Rail Lines and Demarcation Lines:

A Response

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Abstract

In Ferwerda and Miller (2014), we assess whether granting governing authority to natives reduces resistance to foreign rule. We find that devolving authority significantly lowered levels of violent resistance in WW2 France, an effect we argue is driven by a process of political cooptation. Kocher and Monteiro (2015) challenge these results, arguing that the Germans deliberately placed the demarcation line in proximity to strategic railroads, and that due to external involvement by Allies, the locations of resistance events should not be used to infer political motivations. In this research note, we argue that these critiques do not undermine our core findings. Specifically, we demonstrate (1) that Kocher and Monteiro's account overstates the importance of 'strategic' railways in determining the location of the line, (2) that the presence of these railway lines cannot fully account for our findings, and (3) that resistance was locally-rooted, began before D-Day, and was not directed by the Allies in the regions from which we derive our inferences.

Summary

In "Political Devolution and Resistance to Foreign Rule: A Natural Experiment," we assess whether foreign occupiers face less resistance when they increase native governing authority. To gain causal leverage, we focus on the quasi-random assignment of municipalities to German- and Vichy- occupation zones in World War II France. Focusing on narrow bandwidths around the border, we find that municipalities in the German zone experienced a significantly higher level of resistance than comparable municipalities in the Vichy zone. We argue that this discrepancy is driven by a process of political cooptation: the Vichy government effectively empowered and coopted the right-wing population, reducing their motivations to resist. In the German zone, by contrast, no domestic political groups were given significant power, generating incentives to resist across the political spectrum.

In "What's in a Line? Natural Experiments and the Line of Demarcation in WWII Occupied France," Matthew Kocher and Nuno Monteiro offer a four-pronged critique of our article. Specifically, they argue (1) that the placement of the demarcation line was not quasi-random at the local level, but rather was determined by the location of strategic railroads, (2) that once these railroads are accounted for, there is not a significantly higher level of resistance in the German zone, (3) that the findings in our paper are not externally valid to the rest of France, and (4) that locations of resistance events cannot be used to infer political motivations since these campaigns were controlled and directed from abroad in preparation for D-Day.

We appreciate the careful attention that Kocher and Monteiro have given to our article. In particular, we thank them for highlighting the need to provide more historical detail on the placement of the demarcation line, which we acknowledge was not discussed in adequate detail within the original article. However, as we will demonstrate in this research note, the critiques levied by Kocher and Monteiro do not undermine our core findings.

First, the claim that strategic railroads determined the placement of the demarcation line is based on a limited reading of historical sources. Both in a broad sense, and in the

specific regions we study, railroads played at best a partial role in determining the line's location. While it is true that the occupiers deliberately captured key cities and strategic coastlines for the German zone, as acknowledged in our article, at the local level the line was often arbitrary. Indeed, the evidence suggests that the German authorities were unclear as to where to place the line; a problem compounded by the fact that the original demarcation line was drawn on conflicting maps of insufficient resolution. As a result, the line was adapted to idiosyncratic geographic features and frequently modified according to the tactical whims of local German commanders.

Second, drawing on archival sources, we demonstrate that only a subset of the railroad lines highlighted by Kocher and Monteiro's critique can be accurately characterized as "strategic." In the department of Saone-et-Loire, for instance, where the majority of sabotage events took place, pre- and intra-war data indicates that the railroad line that Kocher and Monteiro's account highlights as the key 'Nantes-Tours-Belfort' line was in fact a branch line. Indeed, the main east-west transport route actually ran through the north of the department (via Autun), outside of the bandwidths we study. In contrast, the southern line highlighted by Kocher and Monteiro saw reduced German traffic during the war; a reality underscored by the fact that it was selected to be partially dismantled in order to provide war materiale. Finally, this railway was in fact bisected by the original course of the demarcation line (as established at Rethondes) suggesting that the German authorities did not prioritize the capture of this particular rail line.

Although the evidence suggests that the majority of railroads within the narrow bandwidths we study cannot be accurately characterized as strategic transport routes, it is important to note that our results remain robust to accounting for all railroad lines. For instance, when drawing on improved data and scaling rail sabotage by the length of track within each commune [1], we nevertheless observe significantly elevated levels of resistance activity within the German zone. Most importantly, our core results hold even if we exclude all regions where

[1] This approach is superior to rail intersection given the uneven shape and widely varying size of French municipalities.

"strategic" lines are potentially problematic. In the western departments of Vienne and Charente, for instance, the Paris-Bordeaux railroad is outside the narrow bandwidths we use to obtain point estimates (10km). Within this bandwidth, we nevertheless observe a higher level of resistance within the German zone, despite the fact that double track railroads do not intersect either zone. The results also remain robust to omitting individual departments from the sample, and when buffering the line to exclude potential confounders.

Finally, we present historical evidence that suggests that resistance in our departments of interest was driven by local factors and began before D-Day. Drawing on the same source as Kocher and Monteiro, we also demonstrate that Allied instructions did not drive resistance offensives against railways within the bandwidths we study. While this further underscores the fact that these rail lines are not best characterized as 'strategic', it also suggests that the results are not significantly contiminated by outside intervention. [2]

In sum, although we take Kocher and Monteiro's critiques seriously, the available evidence nevertheless suggests that (1) the demarcation line was not singularly determined by the location of strategic railroads, (2) the higher level of resistance in the German zone holds even when controlling for exposure to rail lines, and (3) resistance in the regions we analyze began before D-Day and was not primarily directed by international actors. As a result, we maintain that their criticisms do not undermine the core findings of our article. The remaining portion of this research note establishes these arguments in detail.

[2]Kocher and Monteiro also claim that our findings are not externally valid to France and use a department-level regression to show that resistance was higher in the Vichy zone. However, given that this data is highly aggregated, it does not directly test the external validity of our commune-level findings. More importantly, their findings on overall resistance levels can only be interpreted as causal if we believe they have controlled for all relevant confounders associated with respect to occupation zone and resistance. As we explain in detail within the article (p 646-7), it is precisely the difficulty of finding and measuring all confounders that led us to focus in on communes in close proximity to the demarcation line. In other words, the tradeoff between external and internal validity was a deliberate choice.

1. Assessing Motivations for the Location of the Demarcation Line

Our research design is based on the argument that the assignment of communes to the German or Vichy zones can be viewed as quasi-random at the local level, particularly within the narrow bandwidths on either side of the line from which we draw our main inferences. As we demonstrate with balance checks on pre-war covariates, communes on either side of the border are statistically indistinguishable within small bandwidths. While Kocher and Monteiro claim that the covariates we assess are "causally irrelevant" (p. 14), many are in fact significant predictors of resistance activity and several are used as covariates in Kocher and Monteiro's own regressions. [3]

As we acknowledge in the article, the placement of the demarcation line was not quasi-random at the macro-level. For instance, the Germans clearly sought to capture the Atlantic coast (p. 645) and made efforts to capture provincial capitals for the German zone (p. 647). At the micro-level, however, we maintain that the line's location can be viewed as essentially arbitrary. In the text, we support this argument by noting that the line cut across existing administrative boundaries for communes, cantons, and departments, as well as geographic features such as rivers and mountain ranges. We also remain sensitive to possibility that the Germans may have sought to capture important targets at certain points near the border— for instance, we explicitly note that "large cities or transportation hubs may have been tempting strategic targets" (p. 647, FN 11). Motivated by this concern, we conducted additional analyses where we use matching and drop communes within 5 kilometers of the line (see appendix A2).

Despite the inclusion of these details in the original text, we fully agree with Kocher and Monteiro's assessment that the published article did not provide sufficient detail on the assignment mechanism. Nevertheless, based on a review of the historical evidence, we will demonstrate that the location of the demarcation line was not predominantly driven by the location of strategic railroads, as asserted in their critique. Rather, the evidence suggests

[3]The covariates in the original article include, among others, distance to the nearest train station, population size, proxies for rough terrain, and measures of support for right vs. left-wing parties.

that a range of idiosyncratic factors determined the line's placement in the departments we study.

German Motivations for Establishing the Demarcation Line

Historical sources suggest a range of motivations for the placement of the demarcation line. First, in a macro-sense, a body of evidence suggests that the contours of the occupied zone were driven by longstanding German ideological and racial plans. [4] For example, the course of the line is similar to an envisioned partition of France contained in a popular German nationalist book, published by Adolf Sommerfeld in 1912. [5] These maps were popular within Nazi discourse as well, with ideological maps from 1937 closely paralleling the eventual location of the demarcation line. [6] Finally, the path in Eastern France closely followed the demarcation line established at the end of the Franco-Prussian war. [7]

Second, economic considerations influenced the placement of the line in some locations. In the East, the occupied zone intentionally captured major industrial centers for the German zone, for example the Schneider armaments factory at Le Creusot and the mines at Montceau.[8] The seizure of these areas simultaneously provided war material to the Germans while handicapping economic conditions within Vichy-administered areas. [9] This is consistent with the Nazi desire to exploit French industry for the German war effort. [10]

Although these two motivations influenced the rough contours of the occupied zone, evidence suggests that incidental geographic features played a key role in determining the

[4]Espieux 1970.

[5]Alary 2003, 35-6.

[6]"Nazi War Aims: Gross-Deutschland 1938-1948" Imperial War Museum: Posters of Conflict - The Visual Culture of Public Information and Counter Information.

[7]Schemp 1891, 331.

[8]Jaeckel 1966, 34,44; Clauss 1942, 45

[9]Alary 2003, 229, 113, 54; Alary 2006. Many of these industrial areas in Saone-et-Loire are either intersected (dropped) or within the 5km buffer (excluded during robustness checks). The elevated pattern of sabotage in the German zone remains when excluding the industrial cities of Montceau-les-Mines, Montchanin, and Le Creusot.

[10]Kedward 1978, 18-19; Gordon 1980, 24-25.

local placement of the line. In the East, the German High Command selected a course that would be easy to identify and enforce.[11] For instance, in Saone-et-Loire and Cher, the line followed a combination of rivers, roads, and canals.[12] In the West, evidence suggests that the placement of the line was relatively haphazard; although the broad contours of the line were driven by a desire to capture the Atlantic coast and ensure a secure link to Franco's regime in Spain,[13] in Vienne the line largely mirrored the extent of the German military advance in 1940. [14]

Regardless of the initial motivations, in practice the demarcation line was imperfectly imposed. The Germans themselves were unsure about where exactly to place the line, with the first version proposed at Rethondes (in June) significantly altered in the final version decided at Wiesbaden in the final months of 1940. [15] Even after the Wiesbaden conference, uncertainty remained concerning the line's exact placement at the local level, largely due to imprecise instructions and the low resolution of the original map. [16] For instance, in western Saone-et-Loire, the location of the demarcation line was modified at least three times; by the time the line was fully enforced and finalized, the initial location had shifted by more than six kilometers in order to provide a more tactically defensible position for local commanders. [17] Similarly, in Charente and Vienne, vague instructions led commanders to substitute local auto-routes as boundaries; the often circuitous nature of these routes in turn substantially modified the location of the demarcation line. [18] As Farisy documents, the

[11]Alary 2006.

[12]Bonnot 2003, 8. Alary 2003, 55; Veyret 2001, 13.

[13]Alary 2003, 55-56.

[14]Alary 2003, 54.

[15]For instance, the French authorities in Saone-et-Loire were informed that only one commune was to be split by the demarcation line (Cersot). However, due to the poor quality of the initial maps, the line as imposed actually intersected numerous communes; these apparent discrepancies between intent and enforcement caused significant administrative confusion. Bonnot 2003, 8, 16; Délégation française auprès de la Commission allemande d'armistice.

[16]Alary 2003, 55; Bonnot 2003, 10.

[17]Bonnot 2003, 9-11; Veyret 2001, 13. See Appendix Figure 3 for an example of these tactical shifts.

[18]Farisy 200, 30-31.

border was substantially altered in Vienne as late as December 1940 to grant more territory to the Vichy zone, with the ultimate course "adapted to the terrain and local geography by different German commanders." [19] In other departments intersected by the line, such as Gironde, a similar picture emerges: the border was imprecisely drawn and modified as late as 1942 according to local tactical considerations. [20] These vagaries suggest that it is misleading to characterize the location of the line as part of 'strategic master plan' within narrow bandwidths.

Strategic Railroads

A full reading of the historical evidence suggests that the location of the line was often idiosyncratic, and above all, locally-determined. In other words, little evidence exists that the location of strategic railroads singularly determined the course of the demarcation line. Nevertheless, taking these claims seriously, we a) evaluate whether the historical evidence suggests that the specific lines highlighted by Kocher and Monteiro were "strategic" and b) whether the overall pattern of sabotage is robust to accounting for the location of these lines.

The clearest evidence that the Germans considered railways as a criterion for the location of the demarcation line concerns the North-South rail line connecting Paris and Bordeaux. This route is in fact the only rail line mentioned explicitly in the Armistice agreement; other landmarks for the line's course omit mentions of railways altogether. The focus on this particular rail line appears to be systematic: Alary documents a June 21, 1940 phone conversation between Weygand and Huntzinger that notes that in the West, the demarcation line "parallels the rail line" from Tours to Angouleme to Bordeaux. By contrast, in the East, the demarcation line was marked "in a general manner" between Geneve, Dole, Chalon, Paray, Moulins, and Vierzon. [21]

The presence of this strategic North-South rail line would clearly bias our results. How-

[19]Farisy 2007, 16, 29, 32.

[20]Soleau 1998, 23, 26.

[21]Alary 2003, 113.

ever, given that the demarcation line was explicitly placed 20km to the East of this rail line [22], outside of the bandwidth we use to obtain point estimates, our analysis should remain unbiased (See Appendix Figure A1).

Kocher and Monteiro highlight a second 'strategic' line within our departments, which they refer to as the Nantes-Tours-Belfort line, running through Cher and close to the border on the German side in Saone et Loire (from Paray Le Monial through Montchanin to Chagny). As evidence for the importance of this rail line (p. 4), they cite Hermann Bohme, a German colonel who recounts a June 1940 conversation between German generals that appears to suggest the necessity of including this East-West "connection" in the German zone. [23] However, historical evidence suggests that this line was not in fact strategically important. First, the original demarcation line, as specified in June at Rethondes, effectively cuts across this rail line (with the border passing north of Chalon), which suggests that the line was not initially deemed critical to the German war effort. [24] Second, archival data from 1941 suggests that section of the line highlighted in Saone-et-Loire was not the main "east-west line" as Kocher and Monteiro suggest, but rather a branch line. Rather, as in the pre-war period, the majority of east-west traffic flowed on a more northerly line, through Nevers (and Autun), with very little traffic through Montchanin, where the supposedly strategically critical line ran. [25] This northern route closely matches German military logistic maps from the period, which also suggest that the Nevers-Autun transport route was critical. [26] Since this particular route is more than 20km from the demarcation line, it likewise does not introduce bias into our study.

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[22]Farisy 2004, 18-19; 30-31.

[23] This source uses the term 'Verbindungen' (Connection) rather than 'Bahn' (Railroad). This term is somewhat ambiguous in German; it may be reasonably interpreted as a railway, but it is also possible that Boehme was referring to a line of communication or road connection. It is worth noting that if it refers to a rail line, the source incorrectly describes it as passing through Le Creusot; in fact the rail line passes to the south, through Montchanin.

[24]Délégation française auprès de la Commission allemande d'armistice. The initial line also cleaved the line at Bourges, and in several places along the Canal du Centre in Saonet-et-Loire.

[25]SNCF 1940-1945, file 0238LM0033-003, 496. This traffic pattern closely matches maps of 'major lines' both pre- and post-war.

[26]"Der Mil. Bef. in Frankreich. Kommandostab Abt.Ia. Durchgangstrassen. Stand v15.4.41"

Finally, and most decisively, as of June 1942, the SNCF planned to convert the double track line from Paray to Montchanin to single track in order to provide material for the German Reichsban; at least a portion of this plan was completed by August 1943, near Montchanin.[27] The fact that this particular double-track line was selected as a candidate for dismantlement suggests its strategic importance is overstated.

Kocher and Monteiro's own discussion of resistance activity in Saone et Loire likewise hints that the double track lines near the border within the German zone were not of paramount importance. As they note, the rail line that was most commonly attacked in Saone was the North-South line between Paris and Lyon (p. 14), which traveled across both the German and Vichy zones. Moreover, they highlight a strategic "triangle of territory delimited by Chagny, Mâcon, and Paray-le-Monial" (p. 13) that the Resistance liberated in 1944, but this area is largely in the Vichy zone. Indeed, most of the important rail lines for the Germans in Saone-et-Loire traveled north-south, cutting across both zones. [28]

We believe that Kocher and Monteiro's railway critique is most valid in Cher, where freight data suggests that the rail line originating from Nevers provided an important connection to Vierzon. Although the key rail hub (Vierzon) on this line is cleaved in two by the demarcation line and thus dropped from our sample, the presence of this strategic line may nevertheless bias our results. [29] As a result, in the following analysis, we exclude Cher as a robustness check. We find that the exclusion of this department strengthens rather than diminishes the original findings.

[27]SNCF 1942-45, file 0026LM0036-002, 341; 534

[28]Veyret 2001, 16, 49-50; Bonnot 2003, 106.

[29]We were unable to find historical documents that reference a deliberate attempt to place the demarcation line in proximity to this particular rail line. In fact, the original demarcation line specified at Rethondes was substantially to the south; running in a near straight line from Moulins (in Allier) to Vierzon along the river Cher. The Western course of the line in Cher continues to follow this river precisely.

2. Does Imbalance in Rail Infrastructure Explain the Results?

Although the historical evidence suggests that the many of the rail lines highlighted by Kocher and Monteiro were not in fact "strategic" or are excluded from the bandwidths we analyze, it remains possible that the location of these rail lines, even if incidental, could have biased the patterns of resistance we find in our article. In particular, given that the article controlled for distance to train stations as the primary rail covariate, it is possible that we were unable to detect underlying bias driven by variation in physical track length within French communes.

To address these concerns, we initially digitized rail lines from 1926 and 1927, which can be viewed in the Online Appendix (Figure A7), and verified that the pattern of results was robust to the intersection of these lines with particular communes. At the time, these particular railroad maps were the most recent source we could obtain from the French National Library.

In this research note, we present new data that allows us to assess the possibility that the location and volume of rail infrastructure explains the results within our article. Specifically, we precisely digitized rail lines using 1943 War Office (British General Staff) maps. When contrasted to the 1926 and 1927 maps, these war maps are characterized by higher resolution and are significantly more proximate to the actual timeline of resistance activity. As a result, we believe that they comprise a more authoritative source, and in the remainder of the text we analyze the results from this source exclusively.

The resolution of the maps implies that we can precisely measure the physical length of track within any given commune. We believe this measure is clearly superior to a simpler variable measuring track intersection: given that commune boundaries are often oddly shaped, intersection with a rail line does not necessarily provide an accurate measurement of the degree to which a commune contains rail infrastructure. Moreover, given that resistance activity occurs on a physical plane, the amount of physical track within a commune should be tightly correlated with the volume of observed attacks.

In the following table, we present the total distance of track located within Vichy and

German zones for several bandwidths. [30] As Kocher and Monteiro accurately point out, the German zone contains a higher degree of rail lines within narrow bandwidths.

Table 1: Rail Sabotage, Adjusted for Rail Length

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
land area (10km^2)	6181	6940	4673	4968	2922	2992	872	961
total rail length (km)	445.72	628.3	336.3	410.2	201.8	328.1	75.5	142.2
rail sabotage / km rail	0.269	0.452	0.262	0.514	0.263	0.482	0.292	0.577
Incidence Rate Difference (t)		5.02		5.61		4.16		3.20
Poisson (t)		4.76		5.33		3.82		2.84

The incidence rate refers to the difference between (Σ Rail Sabotage / Σ Track Length) for each zone and bandwidth, followed by a subsequent hypothesis test (bootstrapped). The poisson model includes the treatment indicator and a logarithmic offset for commune rail length; a standard approach for modeling count data as a function of relative exposure. All types of rail lines included.

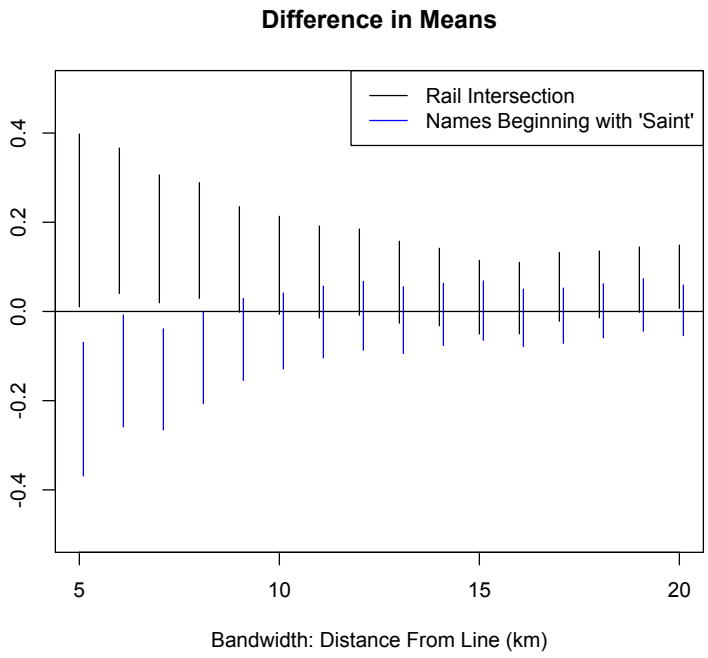
However, we believe this imbalance to be misleading. For bandwidths between 20km and 10km, there is no statistically significant difference between the two zones after accounting for the greater land area within the German zone (due to irregularly shaped departmental and commune boundaries). After 10km, as we point out in our article (footnote 26), the sample size declines rapidly, leading to reduced power. For this reason, in the article we use the 10km distance to establish point estimates (p. 652).

The limited sample size within very narrow bandwidths is relevant because it implies that rare covariates – such as railway track – are likely to be imbalanced by chance. [31] To demonstrate this empirically, the following figure displays the balance between the two zones on two covariates: rail intersection, using the revised measure from 1943 maps, and communes whose name begins with 'Saint'. Due to the small sample size, balance declines steeply after 10km according to conventional measures. Given that the German authorities can be assumed to have been ambivalent with regard to municipal names, this suggests that imbalance within

[30] We omit narrow gauge and tramway lines.

[31] This effect is likely magnified for covariates that are part of a network. If the network is not determined by random walk, the possibility of imbalance due to chance rather than selection remains high.

these bandwidths does not necessarily imply strategic selection. [32]



To what extent did the greater amount of track on the German side of the line influence the result? The bottom rows of Table 1 provide an answer to this question. Subsetting resistance events to include only sabotage against rail targets, we scale the observed level of sabotage within each bandwidth by the total length of track. The results suggest that even when accounting for the higher volume of track within the German zone, sabotage rates within the German zone remain elevated. For instance, within the 10km bandwidth, the results suggest that a given kilometer of track in the German zone was roughly twice as likely to be attacked as a similar section of track within the Vichy zone. This is consistent with our argument that resistance members in the German zone had higher incentives to resist, regardless of infrastructure.

It remains possible that German communes were targeted because they contained strategically-critical "double track," as Kocher and Monteiro assert. In our view, this ar-

[32] Although chance imbalance does not suggest the natural experiment is invalid, it may still influence the results. In this case, however, it is worth noting that track imbalance is mainly driven by rail lines located within 5km of the border. As seen in Appendix Table A2, as well as Table 5 (subsequent pages), which uses the new rail data, the results remain robust to dropping all communes within 5km of the demarcation line.

gument is difficult to evaluate given the structure of the data. Conditioning on communes with double-track lines while overlooking single-track lines (or vice versa) will introduce bias, given that a) single track lines predict the dependent variable, and b) single track lines, as part of a network, are strongly correlated with the location of double track lines. More importantly, given that single and double track lines are often simultaneously located within a commune, the dependent variable is in fact insufficiently granular to permit an accurate assessment of sabotage by specific track type. [33]

Accordingly, we construct a conservative estimate that accounts for variation in track infrastructure by multiplying the observed track length of all double track lines by two. After rescaling sabotage rates in this manner (Table 2), the observed differences between zones remain statistically and substantively significant.

Table 2: Rail Sabotage, Rescaled for Track Density

	<= 20km		**<= 15km**		**<= 10km**		**<= 5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
Sabotage / km rescaled	0.208	0.267	0.199	0.310	0.188	0.285	0.199	0.346
Incidence Rate Difference (t)		2.35		3.69		2.81		2.56
Poisson (t)		2.26		3.50		2.61		2.29

Similarly, the patterns of political targeting remain pronounced when accounting for physical track distance. Table 3 demonstrates the observed rate of rail sabotage, per kilometer of track, for relatively right-wing communes and non right-wing communes across each zone. The results support the cooptation finding: it is clear that the greater amount of sabotage within the German zone was primarily driven by sabotage within relatively right-wing communes. In contrast, no clear differences in sabotage rates between zones are visible within less right-wing communes. Unless one believes that rail lines have a high probability of being placed within right-wing areas, these findings suggest that the location

[33] As seen in the Appendix, when performing a subset analysis where we investigate the rate of sabotage by communes intersected by single and double track, respectively, we nevertheless observe a higher rate of sabotage within the German zone. However, given measurement issues, we view these results as inconclusive.

of infrastructure cannot fully explain resistance attacks.

Table 3: Rail Sabotage, by Political Orientation

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
Right Wing (> Median)	0.016	0.183	0.009	0.188	0.010	0.192	0.013	0.267
Right-Wing (< Median)	0.254	0.269	0.253	0.327	0.253	0.290	0.278	0.309

As a final robustness check, we demonstrate that the results hold when excluding departments and communes from our sample that would be most problematic if imbalance in rail lines were driving the results. For instance, the upper half of Table 4 displays the pattern of rail sabotage when examining the departments of Vienne and Charente only. Within these departments, the demarcation line was deliberately buffered 20km from the strategic railroad line referenced by Kocher and Monteiro (See Appendix). In bandwidths close to the demarcation line, which exclude this line altogether, we nevertheless find sharply elevated rates of sabotage within the German zone. Indeed, within 10km of the line, our data suggests that no rail sabotage occurred whatsoever within the Vichy zone.

Similarly, the results hold when excluding either Cher or Saone-et-Loire from the sample. Given that these two departments contain the majority of potential 'strategic' lines referenced by Kocher and Monteiro, the fact that basic patterns obtain across subsets of the data that exclude either one of departments should raise confidence in the findings.

Table 4: Rail Sabotage, Departmental Restrictions

Vienne and Charente Only (Saone-et-Loire and Cher Omitted)

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
total rail length (km)	181.3	296.4	146.0	124.3	67.5	94.4	26.2	37.2
rail sabotage / km rail	0.055	0.273	0.048	0.105	0	0.106	0	0.161
Incidence Rate Difference (t)		6.23		1.66		3.16		2.45
Poisson (t)		4.77		1.66		-		-

Cher Omitted

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
total rail length (km)	396.9	523.1	293.0	317.58	166.9	259.3	61.8	115.3
rail sabotage / km rail	0.295	0.501	0.290	0.595	0.300	0.540	0.324	0.677
Incidence Rate Difference (t)		5.00		5.70		3.86		3.42
Poisson (t)		4.77		5.50		3.57		2.94

Saone-et-Loire Omitted

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
total rail length (km)	230.11	401.51	189.3	216.9	102.4	163.1	39.9	64.1
rail sabotage / km rail	0.056	0.257	0.053	0.161	0.029	0.172	0.050	0.156
Incidence Rate Difference (t)		6.73		3.39		3.89		1.74
Poisson (t)		5.14		3.11		2.91		1.47

Lastly, the results remain robust to excluding all communes located within 5km of the demarcation line. This bandwidth in Cher and Saone-et-Loire includes many of the railroad lines highlighted by Kocher and Monteiro. After buffering the demarcation line to exclude these communes, we nevertheless find a higher frequency of resistance activity within the German zone.

Table 5: Rail Sabotage, 5km buffer

	<= **20km**		<= **15km**		<= **10km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
total rail length (km)	370.3	486.1	260.8	268.0	126.3	185.9
rail sabotage / km rail	0.265	0.416	0.253	0.481	0.245	0.409
Incidence Rate Difference (t)		3.86		4.34		2.54
Poisson (t)		3.66		4.25		2.40

3. Allied Targeting

In their final critique, Kocher and Monteiro argue that our effort to use the location of resistance events to infer political motivations is fundamentally misguided because the majority of resistance occurred after D-Day, by which time (1) the strictures of the line of demarcation had been removed, meaning that resistance groups could plausibly operate across the border, and (2) resistance groups had been nationally unified and operated under the direction of the Allies, and thus may not have been acting in accordance with local motivations.

On the first count, Kocher and Monteiro claim, "any possible causal mechanism consistent with their theory necessitates that attacks occurring within one of the zones... be perpetrated by Resistance groups based in that same zone. For FM's theory to be testable using their data, spillover between the two zones must be limited or, at any rate, zone-neutral, i.e., with no significant net effect in one direction" (p. 11). We agree with aspects of this argument; in fact, we explicitly address these concerns in our article. We empirically assess the possibility of disproportionate spillover from the Vichy to the German zone and find little evidence in support of it (p. 652, Appendix Figure A5). Moreover, it is incorrect that our theory strictly requires that attacks by perpetrated by groups originating in the same zone. As we write in the article (p. 652), "if some spillover did occur due to increased motivation to resist in the German zone, this would be consistent with our larger argument. Because effective insurgency requires the aid of the local population... the location of attacks provides us with important information about locations in which there was local support for resistance." Nevertheless, even in 1944, the border between zones still affected resistance activity. In Gironde, for example, "the demarcation line represented an ideological break as well as a frontier for the organization of the Resistance ... No Girondese maquis, other than the batallion 'Micky' developed its activities in both zones." [34] Likewise, in Saone-et-Loire, the resistance was organized differently in the two zones, even after 1942. [35]

[34]Souleau 1998, 212.

[35]Veyret 2001, 16, 46.

Second, Kocher and Monteiro contend that, "over half of the sabotage events used in FM's study were part of a centralized plan directed against key railways chosen based on the overall strategic goals of the Allies" (p. 13), and thus cannot be attributed to local political attitudes. We find this critique puzzling, since in their own work with Lawrence they use the location of resistance events to infer political motivations of the insurgents. [36] They conclude that left-wing sympathies were an important determinant of the location of resistance events, in spite of the fact that resistance, as they write, "became widespread only as liberation approached" and "coalesced with massive support from the British and Americans." [37]

We believe that our mutual use of locations to infer political motivations is justifiable for two reasons: (1) resistance groups across France were locally-rooted and did not spontaneously emerge at the behest of the allies in preparation for D-Day, even though that is when they engaged in the most armed activity, and (2) in the specific departments we study, the evidence suggests that the Allies did not target the rail lines located in narrow bandwidths.

First, Kocher and Monteiro are correct to note that resistance in France dramatically increased during and after the Allied landings at Normandy in June 1944. However, locally rooted resistance groups had emerged across France long before this time, and before the resistance was nationally unified. As Kedward points out, "It is indisputable... that the maquis were born outside the initiative of the national leaders of the Resistance... The creation of a national body to locate, train, and co-ordinate the groups which had spontaneously formed, mirrored the initiative already taken by leaders of the Resistance at local level." [38] Even after the national unification of resistance movements, local factors remained crucial: "The theoretical unification of all the maquis... appeared to underscore the national theme as the dominant one in the months of April, May, and early June 1944, but....there was no fundamental change in the nature of most maquis activity in the sense that local objectives,

[36]Kocher, Lawrence, and Monteiro 2013, 29-30.

[37]Kocher, Lawrence, and Monteiro 2013, 12.

[38]Kedward 1993, 35.

local organization, and still more, local constraints, remained paramount." [39]

These groups were not solely local in origin, but also in their membership: "It only slowly became apparent after the war just how many maquis units were composed to a significant extent of men from the immediate rural vicinity and from small towns within the neighboring areas." [40] According to a study of resistance members in Gironde, more than 80% were local residents, with the majority organized within local units. [41]

Most important, Plan Vert, the major coordinated campaign for destroying French railways that Kocher and Monteiro specifically reference (pg. 12-13), identified relatively few targets in the four departments we analyze. According to the same source they use in their paper, in March and April 1944, none of the 30 targets were within our departments; in May, this pattern was exactly repeated; in June, Poitiers and Angouleme were included in a list of 20 targets; and in July, 31 targets were identified, including Vierzon. Of the three instances where towns in the departments we studied were targeted, two are outside the narrow bandwidths we focus on (Poiters and Angouleme), and one is intersected by the line and therefore dropped from our sample (Vierzon). [42] On balance, then, the historical evidence suggests that Allied coordination is thus insufficient to explain the patterns of resistance observed within our sample.

4. Conclusion

We appreciate the attention Kocher and Monteiro have devoted to our article and welcome the opportunity to provide additional historical detail beyond the confines of article word limits. However, contrary to Kocher and Monteiro's critiques, we believe that the evidence suggests that (1) the demarcation line was not singularly determined by the location of strategic railroads, (2) the higher level of resistance in the German zone holds even when controlling for exposure to rail lines, and (3) resistance in the regions we analyze began before D-Day and

[39]Kedward 1993, 163

[40]Kedward 1993, 147.

[41]Souleau 1998, 228-9.

[42]Durand 1968, 432.

was not primarily directed by international actors.

For many important questions in political science, particularly those relating to political violence, true experiments with perfect randomization are impossible. This leaves researchers with a choice between two options: a study that seeks to uncover causal relationships by controlling for measurable confounders, or exploiting a source of quasi-random variation in the key causal variable.

Although natural, or quasi-experiments are by definition imperfect exercises, we maintain that the approach has significant merit. While the Germans did not flip a coin to determine whether a particular commune was in the German or Vichy Zone, the claim to comparability between communes in close proximity to the border is much greater than if we had pooled all communes across France and sought to control for potential confounders. Particularly when dealing with historical and archival data, measuring all possible variables that could influence a nuanced dependent variable such as resistance is a tall task.

Kocher and Monteiro are right to note that natural experiments must rely on deep, qualitative knowledge to satisfy the burden of proof necessary for establishing a causal relationship (p. 15). However, this requirement is equally true for regression-based quantitative work, even if it is rarely acknowledged. Regardless of whether a study explicitly adopts a causal inference framework, the conditional exogeneity assumption is necessary to sustain causal claims. Natural experiments, in effect, are open to criticism precisely because they make these underlying assumptions explicit and transparent.

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Appendix

Fig A1: Bandwidth Used for Point Estimates (Western Departments)

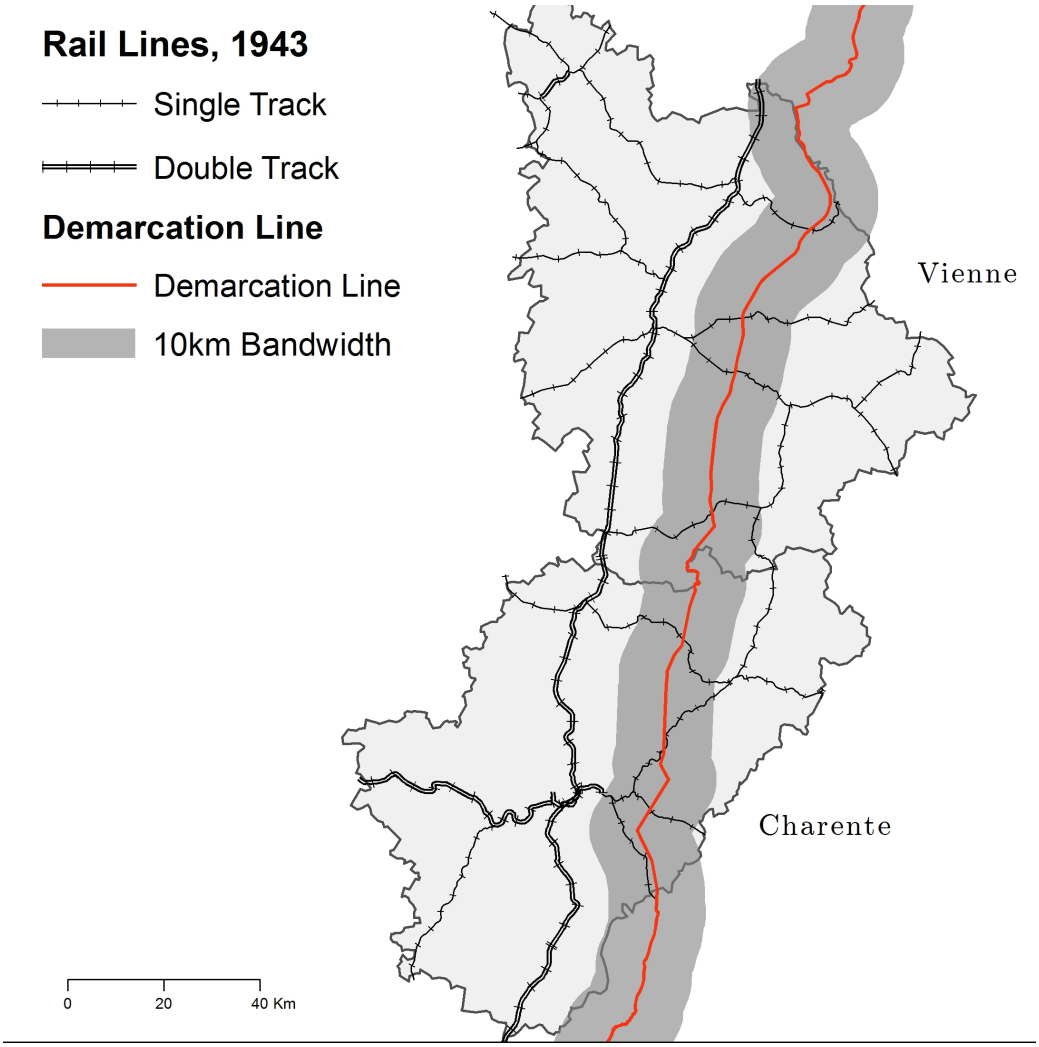
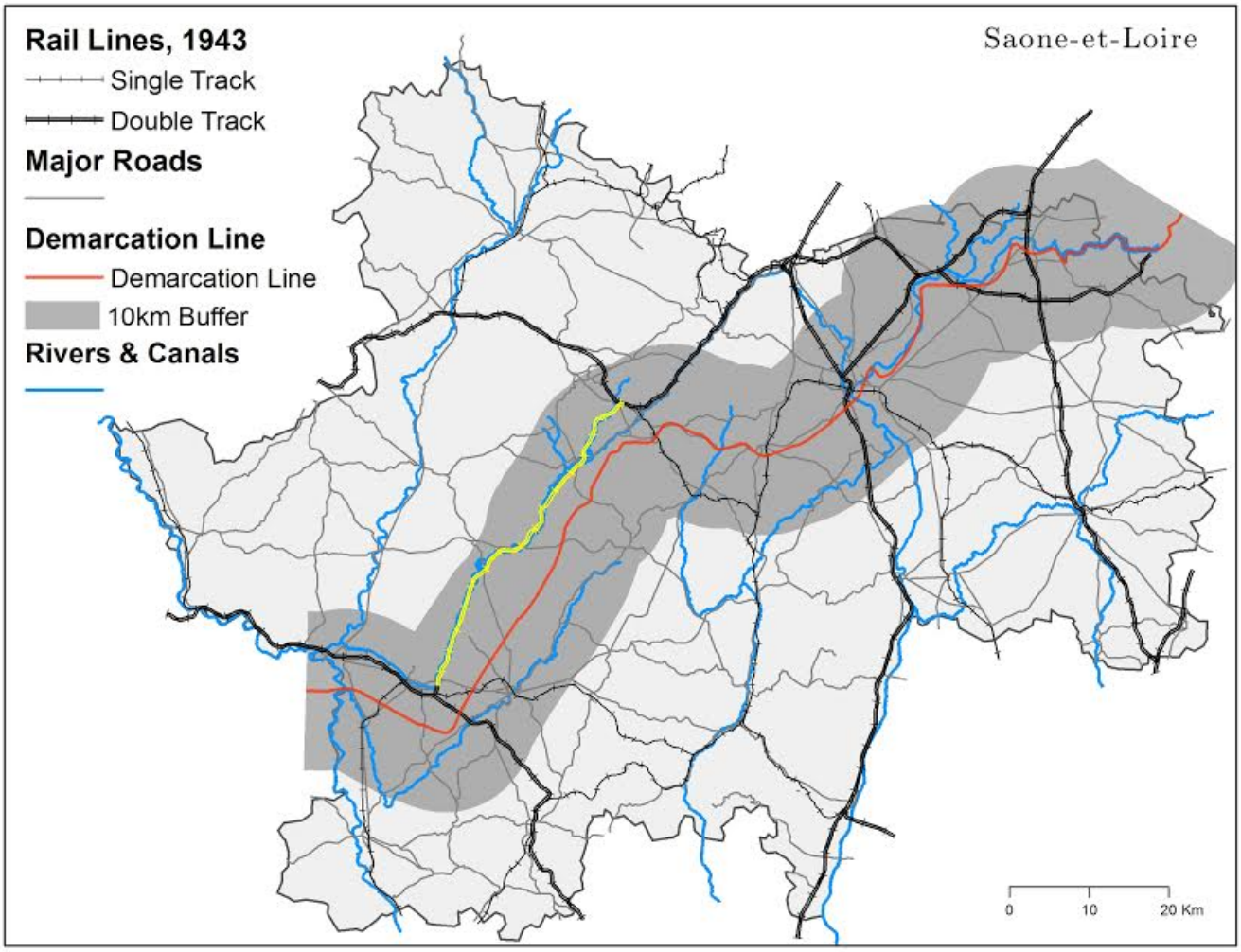


Fig A2: Bandwidth Used for Point Estimates (Saone-et-Loire)



The yellow line indicates the branch line between Paray-le-Monial and Montchanin scheduled for partial dismantlement. In the Eastern half of the department, the demarcation line exclusively follows rivers and auto routes; in the West the demarcation line originally followed the Canal du Centre (overlapping blue line close to the yellow line); its course was modified by a German Kommandant in Montceau-les-Mines.

Fig A3: Vagaries of Local Line Placement: Saone-et-Loire

The placement of the line often varied according to local tactical whims. The maps below, derived from Bonnot (2003), show in detail how the demarcation line was adjusted in late 1940 in two regions within western Saone-et-Loire. In the left-hand region, local commanders moved the line to capture the confluence of two rivers; in the right-plot, the line was decoupled from existing commune boundaries, creating a more defensible border.

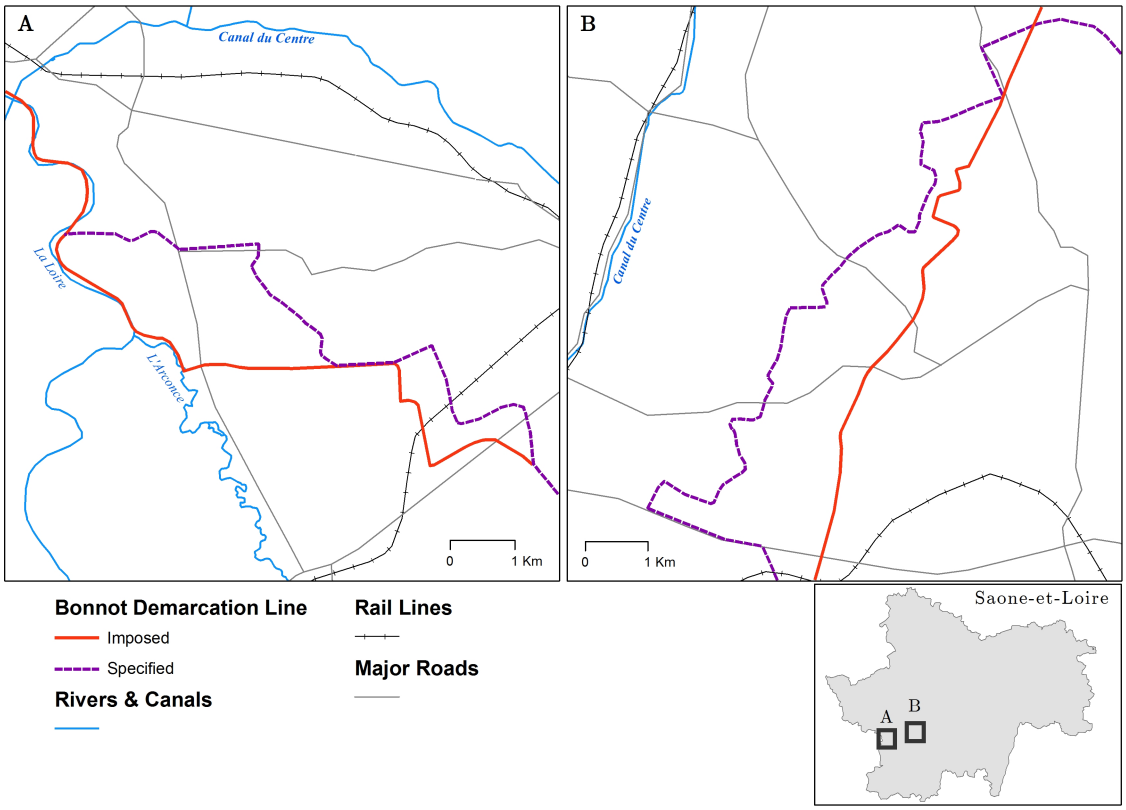


Table A1: Rail Sabotage, By Communes Intersected by Track Type

	<= **20km**		<= **15km**		<= **10km**		<= **5km**	
	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.	Vichy	Ger.
Subset Approach								
single-track length (km)	315.7	191.80	230.2	139.81	121.7	101.2	40.6	47.1
sabotage / km	0.095	0.313	0.087	0.365	0.049	0.415	0.025	0.573
Incidence Rate Difference (t)		5.06		7.04		5.48		4.70
Poisson (t)		5.33		5.44		4.88		3.09
multiple-track (km)	123.0	436.5	106.1	270.4	80.12	226.9	34.9	95.1
sabotage / km	0.700	0.623	0.641	0.736	0.587	0.657	0.602	0.789
Incidence Rate Difference (t)		-0.93		1.01		0.69		1.17
Poisson (t)		-0.96		0.98		0.67		1.09

See discussion on page 14, footnote 33.