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A quasi-natural experiment of Red Army misdeeds in post-WWII Europe

Christian Ochsner

ifo INSTITUTE

Leibniz Institute for Economic Research
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Abstract

I study the economic consequences of the Red Army's misdeeds after WWII. I exploit differences in spatial economic activity across the arbitrarily drawn and only for 74 days lasting liberation demarcation line between the Red Army and the Western Allies in South Austria. Dismantling and pillaging, but also (sexual) crimes made regions liberated by the Red Army a less desirable place to live and to start economic activities compared to adjacent regions. Spatial regression discontinuity (RD) estimates show that the liberation causes a relative population decline by around 26 to 31 percent until the present day. Measures of labor productivity also lag behind in Red Army liberated regions. I explain persistence with the selective migration pattern across the demarcation line in the direct aftermath of WWII.

JEL-Codes: J11, N14, N94, R12, R23.

Keywords: Regional economic activity, population shock, dismantling, Red Army, Austria.

Christian Ochsner[*]
Ifo Institute – Leibniz Institute for Economic Research at the University of Munich
Dresden Branch
Einsteinstr. 3
01069 Dresden, Germany
Phone: +49(0)351/26476-26
ochsner@ifo.de

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1. Introduction

More than 25 years after the fall of the Iron Curtain, countries in Central and Eastern Europe still lag behind Western Europe in various economic figures. The Czech Republic, for instance, belonged to the richest and most industrialized regions in all of Europe before World War II (WWII). Today, GDP per capita is approximately 50 percent of the levels in Western Europe whereas it was comparable prior to WWII.[1] The most striking case in point, however, is East Germany, the former socialist GDR. More than 25 years after German reunification, and despite trillions of subsidies from West Germany, the East still lags in terms of GDP per capita, average hourly wages, and the demographic trend. Labor productivity in East Germany is, for example, only approximately 70 percent of its West German counterpart.[2] Economists, politicians and even *John Doe* or *Joe Public* refer to Soviet domination for more than 40 years and to the command economy in place that causes persistent and ongoing backwardness.

My paper, in contrast, shows that countries in Central and Eastern Europe would lag Western Europe in terms of population dynamics or labor productivity *even* in the absence of long-term Soviet domination or a planning economy. After the liberation of Europe from Nazi Germany in 1945, the Red Army dismantled plants and infrastructure and caused mass exoduses in their liberated regions all over Eastern Europe.[3] I investigate the causal long-term effects of these

[1] In 1930, Czechoslovakia (presently the Czech Republic and Slovakia) was as rich as Italy in terms of GDP per capita (2016: 60% of Italy's GDP per capita). GDP per capita for Czechoslovakia in 1930 was 86% of Austria (2016: 41%), 77% of Germany (2016: 43%), and 66% of France (2016: 48%). The relative fall back of Czecho-slovakia is also confirmed in the demographic trend. The Czech Republic and Slovakia increased their population from 1930 to 2016 by around 14%. France (58%), Italy (49%), or Germany (26%, compared to the German Reich) experienced much higher population growth during the last 80 years. Sources used are Maddison-Project (2013), see also Bolt and van Zanden (2014) and IMF (2016).

[2] GDP per capita in East Germany in 2015 is around 70 percent of the West German level, and GDP per worker around 80 percent. Gross value added per hour worked in East Germany, a proxy for labor productivity, reached 71.6 percent of the West German counterpart. Despite ongoing transfers from the West to the East, all these relative figures do not show any further convergence for more than a decade. Sources used are VGR (2016).

[3] Especially former Allies of Nazi Germany (Hungary, Romania, and especially East Germany), but also Poland and to a lesser extent Bulgaria and Czechoslovakia faced a massive decline in their capital stock due to Red Army misdeeds in the direct aftermath of WWII (see Liberman, 1996 and Bekes et al., 2015). Liberman (1996) also shows that East German "reparations payments" (incl. dismantling activities by the Red Army) in the aftermath of WWII reached around 20 percent of pre-WWII GNP in East Germany. For case studies on East Germany, see e.g.,

Red Army misdeeds after WWII. To do so, I exploit the liberation treatment by the Red Army in South Austria. South Austria has been the only region in entire Europe from the Mediterranean to the Baltic Sea that was initially liberated, but not permanently occupied or dominated by the Soviet Union. On the day of the Nazi German surrender on May 8, 1945, the Red Army and the Western Allies overran these last parts of Europe under Nazi control from different directions within less than one day. The demarcation line between the Red Army and the Western Allies (US and British troops) was fully exogenous. Whether a municipality was simply overrun by the Red Army was – broadly speaking – a function of the respective velocity of the Allies' jeeps. In the Austrian state of Styria, the places where the Allies met became the liberation demarcation line that lasted for only 74 days. Already in July 1945, the Red Army had entirely withdrawn from Styria towards its official assigned occupation zone in East Austria. Styria as a whole was assigned to the UK occupation zone in post-WWII Austria. The presence for 74 days of the Red Army in some parts of Styria led to municipalities being exposed to dismantling and pillaging activities, whereas adjacent Western Allies liberated municipalities were not. Bischof (1999) summarizes the Red Army behavior in the following way:

> *"In Styria, all private property of more or less portable in nature was regarded as fair game."*[4]

Despite the officially reported dismantling of 20 industrial plants, Beer (2004) reports thousands of lootings by Red Army soldiers and approximately 30,000 estimated rapes in the Red Army liberated part of Styria alone. Dismantling and pillaging, but also (sexual) violence thus made regions liberated by the Red Army less favorable places to live and to start economic activity following the war.

Stolper (1960) or Köhler (1965), and for Red Army / Soviet dismantling of infrastructure in Poland, see e.g., Taylor (2008).

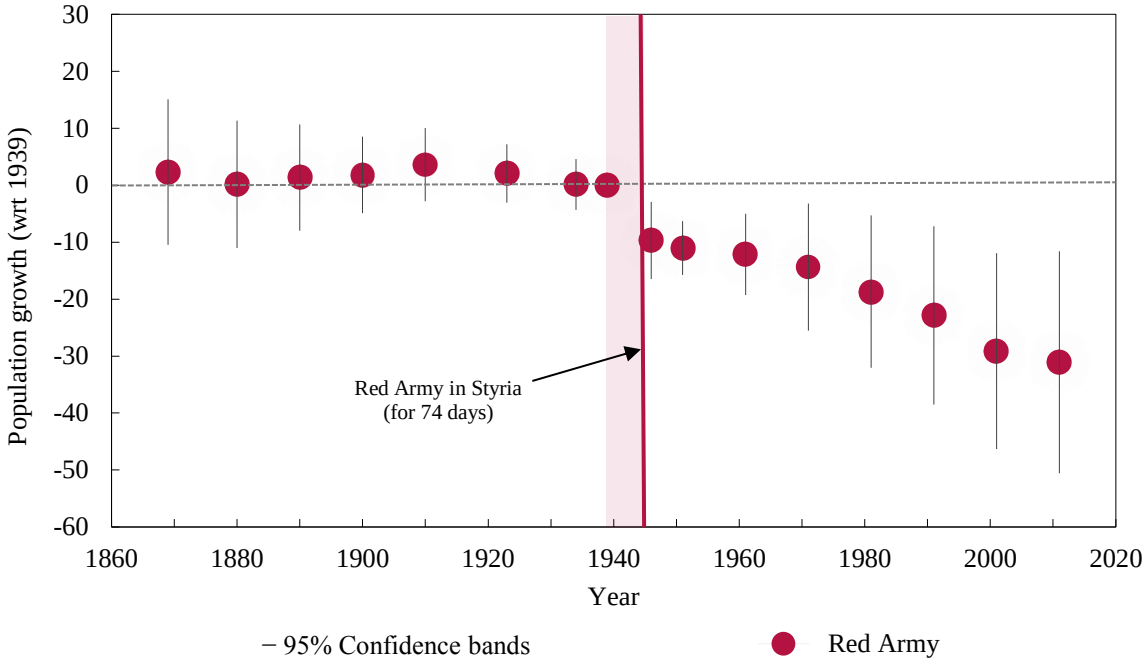
[4] Cited after Bischof (1999, p. 38), based on Eberhart (1995) and Pickl (1995).

I use this spatial discontinuity in the liberation treatment to investigate the long-run economic consequences of a short period of Red Army presence after WWII. I test for spatial discontinuities across the demarcation line lasting 74 days between the Red Army and the Western Allies in municipal population figures[5], measures of local labor productivity and various other economic variables. I find that regions liberated by the Red Army suffered in the long-run, even until the present day. Figure 1 shows the main result of the liberation treatment on municipal population across the 74 days lasting demarcation line. The figure plots spatial discontinuities based on quadratic regression discontinuity (RD) estimates across the temporary demarcation line. Municipal population growth is in respect to the base year 1939. The cross-section estimates depict that the demarcation line does not show any discontinuities in pre-WWII periods (confidence bands cross the 0-line). After the short presence of the Red Army, however, Red Army liberated municipalities immediately lost approximately 11 percent of municipal population compared to adjacent Western Allies liberated units.[6] This pattern accelerated somewhat in the 1970s and 1980s and persists until today. This indicates an echo effect that starts some 25 years after the treatment. Until the year 2011, municipalities that have been liberated by the Red Army face a relative decline of their population of around 26 to 31 percent compared to adjacent units liberated by Western Allies. These results are remarkable given the only two and half months lasting difference in regional history across the demarcation line.

[5] Population dynamics are a widely used proxy for spatial economic activity in both theoretical core-periphery models (e.g., Helpman, 1998) and in the empirical literature (e.g., Redding and Sturm, 2008; Bleakley and Lin, 2012; Kline and Moretti, 2014).

[6] The first municipal population figures after WWII are available for the year 1946. 1946 population data are based on food vouchers and give an accurate figure of municipal population more than one year after the Red Army left their liberated regions in Styria.

FIGURE 1: TREATMENT EFFECT ON POPULATION DYNAMICS



Notes: The figure shows spatial discontinuities in municipal population growth (in percentage points) for municipalities liberated by the Red Army compared to municipalities liberated by the Western Allies (US and UK troops). Spatial discontinuities across the liberation demarcation line are in respect to population figures in 1939 and are based on a quadratic RD polynomial fit in respect to the distance to the nearest demarcation municipality (see column (3) in Table 3, Panel B for the estimates). The red line indicates the presence of the Red Army in Styria from May 9 until July 22, 1945 (74 days). The shaded area indicates the period of WWII. 95% confidence bands are based on robust standard errors corrected for spatial dependence (Conley, 1999, 2008). *The figure reads as followed (example):* The red dot for the year 1946 (first observation after the Red Army presence) indicates that municipalities liberated by the Red Army faced a relative decline in their population of approximately 11 percent compared to adjacent regions liberated by the Western Allies with respect to the base year 1939. The confidence band in 1946 does not overlap the 0-line, which implies that the relative shrinkage is statistically significant.

I inspect other economic variables as well. Measures of labor productivity in 2011, for example, also lag behind in Red Army liberated municipalities. Heterogeneity analyses further indicate that the relative depopulation is more pronounced between US and the Red Army than between British and Red Army liberated regions. My results are robust to different RD specifications and pseudo treatments. Difference-in-differences estimates further corroborate RD results. I show that the selective sorting of people across the demarcation line in the direct aftermath of WWII may explain persistence: Migration towards regions liberated by Western Allies in the direct aftermath of WWII was somewhat occupation specific. These regions received a boost in the share of semi-skilled laborers (industrial workers, craftsmen), whereas adjacent municipalities liberated by the Red Army became relatively more agricultural.

Apart from the question on the ongoing causes of the economic backwardness of Central and Eastern Europe, I contribute to several strands of the literature. First, my study adds to the literature on the distribution of economic activity across space. The literature is roughly divided into two competing explanations. On the one hand, scholars refer to (time-invariant) natural endowments, such as natural resources, topography or climate to explain regional differences. An exogenous shock would therefore not have any long-term impact on the distribution of regional economic activity across space. Empirical studies in this regard are Ellison and Glaeser (1999), Davis and Weinstein (2002; 2008), Brakman et al. (2004), Ellison et al. (2010), and Miguel and Roland (2011), among others. On the other hand, spatial differences in economic activity can endogenously result due to the local interaction of economic agents, and thus are man-made. Seminal theoretical contributions regarding the so-called New Economic Geography literature are made by Henderson (1974), Krugman (1991), and more recently by Davis and Dingel (2016). According to these models, an exogenous shock can persist and may even have accelerating effects as time passes, mainly due to increasing returns to scale.[7] In Styria, the persistent and even accelerating differences in population figures after the 1970s across the demarcation line supports the literature on New Economic Geography. Present-day differences in measures of local labor productivity further indicate endogenous forces at work.

Second, my findings contribute to the debate on regional convergence. The standard neoclassical growth theory would predict convergence of income levels across regions under the assumption of free capital and labor mobility and shared institutions (Solow, 1956). Indeed, studies have found higher growth rates of GDP per capita in poorer regions compared to rich ones, which imply convergence (e.g., Barro et al., 1991; Barro and Sala-i-Martin, 1992; Gennaioli et

[7] Random growth models represent a special kind of a theoretical model in this regard (e.g., Simon, 1955; Gabaix, 1999). According to these models, an asymmetric shock would persist forever. It is thus somewhat one possible solution of Krugman's (1991) core periphery model.

al., 2014). Based on my measures of local labor productivity in 2011, I find considerable differences in the average wage level across the long-gone demarcation line. Municipalities liberated by the Red Army diverges from adjacent units liberated by Western Allies even though they shared the same institutional legacy for centuries, with the exception of the 74 days when the Red Army was present in 1945. However, the presence of the Red Army led to a decline in the capital stock due to pillaging and dismantling and to a sorting of relatively higher skilled workers and laborers in favor of regions liberated by Western Allies. This finding thus supports endogenous growth models that highlight the role of initial endowment and human capital formation to explain ongoing regional differences (e.g., Gennaioli et al., 2013).

Third, my paper adds to the literature on the persistence of historical events or circumstances on present-day economic outcomes. Historic dependencies of economic variation across space are documented for militarily insecure frontiers (Oto-Peralías and Romero-Ávila, 2017), place-based policies (Kline and Moretti, 2014; von Ehrlich and Seidel, 2015), long-obsolete portage cities (Bleakley and Lin, 2012), high sunk costs (Redding et al., 2011), slavery systems (Dell, 2010), or market access (Redding and Sturm, 2008).[8] Two studies on path dependency of a population shock are closely related to mine. Schumann (2014) and Eder and Halla (2016) look on population shocks due to the post-WWII zoning in Europe. Both studies find persistent differences of the initial settlement after WWII. My paper corroborates these papers with a much shorter period of unequal treatment of adjacent regions; Schuman (2014) uses a 4 years lasting, and Eder and Halla (2016) a 10 years lasting unequal treatment of adjacent units whereas my units of interest have been treated unequally for only 74 days.

[8] Apart from persistence in (hard) economic variables, long-term persistence is well documented for social behavior and attitudes as well. Seminal contributions in this regard are Voigtländer and Voth (2012, 2015) on the persistence of anti-Semitism, Nunn and Wantchekon (2011) and Becker et al. (2016) on historical roots on social trust and corruption into bureaucracy. Other studies examine historical institutions to explain differences in current socio-economic variables (e.g., Tabellini, 2008a, 2008b, 2010; Guiso, Sapienza and Zingales, 2016)

Fourth, my results align with the debate on the benefits of migration. Hornung (2014) shows that Huguenot immigrants lead to higher labor productivity in their destination region. Semrad (2015) and Braun and Kvasnicka (2016) find supportive effects of German expellees after WWII on industrial growth and schooling outcomes in their destination region, including spill-over effects on local residents. Moser et al. (2014) document a massive boost in scientific output in US regions with German Jewish émigrés escaping the Holocaust, while Waldinger (2016), by contrast, looks on the region of origin and shows that a loss of star scientists leads to a persistent decline in research output mainly resulting from the loss of anchor points for new scientists. All of these studies document substantial effects of relatively high-skilled migrants, including a multiplier effect for local residents. My findings can also be read in this regard. The settlement pattern across the intra-Styrian demarcation line was somewhat skill specific. The relative increase of agriculture and relative decrease in semi-skilled professions in municipalities liberated by the Red Army until 1951 are an economically reasonable cause of ongoing and persistent productivity and education-level differences across the former demarcation line.

The reminder of this paper is organized as follows. Section 2 provides an historical overview, including the short-run consequences for municipalities under the threat of the Red Army. Section 3 introduces the data and the identification strategy, which is preliminary a spatial regression discontinuity (RD) approach. Section 4 shows the results of the short-run presence of the Red Army on population figures and on measures of labor productivity. Section 5 analyzes heterogeneous effects along the demarcation line and offers a set of robustness checks. Section 6 discusses the channels of persistence. Concluding remarks are offered in Section 7.

2. Historical background

2.1 The liberation of Styria

In this section, I show that the demarcation line between the Red Army and the Western Allies, lasting only 74 days, was not foreseeable and fully exogenous. This is a crucial identification assumption for the causal interpretation of RD estimates.

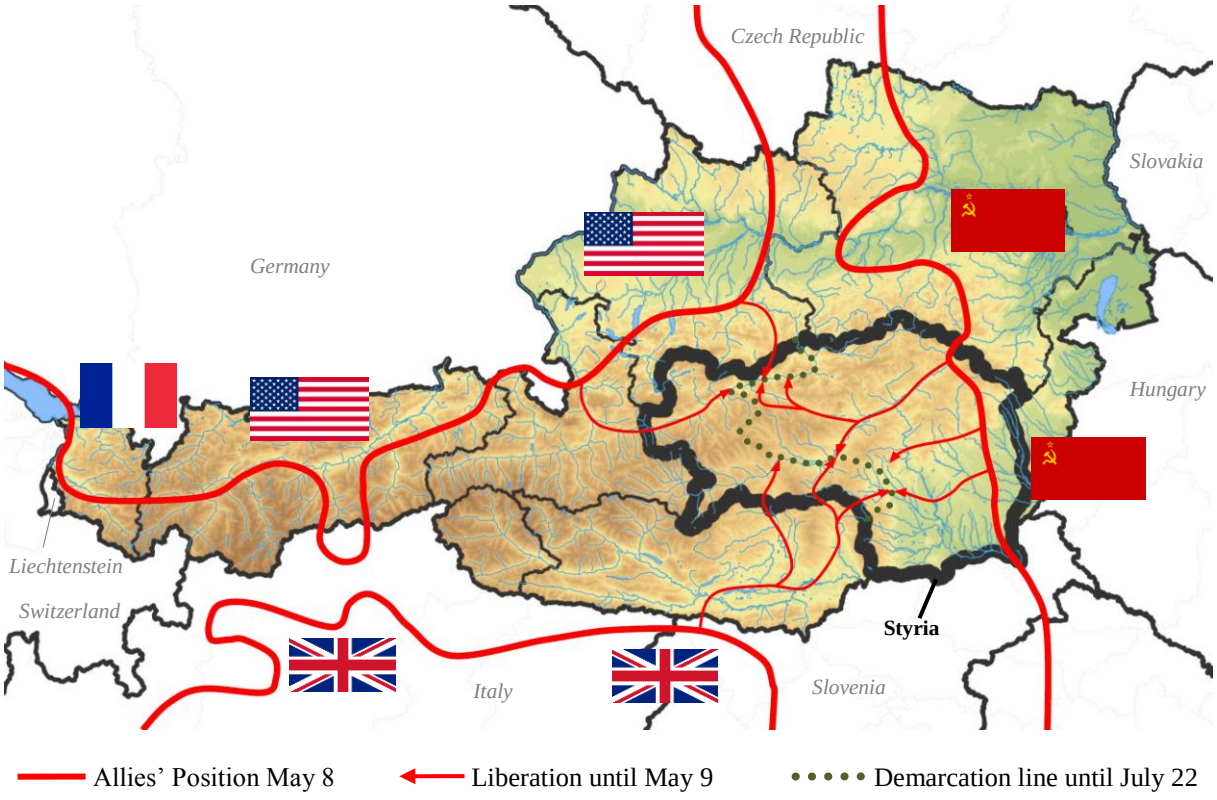
In the final stage of WWII, Allied troops from the US, UK, France and the Soviet Union (and partially Yugoslavian and Bulgarian troops) liberated Austria from Nazi Germany.[9] The Red Army[10] had arrived in the most eastern parts of Austria already in late March 1945 whereas US and French troops did not reach the Austrian border in the West before the final days of WWII. Figure 2 shows Allies' positions on the day of the Nazi German surrender on May 8, 1945 (red bold lines). The demarcation line in Styria between the Red Army and the Western Allies (green dotted line), however, was at that time far from any combat operations.[11] Indeed, the region in South Austria was the largest remaining coherent area under Nazi German control in all of Europe on May 8, 1945.

[9] Austria was an official part of Nazi Germany during WWII and thus part of the Allies' main enemy in Europe. The accession of Austria to Nazi Germany occurred in March 1938. Note that especially the Red Army treated regions that belonged to or collaborated with Nazi Germany more ruthlessly compared to regions that were occupied by Nazi Germany (Liberman, 1996).

[10] The term "Red Army" is used in the entire paper to indicate troops who were under the command of the Soviet Union. Most Soviet troops engaged in the liberation of Austria belonged to the Ukrainian Front (Iber et al., 2008).

[11] The regions on both sides of the intra-Styrian demarcation line were therefore no place for land-warfare during WWII.

FIGURE 2: THE LIBERATION OF STYRIA



Notes: The map depicts the location of Styria (black bold borders) within Austria. Red bold lines show the location of the liberation forces (the Red Army, British, US and French troops) on day of the Nazi German surrender on May 8, 1945. Thin red lines with arrows show (approximately) how Styria was overrun by the respective Ally until May 9, 1945. The locations where the respective liberation Ally met became the intra-Styrian liberation demarcation line until July 22, 1945 (green dotted line). Sources used are Iber et al. (2008) and Stelzl-Marx (2012). External borders are shown in the current territorial status.

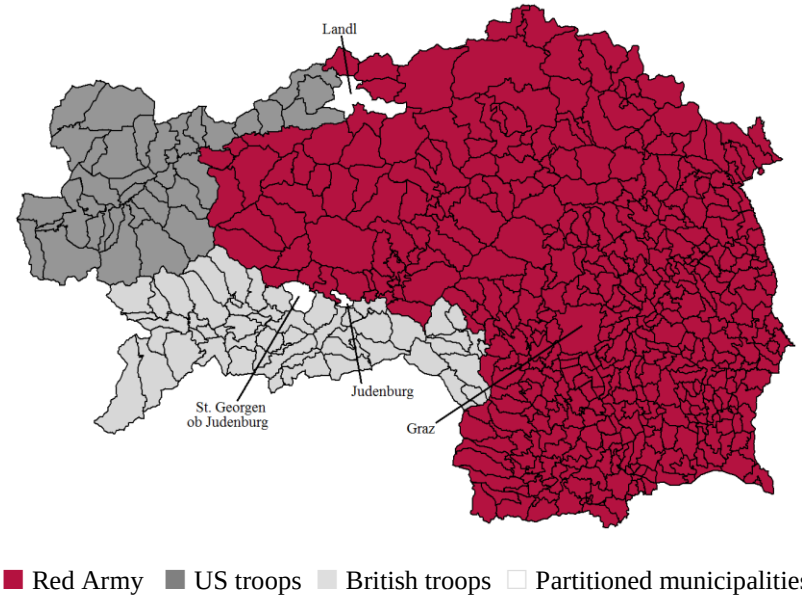
Within less than one day after the Nazi German surrender, Allied troops completely overran these last areas of Nazi Germany. The red lines with arrows in Figure 2 depict approximately the way in which the Allies liberated South Austria. The places where the respective Allies met became the liberation demarcation line (green dotted line in Figure 2). According to Iber et al. (2008) and Stelzl-Marx (2012), US troops met the Red Army in the Enns Valley in the city of Liezen, and British troops ran through Carinthia towards the Mur valley and towards the West in the region of Graz where they met the Red Army on May 9 on the country road between

Köflach and Voitsberg.[12] The drawing of the temporary demarcation line was thus fully exogenous. The demarcation line was drawn through valleys (Enns and Mur valley), followed in some parts small rivers or was located between two adjacent municipalities on the flat land, but did not exist on any mountain ranges. It was neither an historical nor administrative border in the centuries prior to May 9, 1945, nor after July 1945 when the Red Army left Styria. Additionally, the demarcation line was neither foreseeable nor a result of negotiation by the Allies.[13]

The presence of the Red Army in Styria lasted for 74 days until July 22, 1945.[14] I follow an official Soviet report translated in Iber et al. (2008) to assign the municipalities to their respective liberation force.[15] Figure 3 shows the map of Styria with its liberation treatments. The majority of Styrian municipalities (446) were liberated by the Red Army, 56 by British troops and 37 by US troops, and 3 municipalities were partitioned among the forces. After the withdrawal of the Red Army, all of Styria was assigned to the UK occupation zone in post-WWII Austria until the Austrian State Treaty in 1955 (Erickson, 1950). Styria, however, was the only region in Europe from the Mediterranean Sea to the Baltic Sea that was initially liberated but not under Soviet dominance for a longer period. In all other European regions (East Germany, Czechoslovakia, Slovenia) regions that were liberated by the Western Allies were reassigned to the Red Army and its confederates.[16]

[12] Note that some southern regions in Styria were liberated by Bulgarian and Yugoslavian (Tito partisans) troops. However, a direct demarcation line between these troops and the Western Allies never existed (Stelzl-Marx, 2012).
[13] The demarcation line partially followed rivers. These are the Enns River in the Enns Valley between the Red Army and US troops, and for a few kilometers the Mur River in the Mur Valley between the Red Army and British troops. However, even in these cases the Allied troops arrived on May 9 simultaneously on the opposite riverbanks (Stelzl-Marx, 2012). To address a potential issue of rivers, however, I run a pseudo border analysis along the Mur River in Section 5.2.
[14] The last Red Army troops completely withdrew from Styria on July 24, 1945. However, I refer to the presence of the Red Army lasting 74 days (until July 22, 1945) in the entire paper because this is the date when the Red Army started its withdrawal.
[15] In addition, I checked municipal chronicles to assign the municipalities of Kleinlobming, Lassing, Modriach and St. Georgen ob Judenburg to their liberation power. I would also thank Dr. Ernst Reinhold Lasnik for the information about the liberation treatment of the municipality of Salla.
[16] Countries in Central and Eastern Europe liberated by the Red Army were under the Soviet sphere of influence until 1989/1990. Regions in Northeast Austria (state of Burgenland, state of Lower Austria, northern Upper Austria, and parts of Vienna) were assigned a Soviet occupation zone in July 1945 that lasted for more than 10 years.

FIGURE 3: TRIPARTITE STYRIA FROM MAY 9 TO JULY 22, 1945



Notes: The map shows Styrian municipalities according to their liberation power consisting of the Red Army, US and British troops. The situation of tripartite Styria lasted for 74 days (from May 9 until July 22, 1945). Black lines within Styria show municipal borders based on the territorial status in 2011. The municipalities of Landl, Judenburg and St. Georgen ob Judenburg were partitioned among the liberation powers.

2.2 The Red Army in Styria

I here describe Red Army misdeeds in their liberated parts of Styria during their short-run presence. The Red Army treated its liberated regions much more harshly than the Western Allies did. Several historical sources report dismantling and pillaging activities by both the Red Army (official dismantling) and its soldiers (informal pillaging). Iber et al. (2008) collected dismantling resolutions by the Soviet State Defense Committee (GKO). These formal resolutions – signed by Joseph Stalin *after* the dismantling activities in Styria occurred – aimed to legalize the removal of entire production plants in the iron and steel, machinery and electric industries. An agent of the US Office of Strategic Services (OSS) reported that:

> *"Russia's major motivation in evacuating Austrian equipment is obvious: to replace destroyed Soviet producing assets to the maximum extent possible."*[17]

Czechoslovakia is somewhat an exception. The Red Army left the region in 1945, but Soviet dominance returned after the Communist takeover of Czechoslovakia in 1948.

[17] Cited after Bischof (1999, p. 38).

Officially, the Soviet Union claimed that mainly the so-called "*German assets*" would be confiscated and shipped away. However, the Red Army made no special effort to distinguish between equipment installed by Nazi Germany after 1938 (German assets) and machinery already in operation prior to the accession of Austria by Nazi Germany (Bischof, 1999).[18] The geography of official dismantled plants, however, was not exogenous. Figure 11 in the supplementary material gives the location of the 14 municipalities where production facilities were officially shipped away. With the exception of the partitioned city of Judenburg, none of these municipalities directly bordered the demarcation line. Most dismantled plants where along the railway line from Vienna to Graz and thus part of the Styrian industrial mainland.

Apart from officially reported disassembles by the Red Army, however, a wide body of literature reports informal dismantling and pillaging of assets by both the Red Army and by its soldiers. First, the Red Army also dismantled electricity infrastructure, such as transmission lines, electrical overhead cables and transformers, which in turn led to severe electricity shortages in the direct aftermath of WWII (Iber et al., 2008). The Red Army also confiscated railroad tracks and locomotives. Additionally, raw materials and semi-finished goods were carried out of Styria to a large extent (Pickl, 1995; Iber et al., 2008). Second, Red army soldiers were allowed to send bundles back home for free. The soldiers interpreted this as an indirect request to pillage (Stelzl-Marx, 2012). Thus, everything in the part of Styria liberated by the Red Army was subject to pillage: small production facilities of craftsmen, furniture in private apartments, farming tools and even herds of cattle were driven towards Hungary (Eberhart, 1995; Pickl, 1995; Bischof, 1999). Beer (2004) reports 1,484 notified lootings in Styria's capital Graz along – the real numbers might have been even larger. There was also mass violence, mainly sexual crimes against women. There were 9,493 reported rapes and approximately 30,000 estimated rapes,

[18] Dismantled plants are a good proxy for armament industries installed by Nazi Germany. I thus also use the localities of officially dismantled plants to address Nazi German industrial policies in Styria (see Section 6.2).

which led to hundreds of abortions (Beer 2004). Sexual violence in Styria by Red Army soldiers also caused syphilis and gonorrhea epidemics (Iber et al., 2008).

To sum up, parts of Styria liberated by the Red Army were exploited by the Red Army, whereas neighboring regions were not. Dismantling and pillaging, as well as sexual violence made regions liberated by the Red Army a less desirable place to live and start economic activities following the war. Note that Styria might be more exposed to dismantling and pillaging activities than other Red Army occupied regions since the Soviets had to withdraw from this region toward their officially assigned occupation zone in East Austria.[19] Eberhart (1995) and Pickl (1995) report an increasing amount of pillaging events during the withdrawal of the Red Army, indicating a "*devil-may-care*" mentality.

2.3 Population response

The presence of the Red Army for 74 days in one part of Styria led to different population dynamics across the demarcation line. In the direct aftermath of WWII, Austria experienced massive internal migration that was mainly caused by the liberation and the official zoning of Austria. People fled the regions officially assigned to the Soviet Union (Red Army) in East Austria, including Vienna, towards regions assigned to the Western Allies. Eder and Halla (2015) report an absolute decline of the population in the official Soviet occupation zone of approximately 12 percent. As a part of the UK occupation zone after the withdrawal of the Red Army and the US troops, Styria faced an increase of its population of approximately 8 percent from 1939 to 1951.

Figure 4 shows the change of the population from 1939 to 1946 in Styrian municipalities (top figure), and separated population figures from 1939 to 1946 and to 1951 for direct demarcation

[19] See Figure 6 for the official assigned occupation zones in Austria. The reported occupation zone borders were in place from July/August 1945 until all Allied troops withdrew from post-WWII occupation of Austria in 1955 after the Austrian State Treaty was signed which restored the sovereignty of Austria.

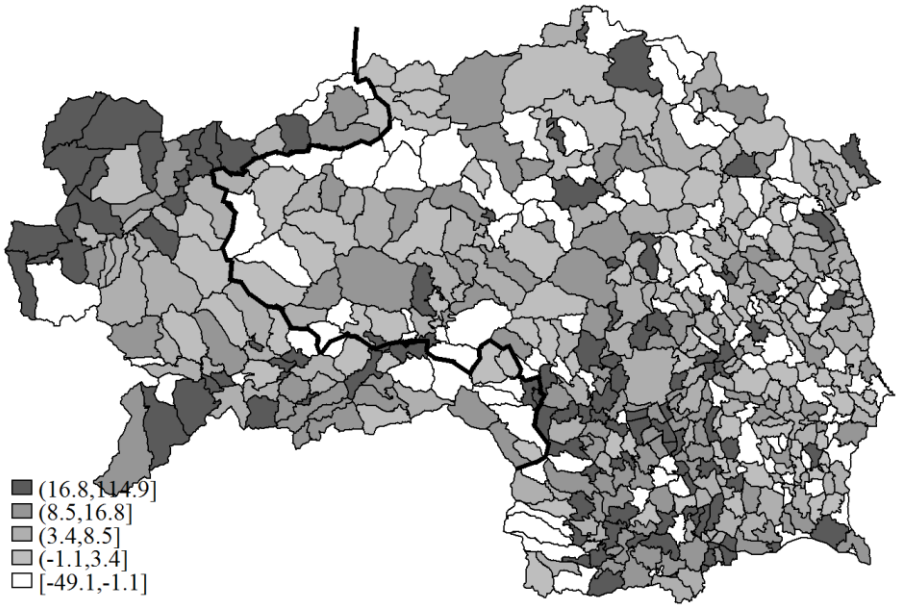
line municipalities (bottom figure). The map depicts that the observed municipal increase in population is very heterogeneous but the liberation demarcation line is clearly visible, especially in central and northern parts of Styria. This is confirmed by population figures in direct demarcation municipalities (bottom figure). For example, municipalities that were liberated by the Western Allies observed a population increase of approximately 11 to 13 percent compared to pre-WWII figures. Adjacent Red Army liberated demarcation municipalities, in contrast, almost stagnated. Thus, (internal) migrants favored municipalities liberated by the Western Allies.[20] Note that population data based on food vouchers in 1946 (more than one year *after* the Red Army withdrew from Styria) provide the first population figures after WWII. I am thus unable to distinguish whether the increase occurred during the presence of the Red Army in Styria until July 1945 or thereafter. Indirect evidence suggest that most of internal migration occurred during summer 1945 before tight travel restriction were in place. However, these figures clearly state that regions in Styria liberated by the Western Allies were, inter alia, a more desirable place to live.

Migrants settle also on considerations other than liberation treatment. I investigate settlement behavior in Table 9 in the supplementary material. I regress the change in population from 1939 to 1946 on time-invariant geographic cofounds. Apart from liberation treatment, distance to Styria's capital Graz and measures of geography predict settlement. To sum up, migrants favored places near the capital Graz (see: distance to Graz, and distance to Graz squared), the flat to hilly land (share of settlement area, elevation range, roughness), and regions liberated by the Western Allies.

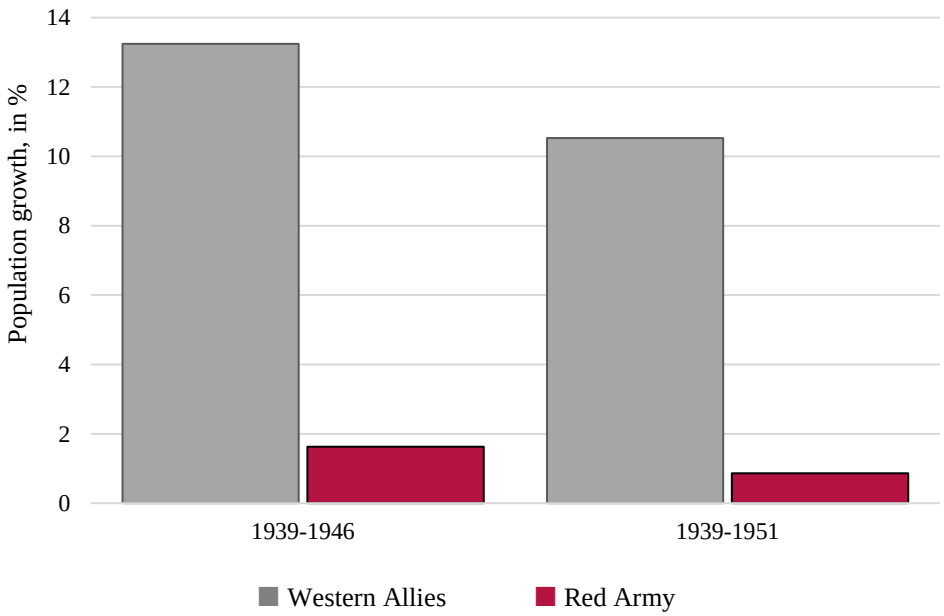
[20] Apart from large-scale internal migration, however, western parts of Austria and especially the US zone were also a favored place for ethnic German expellees from Eastern and Southeastern Europe (see e.g., Radspieler, 1955). Slapnicka (1986) reports that most external refugees left Austria for Germany within the year 1945.

FIGURE 4: POPULATION GROWTH FROM 1939 TO 1946/1951

3a: Population growth 1939 – 1946



3b: Population growth in demarcation municipalities



Notes: Figure 3a shows population growth at the municipal level from 1939 (last census before WWII) to 1946 (first municipal population figures after WWII based on food vouchers) in percentage points. The black bold line shows the liberation demarcation line between the Red Army and the Western Allies (along the municipal borders, if feasible). Figure 3b shows population growth from 1939 to 1946 and from 1939 to 1951 respectively of adjacent demarcation line municipalities between the Red Army and the Western Allies. Figure 5 in the supplementary material gives a graphical representation of demarcation line municipalities.

3. Empirical strategy

3.1 Data

I am interested in the causal effects of a short period of Red Army presence in post-WWII Styria on subsequent economic outcomes. I exploit spatial discontinuities in economic variables across the long-gone and fully exogenous demarcation line between the Red Army and the Western Allies in the Austrian state of Styria.[21] My self-compiled dataset comprises, inter alia, municipal population figures for the years 1869 to 2011. I self-compiled population data for the direct aftermath of WWII in 1946 based on food voucher statistics.[22] I further digitized hard copy municipal data on demographic variables and the sectoral composition of residents based on municipal censuses in 1934, 1939 and 1951.[23] Recent data on socio-demographic variables, sectoral composition, local work places, and tax revenues are retrieved from the statistical database *STATcube* by *Statistik Austria*. Self-compiled data are transformed to the 2011 territorial status of Styrian municipalities.[24]

[21] My data also consist of municipal data for the Austrian state of Carinthia. Some parts of the shared state border between Styria and Carinthia also coincided with the liberation demarcation line between the Red Army and British troops. I thus employ municipal level data for Carinthia in Section 5.2.

[22] Municipal population data are obtained from *Statistik Austria* for 1869 to 1939 and for 1951 to 2011. For the year 1946, I use the "*Gemeindeverzeichnis von Österreich 1946",* which comprises the number of municipal residents eligible for food vouchers. These food voucher data provide the best figure of municipal population after WWII.

[23] Data sources for municipal demographic variables and the sectoral composition are: *Die Ergebnisse der Österreichischen Völkszählung vom 22. März 1934, Heft 5* (for 1934), *Ergebnisse der Volks-, Berufs- und Betriebszählung vom 17. Mai 1939 – Heft 13: Alpen- und Donau-Reichsgaue* (for 1939), and *Ergebnisse der Volkszählung vom 1. Juni 1951 nach Gemeinden, Heft 8* (for 1951).

[24] The number of Styrian municipalities decreased from 1,030 in 1934 to 542 in 2011. Mergers of municipalities during this time did not take place across the temporary intra-Styrian demarcation line. In January 2015, a major municipal reform took place in Styria which decreased the number of municipalities further to 287. Thus, the most current territorial status of 2015 would not allow to identify spatial discontinuities across the demarcation line anymore since municipalities have been merged across the former demarcation line.

TABLE 1. DESCRIPTIVE STATISTICS

	Obs.	Mean	Std. Dev.	Min.	Max.
	(1)	(2)	(3)	(4)	(5)
Liberation of Styria					
Red Army (n=446)	542	0.82	0.38	0	1
Western Allies (n=93)	542	0.17	0.38	0	1
US troops (n=37)	542	0.07	0.25	0	1
British troops (n=56)	542	0.10	0.30	0	1
Partitioned municipalities (n=3)	542	0.01	0.07	0	1
Population figures					
Population	8,672	1,901.04	9,062.03	99.00	261,726.00
Population growth 1869-2011 (annualized, in %)	8,130	0.22	1.39	-8.93	21.19
Pre-WWII Pop. growth, 1869-1939 (annualized, in %)	3,794	0.23	1.25	-4.60	20.54
Post-WWII Pop. growth, 1939-2011 (annualized, in %)	4,336	0.21	1.49	-8.93	21.19
Census 1934					
Population share female	542	50.18	1.94	41.71	58.85
Population share > 20 years < 65 years [a]	542	65.37	4.08	52.99	83.74
Share unemployed	542	10.60	5.34	2.19	42.05
Share agriculture	542	68.92	24.32	1.84	98.97
Share industry	542	20.37	16.37	0.98	84.82
Share self-employed [a]	542	32.20	11.77	3.38	53.67
Census 1951					
Population share female	542	51.51	2.00	44.15	59.20
Population share > 20 years < 65 years	542	58.54	3.13	47.56	67.62
Population share foreigners	542	3.44	4.26	0.00	46.09
Share agriculture	542	58.07	24.60	1.59	95.98
Share industry	542	30.30	17.83	0.57	89.07
Share self-employed	542	21.92	6.66	4.09	35.54
Census 2011					
Population share female	542	50.28	1.72	37.75	55.71
Population share > 20 years < 65 years	542	61.20	2.35	51.18	67.66
Population share foreigners	542	3.34	2.79	0.00	34.93
Share unemployed	542	3.88	1.58	0.65	11.08
Share agriculture	542	9.77	7.11	0.17	46.43
Share industry	542	34.97	7.99	10.39	58.18
Share self-employed	542	12.63	4.14	4.21	31.18
Share workplaces in industry	542	24.69	16.70	0.00	87.72
Share workplaces in services	542	51.07	18.04	9.46	97.17
Municipal tax revenue per employee (in €) [b]	540	408.88	251.08	10.14	1,406.40
Geography					
Area	542	30.84	32.31	1.08	285.30
Share of settlement area	542	48.82	24.44	2.19	100.00
Elevation range	542	636.02	553.98	12.60	2,118.25
Distance to highway [c]	542	12.11	8.80	0.22	39.08
Distance to Graz	542	47.43	28.87	0	141.85

Notes: The table shows the summary statistics for 542 municipalities in Styria (territorial status in 2011). Population data cover 15 censuses from 1869 to 2011 and food vouchers data for 1946. Census data about demographic and occupation characteristics (according to the head of the family) until 1951 are self-compiled and merged to the municipal territorial status of 2011. More recent data are retrieved from *STATcube* from *StatistikAustria*. a) Pre-WWII data on age cohorts and self-employed are only available for 1939. b) Three-year average of the years 2010 to 2012 (some municipalities have missing values). c) Distance to highway is the municipal distance to the nearest highway slip road in 2016.

Table 1 shows the summary statistics with selected variables of my sample that consists of 542 municipalities in Styria. The top panel shows the liberation treatment of Styrian municipalities.

82 percent of all Styrian municipalities were liberated by the Red Army, 7 percent by US and 10 percent by British troops. Population figures indicate that the average Styrian municipality (territorial status of 2011) is rather small. Pre- and post-WWII annual population growth rates are almost identical at approximately 0.2 percent per year. Census data for 1934 and 1951 show that Styria was an agricultural society around WWII, approximately 60 to 70 percent of the population (according to the head of the family) belonged to the agricultural sector (industry: 20 to 30 percent). Data for 2011 show the sectoral change towards industry and services. I also report municipal tax revenues per employee as a measure of municipal labor productivity. The bottom panel finally shows geographic characteristics of Styrian municipalities.

3.2 Identification

I test whether the presence of the Red Army for 74 days in the direct aftermath of WWII is impacting spatial distribution of economic variables in the post-WWII period. I employ a semi-iparametric spatial regression discontinuity (RD) approach as in Dell (2010), Schumann (2014), Egger and Lassmann (2015), Becker et al. (2016) and Oto-Peralías and Romero-Ávila (2017), among others. RD controls for unobservable heterogeneity across treated and non-treated units that are arbitrarily close to each other (Imbens and Lemieux, 2008; Lee and Lemieux, 2010). In the context of Styria, this means that neighboring municipalities on each side of the 74 days lasting demarcation line are the most comparable units of observation to estimate a causal (local average treatment) effect of unequal liberation treatment between otherwise comparable units. The baseline cross-section regression in the RD approach takes the following form:

$$Y_{ij} = \alpha + \beta Red\ Army_i + f(geolocation_i) + \phi_j + X_i'\gamma + \varepsilon_{ij} \quad (1)$$

Y_{ij} denotes the dependent variable of interest (e.g., population growth, tax revenue per employee, sectoral shares, etc.) in municipality i along border segment j. $Red\ Army_i$ is a dummy variable that equals one if a municipality was liberated by the Red Army, and zero otherwise

(US or British troops).[25] β is the coefficient of interest. It measures the (local average) treatment effect at the demarcation line, i.e., the spatial discontinuities between adjacent demarcation municipalities by crossing the demarcation line from a municipality liberated by the Western Allies to Red Army liberated municipalities. $f(geolocation_i)$ is the RD polynomial that controls for smooth function of geographic location over municipality i. In some specifications, I also interact $Red\ Army_i$ with $geolocation_i$ to estimate spatial discontinuities based on interacted RD polynomials. I use the minimum distance of municipality i to its nearest demarcation municipality in regions liberated by the Red Army or Western Allies as the forcing variable in the baseline specification.[26] ϕ_j is a set of border segments that captures heterogeneous geographic treatment effects *along* the demarcation line.[27] X_i represents a vector of control variables. I include the time-invariant municipal cofounds that predict post-WWII migration patterns to isolate the liberation treatment from other post-WWII migration determinants, i.e., the attractiveness of the region around Styria's capital Graz (see the discussion in Section 2.3 and Table 9 in the supplementary material). α is a constant and ε_{ij} are robust standard errors, and standard errors corrected for spatial dependence (Conley, 1999, 2008).[28] I restrict the baseline sample to municipalities within 25 kilometers to the nearest demarcation municipality. This is roughly the maximum distance to the state borders towards the West in regions liberated by the Western Allies (see Figure 10 in the supplementary material for a graphical impression).

[25] The three partitioned municipalities that are directly located on the demarcation line are excluded in all analyses.
[26] I use the closest distance in kilometers to the respective municipalities' centroids. Note that the liberation demarcation line does not necessarily fully coincide with the (present-day) municipal border. I rather use the information in Iber et al. (2008) to assign municipalities (and groups of houses) to their respective liberation power (see also Section 2.1).
[27] I divide the intra-Styrian demarcation line into three segments according to geographic consideration. Thus, the segments consist of the Enns Valley in the north (municipalities either liberated by the Red Army or US troops), the central Mur Valley and the Graz region in the south (municipalities liberated by the Red Army or British troops).
[28] I use the Stata command provided by Hsiang (2010) to estimate spatial dependence of the error terms. The spatial correlation cutoff is set to 0.1 degree of latitude. In Styria, I thus correct for spatial dependence in the error term for municipalities within a radius of 8 kilometers. Estimates with other cutoff levels are available upon request.

I show that all relevant identifying assumptions for a spatial RD approach are met. First, the location where the Red Army and the Western Allies met was arguably fully exogenous, somewhat solely driven by the respective velocity of their jeeps (see Section 2.1 on the liberation of Styria). Furthermore, the demarcation line does not coincide with any historical border. Demarcation municipalities belonged to the same jurisdictional entity for centuries prior to May 1945 (Duchy of Styria, crown land of Styria, and state of Styria after 1918) and in the decades after July 1945 (UK occupation zone from July 1945 to 1955 and state of Styria). The demarcation line was neither any border of political districts nor does it coincide with any mountain ranges which may isolate economic regions. The Allies met more or less in the middle of the flat land (Graz region), in the middle of wide valley (Mur Valley) or arrived simultaneously at the opposite riverbanks (Enns Valley).[29]

Second, my units of observation (municipalities) should not be able to manipulate the liberation treatment. In all relevant sources cited in Section 2.1, I do not find any evidence that the local population acted as resistance fighters after the Nazi German surrender on May 8, 1945 to prevent the Red Army from overrunning their municipality. Additionally, Erickson (1950) notes that the Allies partitioned Austria after WWII without consideration for Austrian internal requests. It is thus unlikely that the Allies took care of regional considerations while overrunning Styria within one day. I thus can exclude self-selection of municipalities into the treatment.

Third, I show that the demarcation line does not show any spatial discontinuities in pre-WWII socio-demographic and economic covariates. Panel A Table 2 reports OLS differences of a dummy variable that equals one (zero) if a municipality was liberated by the Red Army (Western Allies) and spatial discontinuities between demarcation municipalities for different RD polynomials (Panels B to D). The sample is restricted to municipalities within 25 kilometers to the

[29] Parts of the demarcation line follows rivers. I will thus provide pseudo border estimates along the Mur River in Section 5.2.

nearest demarcation municipality. Columns (1) to (3) show the estimates for time-invariant geographic characteristics. Socio-demographic and economic variables based on the censuses in 1934 and 1939 are reported in columns (4) to (15). I find some mean differences in the OLS Dummy specification that are statistically significant. For example, municipalities liberated by the Red Army are on average larger (column (1) in Panel A), are closer to Graz (column (3) in Panel A) and have fewer dwellers per household (column (12) in Panel A). These mean differences, however, vanish in different RD estimates in Panel B to Panel D. Two exceptions remain. The first exception is the distance to Graz that differs in the absolute mean (Panel A) but also between demarcation municipalities in the RD estimates. Given the location of Graz within the Red Army liberated part of Styria, however, this finding is not very surprising. Second, I also find statistically weak discontinuity for the share of females (column (15) in Panel B), which vanishes in higher RD polynomial orders.

In addition, municipal population growth across the demarcation line does not differ prior to 1939. Figure 6 in the supplementary material shows that municipalities within a bandwidth of ± 5 kilometers and municipalities of ± 10 kilometers to demarcation municipalities follow a common pretreatment trend in population growth. I thus conclude that the municipalities on both sides of the demarcation line do not show any socio-demographic or economic differences in pre-WWII periods.

TABLE 2. CONTINUITY OF COVARIATES ACROSS THE DEMARCATION LINE

	Dependent variable: Municipal covariates															
	Geography			Census in 1934				Census in 1939								
	Area	Settlement Area	Distance to Graz	Agriculture	Industry	Services	Unem-ployed	Agriculture	Industry	Services	Self em-ployed	Pop per household	Age below 18	Age above 65	Female ra-tio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Panel A: *OLS – Dummy variable specification*																
Red Army	13.85	4.81	-22.27	-0.67	-0.14	0.82	0.95	-0.76	-0.72	1.48	-1.38	-0.49	-1.33	0.44	-1.58
	(5.98)**	(3.18)	(2.19)***	(4.85)	(3.93)	(1.88)	(1.05)	(4.47)	(3.75)	(1.80)	(3.53)	(0.25)**	(0.67)*	(0.28)	(1.52)
	[8.13]*	[5.09]	[4.01]***	[7.10]	[5.88]	[2.03]	[1.38]	[6.56]	[5.51]	[1.92]	[5.43]	[0.25]**	[0.86]	[0.32]	[1.50]
R^2 *adj.*	0.22	0.35	0.86	0.19	0.14	0.20	0.15	0.24	0.15	0.23	0.28	0.27	0.41	0.31	0.14
Panel B: *Linear-interacted polynomial*																
Red Army	0.72	1.99	-9.20	4.69	-4.17	-0.52	0.27	4.90	-5.03	0.13	1.69	-0.11	0.14	0.13	-3.28
	(6.73)	(5.03)	(2.54)***	(5.74)	(4.58)	(2.45)	(1.07)	(5.17)	(4.34)	(2.34)	(4.05)	(0.28)	(0.81)	(0.32)	(1.96)*
	[9.07]	[7.32]	[4.17]**	[7.00]	[5.60]	[2.42]	[1.21]	[6.44]	[5.20]	[2.51]	[5.24]	[0.25]	[1.03]	[0.36]	[1.99]
R^2 *adj.*	0.25	0.35	0.89	0.20	0.15	0.20	0.17	0.25	0.17	0.24	0.29	0.30	0.44	0.31	0.16
Panel C: *Quadratic polynomial*																
Red Army	1.41	1.87	-8.38	4.27	-3.84	-0.44	0.40	4.56	-4.66	0.10	1.37	-0.13	0.12	0.13	-3.25
	(6.77)	(5.03)	(2.52)***	(5.76)	(4.59)	(2.47)	(1.07)	(5.21)	(4.35)	(2.36)	(4.08)	(0.28)	(0.82)	(0.32)	(2.03)
	[9.06]	[7.21]	[4.11]**	[6.99]	[5.59]	[2.42]	[1.22]	[6.44]	[5.18]	[2.51]	[5.24]	[0.25]	[1.03]	[0.36]	[2.00]
R^2 *adj.*	0.25	0.35	0.89	0.21	0.16	0.20	0.18	0.25	0.18	0.23	0.29	0.31	0.44	0.31	0.16
Panel C: *Quadratic-interacted polynomial*																
Red Army	-1.76	3.78	-7.70	1.22	-2.47	1.24	-0.22	2.67	-3.56	0.89	-0.61	-0.06	0.03	0.06	-1.89
	(7.39)	(6.05)	(2.96)***	(6.74)	(5.52)	(2.94)	(1.27)	(6.06)	(5.19)	(2.78)	(4.65)	(0.32)	(0.92)	(0.36)	(2.38)
	[8.68]	[6.94]	[3.95]*	[7.44]	[5.99]	[2.60]	[1.27]	[6.87]	[5.53]	[2.52]	[5.36]	[0.25]	[1.12]	[0.37]	[2.57]
R^2 *adj.*	0.25	0.36	0.89	0.23	0.18	0.21	0.18	0.27	0.21	0.24	0.31	0.32	0.44	0.32	0.18
Panel D: *Cubic polynomial*																
Red Army	-0.44	3.51	-7.92	2.06	-2.88	0.82	-0.36	3.04	-3.70	0.65	-0.31	-0.11	0.14	0.05	-2.30
	(7.26)	(5.91)	(2.86)***	(6.70)	(5.45)	(2.86)	(1.23)	(6.08)	(5.16)	(2.72)	(4.70)	(0.32)	(0.90)	-0.36	(2.40)
	[9.01]	[7.38]	[4.06]*	[7.50]	[5.97]	[2.63]	[1.26]	[6.90]	[5.52]	[2.61]	[5.52]	[0.26]	[1.11]	-0.38	[2.40]
R^2 *adj.*	0.25	0.35	0.89	0.21	0.16	0.20	0.18	0.25	0.18	0.23	0.29	0.31	0.44	0.31	0.16
Segments FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Geographic FE	–	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of obs.	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231

Notes: The table tests for spatial discontinuities across demarcation municipalities in various pretreatment covariates using an OLS dummy specification (Dummy=1 for Red Army liberated municipalities, Panel A) and different RD polynomials with respect to the distance to the nearest liberation demarcation municipality (Panel B – D). The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Area is km^2. Settlement area and census data for 1934 and 1939 are reported in percentage points. The shares of the industrial sectors, of unemployed and of self-employed are according to the head of the family. The estimates include segment- and geography-fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10

4. Results

4.1 Population figures

I first inspect whether population dynamics as a proxy for regional economic activity are affected due to the Red Army misdeeds after WWII in their liberated regions. I test for spatial discontinuities in municipal population growth across municipalities liberated by the Red Army and municipalities liberated by the Western Allies (US and UK troops).

Table 3 reports the spatial discontinuities at demarcation municipalities for different RD polynomials (Panel A to Panel D) for municipalities within 25 kilometers to the nearest demarcation municipality. Population growth rates are in percentage points with respect to the reported base year. Columns (1) and (2) test for pre-WWII discontinuities in population growth rates across the demarcation line. Pre-WWII population dynamics do not show any differences across demarcation municipalities either for the entire pre-WWII time span from 1869 to 1939 (column (1)) or for the inter-war period from 1923 to 1939 (column (2)). Columns (3) and (4) report discontinuities in population growth between the last pre-WWII census in 1939 and population data based on food vouchers in 1946 and census data in 1951, respectively. As outlined in Section 2.3, population dynamics during this period across the demarcation line are hardly triggered by anything other than Red Army intervention from May to July 1945. Population growth during these periods show sharp discontinuities across demarcation municipalities. Red Army liberated municipalities lost approximately 9 percent until 1946 (estimates in column (3)) and approximately 11 percent until 1951 (column (4)) of their population compared to adjacent municipalities liberated by the Western Allies. The estimates are robust to different RD polynomials as well as for robust standard errors, and standard errors corrected for spatial dependence (Conley, 1999, 2008). However, higher polynomial orders lead to somewhat weaker significant levels, especially in column (3) compared to the levels in 1951 (column (4)). I interpret this finding that the demarcation line becomes more visible as time goes by, i.e., people begin

to sort across the demarcation line between 1946 and 1951. This may be an indicator of worse economic conditions in municipalities liberated by the Red Army due to their pillaging and dismantling activities; once the economy began to grow, people may have relocated to better equipped municipalities.[30] Column (5) reports the relative decline of municipalities liberated by the Red Army for the entire post-WWII period (from 1939 to 2011). The results are substantial. Red Army demarcation municipalities relatively shrank by approximately 26 percent (Panel C and D in column (5)) to 31 percent (Panel A and B in column (5)) compared to adjacent municipalities liberated by the Western Allies. I further show that the relative decline of regions liberated by the Red Army continued after 1951. Columns (6) and (7) test for discontinuities in population growth between demarcation municipalities from 1951 to 2011 and from 1971 to 2011 respectively. The short period of the presence of the Red Army for only 74 days seems to have long-lasting and even accelerating effects after 1951. Municipalities liberated by the Red Army relatively shrank further during this period. The relative shrinkage seems to be more pronounced after 1971 which implies an echo effect some 25 years after the initial post-WWII population shock.

I also depict these findings graphically. Figure 8 in the supplementary material shows the results of Panel C in Table 3 (quadratic-interacted RD) for different time periods. The figures show population growth averages in 5-kilometer bins by distance to the nearest demarcation municipality and the estimated shape of the polynomial fit. The figures confirm the findings in Table 3 and show that the effects are particularly pronounced for municipalities within 10 to 15 kilometers of the demarcation line. Note that the Styrian capital Graz and its suburbs are located approximately 20 kilometers away from the nearest demarcation municipalities, which explains the local peak within the region liberated by the Red Army. I conclude that all RD specifications

[30] However, an alternative explanation for the fuzzier population figures along the border from 1939 to 1946 compared to 1951 are potentially biased population figures based on the food voucher data in 1946.

indicate a relative decline in population figures in municipalities that had been formerly liberated by the Red Army compared to adjacent municipalities that have been liberated by the Western Allies until the present day, with even an accelerating effect after 1971.

TABLE 3. POPULATION DYNAMICS

	Dependent variable: Municipal population growth						
	Pre-WWII		Pre-WWII vs. post-WWII			Post-WWII	
	1869–1939	1923–1939	1939–1946	1939–1951	1939–2011	1951–2011	1971–2011
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: *Linear-interacted polynomial*							
Red Army	2.73	1.87	-9.66	-11.23	-31.29	-17.89	-11.43
	(5.75)	(2.99)	(4.52)**	(3.49)***	(9.03)***	(7.41)**	(4.88)**
	[6.49]	[2.52]	[3.40]***	[2.46]***	[10.04]***	[7.92]**	[3.71]***
R^2 *adj.*	0.25	0.08	0.18	0.12	0.54	0.59	0.61
Panel B: *Quadratic polynomial*							
Red Army	2.31	2.06	-9.69	-11.04	-31.09	-17.87	-11.69
	(5.74)	(3.05)	(4.55)**	(3.49)***	(8.92)***	(7.32)**	(4.86)**
	[6.48]	[2.61]	[3.44]***	[2.40]***	[9.88]***	[7.80]**	[3.72]***
R^2 *adj.*	0.25	0.07	0.18	0.12	0.54	0.59	0.61
Panel C: *Quadratic-interacted polynomial*							
Red Army	0.19	0.35	-9.52	-10.78	-26.10	-15.18	-12.53
	(7.46)	(3.84)	(5.84)	(4.44)**	(9.39)***	(7.68)**	(5.58)**
	[7.86]	[2.93]	[4.61]**	[2.53]***	[9.84]***	[7.46]**	[4.15]***
R^2 *adj.*	0.25	0.09	0.18	0.12	0.54	0.6	0.61
Panel D: *Cubic polynomial*							
Red Army	0.87	0.57	-8.97	-10.55	-26.82	-15.83	-12.27
	(7.16)	(3.7)	(5.49)	(4.21)**	(9.37)***	(7.55)**	(5.40)**
	[7.78]	[3.00]	[4.28]**	[2.55]***	[9.72]***	[7.37]**	[4.02]***
R^2 *adj.*	0.25	0.07	0.18	0.12	0.54	0.59	0.61
Segments FE	✓	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓	✓
No. of obs.	231	231	231	231	231	231	231

Notes: The table tests for spatial discontinuities in municipal population growth (in percentage points) across demarcation municipalities for different RD polynomials with respect to the distance to the nearest demarcation municipality. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Columns (1) and (2) test for discontinuity for pre-WWII population growth (with respect to 1939 municipal population), columns (3) and (4) for pre-WWII versus post-WWII population growth (with respect to 1939), and columns (5) and (6) for post-WWII population growth with respect to 1951 and 1971 respectively. The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

4.2 Labor productivity

Next, I examine whether the demarcation line, long gone and lasting only 74 days, is visible in present-day economic variables other than population figures. One of the most compelling indicators of regional economic activity is labor productivity. Labor productivity combines different aspects of production conditions, i.e., the capital stock (technology), skill levels of workers and laborers, and variables such as economics of scale and scope. It is likely that the initial

conditions for determinants of local labor productivity (e.g., the capital stock, skill levels of laborers) have been shaped due to the presence of the Red Army.

To address potential spatial discontinuities in local labor productivity, I rely on municipal tax revenues. The municipal tax in Austria is a 3% tax rate on the total wage sum paid by privately owned establishments within a municipality.[31] I divide the total municipal tax revenues by the number of employees within the same municipality to get a measure of local average wages, which is in turn a proxy for municipal labor productivity.[32]

Table 4 tests for spatial discontinuities in municipal tax revenues per local employee as a proxy for municipal labor productivity in 2011.[33] Column (1) shows the baseline results for different RD specifications (Panel A to Panel D) for municipal tax revenues per employee conditioned on segments and geography-fixed effects as in the previous section. The estimates base on municipalities within 25 kilometers to the nearest demarcation municipality. Red Army liberated municipalities face a smaller average tax revenue per local employee of around 113 Euro in Panel B up to 128 Euro in Panel D compared to adjacent municipalities liberated by the Western Allies. Almost all results are significant at the 5% level for both reported error term assumptions.[34]

[31] The municipal (communal) tax is called "*Kommunalsteuer*" in German. The taxable base is the total wage sum paid by privately owned establishments in a municipality. Establishments that have a monthly wage sum below €1,460 (e.g., one part-time employee) get a tax allowance of around €1,000 per month. Wages paid in public administration, schools or (public) hospitals, for example, are not taxed as they are for those who are self-employed, among them family farmers. See https://www.bmf.gv.at/steuern/a-z/kommunalsteuer/kommunalsteuer.html for a detailed description of the taxable base. Note that certain occupations might be industrial but belong to a public company (water, electricity, city cleaning, waste industry, etc.). Unfortunately, I cannot distinguish my employee data by type of establishment. I thus test whether potential differences across the former demarcation line in the share of non-taxable occupation influence the magnitude of my findings.

[32] Tax revenues may be volatile from year to year and thus influence my estimates. I thus take the three-year average of municipal tax revenues for the years 2010 to 2012 to get a more accurate figure. Table 4 shows spatial discontinuities based on these three-year averages. Table 10 in the supplementary material shows the estimates with 2011 municipal tax data only. The results are hardly unaffected.

[33] Measures of labor productivity are not available for direct pre- and post-WWII periods. Some sorts of municipal tax were in place since the 1970s or 1980s but with incomplete figures of the number of local employees. I thus restrict my analysis to the most current data available.

[34] The estimated differences of municipal tax revenues per local employee of around €100 translates into an annual wage differential of around €3,000 (100/0.03) or €250 per month. These numbers are likely to be upward biased

TABLE 4. LABOR PRODUCTIVITY

	Dependent variable: Municipal tax revenues per employee (in €)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: *Linear-interacted polynomial*						
Red Army	-117.59	-97.20	-137.00	-94.33	-92.22	-104.13
	(50.93)**	(39.49)**	(43.34)***	(43.79)**	(41.29)**	(39.95)***
	[56.37]**	[45.49]**	[37.79]***	[44.48]**	[41.64]**	[37.00]***
R^2 *adj.*	0.25	0.52	0.47	0.48	0.48	0.56
Panel B: *Quadratic polynomial*						
Red Army	-113.52	-94.53	-133.52	-92.64	-90.02	-102.30
	(50.77)**	(39.29)**	(43.21)***	(43.76)**	(41.16)**	(40.00)**
	[56.35]**	[45.41]**	[37.70]***	[44.51]**	[41.44]**	[37.13]***
R^2 *adj.*	0.25	0.52	0.48	0.48	0.48	0.56
Panel C: *Quadratic-interacted polynomial*						
Red Army	-123.84	-108.30	-149.58	-97.13	-109.44	-113.95
	(58.14)**	(44.02)**	(47.68)***	(52.19)*	(48.35)**	(45.04)**
	[63.04]*	[52.02]**	[41.31]***	[53.01]*	[47.33]**	[44.52]**
R^2 *adj.*	0.25	0.52	0.48	0.48	0.48	0.56
Panel D: *Cubic polynomial*						
Red Army	-127.99	-109.16	-148.94	-98.63	-110.75	-114.51
	(57.00)**	(43.11)**	(46.57)***	(50.26)*	(46.71)**	(43.84)***
	[63.04]**	[51.19]**	[39.98]***	[51.44]*	[46.85]**	[42.68]***
R^2 *adj.*	0.25	0.52	0.48	0.48	0.48	0.56
Industrial sector	–	✓	–	–	–	✓
Average firm size	–	–	✓	–	–	✓
Work occupation	–	–	–	✓	–	✓
Non-taxable occupations	–	–	–	–	✓	✓
Segments FE	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓
No. of obs.	225	225	225	225	225	225

Notes: The table tests for spatial discontinuities across demarcation municipalities in municipal tax revenues per local employee in Euro for different RD polynomials with respect to the distance to the nearest demarcation municipality. Tax revenues per local employee for 2011 are three-year averages for 2010 – 2012 (see Table 10 in the supplementary material for 2011 tax data only). The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Column (1) shows the baseline specification. Columns (2) – (5) include economic variables that determine the taxable base (Industrial sector: share of workplaces in industry, share of workplaces in services, share of workplaces in agriculture as residual; Firm size: workplaces divided by the number of firms, industrial workplaces dived by the number of industrial firms; Work occupation: share of blue collar workers; Non-taxable occupations: share of self-employed, share of workplaces in public administration). Column (6) gives the combined view. The estimates include segment and geographic fixed effects. Spatial discontinuities of variables that affect the taxable base are shown in Table 11 in the supplementary material. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

Municipal tax revenues per employee, however, might be biased due to local differences in the local economic structure that directly affect the taxable base (e.g., share of self-employed, incl. family farmers), the share of firms with only part-time employees, the share and the extent of the public administration and the type of public firms, etc., see footnote No. 31) or indirectly

given the higher shares of employment in non-taxable occupations such as agriculture, or self-employed in Red Army liberated municipalities in 2011 (see the discussion below or Table 11 in the supplementary material).

determine labor productivity (e.g., sectoral shares, firm size, etc.).[35] I address the measures that affect the taxable base in columns (2) to (6) in Table 4. Column (2) adds the municipal industrial shares (among them the share of agriculture as a majorly non-taxable occupation) to the baseline specification. Discontinuities somewhat decrease compared to the baseline specification, but significance levels are unaffected. Column (3) controls for average firm size, which predicts productivity (e.g., Melitz, 2003). The discontinuities increase up to 150 Euro for higher RD polynomials and are statistically significant at the 1 percent level. Thus, once I adjust for differences in local firm size, the long-gone demarcation line becomes even more pronounced in present-day local tax figures. Column (4) controls for the share of blue collar workers, and column (5) includes the share of occupations that are not part of the taxable base (administration, self-employed). Discontinuities are somewhat smaller in both magnitude and significance but remain substantial. Lastly, column (6) gives the combined view of all variables that account for potential differences in the taxable base. All these estimates confirm that municipal tax revenues per employee as a proxy for both the local labor productivity and the local average wage level in privately owned establishments vary across the former demarcation line more than 75 years after the 74 days lasting liberation treatment.

I further inspect whether economic variables other than municipal tax revenues per employee vary across the former demarcation line in 2011. Table 11 in the supplementary material shows potential spatial discontinuities in municipal cofounds, and Figure 9 in the supplementary material provides RD plots on municipal tax revenues and selected cofounds. Most of the reported variables in Table 11 directly or indirectly affect the taxable base (see also footnote 31). I find that municipal employment shares by industrial sector, average firm size and several measures for the type of occupation vary smoothly across the former demarcation line. Municipalities

[35] Sectoral shares and (average) firm size may be endogenous to the liberation treatment. The aim in this section, however, is to identify spatial discontinuities in labor productivity *today* independent of whether labor productivity is caused directly or indirectly by the liberation treatment.

liberated by the Red Army, however, have on average a higher share of agriculture, a lower share of services, and a higher share of self-employed, but these estimates do not show any statistical significance based on conventional levels. Moreover, the shares of unemployed and out-commuters vary smoothly, too. The sole spatial discontinuity is observed in the share of residents regarding their highest achieved school-level qualification. Column (12) in Table 11 indicates that municipalities liberated by the Red Army have a 1.6 to 1.9 percent higher share of residents whose highest school level achieved is compulsory education. The education level, however, is a crucial input factor in the production process that may explain the observed differences in the measures of labor productivity across the demarcation line. In Section 6.1, I discuss whether this finding can be explained by the selective migration pattern in the direct aftermath of WWII.

To sum up, measures for municipal labor productivity in 2011 vary between demarcation municipalities whereas other variables such as sectoral shares, average firm size, etc., do not. The sole exception is the formal skill level which is lower in municipalities liberated by the Red Army. I conclude that productivity seems to be more sensitive to adverse shocks than other variables such as the sectoral shares or the average firm size.

5. Heterogeneous effects and robustness checks

5.1 Heterogeneous effects

In this section, I inspect potential differences in the liberation treatment *along* the demarcation line. I thus compare regions liberated by the Red Army and US troops and regions liberated by the Red Army and British troops separately. Section 2.3 has already shown that migration patterns varies along the demarcation line. Migrants in the direct aftermath of WWII generally favored US liberated and US occupied regions (Slapnicka, 1986). The map in Figure 4 shows that Styrian municipalities that were liberated by US troops face a higher population growth

until 1946 compared to British liberated regions. I thus inspect whether the liberation of Styria yields any heterogeneous effects along the demarcation line between the Red Army on the one hand and US and British troops respectively on the other and whether these initial differences persist to the present day.

I inspect the heterogeneous effects of the presence of the Red Army along the demarcation line. Table 5 shows spatial discontinuities in municipal population growth and municipal tax revenues per employee between regions liberated by the US and Red Army (columns (1) to (3)) and regions liberated by the British and Red Army (columns (4) to (6)) separately.[36] First, I focus on population dynamics. Municipalities liberated by the US faced a substantially higher relative population growth until 1951 compared to regions liberated by the British in all RD specifications (this can be seen due to the higher relative decline of municipalities liberated by the Red Army across the US – Red Army demarcation line in column (1) compared to the British – Red Army demarcation line in column (4)). The initial population dynamics are nearly twice as large for US regions than for British regions. These relative population figures along the demarcation line went hardly unchanged until 2011. I conclude that initial differences *along* the demarcation line persist. To sum up, regions liberated by the US profited the most, followed by regions liberated by the British, whereas regions liberated by the Red Army fell behind.

Second, I inspect potential differences in municipal tax revenues per employee along the border. Columns (3) and (6) in Table 5 repeat the RD estimates for municipal tax revenues per employee for the two sub-regions along the demarcation line. The coefficients for both regions yield similar magnitudes as for the entire sample employed in Table 4. Red Army liberated municipalities lag behind local tax revenues of around 110 Euro per employee independent

[36] These regional subsamples employ the same geographic delimitation as the segment-fixed effects used in the RD specifications. Thus, the region liberated by US troops and by the Red Army in the north consists of municipalities in the Enns Valley, regions liberated by British troops and by the Red Army consist of the Mur Valley (center) and the Graz region (south).

whether adjacent municipalities have been liberated by US or British troops. Given the small number of observations in the north (US vs Red Army in the Enns Valley), however, I cannot report any statistically significant estimates at the conventional levels in column (3). Municipal tax revenues per employee between municipalities liberated by the British and Red Army, however, face statistically significant discontinuity at the 5% or 10% level, depending on the RD polynomial.

TABLE 5. HETEROGENEOUS EFFECTS

	Dependent variable: Municipal population growth // Municipal tax revenues per employee (in €)					
	US vs Red Army			UK vs Red Army		
	Population growth		Municipal tax revenues	Population growth		Municipal tax revenues
	1939–1951	1939–2011		1939–1951	1939–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: *Linear-interacted polynomial*						
Red Army	-16.94	-36.64	-77.69	-9.41	-26.54	-120.40
	(5.94)***	(16.36)**	(126.42)	(4.07)**	(10.59)**	(56.23)**
	[3.52]***	[17.14]**	[117.65]	[2.96]***	[10.92]**	[63.64]*
R^2 *adj.*	0.31	0.58	0.20	0.11	0.55	0.25
Panel B: *Quadratic polynomial*						
Red Army	-16.01	-38.07	-120.65	-9.01	-25.66	-112.00
	(6.43)**	(16.59)**	(124.95)	(4.13)**	(10.24)**	(55.93)**
	[3.56]***	[17.52]**	[116.24]	[2.76]***	[10.11]**	[65.21]*
R^2 *adj.*	0.30	0.58	0.24	0.11	0.55	0.26
Panel C: *Quadratic-interacted polynomial*						
Red Army	-16.25	-40.37	-113.11	-7.11	-17.00	-116.50
	(6.95)**	(18.12)**	(136.93)	(5.48)	(10.89)	(61.52)*
	[4.15]***	[17.95]**	[125.69]	[2.88]**	[8.54]**	[68.32]*
R^2 *adj.*	0.32	0.58	0.26	0.11	0.55	0.26
Panel C: *Cubic polynomial*						
Red Army	-15.67	-39.50	-124.82	-7.13	-20.05	-119.97
	(6.92)**	(17.51)**	(129.46)	(5.15)	(11.43)*	(61.12)*
	[3.92]***	[18.04]**	[117.38]	[2.93]**	[9.58]**	[70.40]*
R^2 *adj.*	0.30	0.58	0.24	0.11	0.55	0.26
Segments FE	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓
No. of obs.	46	46	46	185	185	185

Notes: The table tests for spatial discontinuities across demarcation municipalities in municipal population growth with respect to 1939 (in %) and municipal tax revenues per local employee in Euro (average 2010 – 2012) for different RD polynomials with respect to the distance to the nearest demarcation municipality. Columns (1) – (3) test for discontinuities between US and Red Army liberated municipalities (Enns Valley), and columns (4) – (6) between UK and Red Army liberated municipalities (Mur Valley, Graz region). The subsamples are restricted to municipalities within 25 km to the nearest demarcation municipality. The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

5.2 Entire UK zone and robustness checks

In this section, I extend the demarcation line along the shared border between the state of Styria and the state of Carinthia. I further run several robustness exercises, including difference-in-differences estimates.

First, I expand the liberation demarcation line with municipalities located at the shared border between the state of Styria and the state of Carinthia. Styrian municipalities along this shared border have been liberated by the Red Army, and adjacent Carinthian municipalities by British troops. This shared border follows a mountain range and is also a border between two jurisdictional entities. Post-WWII occupation treatment, however, does not differ between Styria and Carinthia. Both states belonged to the UK occupation zone from July 1945 to 1955. Thus, potential differences along this border until 1951 can be interpreted as a causal liberation effect, but figures until 2011 may be biased due to state policy related idiosyncrasies, i.e., when regional policy or public infrastructure differ between the state of Styria and Carinthia. Column (1) in Table 6 inspects municipal tax revenues per employee across the entire demarcation line including the shared border of Styria and Carinthia. Municipal tax revenues per employee in 2011 are somewhat smaller than the numbers in the baseline specification with Styrian municipalities only (see column (6) in Table 4). Significance levels increase up to 1% in higher RD polynomials. Population growth rates until 1951 (column (2)) and until 2011 (column (3)) are almost identical in magnitudes as in the baseline sample (see columns (4) and (5) in Table 3).

TABLE 6. ENTIRE UK ZONE AND ROBUSTNESS CHECKS

	Dependent variable: Municipal population growth // Municipal tax revenues per employee (in €)														
	Entire UK zone			Subsamples within Styria						Pseudo demarcation line					
	Styria and Carinthia (max ±25km)			Styria (max ±40km)			Styria (max ±15km)			East-West Divide (Mur River)			North-South Divide (through Graz)		
	Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth	
		1939–1951	1939–2011		1939–1951	1939–2011		1939–1951	1939–2011		1939–1951	1939–2011		1939–1951	1939–2011
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Panel A: *Linear-interacted polynomial*															
Red Army	-82.85	-10.78	-23.87	-51.23	-5.04	-14.45	-79.58	-10.82	-25.91	-17.38	-2.96	-8.11	-43.03	-2.01	-9.97
	(36.30)**	(3.11)***	(8.47)***	(38.52)	(2.99)*	(7.17)**	(45.15)*	(3.89)***	(8.51)***	(45.98)	(2.94)	(14.28)	(32.32)	(2.45)	(9.50)
	[34.55]**	[2.30]***	[10.10]**	[36.02]	[2.85]*	[9.06]	[41.34]*	[2.49]***	[9.15]***	[14.15]	[3.47]	[18.99]	[29.73]	[3.14]	[15.40]
R^2 *adj.*	0.57	0.11	0.50	0.55	0.08	0.48	0.60	0.23	0.58	0.67	0.22	0.57	0.68	0.23	0.60
Panel B: *Quadratic polynomial*															
Red Army	-88.64	-11.08	-27.36	-51.09	-5.60	-21.08	-80.10	-10.81	-25.79	-18.28	-2.98	-8.19	-43.37	-1.84	-10.36
	(37.66)**	(3.21)***	(8.83)***	(38.68)	(3.06)*	(7.34)***	(45.53)*	(3.90)***	(8.47)***	(46.45)	(3.02)	(14.39)	(32.24)	(2.49)	(9.56)
	[36.15]**	[2.40]***	[10.66]**	[36.35]	[2.65]**	[8.90]**	[41.20]*	[2.48]***	[9.13]***	[15.13]	[3.50]	[18.45]	[29.41]	[3.14]	[15.57]
R^2 *adj.*	0.57	0.11	0.51	0.55	0.08	0.50	0.59	0.23	0.58	0.66	0.22	0.57	0.68	0.23	0.60
Panel C: *Quadratic-interacted polynomial*															
Red Army	-116.00	-11.64	-32.33	-125.39	-11.46	-33.53	-91.62	-10.58	-18.96	-14.20	-3.65	4.11	-48.72	-1.95	-10.54
	(40.62)***	(3.92)***	(9.35)***	(41.86)***	(3.91)***	(8.99)***	(50.66)*	(4.42)**	(8.83)**	(61.16)	(3.88)	(17.73)	(40.28)	(2.75)	(10.59)
	[41.29]***	[2.26]***	[11.01]***	[40.89]***	[2.58]***	[11.03]***	[45.39]**	[2.59]***	[9.91]*	[15.64]	[4.90]	[22.64]	[36.87]	[3.27]	[16.10]
R^2 *adj.*	0.58	0.11	0.51	0.56	0.11	0.51	0.61	0.23	0.58	0.67	0.25	0.61	0.68	0.24	0.60
Panel D: *Cubic polynomial*															
Red Army	-100.84	-11.03	-30.06	-102.64	-10.32	-34.11	-85.58	-10.86	-20.02	-26.65	-3.15	0.16	-44.63	-1.72	-9.06
	(39.73)**	(3.51)***	(8.95)***	(39.38)***	(3.47)***	(8.85)***	(49.77)*	(4.29)**	(8.80)**	(58.22)	(3.91)	(17.87)	(32.84)	(2.44)	(9.62)
	[38.80]***	[2.32]***	[10.89]***	[38.01]***	[2.48]***	[11.24]***	[44.94]*	[2.43]***	[9.64]**	[18.33]	[4.55]	[22.03]	[30.15]	[3.11]	[15.72]
R^2 *adj.*	0.57	0.11	0.51	0.56	0.1	0.51	0.59	0.23	0.58	0.67	0.22	0.57	0.68	0.23	0.60
Segments FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tax base contr.	✓	–	–	✓	–	–	✓	–	–	✓	–	–	✓	–	–
No. of obs.	254	260	260	338	345	345	150	156	156	241	242	242	258	260	260

Notes: The table tests for spatial discontinuities across demarcation municipalities in municipal population growth with respect to 1939 (in %) and municipal tax revenues per local employee in Euro (average 2010 – 2012) for different RD polynomials. Columns (1) – (3) extend the baseline sample with demarcation line municipalities along the shared Styrian-Carinthian border within 25 km to the nearest demarcation municipality. Columns (4) – (9) tests for spatial discontinuities at the intra-Styrian liberation demarcation line with different bandwidths to the nearest demarcation municipality. Columns (10) – (15) test for spatial discontinuities at different pseudo liberation demarcation lines. A graphical representation of the samples is given in Figure 10 in the supplementary material. The estimates include segment and geographic fixed effects. Tax base controls are the shares of industrial sectors, average firm size, shares of work places, and shares of non-taxable occupations. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

Second, I employ several robustness checks. I vary the bandwidth of the baseline specification (municipalities within Styria only) with respect to the nearest demarcation municipality. Columns (4) to (6) expand the sample to municipalities within 40, and columns (7) to (9) reduce the sample to municipalities within 15 kilometers of the nearest demarcation municipality. Both the magnitudes and the significance levels of the discontinuities in population and municipal tax figures confirm the baseline results. However, lower RD polynomials in the enlarged sample (± 40 km) and higher RD polynomials in the reduced sample (± 15 km) yield weaker results in both magnitude and in significance. These findings, however, are not that surprising given the local treatment effect that is particularly pronounced for municipalities within 10 to 15 kilometers to the demarcation line. Moreover, the small sample size in the reduced sample (columns (7) to (9)) reduces the degrees of freedom which in turn make higher significance levels less likely in more demanding RD specification.

Next, I employ pseudo demarcation lines within Styria. The pseudo demarcation line in columns (10) to (12) uses the Mur River as the threshold. This exercise implies a pseudo border approximately 30 to 40 kilometers east of the realized demarcation line within the Red Army liberated areas along the major river in Styria. This robustness analysis thus addresses that rivers partially form the demarcation line between the Red Army and the Western Allies.[37] This pseudo demarcation line, however, does not show any discontinuities either in municipal tax revenues per employee (column (10)) or in population dynamics (columns (11) and (12)). I further investigate a potential north-south divide to contrast the realized liberation line, which is mainly an east-west divide. Columns (13) to (15) employ this pseudo north-south divide through Styria's capital Graz. Neither population growth nor municipal tax revenues per employee varies across this pseudo demarcation line.

[37] The Enns River in the north was part of the demarcation line between the Red Army and the US troops as it was the Mur River for a few kilometers between the Red Army and British troops in central Styria.

Finally, I test whether the results are robust under different forcing variables and in a difference-in-differences framework with different bandwidths. First, I inspect spatial discontinuities in longitude and latitude as an alternative forcing variable as proposed by Dell (2010) in Table 12. The main findings are confirmed, even though lower RD polynomials show weaker results in both magnitude and significance levels than higher polynomials for post-WWII population figures and municipal tax revenues.[38] Second, Table 13 in the supplementary material investigates whether population estimates in the RD approach are confirmed in a difference-in-differences setup. I employ different bandwidths with respect to the nearest demarcation municipality to show post-WWII growth differentials between municipalities liberated by the Red Army and Western Allies conditioned on pre-WWII trends. The results of the interaction terms $Red\ Army \times Post - WWII$, which compares pre- versus post-WWII municipal population growth (columns (1), (3) and (5)) and $Red\ Army \times Sub - period$, which divides post-WWII growth rates into sub periods are in line with the RD estimates (columns (2), (4) and (6)). Red Army demarcation municipalities (n=25) faced a relative population decline of nearly 32 percentage points compared to adjacent demarcation municipalities liberated by the Western Allies (n=25) for the entire time span until 2011(see column (1)). This estimate yields a similar effect as the RD findings reported in Table 3. Larger bandwidths, however, reduce the entire effect, which confirms previous results that the effects are pronounced for municipalities within 10 to 15 kilometers of the demarcation line. Columns (2), (4) and (6) further show the massive decline in population in municipalities liberated by the Red Army from 1939 to 1951 independent of the chosen bandwidths. The population steadily declines further in regions liberated by the Red Army in most post-WWII sub periods. This echo effect is particularly pronounced in demarcation municipalities where most coefficients yield a negative signs for the decades after 1971.

[38] Discontinuities in municipal tax revenues per employee are not statistically significant at the conventional levels. However, Panels A and B have significance levels of 0.13 and 0.16, respectively.

6. Channels of persistence

So far, I have shown that Red Army liberated municipalities were harmed in the long-run. In this section, I look for channels that may explain these persistent figures of the relative decline in population figures and lower measures of labor productivity in municipalities liberated by the Red Army. Section 6.1 asks whether the migration towards Western Allies' liberated regions in the direct aftermath of WWII was somewhat skill specific. Section 6.2 looks at regional policies that may influence post-WWII outcomes and in turn may explain persistence, too.

6.1 Selective migration

In this section, I focus on the potential drivers to explain why the presence of the Red Army for only 74 days causes persistent effects even 70 years after the event. Section 2 already described the population influx to Styria of mostly internal migrants from regions that have been assigned to the permanent Soviet occupation zone in Austria. These migrants, however, sort in favor of the regions liberated by the Western Allies in Styria (despite the attractiveness of Styria's capital Graz and its suburbs).

I test whether the population characteristics with respect to demographic and economic variables differ among the adjacent demarcation municipalities between pre- and post-WWII figures. I thus employ the following difference-in-differences model:

$$Pop\_characterisitcs_{it} = \alpha_i + \beta(Red\ Army_i \times post{-}WWII_t) + \delta_t + \varepsilon_{it} \qquad (2)$$

$$\text{with } i = 1, \dots, 50; \quad \text{and } t = 1934, 1951$$

$Pop\_characterisitcs_{it}$ is the dependent variable and describes the municipal population characteristics in municipality i in period t. The interaction $Red\ Army_i \times post{-}WWII_t$ relates to the coefficient of interest, β. $Red\ Army_i$ is a dummy that equals 1 for demarcation municipalities liberated by the Red Army, and zero otherwise. The time-specific dummy variable

$post{-}WWII_t$ equals one after 1945 (pre-WII: zero). Thus, β measures potential differences between pre- and post-WWII population characteristics in adjacent but differently treated municipalities. α_i are municipality-fixed effects that control for time-invariant local characteristics. δ_t captures the time trend. ε_{it} are robust standard errors, and standard errors corrected for spatial dependence (Conley, 1999, 2008). I focus on demarcation municipalities only ($i = 50$). These municipalities have been liberated by the Red Army (25) or by British (15) or US troops (10).

Column (1) in Table 7 shows the treatment effects β of residents' characteristics for the pre- to post-WWII period between Red Army and Western Allies liberated demarcation municipalities.[39] Columns (2) and (3) report the mean absolute change in residents' characteristics for the same period for municipalities liberated by the Western Allies and Red Army, respectively. The population decreased significantly in Red Army demarcation municipalities compared to Western Allies demarcation municipalities, which confirms previous findings. Demographic characteristics such as the share of females or the share of specific age cohorts of residents, however, do not show any huge treatment effects between adjacent but unequally treated municipalities. The sole exception is a relative increase in the share of females in municipalities liberated by the Red Army, but this estimate yields only a reasonable significance level when I account for spatial dependence of the error term. I also check whether people live closer together in municipalities liberated by the Western Allies. Population per household implies that the number of

[39] I compare population figures based on the last Austrian municipal census in 1934 before the accession to Nazi Germany to the first post-WWII municipal census in 1951. I also employ population characteristics on age cohorts based on the 1939 census conducted by Nazi Germany. The Nazi German census (1939), however, uses somewhat different criteria to classify sectoral shares than the Austrian censuses (1934, 1951) and differs in terms of territorial status (some towns and especially groups of houses were spread to different municipalities). I thus rely on the difference-in-differences estimates in the 1934 and 1951 censuses, if possible. (Biased) difference-in-differences estimates with the Nazi German census in 1939 are available upon request.

dwellers per household relatively decreased by 0.32 in municipalities liberated by the Red Army, which corroborates the relative decrease in population.

TABLE 7. SELECTIVE MIGRATION

	Pre-WWII vs. Post-WWII		
	Difference-in-Differences	Absolute Change (municipal mean)	
	Red Army × Post-WWII	Western Allies	Red Army
	(1)	(2)	(3)
Demographic characteristics			
Population [a]	-18.18 (8.54)** [4.64]***	274.16	97.48
Share female	0.69 (0.41) [0.28]**	175.96	138.8
Population share < 20 years [b]	-0.60 (0.67) [0.53]	188.16	183.12
Population share > 20 and < 65 [b]	0.10 (0.72) [0.59]	69.64	-97.16
Dwellers per household	-0.32 (0.38) [0.18]*	-0.62	-0.94
Economic characteristics			
Share agriculture	4.52 (2.57)* [2.13]**	-92.60	-114.56
Share industry	-4.32 (2.26)* [1.92]**	337.72	255.56
Share services	-0.21 (1.41) [0.81]	50.60	48.28
Share public administration	-0.61 (0.54) [0.44]	18.92	11.20
Share liberal profession	-0.32 (0.40) [0.25]	11.76	16.28
Municipality FE	✓	–	–
Year FE	✓	–	–
No. of obs.	100	25	25

Notes: The table shows measures of selective migration across the liberation demarcation line based on the census in 1934 and the first post-WWII census in 1951. The sample is restricted to the 50 direct demarcation line municipalities (see Figure 5). Column (1) reports the interaction effects (*Red Army × Post-WWII*) of the difference-in-differences model. Columns (2) – (3) show the absolute change of local residents in Western Allies liberated demarcation line municipalities and adjacent Red Army liberated municipalities respectively (municipal means). a) Difference-in-Differences estimates compare post-WWII population dynamics (1939–1951) to pre-WWII figures (1923–1939). b) Data are from the 1939 census (pre-WWII data on age cohorts are not available for 1934). Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

Next, I inspect the changes in economic characteristics of residents from pre- to post-WWII figures. I find considerable changes in the sectoral shares of residents between adjacent municipalities. The share of families employed in the agricultural sector increased by more than 4.5%, and the share in industry decreased by around the same amount in municipalities liberated by the Red Army, which is statistically significant.[40] Absolute changes in columns (2) and (3) confirm these difference-in-differences estimates: on average, municipalities liberated by the Western Allies experienced an increase of industrial residents by 338 from pre- to post-WWII numbers. This are in average 82 more than municipalities liberated by the Red Army. Further estimates on residents employed in public administration or liberal professions (e.g., lawyers, doctors) do not show any remarkable differences, either in the treatment effects or in the absolute changes.[41]

The results of the difference-in-differences exercise imply two meaningful insights for a better understanding of the causes of persistence. First, migration toward regions liberated by the Western Allies was somewhat (work) occupation specific. Industrial workers and craftsmen seem to favor regions without any Red Army interventions. This finding may thus reflect the worse economic conditions in municipalities liberated by the Red Army in the direct aftermath of WWII due to their pillaging and dismantling activities. Second, farmers, and family farmers in particular, are tied to the land and thus are not counted among internal migrants. Both findings together shaped the economic conditions in demarcation municipalities until 1951: regions liberated by the Western Allies received a boost in the share of semi-skilled labor (industrial

[40] Note that all economic characteristics are according to the head of the family.

[41] Apart from internal migration, Western Allies' liberated and occupied regions in Austria were also a favored place for external refugees, mainly for German refugees from Eastern and Southeastern Europe (Radspieler, 1955). The share of foreigners in 1951 is around 1 percent larger in municipalities liberated by the Western Allies, but not or only weakly statistical significant. Numbers on foreign population do not exist for the interwar period. RD estimates on discontinuities in the share of foreigners for the year 1951 are available upon request.

workers, craftsmen), whereas municipalities liberated by the Red Army became relatively more agricultural.[42]

Apart from residents' demographic and economic characteristics, I further examine whether the demarcation line shows any discontinuities in the political preferences of residents. Political preferences can be seen as a proxy of local attitudes or social behavior that are otherwise not observable. However, differences in political orientation may influence the economic behavior of residents, i.e., the likelihood of being or becoming an entrepreneur. Moreover, broad anecdotal evidence suggests that Nazis in particular were in favor of escaping Soviet liberated or Soviet assigned regions (Hindinger, 1968; Schuster, 2004; Stiefel, 1981, 1986). To test whether political preferences differ across demarcation municipalities, I inspect the election outcomes in the national election in 1945 and 1949. The results are shown in Table 14 in the supplementary material. Politically, the adjacent municipalities do not differ in 1945. In 1949, however, municipalities liberated by the Western Allies gave higher vote shares for the VdU, the right-wing party that was newly formed by former Nazis (Staeuber, 1974; Ignazi, 2003).[43] This finding is in line with Ochsner and Roesel (2016), who show that former Nazis escaped from regions controlled by the Red Army/Soviet Union. Note that in its yearly years (1949) the VdU also consisted of a relatively strong liberal fraction. Thus, higher VdU vote shares may reflect more entrepreneurial activity in regions liberated by Western Allies. The conservatives, social

[42] In 2011, the average formal school level of residents in municipalities liberated by the Red Army is statistically significantly lower compared to adjacent municipalities liberated by the Western Allies (see Table 11, column (12) in the supplementary material). I am not able to convincingly show either a direct or an endogenous effect of the observed differences in the municipal industrial structure in 1951 on lower average school levels in 2011. However, the relative increase of agriculture (and relative decrease in semi-skilled professions) in 1951 are an economically reasonable cause of ongoing and persistent (formal school level) differences.

[43] Note that former Nazis and extreme right-wing parties were banned in the 1945 election. First spatial differences in extreme-right political attitudes can thus be observed not prior to 1949.

democrats and communists, however, do not show any discontinuities across the former demarcation line. The same holds for voter turnout in both elections in 1945 and 1949, which is often used a proxy for social capital.[44]

6.2 Regional policies

Regions on either side of the border may have been affected by different region-specific policies during or after WWII, which in turn may (partially) explain present-day differences. I thus investigate whether region-specific policies during and after WWII may explain the persistent differences across the former demarcation line. I look at the following regional interventions that have been occurring in Styria until the present day: aerial bombing during the last two years of WWII[45], plants officially dismantled by the Red Army during the presence of the Red Army in Styria (see Iber et al., 2008), construction of highways[46], and EU regional funds. Figure 11 in the supplementary material gives a graphical illustration of these regional policy measures. The figures already indicate that these regional policy measures do not seem to change abruptly on either side of the demarcation line. However, I employ formal tests of these regional policies in Table 8. I add municipal dummy variables for each of these policies to a quadratic-interacted RD polynomial to test whether regional policies show any significant effects on population growth until 2011 (Panel A) or on municipal tax revenues per employee in 2011 (Panel B). These procedures also allow to compare the effects of these variables on the discontinuity across the demarcation line (compare the respective discontinuities in columns (2) to (6) to the discontinuity in column (1)).

[44] Results on voter turnout are available upon request.
[45] Air-strikes against Austrian targets became frequent after June 1944. The major targets in Styria were around the capital Graz, around Bruck an der Mur, and around Spielfeld-Knittelfeld. See Ulrich (1978) for a detailed description.
[46] The highways close to the (former) demarcation line were entirely constructed in the post-WWII period.

TABLE 8. REGIONAL POLICIES AFTER WWII

Panel A: Population growth	Dependent variable: Municipal population growth (1939–2011)					
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army	-26.10	-27.54	-24.95	-26.32	-20.98	-20.76
	(9.39)***	(9.21)***	(9.25)***	(9.37)***	(8.92)**	(8.87)**
	[9.84]***	[9.87]***	[9.81]***	[9.95]***	[9.39]**	[9.77]**
Aerial Bombing WWII (Yes = 1)		25.85				32.50
		(21.37)				(21.58)
		[17.24]				[20.91]
Disassembled plants (Yes = 1)			-14.07			-26.00
			(14.85)			(14.66)*
			[15.54]			[17.33]
Highway (dist < 10km = 1)				3.81		0.95
				(7.20)		(6.93)
				[9.03]		[8.45]
EU funds ("objective 2" = 1)					-42.27	-39.59
					(18.71)**	(19.39)**
					[21.69]*	[20.92]*
EU funds ("Phasing-Out" = 1)					-47.05	-46.46
					(18.87)**	(19.51)**
					[21.55]**	[21.62]**
Segments FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographic FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	231	231	231	231	231	231
R2 adj.	0.54	0.55	0.54	0.54	0.56	0.58
Panel B: Communal tax	Dependent variable: Municipal tax revenues per employee (in €)					
Red Army	-113.95	-113.91	-112.44	-113.11	-107.38	-103.44
	(45.04)**	(45.16)**	(45.42)**	(45.13)**	(46.49)**	(47.30)**
	[44.52]**	[44.37]**	[44.98]**	[43.97]**	[43.66]**	[43.70]**
Aerial Bombing WWII (Yes = 1)		-1.03				-5.50
		(45.32)				(49.7)
		[28.76]				[34.13]
Dismantled plants (Yes = 1)			-12.76			-20.25
			(36.06)			(39.11)
			[39.40]			[43.43]
Highway (dist < 10km = 1)				-14.96		-12.85
				(36.76)		(37.96)
				[32.95]		[33.79]
EU funds ("objective 2" = 1)					-76.93	-81.39
					(62.03)	(63.59)
					[31.60]**	[30.32]***
EU funds ("Phasing-Out" = 1)					-5.57	-10.14
					(64.10)	(66.69)
					[46.73]	[46.77]
Segments FE	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓
Tax base controls (Panel B)	✓	✓	✓	✓	✓	✓
No. of obs.	225	225	225	225	225	225
R^2 adj.	0.56	0.56	0.57	0.57	0.58	0.58

Notes: The table tests for spatial discontinuities across demarcation municipalities in municipal population growth from 1939 to 2011 in percentage points (Panel A) and in municipal tax revenues per local employee in Euro in Panel B (three-years averages) based on a quadratic RD polynomial with respect to the distance to the nearest demarcation municipality. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality and includes segment fixed effects, geographic fixed effects, and tax base controls in Panel B (see Table 4). Column (1) repeats the baseline results from Table 3 (Panel A) and Table 4 (Panel B). Columns (2) – (5) include regional variables that may determine local economic activities since WWII (Arial bombing during WWII: dummy (=1) if municipality was a target; Dismantled plants: dummy (=1) for municipalities with officially dismantled plants incl. municipalities within 5 kilometers; Highway: dummy (=1) if the nearest slip road is within 10 km; EU funds: dummy (=1) if municipality was eligible for EU regional funds in the period 2000–2006; see text or Figure 11 in the supplementary material for a graphical representation of regional policy cofounds). Column (6) gives the combined view. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

The regional measures of aerial bombing (column (2)), disassembled plants (column (3)) and closeness to the nearest highway slip road (column (4)) do not affect the discontinuities across the demarcation line either of the population or of the municipal tax figures. Municipalities with dismantled plants face a decline in population, which is weakly statistical significant under one error term assumption.[47] Note that the variables on bombing and dismantling are a good proxy of Nazi-related industrial policies from 1938 to 1945. Aerial targets and disassemblies by the Red Army focus on industrial plants and regions that were promoted by the Nazi government after the accession of Austria to Nazi Germany (Ulrich, 1978; Iber et al., 2008). The coefficients of the respective dummy variables may thus also capture the loss of armament related industries in the post-WWII period, but also the loss of industrial equipment installed by Nazi Germany (so-called *German Asset*s) which have already influenced economic conditions before WWII.

Lastly, present-day population figures and especially measures of labor productivity may be influenced by EU subsidies. To address this issue, I add in dummy variables column (5) that equal one for municipalities eligible to 'Objective 2' (zero: no funding or 'Phasing-out') and eligible to 'Phasing-out' (zero: no funding or 'Objective 2') for EU regional funds in the period between 2000 to 2006 to the RD estimates.[48] The coefficients of the dummies show negative and somewhat statistically significant effects of EU funding on population and tax figures. In addition, the discontinuities of population dynamics loose somewhat in magnitude. This finding, however, does not challenge the persistence of Red Army intervention; rather, it shows that EU funds after 1995 were allocated especially to municipalities that face a huge population loss during the post-WWII period. Column (6) adds all variables that account for differences in

[47] The dummy variable for municipalities with dismantled plants include also adjacent municipalities within 5 kilometers to these municipalities to account for spatial spillovers of dismantling.

[48] Note that Austria joined the European Union (EU) in 1995. Thus, there were no EU regional structural funds prior to 1995. The municipalities eligible for 'Objective 2' during the period 2000 to 2006 are mostly 'Phasing-out' regions in the subsequent funding period from 2007 to 2013 whereas regions eligible to 'Phasing-out' in 2000 to 2006 have been eligible to 'Objective 2' prior to 2000. Thus, eligibility in 2000 to 2006 are a good proxy for EU regional funding in Styria for the entire period since 1995.

regional policies into one regression. The findings of the previous separated estimates of regional policy cofounds and the nearly unaffected spatial discontinuities between demarcation municipalities are confirmed.[49] I conclude that regional policies do not matter to explain the ongoing spatial differences across the long-gone liberation demarcation line lasting for only 74 days between the Red Army and the Western Allies.

7. Conclusion

My paper shows that a short period of Red Army intervention in the direct aftermath of WWII is enough to hurt a region in the long-run. I exploit spatial differences in population growth, measures of local labor productivity, and other economic variables across the arbitrarily drawn liberation demarcation line between the Allies in the Austrian state of Styria. The presence of the Red Army in some parts of Styria, which lasted only 74 days, lead to a region exposed to dismantling and pillaging activities, whereas adjacent regions were not. After 74 days, the Red Army withdrew completely from Styria and never returned. This unique setting makes Styria the perfect laboratory (and the only one in entire Europe) to answer the question of whether Red Army misdeeds after WWII affect regional economic activity without any long-run Soviet domination or the presence of a planning economy.

My finding suggests that the 74 days when the Red Army was present combined with the reported Red Army behavior were enough to harm a region in the long-run. This gives useful insights into how economists, politicians and the public view the communist legacy in East

[49] One major regional policy not considered in my empirical analysis is the US induced European Reconstruction Program (ERP) from 1948 to 1952(3), better known as the Marshall Plan. No municipal specific allocation of ERP money is available. However, during the initial years, ERP money was used to improve nutrition among the Austrian population. Moreover, Styria was not the primary region in Austria that received ERP investments. Hofbauer (1992) calculates an ERP investment in Styria of around 14,600 Austrian Schilling (AS) per industrial worker (AS value of 1952/53). The states of Upper Austria (21,800 AS), Carinthia (28,000 AS) and Salzburg (66,000 AS) received a substantially higher amount of ERP money. It is thus unlikely that ERP money majorly influenced economic conditions in Styria in the long-run.

Germany, but also in Central and Eastern Europe. It is widely believed and accepted as conventional wisdom that the ongoing economic backwardness of former socialist states is due to the Soviet dominance and the presence of a planning economy for more than 40 years. I show that a part of the ongoing backwardness of these states can be attributed to Red Army interventions in the direct aftermath of WWII. This finding, however, may especially hold for countries that belonged to the WWII enemy of the Soviet Union such as East Germany (the former GDR and part of Nazi Germany) but also Hungary or Romania.

In addition, it turns out that selective migration, i.e., the loss of relatively higher skilled workers and laborers in disadvantaged regions seems to be a crucial determinant to explain persistence. Present-day military conflicts all over the world still lead to mass migration. This may thus harm the region of origin over decades.

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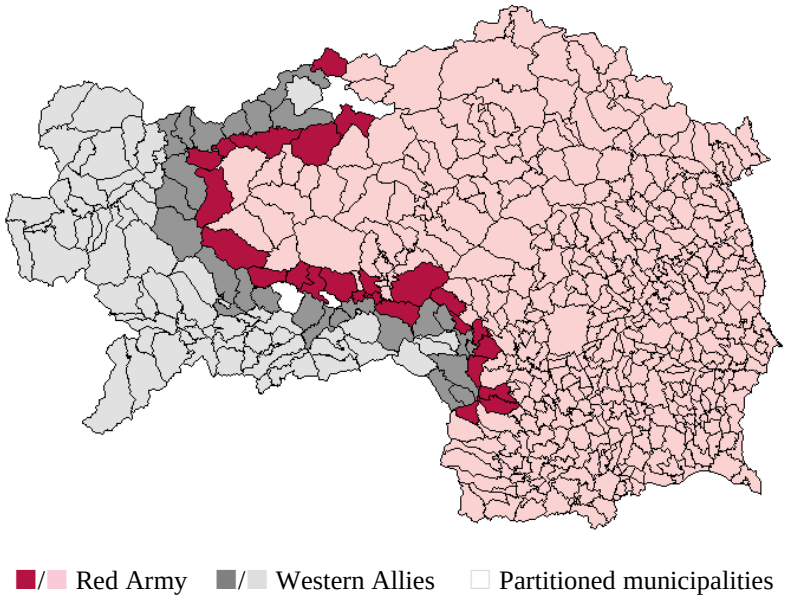
Supplementary material: Figures and tables

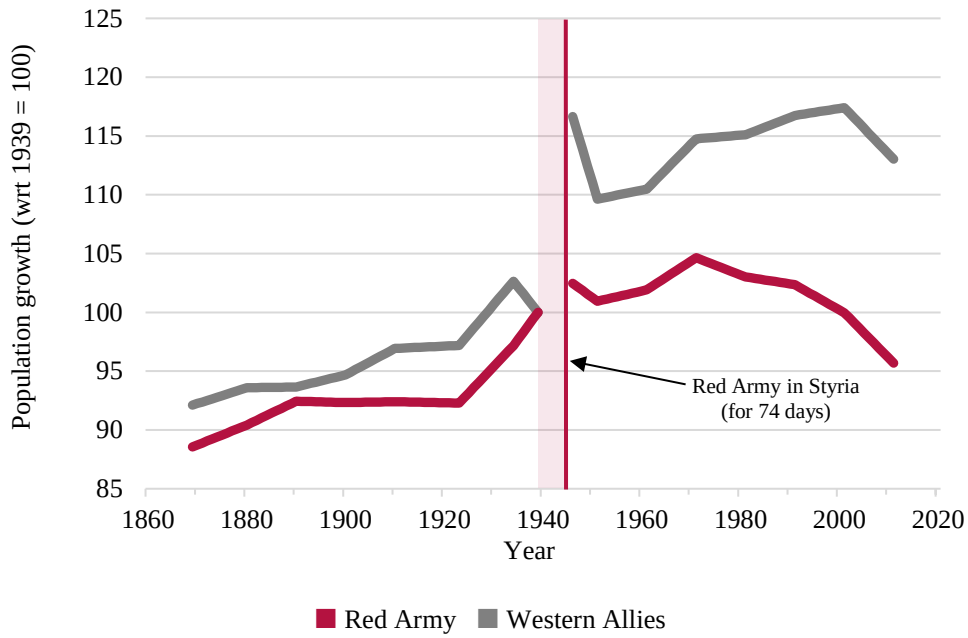
FIGURE 5: LIBERATED STYRIA AND DEMARCATION MUNICIPALITIES



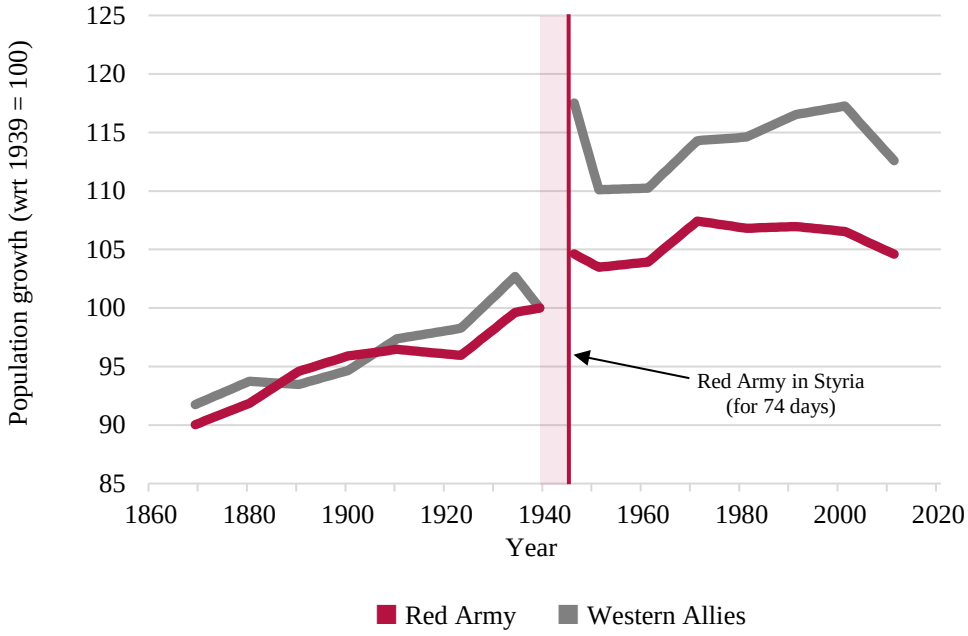
Notes: The map shows Styria according to Red Army and Western Allies liberated municipalities. The 50 municipalities at the liberation demarcation line (demarcation municipalities) are highlighted. Demarcation municipalities were liberated by the Red Army (25 municipalities), US troops (10) and British troops (15). Black lines within Styria show municipal borders as of 2011.

FIGURE 6: POPULATION DYNAMICS ACROSS THE DEMARCATION LINE

5a: Within 5 km to demarcation municipalities



5b: Within 10 km to demarcation municipalities

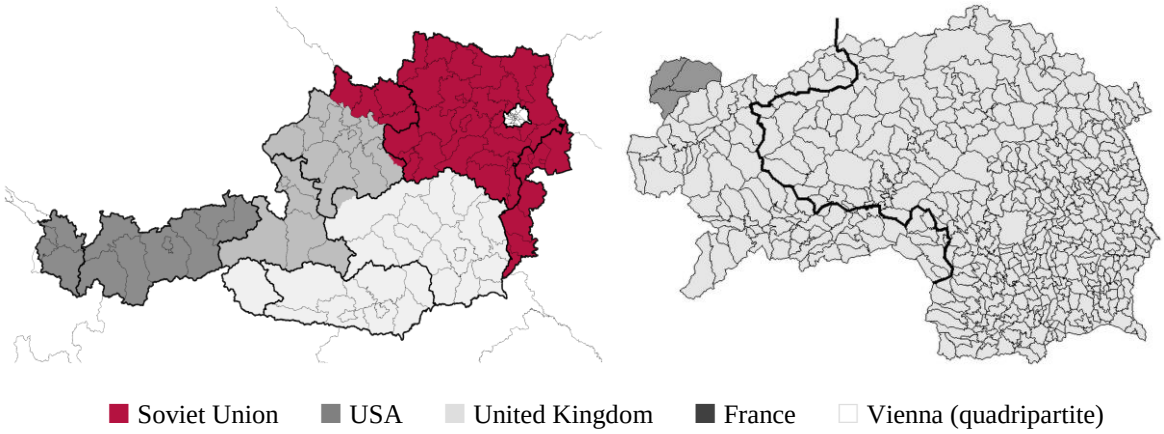


Notes: The figures show municipal population growth with respect to 1939 (last pre-WWII census) for municipalities across the liberation demarcation line. Municipal population is standardized to 100 for the year 1939. Figure 4a plots population growth of Red Army and Western Allies liberated municipalities within 5 km to the nearest liberation demarcation municipality, Figure 4b within 10 km to the nearest liberation demarcation municipality. The red lines indicate the presence of the Red Army in Styria from May 9 until July 22, 1945 (74 days). The shaded areas indicate the period of WWII.

FIGURE 7: OCCUPATION FROM 1945 – 1955 IN AUSTRIA AND STYRIA

6a: Occupied Austria from July 1945 – 1955

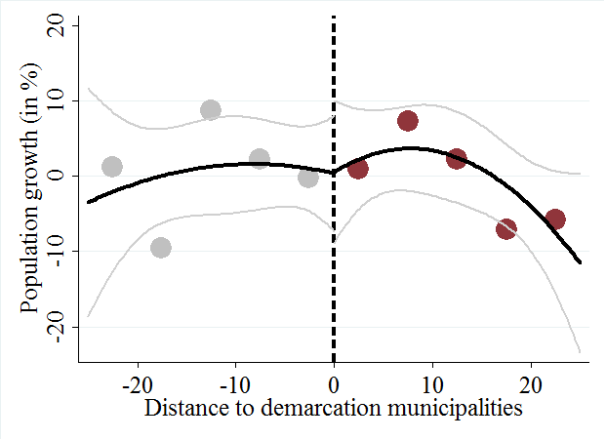
6b: Occupied Styria from July 1945 – 1955



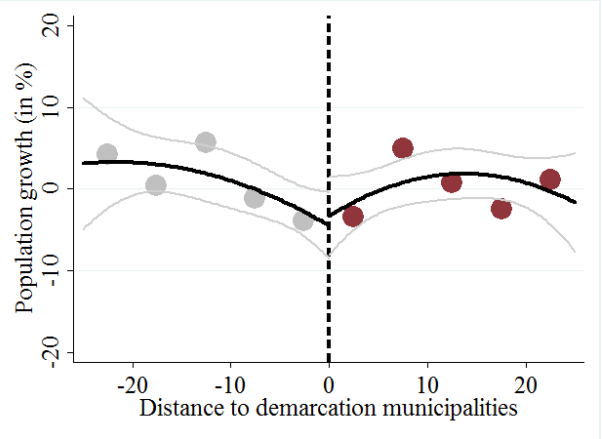
Notes: The maps show the official assigned occupation zones of the four Allies in Austria (Figure 6a) and for Styria (Figure 6b) from July 1945 to 1955. Black bold lines in Figure 6a show state borders, thin black lines show district borders. The bold black line in Figure 6b shows the liberation demarcation line between the Red Army and the Western Allies (along the municipal borders, if reasonable), thin black lines show municipal borders.

FIGURE 8: RDD PLOTS ON MUNICIPAL POPULATION GROWTH

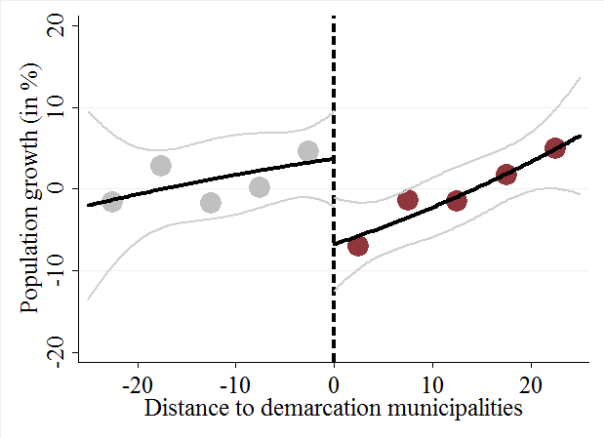
7a: 1869 – 1939



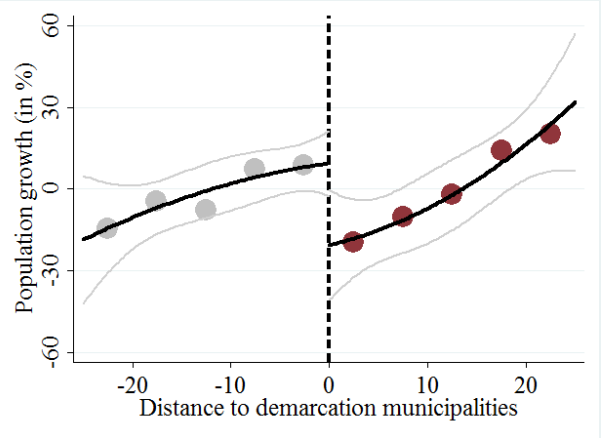
7b: 1923 – 1939

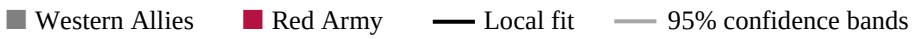


7c: 1939 – 1951



7d: 1939 – 2011

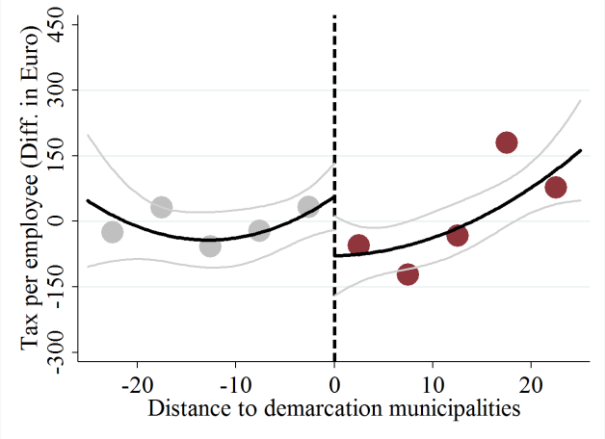




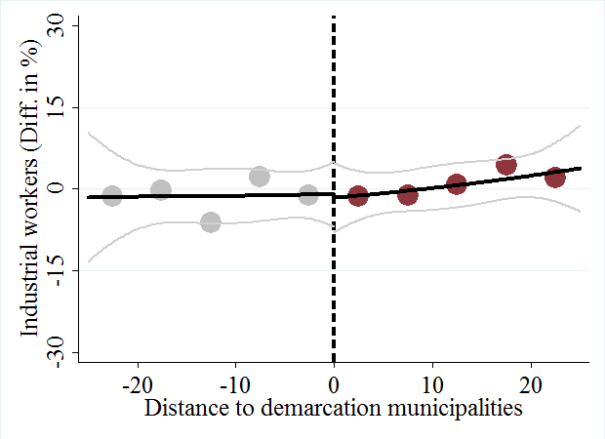
Notes: The figures show quadratic-interacted RDD plots of municipal population growth for different time periods with respect to the year 1939. The plots are restricted to municipalities within 25 km to the nearest demarcation municipality and include a set of segment fixed effects and geographic fixed effects. The black dashed vertical lines indicate the liberation demarcation line. Negative (positive) values of the distance to demarcation municipalities are for Western Allies (Red Army) liberated regions. The bins show local averages of 5 km bandwidths. The grey lines indicate 95% confidence bands.

FIGURE 9: RDD PLOTS OF MUNICIPAL ECONOMIC VARIABLES IN 2011

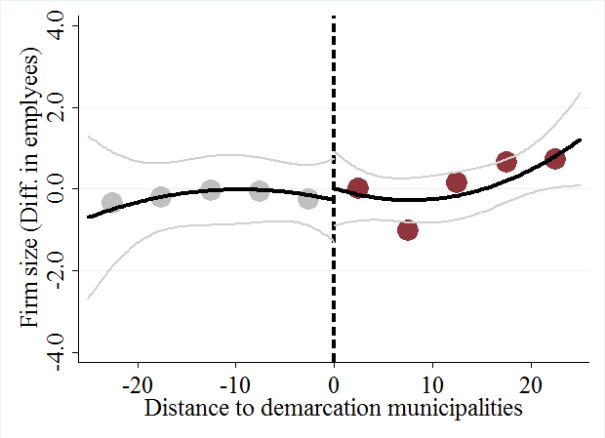
8a: Communal tax revenue per employee



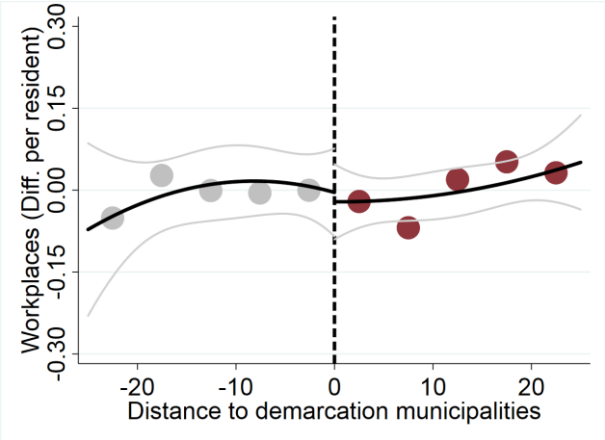
8b: Share of industrial workplaces



8c: Average firm size



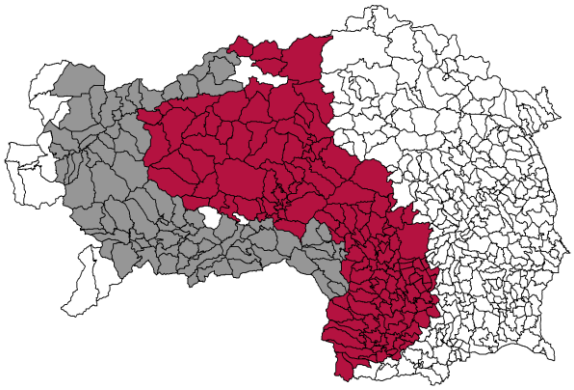
8d: Workplace per resident



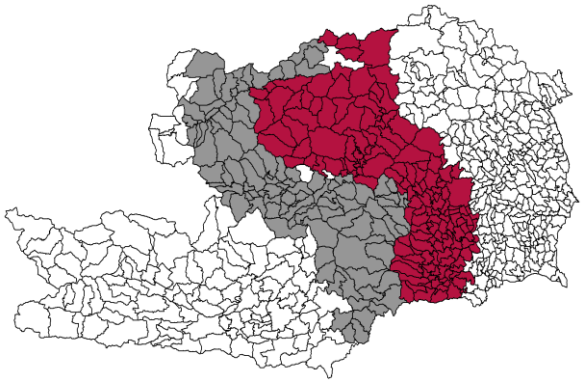
Notes: The figures show quadratic-interacted RDD plots of municipal economic variables restricted to municipalities within 25 km to the nearest demarcation municipality. Figure 8a uses municipal tax revenues per local employee (average 2010–2012), Figure 8b the local share of industrial workplaces (as percentage of all workplaces), Figure 8c the average firm size (local employees divided by the number of firms), and Figure 5d workplaces per resident (workplaces within the municipality divided by municipal population). The estimates include a set of segment fixed effects and geographic fixed effects. The black dashed vertical lines indicate the liberation demarcation line. Negative (positive) values of the distance to demarcation line municipalities are for Western Allies (Red Army) liberated regions. The bins show local averages of 5 km bandwidths. The grey lines indicate 95% confidence bands.

FIGURE 10: ILLUSTRATION OF ROBUSTNESS CHECKS

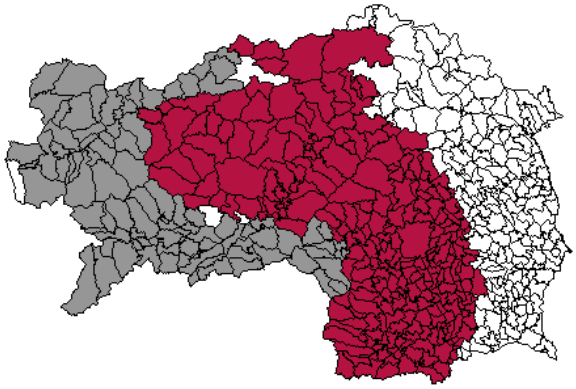
9a: Main sample (± 25 km)



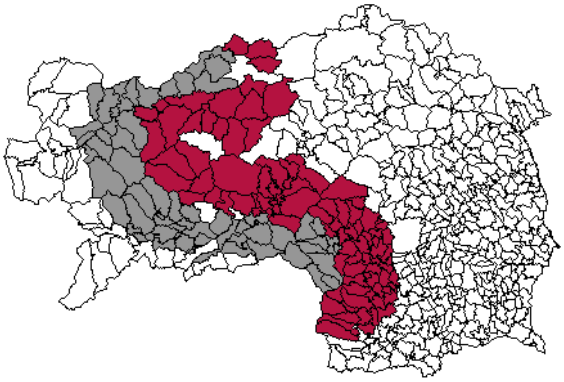
9b: Entire UK zone (incl. Carinthia, ± 25 km)



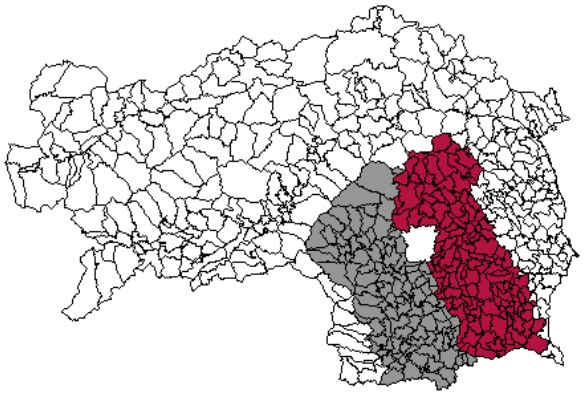
9c: Robustness check (± 40 km)



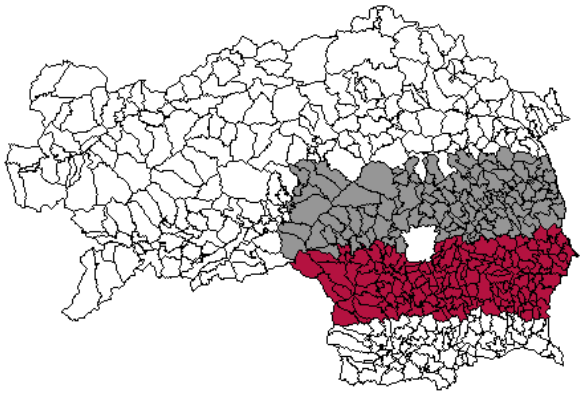
9d: Robustness check (± 15 km)



9e: Pseudo border: Mur River (± 25 km)



9f: Pseudo border: North-South divide (± 25 km)

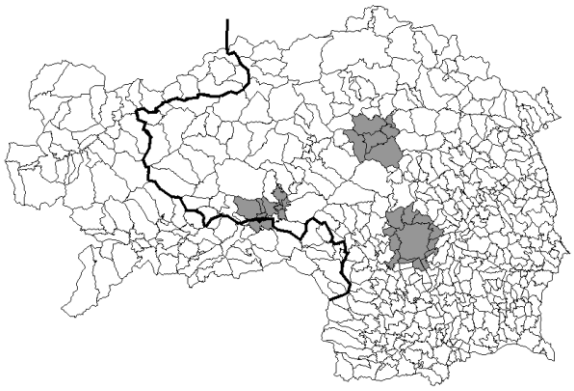


■ (Pseudo) Red Army ■ (Pseudo) Western troops

Notes: The maps show subsamples of Styrian municipalities employed in the RDD estimates. Figure 9a show the baseline sample with municipalities restricted to municipalities within 25 km to the nearest demarcation municipality. Figure 9b includes demarcation line municipalities along the shared Styrian-Carinthian border. Figure 9c – 9f represent the regional subsamples employed in the robustness checks (see Section 5.2).

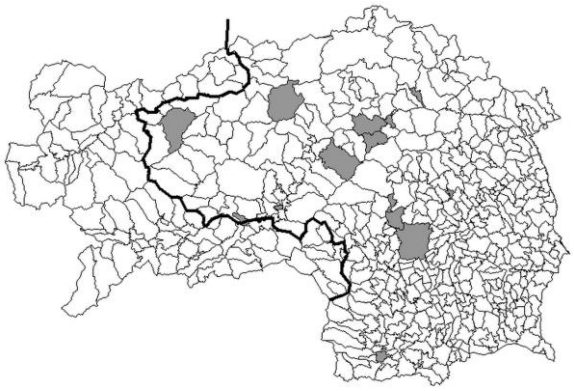
FIGURE 11: ILLUSTRATION OF REGIONAL POLICY COFOUNDS

10a: Targets of aerial bombing during WWII



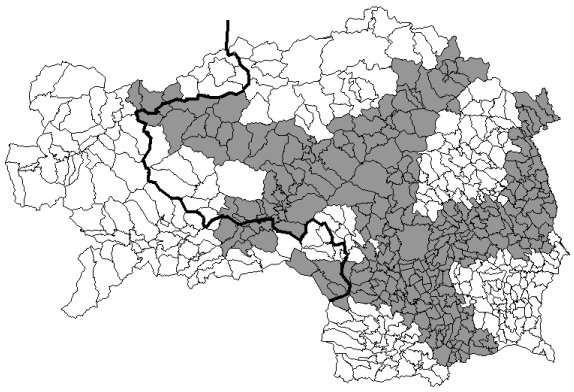
■ Bombing □ No bombing

10b: Official dismantled plants by the Red Army



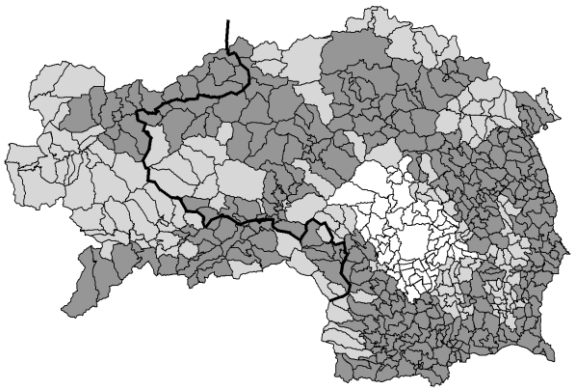
■ Dismantled plants □ No dismantled plants

10c: Distance to highway



■ <10 km to slip road □ >10 km to slip road

10d: EU funds in period 2000 – 2006



■ Objective 2 ■ Phasing-Out □ No EU funds

Notes: The maps show the localities of regional policy cofounds in Styria. Thee cofounds are employed in Section 6.2.

TABLE 9. DETERMINANTS OF POPULATION GROWTH AFTER WWII

	Dependent variable: Municipal population growth (1939–1946)			
	(1)	(2)	(3)	(4)
Red Army	-7.953	-4.886	-10.511	-9.956
	(1.753)***	(2.506)*	(1.926)***	(2.037)***
	[2.404]***	[3.141]	[2.500]***	[2.337]***
Distance to Graz		-0.344		
		(0.084)***		
		[0.78]***		
Distance to Graz squared		0.003		
		(0.001)***		
		[0.001]***		
Share of settlement area			0.093	
			(0.030)***	
			[0.034]***	
Elevation range				-0.032
				(0.007)***
				[0.010]***
Roughness				0.128
				(0.030)***
				[0.049]***
Constant	114.736	119.697	112.298	119.194
	(1.590)***	(3.466)***	(1.764)***	(2.356)***
	[2.307]***	[3.527]***	[2.502]***	[2.728]***
No. of obs.	542	542	542	542
R2 adj.	0.037	0.070	0.053	0.088

Notes: The dependent variable is municipal population growth from 1939 (last census before WWII) to the first municipal population figures in 1946 (data based on food vouchers) in percentage points. The explanatory variables are geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

TABLE 10. LABOR PRODUCTIVITY

	Dependent variable: Municipal tax revenues per employee in 2011 (in €)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: *Linear-interacted polynomial*						
Red Army	-120.84	-100.29	-142.64	-96.62	-94.90	-107.78
	(53.42)**	(42.30)**	(45.64)***	(45.8)**	(44.02)**	(42.41)**
	[58.35]**	[48.77]**	[40.47]***	[46.47]**	[44.74]**	[40.24]***
R^2 *adj.*	0.26	0.53	0.49	0.50	0.49	0.59
Panel B: *Quadratic polynomial*						
Red Army	-115.72	-96.72	-138.05	-94.03	-91.74	-105.11
	(53.36)**	(42.21)**	(45.68)***	(45.86)**	(44.00)**	(42.57)**
	[58.48]**	[48.86]**	[40.61]***	[46.65]**	[44.71]**	[40.57]**
R^2 *adj.*	0.26	0.54	0.50	0.50	0.49	0.59
Panel C: *Quadratic-interacted polynomial*						
Red Army	-111.87	-96.58	-140.09	-84.14	-97.14	-102.29
	(61.55)*	(48.02)**	(51.15)***	(54.80)	(52.28)*	(48.67)**
	[66.14]*	[56.91]*	[46.31]***	[55.88]	[52.35]*	[49.50]**
R^2 *adj.*	0.27	0.54	0.50	0.50	0.49	0.59
Panel D: *Cubic polynomial*						
Red Army	-115.96	-97.09	-139.47	-85.40	-98.39	-102.88
	(60.08)*	(46.66)**	(49.79)***	(52.65)	(50.16)*	(47.13)**
	[65.85]*	[55.69]*	[44.38]***	[54.02]	[51.4]*	[47.00]**
R^2 *adj.*	0.26	0.54	0.50	0.50	0.49	0.59
Industrial sector	–	✓	–	–	–	✓
Average firm size	–	–	✓	–	–	✓
Work occupation	–	–	–	✓	–	✓
Non-tax employees	–	–	–	–	✓	✓
Segments FE	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓
No. of obs.	231	231	231	231	231	231

Notes: The table tests for spatial discontinuities across demarcation municipalities in municipal tax revenues per local employee in Euro for the year 2011 for different RD polynomials with respect to the distance to the nearest demarcation municipality. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Column (1) shows the baseline specification. Columns (2) – (5) include economic variables that determine the taxable base (Industrial sector: share of workplaces in industry, share of workplaces in services; Firm size: workplaces divided by the number of firms, industrial workplaces dived by the number of industrial firms; Work occupation: share of blue color workers; Non-taxable occupations: share of self-employed, share of workplaces in public administration). Column (6) gives the combined view. Spatial discontinuities of variables that affect the taxable base are shown in Table 11 in the supplementary material. The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

TABLE 11. INDUSTRIAL AND MUNICIPAL COVARIATES IN 2011

	Dependent variable:														
	Employees per industrial sector (in %)					Average firm size		Type of occupation (in %)				Municipal residents characteristics (in %)			
	Agriculture	Services	Industry	Production	Construc-tion	All firms	Industry	Blue collar	Public	Self-em-ployed	Workplaces p. resident	Compulsory educ.	Tertiary educ.	Unem-ployed	Out-com-muters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Panel A: *Linear-interacted polynomial*															
Red Army	5.46	-5.89	0.43	5.19	1.67	-0.03	0.75	-2.25	0.13	3.77	-0.03	1.84	-0.63	-0.30	-2.28
	(3.89)	(4.25)	(4.09)	(7.55)	(7.05)	(0.50)	(2.35)	(3.32)	(1.41)	(4.54)	(0.04)	(0.86)**	(0.56)	(0.36)	(1.79)
	[4.44]	[4.91]	[3.93]	[7.33]	[5.31]	[0.57]	[2.14]	[3.67]	[1.37]	[5.53]	[0.04]	[0.96]*	[0.53]	[0.40]	[1.92]
R^2 *adj.*	0.33	0.18	0.12	0.05	0.04	0.14	0.11	0.11	0.04	0.29	0.06	0.38	0.28	0.08	0.18
Panel B: *Quadratic polynomial*															
Red Army	5.19	-5.60	0.41	5.45	1.36	-0.02	0.76	-2.02	0.13	3.49	-0.03	1.88	-0.65	-0.23	-2.33
	(3.91)	(4.27)	(4.09)	(7.60)	(7.10)	(0.50)	(2.34)	(3.33)	(1.43)	(4.55)	(0.04)	(0.86)**	(0.56)	(0.37)	(1.80)
	[4.46]	[4.92]	[3.95]	[7.38]	[5.33]	[0.57]	[2.13]	[3.69]	[1.39]	[5.54]	[0.04]	[0.95]**	[0.53]	[0.41]	[1.93]
R^2 *adj.*	0.34	0.18	0.12	0.05	0.04	0.14	0.11	0.12	0.04	0.30	0.06	0.39	0.28	0.12	0.18
Panel C: *Quadratic-interacted polynomial*															
Red Army	4.67	-5.24	0.57	7.72	-0.75	0.48	1.92	-2.60	0.37	1.79	-0.01	1.66	-0.13	-0.37	-2.96
	(4.48)	(5.26)	(4.79)	(9.18)	(8.46)	(0.61)	(2.73)	(3.78)	(1.65)	(5.04)	(0.04)	(0.99)*	(0.63)	(0.43)	(2.01)
	[5.06]	[5.88]	[4.44]	[9.12]	[6.20]	[0.70]	[2.56]	[4.20]	[1.58]	[6.25]	[0.05]	[0.95]*	[0.54]	[0.42]	[2.18]
R^2 *adj.*	0.34	0.19	0.12	0.05	0.04	0.15	0.12	0.12	0.05	0.3	0.07	0.39	0.30	0.21	0.18
Panel D: *Cubic polynomial*															
Red Army	4.66	-4.72	0.06	6.44	-0.42	0.28	1.34	-2.85	0.18	2.46	-0.02	1.64	-0.18	-0.31	-2.83
	(4.39)	(5.08)	(4.62)	(8.82)	(8.16)	(0.58)	(2.63)	(3.69)	()1.61	(4.99)	(0.04)	(0.95)*	(0.62)	(0.42)	(1.95)
	[4.94]	[5.77]	[4.33]	[8.80]	[6.06]	[0.67]	[2.44]	[4.09]	[1.56]	[6.13]	[0.05]	[0.96]*	[0.56]	[0.45]	[2.12]
R^2 *adj.*	0.34	0.18	0.12	0.05	0.04	0.15	0.12	0.12	0.04	0.30	0.06	0.39	0.29	0.12	0.18
Segments FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of obs.	231	231	231	231	231	231	231	231	231	231	231	231	231	231	231

Notes: The table tests for spatial discontinuities across demarcation municipalities in various 2011 covariates using different RD polynomials with respect to the distance to the nearest liberation demarcation municipality. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Employees per sectors in columns (1) – (5) reports the number of workplaces in a certain sector in percentage points to total workplaces. Average firm size in columns (6) – (7) are the number of all (industrial) employees within a municipality divided by the total number of firms (number of industrial firms). Blue collar workers (column (8)) and the number of workforce in public administration (column (9)) are the share in percentage points of total municipal employees. Self-employed in column (10) are the share in percentage points of self-employed residents (according to the head of the family) dived by municipal population. Workplaces per resident (column (11)) are the number of municipal workplaces divided by municipal population (in %). Columns (12) – (15) report municipal population characteristics in percentage points of total population. The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

TABLE 12. DIFFERENT FORCING VARIABLE

	Dependent variable:			
	Municipal population growth			Municipal tax revenues per employee (in €)
	1869–1939	1939–1951	1939–2011	
	(1)	(2)	(3)	(4)
Panel A: *Linear polynomial in longitude and latitude*				
Red Army	-0.35	-8.04	-15.21	-66.71
	(4.93)	(2.87)***	(7.48)**	(48.49)
	[5.50]	[2.52]***	[8.34]*	[52.84]
R^2 *adj.*	0.24	0.11	0.51	0.22
Panel B: *Quadratic polynomial in longitude and latitude*				
Red Army	-1.59	-7.26	-14.62	-73.63
	(5.05)	(2.89)**	(7.87)*	(49.50)
	[5.49]	[2.62]***	[8.71]*	[51.89]
R^2 *adj.*	0.26	0.14	0.52	0.23
Panel C: *Cubic polynomial in longitude and latitude*				
Red Army	1.04	-11.11	-18.81	-34.46
	(6.37)	(3.75)***	(9.22)**	(59.78)
	[6.76]	[2.97]***	[8.81]**	[59.78]
R^2 *adj.*	0.30	0.18	0.55	0.26
Panel C: *Quartic polynomial in longitude and latitude*				
Red Army	-1.08	-13.12	-35.62	-70.83
	(8.11)	(4.21)***	(9.92)***	(64.52)
	[8.57]	[3.07]***	[10.71]***	[65.02]
R^2 *adj.*	0.36	0.20	0.59	0.30
Segments FE	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓
No. of obs.	331	331	331	225

Notes: The table tests for spatial discontinuities across demarcation municipalities for different RD polynomials that use longitude and latitude as forcing variables. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. Columns (1) – (3) report discontinuities for municipal population growth in percentage points for different time periods with respect to the year 1939. Column (4) reports discontinuities for municipal tax revenues per local employee in Euro (average 2010 – 2012). The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

TABLE 13. DIFFERENCE-IN-DIFFERENCES

	Dependent variable: Municipal population growth					
	Demarcation municipalities		± 10km to demarcation municipalities		± 15km to demarcation municipalities	
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army× Post-WWII	-31.92		-16.47		-4.12	
	(17.75)*		(10.57)		(8.95)	
	[13.37]**		[8.87]*		[9.55]	
Red Army× Year 1939-46		-14.39		-9.15		-8.54
		(6.71)**		(3.80)**		(3.10)***
		[6.20]**		[3.73]**		[2.90]***
Red Army× Year 1946-51		-4.11		-4.32		-2.60
		(5.80)		(3.68)		(2.83)
		[5.66]		[3.27]		[2.79]
Red Army× Year 1951-61		0.73		-1.75		-2.05
		(2.58)		(1.97)		(1.52)
		[2.18]		[2.25]		[1.84]
Red Army× Year 1961-71		-0.18		-1.18		-0.65
		(3.91)		(2.15)		(1.73)
		[3.36]		[2.12]		[1.77]
Red Army× Year 1971-81		-3.71		-2.39		-1.69
		(3.41)		(1.94)		(1.62)
		[2.39]		[1.51]		[1.60]
Red Army× Year 1981-91		-4.00		-1.51		-0.57
		(3.38)		(2.05)		(1.68)
		[2.61]		[1.53]		[1.55]
Red Army× Year 1991-2001		-5.94		-2.67		-0.24
		(3.19)*		(1.91)		(1.51)
		[2.91]**		[1.80]		[1.63]
Red Army× Year 2001-11		-4.70		1.10		2.52
		(2.80)*		(1.96)		(1.59)
		[2.07]**		[1.71]		[1.61]
Constant	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓
Period FE	✓	✓	✓	✓	✓	✓
No. of observations	100	750	224	1680	326	2445
No. of municipalities	50	50	112	112	163	163
R^2 *adj. (within)*	0.14	0.12	0.06	0.08	0.01	0.07

Notes: The dependent variable is municipal population growth in percentage points for different bandwidths to the nearest demarcation municipality. Columns (1), (3) and (5) report the the interaction effects (*Red Army × Post-WWII*) of a difference-in-differences model for the entire post-WWII time period (municipal population growth from 1939 to 2011). Columns (2), (4) and (6) report the interaction effects (*Red Army × Sub-period*) of a difference-in-differences model for post-WWII sub periods. The coefficients of the respective sub periods indicate relative population growth in percentage points during tis sub period. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

TABLE 14. ELECTION OUTCOMES

	Dependent variable: Vote shares						
	National election 1945			National election 1949			
	Conservatives (ÖVP)	Social Democrats (SPÖ)	Communists (KPÖ)	Conservatives (ÖVP)	Social Democrats (SPÖ)	Communists (KPÖ)	Right-wing (VdU)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: *Linear-interacted polynomial*							
Red Army	-1.15	-0.06	1.21	-0.15	2.65	0.77	-3.17
	(4.43)	(3.66)	(1.21)	(3.42)	(2.87)	(0.90)	(1.51)**
	[4.67]	[3.54]	[1.50]	[3.67]	[2.98]	[1.11]	[1.61]**
R^2 *adj.*	0.20	0.18	0.18	0.14	0.27	0.20	0.25
Panel B: *Quadratic polynomial*							
Red Army	-1.46	0.16	1.30	-0.36	2.85	0.86	-3.25
	(4.45)	(3.69)	(1.21)	(3.43)	(2.89)	(0.90)	(1.53)**
	[4.69]	[3.56]	[1.49]	[3.66]	[2.99]	[1.11]	[1.62]**
R^2 *adj.*	0.21	0.19	0.18	0.14	0.27	0.21	0.25
Panel C: *Quadratic-interacted polynomial*							
Red Army	-1.27	0.10	1.17	-0.16	2.22	1.18	-3.12
	(5.39)	(4.41)	(1.47)	(4.22)	(3.52)	(1.14)	(1.75)*
	[4.96]	[3.72]	[1.68]	[4.12]	[3.30]	[1.31]	[1.75]*
R^2 *adj.*	0.22	0.20	0.20	0.15	0.28	0.23	0.27
Panel C: *Cubic polynomial*							
Red Army	-1.21	0.17	1.04	-0.06	2.38	1.02	-3.23
	(5.24)	(4.28)	(1.43)	(4.05)	(3.42)	(1.11)	(1.68)*
	[4.99]	[3.74]	[1.65]	[4.06]	[3.28]	[1.29]	[1.74]*
R^2 *adj.*	0.21	0.19	0.19	0.14	0.27	0.21	0.25
Segments FE	✓	✓	✓	✓	✓	✓	✓
Geographic FE	✓	✓	✓	✓	✓	✓	✓
No. of obs.	229	229	229	229	229	229	229

Notes: The table tests for spatial discontinuities across demarcation municipalities in vote shares (in %) for the 1945 and 1949 national elections for different RD polynomials with respect to the distance to the nearest demarcation municipality. The sample is restricted to municipalities within 25 km to the nearest demarcation municipality. The estimates include segment and geographic fixed effects. Robust standard errors are in parentheses, and standard errors corrected for spatial dependence (Conley, 1999, 2008) are in brackets. Significance levels: *** 0.01, ** 0.05, * 0.10.

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