

HIGHWAY TO HITLER*

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Abstract: Can infrastructure investment win “hearts and minds”? We analyze a famous case – the building of the highway network in Nazi Germany. Construction began shortly after Hitler’s takeover of the government, and was one of the regime’s most important projects. We collect new data on highway construction, and examine its role in increasing support for the Nazi regime during the period that led up to the 1934 referendum. The plebiscite merged the offices of chancellor and president, establishing Hitler’s supreme power as *Führer*. Our results suggest that highway construction was highly effective, building popular support and helping to entrench the Nazi dictatorship.

Keywords: political economy, entrenchment of dictatorships, infrastructure spending

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I. Introduction

How do dictatorships become firmly entrenched? Some authoritarian regimes develop deep roots in society and become enormously popular; others are overthrown at the earliest opportunity. Two strategies are particularly common – the pursuit of populist policies (Acemoglu, Egorov, and Sonin 2013) and the holding of (staged) elections.¹ The former are intended to win “hearts and minds”; the latter, to showcase the overwhelming support of the population for the government. Some dictatorships have a particular preference for large-scale building projects – Josef Stalin built the White Sea-Baltic Canal shortly after his accession to supreme power, and Ferdinand Marcos committed to a large highway building program immediately after coming to office.

We examine the interplay of infrastructure spending and elections in the consolidation of a genocidal and belligerent dictatorship – the Nazi regime. When Hitler became chancellor in January 1933, the Nazi grip on power was not yet absolute. By 1934, the regime was under strain: Conservatives around the President increasingly resented the Hitler government, even threatening military rule; and the regime’s popularity amongst the middle class and workers was falling. Hitler only established himself in a position of supreme power in August 1934, after a referendum demonstrated overwhelming support for combining the positions of chancellor and president, concentrating singular authority in the hands of the *Führer* in a legitimate fashion.² We ask whether, in the period leading up to the referendum, the Nazis effectively “bought” popular support through public works programs and infrastructure investment. Existing research on the political economy of “bread and circuses” have largely focused on democratic settings.³ Some studies only find minimal effects of infrastructure spending on support of the government.⁴ Others document that spending programs and

¹ Simpson 2013; Jessen and Richter 2011; Egorov and Sonin 2014.

² In addition to the referendum, the wholesale murder of the SA-leadership and other prominent anti-Nazis in the *Night of the Long Knives* allowed Hitler to consolidate his powers.

³ Burgess et al. (2015) is a notable exception, examining the effect of democracy and dictatorship on ethnic favoritism in road building.

⁴ Stein and Bickers (1994), and Feldman and Jondrow (1984). In line with this, deficit spending before elections is not reliably associated with electoral success (Brender and Drazen 2008; Brender and Drazen 2005). Also, government spending is often focused on the more informed and politically active parts of the electorate

income transfers in democracies can boost the government’s performance at the ballot box.⁵ The extent to which new dictatorships can buy their way into the hearts and minds of the populace is largely unexplored.⁶ To succeed in showing very high levels of public support, dictatorships need to convince previously opposed groups – which is arguably more difficult than swaying voters with preferences close to the median.

In this paper, we examine whether populist policies increased the Nazi regime’s popularity at a critical juncture in history. We analyze the electoral benefits of building the world’s first nationwide highway network – the German *Autobahn*. Its construction by the Nazi regime after 1933 is one of the canonical cases of government infrastructure investment. It was also exploited by propaganda as a testament to the new regime’s effectiveness in overcoming austerity (Shand 1984). To measure the effects of road-building, we compare local election results from the November 1933 parliamentary election (when construction had barely begun) and the August 1934 referendum (when large-scale building was already under way).⁷ While support for the Nazi party was around 90 percent in both elections, local results varied widely: in Garrel, Lower Saxony, in August 1934, only 60 percent of voters said yes. In Wendlingen, officials recorded support of 99.9 percent.⁸

We first illustrate our main finding by mapping road-building and the geographical distribution of voting results.⁹ Fortunately for our analysis, road-building had started in

(Strömberg 2004; Besley and Burgess 2002), making it more plausible that these measures are expected to have an effect.

⁵ Levitt and Snyder (1997), Manacorda, Miguel, and Vigorito (2011), and Litschig and Morrison (2010).

⁶ In a different context, Beath et al. (2011) show that support for the government in Afghanistan increased alongside local spending on community development. There is also some evidence that infrastructure spending targeted at rebel areas during the Iraq occupation induced civilians to share information about insurgents, and thus helped to reduce violence (Berman, Shapiro, and Felner 2011).

⁷ We do not assume that the share of yes-votes cast is an unbiased indicator of support for the regime (Evans 2006). The elections in 11/1933 and 8/1934 are not strictly comparable – we compare support for the Nazi list in the German parliament with support for a constitutional change in a plebiscite. That is why we focus on differential changes over time in the standardized local level of support – the share of votes cast in favor of the Nazi Regime.

⁸ Even large cities recorded substantial differences: In Aachen, for example, 24% voted “no”; in Nuremberg, on the other hand, only 4.6% voted against the government proposition.

⁹ The transition between highway segments “approved for construction” and “under construction” in Figure 5 is fluid, and even the historical maps discussed in Section 2 are not completely clear about the exact timing. For example, a few smaller segments are listed as “under construction” in the May 1934, but as “approved for construction” in the November 1934 map. We use “under construction” as our main ‘treatment’ variable, and

earnest, in many locations, by August 1934 – but there was almost none before the preceding election, in November 1933.¹⁰ In Figure 1, we plot changes in support for the Nazi regime between November 1933 and August 1934, after accounting for log city population and unemployment in 1933, as well as regional fixed effects corresponding to 77 administrative districts in Weimar Germany (*Regierungsbezirke*).¹¹ The darker the red on the map, the greater the (residual) electoral gains of the Nazi Party. Solid black lines are roads under construction; dashed ones, roads approved but not yet being built. The map demonstrates that, on average, areas through which the new highways passed saw much greater gains in support for the Nazis than the rest. This is particularly true in East Prussia, the North of Germany, in the West around the Ruhr, and in the area around Frankfurt. While there are areas with massive increases in support without road-building (such as along the shoreline of the North Sea near Holland), they are relatively rare.

document the robustness of results to including “approved for construction” below. Whenever we refer to “highways” in the following, we mean segments that were listed as “under construction.”

¹⁰ Cf. Figure A.1 in the Appendix, which shows that by November 1933, almost no labor was employed in highway construction.

¹¹ In order to compare Nazi support across different elections and referenda, we use the difference in standardized vote shares with mean zero and standard deviation one. The log of city population and the unemployment rate are the baseline controls in our empirical analysis, motivated by the fact that larger cities were more likely to see highway construction, and the popular argument that motorway building was meant to create jobs.

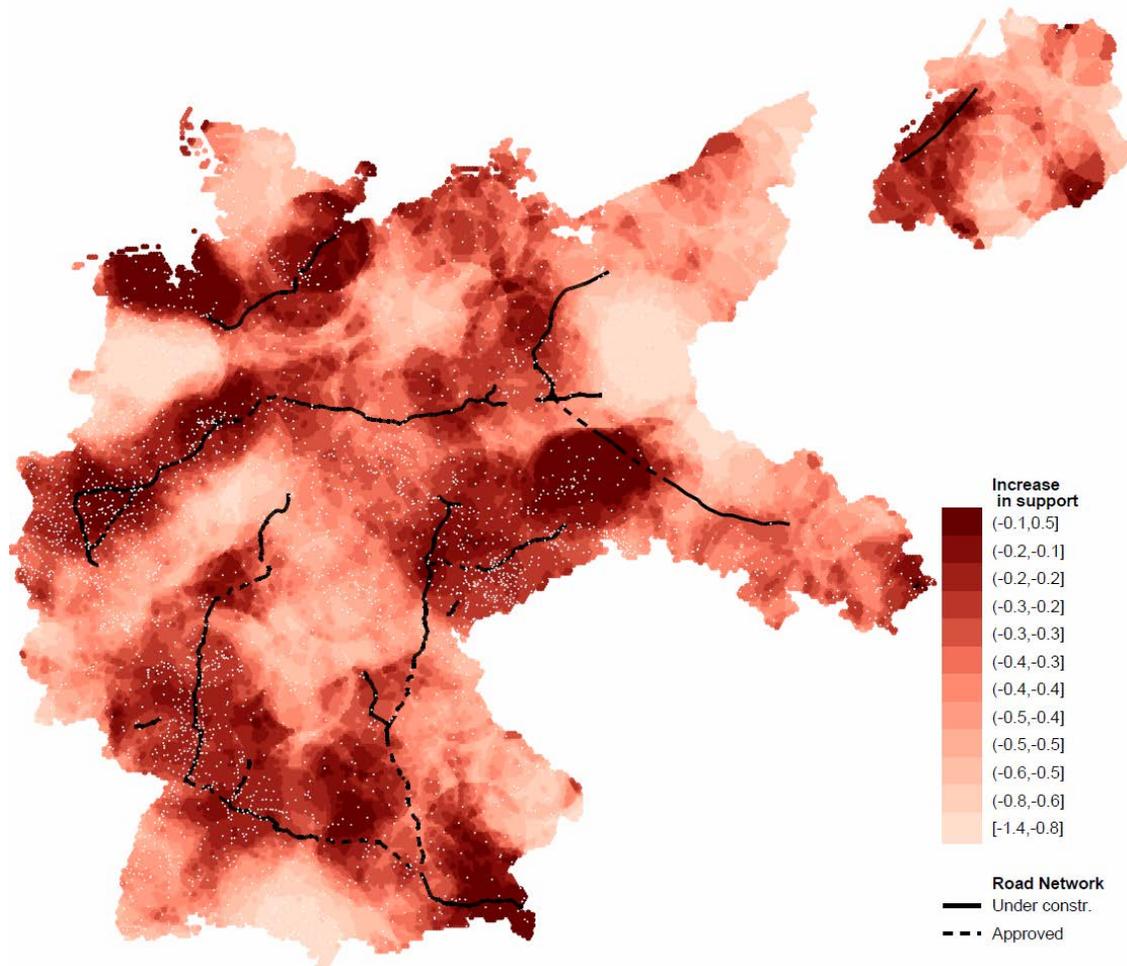


Figure 1: Shift in favor of the Nazi Regime between Nov. 33 and Aug. 34

Note: The figure shows the difference in standardized pro-Nazi votes between the November 1933 election and the August 1933 referendum, after controlling for city population, unemployment, and fixed effects for 77 administrative districts (*Regierungsbezirke*). Small white dots in the figure indicate towns and cities in our dataset.

Complementing the map shown above, we can also illustrate that the shift Nazi support between November 1933 and August 1934 varied systematically with distance to highway segments under construction. Figure 2 plots the change in support for the Nazi regime by distance bracket. Where the roads were close, the Nazis gained support. Where they were more than 40 km away, they lost support – and the greater the distance, the bigger the increase in opposition.

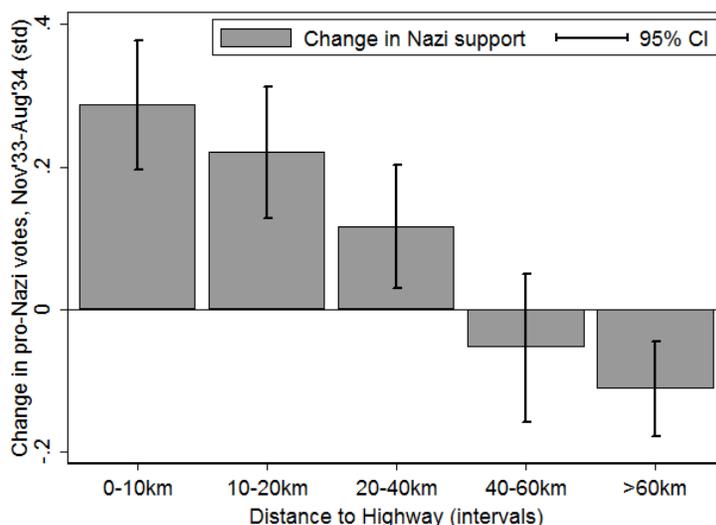


Figure 2: Change in Nazi support, Nov. 33 and Aug. 34, by distance to highway

Note: The figure shows the difference in standardized pro-Nazi votes between the November 1933 election and the August 1933 referendum, for different distance brackets to highway segments under construction. Bars indicate the average change in (standardized) Nazi support; the black lines, the 95% confidence interval.

Motorway planning may have followed a political lead after 1933. To deal with potential endogeneity, we construct least-cost paths between terminal cities. Building costs reflect the roughness of the terrain, the number of rivers to be traversed, etc. We then use these least-cost paths as an instrument for actual construction. Our IV results confirm the OLS estimates both in terms of magnitude and statistical significance.

What accounts for the *Autobahn*'s success in winning "hearts and minds"? We discuss the economic and transport benefits. In the aggregate, these have been shown to be small (Ritschl 1998). While these may have played a role locally, the motorways likely also increased support because they were energetically exploited by propaganda as powerful symbols of an energetic government (Shand 1984; Evans 2006).¹²

In addition to the literature on non-democratic regimes using elections as a means to legitimize their rule (as discussed above), we also relate more broadly to research on the political economy of regime change (Acemoglu and Robinson 2000), and of interactions between the military and old elites (Finer 1976; Acemoglu, Ticchi, and Vindigni 2010). Closely linked is

¹² This is in the spirit of Rogoff (1990).

work on the origins of totalitarian dictatorships, much of which emphasizes differences between normal autocracies and regimes like the Nazi dictatorship or Communist rule in Russia. Theories of “mass society” focus on industrialization and the associated rise of a large group of economically marginal individuals who have lost their traditional roots (Ortega y Gasset 1993; Arendt 1973). These in turn are said to create a fertile recruiting ground for totalitarian ideology, from both the left and the right. Applications of this approach to the German context include Shirer (1960) and Stern (1972). Schmitt (1926), on the other hand, emphasized the need for an – alleged – external or internal threat for totalitarian states to consolidate.

There is also a large literature on the effects of infrastructure on economic performance and the spatial distribution of economic activity. Classic papers in this literature include Fogel (1964) and Fishlow (1965).¹³ Recent work uses micro-level variation and seeks to exploit exogenous variation in trajectories (Banerjee, Duflo, and Qian 2012; Donaldson and Hornbeck 2013). Our identification approach using least-cost paths is similar in spirit to Faber (2014) and Hornung (2015), who analyze the effects of Chinese and Prussian railways, respectively, on growth using least-cost path and straight-line identification.

Relative to the existing literature, we make a number of contributions: First, we show how even unfree elections under a brutal dictatorship can be used to make inferences about changes in regime popularity and its determinants. Second, we demonstrate the political benefits of infrastructure spending on the entrenchment of dictatorships, by affecting electoral outcomes. At a crucial moment when the Hitler regime needed to showcase its wide popularity, *Autobahn* building boosted support. We thus contribute to a rich literature that studies regime change in general and the rise of the Nazis in Germany more specifically (King et al. 2008; Bracher 1978). Third, we offer suggestive evidence on how infrastructure projects can turn opposition voters into supporters of the regime. We find that road building was most effective in swaying voters who were previously vociferously opposed to the Nazis, such as Catholics. In areas with many blue-collar workers, and where unemployment was high, on the other hand, the effect of winning “hearts and minds” is not stronger than elsewhere. This suggests

¹³ For a critique, cf. David (1969).

that the competence channel (Rogoff 1990) was probably more important than the direct economic benefit channel.

The paper proceeds as follows. We first explain the historical background and context of motorway building in section II, and summarize key facts about elections under the Nazi regime. We then describe our data in section III before presenting our main empirical results (section IV). Next, we test the robustness of our findings (section V). Section VI concludes.

II. Historical Background

In this section, we briefly describe motivations behind the building of the *Autobahn* network and its antecedents. We also discuss the nature of early Nazi elections and the growing strength of the regime.

II.a. Motorway building under the Nazis

The Hitler government pursued two aims with the building of the motorway network. First, it aimed for a propaganda success, signaling its competence by “getting things done”. This aim was pursued vigorously and with success – many elderly Germans still point to the motorway network to argue that the Nazi regime had some positive sides, too. Second, the Nazi government sought to create employment.

The first sod of earth for building the *Autobahn* was turned by Adolf Hitler himself, in September 1933. The weekly news reel shows him addressing a huge crowd of workers, proclaiming that the “gigantic undertaking” was to bear witness to the regime’s resolve and vision. He then told his audience to “get to work.” Together with rearmament, the *Autobahn* is widely seen as a key part of Keynesian demand stimulus by the Hitler government. In line with the regime’s propaganda, many observers took it for granted that building the new highway network reduced unemployment substantially. Quantitative research has since established that neither military spending nor highway construction were important in explaining Germany’s nascent recovery after 1933. Initially planned to employ up to 600,000 workers, motorway building never came close to creating such a number of jobs. At its peak,

only 125,000 Germans were working in highway construction.¹⁴ In 1933 itself, relatively little construction took place, with only 3,900 men employed by year-end; by 1934, this rose to a peak of 84,000 (Humann 2011). Instead, the rapid rise in output under Hitler is typically explained by the strength of a cyclical upswing, helped by an end to deflation and declining uncertainty over the economy (Ritschl 1998).

Immediately after coming to power, the Nazi government began to plan new roads. At the Berlin Motor Show – only 11 days after becoming Chancellor – Hitler proposed far-reaching plans on how to ‘motorize’ Germany, providing not just roads but also cheaper, compact cars. In the Rhineland, another – unrelated – project connected Bonn and Cologne. Konrad Adenauer, later Chancellor of the Federal Republic of Germany, coordinated the building in a bid to reduce unemployment. This first highway opened in 1932.¹⁵ By the summer of 1933, a new publicly-owned company had been founded to build and operate the new highways Germany-wide. The network was planned with the help of a network of local enthusiasts, who also partially drew on earlier plans: Long before the Nazi government began to build highways, a private think tank, the STUFA, had developed detailed plans for a comprehensive motorway network in Germany (Vahrenkamp 2010). The exact trajectory in several cases was decided by Hitler himself, who insisted on scenic routes.

To maximize work creation and to demonstrate that the government was serious about road building, construction began at many points simultaneously. Figure 3 shows the 1934 highway network.¹⁶ Thick black segments were under construction; broad white segments were approved for construction, but not yet begun; and dashed lines indicate planned segments not yet approved for construction. In 11 parts of the country, construction was under way less than a year after the start of the project. Among the first segments to be built were the link from Frankfurt to Darmstadt and on to Stuttgart, from Berlin to Hannover, the connection Bremen-Hamburg-Lübeck, Leipzig towards Munich, and Munich-Stuttgart. None of them

¹⁴ This should be compared with a decline in unemployment from 6 million in January 1933 to 2.5 million in the summer of 1934.

¹⁵ At the time, Italy had already completed the first high-speed roads reserved for car traffic.

¹⁶ We use the September 1934 map from Todt (1934), which is the closest available to August 1934.

were actually open for traffic by the time of the plebiscite; the first segment to be opened to the public was the Frankfurt-Darmstadt road, inaugurated by Hitler himself in Mai 1935.

From the very beginning, the Nazi regime used the motorway building project for propaganda purposes. In the first month of the newly-founded Autobahn company's existence, the *Völkischer Beobachter* – the leading party paper – made construction progress front-page news no fewer than four times. At the behest of Propaganda Minister Josef Goebbels, building time tables were coordinated to ensure that work started simultaneously at 22 locations in March 1934. Instead of building entire stretches of motorway first, construction took place all over the country in a bid to showcase NS economic policy. Speeches and news coverage emphasized economic benefits, especially the reduction in unemployment (Shand 1984).

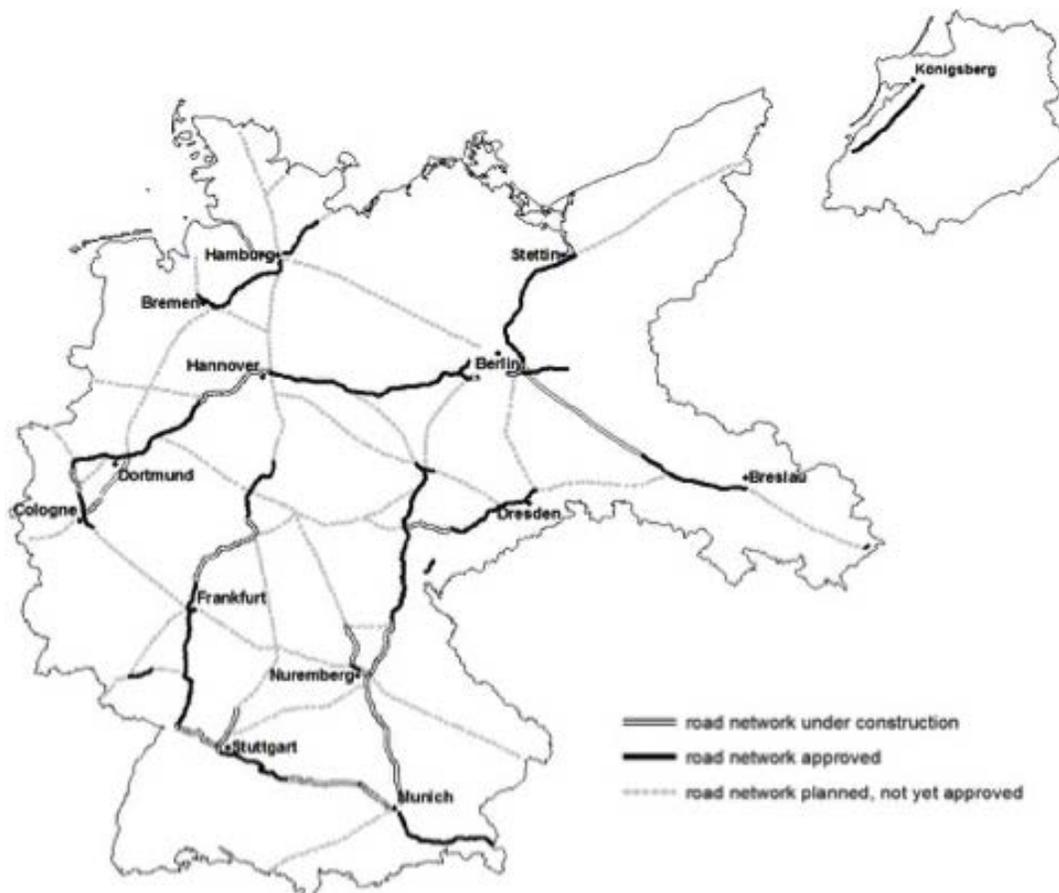


Figure 3: German Highway Network by 1934

As new stretches of motorway opened to the public, the regime celebrated its successes. The first segment was finished in May 1935. Some 90,000 supporters lined the road as Hitler was

driven from Frankfurt to Darmstadt. By 1936, some 1,000 km of road (out of 9,000 planned) had been finished; the simultaneous opening of 17 segments of motorway was used for ceremonies all over Germany. Again, these events were used to high effect by the Nazi regime's propaganda machine. In addition, the *Autobahn* was also celebrated as an aesthetic innovation. The *Autobahn* company commissioned a number of artists to produce paintings of road segments, bridges, ramps, and construction work. A book containing reproductions of these paintings sold over 50,000 copies.

One obvious question is why highway building was prioritized at all, instead of other public works programs – and why it was a popular policy choice. Road building as a make-work measure had been discussed extensively during the Great Depression, but no large-scale construction had taken place. The actual building of the highways signaled a regime change – a willingness to overcome years of austerity. Party propaganda never tired of telling readers that “a decade of Weimar parliaments had produced only talk and sketches, a mere three years of National Socialism had built a thousand kilometres of traversible superhighways... Their very existence seemed to verify the Nazi thesis that the state must be given a free hand, if it were to restore Germany to her former glory.” (Shand 1984).

Interestingly, motorway workers themselves were typically skeptical of the NS regime – a fact that works against our finding. Recruited from the unemployed, many were unskilled. A substantial share sympathized with the Social Democratic Party or the Communist movement. While supporters of highway construction had expected workers to be recruited locally, they were instead often drafted from among the unemployed to work far from their homes, often living in barracks, where they were subjected to harsh discipline, and received only a minimal wage. They frequently expressed dissatisfaction with working conditions, pay, and harsh discipline. Disaffected workers painted anti-Nazi slogans on lorries used for motorway construction (Evans 2006). In one incident, workers demanded pay supplements. When their demands were not met, they went on strike, singing “The International” – the anthem of the socialist and communist workers' movements. Work only resumed after the ringleaders were sent to Dachau concentration camp.

The direct economic benefits of new roads were limited. Car ownership rates in Germany in 1933 were low – approximately one quarter of those in England or France. Most transport of goods and people took place via rail. The new regime intended to boost the German car industry by all means possible, and not simply via road-building. Hitler had high hopes for the automobile industry as a future source of employment, and because its factories could easily be converted to war production. A tax exemption for the purchase of new automobiles from March 1933 onwards boosted car production, and accelerated the recovery of private car purchases (which had begun to rise in the fall of 1932). Between 1932 and 1938, the total number of cars, motorcycles and trucks on German roads doubled (Evans 2006).

The military advantages of road-building were relatively unimportant. While the invasion of Austria used the Autobahn for moving tanks, almost all troop and supply movements before and during World War II took place by rail. Since the Hitler government planned wars of aggression which would take troops far beyond the borders of the Reich, the importance of internal communications was limited. If there was an aspect of road building that mattered militarily, it was motor vehicle production. Boosting the mobility of army units was a general aim of most armed forces after 1920. Increasing car ownership and the number of trucks in Germany was considered desirable because private vehicles could be confiscated in wartime. Indeed, the invasion of France used some 15,000 trucks requisitioned from private industry (Vahrenkamp 2010).

II.b. 1933 Elections and the 1934 Plebiscite

We use two principal measures of Nazi support at the polls – votes for the NSDAP in November 1933, and the share of "yes"-votes in the plebiscite in 1934. In addition, we use the NSDAP vote share from the March 1933 election for robustness checks. Figure 4 illustrates the timeline of elections and highway building.

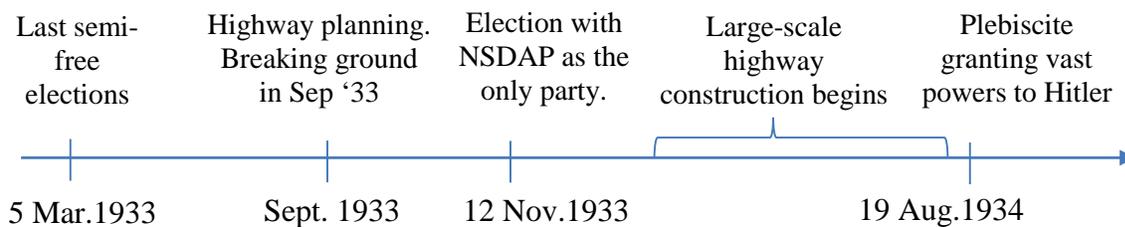


Figure 4: Timeline of events

When Germans went to the polls in March 1933, the Hitler government had already been in power for over a month. Nonetheless, elections were still relatively fair, with intimidation at the polls limited compared to what happened on later occasions. Except for the Communist Party, which had been banned, all parties that had competed during the last free election in November 1932 were still on the ballot paper in March 1933. Despite a massive propaganda campaign, the NSDAP failed to win an absolute majority, receiving 44 percent of the total vote.

In November 1933, the regime held fresh elections. Over the summer, all parties except the NSDAP had been banned. In addition to Nazi MPs, the NSDAP list before the voters also contained 22 “guests” – mostly prominent members of the right-wing elite who were largely aligned with the party’s aims, and were asked to participate to give the new parliament marginally broader representation.¹⁷ On average, the Nazi Party won 92 percent of the popular vote, more than doubling its vote share from March.

Voting in November 1933 was not free and fair; storm troopers collected many voters at home if they had failed to show up, and they stood guard at the voting booths. There, citizens were strongly “encouraged” to vote publicly so that everyone could witness a voter’s support of the Nazi regime. Evans (2006), commenting on elections under the Nazis, observes that

“Intimidation was particularly evident during the national plebiscites and elections that Hitler held from time to time... Under the Third Reich, plebiscites and

¹⁷ In parallel with the parliamentary election, voters were also asked to approve Germany’s leaving the League of Nations. This proposal was wildly popular since the League of Nations was closely associated in the minds of Germans with the harsh Versailles Treaty that had ended World War I (and saddled Germany with a massive reparations bill). The referendum received 95% support.

elections became propaganda exercises in which the regime mobilized the electorate, by all means at its disposal, to provide the appearance of popular legitimacy for controversial measures.”

Despite these intimidation measures, opposition was not zero. On average, eight percent of all Germans voted against the Nazi list (by spoiling their ballot papers –voting “no” was not possible in Nov. 1933). In some areas, there was massive opposition – in the old Hanseatic city of Lübeck, for example, 40,824 voters failed to vote “yes” for the NSDAP list, out of 111,911 votes cast – a proportion of 36.5 percent. Hamburg and Berlin registered similar levels of dissent, with 27 and 26 percent of voters refusing to support to the Nazi list. At the opposite end of the spectrum, in Pirmasens, only 218 out of 31,371 votes were cast against the Nazi list – equivalent to 0.7%.¹⁸

The plebiscite in August 1934 was already described in the introduction. Here, it was possible to vote “no.” The death of the ailing President Hindenburg in August 1934 gave the regime the opportunity to demonstrate its popularity. The official merging of the offices of President and Chancellor removed the last de facto checks and balances that the Nazi state had inherited from the Weimar constitution. Despite massive pressure on the population, the typical German town or city actually saw fewer votes in favor of the proposition to make Hitler both Chancellor and President than there had been “yes” votes for the party list in 1934 – 89.9% voted with yes.¹⁹

II.c. Crisis and Entrenchment of the Nazi Dictatorship 1933-34

The Nazi leadership lost no time asserting administrative and political control after coming to office. Police forces everywhere were brought under control of Nazi politicians; violence against opponents – suspected or real – was frequent in the first half of 1933 (Evans 2006). Despite its ruthlessness in seizing power, during its first 18-24 months the regime was much less firmly established than was the case later. By mid-1934, matters were coming to a head. As storm troopers instituted their own kind of justice all over Germany, and talk of a “second

¹⁸ There are also several smaller towns where support reached 100%.

¹⁹ While the two questions are clearly distinct, there is no obvious downward bias – right down to the end in 1945, Hitler personally was much more popular than the Nazi party.

revolution” by left-wing extremists in the stormtroopers (SA)²⁰ – even more radical in nature than the initial seizing of power – grew louder, opposition to the regime increased. Hitler and his associates had quickly dashed the hopes of conservatives that the Nazis’ entry into government would increase their own mass appeal. Middle class voters who had supported the NSDAP before 1933 were appalled at the lawlessness of the SA and feared wider chaos (Behnken and Rinner 1980), and workers – never very supportive – were growing even more skeptical. As one leading history of the Nazi regime in power put the situation in the summer of 1934:

The moment was ... critical for the regime. ... enthusiasm of the ‘national revolution’ in 1933 had discernibly fallen off ... The brownshirts were not the only section of the population to feel disappointed Social Democratic agents reported to the exiled party leadership in Prague that people were apathetic, constantly complaining, and telling endless political jokes about the Nazi leaders. Nazi meetings were poorly attended ... The educated classes feared that the disorder caused by the stormtroopers might spill over into chaos or, worse, Bolshevism. (Evans 2006)

As the year 1934 wore on, the Nazi leadership increasingly feared that the conservatives around Papen and Hindenburg could join forces with the army, and overthrow the Hitler regime (Evans 2006). The increasingly senile Paul von Hindenburg was still President, and one of his personal favorites, Franz von Papen (a former Chancellor) served as Vice Chancellor. In the summer of 1934, in a speech before university students in Marburg, he warned against a second revolution, decried violence and lawlessness by the SA, and condemned the personality cult of Hitler. Thereafter, his public appearances were often greeted with the shout “Heil Marburg.” Shortly thereafter, the Defence Minister, General Werner von Blomberg, threatened Hitler with the imposition of martial law and a government by the army if the SA was not brought to heel (Wheeler-Bennett 1964). Eventually, Hitler decided to murder both the leadership of the SA and influential conservatives close to

²⁰ The SA grew out of street-fighting paramilitaries; its leaders envisioned themselves as a Nazi People’s Army, and many pursued dreams of a far more left-wing agenda including wholesale nationalization of many industries (a „second revolution“). Threats to Hitler’s leadership, however, were largely invented to justify the crackdown on the SA in the summer of 1934.

Hindenburg, blaming the victims for plotting to overthrow the government (the so-called “Röhm Putsch,” after the head of the SA).

The conflicts and threats of the summer of 1934 show that the Nazi regime was still far from its later, omnipotent position, and that popular support could by no means be taken for granted. It is for these reasons that winning the “hearts and minds” of the population mattered especially, and why the regime cared about being able to showcase overwhelming popular support. It was only after Hitler became both Chancellor and President, and after a growing share of the population genuinely supported the Nazi government, that the regime became fully entrenched.

III. Data

We have voting records for more than 3,000 towns and cities in 901 counties, covering the entire area of Weimar Germany. These data are combined with demographic and socio-economic information from the 1925 and 1933 censuses. To this, we add geographical information from maps of the (planned and built) German motorway network, whose construction began after the summer of 1933.

III.a. Data on Highway plans and construction

As shown in Table 1, of the 3,276 towns and cities in our sample, 2,015 were within 20 km of the planned *Autobahn* according to the general plan (shown in Figure 3). A little more than a third (1,261) was further away. Out of the 2,015 locations close to the planned network, 1,097 saw actual construction – some 54% of the planned total.

Table 1: Number of Towns and Cities in Sample, Conditional on Highway Construction

		Highway under construction in 1934 (< 20 km)		
		No	Yes	Total
Part of National Highway plan? (<20 km)	No	1,261	0	1,261
	Yes	918	1,097	2,015
	Total	2,179	1,097	3,276

Socio-economic characteristics differed between cities close to the highway network and those that were more peripheral. Table 2 gives an overview, showing the sample mean of a variety of socio-economic variables in column 1, the average for cities within 20km of the highway network (planned or built) in column 2, and the means for cities with and without actual highway construction, among those near the planned network (columns 3 and 4). Cities near the planned highway network were more populous than the rest; unemployment, the blue-collar share, and industrial employment were also somewhat higher. Areas of highway construction were less Catholic than the sample overall, but the share of Jewish population was the same. A comparison of columns 3 and 4 shows that construction began in those parts of the planned network that were closer to larger, more industrial cities, and in more Protestant areas. This gives rise to endogeneity concerns, because support for the Nazis also varied with socio-economic factors. In our empirical analysis we address this issue in a variety of ways, such as city fixed effects and the use of least-cost-paths as an instrument for actual highway location.

Table 2: Cities characteristics, by highway plans and construction

Variable	Full sample	Highway planned		
		All	built	not built
Population size 1933	12,294	15,906	21,687	8,992
Unemployment rate 1933	0.152	0.164	0.182	0.142
Blue collar share 1933	0.336	0.347	0.364	0.328
Share Industrial Employment	0.297	0.315	0.340	0.285
Share Catholic	0.364	0.339	0.283	0.404
Share Jewish	0.005	0.005	0.004	0.005
Number of cities	3,276	2,015	1,097	918

Under “Highway planned”, “All” comprise all cities within 20km of planned or highways in 1934, according to the highway network in Figure 3; “not built” are those segments that were planned but not yet under construction by 1934.

III.b. Elections and Plebiscites

Our main analysis focuses on the change in the share of votes supporting the Nazi regime between the November 1933 election and the 1934 plebiscite.²¹ As a proxy for initial Nazi

²¹ We use the electoral support for the NSDAP in November 1933, and not the plebiscite about leaving the League of Nations, which was held in parallel. Membership in the latter was hugely unpopular as it was seen as

support, we also use the NSDAP vote share in the March 1933 election – after Hitler had been appointed as Chancellor, but when other parties were still permitted at the polls. Since elections after March 1933 were no longer fair and free, the officially registered support for the regime at the polls surged. Figure 5 plots the share of “pro-Nazi” votes in the three elections we focus on. While votes for the NSDAP are symmetrically distributed around the mean in March 1933, the distributions are dramatically shifted to the right for the later votes. Between November 1933 and August 1934, the share of pro-Nazi votes declined – if we want to disregard the fact that the nature of the question changed, too. The dispersion of vote shares also declined after March 1933, as the regime used intimidation and other forms of pressure to reduce measured opposition.

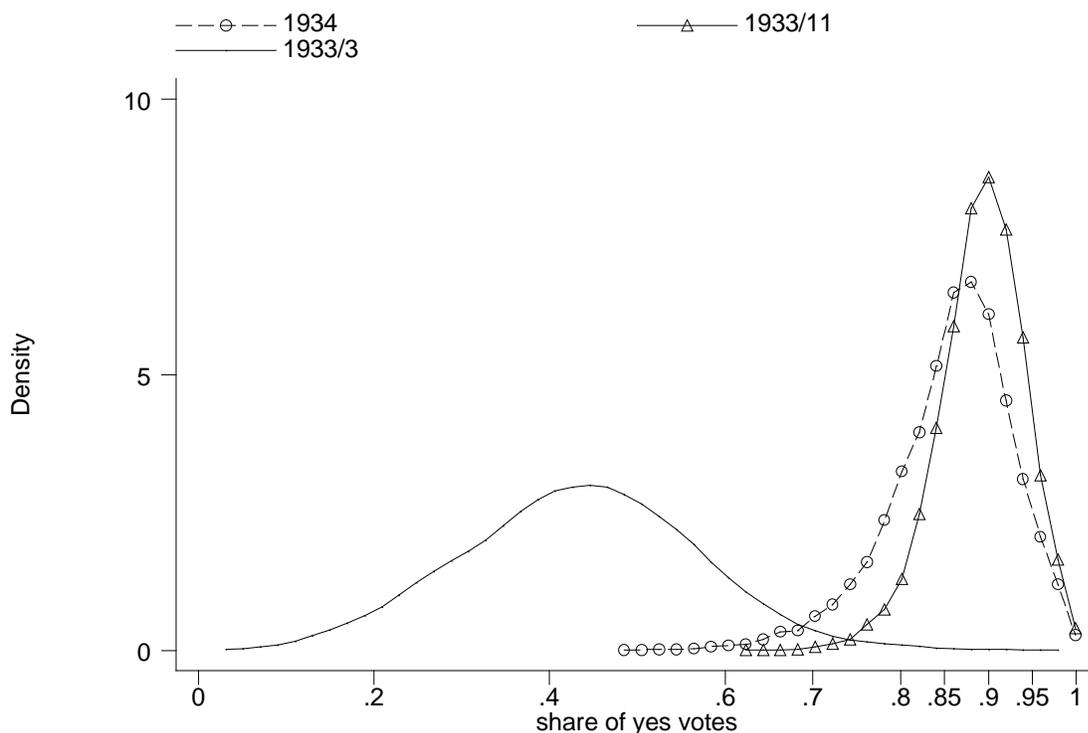


Figure 5: Support for the Nazi Regime, 1933-34

To make the different elections comparable, we rescale vote shares in our empirical analysis, transforming electoral ‘pro-Nazi’ votes for each election into a standardized variable with

an integral element of the (hated) Versailles settlement that brought WW I to a close, and saddled Germany with a large reparations bill (Evans 2006).

zero mean and unit standard deviation. In addition, we compute a broad and a narrow measure of Nazi support. The former (NS_{broad}) is defined as the share of yes votes relative to all *eligible* voters. This variable counts nonvoters as opposition to the Nazi regime – which in many cases is justified given the high pressure for turnout (see Section 2). The narrow measure (NS_{narr}) is defined as the share of yes votes relative to *actual* voters; it is thus unaffected by voter turnout (and thus by potential unobserved spatial variation in the pressure to vote).²² We use NS_{broad} as our main outcome variable, and document the robustness of results using NS_{narr} .

IV. Main Empirical Results

In this section, we show that support for the Nazi regime was systematically higher where the new motorways were being built, controlling for the 1933 level of support.

IV.a. Baseline results

Before presenting econometric estimates, we first illustrate our main finding graphically. Figure 6 shows how much the building of the new highways changed pro-Nazi votes.²³ In order to compare Nazi support across different elections and referenda, we use standardized vote shares. We plot the change in the standardized share of voters supporting the Nazi regime between March 1933 and November (left panel), and between November 1933 and August 1934 (right panel), as a function of distance to highway building, and after controlling for district fixed effects, and the full set of controls listed in Table 2. The first period serves as a placebo, before highway construction began on a large scale; there is essentially no relationship between distance to highways and change in Nazi support. This pattern changes

²² Note that both measures count invalid votes as opposition to the Nazi regime. In fact, the November 1933 election did not allow for a “no” vote, or for votes for any other parties. Thus, conditional on voting, invalidating the ballot was the only way for voters to express their discontent with the Nazi regime. The 1934 referendum, in turn, included an option to vote “no.” This is another reason why the two elections are not strictly comparable, motivating our use of standardized vote shares, rather than comparing levels.

²³ Given that regular scatterplots with every data point would become too crowded for visual interpretation, we use binscatter plots, grouping the x-axis into 50 equal-sized bins. To allow for a more immediate interpretation of the x-axis, we use distance in km, rather than log-km. Results are very similar when we use logs instead.

dramatically after November 1933, when highway building began on a large scale. By August 1934, it was the areas closest to the highway that saw the biggest relative gains in Nazi support.

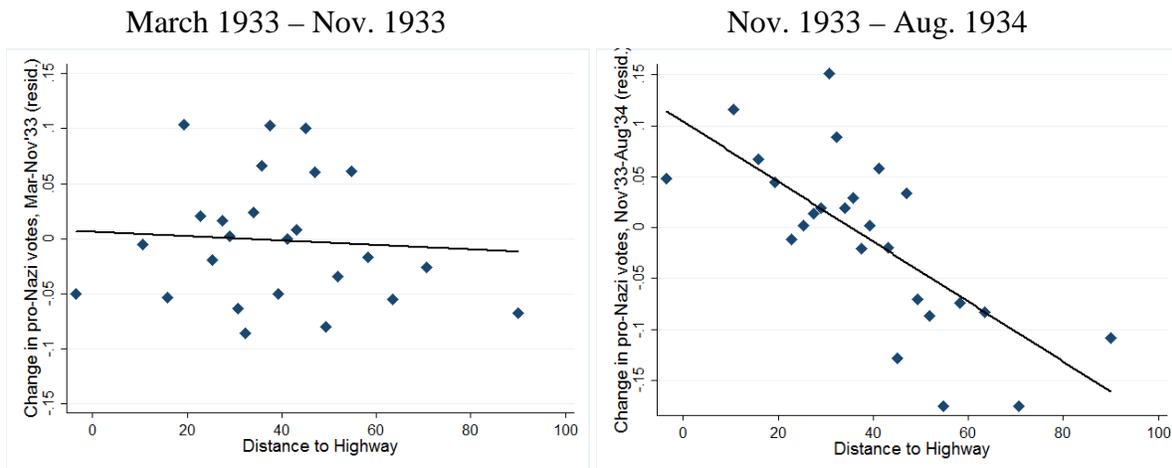


Figure 6: Change in pro-Nazi votes, before and after highway construction began

Note: The figure shows the difference in standardized pro-Nazi votes between the March and Nov. 1933 elections (left panel), and between the Nov. 1933 election and the August 1933 referendum (right panel), as a function of distance from highway segments that were under construction by 1934 (construction began in the autumn of 1933). The underlying regressions include all variables listed in Table 2 and fixed effects for 77 administrative districts (*Regierungsbezirke*). For ease of exposition, the binscatter plot groups the x-axis into 25 equal-sized bins.

Next, we analyze econometrically if motorway building was associated with significantly higher support for the Nazi regime. We first examine whether there were pre-existing differences in voting behavior in areas traversed by highways and then compare vote shifts after highway construction began.

We estimate the relationship

$$NS_{it} = \alpha_i + \delta_t + \beta D_i + \gamma X_i + \varepsilon_{it} \quad (1)$$

where NS_{it} are pro-Nazi votes in city i in election t , D_i is city i 's distance from the *Autobahn*, X_i is a vector of city-level controls, α_i and δ_t are city and election fixed effects (when we estimate a panel specification), and ε_{it} is the error term. Table 3 presents results for three elections – the last relatively free election of March 1933, the November 1933 election when voters could only support the NSDAP or not, and the 1934 plebiscite.

Again, we use standardized pro-Nazi vote shares in order to compare Nazi support across different elections and referenda. Distance from highway in March 1933 was not significantly correlated with distance to highways that would be built from late 1933 onwards (col 1). In columns 2 and 3 we examine whether the Nazis gained more support in areas closer to the highway in the subsequent two elections (note that the regressions control for initial support, so that we effectively examine changes). Until November 1933, before highway construction had started on a large scale, highways are not associated with gains in support for the Nazis. It is only in the August 1934 referendum that we find a strong and significant (negative) relationship between distance to highway and pro-Nazi voting. Going from a distance of 1 km to 100 km is associated with a reduction in support by 0.32 standard deviations in the dependent variable – equivalent to moving from the median city in terms of support change, Bremen (ranked 1,615) to Neuburg an der Donau, ranked 1,095 out of 3,230 cities.²⁴

Table 3: Highways and Percentage Change in Votes for the Nazi Party

	(1)	(2)	(3)
Dep. variable:	NSDAP vote share in March '33 (standardized)	Share of pro- Nazi votes in Nov'33 (standardized)	Share of pro- Nazi votes in Aug'34 (standardized)
log(distance HW)	0.0209 (0.0157)	0.0180 (0.0166)	-0.0591*** (0.0121)
NSDAP votes March '33		0.251*** (0.0165)	
Pro-Nazi votes Aug'34			0.640*** (0.0157)
Controls	✓	✓	✓
Observations	3,230	3,218	3,234
Adjusted R^2	0.025	0.117	0.399

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Controls include the log of city population and the unemployment rate in 1933.

The difference between the coefficients in March/November 1933 and August 1934 is crucial for our argument. It implies that distance from the highway only becomes a predictor of voting changes when construction begins in earnest – after November 1933. In other words, the

²⁴ The naive analysis in Figure 1 – based on taking averages by distance – even implies an increase of 0.49 standard deviations.

March and November 1933 elections effectively serve as placebos. Appendix Figure A.1 shows employment in *Autobahn* construction, by month, for the period 1933-34. Employment in November 1933 was 3,000 men, 5% of the level reached by August 1934, and earlier months had seen even more minute numbers of workers used for highway construction. By April 1934, construction got under way on a significant scale, with the number of men used breaking above the 20,000 level. In August, the number had almost tripled again, to 59,000. While August did not yet constitute the high water mark of *Autobahn* employment, it was higher than in any preceding month, reaching 50% of the all-time peak of employment (June 1936; 121,000 workers).

The non-results for March and November 1933 also imply that *Autobahn* construction was not used to reward districts with strong previous support for the Nazis; in other words, ‘favoritism’ in the sense of Burgess et al’s (2013) finding for Kenya is probably not present in our data.

IV.b. Panel results

The regressions in Table 3 are based on cross-sectional data only. City-level unobservables could be a serious concern. To address this issue, to fully exploit the information in our data, and to be able to control for city-level fixed effects, we pool election data on the success of the Nazi Party from the early years of dictatorship (1933-34), as well as, in some specifications, the Weimar period (1924-33). Table 4 gives the results of estimating panel regressions.

In column 1, we use data from the last three elections, estimating with city and year fixed effects. We find a negative and significant coefficient on distance to the highway only for the August 1934 election; for all earlier elections, the interaction with the highway distance variable reveals no statistically significant or economically meaningful relationship. This also holds when we interact our baseline controls (population and unemployment) with year dummies (col 2). Adding lagged Nazi Party votes does not change the significance or magnitude of our result (col 3). In col 4, we add interactions of additional socio-economic controls from Table 2 with the year dummies. Again, our result changes very little.

In the last two columns, we use data from all elections during the period 1924-34. We estimate both with fixed effects only (col 5), and with extended controls and lagged Nazi votes (col 6). Our results become even stronger in this specification; and again, the 1934 referendum is the only period they shows a statistically significant relationship between Nazi support and distance to highways.

Table 4: Highways and Percentage Change in Votes against the Nazis

	Dependent variable: Standardized votes for the Nazi Party					
	(1)	(2)	(3)	(4)	(5)	(6)
Elections included:	March 1933, Nov 1933, Aug 1934			1924-1934		
log(distance HW) ×	-0.0790***	-0.0647***	-0.0645***	-0.0497**	-0.0671***	-0.0876***
Aug 1934	(0.0204)	(0.0210)	(0.0204)	(0.0225)	(0.0230)	(0.0236)
log(distance HW) ×	0.0174	0.00259	0.00255	0.0159	0.0291	0.0281
Nov 1933	(0.0238)	(0.0247)	(0.0248)	(0.0240)	(0.0258)	(0.0247)
log(distance HW) ×					0.0117	-0.0221
March 1933					(0.0201)	(0.0209)
log(distance HW) ×					0.00410	-0.00194
Sep 1930					(0.0197)	(0.0186)
log(distance HW) ×					-0.0190	
May 1928					(0.0176)	
Lagged Nazi Party			0.0367**	0.0508***		0.113***
votes			(0.0154)	(0.0156)		(0.0141)
City FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Base controls × Year		✓	✓	✓		✓
Additional Controls × Year				✓		✓
District FE × Year				✓		✓
Observations	9,775	9,712	9,681	9,654	19,457	16,095
Adjusted R ²	0.459	0.462	0.464	0.672	0.351	0.564

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Controls include the log of city population and the unemployment rate in 1933. Additional controls include the share of blue collar workers and the share of industrial employment in 1933, as well as the share of Catholics and of Jews in 1925.

Overall, there is no evidence that Nazi support was either high (Table 3, col. 1) or already growing (Table 4) in places where highways were (later) built. Instead, the entire effect of highway construction on electoral outcomes appears quite suddenly, and only for the period November 1933-August 1934. For this reason, we focus on this period in the empirical analysis that follows.

IV.c. Change in Nazi support, November '33 – August '34

In the following, we focus on the period November 1933 – August 1934 and estimate regressions of the form:

$$\Delta NS = \alpha + \beta D + \gamma X + \varepsilon \quad (2)$$

where ΔNS is the change in support for the Nazi regime, D is distance from the *Autobahn* for each town or city, X is a vector of controls, α is a constant, and ε is the error term. If D was randomly assigned, β would reflect the causal effect of motorway building on support for the Nazi regime. We present OLS results first, and then discuss various possible challenges to identification.

In Table 5, we first show the simplest specification, without controls. We find a negative and highly significant coefficient on distance to highways. In column 2, we add our baseline controls as well as initial support for the Nazis in November 1933. The coefficient on highways declines but remains highly significant, and it rises again when we add district fixed effects in col 3. Adding district fixed effects means that we exploit only the distance to the highway within each district, differencing out any regionally-based shifts in voting patterns. Our results in column 3 thus imply that, relative to all the other towns in the same district, those closest to the new highways saw particularly large gains in Nazi support.

In terms of control variables, the coefficient on initial pro-Nazi votes in November 1933 is significant and negative, which is probably due to the mechanical effect – places with close-to-100% support could hardly gain additional votes. The coefficient on city population size is negative and significant – more populous places were on average less likely to vote for the Nazis. Finally, the coefficient on unemployment is ambiguous, switching signs and becoming insignificant when we add district fixed effects.

In col 4, we add additional socio-economic controls – the share of blue-collar workers, of Jews, of Catholics, and of industrial workers – the significance of the distance variable is not affected, but it declines in size. Finally, we define a dichotomous variable that takes on value one for towns or cities that were within 20km of highways under construction, and zero otherwise. In the specification with baseline controls only (col 5), this suggests an increase in

support by 0.12 standard deviation if a town was close to the *Autobahn*. After controlling for fixed effects and all socio-economic variables, we still find an increase in support by 0.05 standard deviations.

Table 5: Distance to highways and change in Nazi support
(Dependent variable: change in standardized pro-Nazi votes, Nov 1933- Aug 1934)

	(1)	(2)	(3)	(4)	(5)	(6)
log(distance HW)	-0.0970*** (0.0132)	-0.0591*** (0.0121)	-0.0775*** (0.0135)	-0.0380*** (0.0125)		
HW within 20km					0.127*** (0.0274)	0.0522** (0.0245)
Pro-NSDAP votes in Nov 1933		-0.360*** (0.0157)	-0.427*** (0.0167)	-0.442*** (0.0158)	-0.359*** (0.0158)	-0.443*** (0.0159)
ln(population) in 1933		-0.0518*** (0.0145)	-0.0357*** (0.0131)	-0.0449*** (0.0135)	-0.0533*** (0.0144)	-0.0443*** (0.0135)
unemployment rate in 1933		0.547** (0.225)	-0.0599 (0.213)	-0.136 (0.221)	0.614*** (0.221)	-0.0764 (0.220)
Share of Jews in 1925				-1.443 (1.609)		-1.514 (1.612)
Share of Catholics in 1925				-1.049*** (0.0570)		-1.054*** (0.0567)
Blue-collar share in 1933				0.730*** (0.202)		0.769*** (0.202)
Share industrial workers in 1933				-0.0671 (0.163)		-0.0863 (0.162)
District FE			✓	✓		✓
Observations	3,256	3,234	3,234	3,216	3,234	3,216
Adjusted R^2	0.014	0.185	0.469	0.554	0.185	0.554

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

IV.d. IV-Results: Least Cost Paths

The NS regime, in planning its network, had to decide which cities to connect – and where the road would run between them. Our results could be affected by endogeneity bias if the Nazis targeted areas that were more likely to increase their support for the regime even in the absence of highway construction. The Nazis could have planned and built highways to reward (newly) loyal districts, or strong local Nazi officials may have been more successful at both attracting the highway and swaying voters. Endogeneity concerns cannot be dismissed out of

hand – for example, Hitler himself intervened in the planning of the road from Munich to Salzburg (Vahrenkamp 2010).

To address possible endogeneity bias, we instrument for actual highway building with least-costs paths. Road construction cost is highly sensitive to the slope of the traversed terrain. We use the *Cost Path* tool in ArcGIS to calculate the cheapest way to connect cities that appear in official German publications as terminal cities for the first wave of highway construction.²⁵ Figure 7 plots least-cost paths and actual highway construction. They coincide to a large extent. Even where the least-cost path does not coincide exactly with the actual trajectory of the highway, differences are often small. Out of the 3,276 towns and cities in our sample, a little less than half (1,465) lie within 20 km of a least cost path. Of these, 1,276 (87.1%) also lie within 20km of the actually planned highway, and 819 (55.9%) of them saw actual construction activity by November 1934. In contrast, of the 1,811 towns and cities that were more than 20 km away from least-cost paths, only 278 (15.4%) saw construction by November 1934.

Our instrumental variable is the distance of each city from the least cost paths (LCPs). Before presenting our IV results, we briefly discuss their interpretation. Importantly, least cost paths affect the *planning* of highways, while the electoral effects we are interested in are due to actual *construction*, or approved segments where construction was imminent and foreseeable to the local voters (see Section V.b below). Planning of highways translated into highway construction in *some* districts by 1934 – depending on the timing of construction. Our IV strategy estimates the average effect of highway construction on pro-Nazi votes for those cities whose ‘treatment status’ (proximity to highway construction) was affected by the instrument (proximity to LCP). Using common IV terminology, we estimate the average treatment effect for “compliers” (cities where proximity to LCP did results in construction). In contrast, cities close to LCPs where no construction occurred by 1934 (“never-takers”) do not affect our estimate; nevertheless, “never-takers” affect the reduced-form relationship between LCPs and pro-Nazi votes, as we discuss when interpreting our results.

²⁵ There are 25 terminal cities. Related work using geographical characteristics or earlier transport infrastructure for identification includes Baum-Snow (2007), Donaldson and Hornbeck (2013), Banerjee et al. (2012), and Faber (2014).

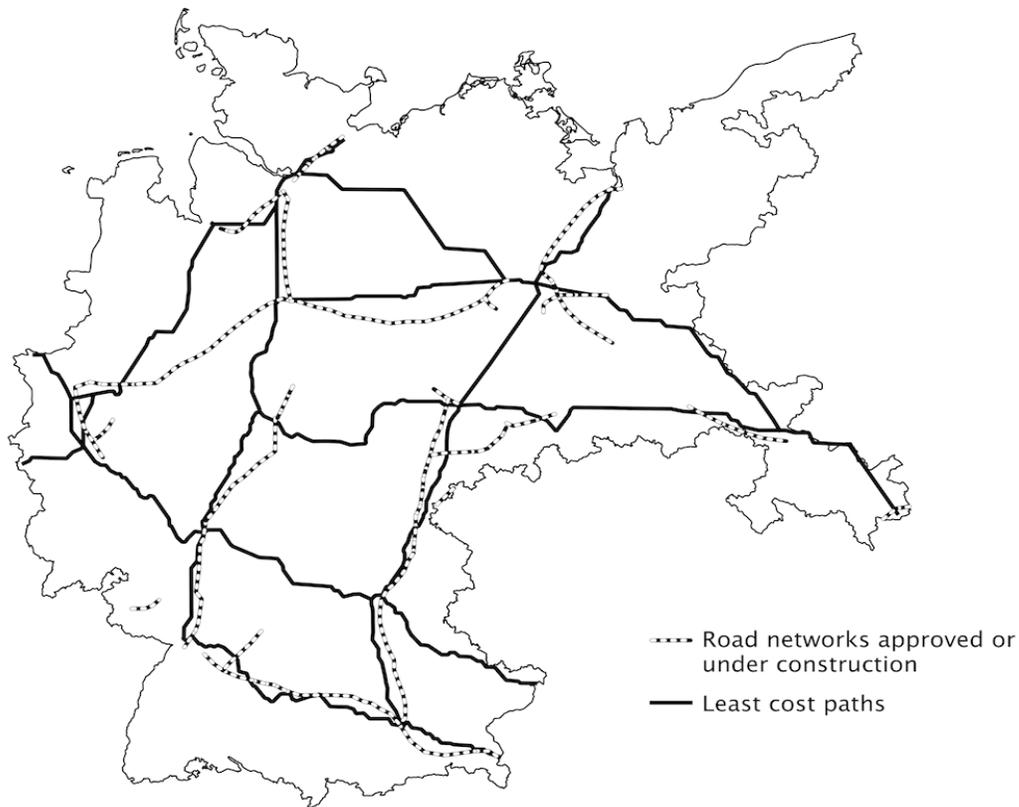


Figure 7: Least Costs Paths and Actual Highway Construction

Table 6 presents our IV results. To avoid confounding effects from the (endogenous) choice of which cities the highway network connected, we exclude the 25 terminal cities from our analysis. We first show results for the reduced form, regressing change in support for the Nazi Party on distance to LCPs. We find strong and significant negative coefficients, both without controls (col 1) and with the full set of controls (col 2). Next, we demonstrate the strength of our instrument (cols 3 and 4). The first stage is powerful, with an F-statistic of 589 to 610. Finally, we find a highly significant coefficient on instrumented distance to highways in the second stage (cols 5+6). The coefficients are of similar magnitude as our OLS estimates in Table 5 (where cols 1 and 4 use the same set of controls as cols 3 and 4, respectively, in Table 6). Comparing the magnitude of our second-stage estimates with the reduced form (cols 1 and 2), the latter is about one-third in size. This is consistent with our first-stage estimates: According to the coefficient on LCPs in cols 3 and 4, cutting the distance to LCPs in half

leads to a decrease in average distance to actual construction by one-third. In other words – in terms of distance – the ratio of “compliers” (cities that saw highway construction because of their proximity to LCPs) to all cities is about one-third. Consequently, we should expect the average change in Nazi support due to distance to LCP to be one-third of its counterpart for “compliers” – i.e., the causal effect of highway construction reported in columns 5 and 6.

Table 6: Instrumental Variable Regressions with Least Cost Paths

	(1)	(2)	(3)	(4)	(5)	(6)
	<u>Reduced Form</u>		<u>First Stage</u>		<u>Second Stage</u>	
Dependent Var:	Change in votes for the Nazi Party, Nov'33-March'34		log(distance to highway)		Change in votes for the Nazi Party, Nov'33-March'34	
log(distance to Least Cost Path)	-0.0291*** (0.0103)	-0.0232** (0.00977)	0.386*** (0.0159)	0.317*** (0.0178)		
log(distance HW)					-0.0754*** (0.0262)	-0.0732** (0.0314)
All controls		✓		✓		✓
District FE		✓		✓		✓
First Stage F-Statistic			588.8	609.5		
Instrument partial R^2			0.237	0.164		
Weak-IV robust p-value					[0.0048]	[0.0196]
Observations	3,220	3,188	3,220	3,188	3,220	3,186
Adjusted R^2	0.002	0.554	0.237	0.509		

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. “All controls” include all variables listed in Table 2, as well as the share of pro-Nazi votes in the November 1933 election. District FE correspond to 77 *Regierungsbezirke* in Weimar Germany.

IV.e. Sample Restriction – Areas with Planned Highways

So far, we have compared locations close to the highway with all other places in Germany. To provide further evidence that it is *construction* of highways that influenced voting, we examine the impact of distance to planned highways, and we restrict the sample to only areas designated for highway building.

In Table 7, col 1, we add the minimum distance to any type of highway segment (planned, approved for construction, or under construction) to our specification. The corresponding

coefficient is negative and insignificant, while the coefficient on distance to highway under construction remains quantitatively unchanged (compared to Table 5, col 1) and statistically highly significant. If we limit the sample those locations within 20 km of the planned highway, we lose about 1,000 towns and cities in our sample. Nevertheless, the coefficient on distance to highway under construction remains large and significant with and without controls (cols 2 and 3). If we use a simple dichotomous variable for highway construction within 20 km, we find that this boosted pro-Nazi votes by 0.23 standard deviations in the basic specification (col 4); when adding district fixed effects and controls, it still adds 0.06 standard deviations to Nazi support (col 5). When we narrow the sample further, to those places within 5 km of the highway, we find an even bigger coefficient on highway under construction within 5km – an increase in Nazi support of 0.12 standard deviations, after the use of all controls and district fixed effects.

Table 7: Planned vs. built highways

Dependent variable: Change in standardized pro-Nazi votes, Nov'33-March'34						
Sample	(1)	(2) Only cities with distance x km from any HW [#]				
	All cities	$x < 20\text{km}$	$x < 20\text{km}$	$x < 20\text{km}$	$x < 20\text{km}$	$x < 5\text{km}$
log(distance HW under construction)	-0.0974*** (0.0187)	-0.109*** (0.0201)	-0.0503*** (0.0163)			
log(distance to any HW) [#]	0.0103 (0.0165)	0.00232 (0.0201)	0.0110 (0.0127)			
HW under construct. within 20km				0.226*** (0.0381)	0.0578* (0.0306)	
HW under construct. within 5km						0.120** (0.0533)
All controls			✓		✓	✓
District FE			✓		✓	✓
Observations	2,797	1,799	1,788	2,002	1,979	711
Adjusted R^2	0.012	0.018	0.567	0.018	0.564	0.568

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. “All controls” include all variables listed in Table 2, as well as the share of pro-Nazi votes in the November 1933 election.

[#] Distance to any highway is the distance to the nearest planned, approved, or built highway segment.

V. Robustness and Discussion

In this section, we discuss the possibility of differential intimidation driving our findings, and we show that our results hold across a wide range of subsamples. We also present results from placebo tests, different measures of distance to highways, and we use matching estimation. Finally, we investigate the possibility of electoral fraud.

V.a. Differential voter intimidation

One obvious concern with our data is that (changes in) votes for the opposition do not reflect genuine changes in preferences, but instead capture differential increases in the regime's repressive activities. For example, public officials may have been under greater pressure to show that "their" districts supported the regime if the new highways passed through a constituency, which may have led to more intimidation at the polling station.

Intimidation likely boosted voter turnout, which is much more visible – and thus easier to control – than voting for the opposition. Voter turnout, in turn affects our broad measure of Nazi support (pro-Nazi votes relative to *eligible* voters). To tackle this issue, we now use our alternative, narrow measure for change in Nazi support (pro-Nazi votes relative to *actual* voters), which is unaffected by voter turnout. Table 8 presents our results using the narrow measure. Cols 1 and 2 replicate our main OLS specifications (corresponding to cols 1 and 4 in Table 5); cols 3 and 4 show the IV results, and cols 5 and 6 control for distance to any planned, approved, or built highway (corresponding to cols 2 and 3 in Table 7). In all cases we find quantitatively similar, and statistically significant results when using the narrow definition of pro-Nazi votes. This suggests that our results are not confounded by voter turnout.

Table 8: Narrow definition of pro-Nazi votes
 Dep. Var.: Narrow Definition of Change in standardized pro-Nazi votes, Nov'33-March'34

	(1)	(2)	(3)	(4)	(5)	(6)
	<u>OLS</u>		<u>IV</u>		<u>Planning vs. Building</u>	
Sample includes:	All cities		All cities		Cities located <20km from any HW [#]	
log(distance HW under construction)	-0.0899*** (0.0146)	-0.0300** (0.0136)	-0.0996*** (0.0278)	-0.0702** (0.0340)	-0.0881*** (0.0219)	-0.0435** (0.0181)
log(distance to any HW) [#]					-0.000415 (0.0226)	0.0102 (0.0144)
All controls		✓		✓		✓
District FE		✓		✓		✓
First Stage F-Statistic			581.9	594.8		
Instrument partial R^2			0.236	0.162		
Weak-IV robust p-value			[0.0005]	[0.0387]		
Observations	3,228	3,188	3,192	3,158	1,788	1,777
Adjusted R^2	0.010	0.564	0.010	0.388	0.009	0.570

Note: The narrow definition of pro-Nazi votes is unaffected by voter turnout or invalid votes; it is defined as the “yes” votes relative to valid votes. “All controls” include all variables listed in Table 2, as well as the share of pro-Nazi votes in the November 1933 election. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
[#] Distance to any highway is the distance to the nearest planned, approved, or built highway segment.

V.b. Highways approved for construction

So far, we have focused on the distance to highway segments *under construction*. The maps shown in Figures 3 and 7 also contain segments that were approved for construction, but that were not yet listed as “under construction.” As discussed in Section IV.a, the transition between the two is fluid – approved segments likely had engineers staking out the trajectories, and the public knew that the highway was coming.

In Table 9, we use both the distance to highways under construction, and to approved highway segments. The two distances are highly correlated since approved segments typically connect to those under construction; thus, the results need to be interpreted with caution. In column 1, without any controls, distance to approved highways is positively correlated with Nazi support, while distance to segments under construction shows the same pattern as documented above. When using the minimum of the two distances, we also find a strong negative coefficient. In column 3, we add our full set of controls and district fixed effects. The coefficient on distance to approved roads is now negative and significant, and of similar magnitude as the coefficient on distance to constructed segments. Again, using the minimum of both distances yields a

negative and significant coefficient. The pattern of the last two specifications is confirmed in columns 5 and 6, where we control for distance to any (planned/approved/constructed) highway, and restrict the sample to cities located within 20km from any highway segment. Overall, the evidence thus suggests that there are no crucial differences between highway segments under construction and those approved for construction. We ultimately cannot differentiate whether this is due to imprecision in the maps (as discussed in Section IV.a.), or because local voters *expecting* the highway had the same effect as actual construction. However, we can conclude that there was one crucial difference – segments that were planned but not yet approved for construction did not see a swing in Nazi support.

Table 9: Using highway under construction and those approved for construction
Dependent variable: Change in standardized pro-Nazi votes, Nov'33-March'34

	(1)	(2)	(3)	(4)	(5)	(6)
Sample includes:	All cities		All cities		Cities located <20km from any HW [#]	
log(distance HW under construction)	-0.113*** (0.0150)		-0.0260* (0.0134)		-0.0448*** (0.0167)	
log(distance approved HW)	0.0328** (0.0129)		-0.0389** (0.0151)		-0.0391** (0.0173)	
log(distance HW approved or under construction)		-0.1000*** (0.0119)		-0.044*** (0.0114)		-0.0617*** (0.0162)
log(distance to any HW) [#]					0.0171 (0.0132)	0.0202 (0.0137)
All controls			✓	✓	✓	✓
District FE			✓	✓	✓	✓
Observations	3,256	3,216	3,220	3,186	1,799	1,788
Adjusted R ²	0.018	0.555	0.016	0.368	0.023	0.568

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The main explanatory variable is the distance to the nearest highway that was under construction or approved for construction in 1934. “All controls” include all variables listed in Table 2, as well as the share of pro-Nazi votes in the November 1933 election.

[#] Distance to any highway is the distance to the nearest planned, approved, or built highway segment.

V.c. Possible manipulation of election results

The Nazi regime brought intense pressure to bear on the population to vote in favor of the party and to vote “yes” in the referenda. It is also possible that votes were manipulated by local authorities. Could our finding of an increase in pro-Nazi votes closer to highways reflect greater pressure there on officials to show positive results – which may in turn have led to

more cheating? There is no simple way to detect the extent of manipulation in electoral data. One method that has been proposed is based on Benford's Law – the empirical regularity that lower digits occur more often than higher digits in most sets of numerical data (such as the set of city population sizes of a country).²⁶ The method itself is controversial (Deckert et al. 2011). We use it here to show that there is no significant difference in the extent to which Benford's Law is violated in locations close to the highway or further away.

Figure 8 shows the distribution of *second* digits in overall votes cast in favor of the Nazi Party in the 1933 elections and the 1934 referendum. The bars are the actual share of digits; the dotted line reflects the theoretical distribution.²⁷ We focus on the second digit because vote manipulation of the first digit would be too egregious – leading to unrealistic shares of pro-Nazi votes in most cases. For example, changing pro-Nazi votes in a city with 1,400 voters from 1,095 to 1,295 may not raise suspicion, while changing it to 2,095 certainly would. In March 1933, actual voting returns broadly follow the predictions of Benford's Law. In November 1933 and August 1934, this is no longer the case, and violations are massive. If we are to believe the Benford indicator, this suggests that manipulation became more common in the later elections.

²⁶ Previous papers using Benford's Law to detect electoral fraud include Pericchi and Torres (2011) and Mebane (2008).

²⁷ For example, in the March 1933 election, about 14% of all cities had zero as the second digit of their total number of NSDAP votes.

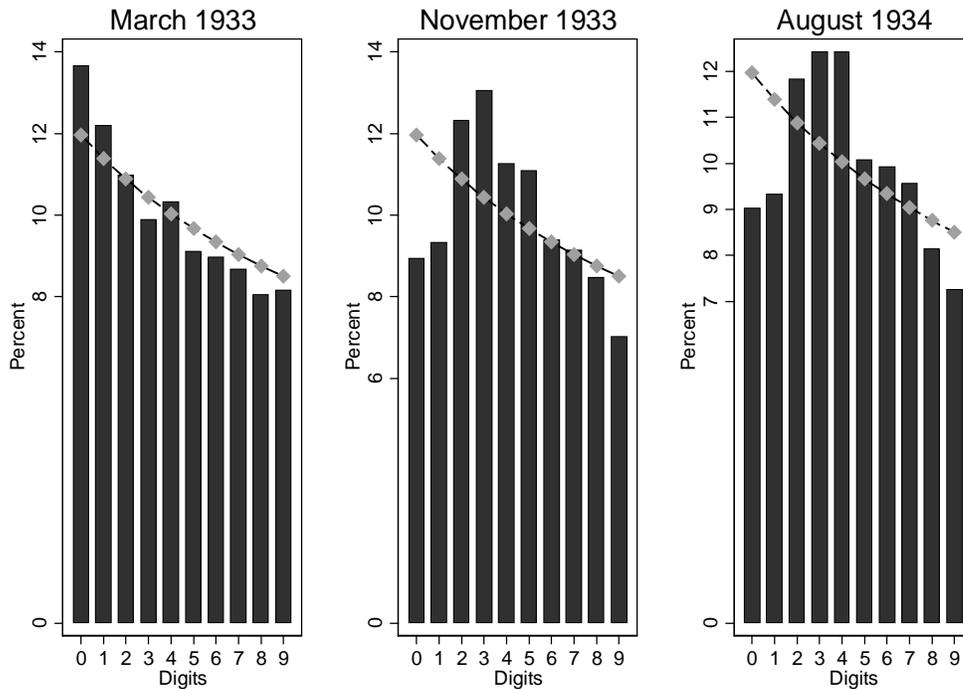


Figure 8: Benford's Law, based on 2nd digit distributions, March 1933-August 1934

Next, we examine if there are differential effects for locations close to the highway. Table 10 gives the statistical results – reporting both χ^2 statistics and p-values for the null of ‘no manipulation.’ In March 1933, there is mild evidence of cheating overall (col 1); in places closer to future highway segments – built from the late autumn onwards – there is *less* of a suggestion that returns were tampered with, as compared to places farther away (cols 2 and 3).²⁸ In the November 1933 election and the August 1934 referendum, we observe strong deviations from Benford's law, and thus suggestive evidence for electoral fraud. However, the χ^2 statistics are very similar for cities with above- and below-median distance to highways, suggesting that manipulation did not differ significantly. While the Benford-based test does not provide conclusive evidence, it makes it less likely that the highway effect is simply driven by higher incidence of electoral fraud, instead of a genuine increase in support by the population.

²⁸ To ensure comparability, we split the sample into cities with below- and above-median distance to highway segments under construction (32km). This ensures that the two subsamples have the same size, so that we can compare the χ^2 statistics in cols 2 and 3.

Table 10: Benford's Law – Second Digit Distributions of pro-Nazi votes

	(1) Full sample	(2) Distance to highway (under construction) below median	(3) above median
March 33	17.0 (0.048)	13.2 (0.155)	18.2 (0.033)
November 33	91.3 (0.000)	50.5 (0.000)	47.6 (0.000)
August 34	86.0 (0.000)	49.5 (0.000)	47.9 (0.000)

Note: The table reports Pearson's χ^2 statistic (probability of rejection the null of no manipulation) based on the second digit of the number of reported votes in favor of the NSDAP (March '33 and November '33) and of yes-votes (August '34), using the *digdis* routine in STATA.

V.d. Sample splits

Table 2 showed that counties with and without highway construction differed along several dimensions: pre-existing voting preferences, population size, unemployment, industrial employment, and the share of Catholics. In Table 11, we examine where highway building was particularly effective in boosting support for the Nazi Party – and where it failed to make a difference. Throughout, we report p-values for the null that coefficients in the respective subsamples are the same.

Table 11, panel A, stratifies the sample by the political preferences in March 1933. Where the Nazi party was already polling strongly, the highway made less of a difference – pro-Nazi vote gains fell off less steeply as distance increased (col 1). The opposite is true for areas with substantial support for parties in the political center (SPD, Zentrum, and BVP). Here, the highway worked particularly well as a tool to change the voting behavior of the population (col 2). In areas with massive Communist support, however, highway worked less well – vote gains were less affected by distance to the *Autobahn* (col 3). This suggests that the highways were less effective in overcoming opposition at the opposite ideological extreme.

In panel B of Table 11, we stratify by religious composition and city size. Where Catholics were more numerous than average, proximity to the highway portended particularly high

gains in August 1934 (col 1). Catholics had been much more resistant to the Nazi message than Protestants until 1933, in part because they had their own party representing their interests, the Zentrum (Falter 1984). Jews accounted for only half a percent of the German population; there is no difference in changes in support for the Nazi Party depending on whether they were more or less numerous (col 2). There is also no difference by city size – additional gains for the Nazis were as big in small towns as in big cities when they were close to the highway (col 3).

In panel C of Table 11, we stratify our sample by socio-economic characteristics. The results in col 1 suggest that blue-collar workers were relatively immune to the effects of *Autobahn* construction, and the same is true for industrial workers (col 2). This is compatible with our finding for supporters of the Communist Party in panel A above, which had its main recruiting ground among workers. Finally, there is not significant difference in highway effects between areas with high and low unemployment in 1933.

In sum, originally intended to reduce unemployment above all else, highways seem to have influenced potential “swing voters” closer to the political middle – those arguably more impressed by the energy and effectiveness of the regime, rather than any direct employment gains or other economic benefits.

Table 11: Sample Splits
(Dependent variable: Change in votes for the Nazi Party, Nov'33-March'34)

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A: Sample split by vote shares in March 1933 election						
	NSDAP relative to median		Moderate parties relative to median		Communist Party relative to median	
	below	above	below	above	below	above
log(distance HW)	-0.141*** (0.0238)	-0.0696*** (0.0220)	-0.0599*** (0.0206)	-0.155*** (0.0264)	-0.144*** (0.0292)	-0.0516*** (0.0182)
Test that coeff are equal:	col (1) = col (2) p-value: 0.024		col (3) = col (4) p-value: 0.004		col (5) = col (6) p-value: 0.006	
Observations	1,609	1,609	1,599	1,619	1,619	1,599
Adjusted R^2	0.393	0.133	0.153	0.370	0.343	0.197
PANEL B: Sample split by religion and population size						
	Share of Catholics relative to 50%		Share of Jews relative to median		City population relative to median	
	below	above	below	above	below	above
log(distance HW)	-0.0521*** (0.0168)	-0.194*** (0.0338)	-0.104*** (0.0211)	-0.115*** (0.0240)	-0.108*** (0.0248)	-0.107*** (0.0210)
Test that coeff are equal:	col (1) = col (2) p-value: 0.0001		col (3) = col (4) p-value: 0.725		col (5) = col (6) p-value: 0.970	
Observations	2,103	1,131	1,598	1,618	1,592	1,642
Adjusted R^2	0.136	0.340	0.351	0.262	0.313	0.287
PANEL C: Sample split by workforce characteristics						
	Share of blue-collar relative to median		Industry employment relative to median		Unemployment rate relative to median	
	below	above	below	above	below	above
log(distance HW)	-0.167*** (0.0284)	-0.0398** (0.0185)	-0.140*** (0.0283)	-0.0688*** (0.0183)	-0.121*** (0.0268)	-0.0903*** (0.0200)
Test that coeff are equal:	col (1) = col (2) p-value: 0.0001		col (3) = col (4) p-value: 0.031		col (5) = col (6) p-value: 0.348	
Observations	1,629	1,605	1,620	1,614	1,626	1,608
Adjusted R^2	0.323	0.251	0.363	0.225	0.355	0.242

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

V.e. Placebo tests

To ensure that our regressions do not pick up the effect of geographical features associated with transport infrastructure (which may have benefited disproportionately from a general revival of economic conditions), we also perform placebo regressions (Table 12). Here, we

use two other forms of transport in exactly the same way as the *Autobahn* – rivers, and railways.²⁹ For each town, we code up distance to the nearest railway line or river.

There is no consistent association between distance to these alternative means of transport and support for the Nazi party. In col 1, we regress Nazi Party votes in November 1933 on distance to the railroad and find a small, insignificant coefficient; when we look at changes in votes between November 33 and August 1934, we again find a small negative and insignificant coefficient (col 2). When we restrict this to locations close to the highway network – to see if access to alternative transport mattered differentially where the highway was being built – we again find no effect (col 3). For distance to river (cols 4-6), we find negative, insignificant coefficients except when we look at places close to highways, when the sign changes.

Table 12: Placebo Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Std Nazi votes, Nov'33	Change in Nazi votes, Nov'33-March'34		Std Nazi votes, Nov'33	Change in Nazi votes, Nov'33-March'34	
Cities in sample	all	all	Distance any HW<20km [#]	all	all	Distance any HW<20km [#]
log(distance to Railroad)	0.00840 (0.0106)	-0.0113 (0.00923)	-0.00437 (0.0123)			
log(distance to River)				-0.00718 (0.0115)	-0.00593 (0.00981)	0.00610 (0.0119)
Controls:						
Baseline	✓	✓	✓	✓	✓	✓
District FE	✓	✓	✓	✓	✓	✓
Observations	3,306	3,306	1,985	3,306	3,306	1,985
Adjusted R^2	0.294	0.286	0.307	0.294	0.285	0.307

Note: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[#] Distance to any highway is the distance to the nearest planned, approved, or built highway segment.

²⁹ We take data on historical trajectories of canals and railways from HGIS – the historical information system for Germany.

Overall, there is no evidence in our placebo exercise to suggest that the highway effects simply capture a general swing of voters towards the Nazis in locations with good communications and access to transport infrastructure.

V.f. Matching results

To demonstrate that our results are not driven by violations of the linearity assumption, or by unobserved heterogeneity, we also perform nearest-neighbor matching. We match with two sets of variables – the baseline controls (log population, unemployment in 1933, and Nazi party support in 11/1934), and the extended set (which adds socioeconomic factors such as the share of Jews, of Catholics, of industrial employment, and of blue collar voters). We use either 3-neighbor-matching or 1-neighbor, so form small comparison groups with a high degree of similarity. We also experiment with defining towns and cities within either 20km or 5km of the highway as treated.

Table 13 shows our results. In all specifications, we find large, significant effects. Matching estimation suggests that places “treated” with the highway show 0.1 to 0.18 standard deviations higher increases in support for the Nazi Party overall. We also add restrictions on the range of locations from which propensity score neighbors can be drawn (col 2-6). When we restrict matches to come from the same district, we find bigger effects; and even under very strict conditions, matching on both the same district and being close to a *planned, approved or built* highway (cols 4-6), we find effects of up to 0.15 standard deviations. Under these specifications, the range of possible matches is restricted even further, to places that are both in the same district and also close to the highway network in general (including planned or approved segments). In other words, when we compare changes in votes for the Nazis in locations that are in the same *Regierungsbezirk* and also close to a planned highway, we find effects that are, if anything, even larger than in our OLS regressions (see in particular cols 4-6 in Table 7).

Table 13: Matching estimation
 Dependent variable: Change in votes for the Nazi Party, Nov'33-March'34

	(1)	(2)	(3)	(4)	(5)	(6)
	Matching with 3 nearest neighbors				1 nearest neighbor	
HW under construct. within 20km	0.101*** (0.0310)	0.181*** (0.0335)	0.159*** (0.0377)	0.149*** (0.0373)	0.108** (0.0461)	
HW under construct. within 5km						0.130** (0.0530)
<u>Matching variables:</u>						
Baseline controls	✓	✓	✓	✓	✓	✓
Additional controls				✓	✓	✓
<u>Matching restrictions:</u>						
within districts		✓	✓	✓	✓	✓
within 20km of any HW [#]				✓	✓	
within 5km of any HW [#]						✓
Observations	3,234	3,234	3,234	3,216	3,216	3,216

Note: The reported coefficients are average treatment effects on the treated (ATT), based on propensity score matching. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Baseline controls are $\ln(\text{city pop in 1933})$, unemployment rate in 1933, and the standardized vote share for the Nazi Party in the November 1933 election. Additional controls include the share of Jews in 1925, the share of Catholics in 1925, the share of blue-collar workers in 1933, and the share of industrial employment in 1933. “Districts” are the 77 *Regierungsbezirke* in Weimar Germany.

[#] Distance to any highway is the distance to the nearest planned, approved, or built highway segment.

VI. Conclusions

We examine if a major, nationwide infrastructure project can boost electoral support for a dictatorship. We turn to one of the most famous examples of road-building in history – the construction of the high-speed road network in Germany after 1933. Construction began in the early days of the Nazi regime, shortly after the “seizure of power.”

While “only” 44% of Germans voted for the NSDAP in March 1933, it went on to become one of the most popular regimes in history. The transition was not smooth. In 1934, the regime was heading towards a crisis as conservatives, middle class citizens and workers became increasingly uneasy about the instability, lawlessness, and radicalism of the Nazi regime. The plebiscite of August 1934 – unifying the leadership of Germany in the hands of Hitler – marked a turning point. Thereafter, any hopes of successful internal opposition were remote. The plebiscite was important in showcasing massive support for the regime and for the leadership of Adolf Hitler.

Of course, the share of yes-votes in the frequent plebiscites cannot be taken as a direct measure of overall support for the Hitler government. Instead, we argue that cross-sectional differences are informative. We examine the size of the electoral swing in favor of the regime during a relatively short period of time – between November 1933 and August 1934. While the layout of the road network was largely determined by the fall of 1933, road construction only began in earnest by the spring of 1934. We find that opposition to the nascent dictatorship declined significantly in districts traversed by the Autobahn – the further away a town or city from newly constructed highway segments, the bigger the increase in opposition between November 1933 and August 1934. There is no such pattern in the data for earlier elections.

The effects are both large and likely to be causal. If we use simple average-by-distance brackets (as in Figure 1), going from less than 10 km to more than 60km changed support by 0.49 standard deviations – equivalent to an extra 2.7% of “yes” votes, or 890,000 additional supporters (and more than a quarter of all opposition votes in August 1934). When we predict where road-building should occur based on terrain features and the associated cost of construction, we find effects of similar magnitude.

Why did motorway building reduce opposition to the regime? We cannot directly establish the channels through which the Autobahn helped to win the “hearts and minds” of Germans. The Nazi regime prioritized road-building as an economic stimulus measure. Original plans were for 600,000 workers to be employed; the actual maximum was around 120,000. Recent analysis suggests that economic effects in the aggregate were modest (Ritschl 1998). The benefits in terms of transport were also minimal – Germany had one of the lowest rates of car ownership in Europe (Evans 2006). Nonetheless, it is possible that local economic effects were sizeable. Workers were initially housed in private homes in the villages and towns where the roads were being built; barracks were only built later. Those employed in building the highway also spent money in inns and shops; construction crews organized film showings, and construction sites became minor local attractions – a popular destination for weekend trips (Eichner-Ramm 2008).

Overall, highway construction was not very successful in convincing workers to vote for the Nazi party – electoral gains were not much greater in towns and cities close to the highway if industrial employment or their share of blue-collar voters was high. Instead, the Nazis received greater support in areas with a history of voting for centrist parties, and those with a high share of Catholics – parts of society that had traditionally been skeptical of the Nazis. This suggests an alternative channel: The *Autobahn* may have demonstrated the new government’s determination and abilities in a convincing fashion, along the lines of Rogoff (1990). In other words, the *Autobahn* demonstrated Nazi Germany’s ruthless energy and organizational capabilities, as Hitler promised in his speech inaugurating the project. The rapid fall in aggregate unemployment figures after 1933 may have convinced many that road-building had “worked” – even if they were due to an economic upswing that had begun earlier. After the perceived incompetence and gridlock of Weimar politics, many Germans were undoubtedly impressed by the *Autobahn’s* rapid progress. The propaganda machine took particular care to connect the roads in the public imagination with Adolf Hitler himself – the motorways were called “roads of the *Führer*.” While demonstrating competence would have affected voting in the country as a whole, it is plausible that the regime’s accomplishments in building the *Autobahn* were more salient for voters in districts where the new roads were taking shape.³⁰

Our results suggest that infrastructure spending can indeed create electoral support for a nascent dictatorship – it can win the “hearts and minds” of the populace. Direct economic benefits of public works in affected districts may have played a role. In addition, in the hands of Goebbels’s propaganda, the “*Führer’s* highways” became concrete proof of the regime’s ability to overcome the gridlock of Weimar days and to “get things done” (Vahrenkamp 2010).

³⁰ This is in the spirit of Gennaioli and Shleifer (2010), who emphasize that attention is limited, and that “what comes to mind” most readily is a powerful determinant in decision-making.

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Appendix: Additional Figures and Tables

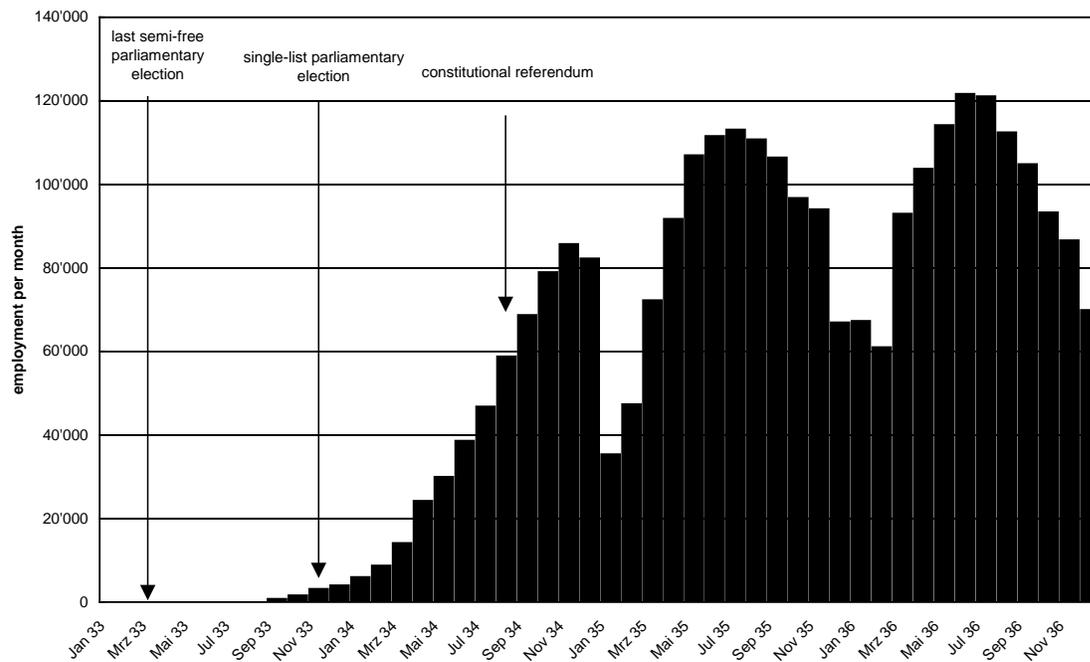


Figure A.1: Manpower used for highway construction

Source: Humann (2011)