# The Forced Melting Pot: Temporary Migration and International Cooperation.*

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**Abstract**

This paper examines the effects of temporary migration on international cooperation. We explore this question within the context of forced migration in Germany during World War II. We exploit the quasi-random distribution of temporary migrants across German counties, which was not determined by prior migration patterns or existing ties. We find that a greater presence of temporary migrants of a given nationality increases both personal links as well as the number of firm links and joint patents between German counties and the forced migrants' countries of origin in the post-war period. We further show that this effect persists when ties are institutionalized via formal town twinning. These findings show that even coercive, temporary migration can foster lasting international cooperation when embedded in formal institutions.

**Keywords:** Temporary migration; Forced migration; Town twinning; International cooperation; Gravity model

**JEL Codes:** F22, F55, D02, N44, Z13

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# 1 Introduction

International cooperation is essential not only for economic development, innovation, and global stability, but also for addressing cross-border challenges such as climate change and pandemics. While long-term exposure in the context of migration has been shown to foster cross-border cooperation (e.g. Burchardi et al., 2019), much less is known about the role of short-term exposure and temporary migration. Understanding the effects of temporary migration is increasingly important, as the number of temporary migrants has grown rapidly, with 2.4 million new temporary labor migrants and 2.4 million new asylum seekers arriving in OECD countries in 2023 alone (OECD, 2024).

This paper examines whether temporary migration can generate cooperative ties, and under what conditions these ties persist. We study this question in the context of forced migration in Germany during World War II (WWII), when millions of civilians from occupied countries were brought to Germany. Crucially, their allocation across German counties was quasi-random and not driven by preexisting ties, but determined centrally given labor demands at the time of transportation (Marx, 2019). Foreign workers, who constituted approximately 20 percent of the wartime labor force, often interacted with the local population through shared housing, workplace interactions, and participation in religious or cultural events (Buggeln, 2017; Spoerer & Fleischhacker, 2002). We restrict our analysis to non-Soviet migrants, the vast majority of whom were repatriated shortly after the war (Proudfoot, 1957).

We compile county-level data on the number and nationality of forced migrants who were present in Germany during WWII (Arolsen Archives, 2024) and link them to present-day indicators of international cooperation varying at the county-country level. First, we use a social connectivity measure based on Facebook friends (Bailey et al., 2018; Facebook Data for Good, 2025) to confirm the existence of interpersonal relationships between German counties and the migrants' countries of origin. To measure economic cooperation, we use cross-border firm links (foreign direct investment) using data from van Dijk (2024), as well as joint patenting using data from Bergeaud and Verluise (2024).To measure the institutionalization of ties, we use data on town twinnings (RGRE, 2024). Town twinnings largely emerged after WWII as part of a European initiative to promote reconciliation between former enemies and to foster international cooperation, driven by a bottom-up

process in which civil society played a central role.

Using a gravity-style Poisson pseudo-maximum likelihood model with German county and country fixed effects, we find that an increase in the number of forced migrants is associated with higher cooperation between German counties and the migrant's countries of origin today in all dimensions that we measure. We find stronger personal connections: a one standard deviation increase in the inverse hyperbolic sine (arsinh)-transformed number of forced migrants is associated with a 24.1 percent increase in social connectivity. We also find effects on economic behavior: a one standard deviation increase in the arsinh-standardized number of forced migrants is associated with 15.1 percent more firm links and 19 percent more joint patents. We study under which conditions these effects emerge by investigating differences depending on the intensity and nature of contact.

The effects persist over the long-run only in county-country pairs where initial connections have been institutionalized through town twinning. In the absence of such institutions, temporary migration does not appear to have a persistent effect on international cooperation. To distinguish whether direct personal connections or a more general shift in attitudes towards foreigners from a given nationality drive our results, we will perform a case study for the Netherlands exploiting variation on the sub-national level.

Our findings contribute to several strands of literature. First, we add to research on connectivity and economic activity (Burchardi & Hassan, 2013; Burchardi et al., 2019; Flückiger et al., 2022) by exploiting a rare setting of temporary migration with universal return, with exogenous variation largely free from confounding factors such as chain migration or self-selection. This allows us to isolate causal effects of temporary migration on international cooperation.

By studying a setting with universal return we also contribute to the literature on (forced) migration, to which we additionally add by showing that even under temporary and involuntary conditions, migration can generate cross-border ties (Bahar et al., 2020; Becker, 2022; Becker & Ferrara, 2019). This is particularly relevant given the continuing prevalence of forced displacement worldwide.

Third, our paper contributes to work on changes in attitudes and behavior through contact (Battiston, 2018; Carrell et al., 2019; Corno et al., 2022; Green, 2024; Schindler & Westcott, 2021), by focusing on cooperative behavior, and by investigating how different circumstances of interactions shape effects. We show that ties can emerge even when initial interactions occurred

under adverse conditions .

Fourth, we connect to the literature on the transmission of norms (Bisin & Verdier, 2001; Tabellini, 2008), highlighting institutionalization as a channel through which cooperative behavior persists. Our findings thereby also add to the still small literature studying town twinnings (Brakman et al., 2016), showing that it can serve as an institution to solidify interpersonal connections.

Finally, we connect to the literature on nation-building and political integration (Alesina et al., 2020, 2021; Tilly, 1975). Our findings suggest that interpersonal contact can play a critical role in rebuilding trust and fostering the relationships that underpin international cooperation, and that the institutionalization of personal ties is crucial for long-run cooperation.

## 2 Setting: Temporary Migrants in Germany during World War II

This section outlines the historical context of forced migration to Germany during WWII, including the recruitment of foreign laborers, their distribution across German counties, interactions with the local population, and their repatriation after the war.

### 2.1 Recruitment Process

To address acute labor shortages during WWII, driven by the rapid expansion of the armaments industry and the conscription of German men into military service, the Nazi regime largely relied on forced labor from occupied countries.[1] Beginning in the early 1940s, the Reich Ministry of Labor (*Reichsarbeitsministerium*) recruited civilians from occupied territories to work in Germany. Initially, this recruitment relied on voluntary advertising campaigns targeting mostly unemployed workers. However, it soon escalated into increasingly coercive measures (Spoerer, 2001).[2] Table A1 in the appendix summarizes recruitment processes by country. Figure A1 shows examples of two recruitment posters posted in the Netherlands, one voluntary, one coercive.

In total, an estimated 10 to 15 million forced workers and prisoners of war were present in Germany during the war, comprising roughly 20 percent of the wartime labor force (Buggeln,

[1] The regime tried to avoid a renewed increase in employment of women, as had occurred after World War I (Homze, 1967).

[2] Note that the distinction between foreign workers who came voluntarily, forced workers who were deported, forced workers in concentration camps, and prisoners of war are not clear-cut and sometimes overlapping (Spoerer, 2001). We cannot distinguish between these different categories in our data, so throughout this paper we will use forced migrants and temporary migrants interchangeably to indicate any type of displaced person.

2017).

### 2.2 Distribution across German Counties

The assignment of forced migrants within Germany was centrally coordinated by the Reich Labor Ministry and driven primarily by local labor shortages, which firms would report to their local employment offices. Due to prohibitively high administrative costs considering the sheer number of forced migrants, the allocation process paid little attention to individual skills or nationality in the allocation process (Marx, 2019). While the total number of temporary migrants was endogenous to local labor demand, the composition of nationalities across German counties can be considered quasi-random. Figure A2 shows the geographic distribution of forced migrants from all countries in our sample across German counties during WWII.

### 2.3 Places of Encounter

Temporary migrants and German civilians interacted in multiple settings during WWII. First, they worked side by side across a wide range of sectors. Second, some migrants, particularly those employed in agriculture, lived in private German households. Third, outside of work, and despite restrictions on their mobility and leisure time, foreign workers occasionally took part in social activities such as sports, theater visits, and church services. This created further opportunities for contact with the local population (Fernhout, 1996; Spoerer, 2001). Historical records also document romantic relationships and children born to German women and foreign workers (Debus et al., 2025).

### 2.4 Post-War Repatriation

Following the liberation of Germany in 1945, the Allied Forces initiated a large-scale repatriation effort to return former forced workers and displaced persons to their countries of origin. This process was coordinated by military and humanitarian agencies. The majority of displaced persons from Western European countries had been repatriated by the fall of 1945. The situation was more complex for displaced persons from Eastern European countries, many of whom were not able or did not want to return (Grüter & Mourik, 2020). By the fall of 1946, approximately 650,000 displaced persons from territories of the Soviet Union were still present in West Germany (Gatrell,

2013; Proudfoot, 1957). We therefore restrict our analysis to countries outside the former Soviet Union to ensure that we capture the effects of temporary migration only.

# 3 Data

For our empirical analysis, we combine historical data on the location of forced migrants during WWII with post-war data on cross-border connections between German counties and the forced migrants' countries of origin. Our final dataset is structured at the county-country level. In this section, we describe how we constructed the dataset, define key variables, and present summary statistics. Descriptive statistics for all variables are shown in Table 1.

Table 1: Descriptive Statistics of Main Variables

| Variable | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| N Temporary Migrants | 5808 | 655 | 3302 | 0 | 123044 |
| Avg. Social Connectivity | 5808 | 780 | 3499 | 14 | 149686 |
| N Firm links | 5808 | 4.9 | 26 | 0 | 808 |
| N Joint Patents (Pre-WWII) | 5808 | 0.37 | 2.4 | 0 | 84 |
| N Joint Patents (Post-WWII) | 5808 | 4.1 | 24 | 0 | 847 |
| N Joint Patents (Late Post-WWII) | 5808 | 3.1 | 18 | 0 | 654 |
| N Joint Patents (Early Post-WWII) | 5808 | 0.88 | 9 | 0 | 496 |
| Town Twinning (binary) | 5808 | 0.23 | 0.42 | 0 | 1 |
| Distance Country Border (km) | 5808 | 574 | 433 | 1.9 | 1793 |

*Notes*: This table reports descriptive statistics at the county–country level for the main variables used in our analysis. The unit of observation is a German county × origin country pair. See Section A.3 for variable descriptions and data sources.

## 3.1 Treatment: Temporary Migrants in Germany During World War II

To measure the allocation of foreign forced workers across Germany, we use data by the Arolsen Archives on displaced persons, defined as individuals deported by the Nazi regime (Arolsen Archives, 2024).[3] The data largely comes from registration efforts by the Allied forces after WWII who organized the repatriation of displaced persons to their countries of origin. The records include the forced migrants' nationality, the county in which they were located while in Germany, and, for a subset, also their place of birth.

We are interested in the impact of temporary migration. We therefore restrict our analysis to

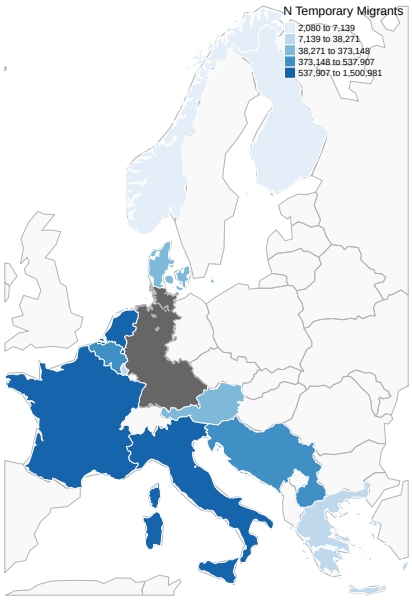
[3]The records on displaced persons also include prisoners of war and former inmates of concentration camps.

occupied countries outside the former Soviet union, as a large share of the displaced persons from these countries did not repatriate after WWII, making it impossible to distinguish between the effects of temporary and long-term migration. Figure **??** shows the countries in our sample.

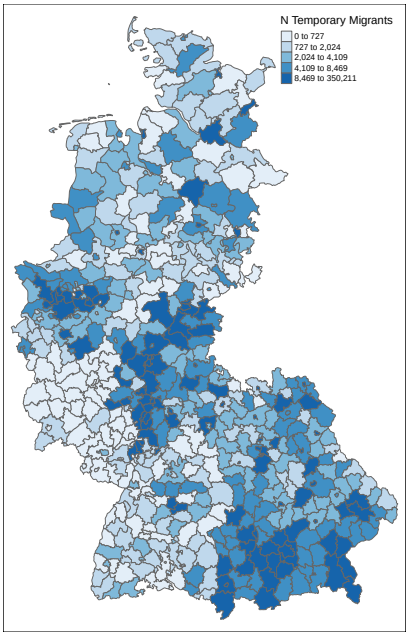
In total, our sample covers 3.81 million displaced persons from eleven nationalities who were located in Germany during WWII. Most forced migrants were from France, with 1.5 million (see Table A2). These numbers are in line with historical evidence from other sources (Spoerer, 2001). For a case study on the sub-national level focusing on the Netherlands, we geocode the place of birth of XX Dutch forced migrants, covering XX percent of all Dutch individuals in our sample.

Figure 1b illustrates the distribution of forced migrants in German counties, showing that they were present throughout the country. Figure A2 shows the distribution of forced migrants separately by country of origin, which does mostly not show clear spatial clustering.

On average, a German county hosted 7,209 forced foreign workers from the eleven countries in our sample, with a range from 0 to 350,211. Note that our identification relies on variation in the composition instead of variation in the total exposure to forced migrants.




(a) Countries of Origin of Temporary Migrants




(b) Geographic Distribution of Temporary Migrants within Germany

Figure 1: Country Origins and Geographic Allocation of Temporary Migrants

*Notes:* Panel (a) shows the number of forced migrants during WWII from each country of origin in our sample: Belgium, Denmark, France, Greece, Italy, the Netherlands, Norway, Yugoslavia, Austria, Luxembourg, and Finland. Panel (b) shows their distribution across German counties.

## 3.2 Outcome: Cooperation Measures

### 3.2.1 Social Connectivity

To measure interpersonal connections between people from German counties and the respective countries of origin of forced migrants, we use a social connectivity measure. The measure captures the intensity of Facebook friendship links between users in different geographic regions as of 2023 (Bailey et al., 2018; Facebook Data for Good, 2025). We aggregate the measure to the county-country level following Bailey et al. (2020) to construct a measure that reflects the relative intensity of social (Facebook) ties between German counties and the forced migrants' countries of origin.[4]

Figure A3a shows the average social connectivity with all countries in our sample across German counties. Notably, the connections are stronger for regions with language similarity. Table A2 shows the average social connectivity separately by country.

### 3.2.2 Firm Links

To complement our analysis of social ties, we also use data on firm-level ownership links as an indicator for strategic and durable economic connection. We use firm-level data from the Bureau van Dijk's Orbis database, retrieved on July 3, 2024 (van Dijk, 2024) to measure economic relationships between German counties and foreign countries. The dataset provides detailed information on ownership structures, allowing us to identify cross-border firm links between German and foreign entities.

Our final dataset includes all links in which either a foreign entity holds shares in a German corporation or a German entity owns (part of) a foreign corporation.[5] We restrict the analysis to direct ownership links, i.e., those that do not pass through any intermediary entity, to focus on direct cooperation between two locations. We restrict the sample to at least medium sized firms, defined as having operating revenue of at least 1 million euros, total assets of at least 2 million euros, or at least 15 employees.

We geolocate the German entities to the respective headquarters address and aggregate them

[4] Since we lack data for the number of Facebook which the authors suggest for re-weighting to different levels of observation, we instead weigh the number of friendship links with the sum of the possible connections of the whole population, taken from Eurostat (2024). In a robustness check shown in Table XX, we restrict to the population aged 15–64 and find similar results.

[5] Shareholders in the data can be corporations, private individuals, governments, or collectively described entities, while subsidiaries are always classified as corporations.

to the county level. Additionally, we record the country of the foreign entity, which enables us to construct a county–country-level panel of firm ownership ties.

In total, we record 28,424 links between German counties and the eleven foreign countries in our sample. Most links are with Austria, namely 7,039 (see Table A2). Figure A3b shows the distribution of total firm links over German counties. On average, a German county has 53.8 links, with a span of 0 to 2,818.

#### 3.2.3 Joint Innovation

To capture cross-border collaboration in innovation, we use data on international co-inventorship from Bergeaud and Verluise (2024) covering 1946–2013. These data record the geographical location of each patentee listed on a patent application. We aggregate co-inventorships to the county–country level. A joint innovation link is then defined as a patent co-authored by at least one patentee from a given German county and at least one patentee from a foreign country. A patentee here includes individual inventors and the firms to whom the patent is assigned to capture all economically relevant cooperation. In a robustness check, we repeat the analysis restricting to joint patents of individual inventors only.

There are in total 23,534 patent links between German counties and the eleven foreign countries in our sample. Most joint patents are with France, namely 8,854 (see Table A2). Figure A3c shows the distribution of total joint patents across German counties. On average, a German county has 44.6 joint patents, with a span from 0 to 1,272.

### 3.3 Further Variables

#### 3.3.1 Controls

**Pre-War Cooperation.** While the assignment of forced migrants is arguably exogenous, we still want to account for pre-existing cross-border relationships between German counties and the countries of origin of forced migrants that may be correlated with the number of forced migrants and the level of international cooperation. We construct a proxy for historical cooperation using joint patenting activity prior to WWII. Specifically, we draw on the patent database by Bergeaud and Verluise (2024) and restrict the sample to patents filed between 1877 and 1938. We aggregate

the number of pre-war patents co-authored by patentees located in a given German county and patentee in a given foreign country. Figure A4b in the appendix illustrates the spatial distribution of historical patenting activity.

**Distance to Border.** Geographic proximity is a strong determinant of cross-border cooperation. While forced migrants were assigned centrally, considerations of transport cost or, conversely, the concern of forced migrants fleeing back to their home country, could still have played a role. To control for this possible confounder, we include the bilateral distance between each German county and the corresponding country of origin of forced migrants in our regressions. Distance is calculated as the great-circle distance between the centroid of the German county and the nearest point on the border of the foreign country.

### 3.3.2 Heterogeneity

**Sectoral Composition.** To explore heterogeneity in the experience of forced migrants in Germany, we use data on the sectoral composition of German counties during WWII from the 1939 occupational census, taken from Braun and Franke (2021). Specifically, we calculate the ratio of industrial employment (manufacturing and industry) relative to agricultural employment (agriculture, forestry, and fishing) and classify a county as industrial if this ratio is above the median, and else as agricultural, with the median being 0.79. This classification allows us to compare the effects of forced migration in contexts where migrants were more likely to live and work in close proximity to German civilians (e.g., on farms) versus contexts where they were more often housed separately (e.g., in barracks or dormitories).

**Exposure to War and Repression.** Another dimension along which the experience of forced migrants varied is their exposure to violence and repression during their time in Germany. We proxy this in two ways. First, we use data on the share of residential buildings damaged during WWII, taken from Peters (2021), as a measure of local exposure to Allied bombings. Second, we use the distance to so-called *labor-education camps* (Lofti, 2000), which were temporary punishment facilities for forced migrants who disobeyed orders. Proximity to such camps serves as a proxy for the likelihood of experiencing coercive punishment.

**Cultural Similarity.** We examine whether the long-term effects of forced migration vary depending on the cultural similarity between the migrants and the local German population. Following Braun and Dwenger (2020), we construct a measure of religious distance by combining historical data on the religious composition of German counties in 1939 (shares of Protestants, Catholics, and other religious affiliations) with data on the religious composition of the forced migrants' countries of origin, taken from [XX]. The idea is that migrants who were more culturally or religiously similar to the host population may have experienced more frequent and positive contact, which could strengthen the persistence of cross-border ties.

### 3.3.3 Mechanism

**Institutionalization of Ties.** We use town twinning as an indicator of the institutionalization of interpersonal ties between German counties and foreign countries. After WWII, European countries sought to rebuild cross-border relationships and foster reconciliation among former adversaries. One institutional outcome of these efforts was the establishment of town twinning. These long-term partnerships between municipalities in different countries promote political understanding, cultural exchange, and economic cooperation (Brakman et al., 2016; Falkenhain et al., 2012).

Town twinning is typically initiated at the municipal level and often emerges from pre-existing social or civic ties.[6] This bottom-up structure distinguishes town twinning from nationally coordinated foreign policy and reflects a decentralized form of international cooperation. In practice, partnerships often involve official municipal visits, joint events, educational and language programs, as well as economic cooperation facilitated through local institutions such as chambers of commerce.

To measure town twinning, we use data on all international town twinning agreements involving German municipalities from 1945 to the present (RGRE, 2024).[7] We geolocate each German municipality and aggregate twinning agreements at the county-country level.[8]

Town twinning expanded significantly after WWII.[9] Initial partnerships were mostly formed

[6] For example, the twinning between Cologne and Turin originated from the friendship between the Cologne-based art historian Albert-Erich Brinckmann and Turin museum director Vittorio Viale (Speer, 2022).

[7] We include both formal, open-ended partnership agreements as well as project-based partnerships. Our results are robust to restricting to only open-ended partnerships.

[8] Whenever we refer to a county's number of town twinnings, this reflects the total number of agreements across all municipalities within that county.

[9] Only very few town twinning agreements were established before WWII.

with municipalities in Western Europe.[10] Figure A5 shows the number of new town twinning agreements over time between German counties and the Western European countries included in our sample.[11]

Figure A4a displays the geographic distribution of town twinning across German counties with the eleven countries in our sample. 97.4 percent of counties have at least one twinning agreement, and the average county has 6.4 partnerships. Table A2 summarizes the total number of town twinnings by partner country. In our sample, German counties have the most town twinnings with France (1,915).

## 4 Empirical Strategy: Gravity Model

To examine whether the presence of forced migrants during WWII shaped cooperation between German counties and the migrants' countries of origin, we estimate a gravity model using the Poisson pseudo–maximum likelihood (PPML) estimator. Formally, we estimate the following model at the county–country level:

$$\begin{aligned}\mathbb{E}\left[Y_{ij} \mid X_{ij}\right] = \exp\big(&\beta_0 + \beta_1 \operatorname{arsinh}(TemporaryMigrants_{ij}) + \\ &\beta_2 \ln(DistanceToBorder_{ij}) + \beta_3 \operatorname{arsinh}(PreWarCooperation_{ij}) + \gamma_i + \delta_j\big)\end{aligned} \tag{1}$$

where $Y_{ij}$ denotes the cooperation measure of interest between German county $i$ and country $j$. The variable $TemporaryMigrants_{ij}$ captures the number of wartime forced migrants from country $j$ who were present in county $i$, and $DistanceToBorder_{ij}$ measures the distance between the centroid of county $i$ and the nearest border point of country $j$. The term $PreWarCooperation_{ij}$ captures pre-existing cooperation between the two locations, measured as the number of jointly filed patents between patentees in county $i$ and country $j$ between 1877 and 1938. Including this variable allows us to control for historical cooperation patterns that might have influenced both wartime

[10] Partnerships with Eastern Bloc countries largely emerged after the end of the Cold War in 1989.

[11] There is a notable increase in new twinning agreements around the year 2000, likely driven by the European Union's enlargement and related integration initiatives. The subsequent decline reflects a saturation effect because most counties had already established partnerships by then, as well as constraints due to the municipal financial crisis (Wingert-Beckmann, 2012).

migrant allocation and post-war ties. County fixed effects $\gamma_i$ and country fixed effects $\delta_j$ absorb unobserved heterogeneity at both levels. We use the inverse hyperbolic sine transformation for variables that include zero values.

**Identifying Assumption.** Our identification strategy relies on the assumption that the distribution of forced migrants across German counties during WWII is independent of other factors that affect international cooperation between county $i$ and country $j$, conditional on our controls. In many migration contexts, this assumption is difficult to satisfy due to endogeneity in migrants' location choices. Migrants typically self-select into areas with better economic prospects or established diaspora networks, which can bias estimates of migration effects. In contrast, in our setting, migrants had no agency over their placement within Germany. As discussed in Section 2, their allocation was centrally coordinated and determined by local labor shortages and wartime production needs at the time of deportation. That is, conditional on controls, the specific countries of origin represented in each county were not systematically related to pre-existing social or economic cooperation between those counties and the respective countries.

One potential concern is that proximity to the country of origin may have influenced placement decisions, for example, due to transport costs or security considerations. For instance, Nazi authorities may have placed certain national groups farther from the border to reduce escape risk. We address this by controlling for the distance between the county centroid and the nearest border of the origin country in all specifications. Additionally, any county-specific determinants of labor demand, such as industrial structure or production capacity, are absorbed by county fixed effects ($\gamma_i$). Country fixed effects ($\delta_j$) further account for differences across sending countries, such as baseline cooperation intensity or post-war geopolitical alignment with Germany.

In addition, we use the time-varying structure of the patent data to control for pre-WWII levels of patenting as a proxy for pre-war relationships between a German county and a foreign country, keeping any preexisting international connections fixed.

To further assess the plausibility of our identification assumption, Table XX presents balance tests showing that pre-1939 county-level characteristics do not predict the nationality composition of foreign workers.

# 5 Results

## 5.1 Effect of Temporary Migration on International Cooperation

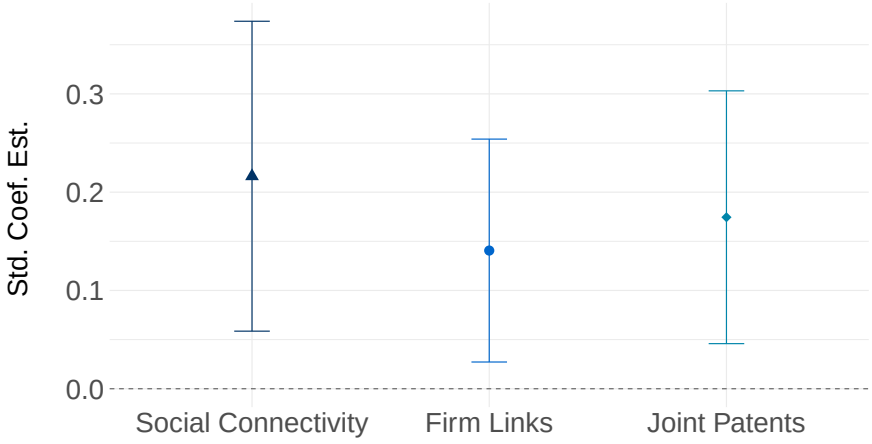



Figure 2: Effect of Temporary Migration on Cross-Border Linkages

*Notes:* This figure plots estimated coefficients from Equation 1, showing the effect of temporary migration during WWII on three measures of cross-border cooperation: the average social connectivity (left), the number of firm links (center), and the number of joint patents (right). The dependent variables are standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in kilometers (km)). See Section A.3 for variable definitions and data sources. Table A3 shows the corresponding regression estimates.

We begin our analysis by estimating the effect of temporary migration during WWII on international cooperation between German counties and the countries of origin of the migrants. We find strong evidence that the presence of foreign forced migrants increased cross-border ties.

We distinguish between two broad types of cross-border cooperation: interpersonal ties, measured through social connectivity, and formal economic cooperation, captured by firm links and joint patenting. Using the gravity model specified in Equation 1, we estimate the impact of the presence of foreign forced migrants in a German county on later ties with the migrants' countries of origin. Figure 2 presents the estimated effects for our three main outcome variables.[12] Both the independent and dependent variables are standardized to have mean zero and unit standard

[12]The corresponding regression estimates are reported in Table A3.The share of zeros in the dependent variable (0 for social connectivity, 46.6 percent for firm links, and 61.2 percent for joint patenting) is well within the range where PPML performs well (Santos Silva & Tenreyro, 2011). Note though that observations of counties which have zero values for all eleven countries in our sample get dropped because conditional on county fixed effects there is no variation left, which explains the differences in sample sizes (27 counties in the case of firm links, and 22 counties in the case of joint patenting).

deviation. We find that a one standard deviation increase in the arsinh-transformed number of temporary migrants leads to a 24.1 percent increase in social connectivity, a 15.1 percent increase in cross-border firm links, and a 19 percent increase in the number of joint patents.[13] To put some concrete numbers to this, at the mean (of the arsinh-transformed variable) such a one standard deviation increase amounts to an additional 448 temporary migrants.[14] Put differently, a one standard deviation increase in the number of temporary migrants at the mean (both non arsinh-transformed) results in an increase of social connectivity by 13.4 percent, an increase of cross-border firm links by 8.6 percent, and an increase in joint patents by 10.7 percent.[15]

These estimates suggest that even brief, involuntary contact between people can lead to social and economic cooperation across national borders. Importantly, the effects are not limited to one domain but appear across distinct dimensions of cooperation, with remarkably similar effect sizes. While social ties may reflect continued interpersonal relationships or shared cultural affinities, foreign direct investment and joint patenting represent actual economic cooperation. Taken together, the results imply that temporary migration can foster the creation of international ties.

**Personal Connections or Shift in Attitudes?** There are two possible explanations for our findings: One, it could be that the direct personal connections that emerged between Germans and forced migrants during WWII formed the basis of ongoing international cooperation. The alternative explanation is that the personal contact of Germans with forced migrants of a given nationality shifted the attitudes of Germans towards people of that nationality in general. This could have increased their probability of cooperating with people from that country more broadly, independent of direct personal connections. It is of course possible that both mechanisms are at play at the same time. Note that for a shift in attitudes of foreigners towards Germans to be driving our results, the foreigners would have needed to change their attitudes towards Germans from a specific county to explain our results, as we rely on county-variation on the German side.

To possibly distinguish between the two alternative explanations, we run a supplementary

[13] We calculate: $(\exp(\beta_1) - 1) * 100$ to derive these numbers.

[14] To derive at this number, we compute the mean and standard deviation of the inverse hyperbolic sine-transformed number of temporary migrants, and calculate the hyperbolic sine-transformed change of adding the standard deviation at the mean to receive the underlying number of temporary migrants. More formally, we calculate: $\sinh(\text{mean}(\text{arsinh}(TemporaryMigrants_{ij})) + \text{sd}(\text{arsinh}(TemporaryMigrants_{ij}))) - \sinh(\text{mean}(\text{arsinh}(TemporaryMigrants_{ij})))$.

[15] More formally, we calculate: $\text{arsinh}(\text{mean}(TemporaryMigrants_{ij}) + \text{sd}(TemporaryMigrants_{ij})) - \text{arsinh}(\text{mean}(TemporaryMigrants_{ij}))$.

analysis where, instead of using county-country variation, we exploit variation on the regional level in both Germany and the country of origin. At the moment, we focus on the Netherlands as a case study, as it has one of the highest share of forced migrants for whom we have information about their place of birth (27.8 percent).

We will estimate Equation 1 again, this time at the German county-Dutch municipality level. Instead of including Country fixed effects, we include Dutch municipality fixed effects.

If the cooperation was directly born out of personal connections, we would expect $\beta_1$ to be positive and significant: Assuming that a large enough share of forced migrants returned to their place of birth, international cooperation of a given German county should be more pronounced with the exact places in the Netherlands where forced migrants came from.[16] If we instead do not find positive effects on the county-municipality level, the effects that we find in our main results are more likely to be driven by shifts in attitudes of Germans towards people from the respective nationality in general. Note that a positive $\beta_1$ does not rule out that a general shift in attitudes took place as well, but it indicates that personal connections did play an important role in forming cross-border cooperation.

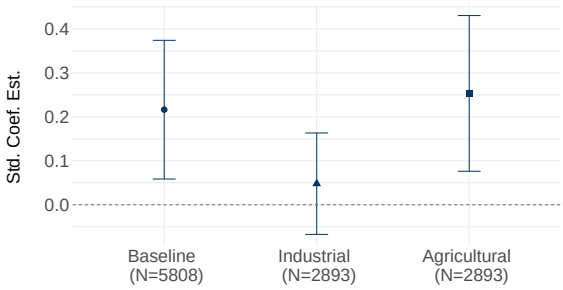
Table XX shows the results.

### 5.2 Heterogeneity by Nature of Contact

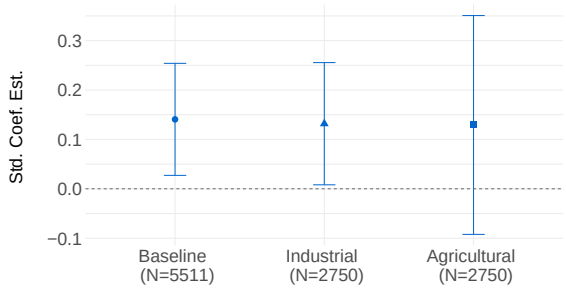
Next, we examine whether the effects of temporary migration on cooperation depend on the context in which temporary migrants interacted with German civilians. Specifically, we explore whether variations in interaction frequency and nature, shaped by local employment structures, pre-existing cultural similarity, and wartime conditions, affected the persistence of international ties.

**Sector of Employment.** We first study heterogeneity by the sector of employment. Forced migrants employed in agriculture were often housed directly on farms, often sharing living quarters with German families. In contrast, those working in industry were more likely to be housed in separate facilities alongside other foreign workers, limiting their everyday interaction with the local population. This suggests that agricultural settings may have enabled more personal and intensive contact.

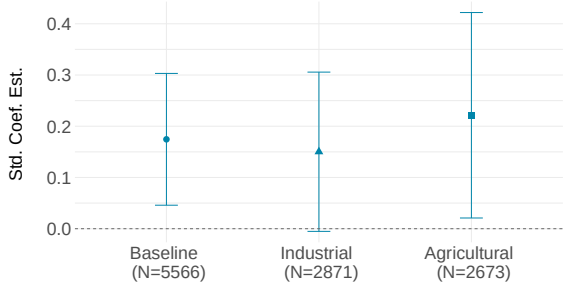
[16] Anecdotally, most former forced migrants from the Netherlands did return to their place of birth. In 1971, around 40 percent of conscripted men lived in their municipality of birth (Stapper, 2024).




(a) Avg. Social Connectivity




(b) Number of Firm Links




(c) Number of Joint Patents

Figure 3: Heterogeneity in the Effect of Temporary Migration by Sector of Employment

*Notes:* This figure plots estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by sector of employment on three measures of cross-border cooperation: the average social connectivity (Panel a), the number of firm links (Panel b), and the number of joint patents (Panel c), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources. Table A4 includes the corresponding regression estimates.

Figure 3 presents subsample regressions of our baseline specification separately for counties with more prevalent pre-war agricultural employment and those with a more industrial employment structure (defined as having an above/below median ratio of agricultural employment to industrial employment), across all three outcome measures. We find a positive and statistically significant effect of forced migration on social connectivity in counties with more dominant agricultural employment. In contrast, the corresponding estimate for more industrial counties is smaller and not statistically significant. Notably, this heterogeneity is specific to social ties. We do not observe comparable differences between agricultural and industrial counties when examining firm links or joint patenting. This pattern is consistent with the interpretation that agricultural settings, where forced migrants were more likely to live in close proximity to German households, facilitated deeper interpersonal contact, which is particularly relevant for the formation of lasting social relationships, but less so for formal economic cooperation. Moreover, personal connections formed with Germans from more agricultural regions may have been less relevant in the creation of foreign direct investment and joint patenting activity, which is usually more common in the industrial sector.

**Exposure to War and Repression.** We next examine whether the effects of forced migration on international cooperation depend on the severity of the conditions faced by foreign workers during the war. Historical accounts suggest that forced migrants experienced particularly harsh conditions in areas exposed to heavy bombing and in regions close to so-called *labor education camps*, where workers could be detained temporarily as punishment for disobedience. These experiences may have affected how migrants perceived their time in Germany and may have reduced the potential for forming lasting ties.

We proxy adverse conditions using two measures. First, we use exposure to Allied bombings, as forced migrants were especially vulnerable in heavily bombed areas: access to air-raid shelters was often restricted, and forced workers were often assigned to dangerous cleanup tasks after bombings. Second, we use the distance to the nearest labor education camp, assuming proximity increased the probability for forced migrants to be sentenced to a stay in such camps.

Figure XX presents the corresponding coefficient estimates.

**Cultural Similarity.** The extent to which temporary contact translates into cooperation may depend on the degree of cultural similarity. We proxy cultural similarity with religious similarity: There are two possible mechanisms at play: First, as discussed in Section 2.3, churches were places where forced migrants and German civilians could interact during the war, increasing the frequency of contact. Second, shared religious affiliation may have facilitated trust, thereby amplifying the impact of temporary contact on later cooperation. Figure XX presents the corresponding coefficient estimates.

### 5.3 Time-varying Effects of Temporary Migration on International Cooperation

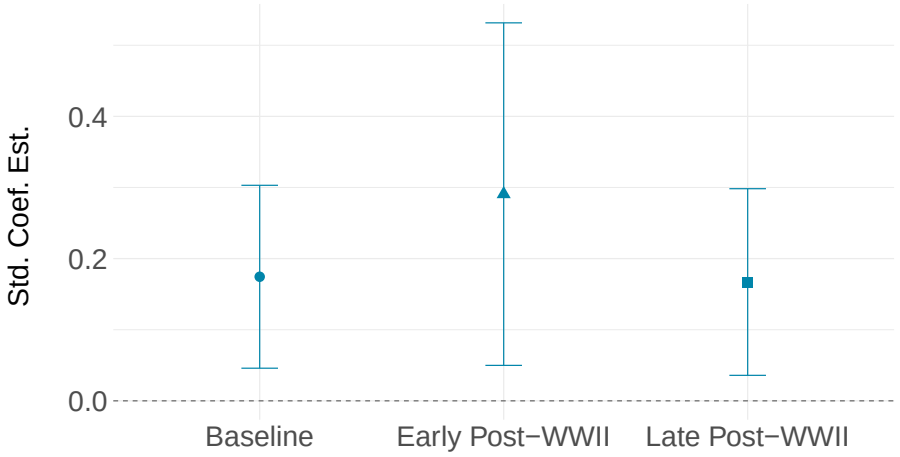



Figure 4: Time-varying Effect of Temporary Migration on Joint Patents

*Notes:* This figure plots estimated coefficients from Equation 1, showing the time-varying effect of temporary migration during WWII on the number of joints patents (left), the number of joint patents in the early post-war period (1946–1965) (center), and the number of joint patents in the late post-war period (1966–2013) (right), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources. Table **??** includes the corresponding regression estimates.

We have shown that temporary migration during WWII led to persistent increases in social and economic cooperation between German counties and the countries of origin of forced migrants. We now examine how this relationship evolved over time.

To do so, we exploit the fact that our patent data spans several decades. We estimate the effect of temporary migration on cross-border patenting separately for the early and late post-war period.

Figure 4 presents the resulting coefficient estimates from Equation 1.[17] The first estimate replicates our baseline specification using all joint patents after WWII. The two additional estimates show the results when restricting to joint patents filed in the early post-war period (1946–1965) and in the late post-war period (1966–2013), respectively.

We find that the effect of temporary migration on joint patenting was slightly stronger in the immediate post-war decades, when people still had vivid memories of wartime encounters, and decays in the later post-war period, more than 20 years after the war. However, the effect remains sizable and statistically significant in the later post-war period, consistent with the findings reported in Section 5.1.

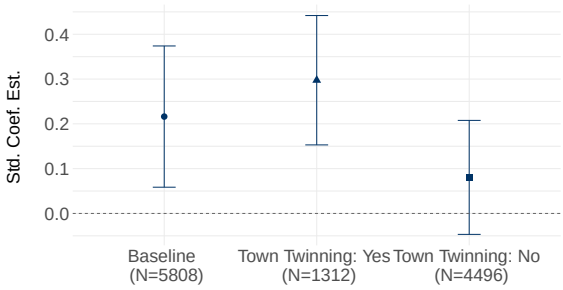
### 5.4 Mechanisms: Persistence of Cross-Border Ties

What explains the persistence of the effect of temporary migration on social and economic cooperation? One possibility we investigate is that early interpersonal contact create the foundation for formal institutional ties that continue to foster cross-border collaboration long after the migrants had returned home. Once established, such institutions may sustain international engagement even when the individuals with initial personal connections are not the primary actors anymore.

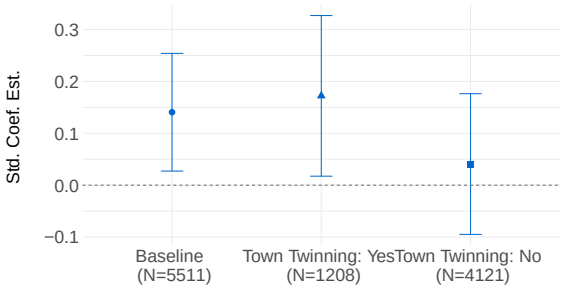
To assess whether institutionalization helps explain long-term effects, we examine heterogeneity by town twinning status. As discussed in Section 3.3.3, town twinning is a decentralized local institution of international cooperation that is often rooted in interpersonal connections. If initial contact during the war led to the formation of town twinning partnerships, then the institutionalization of these ties may have preserved and possibly reinforced the long-term effects of the initial contact. To test this, we first estimate the effect of forced migration on the formation of town twinning, see Table A7. We find positive and significant effects: A one standard deviation increase in the arsinh-transformed number of forced migrants increases the probability of a town twinning partnership by 18.1 percent.

Next, we estimate the effect of forced migration separately for county-country pairs with and without town twinning agreements. Figure 5 presents the results. Our findings suggest that the

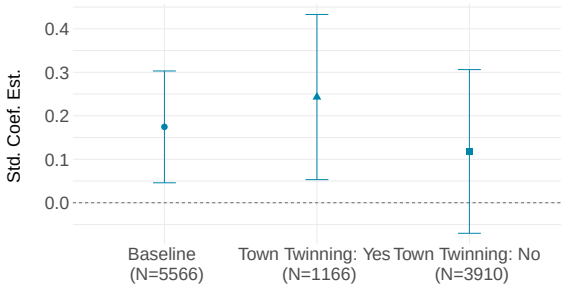
[17] Table A6 shows the underlying regression results. Note that observations of counties which have zero joint patenting activity with any country in our sample get dropped (166 counties for early patenting, 28 for late patenting) because, conditional on county fixed effects, there is no variation left, which explains the differences in sample sizes. In Table XX, we repeat the analysis with a restricted sample including only counties with at least one joint patenting link with any country in both periods.




(a) Avg. Social Connectivity




(b) Number of Firm Links




(c) Number of Joint Patents

Figure 5: Heterogeneity in the Effect of Temporary Migration by Town Twinning Status

*Notes:* This figure plots estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by town twinning status on three measures of cross-border cooperation: the average social connectivity (Panel a), the number of firm links (Panel b), and the number of joint patents (Panel c), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources. Table A5 includes the corresponding regression estimates.

long-term impact of temporary migration on cooperation is concentrated among county-country pairs that eventually establish town twinning partnerships. In contrast, in pairs without such institutionalized ties the coefficient size is closer to zero and no longer statistically significant. This pattern holds true for all three outcomes: social connectivity, firm links, and joint patenting. This suggests that local institutions played a critical role in maintaining cross-border ties over time.

Importantly, we do not observe the same heterogeneity by town twinning status for joint patenting in the early post-war period. As shown in Figure A6, the effect of forced migration on patents immediately after the war appears similarly strong regardless of whether a formal partnership was eventually established. It is only for joint patenting activity in the later post-war period that we see that town twinning drives the effect of temporary migration on long-term cooperation.

Taken together, these findings suggest that interpersonal contact alone drives early cooperation, while institutionalization becomes critical for maintaining and reinforcing these ties over time. Town twinning, in this context, appears to act as a channel through which temporary experiences are translated into enduring international relationships.

### 5.5 Robustness of the Results

We conduct several robustness checks to assess the validity of our empirical strategy and the stability of our main findings.

**Alternative Model Specifications.** We re-estimate our main results dropping the control for pre-war cooperation to give suggestive evidence for the quasi-random distribution of forced migrants conditional on distance.

**Alternative Variable Specifications.** We perform robustness checks for choices regarding the specification of our outcome variables: We re-calculate our social connectivity measure using only the population aged 15–64 as weights, we restrict firm links to only large firms, we restrict joint patenting to only include inventors (excluding firms who own the patent), we estimate more flexible time-varying effects on patents, and we restrict town twinning to include only formal open-eneded partnerships. To address the different weighting of intensive and extensive margin when using arsinh-transformed variables described in Bellemare and Wichman (2020), we restrict the sample

to only observations with values greater than zero in the dependent and independent variable, capturing the intensive margin effect only. In addition, we follow Aihounton and Henningsen (2021) to determine the optimal scale factor for arsinh-transformed variables and re-estimate our main results accordingly.

**Alternative Sample Specifications.** To ensure that our results are not driven by certain countries, we repeat our analysis excluding one country at a time. To address the varying sample sizes due to differences in variation in the dependent variable, we re-estimate our results on a subsample with at least some variation in all dependent variables.

# 6 Conclusion

This paper examines the effects of temporary migration on international cooperation. We study this in the context of forced labor during WWII, when millions of civilians from occupied countries were deported to Germany. Exploiting the quasi-random distribution of forced migrants, which was independent of preexisting cross-border ties or migration patterns, we estimate the impact of short-term interactions between forced migrants and German civilians on the development of cooperative relationships across borders.

For our analysis, we combine archival data on the location and nationality of forced migrants with measures of social and economic cooperation at the county-country level. Using a gravity model, we find that counties with greater exposure to forced migrants from a given country had significantly stronger bilateral ties with that country after WWII. Specifically, we observe substantial and statistically significant increases in social connectivity, firm links, and joint patenting activity.

We also find that the effects depend on the nature of the initial contact. The positive impact of temporary migration on personal ties is stronger where forced migrants were more likely to interact closely with the local population. These patterns suggest that the context and quality of contact are critical in shaping international cooperation.

We further show that the persistence of these effects is closely linked to the institutionalization of early interpersonal ties. In particular, the long-run impact of forced migration on social

connectivity, firm links, and joint innovation is concentrated in county–country pairs that later established formal town twinning partnerships. Where no such institutional relationship exists, we find little evidence of enduring effects. This pattern suggests that while temporary contact can generate initial cross-border relationships, their durability depends on whether they are subsequently embedded in formal local institutions that promote repeated interaction and cooperation. Town twinning thus appears to have transformed short-term wartime encounters into stable and lasting international cooperation.

Taken together, our findings demonstrate that even under coercive and adverse conditions, temporary migration can foster lasting cross-border cooperation. These effects persist primarily when initial interpersonal contact is subsequently institutionalized through formal mechanisms that help sustain long-term ties.

This insight carries important implications for policy. Our results highlight the importance of local, personal interactions in promoting long-lasting international cooperation. Programs that promote short-term cross-border contact, such as student exchanges or volunteer initiatives, can have long-lasting effects, especially when these encounters are formalized through institutions. Therefore, fostering short-term contact between foreigners and local populations and building institutions that preserve and extend these initial ties may be an effective strategy for promoting persistent international cooperation.

Last but not least, our findings also speak to the origins of European integration, which started after a devastating war with Germany as the clear perpetrator. Personal connections and the subsequent cross-border institutions appear to have played a critical role in laying the foundation for the post-war reconciliation and cooperation between former adversaries and laid the groundwork for what would later become the European Union.

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Der Katalog zur Wanderasstellung "trotzdem da! - Kinder aus verbotenen Beziehungen zwischen Deutschen und Kriegsgefangenen oder Zwangsarbeiter*innen".

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# A Appendix

## A.1 Additional Tables

### A.1.1 Background

Table A1: Recruitment of Temporary Migrants by Country

| **Country** | **Occupation** | **Recruitment process** |
|---|---|---|
| Austria | 1936 | Initial voluntary recruitment. Later on mostly Jews and other political enemies. |
| Belgium | May 1940 | Early recruitment was voluntary. From 1942 onward, all working-age individuals were required to hold employment and could be assigned to work in Germany; conscription of specific male cohorts followed in 1943. |
| Denmark | April 1940 | Recruitment was formally voluntary and primarily targeted unemployed workers, promising favorable working conditions in Germany. In some cases, threats to cancel unemployment benefits were used. |
| Finland | | No official recruitment, mostly as part of workers taken from formerly temporarily Russian areas. |
| France | June 1940 | After an initial phase of voluntary recruitment, coercive measures intensified from 1942 onward, targeting unemployed workers and prisoners of war, who were exchanged for larger numbers of civilian laborers. Men from specific cohorts were also conscripted. |
| Greece | April 1941 | Voluntary recruitment campaigns failed to generate sufficient labor inflows, leading to predominantly coercive recruitment. |
| Italy | 1938 / July 1943 | Initially characterized by voluntary migration of unemployed workers starting in 1938. Labor quotas were introduced in 1941. Following the overthrow of Mussolini in July 1943, Germany conscripted specific cohorts, conducted razzias, and deployed prisoners of war as forced labor. |
| Luxembourg | | Were largely viewed as Germans, so recruitment mostly restricted to Jews and political enemies. |
| Netherlands | May 1940 | Initially relied on advertising campaigns to encourage voluntary migration. Over time, coercive measures increased, including the cancellation of unemployment benefits, conscription of specific birth cohorts in 1943, and large-scale razzias, notably in Rotterdam. |
| Norway | April 1940 | Mostly voluntarily. |
| Yugoslavia | April 1941 | Some workers migrated voluntarily prior to occupation due to high unemployment. Recruitment became increasingly coercive, initially focusing on ethnic minorities and prisoners of war, and later extending to the general population through municipality-level quotas. |

*Notes*: This table summarizes the recruitment processes of temporary migrants in the countries included in our sample. All information is based on Spoerer (2001, pp. 40–89).

### A.1.2 Descriptive Statistics

Table A2: Descriptive Statistics by Country of Origin of Temporary Migrants

| Country | N Temporary Migrants | Avg. Social Connectivity | N Firm Links | N Joint Patents | N Town Twinnings |
|---|---|---|---|---|---|
| Austria | 83618 | 2637 | 7039 | 4255 | 239 |
| Belgium | 373263 | 285 | 1243 | 3443 | 107 |
| Denmark | 38271 | 309 | 1263 | 446 | 49 |
| Finland | 2080 | 160 | 424 | 215 | 38 |
| France | 1500981 | 142 | 3875 | 8854 | 1915 |
| Greece | 33230 | 838 | 171 | 25 | 25 |
| Italy | 851387 | 391 | 3499 | 1720 | 321 |
| Luxembourg | 7139 | 2146 | 4831 | 245 | 13 |
| Netherlands | 537907 | 462 | 4569 | 3711 | 130 |
| Norway | 5487 | 27 | 678 | 332 | 5 |
| Yugoslavia | 373148 | 1185 | 832 | 288 | 44 |

*Notes*: This table reports descriptive statistics by country of origin of temporary migrants during WWII. For each origin country, we show the total number of temporary migrants assigned to German counties, the average social connectivity, the number of firm links, the number of joint patents, and the number of town twinnings with German counties. See Section A.3 for variable descriptions and data sources.

### A.1.3 Regression Tables

Table A3: Effect of Temporary Migration on Cross-Border Linkages

| | Social Connectivity (1) | Firm Links (2) | Joint Patents (3) |
|---|---|---|---|
| Temporary Migrants | 0.216*** | 0.141** | 0.174*** |
| | (0.080) | (0.058) | (0.066) |
| Distance to Border | -0.663*** | -0.527*** | -0.334*** |
| | (0.064) | (0.063) | (0.044) |
| Pre-War Cooperation | -0.012 | -0.074*** | 0.170*** |
| | (0.019) | (0.021) | (0.066) |
| Observations | 5,808 | 5,511 | 5,566 |
| County fixed effects | ✓ | ✓ | ✓ |
| Country fixed effects | ✓ | ✓ | ✓ |

*Notes*: This table shows estimated coefficients from Equation 1, showing the effect of temporary migration during WWII on three measures of cross-border cooperation: the average social connectivity (Column 1), the number of firm links (Column 2), and the number of joint patents (Column 3), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources.

Table A4: Heterogeneity in the Effect of Temporary Migration by Sector of Employment

| | Social Connectivity | | | Firm Links | | | Joint Patents | | |
|---|---|---|---|---|---|---|---|---|---|
| | Baseline (1) | Industrial (2) | Agricultural (3) | Baseline (4) | Industrial (5) | Agricultural (6) | Baseline (7) | Industrial (8) | Agricultural (9) |
| Temporary Migrants | 0.216*** | 0.048 | 0.253*** | 0.141** | 0.132** | 0.129 | 0.174*** | 0.150* | 0.221** |
| | (0.080) | (0.059) | (0.090) | (0.058) | (0.063) | (0.113) | (0.066) | (0.079) | (0.102) |
| Distance to Border | -0.663*** | -0.528*** | -0.735*** | -0.527*** | -0.451*** | -0.730*** | -0.334*** | -0.325*** | -0.362*** |
| | (0.064) | (0.101) | (0.077) | (0.063) | (0.068) | (0.060) | (0.044) | (0.053) | (0.060) |
| Pre-war Cooperation | -0.012 | -0.030** | 0.011 | -0.074*** | -0.097*** | -0.013 | 0.170*** | 0.158** | 0.057* |
| | (0.019) | (0.015) | (0.030) | (0.021) | (0.028) | (0.022) | (0.066) | (0.076) | (0.033) |
| Observations | 5,808 | 2,893 | 2,893 | 5,511 | 2,750 | 2,750 | 5,566 | 2,871 | 2,673 |
| County fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes*: This table shows estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by sector of employment on three measures of cross-border cooperation: the average social connectivity (Columns 1–3), the number of firm links (Columns 4–6), and the number of joint patents (Columns 7–9),all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources.

Table A5: Heterogeneity in the Effect of Temporary Migration by Town Twinning Status

| | Social Connectivity | | | Firm Links | | | Joint Patents | | |
|---|---|---|---|---|---|---|---|---|---|
| | Baseline | Town Twinning | | Baseline | Town Twinning | | Baseline | Town Twinning | |
| | | Yes | No | | Yes | No | | Yes | No |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Temporary Migrants | 0.216*** | 0.297*** | 0.081 | 0.141** | 0.172** | 0.041 | 0.174*** | 0.243** | 0.118 |
| | (0.080) | (0.074) | (0.065) | (0.058) | (0.079) | (0.069) | (0.066) | (0.097) | (0.096) |
| Distance to Border | -0.663*** | -0.393*** | -0.736*** | -0.527*** | -0.500*** | -0.542*** | -0.334*** | -0.166** | -0.376*** |
| | (0.064) | (0.030) | (0.092) | (0.063) | (0.072) | (0.075) | (0.044) | (0.079) | (0.071) |
| Pre-War Cooperation | -0.012 | -0.033 | -0.026* | -0.074*** | 0.039 | -0.076*** | 0.170*** | 0.098 | 0.190** |
| | (0.019) | (0.025) | (0.014) | (0.021) | (0.037) | (0.022) | (0.066) | (0.077) | (0.084) |
| Observations | 5,808 | 1,312 | 4,496 | 5,511 | 1,208 | 4,121 | 5,566 | 1,166 | 3,910 |
| County fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes*: This table shows estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by town twinning status on three measures of cross-border cooperation: the average social connectivity (Columns 1–3), the number of firm links (Columns 4–6), and the number of joint patents (Columns 7–9), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources.

Table A6: Heterogeneity in the Time-varying Effect of Temporary Migration by Town Twinning Status

| | Joint Patents: Early Post-WWII | | | Joint Patents: Late Post-WWII | | |
|---|---|---|---|---|---|---|
| | Baseline | Town Twinning | | Baseline | Town Twinning | |
| | | Yes | No | | Yes | No |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Temporary Migrants | 0.291** | 0.330 | 0.460*** | 0.167** | 0.265** | 0.032 |
| | (0.123) | (0.201) | (0.152) | (0.067) | (0.105) | (0.100) |
| Distance to Border | -0.291*** | 0.059 | -0.333*** | -0.352*** | -0.242*** | -0.433*** |
| | (0.082) | (0.133) | (0.106) | (0.045) | (0.067) | (0.080) |
| Pre-War Cooperation | 0.419*** | 0.277* | 0.420*** | 0.075 | 0.049 | 0.085 |
| | (0.094) | (0.147) | (0.087) | (0.057) | (0.055) | (0.085) |
| Observations | 3,982 | 772 | 2,203 | 5,500 | 1,148 | 3,747 |
| County fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Country fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes*: This table shows estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by town twinning status on the number of joint patents in the early post-war period (1946–1965) (Columns 1–3), and the number of joint patents in the late post-war period (1966–2013) (Columns 4–6), all standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources.

Table A7: Effect of Temporary Migration on Town Twinning

| | Town Twinning (1) |
|---|---|
| Temporary Migrants | 0.166*** |
| | (0.063) |
| Distance to Border | -0.505*** |
| | (0.039) |
| Pre-War Cooperation | -0.086*** |
| | (0.028) |
| Observations | 5,654 |
| County fixed effects | ✓ |
| Country fixed effects | ✓ |

*Notes*: This table shows estimated coefficients from Equation 1, showing the effect of temporary migration during WWII on town twinning partnerships (dummy). The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources.

## A.2 Additional Figures

### A.2.1 Historical Background


(a) *Source:* Fernhout (1996)

(b) *Source:* NIOD Inst. v. Oorlogs-, Holocaust- en Genocidestudies (2026)

Figure A1: Illustration of Recruitment Process in the Netherlands

*Notes:* These two posters illustrate the evolution of the recruitment process in the Netherlands. The left panel shows an early voluntary labor recruitment campaign, while the right panel reflects later coercive practices, including the conscription of specific cohorts.

### A.2.2 Maps

### A.2.3 Descriptives

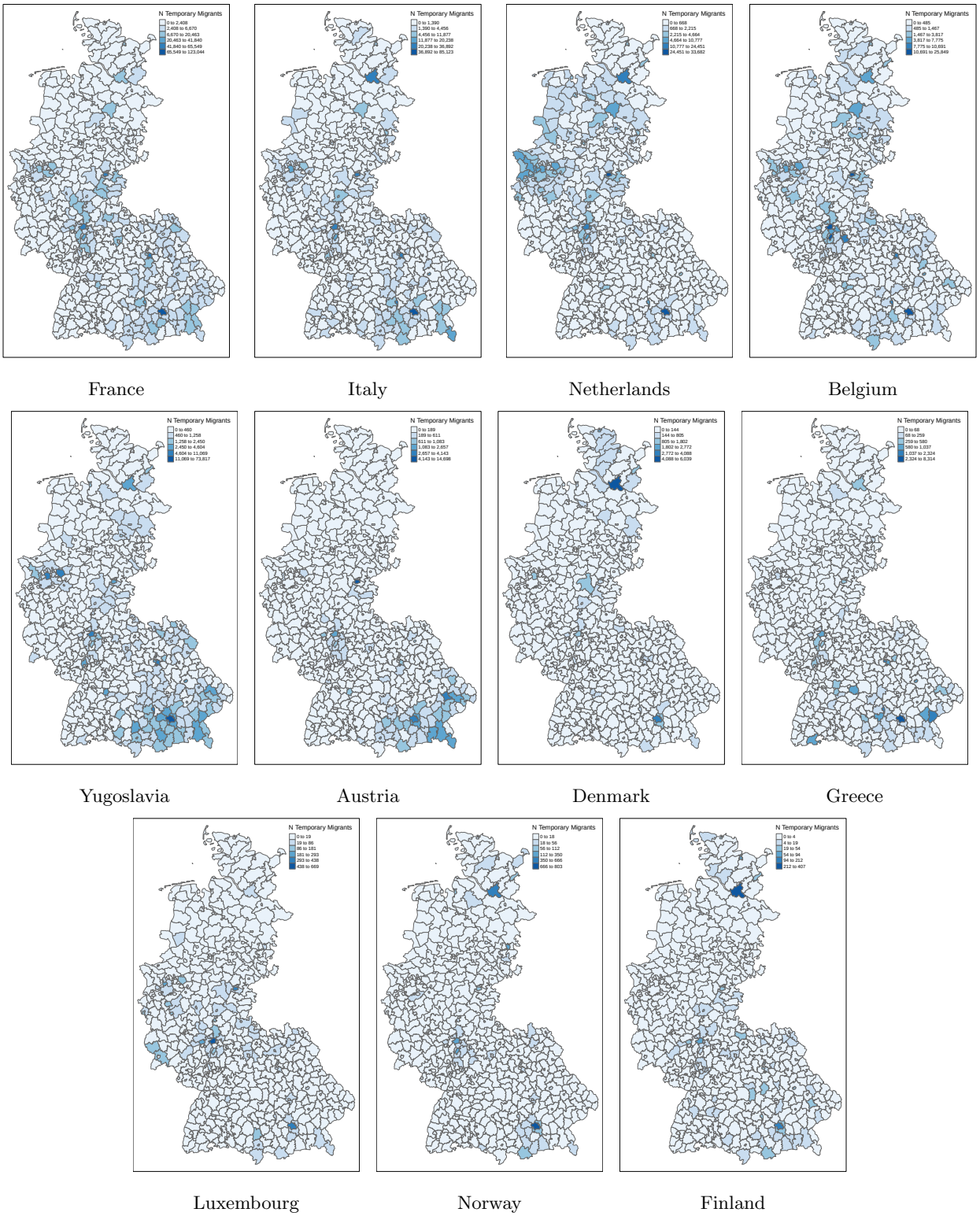
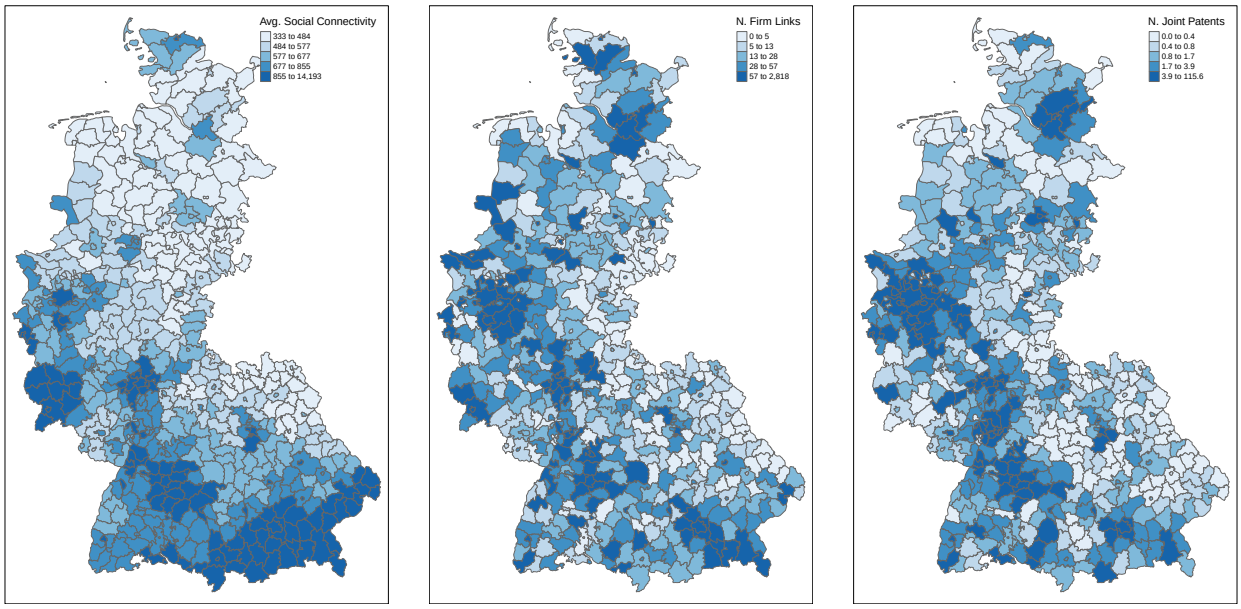



Figure A2: Distribution of Temporary Migrants over German Counties during WWII by Country of Origin

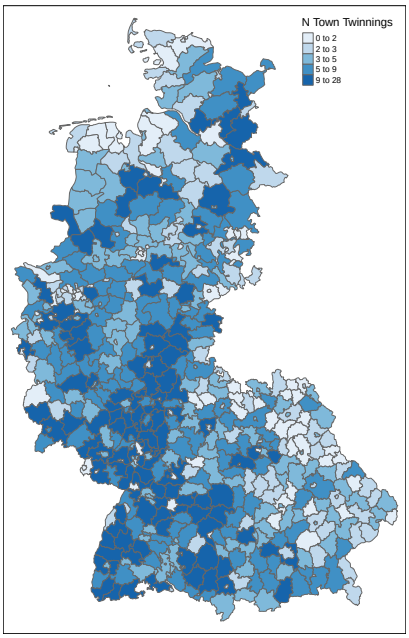
*Notes:* These maps shows the distribution of temporary migrants over German counties during WWII by country of origin. See Section A.3 for variable descriptions and data sources.



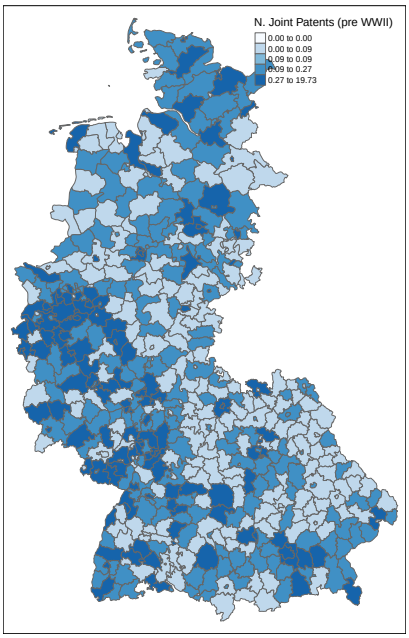

(a) Avg. Social Connectivity (b) Number of Firm Links (c) Number of Joint Patents

Figure A3: Cross-Border Linkages Between German Counties and Countries of Origin

*Notes:* These maps show the number of cross-border cooperation between German counties and the countries of origin of forced migrants, measured in three distinct ways: the number of Facebook friendship ties in Panel (a), the number of firm links in Panel (b), and the number of joint patents in Panel (c). See Section A.3 for variable descriptions and data sources.




(a) Town Twinnings




(b) Pre-War Cooperation

Figure A4: Geographic Distribution of Town Twinnings and Pre-War Cooperation

*Notes:* Panel a shows the total number of formal town twinning partnerships between German counties and the countries of origin of temporary migrants in our sample. Panel b shows the number of joint patents filed between 1877—1938 by inventors in German counties and inventors in the same set of origin countries. See Section A.3 for variable descriptions and data sources.

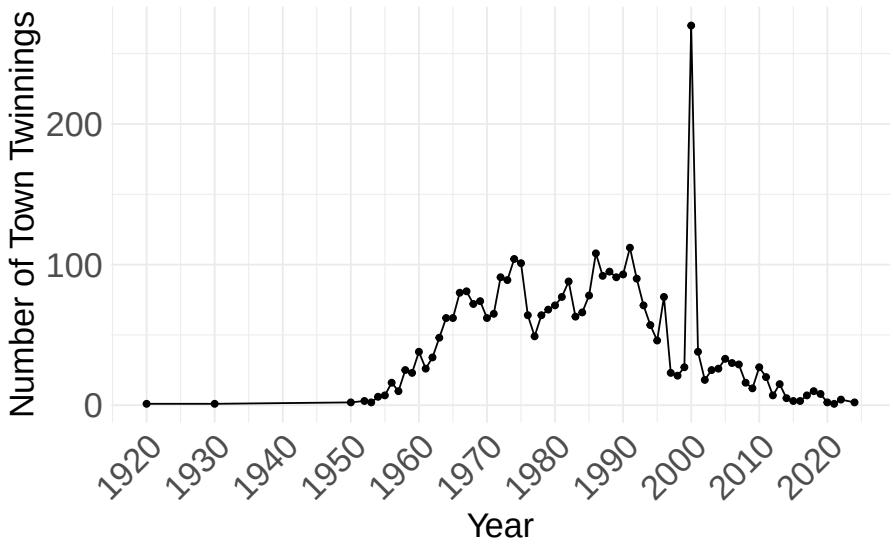
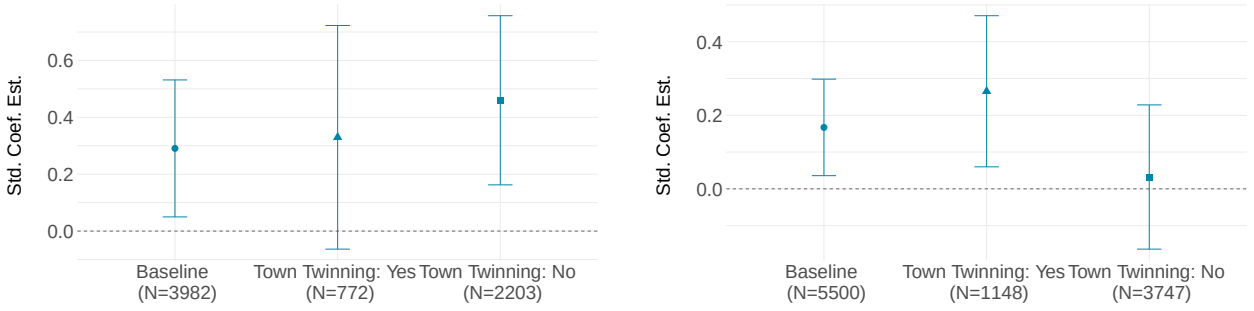



Figure A5: Establishment of New Town Twinnings Over Time

*Notes:* The figure shows the number of new town twinning partnerships formed between German municipalities and foreign partners in each year. See Section A.3 for data sources.

### A.2.4 Coefficient Plots




(a) Number of Joint Patents Early Post-WWII

(b) Number of Joint Patents Late Post-WWII

Figure A6: Heterogeneity in the Time-varying Effect of Temporary Migration by Town Twinning Status

*Notes:* This figure plots estimated coefficients from Equation 1, showing the effect of temporary migration during WWII by town twinning status on the number of joint patents in the early post-war period (1946–1965) (Panel a), and the number of joint patents in the late post-war period (1966–2013) (Panel b), both standardized to have mean zero and unit standard deviation. The independent variable is the number of temporary migrants (arsinh-transformed), standardized to have mean zero and unit variance. All regressions include German county and country fixed effects, and control for pre-WWII cooperative ties, measured by the number of pre-war joint patents (arsinh), as well as the log-distance between the German county and the country of origin (in km). See Section A.3 for variable definitions and data sources. Table A6 includes the corresponding regression estimates. See Section A.3 for variable descriptions and data sources.

## A.3 List of Variables and Data Sources

### A.3.1 Treatment

**Temporary Migrants:** The number of forced foreign migrants from specific countries in each German county during WWII. Based on individual-level records from the Arolsen Archives. Source: Arolsen Archives (2024).

### A.3.2 Outcome

**Social Connectivity:** A measure of the intensity of Facebook friendship links between users in German counties and users in foreign countries, normalized by the total number of possible connections (proxied by the total population). Constructed from Meta's Social Connectivity dataset (as of 2023). Source: Bailey et al. (2018) and Facebook Data for Good (2025). Population data from Eurostat (2024).

**Firm Links:** The number of direct cross-border firm links between German entities and foreign entities, aggregated to the county–country level. Based on corporate ownership data from the Bureau van Dijk Orbis database, retrieved July 3, 2024. Source: van Dijk (2024).

**Joint Patents:** The number of patents co-authored by inventors in German counties and inventors in foreign countries between 1946–2013, based on patentee-level data. Aggregated to the county–country level. Source: Bergeaud and Verluise (2024).

### A.3.3 Controls

**Distance to Border:** The logarithm of the great-circle distance (in km) between the centroid of German county $i$ and the nearest border of origin country $j$, calculated using geospatial shapefiles from Bundesamt für Kartographie und Geodäsie (2011) and Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics, University of Rostock (2011).

**Pre-War Cooperation:** The number of patents co-authored by patentees located in a German county and patentees in a foreign country before WWII, constructed by aggregating patentee-level patent data to the county–country level. Patents are drawn from the database by Bergeaud and Verluise (2024) and restricted to applications filed between 1877 and 1938. This variable serves as a proxy for pre-WWII cross-border cooperation.

### A.3.4 Heterogeneity

**Sector of Employment:** A binary indicator for whether the prewar economy of a county was predominantly agricultural or industrial. Based on historical employment statistics by sector from the 1939 occupational census, taken from Braun and Franke (2021), we calculate the ratio of industrial employment relative to agricultural employment and classify counties with a ratio above the national median (0.79) as "industrial" and the remainder as "agricultural". This classification helps proxy the nature and intensity of migrant–civilian contact during wartime.

**Wartime Conditions:** We capture variation in hardship during the temporary migration period using two proxies. First, bombing intensity is measured as the number of buildings damaged by Allied bombings in each county, expressed as a share of the county's housing stock. Data are from Peters (2021). Second, proximity to labor education camps is calculated as the inverse distance from a county centroid to the nearest labor camp *Arbeitserziehungslager*, based on historical records of camp locations from Lofti (2000).

**Cultural Similarity:** Measured by religious similarity between forced migrants and the local German population. Specifically, we follow Braun and Dwenger (2020) and construct the Euclidean distance between the share of religious affiliations $k$ of forced migrants from country $j$ and the share of religious affiliations $k$ in German county $i$:

$$ReligousDistance_{ij} = \sqrt{\sum_{k}(share_{ik} - share_{jk})^2} \tag{2}$$

We use the share of Protestants, Catholics, and other religious affiliations. A smaller difference implies higher cultural similarity. Data for German counties is taken from Braun and Dwenger (2020), which is based on the 1939 census. Data for foreign countries is taken from [XX].

### A.3.5 Mechanism

**Town Twinning:** A binary variable indicating the presence of town twinning partnerships between a German county and a foreign country. Source: RGRE (2024).