]	[0.015]	[0.067]	[0.019]	[0.074]
All baseline and unemployment controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	808	808	833	833	810	810	809	809
R-squared	0.65	0.62	0.73	0.73	0.51	0.51	0.67	0.65

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Other baseline controls include voter turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924; fifth-order polynomial of population, and province fixed effects. Unemployment controls include share of unemployed and the share of people without full-time employment. Observations are weighted by district-level population. Number of observations changes between July and November of 1932 because of redistricting. Persuasion rates are computed under a conservative assumption that there were four radio listeners per radio subscription. Because of concerns about the quality of data, we take subscription numbers from 1932 for 1933 elections.

Table 5. Radio Availability, Hitler's Speeches, and Voting for the Nazis in 1933

	Nazi Vote Share, March 1933			
Signal strength x Number of speeches in 1932	0.129***	0.117***		
	[0.037]	[0.037]		
Number of speeches in 1932	-1.844*	-1.640*		
	[0.971]	[0.966]		
Signal strength x Dummy for a speech in 1932			0.124***	0.111***
			[0.038]	[0.039]
Dummy for a speech in 1932			-1.788*	-1.598
			[1.028]	[1.027]
Radio signal strength	-0.072**	-0.065*	-0.071*	-0.064*
	[0.035]	[0.036]	[0.035]	[0.035]
Share of Jewish population, 1925	131.306***	135.314***	132.679***	136.442***
	[45.703]	[43.054]	[45.635]	[42.938]
Share of Catholic population, 1925	-31.482***	-31.504***	-31.608***	-31.638***
	[4.779]	[4.847]	[4.759]	[4.825]
Share of blue-collar workers, 1925	-3.627	-2.867	-3.616	-2.858
	[4.886]	[5.017]	[4.906]	[5.040]
Share of white-collar workers, 1925	-18.344***	-15.619**	-18.230***	-15.473**
	[6.512]	[6.900]	[6.580]	[6.991]
City (*Stadtkreis*)	-1.074	-0.424	-1.096	-0.439
	[0.813]	[0.776]	[0.816]	[0.781]
Pogroms in 1349	0.478	0.428	0.515	0.465
	[0.825]	[0.815]	[0.827]	[0.817]
Jewish settlement in 1349	-1.360*	-1.230	-1.391*	-1.256*
	[0.732]	[0.737]	[0.734]	[0.738]
War participants per 1,000	-0.002	0.013	-0.005	0.010
	[0.063]	[0.063]	[0.063]	[0.063]
Welfare recipients per 1,000	0.001	0.001	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Pensioners with social assistance per 1,000	-0.033	-0.026	-0.030	-0.023
	[0.057]	[0.052]	[0.057]	[0.052]
Log of average property tax payment	-0.475	-0.549	-0.456	-0.532
	[0.493]	[0.490]	[0.495]	[0.493]
Province fixed effects	Yes	Yes	Yes	Yes
Population, fifth-order polynomial	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes
Observations	918	918	918	918
R-squared	0.83	0.83	0.83	0.83

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Observations are weighted by district-level population.

Table 6. Radio Availability and Voting for the Nazis: District Fixed Effects

	Nazi Vote Share					
Sample:	*September 1930, July 1932, and November 1932*		*All parliamentary elections 1928 – 1933, combined*		*All parliamentary elections 1928 – 1933, combined*	
Radio signal strength, t	-0.036**	-0.036**				
	[0.017]	[0.017]				
Radio signal strength, May 1928			-0.001	-0.000		
			[0.017]	[0.017]		
Radio signal strength, September 1930			-0.038**	-0.043***		
			[0.016]	[0.016]		
Radio signal strength, July 1932			0.005	0.005		
			[0.016]	[0.016]		
Radio signal strength, November 1932			0.021	0.022		
			[0.016]	[0.015]		
Radio signal strength, March 1933			0.070***	0.076***		
			[0.017]	[0.017]		
Radio signal strength, t x Indicator for pro-Nazi bias (0 for 1928, -1 for 1930 – 1932, +1 for 1933)					0.029***	0.032***
					[0.007]	[0.007]
Standard controls, interacted with time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933, interacted with time fixed effects	No	Yes	No	Yes	No	Yes
p-value for test (signal strength in 1933=average signal strength in 1930 – 1932)			0.000	0.000		
p-value for test (signal strength in 1928=average signal strength in 1930 – 1932)			0.853	0.763		
Observations	2,835	2,835	4,711	4,711	4,711	4,711
R-squared	0.97	0.97	0.97	0.97	0.97	0.97

Note: Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Controls comprise fifth-order polynomial of population, share of Jewish and Catholic population, shares of blue- and white-collar workers in 1925, city dummy, dummy for pogroms in 1349 and a dummy for existence of a Jewish settlement in 1349, number of war participants per 1,000, number of welfare recipients per 1,000, number of renters of social housing per 1,000, log of average property tax, turnout and

Table 7. Radio Availability and Anti-Versailles-Treaty Referendum

	Referendum on the "Law against the Enslavement of the German People"							
	Signatures for the Law Proposal (share of eligible voters)				Voted "Yes" in the Referendum (share of eligible voters)			
Radio signal strength	-0.095**	-0.093*	-0.074**	-0.071*	-0.095**	-0.095**	-0.071***	-0.070***
	[0.045]	[0.046]	[0.035]	[0.035]	[0.037]	[0.037]	[0.025]	[0.025]
Share of Jewish population, 1925	-78.463	-79.637	-55.585	-55.511	-70.253	-71.946	-43.420	-43.826
	[60.158]	[62.021]	[43.358]	[44.224]	[66.439]	[67.483]	[48.361]	[48.451]
Share of Catholic population, 1925	-10.479**	-10.449**	-4.013	-3.907	-22.150***	-22.142***	-14.565***	-14.517***
	[3.830]	[3.869]	[3.260]	[3.274]	[4.434]	[4.453]	[3.818]	[3.829]
Share of blue-collar workers, 1925	15.110***	15.198***	13.202***	13.447***	13.504***	13.392***	11.266***	11.351***
	[3.320]	[3.383]	[2.838]	[2.874]	[3.009]	[2.954]	[2.392]	[2.349]
Share of white-collar workers, 1925	-24.518***	-23.345***	-29.844***	-28.676***	-14.768*	-14.089*	-21.015***	-20.303***
	[7.095]	[6.852]	[6.334]	[6.034]	[7.643]	[7.627]	[6.866]	[6.879]
City (*Stadtkreis*)	1.635	1.821	1.341	1.674*	0.630	0.604	0.285	0.432
	[1.198]	[1.091]	[0.926]	[0.915]	[1.441]	[1.270]	[1.093]	[1.061]
Pogroms in 1349	0.263	0.273	-0.201	-0.205	0.030	0.046	-0.514	-0.512
	[0.817]	[0.830]	[0.774]	[0.783]	[0.970]	[0.990]	[0.948]	[0.966]
Jewish settlement in 1349	-0.191	-0.125	0.151	0.253	-0.009	0.001	0.392	0.441
	[0.590]	[0.606]	[0.531]	[0.532]	[0.610]	[0.640]	[0.504]	[0.514]
War participants per 1,000	0.021	0.025	0.009	0.016	0.070	0.069	0.056	0.059
	[0.104]	[0.105]	[0.091]	[0.091]	[0.107]	[0.108]	[0.087]	[0.088]
Welfare recipients per 1,000	-0.008***	-0.007***	-0.008***	-0.007***	-0.009***	-0.009***	-0.009***	-0.009***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Pensioners with social assistance per 1,000	-0.066	-0.061	-0.098**	-0.094*	-0.032	-0.028	-0.070	-0.067
	[0.053]	[0.052]	[0.046]	[0.046]	[0.065]	[0.063]	[0.059]	[0.060]
Log of average property tax payment	1.294***	1.270***	1.133**	1.088**	0.845*	0.848*	0.656	0.636
	[0.423]	[0.417]	[0.421]	[0.413]	[0.453]	[0.444]	[0.461]	[0.450]
Nazi party vote share in 1928			0.635***	0.639***			0.760***	0.761***
			[0.076]	[0.078]			[0.108]	[0.109]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes	No	Yes
Observations	949	949	949	949	949	949	949	949
R-squared	0.81	0.81	0.83	0.83	0.82	0.82	0.85	0.85

Note: Standard errors clustered by province (*Wahlkreis*) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Observations are weighted by district-level population.

Table 8. Radio Availability and Voting in April 1932 Presidential Elections

	Von Hindenburg Vote Share		Hitler Vote Share		Thälmann Vote Share		Voter Turnout	
Radio signal strength	0.092***	0.098***	-0.085**	-0.087**	0.003	0.000	-0.021	-0.021
	[0.031]	[0.031]	[0.040]	[0.041]	[0.019]	[0.018]	[0.022]	[0.021]
Share of Jewish population, 1925	-24.268	-16.432	81.460*	77.329	9.195	5.722	40.228	41.079
	[50.632]	[52.061]	[45.331]	[46.741]	[14.266]	[15.094]	[27.179]	[27.284]
Share of Catholic population, 1925	34.620***	34.705***	-32.628***	-32.648***	3.009***	2.960***	-3.721**	-3.730**
	[4.012]	[3.955]	[3.856]	[3.856]	[0.945]	[0.956]	[1.643]	[1.652]
Share of blue-collar workers, 1925	-7.061*	-5.987	-1.808	-2.233	2.276*	1.735	2.674	2.697
	[3.469]	[3.537]	[4.270]	[4.558]	[1.281]	[1.109]	[2.278]	[2.249]
Share of white-collar workers, 1925	21.514***	21.330**	-16.335**	-15.565*	-3.895	-4.123	6.591**	6.123*
	[7.440]	[7.933]	[8.014]	[8.005]	[2.671]	[2.900]	[3.234]	[3.407]
City (*Stadtkreis*)	-1.537	-0.827	0.214	-0.004	0.487	0.101	0.067	0.039
	[1.262]	[1.111]	[1.336]	[1.201]	[0.482]	[0.469]	[0.561]	[0.571]
Pogroms in 1349	-0.235	-0.313	0.125	0.165	-0.401	-0.366	0.137	0.130
	[0.784]	[0.792]	[0.771]	[0.803]	[0.318]	[0.316]	[0.397]	[0.392]
Jewish settlement in 1349	0.009	0.134	-0.576	-0.600	0.421	0.346	0.465	0.450
	[0.794]	[0.835]	[0.892]	[0.905]	[0.316]	[0.317]	[0.353]	[0.347]
War participants per 1,000	0.004	0.022	0.050	0.045	0.015	0.006	0.093*	0.093*
	[0.113]	[0.111]	[0.063]	[0.060]	[0.038]	[0.037]	[0.049]	[0.051]
Welfare recipients per 1,000	0.004***	0.004***	-0.003***	-0.003**	0.001**	0.001***	-0.002**	-0.002**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Pensioners with social assistance per 1,000	0.023	0.014	0.015	0.022	0.005	0.008	0.060**	0.058**
	[0.069]	[0.067]	[0.063]	[0.064]	[0.023]	[0.024]	[0.025]	[0.025]
Log of average property tax payment	0.839***	0.735**	-0.910**	-0.879**	-0.259	-0.202	0.199	0.204
	[0.302]	[0.289]	[0.340]	[0.348]	[0.160]	[0.146]	[0.226]	[0.220]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes	No	Yes
Observations	952	952	952	952	952	952	952	952
R-squared	0.86	0.86	0.77	0.77	0.88	0.88	0.69	0.69

Note: Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. The results for the second round of elections (May 1932) are qualitatively and quantitatively similar. Observations are weighted by district-level population.

Table 9. Radio Availability and Nazi Party Membership: Cross-Sectional Estimates

	Log of the Number of Party Members of NSDAP					
	November 1932		*March 1933*			
Radio signal strength	0.002	0.002	0.004*	0.003*	0.003*	0.003*
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
Share of Jewish population, 1925	-5.858	-5.590	3.204	2.574	3.827	3.177
	[5.652]	[5.770]	[3.464]	[3.579]	[3.256]	[3.375]
Share of Catholic population, 1925	-0.725**	-0.734***	-0.011	-0.021	0.067	0.058
	[0.266]	[0.264]	[0.138]	[0.143]	[0.132]	[0.138]
Share of blue-collar workers, 1925	-0.175	-0.157	-0.043	-0.108	-0.024	-0.091
	[0.417]	[0.411]	[0.344]	[0.342]	[0.337]	[0.333]
Share of white-collar workers, 1925	2.377***	2.705***	0.967*	1.062*	0.712	0.770
	[0.667]	[0.700]	[0.547]	[0.531]	[0.524]	[0.508]
City (*Stadtkreis*)	-0.093	-0.047	-0.033	-0.048	-0.024	-0.044
	[0.108]	[0.115]	[0.065]	[0.069]	[0.064]	[0.065]
Pogroms in 1349	-0.054	-0.053	0.044	0.045	0.050	0.051
	[0.076]	[0.074]	[0.076]	[0.077]	[0.077]	[0.078]
Jewish settlement in 1349	-0.072	-0.059	-0.008	-0.006	-0.000	0.000
	[0.068]	[0.067]	[0.048]	[0.049]	[0.050]	[0.050]
War participants per 1,000	0.000	-0.000	0.013	0.013	0.013	0.013
	[0.012]	[0.012]	[0.011]	[0.011]	[0.010]	[0.010]
Welfare recipients per 1,000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pensioners with social assistance per 1,000	0.010	0.012*	-0.003	-0.003	-0.004	-0.004
	[0.007]	[0.007]	[0.006]	[0.006]	[0.006]	[0.006]
Lof of average property tax payment	-0.009	-0.015	-0.016	-0.010	-0.015	-0.009
	[0.053]	[0.053]	[0.043]	[0.043]	[0.042]	[0.042]
Log of party membership in 1932					0.107***	0.108***
					[0.031]	[0.032]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933	No	Yes	No	Yes	No	Yes
Observations	633	593	633	633	633	633
R-squared	0.56	0.58	0.41	0.41	0.42	0.43

Note: Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment.

Table 10. Radio Availability and Anti-Semitism

Sample:	*All Cities*			*Only Cities with Jewish Settlements in 1349*		
	Letters to *Der Stürmer*	Attacks on synagogues	Log(deportations before 1942)	Letters to *Der Stürmer*	Attacks on synagogues	Log(deportations before 1942)
Radio signal strength in 1935	0.006**	0.001	0.013***	0.008**	-0.001	0.005
	[2.394]	[0.545]	[2.678]	[2.019]	[-0.431]	[0.579]
Log (population)	0.176***	-0.013	0.282***	0.262***	-0.019	0.485***
	[5.222]	[-1.092]	[4.812]	[4.195]	[-1.194]	[4.719]
Share of Jewish population, 1925	11.733***	3.653***	44.299***	15.018***	1.513	52.862***
	[4.802]	[3.954]	[8.890]	[3.247]	[0.740]	[4.202]
Share of Catholic population, 1925	-0.059	0.050	0.395*	-0.066	-0.182	0.502
	[-0.523]	[0.642]	[1.771]	[-0.221]	[-1.406]	[0.996]
Share of blue-collar workers, 1925	-0.035***	-0.015**	-0.120***	-0.075**	-0.007	-0.180***
	[-4.344]	[-2.419]	[-7.240]	[-2.488]	[-0.636]	[-3.655]
Share of white-collar workers, 1925	0.034**	0.031***	0.159***	0.078	0.015	0.186*
	[2.285]	[2.679]	[4.768]	[1.244]	[0.843]	[1.758]
Pogroms in 1349	0.345***	0.137**	0.716***	0.332***	0.128*	0.593***
	[3.661]	[2.417]	[4.510]	[3.190]	[1.853]	[3.221]
Jewish settlement in 1349	0.156**	-0.022	0.238*			
	[1.974]	[-0.431]	[1.682]			
War participants per 1,000	-0.012	-0.003	-0.046*	0.004	0.000	-0.025
	[-0.881]	[-0.547]	[-1.812]	[0.154]	[-0.028]	[-0.832]
Welfare recipients per 1,000	0.000	-0.001***	0.001	-0.000**	-0.000*	0.000
	[0.977]	[-5.311]	[1.086]	[-2.242]	[-1.653]	[-0.217]
Pensioners with social assistance per 1,000	0.006	0.003	0.033***	0.019	0.001	0.049**
	[0.987]	[0.994]	[2.769]	[1.648]	[0.180]	[2.212]
Log of average property tax payment	0.192***	0.002	0.197***	0.240***	-0.006	0.405***
	[5.237]	[0.114]	[2.763]	[3.428]	[-0.235]	[3.066]
Synagogues in 1933		0.608***			0.682***	
		[16.709]			[8.086]	
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,216	1,181	1,156	308	302	286
R-squared	0.39	0.37	0.44	0.54	0.52	0.63

Note: Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Unit of observation is city in Voigtländer and Voth (2012) sample. Voting controls include voter turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. The results are qualitatively similar if we use only the set of controls of Voigtländer and Voth (2012), i.e., the share of Jews, share of Catholics, population, and pogroms in 1349.

Table 11. Radio Availability and Anti-Semitism, the Role of Historic Predispositions

Sample:	*All Cities*			*Only Cities with Jewish Settlements in 1349*		
	Letters to *Der Stürmer*	Attacks on synagogues	Log(deportations before 1942)	Letters to *Der Stürmer*	Attacks on synagogues	Log(deportations before 1942)
Pogroms in 1349 * Radio signal strength	0.014***	0.002	0.017*	0.032***	0.014**	0.047**
	[3.090]	[1.187]	[1.772]	[2.740]	[2.555]	[2.504]
Radio signal strength (1935)	0.001	0.000	0.009*	-0.021*	-0.014**	-0.036**
	[0.508]	[-0.077]	[1.714]	[-1.890]	[-2.470]	[-2.029]
Log (population)	0.169***	-0.015	0.272***	0.265***	-0.017	0.482***
	[5.117]	[-1.171]	[4.716]	[4.321]	[-1.085]	[4.751]
Share of Jewish population, 1925	11.647***	3.644***	44.111***	14.627***	1.335	51.940***
	[4.833]	[3.968]	[8.856]	[3.253]	[0.673]	[4.191]
Share of Catholic population, 1925	-0.058	0.050	0.399*	-0.090	-0.193	0.471
	[-0.511]	[0.639]	[1.794]	[-0.311]	[-1.604]	[0.921]
Share of blue-collar workers, 1925	-0.035***	-0.015**	-0.121***	-0.076**	-0.007	-0.180***
	[-4.343]	[-2.411]	[-7.306]	[-2.558]	[-0.699]	[-3.792]
Share of white-collar workers, 1925	0.035**	0.031***	0.161***	0.078	0.015	0.185*
	[2.349]	[2.700]	[4.913]	[1.305]	[0.879]	[1.835]
Pogroms in 1349	-0.017	0.074	0.268	-0.455	-0.226*	-0.561
	[-0.114]	[1.119]	[0.931]	[-1.634]	[-1.662]	[-1.140]
Jewish settlement in 1349	0.156**	-0.022	0.238*			
	[1.990]	[-0.433]	[1.698]			
War participants per 1,000	-0.012	-0.003	-0.047*	0.007	-0.001	-0.021
	[-0.947]	[-0.576]	[-1.883]	[0.271]	[-0.121]	[-0.764]
Welfare recipients per 1,000	0.000	-0.001***	0.001	-0.001**	-0.000**	0.000
	[0.822]	[-5.356]	[0.996]	[-2.580]	[-2.216]	[-0.648]
Pensioners with social assistance per 1,000	0.006	0.003	0.033***	0.022*	0.002	0.053**
	[1.019]	[1.010]	[2.830]	[1.904]	[0.556]	[2.522]
Log of average property tax payment	0.192***	0.002	0.194***	0.227***	-0.011	0.391***
	[5.233]	[0.111]	[2.740]	[3.339]	[-0.408]	[2.995]
Synagogues in 1933		0.608***			0.682***	
		[16.668]			[8.491]	
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,216	1,181	1,156	308	302	286
R-squared	0.39	0.37	0.44	0.55	0.54	0.64

Note: Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Unit of observation is city in Voigtländer and Voth (2012) sample. Voting controls include voter turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. The results are qualitatively similar if we use only the set of controls of Voigtländer and Voth (2012), i.e., the share of Jews, share of Catholics, population, and pogroms in 1349.

Table 12. Placebo Tests

Panel A: Radio Availability in 1930 and Voting in 1924

Dependent Variables:	Radio Signal Strength in 1930	Baseline Controls	Unemployment Controls	Obs.	R-squared
Vote share of DNVP in 1924	-0.00074	Yes	Yes	895	0.86
	[0.00049]				
Vote share of KPD in 1924	-0.00004	Yes	Yes	895	0.71
	[0.00020]				
Vote share of SPD in 1924	-0.0001	Yes	Yes	895	0.86
	[0.00028]				
Vote share of Zentrum in 1924	-0.00014	Yes	Yes	895	0.99
	[0.00016]				
Voter turnout in 1924	-0.00380	Yes	Yes	895	0.73
	[0.01967]				

Panel B: Radio Availability in 1930 and Voting in 1925 Presidential Elections

Dependent Variables:	Radio Signal Strength in 1930	Baseline Controls	Unemployment Controls	Obs.	R-squared
Vote share of von Hindenburg in 1925	-0.024	Yes	Yes	953	0.92
	[0.033]				
Vote share of Marx in 1925	0.015	Yes	Yes	953	0.93
	[0.031]				
Vote share of Thälmann in 1925	0.009	Yes	Yes	953	0.95
	[0.007]				
Voter turnout in 1925	-0.004	Yes	Yes	953	0.86
	[0.024]				

Panel C: Radio Availability in 1935 and City-Level Violence Before 1930s

Dependent Variables:	Radio Signal Strength in 1935	Baseline Controls	Unemployment Controls	Obs.	R-squared
	All cities				
Crime rate, 1900 – 1920	-0.0002	Yes	Yes	1,142	0.42
	[-1.3444]				
Pogroms in 1920s	0.0007	Yes	Yes	1,194	0.15
	[0.6408]				
	Only cities with Jewish settlements in 1349				
Crime rate, 1900 – 1920	-0.0003	Yes	Yes	301	0.44
	[-1.1726]				
Pogroms in 1920s	0.0025	Yes	Yes	303	0.24
	[1.1463]				

Note: Each line reports results of a separate regression. Specifications are exactly the same as in corresponding regressions with real rather than placebo outcomes. Results are the same if we do not include unemployment controls.

Appendix

Data sources

Data on transmitters: *Rundfunk Jahrbuch 1929*, 1929, Sept 1930 – *Mitteilungen der Reichs-Rundfunk-Gesellschaft*, 211, 1930, April 1932 – *Mitteilungen der Reichs-Rundfunk-Gesellschaft*, 303, 1932, October 1932 – *Mitteilungen der Reichs-Rundfunk-Gesellschaft*, 330, 1932, March 1933 – *Mitteilungen der Reichs-Rundfunk-Gesellschaft*, 351, 1933, and others till 1938. All those sources cite as a primary source "Union Internationale de telecommunications." – Brundjak, Andreas (2010) *Die Geschichte der deutschen Mittelwellen-Sendeanlagen von 1923 bis 1945*. Funk Verlag Bernhard Hein e.K., Table p. 109ff. Signal strength has been calculated using Irregular Terrain Model (Hufford 2002, Olken 2008)

Electoral and sociodemographic data: "*Wahl- und Sozialdaten der Gemeinden und Kreise des Deutschen Reiches 1920 – 1933*" (ZA study number 8013). Principal investigator: J.W. Falter; available through the Zentralarchiv für empirische Sozialforschung in Köln, Germany, (March/April 1988).

Data on listeners: "Teilnahme am Rundfunk in den einzelnen OPD-Bezirken in Orten mit mehr als 2500 Einwohnern am 1. April 1933," *Veröffentlichungen des Verbandes der Funkindustrie e.V.*, 12, 1933. We use data from the appendix: the number of registered listeners (paying a radio license fee or exempt from paying) divided by the number of households for the years 1931, 1932, and 1933 – *Mitteilungen der Reichsrundfunkgesellschaft*, various numbers from the end of 1933 and beginning of 1934.

Data on deportations: *Gedenkbuch*, Bundesarchiv.

Letters to *Der Stürmer*, pogroms in 1349, and attacks on synagogues: Voigtländer and Voth (2012).

Hitler's electoral speeches: Domarus, Max (1962) "*Hitler Reden und Proklamationen 1932 – 1945*", Band 1, Würzburg, p. 115ff., p. 139ff.

Data on woodland: "Ergebnisse der Forstwirtschaftlichen Erhebung," *Statistik des Deutschen Reichs*, Band 386 (1927).

Data on welfare: "*Die öffentliche Fürsorge im Deutschen Reich in den Rechnungsjahren 1927 bis 1931,*" *Statistik des Deutschen Reichs*, Band 421, Berlin, 1933, *Verlag Hobbing*. We use data from *Statistik der Bezirksfürsorgeverbände*. *Einzelergebnisse*, Tabelle 5. *Gesamter Personenkreis der unterstützten Hilfsbedürftigen und Fürsorgekosten im Rechnungsjahr 1929, Spalten: Einwohnerzahl in*

1000, 3- Auf 1000 Einwohner, 4- Kriegsbeschädigte, Kriegshinterbliebene und Gleichgestellt, 5- Sozialrentner, 6- Kleinrentner und Gleichgestellte, S. 114-135

Data on income tax: "*Die Einkommen- und Körperschaftssteuerveranlagungen für 1932 und 1933*," *Statistik des Deutschen Reichs,* Band 482*,* Berlin, 1936*, Verlag für Sozialpolitik, Wirtschaft und Statistik*. We use data from Teil I Abschnitt A, *Einkommensteuerveranlagung, Steuerpflichtige, Einkünfte und festgesetzte Steuer 1932 und 1933*, S. 62 – 93.

Data on corporate tax: "*Die Einkommen- und Körperschaftssteuerveranlagungen für 1932 und 1933*," *Statistik des Deutschen Reichs*, Band 482, Berlin 1936, *Verlag für Sozialpolitik, Wirtschaft und Statistik*. We use data from Teil II Abschnitt A, *Körperschaftsteuerveranlagung*, S. 302 – 310.

Data on property tax: "*Die Hauptveranlagung der Vermögensteuer nach dem Stand vom 1 Januar 1935," Statistik des Deutschen Reichs,* Band 519, Berlin, 1938, *Verlag für Sozialpolitik, Wirtschaft und Statistik*. We use data from Anhang, Abschnitt A, *Vermögensteuerveranlagung* 1931, S. 194 – 209

Data on NSDAP Party membership: Project by Prof. Falter: "NSDAP-Members in Germany Who Joined the Party in the Years Before 1933 – 1934". The samples were taken at random by members of the *Arbeitsbereich Vergleichende Faschismusforschung des ZI6 der FU Berlin*, in cooperation with the Department of Sociology, University of Minnesota, Minneapolis. Sample description: Historical Social Research, Vol. 16, 1991, No. 3, 113 – 151. We use only 1932 and 1933 data.

Table A1. Summary Statistics

Panel A. Voting Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Vote share of SPD, 1924	1021	0.227	0.119	0.007	0.550
Vote share of KPD, 1924	1021	0.063	0.060	0.002	0.427
Vote share of DNVP, 1924	1021	0.207	0.156	0.006	0.848
Vote share of Zentrum, 1924	1021	0.146	0.232	0.000	0.922
Turnout, 1924	1021	78.939	6.835	55.449	94.059
Turnout, April 1925	1007	75.602	11.212	24.469	99.296
Vote share of von Hindenburg, 1925	1007	53.303	19.466	5.506	96.472
Vote share of Marx, April 1925	1007	42.293	19.394	3.354	94.064
Vote share of Thälmann, 1925	1007	4.345	4.885	0.119	36.373
Vote share of NSDAP, 1928	1016	3.172	4.008	0.144	36.152
Vote share of SPD, 1928	1016	0.262	0.130	0.013	0.591
Vote share of KPD, 1928	1016	0.063	0.065	0.001	0.425
Vote share of DNVP, 1928	1016	0.147	0.133	0.005	0.787
Vote share of Zentrum, 1928	1016	0.202	0.226	0.001	0.811
Turnout, 1928	1016	74.676	7.980	41.552	93.548
Approval of anti-Treaty referendum, 1929	986	12.661	12.632	0.016	64.717
Share of votes "yes" for anti-Treaty referendum, 1929	986	17.608	13.750	0.212	76.060
Vote share of NSDAP, 1930	998	19.036	8.999	1.011	58.803
Vote share of SPD, 1930	998	0.219	0.116	0.012	0.558
Vote share of KPD, 1930	998	0.085	0.069	0.002	0.444
Vote share of DNVP, 1930	998	0.070	0.074	0.003	0.492
Vote share of Zentrum, 1930	998	0.197	0.224	0.001	0.832
Turnout, 1930	998	80.807	6.424	56.704	94.967
Vote share of von Hindenburg, 1932	984	50.043	15.744	8.202	88.522
Vote share of Hitler,1932	984	32.995	12.196	6.737	80.035
Vote share of Thälmann, 1932	984	9.207	6.672	0.287	42.235
Turnout, April 1932	984	85.347	5.082	58.196	99.420
Vote share of NSDAP, July 1932	993	39.449	14.721	5.865	83.004
Vote share of SPD, July 1932	993	0.186	0.101	0.009	0.495
Vote share of KPD, July 1932	993	0.101	0.067	0.004	0.395
Vote share of DNVP, July 1932	993	0.059	0.043	0.003	0.320
Vote share of Zentrum, July 1932	993	0.201	0.225	0.001	0.864
Turnout, July 1932	993	83.608	6.151	54.242	95.079
Vote share of NSDAP, November 1932	939	34.992	13.454	5.328	76.424
Vote share of SPD, November 1932	939	0.178	0.096	0.012	0.502
Vote share of KPD, November 1932	939	0.122	0.070	0.005	0.436
Vote share of DNVP, November 1932	939	0.080	0.060	0.005	0.358
Vote share of Zentrum, November 1932	939	0.200	0.222	0.001	0.826
Turnout, November 1932	939	79.770	7.051	49.193	98.269
Vote share of NSDAP, 1933	939	47.221	12.170	13.293	83.006
Vote share of SPD, 1933	939	0.156	0.091	0.007	0.464
Vote share of KPD, 1933	939	0.083	0.060	0.002	0.360
Vote share of Zentrum, 1933	939	0.175	0.191	0.000	0.777
Turnout, 1933	939	88.566	3.680	69.749	96.046

Panel B. Signal and Listener Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Radio signal strength, 1928	1023	11.159	12.748	-34.748	61.195
Radio signal strength, 1929	1023	11.344	12.827	-34.748	61.195
Radio signal strength, 1930	1023	12.364	12.902	-34.079	61.987
Radio listenership (subscriptions per 100), 1931	844	18.795	8.123	4.467	59.600
Radio signal strength, July 1932	1023	17.250	11.472	-20.224	61.195
Radio listenership (subscriptions per 100), 1932	877	22.167	8.141	4.867	71.800
Radio signal strength, November 1932	1023	17.754	11.636	-20.224	64.206
Radio signal strength, 1933	1023	21.801	11.127	-7.268	61.195
Radio listenership (subscriptions per 100), 1933	878	26.311	8.653	0.443	79.337
Radio signal strength, 1935	1023	25.112	10.204	-1.985	69.971

Table A1. Summary statistics (continued)

Panel C. Census and Official Statistics Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Population (in thousands), 1924	1021	54.225	67.483	1.576	1050.359
Population (in thousands), 1928	1023	57.495	75.055	1.577	1152.523
Population (in thousands), 1930	1023	59.130	79.071	1.577	1152.523
Population (in thousands), July 1932	1023	59.376	79.341	1.577	1152.523
Population (in thousands), November 1932	1023	61.010	79.469	1.577	1152.523
Population (in thousands), 1933	1023	61.031	79.518	1.577	1152.523
Share of Jewish population, 1925	987	0.005	0.006	0.000	0.053
Share of Catholic population, 1925	987	0.368	0.379	0.003	0.998
Share of blue-collar workers, 1925	987	0.382	0.129	0.113	1.610
Share of white-collar workers, 1925	987	0.122	0.068	0.024	0.379
War participants per 1,000, 1930	990	0.610	1.941	0.000	28.778
Welfare recipients per 1,000, 1930	990	27.479	51.470	3.500	1531.000
Pensioners with social assistance per 1,000, 1930	990	8.753	5.117	0.000	36.879
Log of average property tax payment, 1930	976	6.198	0.728	2.228	8.446

Panel D. Other variables

Variable	Observations	Mean	Std. Dev.	Min	Max
City (*Stadtkreis*) dummy	1023	0.223	0.416	0.000	1.000
Pogroms in 1349	1023	0.196	0.397	0.000	1.000
Jewish settlement in 1349	1023	0.304	0.460	0.000	1.000
NSDAP new members, 1932	1024	1.643	0.897	0.000	4.844
NSDAP new members, 1933	1024	0.765	0.690	0.000	3.611
Log number of deported, 1933 – 1939	106	1.596	0.853	0.693	4.369
Number of deported, 1933 – 1939, missings replaced with zeros	1024	0.165	0.558	0.000	4.369
Number of Hitler's speeches, 1932	1024	0.094	0.311	0.000	2.000
Number of Hitler's speeches, 1932 – 1933	1024	0.103	0.357	0.000	3.000

Table A2. Radio Availability and Voting for the Nazis in 1930: The Effect of Adding Controls

	Nazi Vote Share, September 1930								
Radio signal strength	-0.118***	-0.101**	-0.101**	-0.088***	-0.088***	-0.090***	-0.091***	-0.090***	-0.091***
	[0.030]	[0.040]	[0.042]	[0.025]	[0.025]	[0.026]	[0.027]	[0.027]	[0.027]
Share of Jewish population, 1925					20.403	16.800	9.510	5.878	3.408
					[55.842]	[55.970]	[56.194]	[59.504]	[59.836]
Share of Catholic population, 1925					-15.660***	-15.486***	-15.540***	-15.480***	-15.500***
					[4.216]	[4.109]	[4.148]	[4.126]	[4.119]
Share of blue-collar workers, 1925					-1.432	-0.824	-0.653	-0.655	-0.937
					[4.331]	[4.643]	[4.689]	[4.613]	[4.571]
Share of white-collar workers, 1925					19.238***	15.452***	14.754**	13.186**	13.230**
					[4.683]	[5.388]	[5.652]	[6.015]	[5.945]
City (S*tadtkreis*)						0.883	0.890	0.825	0.648
						[0.999]	[1.001]	[1.052]	[0.988]
Pogroms in 1349							0.925*	0.888*	0.910*
							[0.517]	[0.522]	[0.529]
Jewish settlement in 1349							-0.289	-0.274	-0.309
							[0.524]	[0.525]	[0.543]
War participants per 1,000								0.033	0.028
								[0.068]	[0.068]
Welfare recipients per 1,000								-0.001	-0.001
								[0.001]	[0.001]
Pensioners with social assistance per 1,000								0.023	0.026
								[0.053]	[0.053]
Log of average property tax payment								0.299	0.324
								[0.361]	[0.370]
Province fixed effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population, fifth-order polynomial			Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924				Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933									Yes
Observations	959	959	959	959	959	959	959	959	959
R-squared	0.03	0.34	0.35	0.60	0.64	0.64	0.64	0.64	0.65

Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment.Observations are weighted by district-level population.

Table A3. Radio Availability and Turnout: Cross-Sectional Estimates

	Voter Turnout									
	March 1928		*September 1930*		*July 1932*		*November 1932*		*March 1933*	
Radio signal strength	0.004	0.005	-0.012	-0.012	-0.051*	-0.051*	-0.046*	-0.046*	-0.028*	-0.029*
	[0.019]	[0.019]	[0.018]	[0.018]	[0.025]	[0.025]	[0.026]	[0.026]	[0.015]	[0.015]
Share of Jewish population, 1925	50.589	52.826	48.673	49.385	89.208**	90.988**	115.325**	119.963**	34.365	33.903
	[42.365]	[42.094]	[32.531]	[32.821]	[38.668]	[38.576]	[51.413]	[50.629]	[22.029]	[21.834]
Share of Catholic population, 1925	1.580	1.606	1.407	1.416	-2.527	-2.552	-3.167	-3.101	-2.641***	-2.635***
	[1.239]	[1.251]	[1.528]	[1.526]	[2.201]	[2.213]	[2.285]	[2.273]	[0.905]	[0.921]
Share of blue-collar workers, 1925	7.868***	8.093***	6.390**	6.483**	8.399***	8.403***	5.808**	5.996**	3.299**	3.154**
	[2.366]	[2.488]	[2.676]	[2.755]	[2.773]	[2.763]	[2.650]	[2.680]	[1.269]	[1.199]
Share of white-collar workers, 1925	-6.483	-6.694	11.216***	11.271***	0.468	-0.733	-0.486	-3.100	0.069	-0.800
	[4.499]	[4.350]	[3.407]	[3.477]	[4.773]	[4.840]	[4.355]	[4.562]	[2.968]	[3.078]
City (*Stadtkreis*)	2.275***	2.444***	1.747**	1.812**	0.225	0.130	0.619	0.508	0.811	0.660
	[0.678]	[0.688]	[0.771]	[0.801]	[0.763]	[0.768]	[0.829]	[0.818]	[0.545]	[0.556]
Pogroms in 1349	0.201	0.182	-0.819*	-0.826*	-0.038	-0.051	-0.106	-0.136	0.361	0.371
	[0.628]	[0.615]	[0.454]	[0.449]	[0.431]	[0.433]	[0.554]	[0.553]	[0.292]	[0.299]
Jewish settlement in 1349	0.061	0.090	0.553*	0.568*	0.580*	0.536*	0.708*	0.674*	0.159	0.128
	[0.438]	[0.437]	[0.326]	[0.324]	[0.302]	[0.296]	[0.390]	[0.387]	[0.229]	[0.227]
War participants per 1,000	-0.042	-0.037	0.087**	0.089**	0.084**	0.083**	0.131**	0.131**	0.041*	0.038
	[0.057]	[0.058]	[0.041]	[0.042]	[0.039]	[0.040]	[0.057]	[0.057]	[0.023]	[0.024]
Welfare recipients per 1,000	0.003	0.002	0.001	0.001	-0.000	-0.001	-0.002***	-0.002***	-0.001***	-0.001***
	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]
Pensioners with social assistance per 1,000	0.117***	0.114***	0.048	0.047	0.130***	0.125***	0.139***	0.124***	0.051***	0.048***
	[0.034]	[0.035]	[0.039]	[0.039]	[0.028]	[0.029]	[0.027]	[0.030]	[0.018]	[0.017]
Log of average property tax payment	0.596**	0.575*	0.861**	0.851**	0.293	0.303	0.310	0.308	0.053	0.069
	[0.284]	[0.285]	[0.315]	[0.314]	[0.247]	[0.246]	[0.276]	[0.270]	[0.138]	[0.141]
Population, fifth-order polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting controls, 1924	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment controls, 1933		Yes		Yes		Yes		Yes		Yes
Observations	959	959	960	960	959	959	919	919	919	919
R-squared	0.45	0.46	0.64	0.64	0.87	0.87	0.83	0.83	0.79	0.81

Standard errors are clustered by province (*Wahlkreis*). * p<0.1, ** p<0.05, *** p<0.01. Voting controls include turnout and vote shares of DNVP, KPD, SPD, and Zentrum in 1924. Unemployment controls include share of unemployed and the share of people without full-time employment. Observations are weighted by district-level population. Number of observations changes between July and November of 1932 because of redistricting.

Figure A1. The change in Nazi party vote share, actual and predicted for signal strength set to a sample minimum. Kernel density estimates. Blue lines – raw data, red lines – prediction for the case of minimal signal strength.

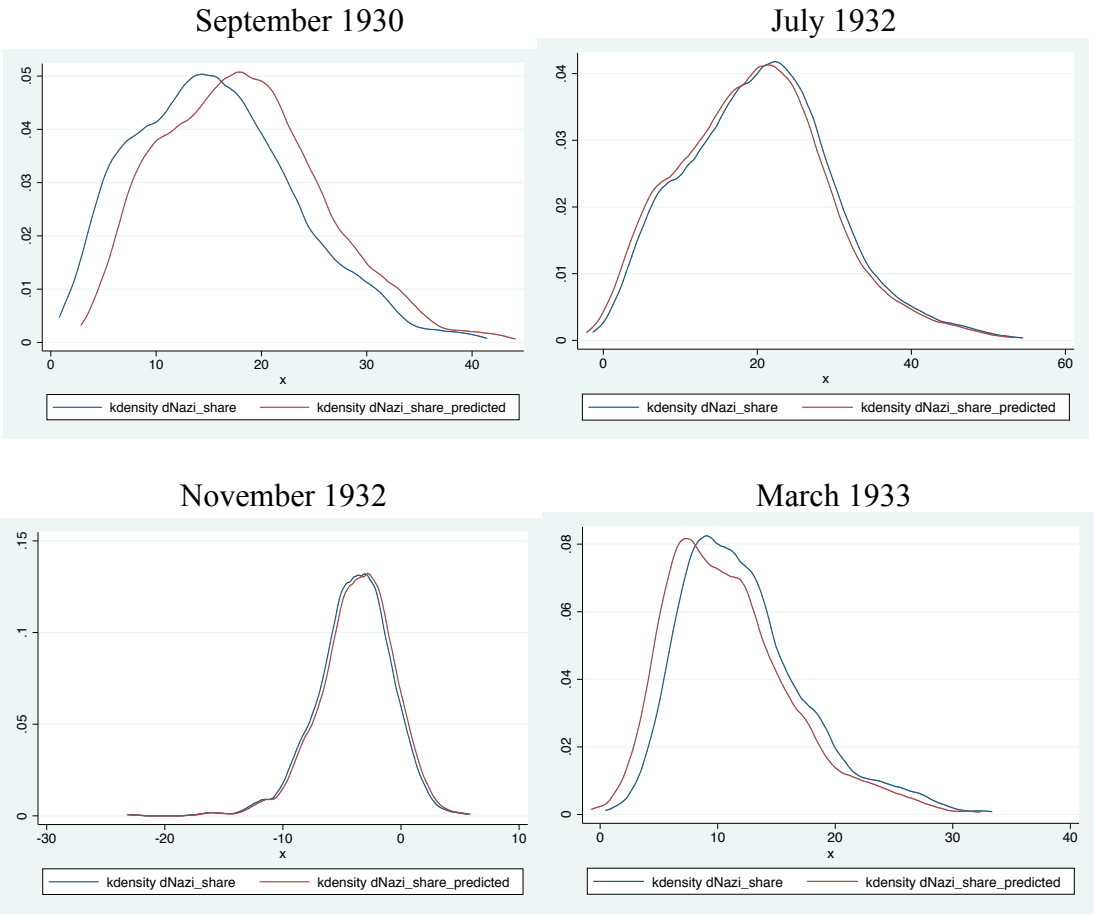
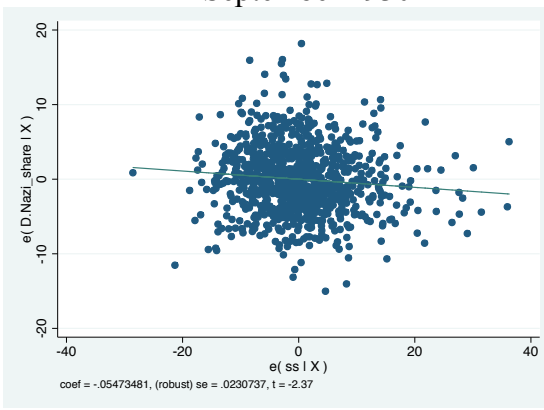
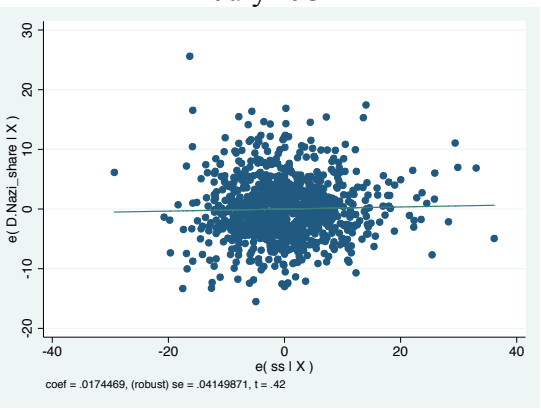


Figure A2. Changes in Nazi vote share: Residual plots

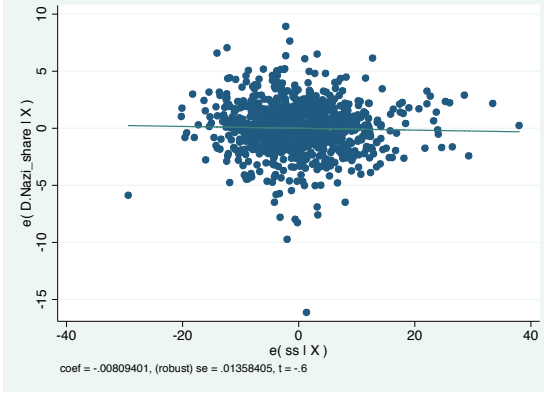
September 1930



July 1932



November 1932



March 1933