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Hostility, Population Sorting, and Backwardness: Quasi-Experimental Evidence from the Red Army after WWII

Christian Ochsner

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Hostility, population sorting, and backwardness: Quasi-experimental evidence from the Red Army after WWII*

Christian Ochsner†

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Abstract

Does a short episode of conflict or exposure to hostile troops cause regional economic backwardness, and if so, why and how does it persist? I answer these questions by exploiting economic differences across the idiosyncratic and short-lived line of contact between the Red Army and the Western Allies in South Austria at the end of WWII. Spatial regression discontinuity estimates show that hostile presence of the Red Army for 74 days caused an immediate relative population decline of around 12%, amplified to 25% by today. Age-specific migration patterns and subsequent fertility differences explain the multiplying effects. Sector development and measures of local labor productivity in 2011 also lag behind in regions briefly seized by the Red Army, likely driven by skill-specific migration and hampered investment patterns after WWII. The findings provide novel insights into the long-run effects of wars and conflicts, and point to the isolated role of the Red Army's hostile actions after WWII to understand the European economic East-West divide.

JEL–Classification: D74, J13, N44, O14

Keywords: Conflict, Hostility, Population shock, Regional development, Red Army

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†CERGE–EI—A joint workplace of Charles University and the Economics Institute of the Czech Academy of Sciences, Politickych veznu 7, 111 21 Prague, Czech Republic, Phone: +420 224 005 173, e-mail: `christian.ochsner@cerge-ei.cz`.

1 Introduction

In recent years, the number of globally reported conflicts has reached an all-time peak since World War II (WWII). At the same time, the UNHCR estimates the number of internally and externally displaced people to exceed 100 million in 2022—figures that exceed even the period of mass-expulsions and displacement after WWII.[1] Inevitably, such figures impact the long-run economic trajectory of affected regions. A growing literature analyzes the economic consequences of wars, conflict and hostile invasions of regular armies or armed groups (for reviews see Blattman and Miguel (2010), Rohner and Thoenig (2021) or Munroe *et al.* (2023)). On the one hand, there is somewhat of a consensus in the literature that the tangible and measurable costs of conflicts—destruction of physical capital—has limited long-run effects on economic figures (Davis and Weinstein, 2002; Brakman *et al.*, 2004; Miguel and Roland, 2011; Waldinger, 2016; Yamada and Yamada, 2021). On the other hand, conflicts also lead to migration, affect intangible assets such as health, behavior and educational attainment, and disrupt social capital and institutions.[2] Studies on these matters often focus on short-run outcomes on individuals, while their long-run impacts on the economic trajectory of regions are hard to disentangle from each other since they are interwoven and affect the social fabric of societies (Rohner and Thoenig, 2021).

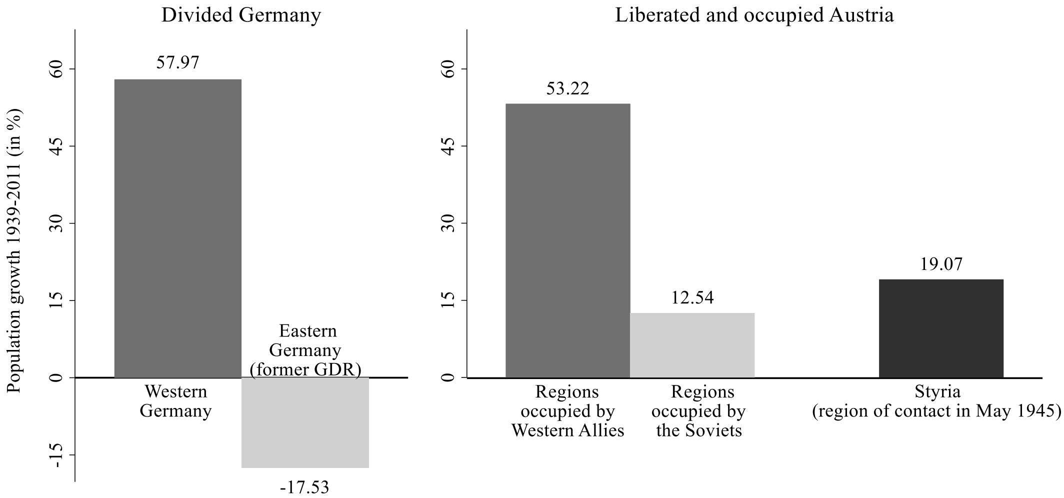
In this paper, I focus on a violent period with high stakes: The Red Army's hostility in Europe at the end of WWII.[3] I study the isolated effects of the fear of and the hostility by the Red Army during the liberation of Europe from Nazi Germany on subsequent regional economic development. In the course of the liberation of Europe from Nazi Germany in Spring 1945, the Red Army caused mass exoduses in regions all over Central and Eastern Europe that they liberated, and also dismantled plants and infrastructure. I aim to isolate the presence of the Red Army at the end of the war from other East-West differences across the Iron Curtain such as war damage, Soviet domination for several decades, different institutional and economic legacies or changed behavior and preferences of people (Alesina and Fuchs-Schündeln, 2007). I focus on the Austrian state of Styria in South Austria, where some regions that were initially seized by the Red Army in May 1945 were handed over to the Western Allies after 2.5 months. In fact, these regions in Styria comprised the largest coherent area in Europe that was initially seized by the Red Army, but was not under long-term Soviet control. Post-WWII population growth already points to the long-run effects of the short-term presence of the Red Army. Figure 1 shows

[1] Data on conflicts are from the UCDP Armed Conflict Database (`https://ucdp.uu.se/`) and on displacements from UNHCR (`https://www.unhcr.org/global-trends`); retrieved in September 2023.

[2] The effects on social capital (Bellows and Miguel, 2009; Rohner *et al.*, 2013a,b; Besley and Reynal-Querol, 2014; Bauer *et al.*, 2016; Dell and Querubin, 2017) and education (Bedard and Deschênes, 2006; Akresh *et al.*, 2012) are ambiguous, while health outcomes are negative (León, 2012; Aghion *et al.*, 2018).

[3] The term "Red Army" is used throughout the paper to indicate troops that were under the command of the Soviet Union, including Bulgarian and Yugoslavian troops that arrived in southern Austria. Most Soviet troops engaged in the seizing of Austria belonged to the 3^{rd} Ukrainian Front (Stelzl-Marx, 2012).

Figure 1: Population growth along the Iron Curtain (Germany) and in occupied Austria



Notes: The figure shows the long-run population growth from 1939 (last data before division) to 2011 in percentage points in divided Germany and liberated and occupied Austria. German figures include divided Berlin in the respective parts. The Western-Allies occupied regions in Austria are Upper Austria (South of the River Danube), Salzburg, Styria, Carinthia, Tyrol and Vorarlberg. The Soviet occupation zone in Austria consists of Lower Austria, Burgenland and nothern Upper Austria (Mühlviertel). The divided cities of Linz and Vienna are excluded in all figures. Styria was initially liberated by the Red Army, US and UK troops and was then fully allocated to the Western (UK) occupation zone. Source: See text and Online Appendix B.

the post-WWII population growth in Austrian regions according to the occupation zones instituted from July 1945 to October 1955 and compares them to the figures in divided Germany across the Iron Curtain. In both countries, regions liberated and occupied by the Western Allies show substantial population growth in the last eighty years. In contrast, the population in East Germany, the former German Democratic Republic—largely seized by the Red Army after WWII and under Soviet control until 1989—had a lower population in 2011 than in 1939. In Austria, population figures for regions occupied by the Soviets for more than ten years also lag behind those of regions seized and occupied by the Western troops. Styria, the region of contact between the Red Army and the Western Allies, has also performed poorly, despite the fact that only parts of Styria were dominated for 74 days by the Red Army. These figures already provide a first impression that the Red Army's legacy right after WWII seems to have long-lasing impacts on regional economic trajectories, and this without long-run Soviet domination or changed institutions.

I investigate the isolated and causal long-term effects of the Red Army's hostility at the end of WWII on subsequent population dynamics, sector development and labor productivity up to the present. I focus on the arbitrarily-drawn line of contact within Styria between the Red Army and the Western Allies (US and UK troops). 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-German control from different directions, and in less than one day. The places where the respective Allies met became the line of contact. Whether a certain municipality was the last unlucky one to be seized by the Red Army, or the last fortunate one to be captured by Western troops was—broadly speaking—fully exogenous.[4] In Styria, this line of contact lasted for only 74 days. In July 1945, the Red Army had entirely withdrawn from Styria towards its officially assigned occupation zone in East Austria. This withdrawal of the Red Army was unique in all of Europe: it only happened at a large scale in Styria due to zoning negotiations (Erickson, 1950; Slapnicka, 1986). Styria as a whole was thereafter assigned to the UK occupation zone. Austria remain occupied by the Allies for more than 10 years until the fall of 1955.

The presence of the Red Army for 74 days in some parts of Styria led to municipalities being exposed to hostile troops. The Austrian civic population feared the arrival of the Red Army mainly due to Nazi propaganda, poor reputation and reports of crimes committed by Red-Army soldiers against civilians in Eastern Europe (Mascher-Pichler, 2009; Stelzl-Marx, 2012). During the last weeks of WWII until the final zoning of Austria in July 1945, a mass exodus from eastern to western Austria took place by people fleeing from the Red Army. Living conditions in places that were seized by the Red Army were hostile: Beer (2004) reports 30,000 estimated rapes in the parts of Styria initially seized by the Red Army. There was also official dismantling of industrial plants and infrastructure, and thousands of informal lootings by the Red Army and its soldiers (Bischof, 1999; Eberhart, 1995; Pickl, 1995). Thus, regions initially seized by the Red Army were less favorable places to live and to initiate economic activity following the war.

I use this spatial discontinuity in hostility along the 74-day-long line of contact between the Red Army and the Western Allies in spatial regression discontinuity (RD) setups. I combine a battery of self-compiled archival data with data from official statistics. I first show that the line of contact divided formerly identical regions in terms of geographical characteristics, and pre-treatment population dynamics and sector shares. I find that regions seized by the Red Army—but without any long-term Soviet dominance or institutional differences in place—suffered in the long-run, even until the present day. Spatial RD estimates show that the liberation caused an immediate relative population decline of around 12%, amplified to 25% by today. I find that younger cohorts, and young families with children in particular, were more likely to escape the Red Army and settled in places liberated by the Western Allies. Age-specific migration patterns and the resulting fertility- and death-rates differentials across the line of contact cause the multiplying effects over the decades. Sector development and measures of local labor productivity in 2011 also lagged behind in regions initially seized by the Red Army. The lag in economic and sector development is likely driven by a skill-specific migration pattern after WWII: Regions liberated by the

[4]The seizing of Germany and Czechia was less exogenous than of Styria. In Germany, US troops strategically waited at the River Elbe until the Red Army had seized the rest of Germany. In Czechia, US troops waited in West Bohemia to let the Red Army proceed. Studies using the line of contact in Germany are Martinez *et al.* (2023) and Eder *et al.* (2023), and Grossmann *et al.* (forthcoming) in Czechia.

Western Allies received a boost in the share of semi-skilled laborers (industrial workers, craftsmen), whereas adjacent municipalities seized by the Red Army immediately became more agricultural, and remained trapped in agriculture until 2011. I also find strong evidence for hampered investments in places seized by the Red Army by analyzing the investment patterns into agricultural machinery after WWII. In contrast, I do not find any long-term effects of local aerial bombing or officially reported dismantling activities by the Red Army. This indicates that people seem to matter more than the loss of tangible assets for long-run economic development of regions. The results are robust to various types of RD specifications, including estimates with single- and multidimensional forcing variables and pairwise regressions with line of contact municipalities, robust bias-corrected RD estimates with a data-driven bandwidth selection, different regional sub-samples, pseudo treatments and difference-in-differences specifications. I also show that the effects are not just locally pronounced by applying the synthetic control method to compare the Styrian capital city of Graz with other cities in eastern and western Austria. The results confirm the economic backwardness of places initially seized by the Red Army. Multiple hypothesis testing shows that population figures and differences in measures of labor productivity are the main long-run outcomes of Red-Army hostility at the end of WWII.

I contribute to several strands of the literature. First, my findings provide novel understanding of the long-run economic trajectory and amplifying effects due to selective migration in the course of conflicts or hostility. Surprisingly, the literature is very scarce here. Only two empirical studies with somewhat extreme settings have explored the long-run effects on sending regions directly. Testa (2020) studies the mass expulsion of ethnic Germans from Czechia after WWII and Chaney and Hornbeck (2016) look at the expulsion of Moriscos from Spain in the 17th century. They find that expulsions caused regional economic backwardness in the long run. Other studies focus on a specific group of people, mainly ethnic or religious minorities, to test how prosecution and displacement affects regional outcomes (Acemoglu *et al.*, 2011; Akbulut-Yuksel and Yuksel, 2015; Pascali, 2016; Arbatlı and Gokmen, 2022). In the same vein, Waldinger (2010, 2016) and Huber *et al.* (2021) investigate the loss of business and scientific elites on subsequent decline in performance.[5] My study contributes to these findings by showing how selective settlement patterns with respect to age and occupational characteristics cause initial differences that amplify over time. These new insights may also help to assess the long-run regional economic costs of the Russian-Ukrainian war today, with millions of displaced people, mainly women and children.

[5] In contrast, a large body of literature analyze how migrants affect the receiving regions. Examples are Hornung (2014) on Huguenot immigrants in Prussia, Semrad (2015), Braun and Kvasnicka (2014), Braun and Omar Mahmoud (2014), Schumann (2014) and Peters (2022) on German expellees after WWII on regional economic activity, industrial growth and schooling outcomes in Germany or the boost of scientific output in US regions that received German Jewish émigrés escaping the Holocaust (Moser *et al.*, 2014). See also Becker and Ferrara (2019), Becker (2022) or Munroe *et al.* (2023) for recent reviews.

Second, my study points to the isolated effects of the hostility by the Red Army after WWII in their seized parts of Europe to understand the ongoing European economic east-west divide along the former Iron Curtain. Despite the conditional convergence of planning economies during the first postwar decades (Ofer, 1987; Allen, 1998; Harrison, 2003), studies document a rather inefficient use of labor and capital in the Soviet economy (Cheremukhin *et al.*, 2013, 2016) or use the inefficiencies in the planning process to explain rent seeking and corruption (Harrison and Kim, 2006; Harrison, 2011). Another strand of literature explains the backwardness in the Soviet hemisphere with reference to war destruction and low investments (Vonyó, 2017, 2020) and reparations mainly paid by satellite states of the Soviet Union.[6] Regarding differences within re-unified Germany, Fuchs-Schündeln and Masella (2016) and Lichter *et al.* (2020) show the long-run negative effects of socialist education and government surveillance, respectively. Generally, social norms and trust in East and West Germany are still different even decades after the fall of the Iron Curtain and might thus affect the social fabric of society (Ockenfels and Weimann, 1999; Alesina and Fuchs-Schündeln, 2007; Brosig-Koch *et al.*, 2011; Bondar and Fuchs-Schündeln, 2023). In contrast to these explanations, I show that regions that were initially seized by the Red Army would lag behind Western Europe in terms of population dynamics, sector development or labor productivity even in the absence of long-term Soviet domination or a planning economy. I explain these effects with age- and occupation-specific migration caused by the advance of the Red Army and hampered investment patterns in the direct aftermath of WWII.

Third, my study adds to the literature on regional economic inequality and regional convergence. This literature is roughly divided into two competing explanations. On the one hand, scholars refer to (time-invariant) natural endowments such as resources or geography to explain regional economic differences (Ellison and Glaeser, 1999; Davis and Weinstein, 2002, 2008; Brakman *et al.*, 2004; Redding and Sturm, 2008; Ellison *et al.*, 2010; Nagy, 2022). On the other hand, spatial differences in economic activity can result endogenously due to the local interaction of economic agents and scale economies. 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 (2019).[7] These models predict that short-term shocks can persist and even amplify mainly due to the sorting of people and increasing returns to scale. This also links to the big push theory established by Rosenstein-Rodan (1943) and formalized by Murphy *et al.*

[6] Especially former Allies of Nazi-Germany (Hungary, Romania, Slovakia) and East Germany, but also Poland, Bulgaria and Czechoslovakia faced a decline in capital stock due to the Red-Army dismantling after WWII (see, for example, Stolper (1960); Köhler (1965); Liberman (1996); Taylor (2008) and Bekes *et al.* (2015)). Liberman (1996) also shows that East-German "reparations payments" (incl. dismantling by the Soviets) in the aftermath of WWII reached around 20% of pre-WWII GNP in East Germany.

[7] Random growth models (Simon, 1955; Gabaix, 1999) are a special group of theoretical models that would also predict persistence, but without amplifying effects.

(1989) to explain how an initial reallocation of resources leads to increasing growth rates thereafter (see Kline and Moretti (2014) or Peters (2022) for empirical studies). My findings corroborate these predictions and show a divergence of regions over time rather than a (re-)convergence after the initial shock.[8]

Lastly, my paper also adds to the fast-growing literature on the persistence of historical events on present-day economic outcomes. Examples of historic dependencies of economic variation across space are documented for militarily insecure frontiers (Oto-Peralías and Romero-Ávila, 2016), ancient Roman road infrastructure (Wahl, 2017; Dalgaard *et al.*, 2022), loss of credit collateral due to wartime destruction (Feigenbaum *et al.*, 2022), place-based policies (Kline and Moretti, 2014; Ehrlich and Seidel, 2018), long-obsolete portage cities (Bleakley and Lin, 2012), high sunk costs (Redding *et al.*, 2011) or long-gone exploitative institutions (Dell, 2010). One study on path dependence of a population shock in post-WII Austria is closely related to mine. Eder and Halla (2016) look at population shocks across the 1945 to 1955 occupation zone border in Austria and document a similar population shift as in my setup. However, my paper corroborates this paper based on a very short treatment period and adds a detailed channel discussion of the amplifying population figures and ongoing economic differences.

The remainder of this paper is as follows. Section 2 provides a historical overview. Section 3 introduces the data. Section 4 introduces the pairwise and spatial regression discontinuity (RD) approaches for causal inference. Section 5 shows the results on population and local tax figures. Section 6 adds robustness exercises including a synthetic control method with the city of Graz. Section 7 discusses the mechanism of the amplifying effects and its persistence. Concluding remarks are offered in Section 8.

2 Historical background

Austria was historically the heartland of the Habsburg Empire that collapsed in 1918, and Styria was one of its crown lands. The Austrian economy was dominated by agriculture until WWII, with some industrial core areas around Vienna (Industrieviertel), in Styria (Leoben-Graz) and in Upper Austria (Wels-Linz-Steyr). During the post-WWII occupation from 1945 to 1955, markets and elections were free in all occupation zones and there were—despite dismantling activities by the Soviets—no attempts to introduce different economic legacies by the respective occupation powers. However, Hofbauer (1992) has described a westward shift in economic activity due to the post-WWII order in Austria. After WWII, and mainly after Austria's restoration in 1955, the country developed fast

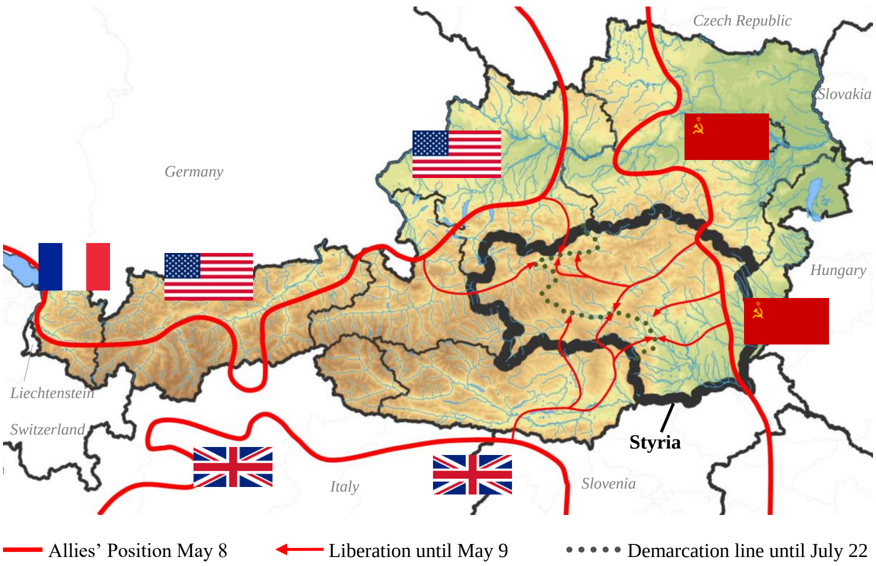
[8] The standard neoclassical growth theory would predict conditional convergence of regions independent of the starting condition (Solow, 1956). Studies that support regional convergence are Barro and Sala-i Martin (1991, 1992) and Gennaioli *et al.* (2014). My findings are more in line with endogenous growth models that highlight the role of initial endowment to explain regional differences (Gennaioli *et al.*, 2012).

and is among the richest countries of the European Union today. In the following, I outline the seizing and zoning of Austria and Styria after WWII, the hostile actions of the Red Army, and the shift in population in all of Austria and across the line of contact in Styria.

2.1 The seizing of Styria and the zoning of Austria

Austria became part of Nazi Germany with the *Anschluss* in 1938 and was as such part of the liberation campaign by the Allies to liberate Europe from Nazism. In the final stage of WWII, Allied troops from the US, UK, France and the Soviet Union reached the Austrian borders from different directions. The Red Army arrived in the easternmost parts of Austria in March 1945 whereas the Western Allies did not reach Austria until the final days of WWII. Figure 2 shows the Allies' positions on the day of the Nazi-German surrender on May 8, 1945 (bold red lines). The later line of contact in Styria between the Red Army and the Western Allies (dotted line) was at that time far away from the front line and from any combat operations. Indeed, the South-Austrian region was the largest remaining coherent area under Nazi-German control in all of Europe on May 8, 1945.

Figure 2: The seizing of Styria



Notes: The map depicts the location of Styria (bold black borders) within Austria. Bold red lines show the location of the Western Allies (UK, US and French troops) and the Red Army on the day of the Nazi-German surrender on May 8, 1945. Thin red lines with arrows show how Styria was overrun by the Allies until May 9, 1945. The locations where the Allies met became the line of contact until July 22, 1945 (dotted line). Sources: Own illustration based on Karner (2000), Iber *et al.* (2008) and Stelzl-Marx (2012).

The seizing of Styria was rather chaotic and mainly driven by the individual Allies' aiming to capture as much land as possible (Iber *et al.*, 2008; Stelzl-Marx, 2012). The Red Army in particular pushed forward until it met troops from the Western Allies (Karner, 2000). Styria was mainly seized within one day from May 8–9, 1945. The red lines with arrows in Figure 2 depict the course of the Allied liberation of South Austria and Styria. Styria's capital city, Graz, was reached by the Red Army during the night, US troops entered Styria over the Ausseerland and Pyhrnpass and encountered the Red Army in the Enns Valley in the city of Liezen, and the UK troops ran through Carinthia towards the Mur Valley and over the Packsattel towards Graz, where advance parties of the British and Red Army met on the country road between Köflach and Voitsberg on May 9, 1945 (Stelzl-Marx, 2012).[9] The places where the respective Allies met became the line of contact within Styria (dotted line in Figure 2), which was in place until the start of the withdrawal of the Red Army on July 22, 1945.[10]

Styria was seized without any land battles, and evidence on local resistance near the line of contact is absent in the respective literature. Additionally, the demarcation line was neither foreseeable nor a result of negotiation by the Allies.[11] The Online Appendix A offers more details on the last land battles, resistance and the seizing of Styria.

The postwar order of Austria was designed by the Allies. The foreign ministers of the Allies had agreed in the 1943 *Moscow Declaration* to liberate Austria from Nazi-Germany and to restore an Austrian state within the pre-*Anschluss* borders of 1937 (Erickson, 1950). Over the following 1.5 years, different zoning proposals were discussed on how to initially occupy Austria after the war. The aim was to partition Austria along state or—in one Soviet proposal—along district borders (Karner, 2000; Stelzl-Marx, 2012). All zoning proposals during the war did not follow the realized line of contact. The final proposal was negotiated secretly and finally agreed on July 9, 1945. Graphic representation of the different proposals, the liberation and the final zoning agreement are provided in Figure C.3 in the Online Appendix. The Soviet Union claimed and finally received, additional regions in northern Austria (Mühlviertel) for military reasons and was thus willing to give up Styria (Erickson, 1950; Slapnicka, 1986).[12] Just 13 days after the zoning agreement, the Red Army began its withdrawal from Styria. All of Styria—with the exception of three municipalities in the Ausseerland—together with the state of Carinthia and East-Tirol became part of the UK occupation zone in postwar Austria. Allied troops stayed in Austria for more than 10 years until the full restoration of Austrian sovereignty with the Austrian State Treaty in 1955.

[9]Stelzl-Marx (2012) reports that it took another two days until the line of contact was reached by larger troop contingents. Moreover, some southern regions of Styria were initially seized by Bulgarian and Yugoslavian (Tito partisans) troops under the Red Army's full or partial command.

[10]Throughout the paper, I refer to the 74-day-long line of contact (from May 9 to July 22, 1945) despite the fact that in some places, such as Judenburg, the Red Army withdrew on July 24, 1945, and the last of its troops did not leave Styria before early August 1945 (Stelzl-Marx, 2012).

[11]Even in areas where the River Enns and Mur formed the line of contact, the Allies arrived simultaneously on the opposite riverbanks (Karner, 2000). There was, however, a potentially arbitrary decision by the Red Army after they reached the River Enns in Landl to follow rather than crossing the river (see Online Appendix A). I address the potential concerns of rivers on subsequent development in Section 6.5.

[12]Styria is thus the largest regional entity in all Europe that was initially seized but not permanently occupied by the Red Army/Soviet Union. However, West Berlin, parts of Vienna and the Danish island of Bornholm were also initially captured by the Red Army and handed over to the Western forces thereafter.

2.2 The Red Army in Styria

The Red Army occupied their seized parts of Styria for around 2.5 months. Figure 3 shows the assignment of Styrian municipalities to the respective liberation forces, indicates divided places and the location of Styria's capital city Graz, which is Styria's main industrial area. The Red Army treated its liberated regions much more harshly than the Western Allies. Several historical sources report (sexual) violence mainly against women, official and unofficial dismantling activities by the Red Army, and lootings and pillages by its soldiers. The official dismantling targeted so-called "German assets", i.e., mainly production facilities installed by Nazi-Germany after the *Anschluss* of Austria to Nazi-Germany. However, the Red Army made no special effort to distinguish between equipment installed by Nazi-Germany after 1938 and machinery already in operation before (Bischof, 1999). Iber *et al.* (2008) collected dismantling resolutions in Styria by the Soviet State Defense Committee (GKO). These formal resolutions—signed by Joseph Stalin *after* the dismantling activities in Styria took place—aimed to legalize the removal of entire production plants in the steel and machinery 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."* [13]

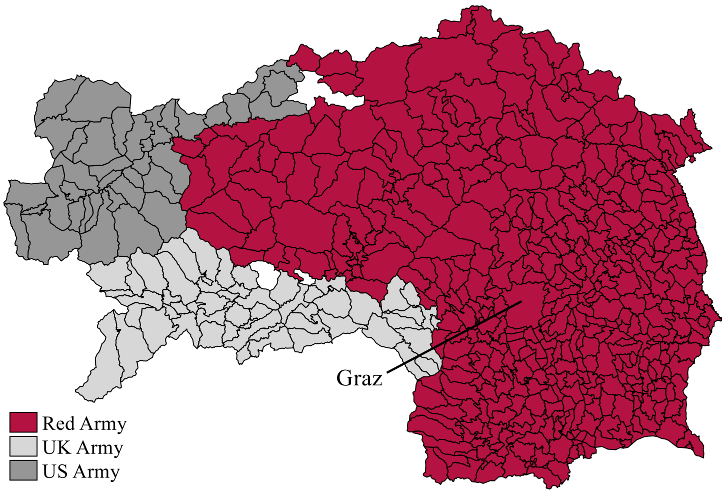
The geography of officially dismantled plants, however, was not exogenous. Figure C.12 in the Online Appendix shows the location of 14 Styrian municipalities where production facilities were officially shipped away. Most dismantled plants—with the exception of the partitioned city of Judenburg—were located in Styria's industrial heartland along the railway line from Vienna to Graz, and thus far away from the line of contact.[14]

A wide body of literature also reports the informal dismantling and pillaging of assets by both the Red-Army authorities and its individual soldiers. The Red Army confiscated railroad tracks and locomotives and also dismantled the electricity infrastructure, including 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). Additionally, raw materials and semi-finished goods were largely removed from Styria (Pickl, 1995; Iber *et al.*, 2008). Moreover, Red-Army soldiers were allowed to send bundles of items back home for free, which was interpreted as an informal request to pillage (Stelzl-Marx, 2012). Thus, everything was subject to pillage: small production facilities, 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

[13] Cited after Bischof (1999). Especially former Allies of Nazi-Germany (Hungary, Romania, and, in particular, East Germany), but also Poland, Bulgaria and Czechoslovakia faced a massive decline in their capital stock due to Soviet' dismantling activities after WWII (Liberman, 1996; Bekes *et al.*, 2015).

[14] I test for potential effects of official dismantling in Section 6.3.

Figure 3: Tripartite Styria from May 9 to July 22, 1945



Notes: The map shows Styrian municipalities according to their liberation forces of the Red Army, US and UK troops. Tripartite Styria lasted for 74 days (from May 9 until July 22, 1945) before the whole Styria became part of the UK occupation zone (until 1955). Black lines within Styria show municipality borders based on the territorial status of 2011. Municipalities in white are Landl, Judenburg and St. Georgen ob Judenburg, which were partitioned among the liberation forces.

in Graz alone—while Eberhart (1995) and Pickl (1995) report an increasing incidence of pillaging during the withdrawal of the Red Army, indicating a "devil-may-care" mentality.

Lastly, there was also mass violence, mainly against women. There were 9,493 reported rapes and approximately 30,000 estimated rapes, which led to hundreds of abortions (Beer, 2004). Sexual violence in Styria by Red-Army soldiers also caused syphilis and gonorrhea epidemics (Stelzl-Marx, 2012). To sum up, Styrian regions liberated by the Red Army suffered, whereas neighboring regions did not. Dismantling, pillaging and violence made regions seized by the Red Army a less desirable place to live and to initiate economic activities. This matters in particular in the direct aftermath of WWII, when migration was still unobstructed and large waves of refugees fled from the Red Army. Refugees might thus have avoided settling in areas previously seized by the Red Army.

2.3 Population dynamics

This section describes the population dynamics during WWII and immediately after the war in Austria and shows that the short-term presence of the Red Army in Styria immediately affected population figures in areas seized by the Red Army. The crucial period of migration and refugee waves occurred in Spring and early Summer 1945. Oral history, written sources and history books report a large scale movement of people from East to West Austria after the arrival of the Red Army at the eastern border in late March 1945 until the finalization of the permanent occupation zones in July 1945 (Rathkolb, 1985; Eder and Halla, 2016). The Austrian civic population feared the arrival of the Red

Army mainly due to Nazi propaganda, poor reputation and reports of crimes by Red-Army soldiers against civilians in Eastern Europe (Mascher-Pichler, 2009; Stelzl-Marx, 2012). By contrast, regions liberated and occupied by the Western Allies were the main target of both internal and external refugees due to better living conditions and food supply right after the war (Beer, 1991; Iber *et al.*, 2008).[15] The period of mass migration ended with the zoning of Austria and associated travel restrictions across the occupation zone borders (*Control Agreements* among the Allies). The free movement of people across the western-Allies occupation-zone borders was reinstalled by 1947, and across the Soviet-occupation zone border by 1953. For Styria, which became part of the UK occupation zone in July 1945, there were no formal travel restriction across the 74-day-long line of contact. However, there are reports that the Red Army stopped people at checkpoints and tried to capture Nazis that fled to the west (Iber *et al.*, 2008).

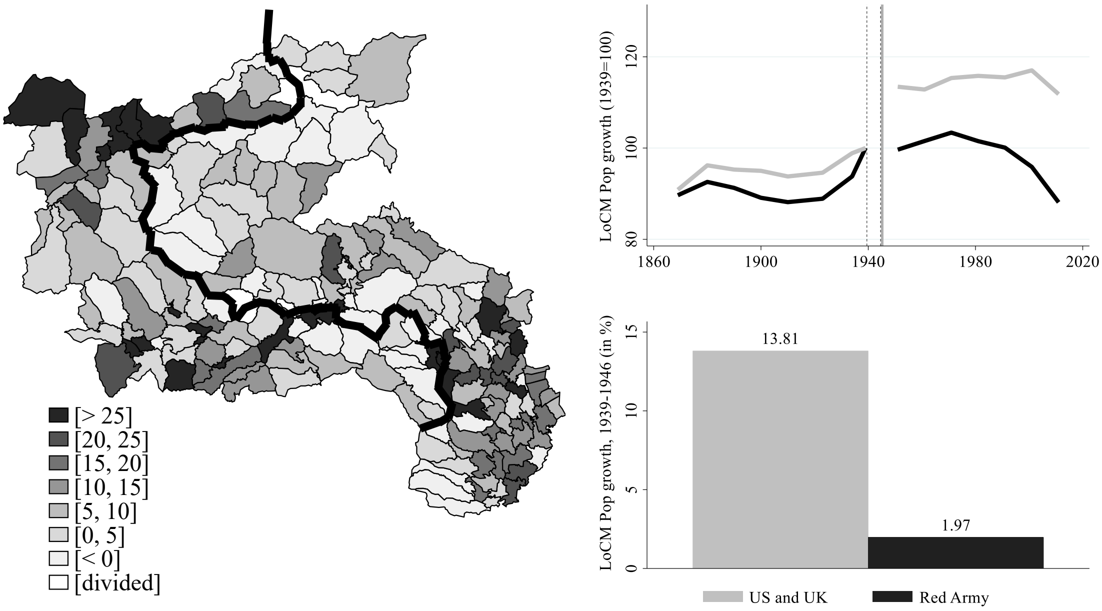
The above-mentioned shifts in population from eastern to western Austria are also visible in population counts: Neither internal migration nor any westward movement of people took place until January 1945 according to the last available district data before the end of WWII (see Figure C.4 in the Online Appendix). By Fall 1946, however, the first postwar population counts based on food voucher data show a massive increase of population in the Western occupation zones, while the Soviet occupation zone had shrunk. In particular, the Soviet occupation zone and quatripartite Vienna lost more than 326,000 inhabitants from 1939 to 1946, while the overall population of Austria grew by around 2.5% during this period—despite more than 200,000 direct and indirect victims of the war—mainly due to the arrival of external refugees and higher fertility rates in the early 1940s. Figure C.5 in the Online Appendix shows population figures by occupation zone and for Vienna from 1869 to 2011 and confirms the reports of a mass exodus of people from eastern to western Austria; quadripartite Vienna and the Soviet occupation zone saw post-war population decline while the population in the Western occupation zones increased.[16]

The population dynamics within Styria are illustrated on the left-hand side in Figure 4 for the municipalities within 20 kilometers of the line of contact (RD sample) and in Figure C.6 in the Online Appendix for the whole of Styria. The figures on the right-hand side in Figure 4 report a rather stable number of population in Red-Army-liberated line of contact municipalities, while the adjacent places, which were liberated by US and UK troops

[15] Apart from large-scale internal migration, however, Austria and especially the US zone were also a favored place for ethnic German expellees from Eastern and Southeastern Europe. Radspieler (1955) and Slapnicka (1986) estimate 500,000 to one million temporary foreign refugees after the war, of which the majority left Austria for Germany in 1945 (Stieber, 1995). Nevertheless, there were more than 300,000 naturalizations (a measure for settlement patterns of foreign refugees after WWII) in Austria from 1946 to 1951; this accounts for 4.4% (Styria: 4.2%) of the total population by 1951 (StatistikAustria, 2014). According to StatistikAustria (2014), naturalization during the late 1940s and early 1950s was uniform across Austria. Therefore, external migration cannot explain the westward shift in population.

[16] The Austrian capital city of Vienna started to shrink before WWII because the Jewish population of Austria, mostly residing in Vienna, had already started to leave Austria before 1939.

Figure 4: Population dynamics across the line of contact (in %)



Notes: The figures show population growth at the municipality level across the line of contact in Styria. The map on the left-hand side shows the population growth for 191 municipalities within 20 kilometers of the line of contact (RD sample). The bold black line depicts the line of contact. The right-hand figures depict the average municipality population growth for line of contact municipalities (LoCM). The upper graph shows population figures by liberation force from 1869 to 2011 (1939=100, pairwise sample) and the bottom figure from 1939 (last census before WWII) to 1946 (food vouchers data).

experienced a population boost by almost 14% from 1939 to 1946. This is remarkable given that migration across the line of contact was free, and that the Red Army has withdrawn from the region for more than one year before the population count in 1946. The line of contact, and the short-term presence of the Red Army in Styria, thus shocked regional population density. It is therefore likely that the initial settlement of refugees during Spring and early Summer 1945 account for these figures, i.e., that relocation of refugees did not occur on a large scale after the Red Army withdrew from Styria.[17]

An empirical test on the determinants of population growth from 1939 to 1946 in Styria reveals that—besides the relative shrinkage of places seized by the Red Army—regions close to Styria's capital city of Graz and the flat to hilly landscape relatively grew, while more rural and mountainous places relatively shrunk.[18] Overall, however, the population in Styria increased until 1946 by around 8% mainly due to the arrival of refugees. To sum up, the reported facts strongly suggest that mainly Austrian internal refugees relatively avoided settling in regions initially seized by the Red Army.

[17]The entire period right after the war is under-studied, in particular at the subregional level. Given the data for Styria, it is possible that internal Styrian refugees returned home after the withdrawal of the Red Army, while refugees from eastern Austria, i.e., from the permanent Soviet occupation zone, remained.

[18]Table C.2 in the Online Appendix shows these results of regressing population changes from 1939 to 1946 on the liberation treatment and various time-invariant controls in different subsamples with Styrian municipalities. In all subsamples and independent of time-invariant controls, the Red-Army-liberated places shrunk relatively from 1939 to 1946. The shrinkage was stronger close to the line of contact.

3 Data and summary statistics

3.1 The line of contact

My dataset comprises municipality-level data on the liberation treatment after WWII. The liberation status of Styrian municipalities mainly stems from Red-Army reports of local checkpoints (Iber *et al.*, 2008). Checkpoints were often located between localities, which allows me to assign the liberation treatment at the municipality level (see Online Appendix A for more details). I cross-checked the unclear liberation treatment of Kleinlobming, Lassing, Modriach, Salla and St. Georgen ob Judenburg with the respective municipality chronicle.[19] Nevertheless, the line of contact did not necessarily follow (2011) municipality borders. Some farms in the municipalities of Edelschrott and Kleinlobming and the hamlet of Piber in the city of Köflach were divided from their main municipality. I assign the liberation treatment in these cases according to liberation of the respective main locality.[20] The upper panel of the summary statistics in Table C.3 in the Online Appendix shows that 446 (82%) Styrian municipalities were seized by the Red Army, while 37 (7%) and 56 (10%) municipalities were liberated by US and UK troops respectively. Three municipalities (Hieflau, St. Georgen, Judenburg) were divided between the Red Army and Western forces and are excluded in all empirical analyses.

3.2 Variables

The dataset uses hand-collected archival data and data retrieved from the Statistical Office of Austria. I collect data on population figures, socio-demographic variables, sector shares, communal tax revenues and birth and death statistics for Styrian and Carinthian municipalities. Population data base on (mostly decennial) censuses and register data from 1869 to 1939 and for 1951 to 2011. I add self-compiled population data for the direct aftermath of WWII in 1946 based on food voucher statistics, and district measures for population figures during WWII. I further digitize the hard-copy municipality data on demographic variables, sector composition of residents (according to the head of the family) and birth and death statistics for 1934 to 1971 (all data whenever available). More recent data on socio-demographic variables, sector composition, local work places per sector, local numbers of firms/establishments, education level, and communal tax revenues are retrieved from the statistical database *StatCube* by Statistik Austria. I further digitize the machinery in agriculture for the 1950s and 1960s at the court district level. The main unit of analysis is the municipality's territorial status as of 2011.[21] I follow mergers of

[19] I would like to thank Dr. Ernst Reinhold Lasnik for information on the municipality of Salla.

[20] The empirical results do not change when excluding the municipalities of Kleinlobming, Edelschrott and Köflach from the main analysis. Results are available upon request.

[21] 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 intra-Styrian line of contact. However, a

municipalities from the 1920s until 2011. Online Appendix B provides more details on data, list all relevant data sources and describes the construction of my dataset.

Table C.3 in the Online Appendix shows the summary statistics for Styria, the RD sample and for the line-of-contact municipalities. Census data for 1939 and 1951 show that Styria was an agricultural society around WWII—approximately 60–70% of the population (according to the head of the family) belonged to the agricultural sector. Data for 2011 show the sector change towards industry and services and that the average firm is small: Average workplaces per firm are around 4, and average workplaces per industrial firm are around 10. Communal tax revenue per local employee is around 400 Euro, implying an average wage sum per employee (full and part-time employees) of around 14,000 Euro. Finally, the bottom panel shows geographic characteristics of Styrian municipalities.

4 Empirical identification strategy

This section introduces the empirical identification strategies and the respective identifying assumptions for causal inference to test for the long-lasting economic impacts of the Red-Army presence after WWII. I employ pairwise estimates with contiguous line-of-contact municipalities and single- and multi-dimensional regression discontinuity designs.

4.1 Pairwise estimates with line of contact municipalities

The first empirical specification limits the analysis to contiguous municipality pairs on both sides of the line of contact. This approach exploits the liberation treatment among neighboring municipalities on subsequent socio-economic outcomes. Each Red-Army-liberated municipality is matched to one or many direct geographical neighbours liberated by the Western Allies. A pair thus consists of two municipalities that share a common land border but experienced a different liberation treatment (Red Army vs. Western Allies).[22] These pairwise estimates base on Holmes (1998) and Dube *et al.* (2010) or more recently Lichter *et al.* (2020) or Galofré-Vilà *et al.* (2021). Pairwise estimates with contiguous municipalities is a form of regression discontinuity design to control for unobservable heterogeneity. The cross-sectional pairwise estimate takes the following form:[23]

$$Y_{i,p} = \alpha + \beta RedArmy_{i,p} + \mu_p + \epsilon_p \tag{1}$$

$Y_{i,p}$ is the outcome in municipality i in the contiguous pair p. The main outcome variables are post-WWII population and sector growth and communal tax revenue per employee.

territorial reform in 2015 reduced the number of municipalities further to 287, and mergers occurred across the former line of contact. Recent data will thus not allow a sharp RD design anymore.

[22] In the case of multiple contiguous municipalities on the other side of the line of contact, this municipality is then repeatedly part of the respective contiguous municipality-pair.

[23] Section 6.6 and Section 7.2 making use of the time dimension of some data and employing difference-in-differences pairwise estimates.

However, Y_i are also pre-treatment covariates to control for smoothness before treatment. α is a constant. $RedArmy_{i,p}$ is a dummy variable that equals one (zero) for municipality i in pair p that was liberated by the Red Army in May 1945 (liberated by the Western Allies). μ_p are contiguous line-of-contact municipality-pair dummies. The coefficient β thus captures differences between contiguous municipalities with a different liberation history. The error term is denoted by ϵ_p. Standard errors are clustered at the contiguous municipality-pair level. This pairwise estimate is a powerful method to estimate local average treatment effects in a very homogeneous sample. Equation 1 does not include any further municipality controls. Instead of including controls at the municipality level, I show the smoothness of pre-treatment covariates and time-invariant geographic characteristics in the section below. Moreover, potential contemporaneous covariates are bad controls since they are likely to also be affected by the treatment (Angrist and Pischke, 2009).

4.2 (Spatial) regression discontinuity design and sample selection

The second empirical specification employs the standard regression discontinuity (RD) design, which includes the respective hinterland of the line-of-contact municipalities. 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-day-long line of contact 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 regression in the RD approach takes the following form:

$$Y_{i,j} = \alpha + \beta RedArmy_i + f(geolocation_i) + \phi_j + X_i'\gamma + \epsilon_i \tag{2}$$

Y_{ij} denotes the dependent variable of interest (post-WWII population growth, communal tax revenue per employee, sector shares, etc.) in municipality i along border segment j. $RedArmy_i$ is a dummy variable that equals one (zero) for municipalities in the east of the line of contact that were seized by the Red Army (west of the line of contact, liberated by the Western Allies). The three partitioned municipalities (Landl, St. Georgen and Judenburg), which are directly located on the line of contact, are excluded in all analyses. The coefficient β captures spatial discontinuities in the outcome Y_{ij} when crossing the line of contact from the west to the east, i.e., from the municipalities liberated by the Western Allies to those seized by the Red Army. The RD polynomial, $f(geolocation_i)$, controls for smooth functions of geographic location. I employ distance in kilometers of the nearest line of contact municipality as a single-dimensional forcing variable[24] and longitude and

[24] I use the closest distance in kilometers to the respective municipalities' centroids as in, e.g., Eugster *et al.* (2011). I do not use the distance to municipality borders because (i) present-day borders do not necessarily coincide with the line of contact, (ii) I can only assign localities, not the entire territory of a municipality, to a liberation force (Iber *et al.*, 2008) and (iii) the use of centroids give similar distances to the line of contact independent of a municipality's area (see the discussion in Schumann (2014)).

latitude as multi-dimensional forcing variables (Dell, 2010). The main functional forms of $f(geolocation_i)$ are a cubic polynomial fit to test for discontinuity in population figures and a quadratic polynomial fit to test for discontinuity in communal tax revenues. The polynomials for the respective outcome are derived from optimal bandwidth selection criteria (Calonico *et al.*, 2014a,b) and are discussed in more detail below. Table C.4 in the Online Appendix reports the main functional forms of $f(geolocation_i)$ and also reports all other RD polynomials that are employed in the paper. ϕ_j is a set of border segment fixed effects that captures heterogeneous geographic treatment effects *along* the line of contact.[25] X_i represents a vector of time-invariant geographic control variables that predict post-WWII settlement patterns independent of the liberation treatment.[26] α is a constant. ϵ_{it} is the error term. Standard errors are corrected for spatial dependence (Conley, 1999, 2010).[27] Spatial clustering addresses inference issues raised by Kelly (2019).

I employ both single-dimensional and multi-dimensional RD estimates with a common RD sample. I use the optimal bandwidth selection criteria developed by Calonico *et al.* (2014a,b) for a single-dimensional forcing variable.[28] Table C.5 in the Online Appendix tests the main outcome variables (population growth from 1939 until 2011 and communal tax revenue per local employee in 2011) with different polynomial fits. Average bandwidths are close to 20 kilometers. I thus define the RD sample as municipalities located within 20 kilometers of the nearest line-of-contact municipality. A cubic polynomial fit for population figures and a quadratic polynomial fit for tax figures have bandwidths closest to the overall averages. These functional forms for $f(geolocation_i)$ will thus be used in the main specifications. However, I will also employ alternative bandwidths, polynomial fits and different specifications of robust bias-corrected estimators with a data-driven bandwidth selection in a sensitivity check in Section 6.4.

4.3 Identifying assumptions and balance

The identifying assumption behind both empirical strategies (pairwise regression and RD) is that any potential outcome variable will run smoothly at the line of contact in the absence of treatment. This assumption is violated if the location of the line of contact was endogenous to municipality characteristics, which may affect post-WWII outcomes. I address potential endogeneity issues with the the line of contact as follows: (i) I restrict

[25] I divide the line of contact into three segments according to geographic consideration: The Enns Valley in the north (region of contact between the Red Army and the US troops), the central Mur Valley and the Graz region in the south (regions of contact between the Red Army and the UK troops).

[26] Geographic controls are the distance to Styria's capital Graz and distance to Graz squared, share of settlement area, elevation range, and roughness (see the discussion in Section 2.3).

[27] I use the Stata command provided by Hsiang (2010) in cross-sectional estimates and the command by Colella *et al.* (2019) for panel estimates to correct for spatial dependence of the standard errors. I will provide estimates with different spatial cutoffs in a sensitivity analysis.

[28] Optimal bandwidth selection with multiple forcing variables (Cattaneo *et al.*, 2020) require straight cut-offs in both dimensions and are thus not feasible for the strongly curved line of contact in Styria.

the main analysis to the quasi-exogenous part of the line of contact within Styria only, (ii) I show the smoothness of economic variables across the line of contact prior to WWII, (iii) I qualitatively show that the line of contact was neither a historical border nor any other administrative border until today, and (iv) I argue that sorting into the liberation treatment did not occur. I provide evidence of these assumptions below.

Line of contact: To alleviate the identification concerns, I focus on the line of contact *within* the Austrian federal state of Styria alone. The extension of the line of contact toward the south follows the mountain range of the Koralpe and forms the federal state border between Styria and Carinthia, and is thus not part of the main analysis. Focusing on within-federal-state variation rules out that the results might be driven by idiosyncratic differences between federal states. Furthermore, the line of contact on May 8, 1945, was not a region of any ground battle and was not a location for any defensive wall by the Nazis (Brettner, 2013). The capture of Styria did not follow any liberation plan or any coordination among the Allies (Pickl, 1995; Iber *et al.*, 2008; Stelzl-Marx, 2012). The liberation of Styria can be described as rather chaotic. This is also illustrated by the fact that there were many competing occupation plans by the Allies, and none of them planned to seize Styria close to the line of contact (Erickson, 1950). See more details on the exact timing of the liberation in Section 2.1 and in the Online Appendix A. I also do not find any pre-liberation sorting of people towards the West based on population counts in January 1945 (see Figure C.4 in the Online Appendix). This confirms that any division of Austria was not anticipated until the end of WWII. Moreover, the majority of the line of contact within Styria does not follow natural borders. Mountain ranges might isolate economic regions, i.e., if one valley had been liberated by the Red Army, and another by the Western Allies. However, the line of contact does not follow mountain ranges. The Allies met each other *within* valleys (Enns and Mur) or met in the flat to hilly landscape in the region of Graz. The sole exception of natural borders forming the line of contact are the River Enns and River Mur for some kilometers. Rivers in Styria, however, should not isolate economic regions since bridges are frequent, and both river banks have similar characteristics. Nevertheless, I will control for the potential effects of rivers in Section 6.5. Overall, the line of contact *within* Styria was exogenous and does not divide economic regions. Whether a certain municipality was just the last one to be seized by the Red Army was random and not foreseeable.

Balance of pre-WWII covariates: I explore the validity of my design by checking for smoothness of time-invariant geographic covariates and pre-WWII socio-economic characteristics based on the population census in 1934 and 1939. Figure 4 has already shown similar population trends across the line of contact before WWII. Table 1 shows the results of a balance test for the RD sample (mean comparison in Panel A, and single and multi-dimensional RD estimates in Panels C and D respectively) and for contiguous

Table 1: Smoothness of pre-treatment (pre-WWII) covariates across the line of contact

	Dependent variable: Municipality covariates															
	Geography				Census in 1934					Census in 1939						
	Area	Usable area	Sea level	Distance to Graz	Agrar	Industry	Unempl.	Female	Agrar	Industry	Farms <10ha	Farms/area	Self-employed	Pop/HH	Age <18	Age >65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel A: OLS dummy specification																
Red Army	0.30	5.53	-196.37***	-19.98***	-0.1	-1.37	1.15	0.15	0.07	-2.29	10.37**	1.48	-1.09	-0.44*	-1.32	0.41
	(0.61)	(5.36)	(68.95)	(3.88)	(6.83)	(5.57)	(1.41)	(0.40)	(6.37)	(5.27)	(4.44)	(1.43)	(5.36)	(0.24)	(0.87)	(0.32)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Mean of Dep. Var.	9.04	36.97	925.75	57.66	64.97	22.35	11.96	49.48	60.69	25.08	54.21	13.74	49.79	4.70	26.90	7.73
Segment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography FE	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Pairwise regression																
Red Army	-1.12	-0.79	-23.88	-2.80***	-2.31	-0.15	0.42	-0.01	-1.14	-0.93	1.24	1.27	-2.19	0.27	0.46	0.01
	(1.09)	(2.44)	(29.04)	(0.72)	(4.49)	(3.61)	(0.81)	(0.31)	(4.29)	(3.49)	(3.1)	(1.03)	(3.17)	(0.24)	(0.65)	(0.220)
No. of obs.	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
No. municipality	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Mean of Dep. Var.	9.78	29.18	1020.11	63.18	59.45	26.56	11.77	48.57	55.27	29.30	46.00	11.68	43.03	4.60	27.58	6.94
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Single-dimensional RDD																
Red Army	0.01	5.63	-141.15*	-7.97**	-0.34	-1.56	0.67	-0.03	1.42	-2.81	3.08	-0.06	-2.25	-0.07	-0.12	0.08
	(0.98)	(7.29)	(84.48)	(3.88)	(6.96)	(5.56)	(1.28)	(0.48)	(6.53)	(5.16)	(5.04)	(2.07)	(5.26)	(0.24)	(1.08)	(0.37)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Mean of Dep. Var.	9.04	36.97	925.75	57.66	64.97	22.35	11.96	49.48	60.69	25.08	54.21	13.74	49.79	4.70	26.90	7.73
Segment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography FE	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel D: Multi-dimensional RDD																
Red Army	-0.02	0.89	-7.58	-0.81**	4.65	-4.13	-0.97	-0.02	4.76	-4.82	1.65	-0.26	0.08	-0.10	-0.43	0.04
	(0.89)	(5.51)	(64.6)	(0.37)	(6.38)	(5.54)	(1.28)	(0.51)	(6.14)	(5.37)	(4.61)	(1.78)	(4.96)	(0.26)	(1.19)	(0.38)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Mean of Dep. Var.	9.04	36.97	925.75	57.66	64.97	22.35	11.96	49.48	60.69	25.08	54.21	13.74	49.79	4.70	26.90	7.73
Segment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography FE	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table tests for smoothness across the line of contact in various pre-treatment and time-invariant covariates. Columns (1) to (4) show geographic covariates, Columns (5) to (9) show covariates based on the census in 1934, and Columns (10) to (16) based on the census in 1939. Coefficients represent shares in percentage points except for area (in km^2), average sea level (in m), distance to Graz (in km), farms per area (farms per km^2) and population per household. The shares of the industrial sectors, of unemployed and of self-employed are according to the head of the family. Panels A, C and D consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RDD sample). Panel B consists of contiguous line-of-contact municipalities. Panel A employs an OLS dummy specification (Dummy=1 for Red-Army liberated municipalities, 0 otherwise). RDD estimates in Panels C and D employ a cubic polynomial fit. The estimates include segment and geography fixed effects. Smoothness of geographic and pre-treatment covariates without segment and geography fixed effects are shown in Table C.6 in the Online Appendix. Standard errors in parentheses in Panel B are clustered at the contiguous pair level and corrected for spatial dependence in Panels A, C and D. Significance levels: *** 0.01, ** 0.05, * 0.10.

line-of-contact municipalities (Panel B); it also reports the mean of the dependent variable. Despite some differences in the sample means (Panel A), I find no statistical significant discontinuities of covariates in all RD setups. The sole exception is the distance to Graz, which, given its location within the Red-Army-liberated part of Styria, is not surprising. Geographic characteristics such as area, share of settlement area and altitude (Columns (1) to (3)), sector shares of local residents, share of unemployed, farm and employment structure, gender ratios, people per household or shares of age cohorts vary smoothly across the line of contact prior to the treatment. The validity of this identifying assumption does not change if I repeat the balance test without any pair, segment and geographic fixed effects in the respective panels.[29] The line of contact thus divides a homogeneous region in terms of geography and pre-treatment socio-economic characteristics.

Historical or administrative borders: In addition to federal state borders, sub-regional borders (Keele and Titiunik, 2015) or long-gone historical borders might affect economic trajectories (Grosfeld and Zhuravskaya, 2015; Becker *et al.*, 2015; Bukowski, 2019). In Austria, districts form the administrative units between federal states and municipalities. Districts in Austria do not have any legislative or executive power; they have to follow the instructions from the federal or state government (Rihs, 2021).[30] However, the line of contact has never and still does not coincide with any district border. Furthermore, the demarcation line does not coincide with any historical border. The municipalities along the line of contact belonged to the same jurisdictional and historical entity for centuries prior to May 1945 (Duchy of Styria, Crown Land of Styria, federal state of Styria after 1918, and Reichsgau Styria during the period of Nazi Germany) and after July 1945 until today (UK occupation zone from July 1945 to 1955 and federal state of Styria) (Pirchegger, 1996). The sole exception of a different historical exposure across the line of contact was during the 74-day-long treatment period. I can thus rule out that sub-regional administrative or historical borders can shape economic outcomes across the line of contact.

Sorting into treatment: Another identification concern is whether the units of observation (municipalities) have manipulated their liberation treatment via, e.g., local resistance or negotiation. Negotiation on the location of the line of contact can be ruled out given the chaotic capture of Styria (see above) and the absence of evidence in the related literature. There was no local resistance or any land battles close to the line of contact.[31] The closest land battle took place during the withdrawal of the German Army at Schanzsattel, around 60 kilometers east of the later line of contact (Pickl, 1995). There is, however, an anecdote

[29]Table C.6 in the Online Appendix repeats the balance tests without fixed effects and confirms the smoothness of almost all covariates in RD estimates (Panels B to D). Distance to Graz does not show statistical discontinuities anymore, while altitude slightly differs in the single-dimensional RD.

[30]As such, local politicians cannot directly influence the economic trajectory of a district. But as an administrative unit, regional policies might differ across district borders, i.e, for EU structural funds.

[31]The relevant literature does not report on local resistance or land battles within 60 kilometers of the demarcation line (Pickl, 1995; Pirchegger, 1996; Iber *et al.*, 2008; Brettner, 2013; Stelzl-Marx, 2012).

of the municipality of Murau. Local citizens flagged thier town with the Union Jack in the hope of avoiding capture by the Red Army (Stelzl-Marx, 2012). In the end, Murau was located around 30 kilometers to the west of the line of contact (outside the RD sample) and was liberated by UK troops anyway. To sum up, local resistance and negotiations did not affect the drawing of the line of contact.

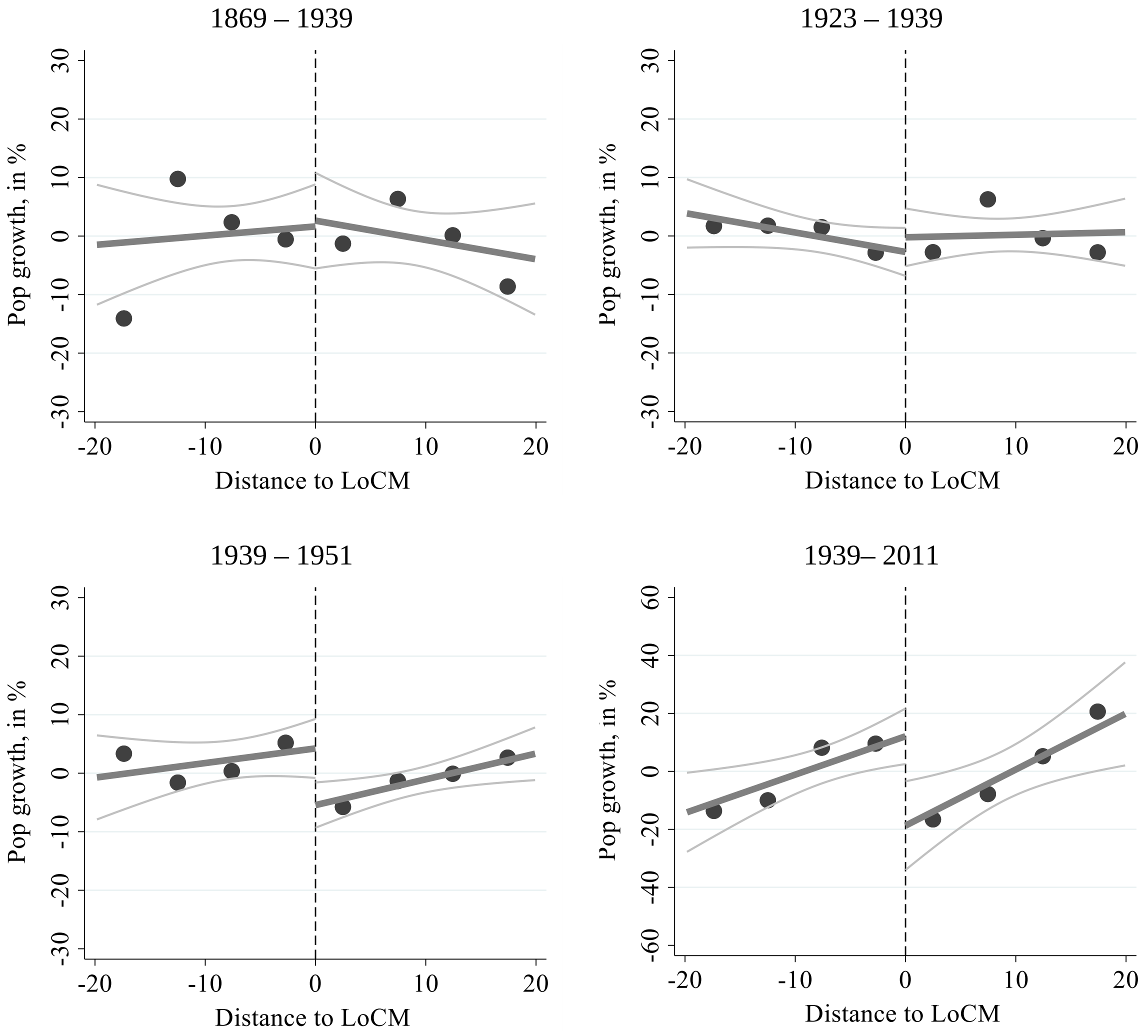
5 Main results

5.1 Population effects

I first test effects of the liberation treatment on population dynamics, a widely used proxy in regional economics. Figure 5 shows RD plots on population dynamics in respect to the last pre-treatment census in 1939. The upper two panels confirm that the later line of contact is also exogenous to population growth before treatment without any pre-treatment discontinuities. By contrast, the liberation matters after WWII. The lower panels show a sharp negative decline in population figures for places liberated by the Red Army. The initial relative decline in population across the line of contact after the war (lower left graph) more than doubled until 2011 (lower right graph). The RD plots also uncover that the effects are rather local; there is a general decline in population from the east to the west. I explain this result with the agglomeration effects of Styria's capital city of Graz, which is located in the east of the RD sample. Section 6.1 zooms into Graz and analyzes how the short period of Red-Army presence affects larger cities and agglomerations.

Empirical estimates confirm the graphical inspection. Table 2 shows the pairwise estimates with contiguous line-of-contact municipalities (Panel A), and RD estimates with single- (Panel B) and multi-dimensional forcing variables (Panel C). Columns (1) and (2) show the smoothness of population dynamics for the entire pre-WWII period and test for a potential shock due to WWI, respectively. Columns (3) and (4) report discontinuities from 1939 to 1946 (data based on food vouchers) and from 1939 to 1951 (first post-WWII census), respectively. These estimates confirm that the liberation had an immediate effect on population figures, even though the Red Army had completely withdrawn from Styria for more than one year (1946) and more than six years (1951). Column (5) shows that the initial relative decline of around 10–14% amplifies to 22% (Panel C) to almost 26% (Panel B) by 2011. Lastly, column (6) shows these amplifying population dynamics across the line of contact from 1951 to 2011. Table C.7 reports population dynamics across the line of contact from census year to census year, i.e., in approximately ten-year steps. While the initial post-WWII decline in population is large, the relative shrinkage of places liberated by the Red Army was modest but ongoing in the decades after, but accelerated somewhat in the 1990s. The legacy of the Red Army is long-lasting and shapes population figures even decades after the Red Army had withdrawn from Styria.

Figure 5: RD plots on population dynamics across the line of contact



Notes: The figures show RD plots on population growth in percentage points across the line of contact. All plots are based on a linear fit and include segment and geography fixed effects. The upper graphs show pre-treatment (pre-WWII) population figures; the bottom graphs show population figures after the liberation treatment. The bins represent local averages of municipalities within a 5-kilometer interval. Negative (positive) distances in all RD plots represent municipalities with respect to the nearest line of contact municipality (LoCM) that were liberated by the Western Allies (Red Army). The vertical dashed lines represent the line of contact. Thin grey lines represent 95% confidence intervals.

5.2 Labor productivity: Communal tax revenues

Next, I examine whether the line of contact is visible in present-day economic variables other than population figures. One of the most compelling indicators of regional economic activity is labor productivity. Local labor productivity combines different aspects of production conditions, i.e., the capital stock (technology), skill levels of workers and laborers, and variables including economies of scale and scope (Krugman, 1991; Davis and Dingel, 2019). To address the long-lasting impact of the liberation by the Red Army on local labor productivity, I rely on the communal tax in Austria (*Kommunalsteuer*). This tax, introduced in 1994, is a payroll-based payment that employers pay for locally

Table 2: Population dynamics across the line of contact

	Dependent variable: Municipality population growth (in %)					
	Pre-WWII		Pre-WWII vs. post-WWII			Post-WWII
	1869–1939	1910–1923	1939–1946	1939–1951	1939–2011	1951–2011
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pairwise regression						
Red Army	-1.19	1.41	-17.60***	-13.80***	-23.71***	-11.42*
	(6.14)	(2.26)	(4.65)	(3.05)	(7.66)	(5.78)
No. of obs.	90	90	90	90	90	90
No. of munc	48	48	48	48	48	48
Mean of Dep. Var.[a]	90.26	101.88	109.60	106.54	99.96	91.88
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted	0.56	0.70	0.64	0.74	0.69	0.68
Panel B: Single-dimensional RDD						
Red Army	-0.24	1.08	-11.18***	-11.60***	-25.70***	-14.23**
	(7.49)	(2.72)	(4.10)	(2.44)	(9.52)	(7.11)
No. of obs.	191	191	191	191	191	191
Mean of Dep. Var.[a]	89.84	101.40	109.26	107.12	115.44	105.97
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[b]	0.21	0.00	0.15	0.13	0.53	0.60
Panel C: Multi-dimensional RDD						
Red Army	1.57	-0.68	-6.43*	-9.74***	-22.14***	-11.87*
	(7.11)	(2.44)	(3.47)	(2.53)	(7.91)	(6.40)
No. of obs.	191	191	191	191	191	191
Mean of Dep. Var.[a]	89.84	101.40	109.26	107.12	115.44	105.97
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[b]	0.21	0.07	0.14	0.14	0.57	0.64

Notes: The table tests for spatial discontinuities in municipal population growth across line-of-contact municipalities (in percentage points). Columns (1) and (2) test for discontinuities in pre-treatment (pre-WWII) population figures; Columns (3) to (5) for pre-WWII versus post-WWII population growth and Column (6) for post-WWII population growth from 1951 to 2011. Panel A consists of contiguous line-of-contact municipalities and include pair fixed effects. Panels B and C consist of municipalities within 20 kilometers to the nearest line-of-contact municipality (RD sample). Panel B uses distance in kilometers of the nearest line-of-contact municipality, and Panel C uses longitude and latitude as the forcing variables. RD estimates employ a cubic polynomial fit and include segment and geography fixed effects. Point estimates on spatial discontinuities for all census years in respect to 1939 are shown in Figure C.7, and in Table C.7 for spatial discontinuities from census to census in the Online Appendix. a) Mean of the dependent variable is in respect to 1939=100 (to 1923 in Column (2)). b) Adj. R^2 measures stem from Stata's reg command. Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panel B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

employed people (Knirsch and Niemann, 2005). Private firms and establishments have to pay 3% of their total wage sum.[32] I divide the total communal tax revenues averaged for 2010 to 2012 (to account for year-to-year volatility) for each municipality by the number

[32]See the assessment of the taxable base and potential exceptions under `https://www.usp.gv.at/en/steuern-finanzen/kommunalsteuer.html`. For example, firms with a monthly wage sum below €1,460 get a tax allowance. Wages in public administration, schools or hospitals are not taxed. Self-employed, among them family farmers, are excluded, too. Note that certain occupations might be industrial but belong to a public company (electricity, waste industry, etc.). Unfortunately, I cannot distinguish my employee data by type of establishment. I thus add non-taxable occupations as controls to my estimates.

of employees in 2011 within the same municipality to get a proxy of local average wages, which is in turn a proxy for municipal labor productivity.

Table 3 tests for spatial discontinuities in communal tax revenues per local employee. Column (1) shows the baseline results for pairwise and different RD estimates without any economic control variables. Columns (2) to (5) sequentially control for local economic characteristics that might differ across the former line of contact and affect the taxable base directly. These are sector shares (i.e., to control for the share of agriculture as a non-taxable sector), firm size distribution, occupation characteristics (i.e, to account for differences in blue collar workers), and non-taxable occupations such as public servants or self-employed. Lastly, column (6) includes all these controls simultaneously.[33]

The estimates in Panel A and B shows a large and statistically significant decline in communal tax revenue per local employee when crossing the former line of contact from the Western Allies' to the Red Army's liberated parts. Effects are larger and more precisely estimated in the pairwise estimates with contiguous line-of-contact municipalities (Panel A) compared to single-dimensional RD estimates (Panel B). Estimates based on multi-dimensional forcing variables (Panel C), however, are smaller and barely statistical different from zero.[34] The results are substantial. By comparing the coefficients with the mean of the dependent variable in column (6), Red-Army-liberated municipalities face a lower communal tax base per local employee of 14% (57/410 in Panel C) up to 32% (139/431 in Panel A). These values are likely to be upward biased. For example, the wages of public servants are not part of the regressions, but this occupation group is paid equally across the former line of contact, which would level the wage differentials somewhat. Once again, the RD plots in Figure C.8 in the online Appendix depict the local nature of the decline of communal tax revenues; places closer Graz have much higher revenue figures.

These results are not sensitive to the base years employed in the regression. Table C.8 in the Online Appendix reports the same estimates with the tax revenues in 2011 only (instead of the three-year averages). As noted above, the communal tax was introduced in 1994, and data availability is only given for more recent years. However, Table C.9 in the Online Appendix tests for spatial discontinuities of other firm-related tax revenues in 1987 (business tax and an earlier type of wage sum tax) and compares them to the communal tax in 2011. I divide these tax figures by proxies of local employees (occupation data are missing for the 1980s). The results confirm that municipalities liberated by the Red Army also had less revenues in previous decades, but the effects are—given the used proxies for local employees—estimated with less precision.

[33] RD estimates on sector shares and other 2011 covariates are discussed in Section 7.2 and reported in Table 5 and Table C.22 in the Online Appendix.

[34] Tax revenues are more unequally distributed across space than population figures and as such, precise estimation in a relatively small RD sample is less feasible. In Section 6.2, I will show that in more homogeneous subsamples, tax figures also differ significantly in the multi-dimensional RD setup.

Table 3: Communal tax revenues per local employee

	Dependent variable: Communal tax revenues per local employee (in €)					
		Tax base controls				
	Baseline	Sector	Firm size	Occupation	Non-tax occupation	All controls
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pairwise regression						
Red Army	-153.29***	-119.60***	-203.91***	-129.58***	-127.13***	-149.31***
	(45.96)	(43.59)	(36.65)	(45.05)	(42.23)	(42.21)
No. of obs.	90	90	90	90	90	90
No. of munc.	48	48	48	48	48	48
Mean of Dep. Var.	431.39	431.39	431.39	431.39	431.39	431.39
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted	0.61	0.74	0.75	0.68	0.72	0.80
Panel B: Single-dimensional RDD						
Red Army	-106.71*	-95.88**	-126.32***	-87.98*	-98.72**	-99.61***
	(59.30)	(46.65)	(45.05)	(45.08)	(42.35)	(37.50)
No. of obs.	191	191	191	191	191	191
Mean of Dep. Var.	410.00	410.00	410.00	410.00	410.00	410.00
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[a]	0.21	0.48	0.44	0.46	0.45	0.54
Panel C: Multi-dimensional RDD						
Red Army	-74.22	-53.54	-87.91*	-47.62	-61.22	-57.35
	(55.60)	(50.00)	(48.64)	(44.48)	(43.56)	(43.72)
No. of obs.	191	191	191	191	191	191
Mean of Dep. Var.	410.00	410.00	410.00	410.00	410.00	410.00
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[a]	0.16	0.45	0.40	0.44	0.43	0.52

Notes: The table tests for spatial discontinuities in municipal tax revenues per local employee (average of 2010-2012) across the intra-Styrian line of contact. Column (1) shows the baseline specification without any tax-base controls. Columns (2) to (5) include different economic variables that determine the taxable base (Sector controls: Share of workplaces in industry, share of workplaces in services (agriculture as residual); Firm size controls: Workplaces divided by the number of firms, industrial workplaces divided by the number of industrial firms; Occupation controls: Share of blue-collar workers; Non-tax occupation controls: Share of self-employed, share of workplaces in public administration). Column (6) includes all tax base controls simultaneously. Panel A consists of contiguous line-of-contact municipalities and includes pair fixed effects. Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). RD estimates employ a quadratic polynomial fit and include segment and geography fixed effects. Spatial discontinuities of variables that affect the taxable base are shown in Table C.22 in the Online Appendix. a) Adj. R^2 measures stem from Stata's reg command. Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panel B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

6 Robustness checks

I test alternative specifications to show the robustness of the long-lasting legacy of the Red Army. I investigate the effects on big cities and agglomerations (Section 6.1), document heterogeneous effects along the line of contact (Section 6.2), and show that regional shocks and regional policies cannot explain persistence (Section 6.3). I also test alternative RD specifications and inference (Section 6.4), look at pseudo-lines of contact (Section 6.5), and employ a differences-in-difference setup (Section 6.6). These exercises confirm that the Red Army's hostility after WWII causes economic backwardness in the long-run.

6.1 Going urban: SCM with the city of Graz

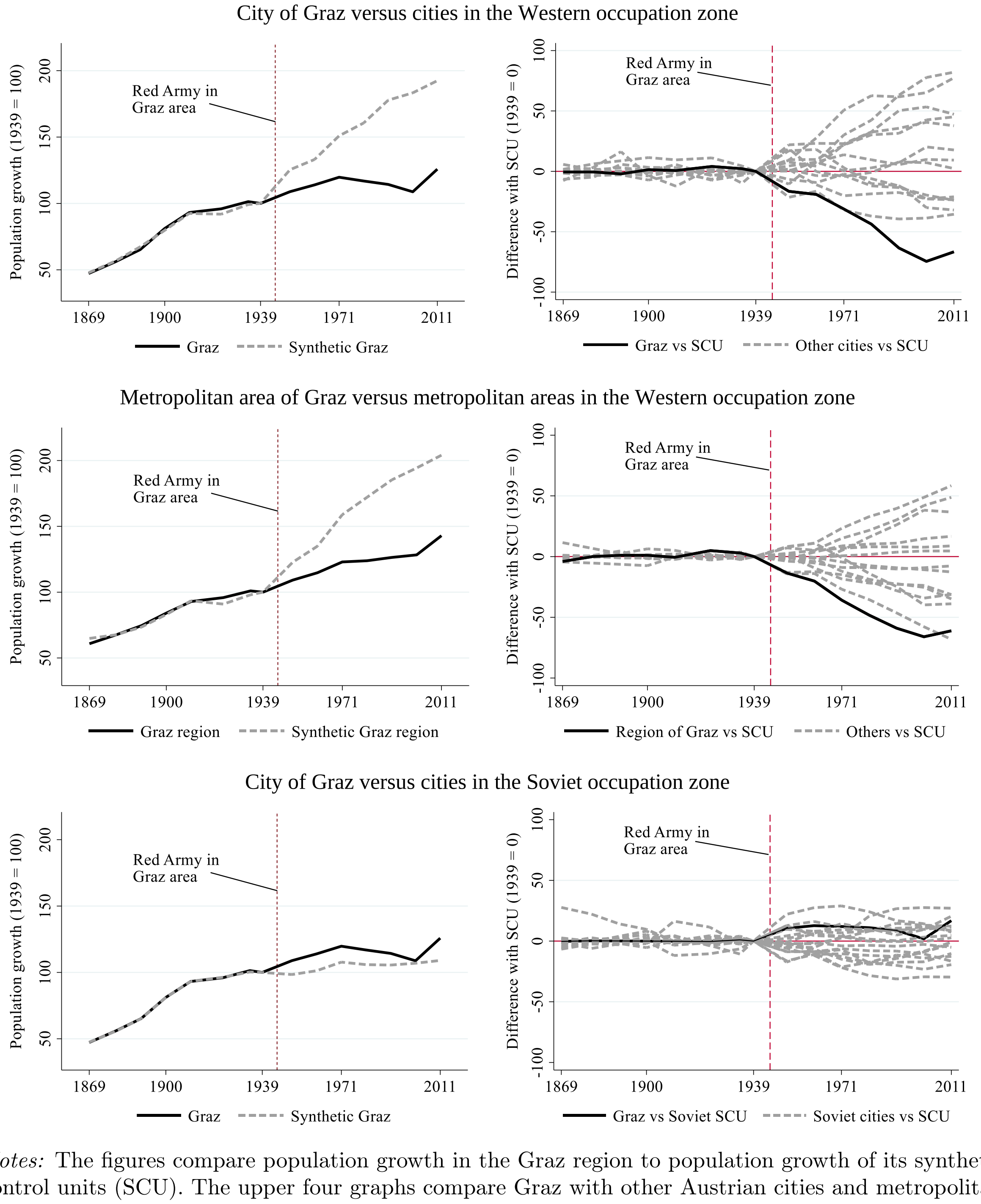
Estimates so far have shown that there is a decline in post-WWII economic activity across the line of contact in areas that were seized by the Red Army. However, RD plots on population dynamics (Figure 5) and communal tax revenue per employee (Figure C.8 in the Online Appendix) have also uncovered that the treatment effects are rather local. There seems to be a general increase in economic activity towards the east, i.e., towards regions that were fully seized by the Red Army. In fact, the economic heartland of Styria is the region in the east of the main RD sample around the Styrian capital city of Graz.

This section tests whether the Red-Army's legacy also matters for regions far away from the line of contact. I focus on the city and agglomeration area of Graz and compare the population dynamic after WWII with other major Austrian metropolitan areas. I employ the synthetic control method (SCM), a technique often applied in comparative studies when one or few aggregate units were exposed to an intervention (Abadie and Gardeazabal, 2003; Abadie *et al.*, 2015). The main advantage of building a regional synthetic control is that the pre-intervention characteristics of the treated region is accurately approximated by a combination of untreated regions in the donor pool rather than by any unaffected unit alone (Abadie, 2021). In the case of Styria, the city of Graz is by far the largest city in the area, and the same applies to the metropolitan area of Graz. Graz also shares similar de-urbanization patterns with other Austrian cities since the 1960s when mainly the surrounding areas of cities experienced rapid population growth. As such, I compare the city Graz and its metropolitan area to other main cities and their metropolitan areas in the rest of Austria. I repeat this exercise twice, once with cities/metropolitan areas in West Austria that were liberated and occupied by the Western Allies after WWII, and once with cities/metropolitan areas in East Austria that were seized by the Red Army and were part of the 10-year-long Soviet occupation zone. Table C.10 in the Online Appendix shows the respective donor pools to Graz and its metropolitan area.[35] I standardize city/metroplitan population to 100 for the last pre-intervention census in 1939; this scaling is suggested by Abadie (2021) to correct for differences in absolute size between the units.

Figure 6 shows the main outcome of the SCM. The left-hand side graphs plot the population dynamics of Graz and its metropolitan area versus the respective synthetic control unit. The upper and middle graphs show that Graz and its metropolitan area grew moderately after WWII. The population of Graz and its metropolitan area grew by around 25–40%

[35] The donor pool consists of all 30 cities with more than 10,000 inhabitants in 1939. Vienna is excluded because of its quadripartite occupation status. Metropolitan areas consist of all municipalities within a 25 kilometer great-circle distance of the respective city with the same occupation treatment from 1945–1955.

Figure 6: Synthetic control method with Graz



Notes: The figures compare population growth in the Graz region to population growth of its synthetic control units (SCU). The upper four graphs compare Graz with other Austrian cities and metropolitan areas (municipalities within 25 kilometers of the respective city) that were seized and occupied by the Western Allies. The bottom graphs compare Graz with other Austrian cities that were seized by the Red Army in 1945 and occupied by the Soviet Union from 1945 to 1955. The respective donor pools consist of Austrian cities with more than 10,000 inhabitants in 1939 (see Table C.10 in the Online Appendix). The graphs on the left compare the city of Graz (metropolitan area of Graz) with its SCU; the graphs on the right show the relative change in population of all major cities (all major metropolitan areas) compared to their respective SCU. SCUs are matched over population trends before WWII and normalized to 100 for 1939. The SCU for Graz consists of Feldkirch (40.5%), Bregenz (33.7%) and Bad Ischl (25.8%). The SCU for the metropolitan area of Graz consists of Feldkrich (57.1%), Bad Ischl (32.3%) and Innsbruck (10.6%). The SCU for Graz with eastern cities consists of Schwechat (28.4%), Waidhofen an der Ybbs (23.3%), Ternitz (19.7%), Mödling (14.5%), St. Pölten (9.0%), Hollabrunn (4.1%) and Amstetten (1,0%).

by 2011, while the population of the respective synthetic control units consisting of cities/metropolitan areas in West Austria doubled. The right-hand graphs in Figure 6 plot differences between all units of the donor pool, including Graz/metropolitan area of Graz, to their respective synthetic control units. This is a way of inference of the SCM suggested by Abadie *et al.* (2015). Graz and its metropolitan area are clear outliers when compared to other cities/metropolitan areas in West Austria. By contrast, the graphs on the bottom in Figure 6 compares the city of Graz with cities in East Austria, i.e., cities that were seized by the Red Army and occupied by the Soviets for more than 10 years. The population dynamics of Graz seem to follow the eastern legacy with long-run Soviet occupation. I also show that the SCM is not sensitive to the inclusion of other matching variables in the pre-treatment period. Figure C.9 in the Online Appendix shows SCM plots with matching over population dynamics and socio-economic variables (occupational shares, density and gender). Matching with alternative variables confirms the rather weak growth performance of Graz. Reducing the donor pool to other state capital cities show that Graz has by far the weakest population dynamics of all state capitals in West Austria (bottom graphs in Figure C.9). To sum up, focusing on Graz and its metropolitan area shows that urban places are also affected by the Red Army's legacy. The analysis with East and West Austrian cities shows that the short liberation treatment of 74 days has similar effects as a 10-year lasting occupation by the Soviet Union.

6.2 Heterogeneous effects along the line of contact

In this section, I examine differences in long-run economic outcomes *along* the line of contact. I first examine whether the liberation of Styria led to different economic trajectories along the line of contact between the Red Army on the one hand and US and UK troops separately on the other hand and whether these initial differences persist to the present day. While the Red Army was advancing from the east, US troops liberated parts of the northwest of Styria (Enns Valley) and the UK troops liberated parts of central- and south-west Styria (Mur Valley and Graz region). Figure C.10 in the Online Appendix shows these regional subsamples of heterogeneous liberation treatment, and Figure C.11 depicts the respective population diagrams from 1869 to 2011. Generally, the relative economic decline of Red-Army-liberated places was strongest compared to neighboring US liberated regions (see Columns (1) to (3) in Table C.11 in the Online Appendix). Right after the war, streams of refugees mainly targeted regions liberated by the US because of better food provision there (Slapnicka, 1986). Depending on the model, this initial relative decline in population in northwestern Styria doubled to 33% (single-dimensional RD) to 56% (pairwise estimates) by 2011 in Red-Army-liberated places. In the Mur Valley and Graz region, where the Red Army met the UK troops on May 8, 1945, the initial decline in population was less severe but is still substantial today. Moreover, communal tax revenues per local employee are estimated more precisely in this subsample; even the coefficient of the two-dimensional RD is highly statistical significant (Panel C in column (6) in Table C.11). Lastly, Columns (7) to (12) include the extension of the line of contact along the Styrian-Carinthian state border, and also examine the effects for the state-border sample alone. This segment of the line of contact is not exogenous and follows a mountain range. The results are comparable with the main results.[36] I conclude that initial differences, mainly of refugee flows, persist and amplify until 2011, that state borders do not affect the outcome, and that the effects on tax figures as a measure of local labor productivity are often estimated with more precision in regional and more homogeneous subsamples.

6.3 Regional shocks and policies

Regions on either side of the line of contact might have been affected by different region-specific shocks or policies during or after WWII, which in turn may (partially) explain present-day differences. I thus examine whether local shocks and policies such as aerial bombing by the Allies during WWII, officially reported dismantling activities by the Red Army during their 74-day-long presence in Styria, the construction of local infrastructure after WWII and eligibility for regional structural funds from the European Union matters in explaining spatial discontinuity in economic activity across the line of contact.[37] Localities that are affected by the respective regional shocks or policies are illustrated in Figure C.12 in the Online Appendix. Graphical inspection reveals that these shocks or policies do not differ across the line of contact.[38] However, I also examine their effects empirically. The results in Table C.12 (population figures) and Table C.13 (tax figures) in the Online Appendix repeat the main empirical specifications (pairwise estimates, single- and multi-dimensional RDs) and include dummy variables that equal one for municipalities that were affected by the respective shocks or policies (zero otherwise). Spatial discontinuities are hardly affected by the step-wise and simultaneous inclusion of these dummies (compared to the baseline results in Tables 2 and 3). If anything, the precision of the estimates—mainly for the tax figures—increases. The respective shocks or policies themselves have ambiguous and almost no statistically significant effects on population and tax figures.[39] Thus,

[36] Estimates in some specifications are not always precise because of the rather small sample size.

[37] Data on air strikes during WWII are from Ulrich (1978) and the localities of officially dismantled plants from Iber *et al.* (2008). The respective dummy variables include targeted municipalities and their direct neighbours. Municipalities exposed to infrastructure investments since WWII include all municipalities within a 10 kilometer distance of the nearest highway slip road in 2011. Local eligibility for the European Regional Development Fund (ERDF) for 2000 to 2006 period stem from the European Commission (`https://ec.europa.eu/regional_policy/en/funding/erdf/`) and include 'Objective 2' and 'Phasing-out' regions. There was no EU ERDF funding before Austria joined the EU in 1995.

[38] I am not aware of any other shocks or polices that might differ across the line of contact. For example, there were no combat operations near the line of contact (see Section 4.3) and the Marshall Plan from 1948 to 1952/3 only marginally targeted Styria (Hofbauer, 1992) (no data at the local level available).

[39] Tax figures are positively correlated with areal bombings during WWII, and negatively correlated with ERDF eligibility. This is, however, explained by the nature of the respective policy: Bombing targeted economic centers that are also richer today, and the ERDF has targeted present-day poor regions.

region-specific shocks and policies, including the loss of tangible assets due to bombing and dismantling, cannot explain spatial discontinuity in present-day economic activity.

6.4 Sensitivity analyses

This section tests whether the main results are sensitive to alternative RD specifications, different bandwidth choices or alternative ways to calculate the standard errors, and examines a multiple-hypothesis test. All tables and figures of the respective sensitivity analyses are reported in the Online Appendix C. First, I use different functional forms of the RD polynomial, $f(geolocation_i)$. Table C.14 examines spatial discontinuities for linear, quadratic, cubic and quartic polynomial fits in both single- and multi-dimensional RDs, and Figure C.7 shows coefficient plots of spatial discontinuities in population figures with respect to 1939 for all census years. Results are robust with somewhat smaller and less-precise estimates in the multi-dimensional RD for population figures only. Second, I vary the RD sample and employ bandwidths of 10, 15, 25 and 30 kilometers and robust bias-corrected estimators based on various RD polynomials with a data-driven equal and unequal bandwidth selection (Calonico *et al.*, 2014a,b). Tables C.15 and C.16, respectively, report that the baseline estimates are robust to these alternative specifications; the precision of the estimates even increases when allowing for unequal bandwidths, while estimates in very small samples (i.e., 10km) somewhat loose precision.[40] Third, Table C.17 reports statistical inference with varying cutoffs for spatially clustered standard errors and for alternative specifications of the standard errors. Results are robust, but inference becomes ambiguous when the spatial cutoff is increased. Generally, larger cutoffs also yield higher statistical significance for communal tax revenues in the multi-dimensional RDs. Lastly, Table C.18 shows that the effects on the main outcomes (population and tax figures) remain statistically significant when adjusting the p-values for multiple hypothesis testing based on List *et al.* (2019) and adapted for regressions by Barsbai *et al.* (2020).

6.5 Soviet proposal and pseudo-treatments

The results might be driven by the respective Allies capturing specific regions, by segments of the line of contact that consist of natural borders, and by a general economic east-west gradient in economic activity. First, I account for strategic liberation of Styria by looking at the only occupation proposal by the Soviet Union from 1944 that aimed to divide Styria. This proposal suggested dividing Styria along mountain ranges and district borders. Second, I propose the River Mur in Central Styria as a natural east-west divide. This pseudo-line of contact accounts for the fact that parts of the realized line of contact follows the River Enns in northwestern Styria, and for some kilometers the River Mur in the Mur Valley. Third, I apply two rather technical pseudo-lines of contact by shifting the line of

[40]Figure C.13 shows the respective regional samples for bandwidths of 10, 15, 20, 25 and 30 kilometers.

contact 20 and 40 kilometers eastward (within the Red-Army-liberated parts). Table C.19 in the Online Appendix examines pairwise and RD estimates across all these pseudo-lines of contact in Styria, and Figure C.14 shows the location of the respective pseudo-samples. The results confirm that the initial Soviet occupation proposal, natural borders and a general east-west gradient in economic activity are not the driver of the main results.[41]

6.6 Differences-in-difference with population figures

I also compare the RD estimates of the population figures with a differences-in-difference (DiD) approach. Table C.20 in the Online Appendix shows various DiD specifications with annualized population growth rates. I run a pairwise and conventional DiD with line of contact municipalities and also examine the treatment effects from census year to census year. The results are comparable with the RD estimates: The relative annualized decline in population in Red-Army-liberated places is 0.46% (Column (3) in Table C.20); this implies a relative shrinkage of around 33% from 1939 until 2011 (0.46×72 years), which is slightly above the pairwise and RD estimates in Section 5.1. Concerning subperiods, the population shrinks mainly in the initial period after WWII. With an enlargement of the bandwidth of included municipalities in the DiD to 5, 10 and 20 kilometers, the effects start to fade out, pointing to the local structure of the effect. I conclude that a differences-in-difference approach yields similar or even larger effects than the RD approach.

7 Mechanism of long-run regional inequality

The analysis has shown that the 74-day-long line of contact after WWII between the Red Army and the Western Allies has long-run effects on regional economic activity. This section examines mechanisms to explain the persistent and amplifying effects of population figures (Section 7.1), and provides evidence that occupation-specific migration (Section 7.2) and hampered investments (Section 7.3) can explain lower communal tax figures.

7.1 Age-specific migration and subsequent fertility differences

I examine the shift in demographic composition of local residents from 1939 to 1951 across the line of contact in terms of age and gender and show how these initial differences explain the amplifying effects over time. I focus on the line of contact municipalities and run pairwise estimates (see equation 1). Panel A in Table 4 reports the general decline of population in Red-Army-liberated places (as shown in Section 5.1) and compares this by gender (Columns (2) and (3)) and by age cohorts (Columns (4) to (6)). The relative decline of the male population is somewhat larger than for females in Red-Army-liberated

[41] Table C.19 reports 36 estimates of which 2 show weak significant spatial discontinuities. However, the signs of the coefficients are ambiguous (one is negative, one positive) and can also be explained by chance.

places.[42] However, I find large differences with respect to the change in the age cohort structure. The relative shrinkage of young people below the age of 20 is large, while there is no significant relative shrinkage of elderly people from 1939 to 1951 (aged above 65). This implies that most likely families with children and young adults settled in regions liberated by the Western Allies, and that Red-Army seized places become relatively older.

Table 4: Selective migration and subsequent natural population growth

Panel A	*Dependent variable:* Municipal population growth from 1939 to 1951					
		By gender		By age cohorts		
	Baseline	Female	Male	Young (below 20)	Working age (20–65)	Old (above 65)
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army	-13.80***	-10.34**	-15.89***	-22.43***	-10.98***	-6.47
	(3.05)	(4.51)	(4.01)	(6.97)	(3.70)	(5.13)
No. of obs.	90	90	90	90	90	90
Mean D.V.[a]	106.54	110.97	102.18	134.20	93.81	121.35
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.74	0.49	0.62	0.54	0.58	0.60

Panel B	Annualized natural population growth (birth – death) in %					Mechanism
	1st generation (1951/1961)	2nd generation (1971–1991)	3rd generation (2001/2011)	Pooled (1951-2011)	Total effect (60 years)	Marriages of 1st generation
	(1)	(2)	(3)	(4)	(5) = (4)×60y	(6)
Red Army	-0.30***	-0.07	-0.25***	-0.19***	-11.17%	-0.22***
	(0.09)	(0.08)	(0.09)	(0.06)		(0.05)
No. of obs.	180	270	180	630		180
Mean D.V.[b]	1.27	0.30	-0.25	0.43		0.92
Pair FE	Yes	Yes	Yes	Yes		Yes
R^2 adj.	0.44	0.21	0.41	0.48		0.35

Notes: The table tests for spatial discontinuities across the line of contact in various demographic characteristics in percentage points. The estimates consist of contiguous line-of-contact municipalities and include pair fixed effects. Panel A divides the shift in population from 1939 to 1951 (Column (1)), by gender (columns (2) and (3)), and age cohorts (Columns (4) to (6)). Panel B tests for differences in annualized natural population growth (birth rate minus death rate) for three time periods based on decennial censuses from 1951 to 2011 (Columns (1) to (3)) and the pooled post-WWII effects (Column (4)). Column (5) calculates the total population effects across the line of contact for the entire post-WWII period. Column (6) tests for differences in marriage patterns based on the censuses in 1951 and 1961. Estimates per census year, and estimates separated by birth and death rates are shown in Table C.21 in the Online Appendix. a) Mean of the dependent variable (Mean D.V) is in respect to 1939=100. b) Mean of the dependent variable (Mean D.V) is in percentage points and in numbers of marriages per 100 people in Column (6)). Standard errors in parentheses are clustered at the contiguous pair level. Significance levels: *** 0.01, ** 0.05, * 0.10.

This shift in age structure has huge implications for the long-run trajectory of population figures. Panel B in Table 4 reports differences in annualized natural population growth rates (birth rates minus death rates) across the line of contact for different post-WWII

[42] Generally, the male population in the sample stays relatively stable from 1939 to 1951, while the female population grows (see the mean of the dependent variables (Mean D.V.) in Panel A (1939=100)). This is an indirect evidence for a lack of men after WWII due to casualties and prisoners of war.

subperiods (Columns (1) to (3)) and the pooled effect for the entire post-WWII period (Column (4)). Table C.21 repeats these estimates based on individual census years and shows the differences in birth rates and death rates separately. Birth rates (death rates) in Red-Army seized places are mostly below (above) the numbers in Western-Allies liberated places. This is likely the result of the shift in the population structure by age: The loss of children and young adults in the direct aftermath of WWII results in lower birth rates and higher death rates in the following decades. The pooled effect of around 0.19% per year implies an amplifying effect of the relative shrinkage of population of around 11% until 2011 (0.19 × 60 years from 1951 to 2011, see Column (5)). This number matches one to one to the estimated amplifying effect in population figures in Column (5) in Table 2. The decline in young people until 1951 is also visible in differences in the marriage rates in the two decades after WWII (Column (6)), which corroborates the natural population figures. I conclude that conflict-related migration has a distinct age pattern that leads to amplifying effects of population figures even in the decades after.

7.2 Shift in employment structure

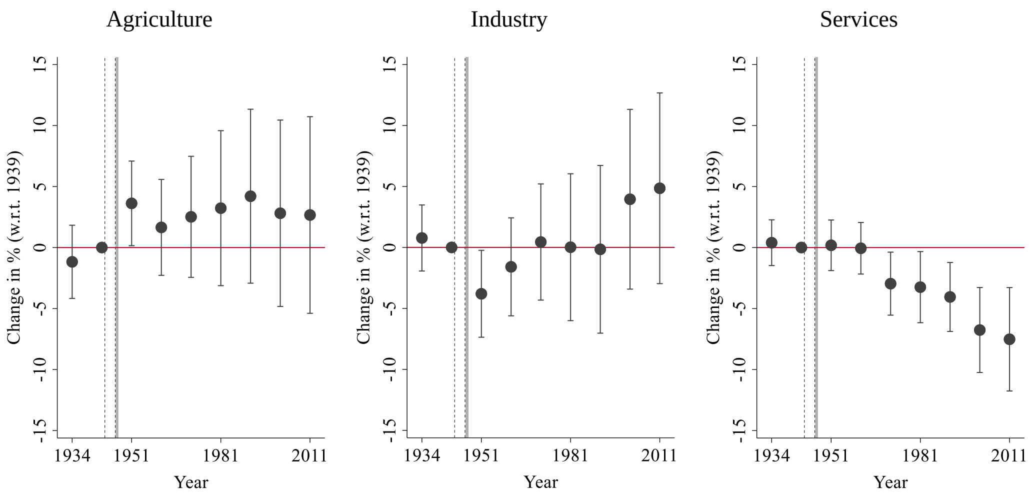
I test whether the migration right after WWII also affects the composition of the workforce in terms of sector development across the line of contact. I focus on municipalities at the line of contact and use detailed population census data from the pre-war period (1934 and 1939 censuses) and the censuses from 1951 onward. For the shift in the occupation structure across the line of contact, I run the following pairwise fixed effects model:

$$Y_i = \beta(RedArmy_{i,p} \times PostWWII_t) + \gamma(\mu_p \times PostWWII_t) + \delta_t + \epsilon_p \qquad (3)$$

Y_i represents the outcomes of interest. $RedArmy_{i,p}$ is a dummy variable that equals one for municipality i in pair p that was seized by the Red Army (zero otherwise). μ_p are pair fixed effects for contiguous line-of-contact municipalities. $PostWWII_t$ is a dummy variables that equals one for the periods after WWII (zero otherwise). δ_t are year fixed effects. ϵ_p is the error term with standard errors clustered at the pair level. Variation stems from within contiguous pair differences across the line of contact over time.

I first inspect coefficient plots based on an event-study design in Figure 7 before turning to the regression outputs. I run different event-study setups based on the census years 1934 to 2011 for occupational shares of agriculture, industry and services separately. Data are based on the head of the family and differences are standardized to zero for the last pre-WWII census in 1939. First, the event study setup confirms the exogeneity of the line of contact since pre-treatment differences are not distinguishable from zero (confirming a parallel pre-treatment trend). Second, the event-study setup reveals a shift in the occupation shares of local residents until 1951: Places seized by the Red Army became more agricultural, while places liberated by the Western Allies became more industrial until 1951. However, these initial post-WWII differences somewhat fade out in the subsequent decades and even reverse for the industrial shares. Third, the service sector—very underdeveloped around WWII with an employment share of roughly 14% in the pairwise sample—does not seem to be affected initially by the liberation treatment, but the graph reveals evidence for a delayed structural change away from agriculture and industry towards the service sector in places seized by the Red Army.

Figure 7: Shift in the sector shares of residents' occupation



Notes: The figures depict coefficient plots of an event-study design for sector shares (in percentage points) of residents at the municipality level (according to the head of the family). The coefficients stem from fixed-effects estimates with contiguous line-of-contact municipalities and include pair and year fixed effects. All sector shares are standardized to the last pre-treatment census in 1939. Dashed vertical lines represent the period of WWII, the grey solid lines show the period of the Red Army's presence in Styria for 74 days. Thin grey lines around the coefficients represent 95% confidence intervals, which are based on standard errors clustered at the contiguous pair level.

The main insights from the event-study setup are confirmed in the regressions in Panel A in Table 5. The share of residents belonging to agriculture increases by around 4.20% (Column (1)) and the industrial share declines by the same amount in places seized by the Red Army (Column (2)), while the shares of the service sector and public administration are not affected (Columns (3) and (5)). Surprisingly, there are more self-employed people in Red-Army-liberated places (Column (6)), which could reflect worse labor market conditions finding an ordinary job. The relative decline in population figures in Red-Army-liberated places is also visible in local living conditions. Column (7) shows that people live less densely in places initially seized by the Red Army. However, all these numbers on sector shares are based on population censuses according to the head of the family, and thus do not reflect one to one differences in local workplaces since people might commute or might have different dependence ratios. Nevertheless, the relative increase of agriculture in Red-Army seized places is reasonable given that farmers—and in particular family farmers with their farmsteads—were less likely to escape the arrival of the Red Army or Soviet occupation. Farmers remain, while other professions are more likely to move.

Table 5: Sector shifts until 1951 and economic conditions in 2011

Panel A	*Dependent variable:* Change of economic variables from 1934/39 to 1951						
	Sectoral shares (in %)					Pop. characteristics	
	Agrar	Industry	Service	Public admin[a]	Liberal professions[a]	Self-employed[a]	Pop/HH
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Red Army × PostWWII	4.20***	-4.19***	-0.02	-0.78**	0.20	2.73***	-0.60**
	(1.36)	(1.27)	(0.75)	(0.37)	(0.21)	(0.88)	(0.27)
No. of obs.	270	270	270	180	180	180	270
Mean of Dep. Var.	54.79	30.88	14.33	1.64	1.69	20.43	4.64
Pair FE × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.59	0.65	0.34	0.52	0.60	0.87	0.43
Panel B	*Dependent variable:* Economic variables in 2011						
	Workplaces by sector (in %)			No. of workplaces		Pop. characteristics (in %)	
	Agrar	Industry	Services	Workplaces per pop	Workplaces per firm	Compulsory schooling	Unemployed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Red Army	7.68**	1.26	-8.94**	-0.01	0.44	1.96***	-0.59
	(3.35)	(2.88)	(3.76)	(0.03)	(0.43)	(0.74)	(0.38)
No. of obs.	90	90	90	90	90	90	90
Mean of Dep. Var.	24.66	22.02	53.31	0.33	3.73	29.24	4.24
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.68	0.69	0.62	0.40	0.55	0.61	0.41

Notes: The table tests for spatial discontinuities across the intra-Styrian line of contact in the shift of economic variables until 1951 (Panel A) and differences in workplaces and residents' characteristics in 2011 (Panel B). The estimates consist of contiguous line-of-contact municipalities. Panel A employs pairwise difference-in-differences estimates with pair and year fixed effects and include the censuses of 1934, 1939 and 1951. Sector shares and self-employment in columns (1) to (6) are according to the head of the family and divided by total population. Columns (7) divides total population by the number of local households. The bottom panel employs pairwise regressions with pair fixed effects. Columns (1) to (3) divide the number of sector-specific local workplaces by total workplaces. Columns (4) and (5) divide the number of local workplaces by local population and the number of local firms, respectively. Columns (6) and (7) divide the respective characteristics of local residents by the overall number of municipality population. a) Data only for 1939 and 1951. Standard errors in parentheses are clustered at the contiguous pair level. Significance levels: *** 0.01, ** 0.05, * 0.10.

I also test for spatial discontinuities across the line of contact in 2011 based on local workplace statistics, and education and unemployment data from local residents.[43] The results are based on pairwise estimates (see equation 1) and are reported in Panel B in Table 5. Spatial differences in sector shares across the line of contact are more pronounced in terms of local workplaces than occupation data according to the head of the family. Places seized by the Red Army have a workplace share in 2011 in agriculture that is around 8% larger than in neighboring places, and fewer workplaces in the service sector of around the same magnitude, while workplaces in the industrial sector are almost identical (see Columns (1) to (3)). These figures may well explain present-day differences in communal tax revenues per local employee as a proxy for differences in labor productivity. However, places do not differ in terms of local workplaces per population or firm (Columns (4) and (5)), indicating that tax figures do not necessarily reflect increasing returns to scale

[43]There are no workplace statistics at the municipality level available until the late 20th century.

due to larger firm entities. Finally, the population residing in Red-Army-liberated places have on average a lower educational level—the share of residents with only compulsory education is about 2% higher, while unemployment figures do not differ across the line of contact.[44] Further variables of the economic and socio-demographic structure in 2011 and the respective single- and multidimensional RD estimates are shown in Table C.22 in the Online Appendix. Generally, RD estimates with these variables yield similar coefficients but are less precisely estimated. To sum up, places seized by the Red Army are still more agricultural and lack workplaces in the services sector today. These differences likely originate from the occupation composition of migrants in the direct aftermath of WWII.

7.3 Early investments

So far, the mechanisms to explain long-run regional economic inequality highlight the crucial role of sorting of migrants by age and occupation. However, the Red Army during their 74-day-long presence also officially dismantled industrial plants, and its soldiers looted in the region. This might have affected the capital stock in Red-Army-liberated places, too, which hinders fast economic development.

Ideally, I should analyse the shift in the local capital stock in pre- and post-WWII periods to account for the long-run effects of dismantling and looting. However, such data are not available at the municipality or firm level (only at the federal state level). The results in Section 6.3 show that neither controlling for dismantling nor dismantling itself can explain the economic trajectory, while informal looting cannot be addressed empirically. Nevertheless, this section aims to find some evidence on the differences in the capital stock accumulation across the line of contact. I rely on a unique measure in this regard: machinery in agriculture. Austria published detailed agricultural machinery data at the court district level after WWII. Court districts are the administrative unit between municipalities and districts. I assign court districts in South Austria to their liberation treatment and run cross-sectional OLS regressions to test whether Red-Army-liberated places had less agricultural machinery after WWII.[45]

Columns (1) and (2) in Table 6 show the differences in agricultural machinery between Red Army and Western-Allies seized court districts. Each coefficient with the respective

[44]Around 80% of school expenses at the municipality level are remunerated by the federal and state level, which rules out local finance differences as a source of different school attainment (Mitterer and Seisenbacher, 2020). The lower educational level in Red-Army-seized places might just reflect the higher share of agriculture, mainly family farmers, which have a lower educational attainment in general.

[45]In particular, I run the following OLS regression: $Y_c = \alpha + RedArmy_c + \epsilon_c$, where Y_c is agricultural machinery, α is a constant and ϵ_c is the error term. $RedArmy_c$ is a dummy variables equal one if the court district c was mainly seized by the Red Army (zero otherwise). Note that the line of contact does not always follow court district borders. The assignment of the treatment at the court district level (by a dummy or by the municipality share) does not affect the estimates. I include court districts along the within-Styrian and Styrian-Carinthian line of contact (line of contact court districts and their respective neighbors). Results with different treatment assignments and within Styria are available upon request.

Table 6: Machinery in Agriculture after WWII

	Dependent variable: Machinery per 1,000 workers			
	OLS differences		Propensity score matching	
			match over: farm structure and occupation shares in 1939	
	1953	1962	1953	1962
	(1)	(2)	(3)	(4)
Panel A: Tractor versus horse-based production				
Tractors all	-9.98**	-34.70**	-7.12*	-31.11**
	(3.99)	(15.07)	(3.56)	(14.68)
Trailer all	-14.43**	-41.41*	-18.17**	-54.77*
	(5.98)	(22.19)	(7.96)	(28.26)
Trailer for tractors	-11.21**		-10.65**	
	(4.15)		(4.81)	
Trailer for horses	-3.23		-7.52	
	(2.53)		(5.23)	
Tillage machines	-4.82*	-11.54**	-4.33*	-11.84**
	(2.60)	(4.85)	(2.51)	(5.18)
Tillage machines for tractors	-0.48	-7.85***	-0.82*	-9.03***
	(0.44)	(2.78)	(0.48)	(3.18)
Tillage machines for horses	-4.33*	-3.69	-3.51	-2.81
	(2.29)	(2.97)	(2.33)	(3.20)
Panel B: Cropland farming				
Cultivation machines[a]	-42.11***	-120.37***	-40.23***	-140.84***
	(13.28)	(32.46)	(11.13)	(38.68)
Harvesters[b]	-18.96***	-54.13***	-23.44***	-66.55***
	(5.93)	(12.82)	(4.14)	(11.97)
Panel C: Dairy farming				
Hay machines[c]	-33.40*	-114.90***	-29.04	-118.81***
	(17.31)	(31.7)	(23.77)	(37.29)
Milking machines	-2.97**	-24.70*	-2.84**	-20.77
	(1.12)	(12.31)	(1.22)	(14.37)
No. of units	38	38	27	27

Notes: The table shows differences in agricultural machinery per 1,000 employees in agriculture among Red-Army- and Western-Allies-liberated areas in South Austria. Each coefficient and its respective standard error stem from a single regression. The sample consists of court districts along the within-Styrian and Styrian-Carinthian line of contact (court districts along the line of contact and their respective neighboring court districts). Census data from 1951 (1961) are merged to the agricultural census in 1953 (1962). Matching variables for columns (3) and (4) include average agricultural residents per farm in 1939, share of agriculture and share of industry in 1939. a) Crop cultivation machines include: plows, harrows, sugar beet hoes, tillage machines (for horses and tractors), network harrows, sewing machines and fertilizer spreaders. b) Harvesters include: sheaf-binding harvesters, combine harvesters and potato harvesters. c) Hay machines include: hay tedders, hay rakes (various types), pasture and hay loaders. Significance levels (robust standard errors): *** 0.01, ** 0.05, * 0.10.

standard error stem from a single regression. Generally, places seized by the Red Army lacked agricultural machinery in 1953 and also in 1962. There were almost 10 tractors less per 1,000 employees in agriculture (according to the head of the family) in 1953 in

Red-Army-liberated parts (Column (1) in Panel A). This is a large number given that tractors in agriculture were almost absent before WWII and in 1953, only 17.9 tractors were in operation per 1,000 employees in agriculture. The delay in mechanization is also confirmed when comparing machinery that can be used with the tractor (the newly arriving technology after WWII) or with horses (the dominant but old technology). I test potential differences for trailer and tillage machinery according to the means of the respective drive unit (tractors vs horses) in Panel A. While machinery that is used with the tractor—and tractors themselves—is less common in Red-Army-liberated places, differences for horse-driven machinery are not statistically different from zero indicating that farmers in places seized by the Red Army were somewhat restricted to the old technology, while their neighbors steadily started to invest in the new one.

Panel B and C in Table 6 test for differences in machinery used in cropland and dairy farming. Once again, Red-Army-liberated places lack behind adjacent places. Moreover, the effects in Panels B and C also show that the resulting differences across the line of contact are not driven by potential differences in agricultural practices in different subregions, i.e., cropland vs. dairy farming. I also employ a propensity score matching approach to account for potential pre-treatment differences in the agriculture sector across the line of contact. The matching results remain stable (Columns (3) and (4)). Moreover, Table C.23 in the Online Appendix employs an alternative matching technique, and also shows differences in machinery for other sub-categories. In conclusion, my analysis of agricultural machinery after WWII gives some indication of a delayed investment pattern into the capital stock in regions initially seized by the Red Army. If these findings can be transferred to other economic sectors, it is likely that these figures influence the economic trajectory of regions to explain present-day tax revenue differences as a proxy for local labor productivity.

8 Conclusion

Short-run exposure to the Red Army after WWII has affected regional economic activity until today. My study disentangles the regional exposure to hostility from other conflict-related shocks that often confound long-run outcomes. I document that an initial population shock that resulted from people escaping the arrival of the Red Army amplifies as time goes by. Regions that were initially seized by the Red Army became relatively older, resulting in lower fertility and higher death rates in the decades after. Selective migration patterns also likely account for ongoing economic backwardness in terms of structural change and local wage-sum tax revenues as a proxy of local labor productivity. While farmers tend to stay, workers in non-agricultural occupations fled the arrival of the Red Army and they shifted industrial employment and boosted the service sector in their destination. I also find evidence for delayed investments in places initially seized by the Red Army.

My findings provide novel insights that aid better understand of the long-run economic effects of conflicts. While studies mainly focus on the effects of destroying tangible and intangible assets, the crucial rule of selective migration due to conflict is so far understudied. This is surprising given the fact that conflicts cause migration. Currently, around 12 million Ukrainians—mainly women and children—are internally or externally displaced persons. Any development plan for regional development after conflicts should certainly address how to bring these people back. Anthologies and blueprints on how to reconstruct Ukraine, for example, mainly focus on the rebuilding of tangible assets and institutions, while strategies for return migration are a side note only (Becker *et al.*, 2022; EconPol-Forum, 2023). Eichengreen (2023) is one of the few advocates for fostering re-migration after the war, with housing stock and voucher programs to motivate people to return. My study shows that such initiatives need a much higher emphasis to foster recovery.

The short-lived line of contact between the Red Army and the Western Allies also provides a unique setting to understand the ongoing European economic east-west divide. More than 30 years after the fall of the Iron Curtain, countries in Central and Eastern Europe still lag behind Western Europe in various economic figures.[46] Economists, politicians and the public refer to the long-term Soviet legacy to explain backwardness. My findings suggest that the short intervention of the Red Army at the end of WWII matters for long-run harm to regions. Regarding the east-west divide in re-unified Germany, a simple back-of-the-envelope calculation suggests that about one third of the shocked demographic trend could be attributed to the period directly after the war.[47] Despite population effects, the short period of the presence of the Red Army also shifts proxies for local labor productivity by at least 15%—a number that also somewhat matches the figures of the east-west divide within Germany.[48] Countries exposed to long-run Soviet dominance after WWII would thus also lag behind Western Europe even if the Red Army and the Soviets had completely withdrawn from the region in summer 1945.

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[46]For example, Czechoslovakia (now Czechia and Slovakia) was among the richest countries in Europe around 1930. Today, GDP per capita is approximately 50% of the levels in Western Europe and the population is only around 14% larger today than before WWII, while France (+58%) or Italy (+49%) experienced higher population growth. Sources: Maddison-Project (2013), Bolt and van Zanden (2014).

[47]My RD estimates suggest a relative population decline in regions seized by the Red Army of about 22 to 25%. The relative shrinkage of East Germany is about 75% (see Figure 1); thus: 25/75 is about 1/3.

[48]GDP per capita (per worker) in East Germany in 2015 was around 70% (80%) of the West German level (VGR, 2016). All these figures do not show any further convergence during the last two decades.

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Online Appendix

Hostility, population sorting, and backwardness

Quasi-experimental evidence from the Red Army after WWII

Christian Ochsner

CERGE-EI Prague

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Appendix A: Detailed historical background

This Appendix provides further details on the historical background in Styria during and in the direct aftermath of World War Two (WWII). I discuss the situation in the last weeks of WWII (last combat operation and local resistance), and outline the formation of the line of contact between the Red Army and the Western Allies in the three subregions of Styria (Enns Valley, Mur Valley, Graz region).

The aims of this appendix are (i) to provide a more detailed picture of the period of study and (ii) to provide a detailed discussion of the quasi-random exposure to the Red Army for some regions of Styria but not for others. The outline of Appendix A is thus motivated to discuss the crucial assumptions of a regression discontinuity (RD) design to establish a causal relationship between Red-Army presence and subsequent economic backwardness.

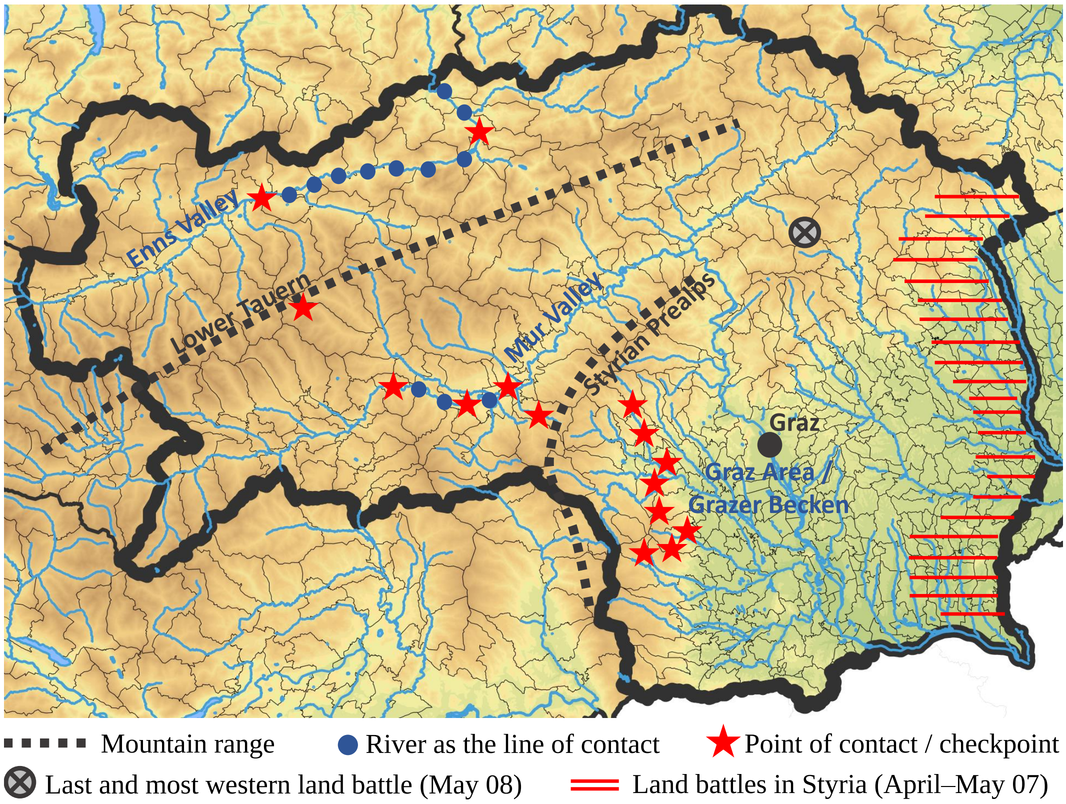
A.1 Last combat operations in Styria

Most parts of Styria were under (Nazi-)German control until the German surrender on May 08, 1945. The later line of contact, i.e., the RD threshold of this study, was thus far away from any battleground and combat operation during WWII. In March 1945, the Red Army reached the eastern border of Austria. The main target at this late period of WWII was the Austrian capital city Vienna. In South Austria, the front line between the (Nazi-)German Wehrmacht and the Red Army was in the very east of Styria and thus around 75 to 100 kilometers east of the later line of contact (Iber *et al.*, 2008; Stelzl-Marx, 2012). Figure A.1 shows the Styrian regions in the very east exposed to combat operations from April until early May 1945 (red dashed areas). Almost all land battles in Styria took place in the very east of Styria along the border between the federal states of Styria and Burgenland. The front line during the last 1.5 months of war operations was more or less stable mainly because the Red Army forces were diverted for the fight in Vienna and did thus not have major achievements in South Austria (Stelzl-Marx, 2012).

The land battles in the very east of Styria started in late March/early April 1945 and continued until early May 1945. The German Wehrmacht had already began to withdraw from eastern Styria on May 7 following Karl Dönitz's (Hitler's successor) command to attempt to surrender to the Western Allies rather than the Soviets (Brettner, 2013). After the ceasefire agreement on May 8, 1945, the last German troops left the front line and also tried to escaped over the Mürz Valley and Mur Valley towards the West. The last defensive battle of some Wehrmacht troops took place in the night of May 8–9 in the region of "Schanz/Schanzsattel" (ca. 60 kilometers east of the later line of contact, see Figure A.1) to secure the withdrawal of (Nazi)German troops from eastern Styria towards the Mürz Valley in the west (Pickl, 1995). The Wehrmacht was only partially successful in fleeing from the Red Army. Nevertheless, what happened was an exodus of the German

Wehrmacht from eastern Styria toward the US troops arriving in the northwest. All related literature (Karner, 2000; Beer, 2004; Iber *et al.*, 2008; Stelzl-Marx, 2012; Brettner, 2013) do not report any further combat operations among the escaping Wehrmacht and the Western Allies. With the exception of the last defensive battle at Schanzsattel, there was thus no strategic behavior of the German Wehrmacht that had any effect on the line of contact. To sum up, land battles in Styria took place in the very east (75 to 100 kilometers away from the later line of contact), and also the last defensive operation at Schanzsattel was around 60 kilometers east of the later line of contact. This setting thus ensures that postwar economic differences across the line of contact are not caused by any (land) battles.

Figure A.1: The line of contact—Land battles, checkpoints, rivers and regions



Notes: The map shows the regions of Styria exposed to land battles between the German Wehrmacht and the Red Army from late March/early April 1945 until May 7, 1945, the location of the last and westernmost land battle in Styria, and the points where the Red Army met the Western Allies (US and UK troops). The map also indicates the main geographical regions and mountain ranges in Styria. Sources: See text. Own illustration.

A.2 Local resistance in Styria

Evidence of local resistance that might have influenced the line of contact is also very limited. Generally, the people of Styria favored liberation by the Western Allies rather than the Red Army but there was no active resistance against the advancing Red Army. There is, however, an anecdote from the city of Murau (around 30 kilometers west of the line of contact, and thus outside the main RD sample). The citizens wanted to avoid capture by the Red Army. They flagged their houses with the Union Jack in the hope that, if the Red Army arrived before the UK troops, they would believe that the city has already been liberated by the UK troops (Stelzl-Marx, 2012). However, Murau was actually captured by UK troops first anyway. Thus, this anecdote of local resistance did not influence the line of contact. The related literature is otherwise silent about examples of local resistance, indicating that the line of contact was not determined by endogenous behavior of Styrian people. The line of contact is, given the absence of any evidence, not a result of any local resistance.

A.3 The line of contact

The capture of Styria did not follow any liberation plan and was not coordinated by the Allies (Karner, 2000; Iber *et al.*, 2008; Stelzl-Marx, 2012). The liberation of Styria can be described as rather chaotic. For example, the city of Leibnitz (35 kilometers south of Graz, and thus outside the RD sample) was triple occupied by the "Eastern Allies" on the same day by troops from the Red Army and Bulgaria and Tito partisans (all of them somewhat under the coordination of the Red Army). This indicates that the liberation did not follow any military strategy and military coordination, not even among the "Eastern Allies" (Karner, 2000).

Confusion and a lack of Allied coordination also dominated in the rest of Styria where the Western Allies and the Red Army tried to capture as much land as possible (Karner, 2000; Stelzl-Marx, 2012). The situation on May 8 and 9, 1945 was somewhat different in the three main regions of Styria where the Allies met (Graz region, Mur Valley, Enns Valley; see Figure A.1). I describe below the random points of contact on May 9 by the Red Army and UK troops (Graz region, Mur Valley) and between the Red Army and the US troops (Enns Valley) respectively. The initial points of contact by the Allies in various parts of Styria was quasi-random, i.e., there were no agreements about the time and place of the initial contact, but some arbitrary decisions were made about how to divide Styria outside these initial points of contact. I will discuss them below.

The demarcation line between the Red Army and the Western Allies was in place until the start of the withdrawal of the Red Army from Styria on July 22, 1945. Figure A.2 shows a transcription of a Red Army report on the location of checkpoints (Iber *et al.*, 2008, p. 298). This report states the exact location of Red Army check points in Styria and along the Styrian-Carinthian state border as of June 1, 1945. I mainly use Iber *et al.* (2008) to assign municipalities to their respective liberation force. I cross-checked the unclear liberation treatment of Kleinlobming, Lassing, Modriach, Salla and St. Georgen ob

Judenburg with the respective municipality chronicle.[49] Nevertheless, the line of contact did not necessarily follow (2011) municipality borders. Some farms in the municipalities of Edelschrott and Kleinlobming and the hamlet of Piber in the city of Köflach were divided from their main municipality. I assign the liberation treatment in these cases according to liberation of the respective main locality.

Figure A.2: Transcription of a Soviet report on checkpoints along the line of contact

Die Fühlungnahme zwischen den Truppen der Roten Armee und jenen der Armeen der [West-]Alliierten verlief mit 1. Juni 1945 entlang folgender Linie: Mauthausen (4060), Lauf der Enns bis Döllach (6040), Kote 2116[4] (5040), Kote 1939 (4040), Mitterhuber[5], Pusterwald (4050), Kote 1504, St. Georgen[6] (2060), Lauf der Mur, Lind, Lobming[7] (2080), Kote 1671, Kote 1555 (2090), Krenhof (1000), Piber, Oberdorf[8], Kowald[9] (1000), Edelschrott[10] (0000), Kote 1026 (8000), Kote (9010), Deutschlandsberg (8010), Kote 2141[11] (8090), Kote 1521[12] (6000), Lauf der Drau, Dravograd.[13]

Notes: The figure shows the locations of Red Army control and check points based on a transcription of a Soviet report (Iber *et al.*, 2008, p. 298). I use these locations of checkpoints to define the line of contact from May 9 to July 22 in Styria (with cross-checking municipality chronicles).

I describe separately for the three main regions in Styria the formation of the intra-Styrian line of contact that was in place for 74 days. However, along most of the line of contact, places were randomly captured by one army first just before the other army arrived from another direction. Whether a certain municipality was just the last unlucky one to be captured by the Red Army, or the last one to be captured by Western troops was neither foreseeable nor determined by any economic or—except for some sections of rivers and connection roads (see discussion below)—geographical characteristics.

Graz region (Red Army and UK troops)

At the end of WWII, the frontline between the German Wehrmacht and the Red Army was in the very east of Styria and thus around 75 to 100 kilometers east of the later line of contact. Starting in the night of May 7 to May 8, 1945 (i.e., the night before the Nazi-German surrender), the Red Army started to advance toward the west after the German Wehrmacht began to escape in the same direction. The Red Army captured the Styrian capital city of Graz in the night from May 08 to May 09 (Karner, 2000; Stelzl-Marx, 2012). Some southern Styrian regions were captured by Bulgarian and Yugoslavian (Tito partisans) troops first before the Red Army took control there, too (Iber *et al.*, 2008; Stelzl-Marx, 2012).

British troops were long held back in northern Italy. After the ceasefire agreement, they expanded toward the Austrian state of Carinthia and over the Packsattel toward Styria.

[49]I would like to thank Dr. Ernst Reinhold Lasnik for the information about the liberation treatment of the municipality of Salla.

The UK troops reached the city of Voitsberg (Graz region) on May 9, 1945. In the evening of May 9, forerunner troops of the 8th British Army met forerunner troops of the 57th Red Army (Ukrainian Front) near Köflach, whereby *"there was a handshake between the generals"* (Stelzl-Marx, 2012, p. 144). This place of contact near the municipality of Rosenthal an der Kainach was fully random and not planned. This location then also became the location of a check point among the UK and Red Army troops until July 1945 (see Figure A.2). However, not all localities along the line of contact were direct and initial meeting points of the respective Allies. Thus, the assignment of municipalities to the liberation force outside of these random places of contact was often determined by connection roads (i.e., starting from the random points of contact, the respective Army tried to figure out how to connect these points): The UK troops entered the Graz region via Packsattel and thus captured the localities from Packsattel to Köflach while those places not connected to this road were captured by the Red Army. In the north of Rosenthal an der Kainach, the road over the Reisstrasse that connects the UK liberated part in the Graz region with the UK liberated part in the Mur Valley defines the line of contact. All in all, the point of contact near Rosenthal an der Kainach was fully random. Regions captured by the respective troops on the way to Rosenthal remained under the control of the respective troops. Stelzl-Marx (2012), however, reports some smaller adjustments of the line of contact in the Graz region in the days after May 9. These adjustments did not affect the assignment of the main localities of a municipality, but may have affected some farms, as discussed in one example in the municipality of Edelschrott.

Mur Valley (Red Army and UK troops)

The Mur Valley is the central region along the line of contact (see Figure A.1). The Red Army (parts of the 26th Army of the Ukrainian Front) approached from the east via Loeben towards Knittelfeld and Judenburg. The UK troops reached the Mur Valley over the Obdacher Sattel from Carinthia and later over the Reissstrasse from the Graz Region (see the liberation of the Graz region). Judenburg, where the respective Ally met, was then divided along the River Mur (Karner, 2000; Iber *et al.*, 2008; Stelzl-Marx, 2012). Places in the southwest of Judenburg came under British control. Towards the east, the localities east of the Reisstrasse (the connection road towards the Graz region) was captured by the Red Army. Once again, the main point of contact in the Mur Valley (Judenburg) was neither foreseeable nor planned (Stelzl-Marx, 2012)). The line of contact partially followed the River Mur and was determined by the advances of the UK troops in other parts, i.e., along the Reisstrasse or via the Obdacher Sattel from the south.

Enns Valley (Red Army and US troops)

The northwest of Styria consists of the Enns Valley (see Figure A.1). There, the Red Army approached the River Enns in the municipality of Landl on May 9, 1945, via Bruck an der Mur, Leoben and Eisenerz. Landl was later divided between the US troops and the Red Army. In Landl, the Red Army continued its expansion and followed the River Enns to the West where they met the approaching US troops in the south of Liezen (Stelzl-Marx, 2012). US troops arrived in Styria from the northwest, mainly from Salzburg and Upper Austria, through the Ausseerland and Pyhrnpass. The bridge over the River Enns in Liezen was the point of contact and became an official check point until the withdrawal of the Red Army. The demarcation line in the Enns Valley region thus followed the River Enns from the Upper Austrian border to the municipality of Liezen. Regions in the north of the River Enns and in the west of Liezen were liberated by US troops while the Red Army captured places south of the River Enns and east of the point of contact in the south of Liezen. Stelzl-Marx (2012) reports that some forerunner troops of the Red Army managed to reach the region close to Schladming in the southwest of Liezen, but Schladming was never under Red Army control in Styria—it seems to be the case that the US troops and the Red Army decide about the line of contact at the point where their regular armies met. To sum up, there were some arbitrary decision in the Enns Valley, i.e., by the Red Army whether to follow the River Enns once they reached Landl, or whether to cross the River Enns. I thus control for potential effects of rivers as the demarcation line in the robustness section. However, the main place of contact, the municipality of Liezen, seems to be orthogonal to any military decisions.

Appendix B: Data sources and definition

This section lists the data sources of the paper. Archival data are digitized from hard copies. Self-compiled data are transformed to the 2011 territorial status of Styrian and Carinthian municipalities. I traced mergers of municipalities since 1934 based on "*Auflösungen bzw. Vereinigungen von Gemeinden ab 1945*" and "*Historisches Ortslexikon: Statistische Dokumentation zur Bevölkerungs- und Siedlungsgeschichte der Steiermark*" (Part 1 and Part 2). Mergers often combined smaller territorial entities to larger ones. In some exceptions, some smaller localities or single farms were portioned and became part of other territorial units than the former main locality of a municipality. This results in minor differences of the merged archival data with the official population data by *Statistik Austria*. However, I only face small deviations of less than 1% on average for around 2,5% of all municipalities (mainly in the census of 1939). To avoid any calculation errors, I always compute self-referential socio-economic and socio demographic shares in the censuses of 1934, 1939, 1951 and 1961, i.e., the share of female is the ratio of $female/(male + female)$.

Population data

Population data for 1869 to 1939 and for 1951 to 2011 at the 2011 territorial status of municipalities are retrieved from the statistical database STATcube by *Statistik Austria* (`https://statcube.at/statistik.at/`). My data contains data for the federal states of Styria and Carinthia as well as for all Austrian municipalities for the SCM analysis.

Population measures for 1946 (at the level of municipalities) and population figures for 1940–1945 (at the level of districts in the German Reich) use the following archival sources (hard copies):

– *Die Zivilbevölkerung des Deutschen Reiches 1940—1945: Ergebnisse der Verbrauchergruppen-Statistik.* Statistische Berichte Arb.Nr. Vlll/19/1. Wiesbaden: Statistisches Bundesamt. 1953.[50]

– *Gemeindeverzeichnis von Österreich: Auf Grund einer besonderen Erhebung aus dem Jahre 1946.* Vienna: Österreichischen Statistischen Zentralamt. 1948.

The archival data comprises the number of local residents eligible for food vouchers during (until January 1945) or in the direct aftermath of WWII (1946). These food voucher data provide the best figures for local population for 1940 to 1946.

[50]Data are based on food voucher data from Nazi Germany and use the territorial status of Austria according to the (Nazi) German Statistical Office. The number of districts is smaller than in the Austrian censuses due to some district mergers in the state of Burgenland and the inclusion of some district free cities to their surrounding area.

Population data separated for West and East Germany base on the following study:

– Roesel, Felix (2019): *Die Wucht der deutschen Teilung wird völlig unterschätzt*, ifo Dresden berichtet 3 (2019), pp. 23-25.

I am grateful to Felix Roesel to provide the underlaying data for my study.

Socio-economic and socio-demographic variables

Socio-economic and socio-demographic variables of municipality populations for 1934, 1939, 1951 and 1961 are based on the following archival sources (hard copies):

– *Die Ergebnisse der österreichischen Volkszählung vom 22. März 1934.* Issue 5. Vienna: Österreichisches Bundesamt für Statistik. 1935.

– *Ergebnisse der Volks-, Berufs- und landwirtschaftlichen Betriebszählung vom 17. Mai 1939: Alpen- und Donau-Reichsgaue.* Volume 559, Issue 13, Berlin/Vienna: Statistik des Deutschen Reichs. 1943.

– *Ergebnisse der Volkszählung vom 1. Juni 1951 nach Gemeinden. Beiträge zur österreichischen Statistik.* Issue 11, Vienna: Österreichischen Statistischen Zentralamt. 1953.

– *Ergebnisse der Volkszählung vom 21. März 1961. Beiträge zur österreichischen Statistik.* Various Issues (Styria: Issue 9), Vienna: Österreichischen Statistischen Zentralamt. 1964.

Data for 1971 to 2001 are based on decennial censuses, and for 2011 on register data. Data for 1971 and thereafter are retrieved from the statistical database STATcube by *Statistik Austria* (`https://statcube.at/statistik.at/`).

Socio-economic variables comprise information on residents' occupation, occupation status, unemployment and self-employment. Data until 2001 mainly comprise counts according to the head of the family. Data for 2011 contains individual measures. Socio-demographic variables comprise information on gender, age cohorts, number of housing units, commuters, and highest achieved education level (some data only available for specific years).

Natural population growth

Data on births, deaths and marriages at the level of municipalities for 1951 to 1971 use the following archival sources (hard copies):

– *Die natürliche Bevölkerungsbewegung im Jahre 1951 nach Gemeinden. Beiträge zur österreichischen Statistik.* Issue 9, Vienna: Österreichischen Statistischen Zentralamt. 1953.

- *Die natürliche Bevölkerungsbewegung im Jahre 1960. Beiträge zur österreichischen Statistik.* Issue 65, Vienna: Österreichischen Statistischen Zentralamt. 1961.[51]
- *Die natürliche Bevölkerungsbewegung im Jahre 1971. Beiträge zur österreichischen Statistik.* Issue 300, Vienna: Österreichischen Statistischen Zentralamt. 1972.

Data on births and deaths at the municipal level for 1981 to 2011 are based on a special evaluation by *Statistik Austria*.

Communal tax data

Communal tax data for 2010 to 2012 are retrieved from the statistical database STATcube by *Statistik Austria* (`https://statcube.at/statistik.at/`). Local tax measures for 1987 use the following archival source (hard copies):

- *Gebarungsübersichten 1987 (Gebietskörperschaften und sonstige öffentlich-rechtliche Körperschaften).* Vienna: Österreichischen Statistischen Zentralamt in collaboration with the Federal Ministry of Finance. 1989.

Occupation and firm data

Data on occupation per sector at the municipality level and the number of firms per sector per municipality in 2011 are retrieved from the statistical database STATcube by *Statistik Austria* (`https://statcube.at/statistik.at/`).

Machinery in agriculture

Machinery in agriculture for 1953 and 1962 are available at the court-district level (*Gerichtsbezirk*) and are based on the following archival sources (hard copies):

- *Ergebnisse der Erhebung des Bestandes an landwirtschaftlichen Maschinen und Geräten im Jahre 1953. Beiträge zur Österreichischen Statistik.* Issue 13, Vienna: Österreichischen Statistischen Zentralamt. 1954.
- *Ergebnisse der Erhebung des Bestandes an landwirtschaftlichen Maschinen und Geräten im Jahre 1962. Beiträge zur Österreichischen Statistik.* Issue 13, Vienna: Österreichischen Statistischen Zentralamt. 1964.

[51] Data on the natural population movement for 1961 do not exist at the municipal level. I thus use the 1960 birth and death census for the birth and death rates for 1961.

The number of farms (incl. information of farm size intervals) are based on the following archival source (hard copies):

– *Ergebnisse der Volks-, Berufs- und landwirtschaftlichen Betriebszählung vom 17. Mai 1939: Alpen- und Donau-Reichsgaue.* Volume 559, Issue 13, Berlin/Vienna: Statistik des Deutschen Reichs. 1943.

Data on regional policies

Local eligibility for the European Regional Development Fund (ERDF) for 2000 to 2006 stem from the European Commission (`https://ec.europa.eu/regional_policy/en/funding/erdf/`).

Data on Red Army dismantling stem from:

– Iber et. al (2008). *Die Rote Armee in der Steiermark—Sowjetische Besatzung 1945.* Graz: Leykam Buchverlag.

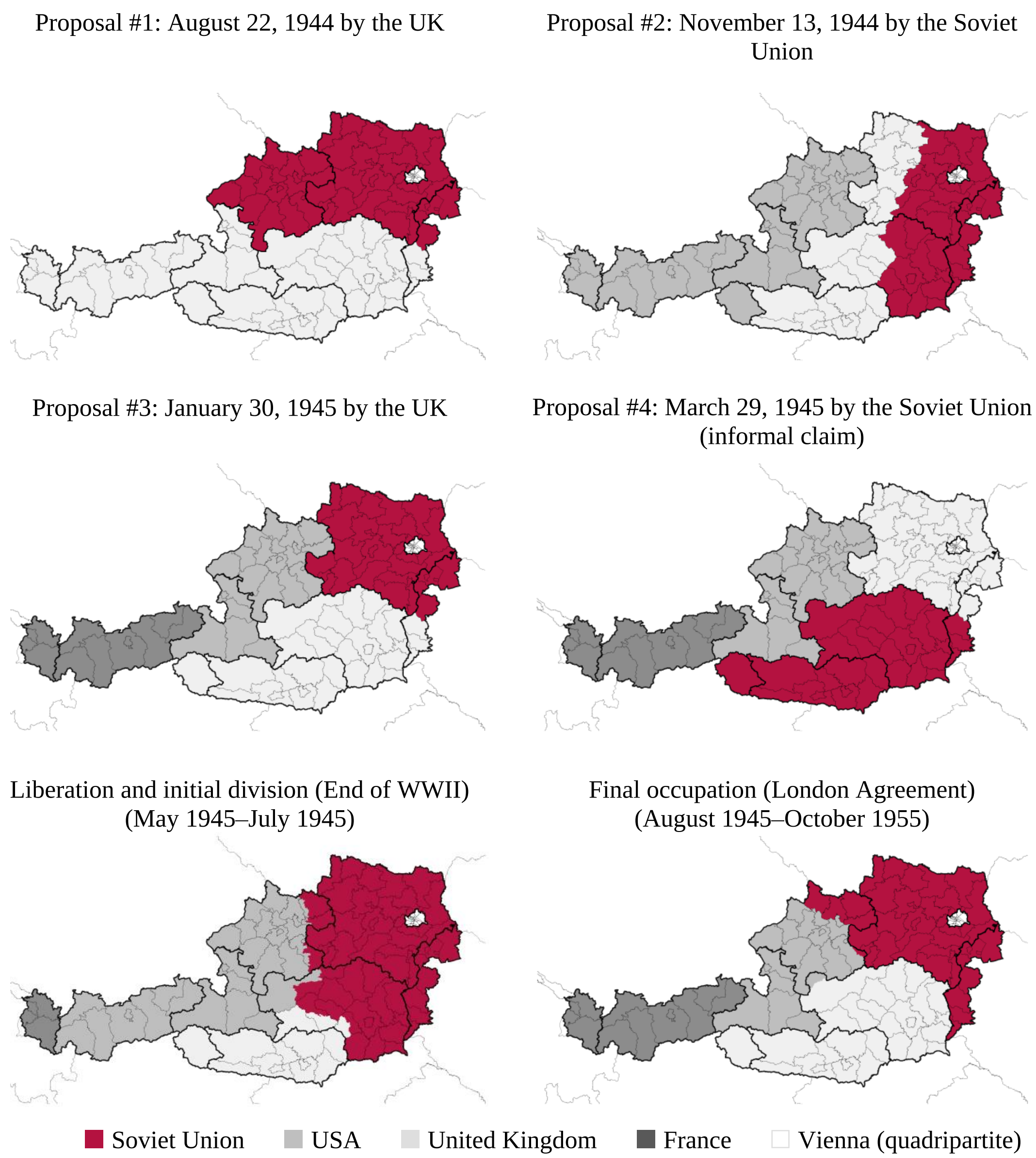
Geographic data

Municipal centroids in longitude and latitude and local land condition (i.e., total area, settlement area, usable land area) are retrieved from *Statistik Austria.* The location of highway slip roads are from google maps. Distance measures use Euclidean distances from municipal centroids. Measures on elevation and roughness are retrieved from the geographic information system QGIS (Version 2.18 and older).

Appendix C: Additional figures and tables

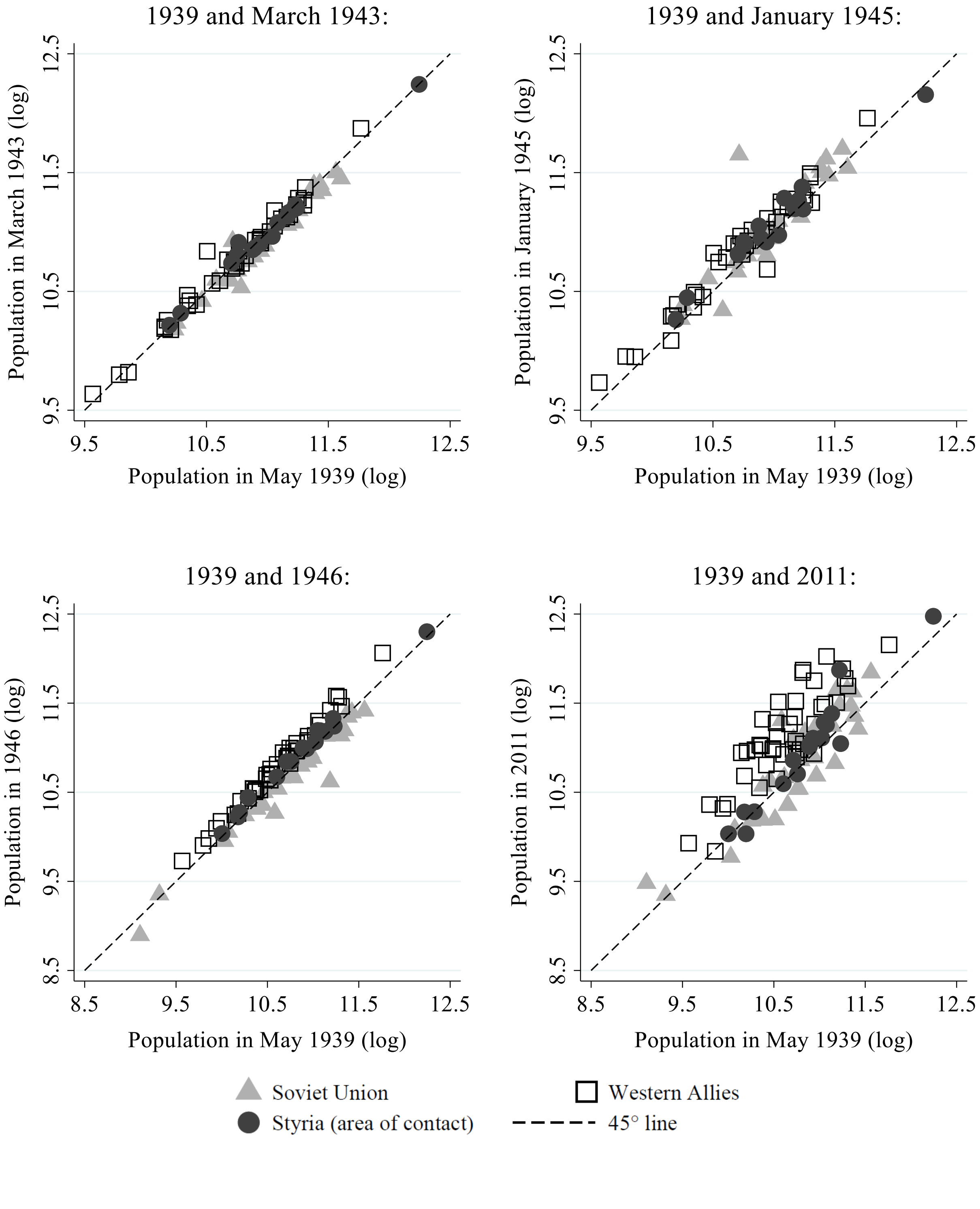
C.1 Additional figures

Figure C.3: Occupation zone proposals, liberation and final occupation



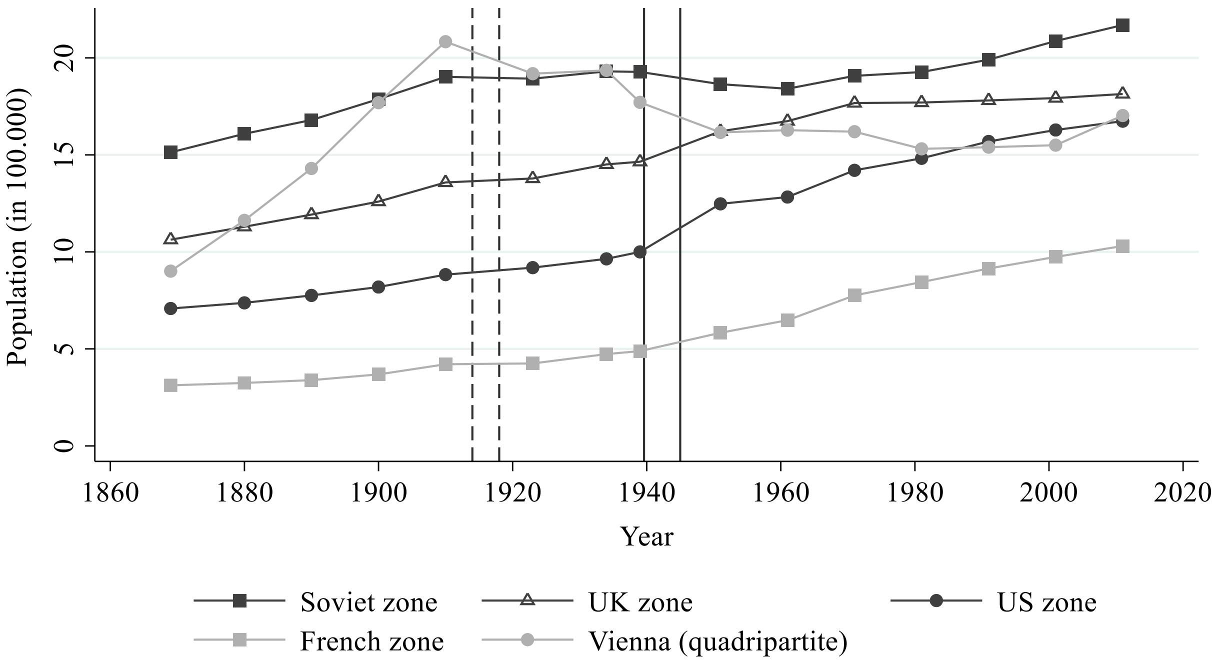
Notes: The maps show different occupation zone proposals by the Allies (figures at the top and in the middle), the liberation treatment as of May 9, 1945 (bottom left) and the final occupation zones (bottom right). Proposals #1 to #3 were official claims by the respective Ally (Erickson, 1950). Proposal #4 was an informal claim by the Soviet Union aiming to control southern Austria to exert influence on the Balkans but was never discussed by the other Allies (Stelzl-Marx, 2012). The date that corresponds to each proposal indicates the day on which the occupation proposal was shared (for the most part in secret) by the respective Ally. The dates for the liberation and occupation treatments show the time period when the respective troops controlled their liberated or occupied regions. Vienna was divided into four occupation zones for the respective Ally, and the Vienna city center (Innerer Berzirk) was a joint zone with rotating responsibility. Bold lines within Austria depict state borders, thin lines show the district borders. Sources: Erickson (1950) and Stelzl-Marx (2012).

Figure C.4: Population changes during and after WWII (District level)



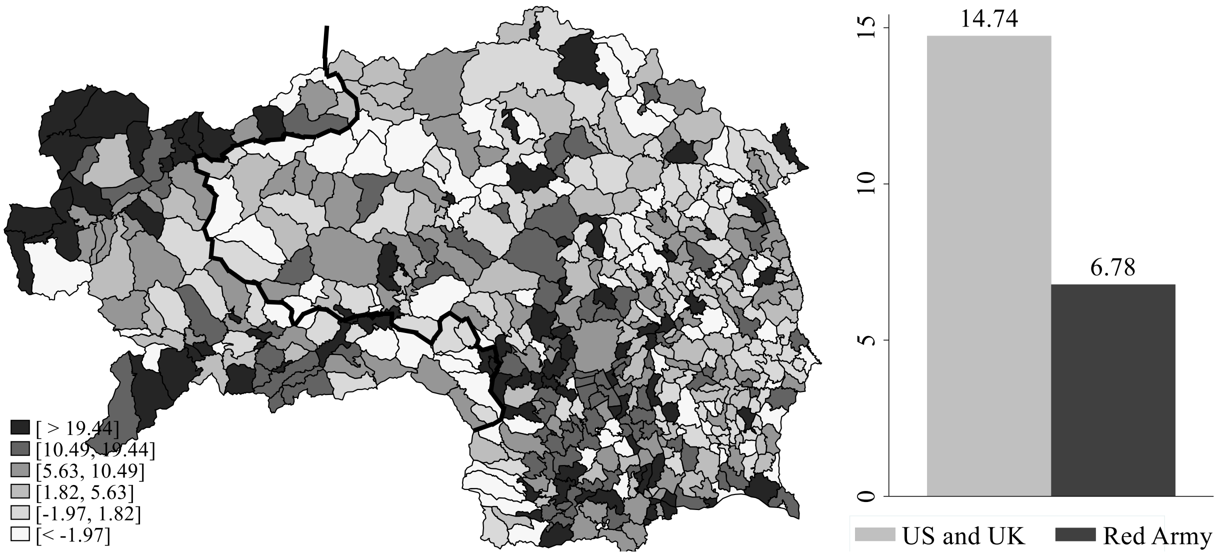
Notes: The figures show the population at the level of 84 Austrian districts. The upper figures show the shift in district population from 1939 to March 1943 (left hand figure) and from 1939 to January 1945 (right hand figure). The lower figures show the shift in population over WWII until 1946 and until 2011 respectively. The occupation zones (Soviet Union and Western Allies) refer to the permanent Austrian occupation zones from July 1945 to 1955. The correlation of district population for 1939 and 1943 is 0.993 (for Styrian districts: 0.998) and the correlation for 1939 and 1945 is 0.983 (Styria: 0.989). The city district of Vienna is not shown in the figures (outlier at 14.4) but is included in the correlation analyses. District population for 1943, 1945 and 1946 show the number of resident population based on food vouchers. Resident population is the entire population less the number of community catered people (mainly foreigners; in 1945 already German refugees). Sources: Die Zivilbevölkerung des Deutschen Reiches, 1940–1945; see Appendix B.

Figure C.5: Population per occupation zone and Vienna, 1869 to 2011



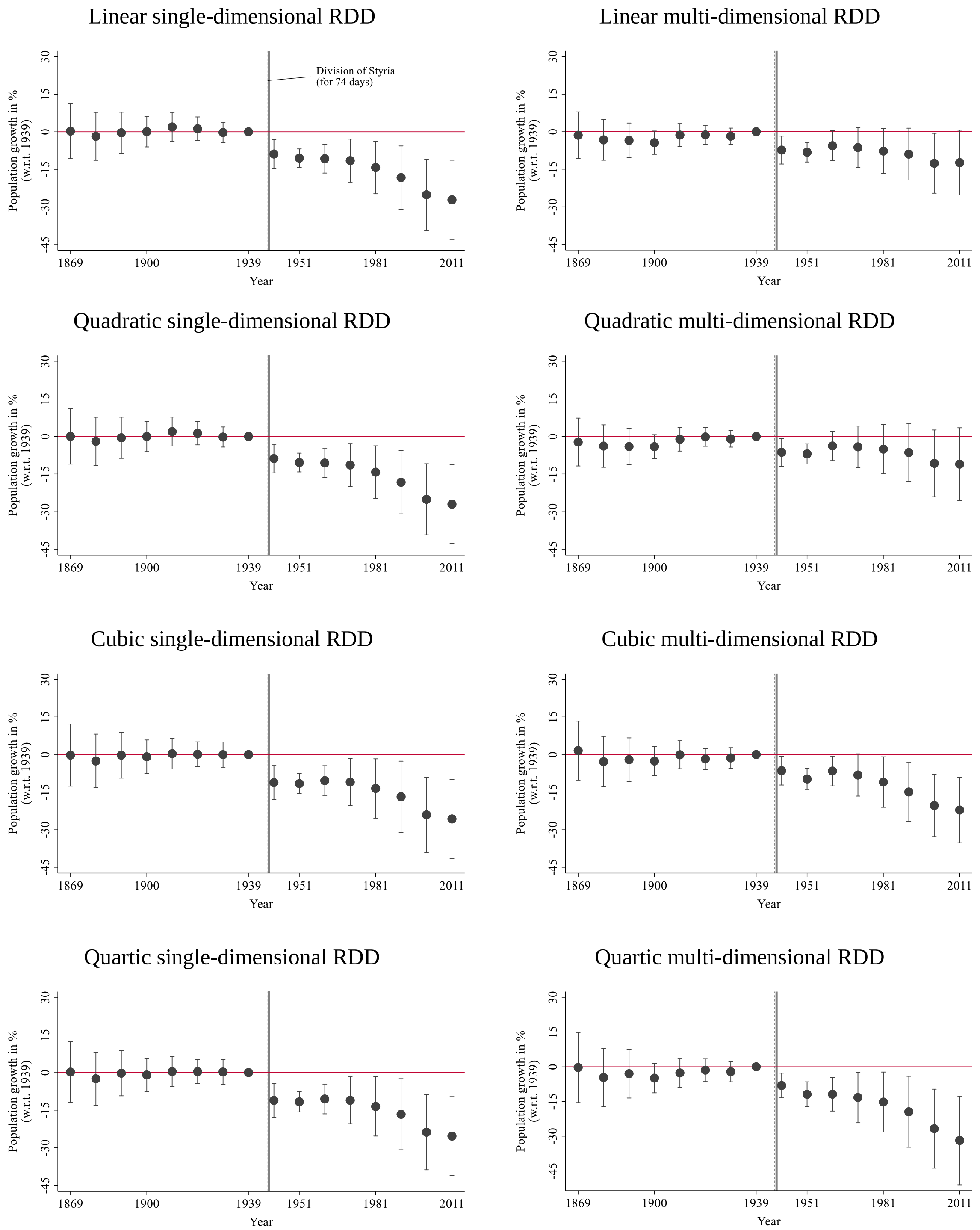
Notes: The figure shows the long-term evolution of population (in 100,000) according to the four post-WWII occupation zones in Austria and separately for quadripartite Vienna. The respective occupation zones were in place from July 1945 to October 1955. Styria, the region of this study, belongs to the UK occupation zone. Dashed vertical lines indicate the period of WWI; solid vertical lines the period of WWII.

Figure C.6: Population growth from 1939 to 1946 in entire Styria (in %)



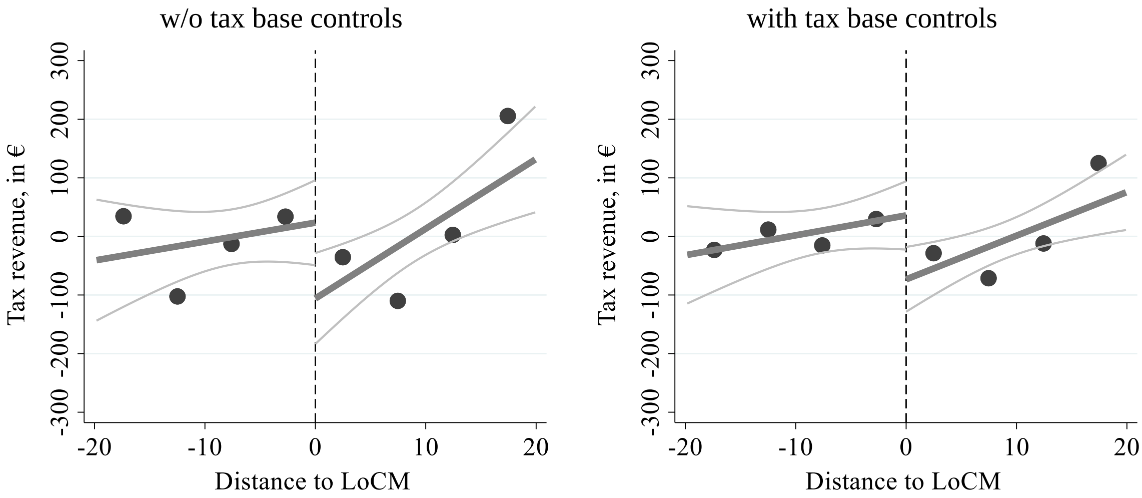
Notes: The figures show population growth at the municipal level from 1939 (last census before WWII) to 1946 (first municipal population figures after WWII based on food vouchers) in percentage points for entire Styria. The map on the left-hand side shows the population growth at the level of 542 municipalities. The black bold line shows the line of contact between the Red Army and the Western Allies (along the municipality borders, if feasible). The right-hand figure depicts the average municipality population shift according to the liberation treatment (Red-Army-liberated parts vs. Western-Allies-liberated regions).

Figure C.7: Coefficient plots of different RD estimates w.r.t. 1939, 1869 to 2011



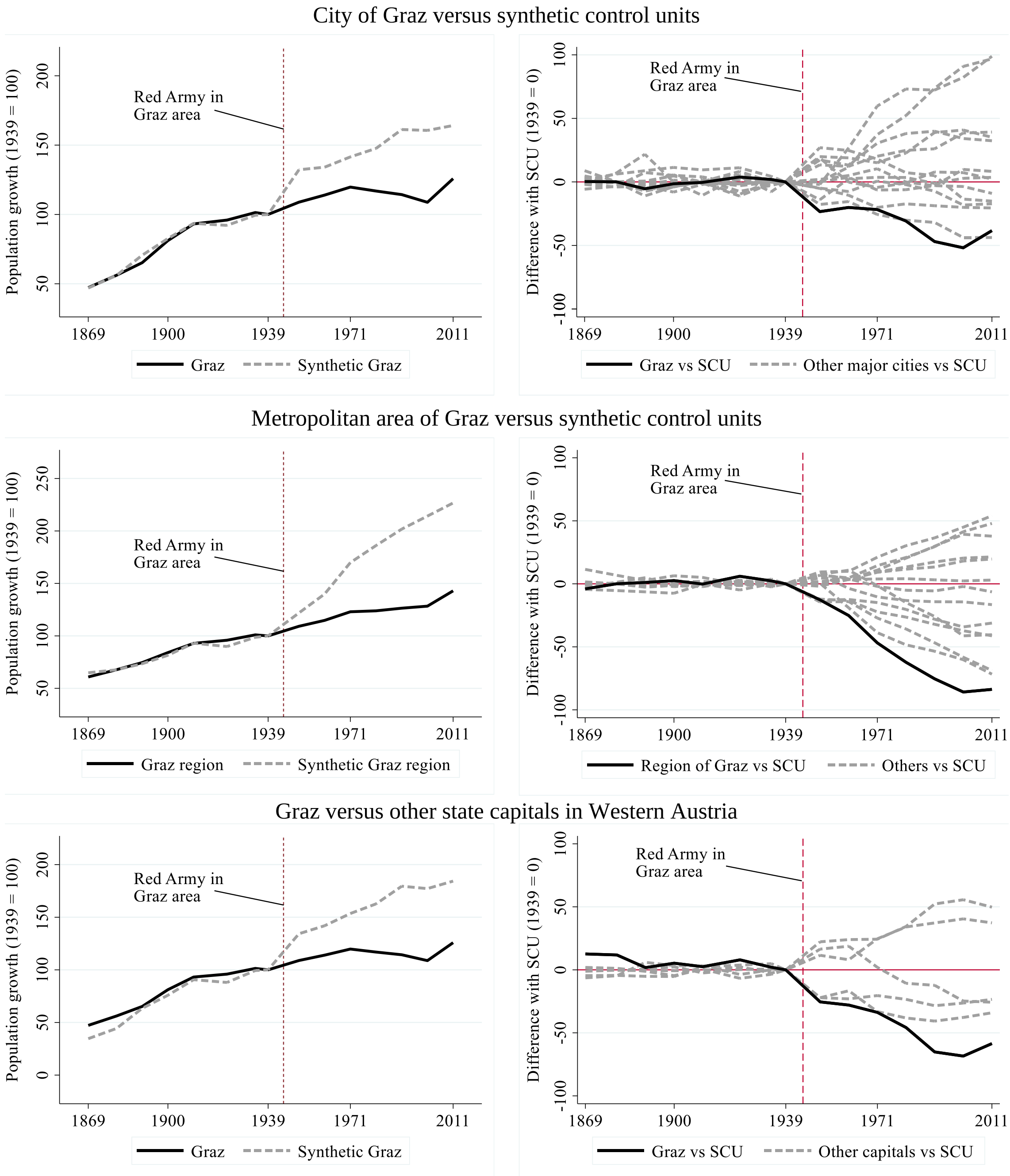
Notes: The figures show coefficient plots of spatial discontinuities in municipality population growth (in percentage points) w.r.t. the year 1939 across the intra-Styrian line of contact. The left-hand figures use distance of the nearest line-of-contact municipality as a single-dimensional forcing variable, the right-hand figures use longitude and latitude as multi-dimensional forcing variables. All RD estimates employ the same set of segment and regional fixed effects as in the baseline specification in Table 2. The sample is restricted to municipalities within 20km of the nearest line-of-contact municipality. The dashed vertical lines show the period of WWII, the grey solid line shows the period of the Red Army's presence in Styria. Coefficients are shown with 95% confidence bands based on spatially corrected standard errors.

Figure C.8: RD plots on local firm tax revenues per employee



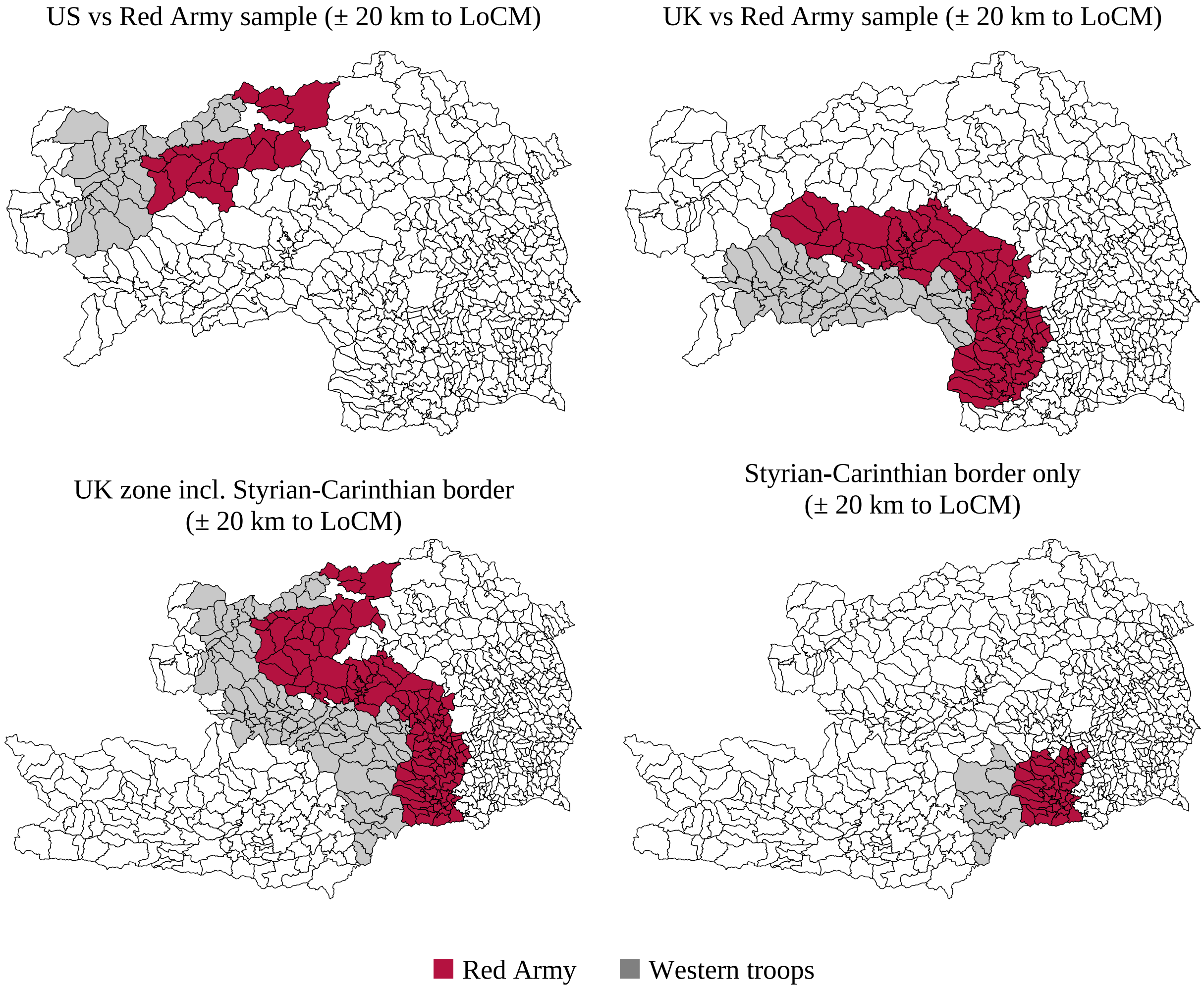
Notes: The figures show RD plots on local tax revenue per employee in 2011 (in Euro) across the line of contact. Plots are based on a linear fit and include segment and geography fixed effects. The left-hand graph shows local tax figures without tax base controls, the right-hand graph includes the full set of tax base controls (see Columns (1) and (6) in Table 3). The bins represent local averages of municipalities within a 5-kilometer interval. Negative (positive) distances in all RD plots represent municipalities with respect to the nearest line-of-contact municipality that were liberated by the Western Allies (Red Army). The vertical dashed lines represent the line of contact. Thin grey lines represent 95% confidence interval.

Figure C.9: Effects on the metropolitan area of Graz with alternative matching



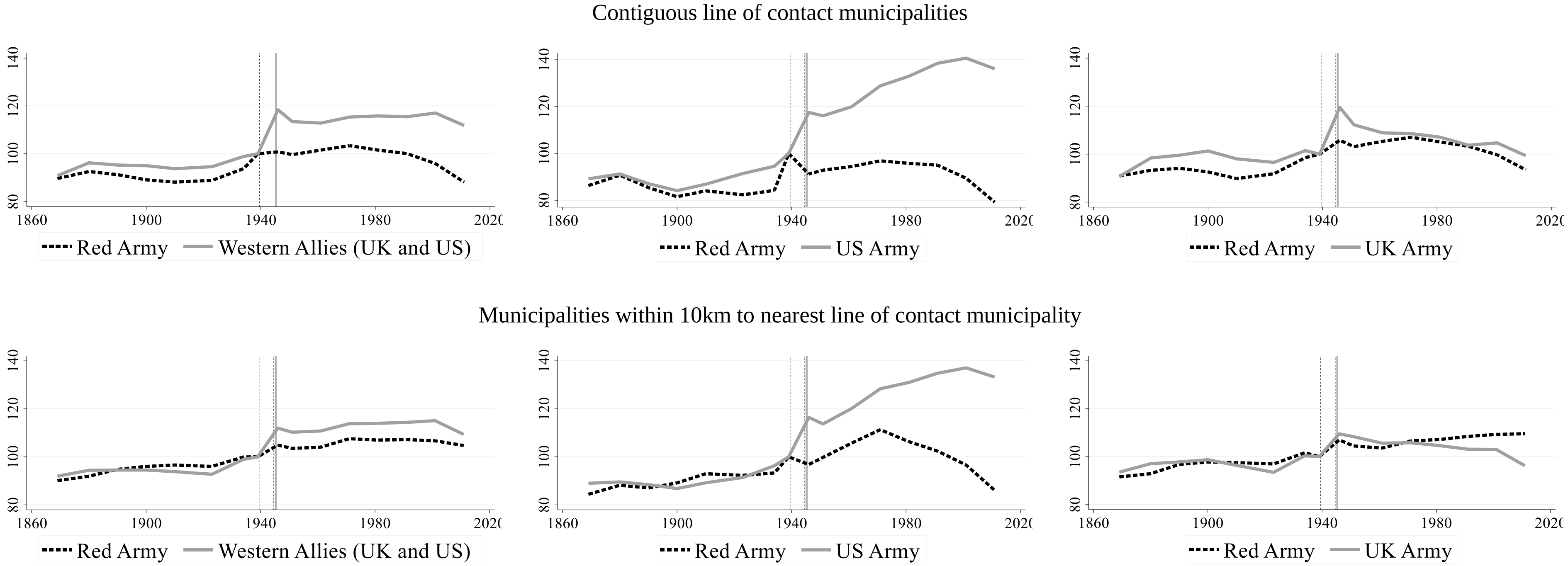
Notes: The figures compare population growth in the Graz region to population growth in its synthetic control unit (SCU). The upper figures show city level outcomes, and the figures in the middle show metropolitan area outcomes of municipalities within 25 kilometers of the respective city. The donor pool of the upper and middle figures consists of all Austrian cities (and their respective surrounding municipalities) with more than 10,000 inhabitants in 1939 that were liberated and occupied by the Western Allies after WWII. The left-hand figures compare the city of Graz (metropolitan area of Graz) with its SCU; the right-hand figures show the relative change in population of all major cities (all major metropolitan areas) compared to their respective SCU. SCUs are matched over population scores in 1880, 1910 and 1934 in respect to 1939, socio-demographic variables in 1934 (occupational share in industry and public sector, share of female) and population density of settlement area in 1934. The SCU of Graz consists of Bregenz (60.3%) and Bad Ischl (39.7%). The SCU of the metropolitan area of Graz consists of Dornbirn (80.1%), Villach (19.7%) and Wolfsberg (0.1%). The bottom figures consist of state capital cities that were liberated and occupied by the Western Allies (Graz, Klagenfurt, Linz, Salzburg, Innsbruck, Bregenz) and are matched over population scores. The state capital of Bregenz forms the SCU of Graz.

Figure C.10: Illustration of RD samples for heterogeneous effects



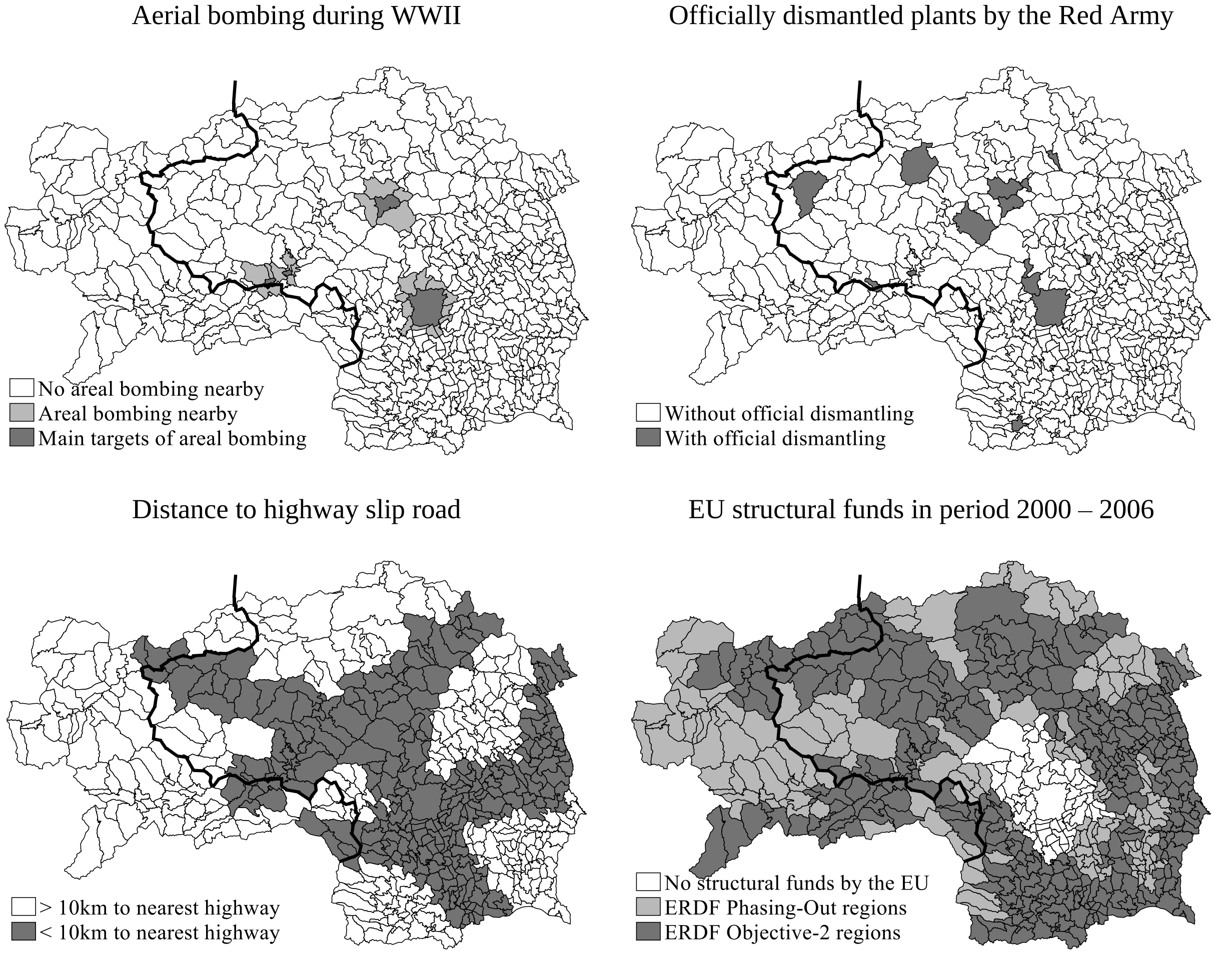
Notes: The maps show different regional subsamples of RD samples with respect to the distance of the nearest line of contact municipality (LoCM). The upper figures divide Styria according to the liberation treatment (US vs. Red-Army liberation in the Enns Valley; UK vs. Red-Army liberation in the Mur Valley and Graz region). The bottom figures extend the line of contact along the Styrian-Carinthian border where the federal state border coincides with the line of contact. The corresponding estimates with samples based on different regional subsamples are shown in Table C.11 in this Online Appendix.

Figure C.11: Population development from 1869 to 2011—Western Allies versus Red Army (1939=100)



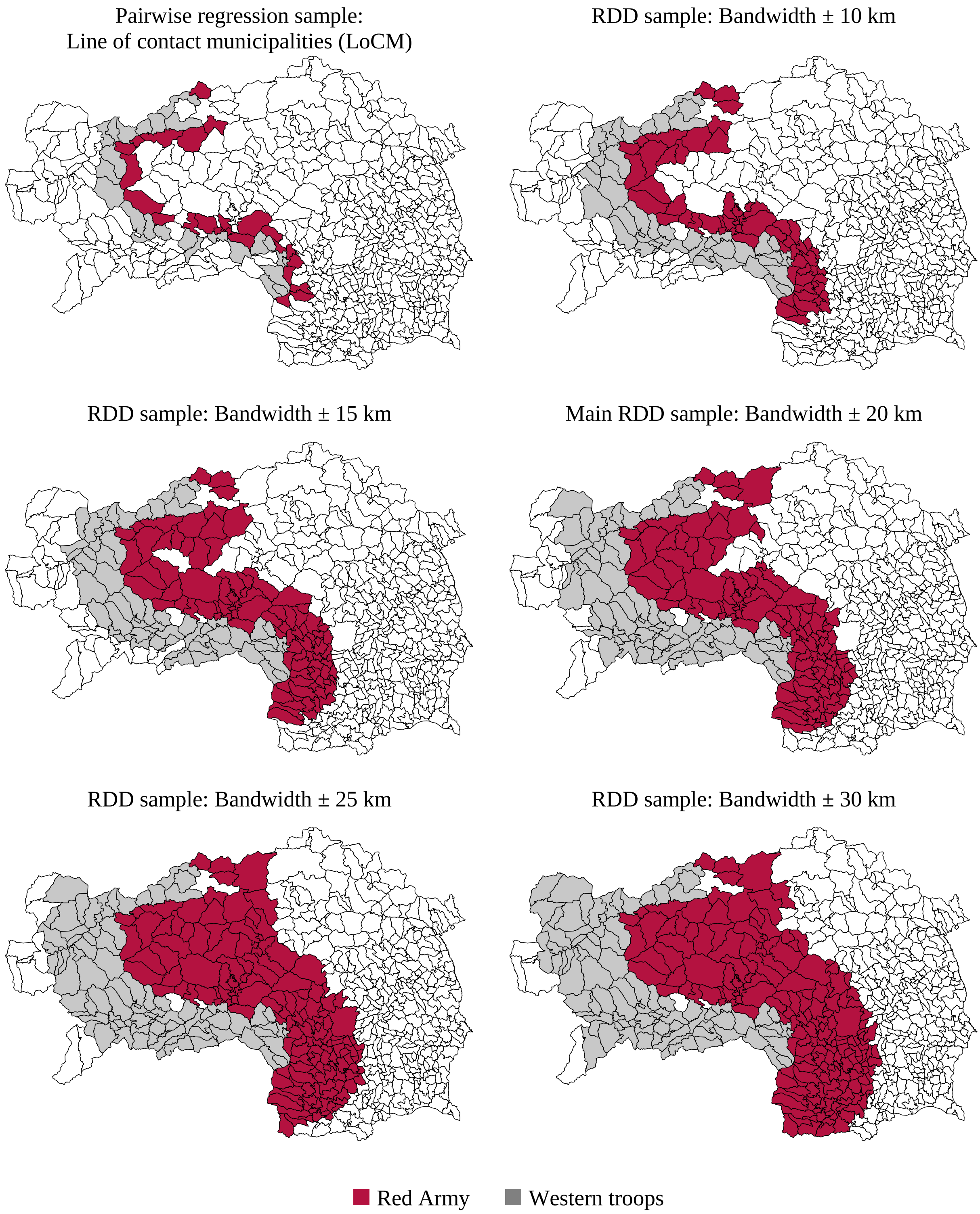
Notes: The figures plot the population dynamics across the line of contact with respect to 1939 (=100). The upper figures consist of contiguous line-of-contact municipalities, the lower figures include municipalities within 10km of the nearest line of contact municipality. The left-hand figures compare population dynamics across the entire line of contact within Styria. The figures in the middle compare population figures across Red Army and US Army liberated places (Enns Valley). The right-hand figures compare population figures across Red Army and British Army liberated places (Mur Valley and Graz region). Dashed vertical lines represent the period of WWII, the grey solid line shows the period of the Red Army's presence in Styria.

Figure C.12: Illustration of regional shocks and regional policies in Styria



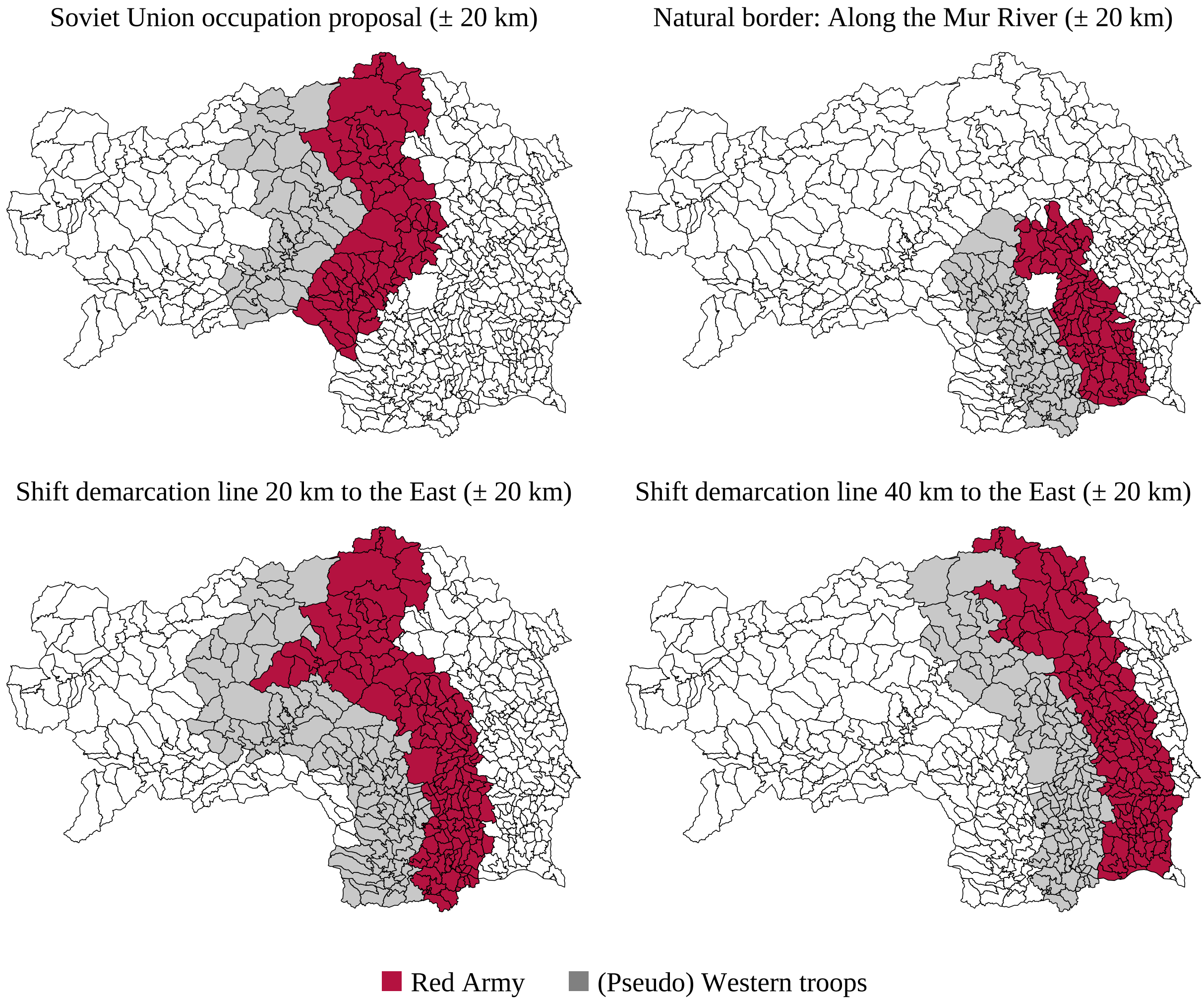
Notes: The maps depict the exposure to regional shocks and regional policies during and after WWII. The upper left-hand map shows the targets of aerial bombing in Styria during the last years of WWII (and their respective surrounding municipalities) based on Ulrich (1978). The upper right-hand map shows the municipalities where the Red-Army officially dismantled plants in Styria (so-called German assets) according to Iber *et al.* (2008). The bottom maps depict regional policies after WWII. These are regions near to highway construction (left-hand map) and regions eligible to different ERDF funding scheme according to the EU funding period of 2000 to 2006 (for the funding periods before and thereafter, regions just changed status but Styrian internal variation in EU funding eligibility remains largely unchanged from 1994/5 to 2012). The corresponding estimates that control for potential effects of these regional shocks and policies are shown in Table C.12 (for population measures) and in Table C.13 (for local tax figures per employee) in this Online Appendix.

Figure C.13: Illustration of RD samples along the line of contact



Notes: The maps show different RD samples with respect to the distance of the nearest line of contact municipality. The upper left-hand figure shows the sample of the contiguous line-of-contact municipalities (employed in the pairwise regressions). The right-hand map in the middle shows the main RD sample of the study with municipalities within 20km of the nearest line of contact municipality. The corresponding estimates that are based on samples with different bandwidths are shown in Table C.15 in this Online Appendix.

Figure C.14: Illustration of RD samples with pseudo-lines of contact



Notes: The maps show different pseudo-RD samples in Styria. The upper left-hand map depicts the pseudo-occupation treatment according to an informal Soviet occupation proposal along district borders in Styria according to (Stelzl-Marx, 2012) (see occupation proposals in Figure C.3 in this Online Appendix). The upper right-hand map shows the pseudo occupation treatment following the River Mur in the Graz region. The bottom maps show pseudo demarcation lines 20 kilometers and 40 kilometers east of the realized line of contact. Distance measures are always with respect to the nearest pseudo-line of contact municipality. The corresponding estimates that are based on samples with different pseudo-lines of contact are shown in Table C.19 in this Online Appendix.

C.2 Additional tables

Table C.2: Geographic determinants of population growth from 1939 to 1946

	Dependent variable: Municipality population growth 1939-1946														
	Entire Styria					RDD Sample					Line-of-contact municipalities (LoCM)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Red Army	-7.96***	-10.39***	-9.76***	-4.49*	-5.16**	-6.58**	-9.72***	-8.57***	-7.28***	-6.23***	-11.84*	-15.91**	-14.16**	-10.87*	-13.76**
	(2.34)	(2.39)	(2.09)	(2.68)	(2.25)	(2.70)	(2.54)	(2.19)	(2.79)	(2.21)	(6.75)	(7.20)	(6.10)	(5.67)	(5.97)
Share of usable area		0.09***			-0.01		0.20***			0.11		0.45***			0.67***
		(0.03)			(0.07)		(0.04)			(0.10)		(0.07)			(0.15)
Elevation range			-0.03***		-0.03***			-0.04***		-0.03***			-0.07***		-0.03*
			(0.01)		(0.01)			(0.01)		(0.01)			(0.02)		(0.02)
Roughness			0.13***		0.11**			0.14**		0.12**			0.26**		0.22**
			(0.05)		(0.05)			(0.06)		(0.06)			(0.10)		(0.08)
Distance to Graz				-0.35***	-0.26***				-0.46***	-0.19				-1.34	-0.57
				(0.08)	(0.08)				(0.12)	(0.13)				(0.87)	(0.43)
Dist. to Graz squared				0.00***	0.00***				0.00***	0.00**				0.01	0.00
				(0.00)	(0.00)				(0.00)	(0.00)				(0.01)	(0.00)
Constant	114.74***	112.47***	118.91***	119.34***	120.87***	113.25***	107.65***	121.53***	124.80***	115.36***	113.81***	103.36***	128.62***	149.66***	96.05***
	(2.24)	(2.49)	(2.45)	(3.25)	(5.62)	(2.46)	(2.99)	(2.81)	(4.14)	(8.01)	(6.49)	(7.44)	(10.25)	(19.71)	(13.85)
No. of obs.	539	539	539	539	539	191	191	191	191	191	48	48	48	48	48

Notes: The dependent variable is municipality population growth from 1939 (last municipality census before WWII) to the first municipality population figures after WWII in 1946 (food vouchers data) in percentage points. The explanatory variables are time-invariant geographic controls. Divided municipalities along the line of contact are excluded from the regressions. Columns (1) to (5) show population growth for all of Styria; Columns (6) to (10) show population growth for the RD sample (municipalities within 20 kilometers of the nearest line of contact municipality); Columns (11) to (15) show population growth for the contiguous line-of-contact municipalities (pairwise sample). Spatial dependent standard errors and standard errors clustered at the pair level in Columns (11) to (15) respectively are in parentheses. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.3: Summary statistics

	Full sample (entire Styria)					RDD Sample (means)		Line-of-contact municipalities (means)	
	Obs.	Mean	Std. Dev.	Min.	Max.	Red Army (n=116)	Western Allies (n=75)	Red Army (n=24)	Western Allies (n=24)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Liberation of Styria									
Red Army (n=446)	542	0.82	0.38	0	1	1.00	0	1.00	0
Western Allies (n=93)	542	0.17	0.38	0	1	0	1.00	0	1.00
US troops (n=37)	542	0.07	0.25	0	1	0	0.33	0	0.42
British troops (n=56)	542	0.10	0.30	0	1	0	0.67	0	0.58
Partitioned municipalities (n=3)	542	0.01	0.07	0	1	–	–	–	–
Population figures									
Population	8,672	1901.04	9062.03	99	261,726	1722.13	1138.37	2123.57	1444.07
Population per km^2 of total area	8,672	96.25	178.30	1.46	3229.34	101.43	56.31	89.01	50.95
Population per km^2 of usable area	8,672	179.35	212.815	35.099	3231.42	196.924	152.81	207.84	156.45
Population in 1900 (1939=100)	542	95.39	16.69	32.92	158.26	93.74	94.26	90.84	93.35
Census 1939									
Population share female	542	50.26	2.60	27.65	59.67	48.83	49.64	47.48	48.25
Population share 20–65 years	542	65.37	4.08	52.99	83.74	66.18	64.10	65.83	65.12
Share unemployed[a]	542	10.60	5.34	2.19	42.05	12.19	11.60	12.72	11.65
Share agriculture	542	66.07	24.21	1.83	98.93	59.96	61.82	51.43	56.46
Share industry	542	22.51	16.59	1.02	85.19	25.89	23.83	31.46	28.01
Share self-employed	542	32.20	11.77	3.38	53.67	26.52	29.66	21.86	25.32
Share medium farms (10–19ha)	542	16.51	7.17	0.00	42.22	14.85	14.58	12.82	13.59
Census 1951									
Population share female	542	51.51	2.00	44.15	59.20	50.82	50.76	50.40	49.74
Population share 20 – 65 years	542	58.53	3.14	47.56	67.62	58.69	56.76	58.30	57.26
Population share foreigners	542	3.44	4.25	0.00	46.09	3.58	2.57	2.96	2.85
Share agriculture	542	58.11	24.63	1.59	95.98	51.93	53.25	46.36	49.42
Share industry	542	30.27	17.85	0.57	89.07	33.99	32.06	37.36	36.99
Share self-employed	542	21.92	6.65	4.09	35.54	19.39	18.26	16.60	16.25
Census 2011									
Population share female	542	50.28	1.72	37.75	55.71	50.37	50.45	50.45	50.53
Population share 20 – 65 years	542	61.20	2.35	51.18	67.66	61.08	60.21	60.21	60.56
Population share foreigners	542	3.34	2.79	0.00	34.93	3.42	3.39	3.57	2.77
Share unemployed	542	3.88	1.58	0.65	11.08	3.81	3.92	4.14	4.50
Share agriculture	542	9.77	7.11	0.17	46.43	9.57	12.68	11.29	12.65
Share industry	542	34.97	7.99	10.39	58.18	33.58	32.68	34.38	30.40
Share self-employed	542	12.63	4.14	4.21	31.18	12.30	13.58	12.14	13.75
Share workplaces in industry	542	24.69	16.70	0.00	87.72	24.73	22.08	24.37	19.46
Share workplaces in services	542	51.07	18.04	9.46	97.17	52.00	50.54	52.41	56.59
Workplaces per firm	542	3.81	2.56	1.25	26.84	3.96	3.52	4.57	3.35
Industrial workplaces per ind. firm	542	9.10	9.55	0.00	75.63	9.77	7.67	11.59	6.88
Share medium farms (10–19ha)	542	18.59	7.40	0.00	45.45	16.84	16.46	14.36	15.42
Municipal tax revenue / employee (€)[b]	540	400.23	241.75	13.43	1323.27	427.10	383.54	407.30	471.81
Geography									
Area (in km^2)	542	30.84	32.31	1.08	285.30	36.08	44.26	50.08	43.02
Share of usable area	542	48.82	24.44	2.19	100.13	43.04	27.58	23.13	32.14
Distance to highway slip road (in km)	542	12.11	8.80	0.22	39.08	9.01	19.38	11.69	9.73
Distance to Graz (in km)	542	47.43	28.87	0	141.85	41.05	83.35	71.47	57.69

Notes: The table shows the summary statistics for all 542 municipalities in Styria (territorial status in 2011). The shares are shown in percentage points. The descriptive statistics for the overall sample are shown in Columns (1) to (5). Columns (6) and (7) divide the RD sample with municipalities within 20 kilometers of the nearest line-of-contact municipality according to the liberation treatment (Red Army vs. Western Allies); Columns (8) and (9) divide line-of-contact municipalities according to the liberation treatment (Red Army vs. Western Allies). Population data cover 15 censuses from 1869 to 2011 and food vouchers data for 1946. Census data on demographic and occupation characteristics (according to the head of the family) in 1934/1939 and 1951 are self-compiled and merged to the municipal territorial status as of 2011. Recent data are retrieved from STATcube from *Statistik Austria*. See data sources in the Online Appendix B. a) Share of population without occupation (only available for 1934). b) Three-year averages (2010–2012).

Table C.4: Functional forms of RD polynomials

Description	Functional form RDD polynomial
(1)	(2)
Panel A: Single-dimensional RDD polynomials	
Linear	km
Quadratic	km + km^2
Cubic	km + km^2 + km^3
Quartic	km + km^2 + km^3 + km^4
Panel B: Multi-dimensional RDD polynomials	
Linear	lon + lat
Quadratic	lon + lon^2 + lat + lat^2 + (lon × lat)
Cubic	lon + lon^2 + lon^3 + lat + lat^2 + lat^3 + (lon × lat) + (lon^2 × lat) + (lon × lat^2)
Quartic	lon + lon^2 + lon^3 + lon^4 + lat + lat^2 + lat^3 + lat^4 + (lon × lat) + (lon × lat^2) + (lon × lat^3) + (lon^2 × lat) + (lon^2 × lat^2) + (lon^2 × lat^3) + (lon^3 × lat) + (lon^3 × lat^2)

Notes: The table provides all functional forms of the RD polynomials that are employed in the paper (either in the main text or in the Online Appendix). The single-dimensional RD uses kilometers (km) as the forcing variable, defined as the municipality distance of the nearest line-of-contact municipality. Distances in the Red-Army-liberated areas (Western-Allies liberated areas) are positive (negative). The multi-dimensional RD employs longitude (lon) and latitude (lat) as forcing variables (standardized to Styrian-Carinthian means).

Table C.5: RD sample selection

	Optimal bandwidth (BW) selection in kilometers						
	Population growth, 1939 to 2011			Tax revenues per local employee 2011			Average
	BW estimator	BW bias	rho (est./bias)	BW estimator	BW bias	rho (est./bias)	BW estimator
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Linear RD regression	11.76	18.37	0.64	17.59	22.43	0.78	14.68
Quadratic RD regression	21.03	24.49	0.86	**19.36**	20.03	0.97	20.20
Cubic RD regression	**19.97**	17.90	1.12	24.35	21.80	1.12	22.16
Quartic RD regression	21.43	19.61	1.09	26.22	25.37	1.03	23.83
Average bandwidth (columns)	18.55	20.09	-	21.88	22.41	-	**20.22**
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	-
No. of obs.	539	539	539	539	539	539	-

Notes: The table reports the optimal bandwidth selection for single-dimensional RD estimates based on Stata's package *rdrobust* (Calonico *et al.*, 2017). The estimates are based on the entire sample of Styrian municipalities (without divided municipalities). The estimates use linear, quadratic, cubic and quartic polynomial fits respectively and a uniform kernel function to construct the local-polynomial estimator(s). Selection of the bandwidth for the main "RD Sample" are based on averages of the BW estimators (20.22 kilometers $\approx$ 20 kilometers). A cubic polynomial fit for population figures and a quadratic polynomial fit for tax revenues per employee have bandwidths closest to the overall averages. The numbers in bold represent those bandwidths that are close to 20 kilometers. Rho (BW estimator divided by BW bias) is reasonably close to one for these bandwidth selections, too. The main estimates will thus use a bandwidth of 20 kilometers, a cubic RD polynomial fit for population estimates, and a quadratic RD polynomial fit for tax revenues per local employee.

Table C.6: Unconditional continuity of covariates across the line of contact

	Dependent variable: Municipality covariates															
	Geography				Census in 1934				Census in 1939							
	Area (km^2)	Share useable area	Average sea level	Distance to Graz (km)	Agriculture	Industry	Unemployed	Female	Agriculture	Industry	Farms <10ha(%)	Farms per useable area	Self employed	Pop per household	Age below 18	Age above 65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel A: OLS dummy specification																
Red Army	0.48	15.46***	-409.55***	-42.30***	-0.81	1.75	0.60	-0.28	-1.87	2.07	18.33***	4.20***	-1.27	-0.62***	-2.85***	0.76*
	(0.57)	(5.49)	(83.66)	(7.73)	(4.15)	(2.97)	(1.04)	(0.34)	(4.25)	(2.95)	(4.63)	(1.29)	(4.01)	(0.20)	(1.00)	(0.40)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Segment FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Geography FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Panel B: Pairwise regression with contiguous demarcation line municipalities																
Red Army	-1.12	-0.79	-23.88	-2.80	-2.31	-0.15	0.42	-0.01	-1.14	-0.93	1.24	1.27	-2.19	0.27	0.46	0.01
	(1.14)	(4.50)	(64.89)	(6.46)	(5.55)	(4.53)	(1.01)	(0.32)	(5.23)	(4.29)	(4.47)	(1.02)	(3.79)	(0.28)	(0.83)	(0.23)
No. of obs.	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
No. municipality	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Pair FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Panel C: Single-dimensional RDD in distance to demarcation line municipalities																
Red Army	0.19	9.45	-185.22**	-15.63	-1.80	0.05	0.76	-0.17	-0.65	-0.51	6.00	0.37	-3.45	-0.14	-0.63	0.13
	(1.05)	(7.07)	(82.24)	(9.70)	(7.95)	(5.94)	(1.64)	(0.48)	(8.10)	(5.39)	(6.00)	(2.20)	(6.35)	(0.26)	(1.30)	(0.43)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Segment FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Geography FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Panel D: Multi-dimensional RDD in longitude and latitude																
Red Army	0.24	3.27	-23.04	-0.41	4.41	-4.54	-0.50	0.13	3.83	-5.34	5.00	0.50	0.65	-0.22	-0.96	0.32
	(0.84)	(6.96)	(76.01)	(0.46)	(8.71)	(7.15)	(1.74)	(0.52)	(8.32)	(6.49)	(6.38)	(1.73)	(6.01)	(0.27)	(1.39)	(0.37)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Segment FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Geography FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in various time-invariant (Columns (1) to (4)) and pretreatment covariates (Columns (5) to (16)). Coefficients represent shares (in %) except for area (in km^2), average sea level (in m), Distance to Graz (in km), farms per km^2 and population per household. The shares of the industrial sectors, of unemployed and of self-employed are according to the head of the family. Panels A, C and D consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). Panel B consists of contiguous line-of-contact municipalities. Panel A employs an OLS dummy specification (Dummy=1 for Red-Army-liberated municipalities, 0 otherwise). RD estimates in Panel C and D employ a cubic polynomial fit. Estimates that include segment and geography fixed effects are shown in Table 1 of the paper. Standard errors in parentheses in Panel B are clustered at the contiguous pair level and corrected for spatial dependence in Panel A, C and D. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.7: Population dynamics across the line of contact from census to census

	Dependent variable: Municipal population growth (in %)															
	Pre-WWII period (census to census)							Pre-WWII vs. post-WWII		Post-WWII period (census to census)						
	1969-1880	1880-1890	1890-1900	1900-1910	1910-1923	1923-1934	1934-1939	1939-1946	1939-1951	1946-1951	1951-1961	1961-1971	1971-1981	1981-1991	1991-2001	2001-2011
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel A: Pairwise regression with contiguous demarcation line municipalities																
Red Army	0.37	1.05	1.90	1.44	1.41	0.06	8.52**	-17.60***	-13.80***	-0.05	2.26	0.05	-2.04	-1.51	-5.34***	-4.21***
	(4.19)	(2.37)	(2.79)	(1.43)	(2.26)	(1.56)	(3.99)	(4.65)	(3.05)	(3.99)	(1.96)	(2.07)	(1.40)	(1.47)	(1.54)	(1.13)
No. of obs.	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
No. municipality	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Single-dimensional RDD in distance to demarcation line municipalities																
Red Army	2.83	4.18	2.36	2.47*	1.08	-0.85	1.08	-11.18***	-11.60***	-4.46	1.39	-0.30	-2.14	-2.60	-5.93***	-2.27*
	(4.91)	(3.00)	(3.48)	(1.29)	(2.72)	(2.35)	(4.37)	(4.10)	(2.44)	(3.80)	(2.36)	(2.56)	(1.68)	(1.73)	(1.76)	(1.21)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Segment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Multi-dimensional RDD in longitude and latitude																
Red Army	-0.69	4.09	1.83	3.49**	-0.68	-0.14	2.59	-6.43*	-9.74***	-7.16**	2.68	-1.02	-2.08	-2.43	-4.19***	-1.15
	(4.32)	(3.23)	(3.32)	(1.49)	(2.44)	(2.45)	(3.55)	(3.47)	(2.53)	(3.20)	(2.25)	(2.46)	(1.71)	(1.72)	(1.57)	(1.23)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Segment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table tests for spatial discontinuities in municipality population growth (in percentage points) across the intra-Styrian line of contact from one census to the next census (incl. the population growth from the census in 1939 to the food voucher data in 1946 in column (8)). Panel A consists of contiguous line-of-contact municipalities. Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). The estimates in Panel A include pair fixed effects; estimates in Panels B and C include segment and geography fixed effects. RD estimates employ a cubic polynomial fit. Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panels B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.8: Measures of local labor productivity across the line of contact in 2011

	Dependent variable: Communal tax revenues per local employee (in €)					
		Tax base controls				
	Baseline	Sector	Firm size	Occupation	Non-tax occupation	All controls
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pairwise regression						
Red Army	-146.12***	-116.57**	-196.95***	-121.65**	-122.21**	-139.94***
	(48.16)	(49.52)	(40.80)	(47.13)	(47.23)	(47.81)
No. of obs.	90	90	90	90	90	90
No. of munc.	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted	0.60	0.71	0.72	0.67	0.69	0.77
Panel B: Single-dimensional RDD						
Red Army	-105.01*	-94.59*	-125.83***	-85.49*	-96.84**	-98.76**
	(62.28)	(50.96)	(48.15)	(48.16)	(46.77)	(41.68)
No. of obs.	191	191	191	191	191	191
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[a]	0.21	0.48	0.45	0.46	0.45	0.54
Panel C: Multi-dimensional RDD						
Red Army	-78.79	-58.20	-92.94*	-51.02	-65.49	-61.58
	(56.76)	(52.37)	(49.51)	(46.01)	(46.61)	(46.46)
No. of obs.	191	191	191	191	191	191
Seg. & Geo. FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adjusted[a]	0.16	0.45	0.41	0.45	0.43	0.52

Notes: The table tests for spatial discontinuities in municipal tax revenues per local employee in 2011 across the intra-Styrian line of contact. Panel A consists of contiguous line-of-contact municipalities. Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). RD estimates employ a quadratic polynomial fit. Column (1) shows the baseline specification. Columns (2) to (5) include economic variables that determine the taxable base (Industrial sector controls: share of workplaces in industry, share of workplaces in services (agriculture as residual); Firm size controls: workplaces divided by the number of firms, industrial workplaces divided by the number of industrial firms; Work occupation controls: share of blue collar workers; Non-taxable occupations controls: 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 C.22 in this Online Appendix. The estimates include segment and geography fixed effects. a) Adj. R2 measures stem from Stata's reg command with robust standard errors. Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panels B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.9: Measures of Labor productivity in other years

Panel A	*Dependent variable:* Wage sum tax in 1987 (in Austrian Schilling)					
	Per population		Per working age cohort		Per taxable occupation of residents	
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army	-66.29	-79.83	-101.21	-124.11	-96.00	-112.22
	(89.53)	(80.51)	(144.08)	(129.23)	(131.04)	(117.19)
No. of obs.	90	90	90	90	90	90
No. of municipalities	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged controls	No	Yes	No	Yes	No	Yes
R^2 adj.	0.53	0.69	0.53	0.69	0.53	0.69
Panel B	*Dependent variable:* Business tax revenues in 1987 (in Austrian Schilling)					
	Per total population		Per working age cohort		Per taxable occupation of residents	
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army	-38.69	-74.37	-51.56	-106.89	-36.41	-79.98
	(91.65)	(101.15)	(149.30)	(164.74)	(137.36)	(153.28)
No. of obs.	79	79	79	79	79	79
No. of municipalities	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged controls	No	Yes	No	Yes	No	Yes
R^2 adj.	0.49	0.52	0.49	0.52	0.48	0.51
Panel C	*Dependent variable:* Communal tax revenues in 2011 (in €)					
	Per total population		Per working age cohort		Per taxable occupation of residents	
	(1)	(2)	(3)	(4)	(5)	(6)
Red Army	-31.71	-35.99	-47.81	-54.65	-56.08	-61.54
	(28.77)	(27.14)	(49.41)	(46.73)	(54.66)	(51.69)
No. of obs.	90	90	90	90	90	90
No. of municipalities	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
R^2 adj.	0.49	0.60	0.49	0.59	0.47	0.58

Notes: The table tests for spatial discontinuities across contiguous line-of-contact municipalities for various tax figures in the year 1987 (Panels A and B) and compares the respective approach to the tax figures in 2011 (Panel C). Columns (1) and (2) divides municipality tax revenues by local population; Columns (3) and (4) by the local number of the working age cohort; and Column (5) and (6) by the local number of residents (according to the head of the family) that work in taxable occupation (i.e., without residents employed in agriculture or public sector). Lagged controls are the tax controls according to Table 3 for the year 1981 in Panels A and B. Standard errors in parentheses are clustered at the contiguous pair level. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.10: Donor pool cities for the synthetic control method

Donor pool West Austria	Donor pool East Austria
Description of Sample: Liberated by Western Allies in May 1945; occupied by Western Allies (USA; UK; France) from July 1945 to October 1955	*Description of Sample:* Liberated by the Red Army in Spring 1945; occupied by the Soviet Union from July 1945 to October 1955
Linz	**St. Pölten**
Innsbruck	Wiener Neustadt
Salzburg	Klosterneuburg
Klagenfurt am Wörthersee	Baden
Villach	Krems an der Donau
Steyr	Amstetten
Wels	Mödling
Wolfsberg	Schwechat
Dornbirn	Stockerau
Bregenz	Ternitz
Feldkirch	Zwettl
Gmunden	Hollabrunn
Bad Ischl	Neunkirchen
	Waidhofen an der Ybbs
	Berndorf
	Perchtoldsdorf
	Mistelbach

Notes: The table lists the donor pools for the synthetic control unit of the city of Graz (of the metropolitan area of Graz). Donor pool cities are all Austrian cities above 10,000 inhabitants in 1939 that were either liberated and occupied by Western Allies or liberated by the Red Army and occupied by the Soviet Union after WWII. Cities are sorted by size in 1939 in the respective donor pools. Cities in bold are state capital cities. Quadripartite Vienna is excluded from all donor pools.

Table C.11: Heterogeneous effects and the entire UK zone

	Dependent variable: Population growth (in %) and tax revenues (in €)											
	Heterogeneous effects within Styria						UK Zone (Styria and Carinthia)					
	US vs Red Army (Enns Valley)			UK vs Red Army (Mur Valley and Graz region)			Entire UK zone (incl. Styrian-Carinthian border)			Styrian-Carinthian border only (South of 46.95°North)		
	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues
	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Pairwise regression												
Red Army	-23.20***	-56.94***	-280.10**	-9.07**	-5.92	-99.45***	-14.10***	-27.87***	-132.61***	-15.44***	-46.57***	411.00
	(5.32)	(14.47)	(116.71)	(3.60)	(7.53)	(36.16)	(2.63)	(6.44)	(39.92)	(4.78)	(5.48)	(421.85)
No. of obs.	30	30	30	58	58	58	110	110	110	20	20	20
No. of municipalities	17	17	17	31	31	31	59	59	59	12	12	12
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Panel B: Single-dimensional RDD												
Red Army	-15.54***	-33.17*	-170.68**	-8.31***	-18.04*	-74.10***	-10.93***	-23.21***	-91.04**	-8.28**	-23.53***	-72.02
	(4.14)	(19.09)	(69.44)	(2.55)	(9.96)	(22.08)	(2.01)	(8.71)	(35.11)	(4.05)	(5.22)	(81.39)
No. of obs.	42	42	42	146	146	146	218	218	218	56	56	56
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Panel C: Multi-dimensional RDD												
Red Army	-16.48**	-43.32**	-123.06	-8.27**	-20.67*	-68.37***	-8.07***	-14.04*	-52.95	-36.12**	-36.78	-228.32*
	(7.09)	(16.68)	(78.68)	(3.64)	(11.82)	(24.17)	(2.56)	(7.75)	(45.26)	(14.38)	(23.55)	(134.13)
No. of obs.	42	42	42	146	146	146	218	218	218	56	56	56
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in municipality population growth (in percentage points) and municipal tax revenues per local employee for different subsamples along the line of contact. Columns (1) to (6) look at within-Styria heterogeneity; Columns (7) to (9) expand the line of contact along the Styrian-Carinthian border; Columns (10) to (12) look at the Styrian-Carintian state border sample separately. A graphical representation of the respective regional subsamples is shown in Figure C.10 in this Online Appendix. Panel A consists of contiguous line-of-contact municipalities and Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality in the respective regional subsample. RD estimates on population growth employ a cubic polynomial fit; RD estimates on tax revenues per local employee employ a quadratic polynomial fit. All estimates include segment and geography fixed effects and estimates on tax revenues per employee also control for economic variables that determine the taxable base (see Table 3). Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panels B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.12: Effects of regional shocks and regional policies on population dynamics

	Dependent variable: Municipality population growth 1939-2011 (in %)														
	Pairwise regression					Single-dimensional RDD					Multi-dimensional RDD				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Red Army	-23.55***	-26.09***	-24.72**	-22.92***	-26.28***	-26.89***	-24.67***	-25.83***	-22.42**	-22.10**	-22.89***	-21.96***	-23.13***	-21.50**	-22.77***
	(7.72)	(7.49)	(9.53)	(7.78)	(9.70)	(9.95)	(9.39)	(9.59)	(9.45)	(9.94)	(7.90)	(7.97)	(8.03)	(8.38)	(8.56)
Aerial bombing WWII	3.61				22.53	13.43				18.49	10.69				12.87
	(53.24)				(48.60)	(16.22)				(20.46)	(12.58)				(15.98)
Dismantled plants in 1945		35.58			43.29		-8.06			-15.43		-2.89			-8.07
		(46.17)			(57.74)		(13.11)			(17.19)		(13.39)			(16.32)
Highway access in 2011			4.55		6.11			3.08		1.15			6.34		5.83
			(13.82)		(14.16)			(6.37)		(6.01)			(6.37)		(6.23)
ERDF Objective-2				8.91	7.56				-24.03	-22.80				-3.89	-1.40
				(12.22)	(12.63)				(18.55)	(18.76)				(12.89)	(14.52)
ERDF Phasing-out[a]									-29.37*	-29.20				-5.89	-3.96
									(17.67)	(17.67)				(11.92)	(13.25)
No. of obs.	90	90	90	90	90	191	191	191	191	191	191	191	191	191	191
No. of municipalities	48	48	48	48	48	191	191	191	191	191	191	191	191	191	191
Pair FE	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Segment & Geo. FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in municipality population growth (in percentage points) and controls for regional shocks and regional policies during and after WWII. Columns (1) to (5) consist of contiguous line-of-contact municipalities. Columns (6) to (15) consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). RD estimates employ a cubic polynomial fit and include segment and geography fixed effects. Proxies for regional shocks and regional policies are: Aerial bombing during WWII (dummy that equals 1 for targeted municipalities and their direct neighbors); Dismantled plants (dummy that equals 1 for municipalities within 5 kilometers of the nearest municipality where the Red Army officially dismantled plants); Highway access (dummy that equals 1 if the nearest slip road is within 10 km of a municipality); ERDF Objective-2 (Dummy that equals 1 for municipalities that were eligible for Objective-2 EU funds in the 2000–2006period); ERDF Phasing-out (Dummy that equals 1 for municipalities that were eligible for Phasing-out EU funds in the 2000–2006 period). a) ERDF Phasing-out" serves as the reference category in the pairwise regression because areas that are not eligible for EU funds are entirely missing at the line of contact. Graphical representations of the respective regional shocks during WWII and regional policies after WWII are shown in Figure C.12 in this Online Appendix. Standard errors in parentheses Columns (1) to (5) are clustered at the contiguous pair level and corrected for spatial dependence in Columns (6) to (15). Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.13: Effects of regional shocks and regional policies on local tax revenues

	Dependent variable: Municipality tax revenues per employee (in €)														
	Pairwise regression					Single-dimensional RDD					Multi-dimensional RDD				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Red Army	-153.30***	-169.14***	-114.91**	-150.21***	-134.36***	-103.60***	-97.16**	-96.83***	-104.34***	-100.60***	-66.87	-57.15	-53.17	-69.05*	-67.68*
	(42.94)	(45.08)	(45.48)	(40.11)	(46.57)	(36.38)	(38.23)	(36.31)	(36.67)	(35.34)	(44.04)	(46.26)	(41.83)	(39.36)	(39.91)
Aerial bombing WWII	-139.58				-37.60	64.62**				76.75**	86.19**				83.38**
	(96.07)				(79.10)	(32.31)				(37.53)	(34.51)				(35.36)
Dismantled plants in 1945		247.20**			199.64		-26.00			-50.78		-1.48			-31.09
		(117.75)			(120.73)		(39.85)			(42.54)		(39.38)			(41.57)
Highway access in 2011			-164.80**		-149.71*			-30.91		-28.86			-42.24		-43.90
			(82.01)		(85.41)			(36.60)		(38.15)			(35.93)		(36.55)
ERDF Objective-2				-13.04	11.32				-41.37	-40.23				-104.85***	-101.74***
				(94.36)	(90.05)				(31.13)	(28.90)				(37.10)	(35.58)
ERDF Phasing-out[a]									19.82	13.65				-35.76	-41.48
									(47.20)	(48.12)				(42.72)	(44.72)
No. of obs.	90	90	90	90	90	191	191	191	191	191	191	191	191	191	191
No. of municipalities	48	48	48	48	48	191	191	191	191	191	191	191	191	191	191
Pair FE	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Segment & Geo. FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in local tax revenue per employee and controls for regional shocks and regional policies during and after WWII. Columns (1) to (5) consist of contiguous line-of-contact municipalities. Columns (6) to (15) consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). RD estimates employ a quadratic polynomial fit and include segment and geography fixed effects. All estimates control for economic variables that determine the taxable base (see Table 3). Proxies for regional shocks and regional policies are: Aerial bombing during WWII (dummy that equals 1 for targeted municipalities and their direct neighbors); Dismantled plants (dummy that equals 1 for municipalities within 5 kilometers of the nearest municipality where the Red Army officially dismantled plants); Highway access (dummy that equals 1 if the nearest slip road is within 10 km of a municipality); ERDF Objective-2 (Dummy that equals 1 for municipalities that were eligible for Objective-2 EU funds in the 2000–2006 period); ERDF Phasing-out (Dummy that equals 1 for municipalities that were eligible for Phasing-out EU funds in the 2000–2006 period). a) ERDF Phasing-out" serves as the reference category in the pairwise regression because areas that are not eligible for EU funds are entirely missing at the line of contact. Graphical representations of the respective regional shocks during WWII and regional policies after WWII are shown in Figure C.12 in this Online Appendix. Standard errors in parentheses in Columns (1) to (5) are clustered at the contiguous pair level and corrected for spatial dependence in Columns (6) to (15). Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.14: Alternative RD polynomials

	Dependent variable: Population growth (in %) and tax revenues (in €)					
	Single-dimensional RDD			Multi-dimensional RDD		
	Population growth		Tax revenues	Population growth		Tax revenues
	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear polynomial						
Red Army	-10.50***	-27.13***	-100.93***	-8.19***	-12.35	-38.41
	(2.22)	(9.57)	(38.50)	(2.37)	(7.83)	(46.24)
Panel B: Quadratic polynomial						
Red Army	-10.42***	-27.03***	-99.61***	-6.97***	-11.05	-57.35
	(2.26)	(9.49)	(37.50)	(2.44)	(8.78)	(43.72)
Panel C: Cubic polynomial						
Red Army	-11.60***	-25.70***	-78.59*	-9.74***	-22.14***	-48.32
	(2.44)	(9.52)	(41.37)	(2.53)	(7.91)	(48.03)
Panel D: Quartic polynomial						
Red Army	-11.65***	-25.36***	-82.88*	-11.90***	-31.85***	-69.77
	(2.45)	(9.53)	(42.35)	(3.25)	(11.59)	(47.71)
No. of obs. in all samples	191	191	191	191	191	191
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in municipality population growth (in percentage points) in Columns (1), (2), (4) and (5) and for spatial discontinuities in local tax revenues per local employee in Columns (3) and (6). Panels A to D employ different functional forms of the RD polynomial for both the single-dimensional RD and the multi-dimensional RD. The definition of the respective functional forms of the polynomial are shown in Table C.4 in this Online Appendix. All estimates include segment and geography fixed effects and Columns (3) and (6) also control for economic variables that determine the taxable base (see Table 3). Standard errors in parentheses are corrected for spatial dependence. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.15: Different bandwidths

	Dependent variable: Population growth (in %) and tax revenues (in €)											
	Bandwidth ±10km			Bandwidth ±15km			Bandwidth ±25km			Bandwidth ±30km		
	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues
	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Single-dimensional RDD 4												
Red Army	-10.22***	-13.54	-108.49***	-11.24***	-18.01*	-85.70**	-10.56***	-25.27***	-98.04**	-12.55***	-31.57***	-82.61**
	(2.77)	(9.98)	(35.76)	(2.36)	(9.45)	(39.68)	(2.48)	(9.52)	(37.96)	(2.33)	(10.82)	(37.45)
No. of obs.	111	111	111	158	158	158	232	232	232	268	268	268
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Panel B: Multi-dimensional RDD4												
Red Army	-9.21***	-11.33	-73.84*	-11.75***	-24.42**	-56.17	-11.22***	-19.40**	-60.32	-10.08***	-22.62**	-56.00
	(3.05)	(11.68)	(37.58)	(2.77)	(10.01)	(35.21)	(2.97)	(8.88)	(42.58)	(2.90)	(8.84)	(43.41)
No. of obs.	111	111	111	158	158	158	232	232	232	268	268	268
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in municipality population growth (in percentage points) and municipal tax revenues per local employee. The estimates employ different bandwidths of 10, 15, 25 and 30 kilometers of the nearest line-of-contact municipality. Panel A uses single-dimensional RD; Panel B uses multi-dimensional RD. RD estimates on population growth employ a cubic polynomial fit; RD estimates on tax revenues per local employee employ a quadratic polynomial fit. A graphical representation of the respective regional samples is shown in Figure C.13 in this Online Appendix. All estimates include segment and geography fixed effects and estimates on tax revenues per employee also control for economic variables that determine the taxable base (see Table 3). Standard errors in parentheses are corrected for spatial dependence. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.16: Optimal data-driven bandwidth selection procedure (rdrobust)

	Dependent variable: Population growth (in %) and tax revenues (in €)							
	Equal bandwidth (MSE-criteria)				Unequal bandwidth (MSE-two-criteria)			
	Population growth		Tax revenues		Population growth		Tax revenues	
	1939–1951	1939–2011	w/o tax controls	Incl. tax controls	1939–1951	1939–2011	w/o tax controls	Incl. tax controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Linear local polynomial for point estimator								
Red Army	-11.77***	-22.43**	-107.47**	-85.22**	-11.53***	-23.91***	-125.47**	-84.03**
	(3.73)	(9.11)	(50.78)	(40.96)	(3.56)	(8.41)	(51.05)	(40.60)
BW selection in km (left/right)	12.6/12.6	11.8/11.8	17.6/17.6	15.1/15.1	12.2/19.7	17.4/14.8	15.6/18.3	15.9/15.2
Effective No. of obs. (left/right)	56/83	54/77	69/108	63/95	54/116	68/95	65/109	66/95
Panel B: Quadratic local polynomial for point estimator								
Red Army	-12.04***	-24.24**	-68.41	-98.98**	-12.61***	-23.89**	-117.07**	-147.56***
	(4.16)	(9.57)	(57.05)	(45.76)	(4.02)	(9.89)	(55.61)	(41.74)
BW selection in km (left/right)	19.2/19.2	21.0/21.0	19.4/19.4	13.1/13.1	20.1/36.1	20.1/25.5	21.0/23.2	14.4/35.8
Effective No. of obs. (left/right)	72/112	76/123	72/115	57/85	76/222	76/150	76/141	61/220
Panel C: Cubic local polynomial for point estimator								
Red Army	-11.40**	-17.17*	-70.85	-106.72**	-12.75***	-25.94***	-99.44*	-138.70***
	(4.48)	(9.99)	(58.66)	(46.22)	(4.23)	(9.77)	(58.10)	(42.89)
BW selection in km (left/right)	28.0/28.0	20.0/20.0	24.3/24.3	15.8/15.8	27/57.2	19.0/39.0	21.5/34.5	16.4/37.2
Effective No. of obs. (left/right)	85/168	75/116	82/143	66/96	85/365	72/248	76/212	67/228
Panel D: Quartic local polynomial for point estimator								
Red Army	-10.95**	-17.81*	-77.80	-115.77***	-11.62***	-22.02**	-108.86*	-131.69***
	(4.49)	(10.06)	(59.71)	(43.63)	(4.49)	(10.06)	(58.98)	(43.50)
BW selection in km (left/right)	23.5/23.5	21.4/21.4	26.2/26.2	21.8/21.8	23.9/57.0	19.4/46.4	25.1/47.0	22.6/58.6
Effective No. of obs. (left/right)	81/143	76/127	84/156	78/131	82/365	73/292	84/298	79/377
No. of obs. in all samples	539	539	539	539	539	539	539	539
Segment and Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	No	Yes	No	No	No	Yes

Notes: The table employs the optimal data driven bandwidth selection procedure *rdrobust* (Calonico *et al.*, 2014a,b, 2017) to test for spatial discontinuities in municipality population growth (in percentage points) and municipal tax revenues per local employee (three-year averages for 2010–2012 in Euro) across the intra-Styria line of contact. Bandwidth selection is based on uniform weighting of observations and ignores the presence of mass points (i.e., line-of-contact municipalities). Columns (1) to (4) employ equal bandwidth selection procedures on both sides of the line of contact; Columns (5) to (8) allow for different bandwidth selections on both sides. *"BW selection in km"* reports the optimal bandwidth to the left (Western Allies) and to the right (Red Army) of the line of contact. The *"Effective number of observations"* reports the respective numbers of municipalities in the subsamples. All estimates include segment and geography fixed effects and Columns (4) and (8) also control for economic variables that determine the taxable base (see Table 3). Standard errors are based on *rdrobust* and are in parentheses. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.17: Standard errors with different spatial cut-offs (RD)

	Dependent variable: Population growth (in %) and tax revenues (in €)							
	Single-dimensional RDD				Multi-dimensional RDD			
	Population growth		Tax revenues		Population growth		Tax revenues	
	1939–1951	1939–2011	w/o tax base controls	Tax base controls	1939–1951	1939–2011	w/o tax base controls	Tax base controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Red Army	-11.60	-25.70	-106.71	-99.61	-9.74	-22.14	-74.22	-57.35
Spatial correlated standard errors								
Spatial cutoff 0.0 km	(3.94)***	(9.27)***	(51.50)**	(37.48)***	(3.54)***	(8.28)***	(52.04)#	(45.92)
Spatial cutoff 2.5 km	(3.93)***	(8.83)***	(52.21)**	(37.88)***	(3.55)***	(8.19)***	(53.12)#	(46.43)
Spatial cutoff 5.0 km	(3.39)***	(9.18)***	(53.29)**	(36.46)***	(3.37)***	(8.15)***	(55.01)#	(46.34)
Spatial cutoff 7.5 km	(2.44)***	(9.52)***	(59.30)*	(37.50)***	(2.53)***	(7.91)***	(55.60)#	(43.72)#
Spatial cutoff 10.0 km	(2.50)***	(10.21)**	(58.08)*	(38.69)**	(1.62)***	(8.11)***	(56.55)#	(40.13)#
Spatial cutoff 12.5 km	(1.25)***	(9.92)**	(58.40)*	(40.32)**	(1.01)***	(8.26)***	(53.99)#	(38.43)##
Spatial cutoff 15.0 km	(2.67)***	(10.85)**	(57.76)*	(44.04)**	(1.81)***	(8.86)**	(60.58)	(45.60)
Spatial cutoff 17.5 km	(3.82)***	(9.69)***	(53.92)**	(47.29)**	(2.42)***	(6.90)***	(55.43)#	(50.04)
Spatial cutoff 20.0 km	(3.90)***	(9.51)***	(34.85)***	(31.24)***	(2.67)***	(6.85)***	(42.63)*	(36.26)##
Spatial cutoff 25.0 km[a]	(2.94)***	(10.76)**	(24.29)***	(13.47)***	(1.26)***	(7.46)***	(29.37)**	(10.48)***
Spatial cutoff 30.0 km	(1.85)***	(9.93)**	(38.22)***	(16.64)***	(1.97)***	(7.26)***	(48.95)##	(11.21)***
Spatial cutoff 35.0 km	(2.92)***	(9.12)***	(29.63)***	(19.08)***	(2.51)***	(3.76)***	(48.10)##	(13.00)***
Spatial cutoff 40.0 km	(2.19)***	(7.37)***	(28.01)***	(29.09)***	(1.86)***	(3.27)***	(47.42)##	(37.24)##
Spatial cutoff 45.0 km	(2.18)***	(6.23)***	(14.95)***	(34.30)***	(2.49)***	(1.02)***	(32.49)**	(13.30)***
Spatial cutoff 50.0 km[b]	(1.72)***	(4.91)***	(16.00)***	(29.95)***	(2.97)***	(2.03)***	(14.92)***	(19.04)***
"Conventional" clustered standard errors								
No correction	(3.57)***	(11.31)**	(55.39)*	(42.75)**	(3.47)***	(10.66)**	(55.33)#	(42.32)#
Clustered at municipality	(4.06)***	(9.58)***	(53.05)**	(39.38)**	(3.71)***	(8.67)**	(54.06)#	(48.68)
No. of obs.	191	191	191	191	191	191	191	191
Segment and Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	No	Yes	No	No	No	Yes

Notes: The table shows different standard errors based on different spatial cutoffs and "conventional" standard errors for the main results in Table 2 and Table 3. The samples consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample). Population figures employ a cubic polynomial fit, local tax revenues per employee employ a quadratic polynomial fit. Segment and geography fixed effects, and tax base controls equal the ones in the main tables. Robust standard errors with various spatial cutoffs (Conley, 1999, 2008; Colella *et al.*, 2019) and "conventional" standard errors are in parentheses. a) Spatial cutoffs in Columns (4) and (8) differ slightly from the reported ones to achieve feasible standard errors. b) Spatial cutoff in Column (8) slightly differs from the reported one to achieve feasible standard errors. Significance levels: *** 0.01, ** 0.05, * 0.10, ## 0.15, # 0.20.

Table C.18: P-Values adjusted for multiple hypothesis testing for variables in 2011

	Dependent variable: Population growth (in %) and tax revenues (in €)					
	Pairwise regression outcomes		MHT adjusted p-values (based on mhtreg)			
	Coefficient (Red Army)	Naïve p-values	Unadjusted	Thm. 3.1 (LSX-2019)	Bonferroni	Holm
	(1)	(2)	(3)	(4)	(5)	(6)
Main outcome variables:						
Population growth, 1939-2011 (in %)	-23.714	0.003***	0.003***	0.037**	0.051*	0.048**
Local tax revenue per employee (in €)	-153.288	0.001***	0.001***	0.016**	0.020**	0.020**
Further variables of interest (among them tax-base controls and variables for channel discussion):						
Workplaces in agriculture (in %)	7.680	0.024**	0.025**	0.208	0.422	0.322
Workplaces in industry (in %)	1.262	0.662	0.635	0.953	1.000	1.000
Workplaces in services (in %)	-8.943	0.020**	0.019**	0.175	0.320	0.263
Workplaces in public services (in %)	0.408	0.772	0.765	0.947	1.000	1.000
Workplaces per resident	-0.008	0.815	0.791	0.791	1.000	0.791
Workplaces per firm	0.437	0.316	0.287	0.866	1.000	1.000
Workplaces per farm	-0.044	0.449	0.419	0.925	1.000	1.000
Workplaces per industrial firm	3.166	0.061*	0.053*	0.364	0.901	0.583
Workplaces per service firm	-0.267	0.540	0.528	0.937	1.000	1.000
Blue collar (in %)	-2.843	0.225	0.205	0.784	1.000	1.000
Self-employed (in %)	3.824	0.309	0.275	0.864	1.000	1.000
Compulsory education (in %)	1.962	0.009***	0.007***	0.074*	0.112	0.099*
Tertiary education (in %)	-0.311	0.390	0.364	0.922	1.000	1.000
Unemployed (in %)	-0.589	0.121	0.106	0.575	1.000	1.000
Out-commuters (in %)	-3.318	0.062*	0.049**	0.353	0.833	0.588

Notes: The table reports p-values adjusted for multiple hypothesis testing (MHT) for different outcomes based on all variables of potential interest in 2011 (main outcomes and the variables reported in the channel discussion in Table C.22 in the Online Appendix). Columns (1) and (2) show the treatment coefficients and the respective p-values from the pairwise regression with line-of-contact municipalities. Columns (3) to (6) show different p-values adjusted for multiple hypothesis testing. The reported p-values control the familywise error rates (FWER) on the treatment coefficient for each outcome and stem from the Stata command "*mhtreg*" introduced by Barsbai *et al.* (2020). *mhtreg* is an adaption to List *et al.* (2019) for regressions (LSX-2019). All reported pairwise regressions are jointly estimated with pair fixed effects, clustered standard errors at the pair level and 5000 replications. Bootstrapped resampling is also clustered. ***/**/* indicate that the corresponding (FWER adjusted) p-values are less than 1%, 5% and 10% respectively.

Table C.19: Soviet proposal and pseudo lines of contact

	Dependent variable: Population growth (in %) and tax revenues (in €)											
	Soviet occupation proposal			Along the Mur River			20 km eastward			40 km eastward		
	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues	Population growth		Tax revenues
	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee	1939–1951	1939–2011	per employee
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Pairwise regression												
Red Army	-5.25	2.31	-73.76	-7.85	-11.77	41.41	0.69	-3.15	-71.61*	-3.50	3.79	-1.62
	(5.60)	(16.08)	(108.15)	(4.90)	(15.42)	(92.00)	(2.45)	(10.03)	(39.90)	(2.12)	(7.22)	(33.34)
No. of obs.	48	48	48	50	50	50	110	110	110	108	108	108
No. of municipalities	25	25	25	30	30	30	55	55	55	56	56	56
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Panel B: Single-dimensional RDD												
Red Army	-4.43	5.89	-9.11	-6.53	1.62	-16.63	1.81	7.40	4.61	-2.73	13.68	30.27
	(8.06)	(21.40)	(39.57)	(5.12)	(23.34)	(18.31)	(4.07)	(16.63)	(46.54)	(2.65)	(14.50)	(27.71)
No. of obs.	128	128	128	191	191	191	272	272	272	279	279	279
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Panel C: Multi-dimensional RDD												
Red Army	-3.15	7.08	-2.28	-6.87	4.19	-28.24	5.04	22.07	4.59	0.32	31.67*	23.10
	(5.56)	(23.98)	(32.96)	(5.07)	(23.89)	(19.22)	(5.61)	(20.43)	(50.13)	(2.22)	(16.53)	(30.86)
No. of obs.	128	128	128	191	191	191	272	272	272	279	279	279
Segment & Geography FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax base controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: The table tests for spatial discontinuities across pseudo-line-of-contact municipalities in municipality population growth (in percentage points) and municipal tax revenues per local employee. Columns (1) to (3) test for potential discontinuities along an occupation zone proposal by the Soviet Union (see Figure C.3 in this Online Appendix). Columns (4) to (6) test for potential discontinuities along the River Mur in the Graz region. Columns (7) to (12) test for potential discontinuities along pseudo-line-of-contact municipalities that are located 20 and 40 kilometers east of the realized line of contact respectively. Panel A consists of contiguous line-of-contact municipalities and Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality in the respective pseudo-sample. RD estimates on population growth employ a cubic polynomial fit; RD estimates on tax revenues per local employee employ a quadratic polynomial fit. A graphical representation of the respective pseudo-samples is shown in Figure C.14 in this Online Appendix. All estimates include segment and geography fixed effects and estimates on tax revenues per employee also control for economic variables that determine the taxable base (in accordance with Table 3). Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panels B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.20: Differences-in-difference estimates with population dynamics

	Dependent variable: Annualized municipal population growth (in %)									
	Pairwise		LoCM		±5km to LoCM		±10km to LoCM		±20km to LoCM	
	Overall	Per period	Overall	Per period	Overall	Per period	Overall	Per period	Overall	Per period
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Red Army × PostWWII	-0.65***		-0.46**		-0.39**		-0.24*		-0.11	
	(0.24)		(0.20)		(0.17)		(0.13)		(0.10)	
Red Army × Year1939-1951		-1.48***		-1.12***		-1.11***		-0.73***		-0.52***
		(0.41)		(0.32)		(0.22)		(0.17)		(0.16)
Red Army × Year1951-1961		-0.10		0.03		-0.10		-0.16		-0.13
		(0.29)		(0.25)		(0.26)		(0.23)		(0.18)
Red Army × Year1961-1971		-0.32		-0.06		-0.17		-0.12		-0.07
		(0.33)		(0.37)		(0.28)		(0.22)		(0.17)
Red Army × Year1971-1981		-0.53*		-0.44		-0.36*		-0.25		-0.20
		(0.30)		(0.28)		(0.22)		(0.17)		(0.16)
Red Army × Year1981-1991		-0.48		-0.48		-0.31		-0.18		-0.05
		(0.37)		(0.32)		(0.22)		(0.17)		(0.15)
Red Army × Year1991-2001		-0.86**		-0.62**		-0.52*		-0.31		-0.04
		(0.36)		(0.30)		(0.27)		(0.21)		(0.17)
Red Army × Year2001-2011		-0.75***		-0.49*		-0.14		0.08		0.25
		(0.28)		(0.25)		(0.22)		(0.19)		(0.16)
No. of obs.	1260	1260	672	672	938	938	1554	1554	2674	2674
No. of municipalities	48	48	48	48	67	67	111	111	191	191
Pair FE	Yes	Yes	No	No	No	No	No	No	No	No
Municipality FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the annualized municipality population growth (in percentage points) from 1869 to 2011 at the level of municipalities across the line of contact. Columns (1) and (2) show pairwise difference-in-differences estimates with year and pair fixed effects. Columns (3) to (10) use year and municipality fixed effects and extend the sample from contiguous line-of-contact municipalities to larger regional samples of municipalities within 5, 10 and 20 kilometers of the nearest line-of-contact municipality. Standard errors in parentheses are corrected for spatial dependence. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.21: Births and deaths by year of census

	Dependent variable: Measures of natural population growth (in %, per year)							
	1951	1961[a]	1971	1981	1991	2001	2011	Pooled (1951–2011)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Natural population growth (Panel B - Panel C) per capita								
Red Army	-0.18	-0.41***	0.17	0.12	-0.51***	-0.28**	-0.22	-0.19***
	(0.14)	(0.14)	(0.26)	(0.11)	(0.13)	(0.12)	(0.15)	(0.06)
No. of obs.	90	90	90	90	90	90	90	630
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.58	0.62	0.52	0.69	0.58	0.52	0.52	0.48
Panel B: Births per capita								
Red Army	-0.13	-0.14	-0.03	-0.00	-0.04	-0.12**	0.17**	-0.04
	(0.17)	(0.10)	(0.11)	(0.07)	(0.09)	(0.06)	(0.08)	(0.03)
No. of obs.	90	90	90	90	90	90	90	630
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.54	0.70	0.42	0.75	0.48	0.59	0.58	0.69
Panel C: Deaths per capita								
Red Army	0.04	0.27**	-0.19	-0.13	0.46***	0.16	0.38***	0.14***
	(0.11)	(0.11)	(0.26)	(0.08)	(0.09)	(0.10)	(0.12)	(0.05)
No. of obs.	90	90	90	90	90	90	90	630
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 adj.	0.40	0.47	0.47	0.53	0.64	0.53	0.56	0.16

Notes: The table tests for spatial discontinuities across contiguous line-of-contact municipalities in measures of natural population growth (as percentage points) based on pairwise regressions. Panels B and C test for differences in births per capita and deaths per capita, respectively, while Panel A shows the combined view (births minus deaths). Columns (1) to (7) show estimates by census year, column (8) shows the pooled estimates based on all decennial census since WWII. Pairwise estimates include pair fixed effects. a.) Data for 1961 are based on the birth and death census in 1960. Standard errors in parentheses are clustered at the contiguous pair level. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.22: Municipal covariates in 2011

	Dependent variable: Municipality covariates														
	Employees per sector (in %)				Workplaces	Employees per production units				Type of occupation (in %)		Municipal residents' characteristics (in %)			
	Agriculture	Industry	Services	Public	per resident	All firms	Farms	Industrial firms	Service firms	Blue collar	Self-employed	Compulsory educ.	Tertiary educ.	Unemployed	Out-commuters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Panel A: Pairwise regression															
Red Army	7.68**	1.26	-8.94**	0.41	-0.01	0.44	-0.04	3.17*	-0.27	-2.84	3.82	1.96***	-0.31	-0.59	-3.32*
	(3.35)	(2.88)	(3.76)	(1.41)	(0.03)	(0.43)	(0.06)	(1.67)	(0.43)	(2.33)	(3.74)	(0.74)	(0.36)	(0.38)	(1.76)
No. of obs.	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
No. of munc	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Single-dimensional RDD															
Red Army	4.81	1.50	-6.31	0.01	0.01	0.75	0.00	2.35	0.20	-0.72	0.06	1.83*	-0.55	-0.15	-3.28
	(4.84)	(4.43)	(5.67)	(1.78)	(0.05)	(0.65)	(0.10)	(2.46)	(0.71)	(4.24)	(6.05)	(1.01)	(0.54)	(0.43)	(2.13)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Seg. & Geo FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Multi-dimensional RDD															
Red Army	5.61	0.26	-5.87	-0.17	0.01	0.41	-0.02	1.97	-0.14	-1.09	3.30	0.80	0.13	-0.22	-4.52**
	(4.78)	(4.49)	(5.95)	(1.44)	(0.05)	(0.62)	(0.10)	(2.48)	(0.63)	(4.29)	(5.88)	(1.01)	(0.51)	(0.42)	(1.81)
No. of obs.	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
Seg. & Geo FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table tests for spatial discontinuities across line-of-contact municipalities in various covariates for the year 2011. Columns (1) to (4) divide the number of local workplaces per sector by the overall number of workplaces in the municipality. Column (5) divides the number of local workplaces by local population. Columns (6) to (9) divide the number of sector-specific local workplaces by the number of local firms per sector. Columns (10) and (11) divide the number of the respective local type of workplace by the total number of local workplaces. Columns (12) to (15) divide the respective characteristics of local residents by the overall municipality population. Panel A consists of contiguous line-of-contact municipalities and includes pair fixed effects. Panels B and C consist of municipalities within 20 kilometers of the nearest line-of-contact municipality (RD sample) and include segment and geography fixed effects. RD estimates employ a cubic polynomial fit. Standard errors in parentheses in Panel A are clustered at the contiguous pair level and corrected for spatial dependence in Panels B and C. Significance levels: *** 0.01, ** 0.05, * 0.10.

Table C.23: Machinery in agriculture (contd.)

	Dependent variable: Machinery per 1,000 workers in agriculture					
	OLS differences		Propensity score matching			
			Match over: Farm structure in 1939		Match over: Farm structure and Occupation shares in 1939	
	1953	1962	1953	1962	1953	1962
Machinery x Red Army:	(1)	(2)	(3)	(4)	(5)	(6)
Tractors all	-9.98**	-34.70**	-9.13**	-40.98**	-7.12*	-31.11**
	(3.99)	(15.07)	(4.33)	(16.08)	(3.56)	(14.68)
Tractor weak (below 16PS)	-4.11*	-8.82	-3.66*	-16.48	-1.58	-8.46
	(2.04)	(9.73)	(2.06)	(11.47)	(1.50)	(11.20)
Tractor strong (above 16PS)	-5.87**	-25.88***	-5.47**	-24.50***	-5.55**	-22.65***
	(2.34)	(7.42)	(2.64)	(7.51)	(2.19)	(6.94)
Engine all (electro, gasoline, diesel)	-26.19	-57.84	-39.16*	-84.03*	-22.20	-57.85
	(19.03)	(34.84)	(21.78)	(45.69)	(19.65)	(53.62)
Stationary diesel and gasoline engines	-33.56***	-30.43***	-32.60**	-22.83**	-34.04***	-19.84*
	(8.38)	(10.23)	(12.01)	(10.99)	(11.93)	(10.31)
Electro engine all	7.37	-27.41	-6.56	-61.20	11.83	-38.01
	(20.71)	(37.24)	(20.16)	(44.30)	(17.33)	(49.89)
Trailer all (for tractors and horses)	-14.43**	-41.41*	-15.87**	-60.46**	-18.17**	-54.77*
	(5.98)	(22.19)	(6.82)	(24.80)	(7.96)	(28.26)
Trailers for tractors	-11.21**		-10.27**		-10.65**	
	(4.15)		(4.45)		(4.81)	
Trailers for horses	-3.23		-5.60		-7.52	
	(2.53)		(3.62)		(5.23)	
Crop machines all (w/o harvesters)[a]	-42.11***	-120.37***	-44.24***	-143.07***	-40.23***	-140.84***
	(13.28)	(32.46)	(13.37)	(34.26)	(11.13)	(38.68)
Tillage machine (for tractors and horses)	-4.82*	-11.54**	-6.12**	-14.58***	-4.33*	-11.84**
	(2.60)	(4.85)	(2.58)	(4.57)	(2.51)	(5.18)
Tillage for tractors	-0.48	-7.85***	-0.81*	-8.95***	-0.82*	-9.03***
	(0.44)	(2.78)	(0.41)	(2.71)	(0.48)	(3.18)
Tillage for horses	-4.33*	-3.69	-5.31**	-5.64*	-3.51	-2.81
	(2.29)	(2.97)	(2.33)	(2.99)	(2.33)	(3.20)
Harvesters (crops and potatos)[b]	-18.96***	-54.13***	-23.26***	-68.74***	-23.44***	-66.55***
	(5.93)	(12.82)	(5.89)	(13.13)	(4.14)	(11.97)
Combined crop harvester	-3.66**	-13.41***	-3.27	-14.48**	-2.80**	-13.35**
	(1.60)	(4.87)	(1.99)	(5.42)	(1.13)	(4.82)
Potato harvester	-15.30***	-40.72***	-19.99***	-54.25***	-20.64***	-53.20***
	(4.79)	(9.42)	(4.38)	(9.51)	(3.68)	(8.97)
Thresing machine all	-52.19***	-65.48***	-63.03***	-75.00**	-64.62***	-80.47**
	(11.32)	(20.41)	(16.29)	(29.51)	(17.23)	(33.74)
Thresing machine incl. cleaning	-8.58*	-17.68*	-5.49	-11.85	-7.30	-13.87
	(4.68)	(10.20)	(5.09)	(12.31)	(4.74)	(13.09)
Thresing machine without cleaning	-43.62***	-47.80***	-57.54***	-63.15***	-57.31***	-66.59**
	(10.23)	(15.10)	(13.90)	(21.63)	(15.17)	(24.04)
Haymachines[c]	-33.40*	-114.90***	-37.92*	-142.40***	-29.04	-118.81***
	(17.31)	(31.70)	(19.92)	(30.74)	(23.77)	(37.29)
Milking machine (electirc)	-2.97**	-24.70*	-3.36***	-26.85*	-2.84**	-20.77
	(1.12)	(12.31)	(1.19)	(14.39)	(1.22)	(14.37)
No of units	38	38	34	34	27	27

Notes: The table shows differences in agriculture machinery per 1,000 employees in agriculture among Red-Army- and Western-Allies-liberated areas in South Austria. The sample consists of court districts along the within-Styrian and Styrian-Corinthian line of contact (court districts along the line of contact and the respective neighboring court districts). Census data from 1939, 1951 and 1961 are merged to the agricultural census in 1953 and 1962. Matching variables for Columns (3) and (4) include average agricultural residents per farm in 1939, matching variables for Columns (5) and (6) include average agricultural residents per farm in 1939, share of agriculture and share of industry in 1939. a) Crop cultivation machines include: Plows, harrows, sugar beet hoes, tillage machines (for horses and tractors), network harrows, sewing machines and fertilizer spreaders. b) Harvesters include: Sheaf-binding harvesters, combine harvesters and potato harvesters. c) Hay machines include: Hay tedders, hay rakes (various types), grass and hay loaders. Significance levels (robust standard errors): *** 0.01, ** 0.05, * 0.10.

Abstrakt

Způsobuje krátká epizoda konfliktu nebo vystavení nepřátelským jednotkám regionální ekonomickou zaostalost, a pokud ano, proč a jak přetrvává? Na tyto otázky odpovídám využíváním ekonomických rozdílů napříč idiosynkratickou a krátkodobou linií kontaktů mezi Rudou armádou a západními spojenci v jižním Rakousku na konci druhé světové války. Regresní odhady využívající prostorové diskontinuity ukazují, že nepřátelská přítomnost Rudé armády po dobu 74 dnů způsobila okamžitý relativní pokles populace o přibližně 12 %, dnes zesílený na 25 %. Věkově specifické migrační trendy a následné rozdíly v plodnosti vysvětlují multiplikační efekty. Rozvoj odvětví a měřítka místní produktivity práce v roce 2011 také zaostávají v regionech, kterých se nakrátko zmocnila Rudá armáda, což je pravděpodobně způsobeno migrací odborné pracovní síly a zbržděnými investičními trendy po druhé světové válce. Zjištění poskytují nový pohled na dlouhodobé dopady válek a konfliktů a poukazují na izolovanou roli nepřátelských akcí Rudé armády po druhé světové válce k pochopení evropského hospodářského rozdělení mezi Východem a Západem.

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Phone: + 420 224 005 153
Email: office@cerge-ei.cz
Web: https://www.cerge-ei.cz/

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