

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 labor in Germany during World War II. We exploit the quasi-random distribution of foreign migrants across German counties, which was not determined by prior migration patterns or existing ties. Estimating a gravity model, we find that a greater presence of foreign 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 postwar period. We further show that this effect persists when ties are institutionalized via formal town partnerships. 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 linkages (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 labor 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, driven by local labor demand at the time of transportation, rather than by preexisting economic ties or migrant characteristics (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 after the war (Proudfoot, 1957). This setting offers a rare opportunity to study the effects of temporary migration with universal return, largely free from confounding factors such as chain migration or self-selection.

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. First, we use a social connectivity measure via 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 more directly measure cooperation, we use foreign direct investment (FDI) relationships using data from van Dijk (2024), as well as joint patenting using data from Bergeaud and Verluise (2024). In future work, we plan to extend this analysis to include additional measures of cooperation, such as international

trade flows. 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 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 social connectivity between German counties and the migrant's countries of origin today, confirming the formation of personal bonds.¹ We also document persistent effects on economic behavior: a one standard deviation increase in the number of forced migrants is associated with 15.4% more firm links and 16.3% more joint patents. Notably, all three effects are concentrated in county-country pairs where institutionalized ties, through town twinning, were established. In the absence of such institutions, short-term contact appears to have no persistent effect. We perform a case study for the Netherlands exploiting variation on the subnational level to test whether personal connections or a shift in attitudes towards foreigners drive the positive effects.

These findings suggest that even coercive temporary migration can foster cross-border cooperation. However, the persistence of this cooperation depends on the institutionalization of interpersonal ties, which ensures that individual connections translate into long-term economic relationships.

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 the exogenous variation in German civilians' contact with different nationalities. This allows us to isolate causal effects of temporary migration on later cooperation.

Second, we contribute to the literature on (forced) migration by studying a setting with universal return to home countries and 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 continued prevalence of forced displacement worldwide.

Third, our paper contributes to work on attitudinal and behavioral change through contact (Battiston, 2018; Carrell et al., 2019; Corno et al., 2022; Green, 2024; Schindler & Westcott, 2021),

¹More precisely, a one standard deviation increase in the number of forced migrants is associated with a 24.1% increase in social connectivity between German counties and the migrants' countries of origin today.

by focusing on actual cooperative behavior in addition to previously studied shifts in attitudes. Moreover, 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. In this context, they also speak to the origins of European integration, where postwar reconciliation between former adversaries laid the groundwork for what would later become the European Union.

2 Setting: Forced 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.² 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 unemployed workers. However, it soon escalated into increasingly coercive measures (Spoerer, 2001).³ Table A1 in

²The regime sought to avoid a renewed empowerment of women, as had occurred after World War I, arguing that female employment would cause moral harm to women (Homze, 1967).

³Note that the categories of 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.

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 laborers and prisoners of war were present in Germany during the war, comprising roughly 20 percent of the wartime labor force (Buggeln, 2017).

2.2 Distribution across German Counties

The assignment of forced migrants within Germany was centrally coordinated and driven primarily by local labor shortages. While the total number of foreign workers sent to each region reflected the labor demand in that area, little attention was paid to individual skills or nationality in the allocation process. Matching workers to jobs based on occupational background was viewed as administratively too costly, and authorities prioritized speed and scale over efficiency in placement (Marx, 2019). Thus, firms had no influence over the national composition of the laborers they received. Assignments were made by central institutions such as the Reich Labor Ministry and local employment offices (*Arbeitsämter*), not by employers or municipal officials Spoerer, 2001. As a result, the variation in the national origin of forced migrants across German counties can be considered quasi-random. Figure A3 shows the geographic distribution of forced migrants from all countries in our sample across German counties during WWII.

2.3 Places of Encounter

Foreign migrants and German civilians interacted in multiple settings during WWII. First, they worked side by side in German firms across a 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). Despite the coercive nature of their presence, these varied forms of interaction suggest that forced migrants had meaningful social contact with German civilians. This contact could have left behind interpersonal ties or memories that influence later cross-border relationships.

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 laborers 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 either unwilling or unable to return (Grüter & Mourik, 2020). By the fall of 1946, approximately 650,000 displaced persons from territories that became part of the Soviet Union were still residing in West Germany (Gatrell, 2013; Proudfoot, 1957). To ensure comparability and to avoid potential confounding due to long-term settlement, we restrict our analysis to countries outside the former Soviet Union. By focusing on forced migrants from Western European countries, most of whom were repatriated shortly after the war, we can be confident that our setting captures temporary migration. This allows us to study whether even short-term, coercive contact can have persistent effects on international cooperation.

3 Data

For our empirical analysis, we combine historical data on the deployment of forced laborers during WWII with postwar data on cross-border connections between German counties and the forced workers' 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 A3.

3.1 Treatment: Temporary Migrants in Germany During World War II

To measure the allocation of foreign forced laborers across Germany, we use data on displaced persons. These are defined as individuals deported by the Nazi regime, collected from the Arolsen Archives (Arolsen Archives, 2024).⁴ The archive contains the largest repository of records on victims and survivors of the Nazi regime. The data largely comes from registration efforts by the Allied forces after WWII who organized the repatriation of displaced persons to their countries of

⁴The records on displaced persons also include prisoners of war and former inmates of concentration camps.

origin.

We are interested in the impact of short-term contact. We therefore restrict our analysis to countries outside the former Soviet union, as a large share of the displaced persons from those countries did not repatriate after WWII. For these cases, we cannot distinguish between effects of short-term contact and long-term migration of former forced migrants who stayed in Germany.

The records include the county in which the persons were located while in Germany, and, for a subset, also their date and place of birth. In total, our sample covers 3.39 displaced persons from 11 nationalities who were located in Germany during WWII. Most forced workers were from France, with 1.5 million (see table A2). These numbers align with historical evidence from other sources XXXCITE. For a case study on the county-level, we geocoded the place of birth for XX Dutch forced migrants, covering XX% of all Dutch individuals in our sample.

Figure A2b illustrates the distribution of forced migrants in German counties, showing that they were present throughout the country. Figure A3 shows the distribution of forced migrants separately by country of origin, which appears largely dispersed without clear spatial clustering.

On average, a German county in our sample hosted about XXXX forced foreign workers, with a span of XX to XX. Note that our identification relies on variation in the composition of the forced migrants, instead of variation in the total exposure to foreigners.

3.2 Outcome: Cooperation Measures

3.2.1 Social Connectivity

To measure interpersonal linkages between German counties and the countries of origin of forced migrants, we use a social connectivity measure. The measure captures the number 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 data to construct a panel at the county-country level following Bailey et al. (2020).⁵ The final social connectivity measure then reflects the relative intensity of social ties between German counties and the forced migrants' countries of origin and serves as a proxy for interpersonal connections.

⁵Since we lack data for the number of Facebook which the authors use for the re-weighting, 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.

Figure A4a 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 examine whether temporary migration fosters economic cooperation by analyzing firm-level ownership links. 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 regions 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.⁶ We restrict the analysis to direct ownership links, i.e., those that do not pass through any intermediary entity, as our focus lies on bilateral ownership connections between two countries. We focus at least medium sized firms (operating revenue at least 1 million euros, total assets at least 2 million euros, or at least 15 employees).

We geolocate the German entities to the respective headquarters address and aggregate them 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 XX links between German counties and the eleven foreign countries in our sample. Most connections are with Austria, namely 7,039 (see table A2). Figure A4b shows the distribution of total firm links over German counties. On average, a German county has XX links, with a span of XX to XX.

Cross-border firm ownership constitutes a meaningful indicator of economic cooperation, as it reflects a strategic and durable form of engagement that typically extends beyond transactional trade relationships or short-term contractual arrangements.

⁶Shareholders in the data can be corporations, private individuals, governments, or collectively described entities, while subsidiaries are always classified as corporations.

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 inventor listed on a patent application. This enables us to identify instances of joint patenting between individuals in Germany and the countries of origin of forced migrants. We aggregate co-inventorships to the county–country level. A joint innovation link is defined as a patent co-authored by at least one patentee from a given German county and 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. Figure A4c shows the distribution of total joint patents across German counties, and table A2 shows the total number of joint patents by country.

3.3 Further Variables

3.3.1 Controls

Pre-War Cooperation. To account for pre-existing cross-border relationships between German counties and the countries of origin of forced migrants, 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 XX and XX.

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. This provides a proxy for pre-WWII cooperation at the bilateral county–country level. By including this control variable in our baseline regressions, we aim to isolate the effect of wartime temporary migration from any pre-existing international ties that could independently influence cooperation outcomes. Figure A5b in the appendix illustrates the spatial distribution of historical patenting activity.

Distance to Border. To account for geographic proximity as a determinant of cross-border cooperation, we include the bilateral distance between each German county and the corresponding country of origin of forced migrants. 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. This measure controls for the role of physical closeness in shaping contemporary social and economic linkages. XX

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 S. Braun and Franke (2021). Specifically, we classify a county as industrial if more than 50 percent of its workforce was employed in the secondary sector (manufacturing and industry), and as agricultural if more than 50 percent was employed in the primary sector (agriculture, forestry, and fishing). 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 industrial labor camps or dormitories). XX

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 S. T. 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 and Catholics) with data on the religious makeup of the forced migrants' countries of origin, sourced from [XX]. The idea is that migrants who were more culturally or religiously similar to the host population may have experienced more interpersonal contact, which could strengthen the persistence

of cross-border ties.

3.3.3 Mechanism

Town Twinning. 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.⁷ This bottom-up structure distinguishes town twinning from nationally coordinated foreign policy and reflects a decentralized form of international engagement. 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).⁸ We geolocate each German municipality and aggregate twinning agreements at the county level.⁹ For each agreement, we record the partner country of the foreign municipality, allowing us to construct a county–country-level panel of town twinning intensity.

Town twinning expanded significantly after WWII.¹⁰ Initial partnerships were mostly formed with municipalities in Western Europe.¹¹ Figure XX shows the cumulative number of town twinning agreements over time between German counties and the Western European countries included in our sample.¹²

⁷For 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).

⁸We include both formal, open-ended partnership agreements as well as project-based partnerships. Our results are robust to restricting to only open-ended partnerships.

⁹Whenever we refer to a county's number of town twinnings, this reflects the total number of agreements across all municipalities within that county.

¹⁰Only very few town twinning agreements were established before WWII.

¹¹Partnerships with Eastern Bloc countries largely emerged after the end of the Cold War in 1989.

¹²There 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. Most counties had already established partnerships by then, as well as constraints due to the municipal financial crisis (Wingert-Beckmann, 2012).

Figure A5a displays the geographic distribution of town twinning across German counties. XX percent of counties have at least one twinning agreement, and the average county has XX 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:

$$\begin{aligned} \mathbb{E}[Y_{ij} | X_{ij}] = & \exp(\beta_0 + \beta_1 \text{lhs}(\text{TemporaryMigrants}_{ij}) + \\ & \beta_2 \ln(\text{DistanceToBorder}_{ij}) + \beta_3 \text{lhs}(\text{PreWarCooperation}_{ij}) + \gamma_i + \delta_j) \end{aligned} \quad (1)$$

where Y_{ij} denotes the cooperation measure of interest between German county i and country j . The variable $\text{TemporaryMigrants}_{ij}$ captures the number of wartime forced migrants from country j who were present in county i , and $\text{DistanceToBorder}_{ij}$ measures the distance between the centroid of county i and the nearest border point of country j . The term $\text{PreWarCooperation}_{ij}$ captures pre-existing bilateral linkages between the two locations, measured as the number of jointly filed patents between inventorsXX in county i and country j prior to 1939/between XX and XX. Including this variable allows us to control for historical cooperation patterns that might have independently influenced both wartime migrant allocation and post-war ties. County fixed effects γ_i and country fixed effects δ_j absorb unobserved heterogeneity at both levels.

4.1 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 linkages 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.¹³ 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 (γ_i). Country fixed effects (δ_j) further account for differences across sending countries, such as baseline cooperation intensity or postwar geopolitical alignment.

In addition, we use the time-varying structure of the patent data to control for pre-WWII levels of patenting as a proxy for any 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

We begin our analysis by estimating the effect of short-term forced 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.

¹³For instance, Nazi authorities may have placed certain national groups farther from the border to reduce escape risk.

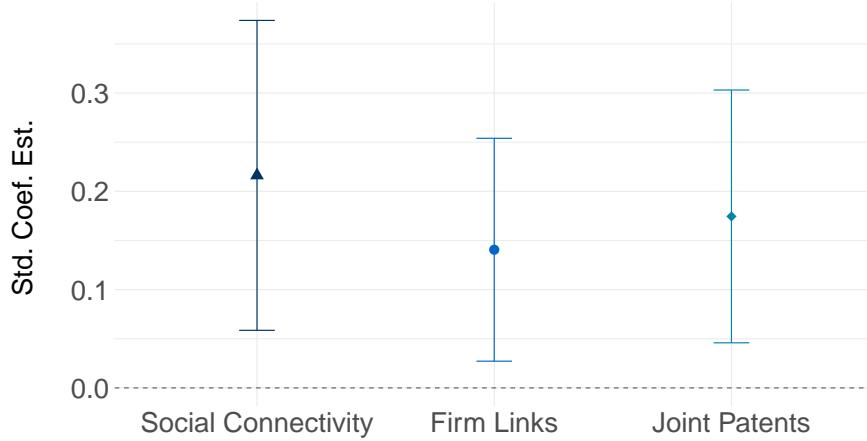


Figure 1: Effect of Temporary Migration on Cross-Border Linkages

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 independent variable is the number of forced migrants (inverse hyperbolic sine (ihs)-transformed). The variable is 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 (ihs), as well as the log-distance between the German county and the country of origin (in 1000 kilometers (km)). Both the independent and dependent variables are standardized to have mean zero and unit standard deviation. See Section A.3 for variable definitions and data sources. Table A4 includes the corresponding regression estimates.

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 1 presents the estimated effects for our three main outcome variables: social connectivity, cross-border firm links, and joint patenting activity.¹⁴ We find that a one standard deviation increase in the (IHS-transformed) number of forced migrants leads to a 24.1 percent increase in social connectivity, a 15.4 percent increase in cross-border firm links, and a 16.3 percent increase in joint patenting activity. These estimates suggest that even brief, involuntary contact between populations can foster enduring social and economic cooperation across national borders. Importantly, the effects are not limited to one domain but appear across distinct dimensions of cooperation. While social ties may reflect continued interpersonal relationships or shared cultural affinities, foreign direct investment and joint patenting represent actual economic cooperation. Taken together,

¹⁴The corresponding regression estimates are reported in Table ??.

the results imply that short-term contact 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 foreigners formed the basis of the international cooperation with the exact former forced migrants that Germans personally got to know during their stay in WWII. An alternative explanation could be that the personal contact of Germans with forced migrants from a given nationality shifted the views of Germans on people with that nationality in general. This could have increased their willingness to cooperate and form town twinnings with people from that country more broadly.¹⁵

To distinguish between the two alternative explanations, we run a supplementary 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 the highest share of forced migrants for whom we have information about their place of birth.

We will estimate Equation 1 again, this time at the 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 π_1 to be positive and significant: Assuming that a large enough share of forced migrants returned to their place of birth, the 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 variation explained by the Netherlands in our main results is more likely to be driven by shifts in attitudes of Germans towards Dutch (and other foreign) people in general. Note that a positive π_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 ?? shows the results.

¹⁵Keep in mind that on the German side, we use variation on the county level, which means that any shifts in attitudes of forced migrants towards Germans would need to have taken place on a more granular regional level to explain our results.

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

5.2 Heterogeneity by Nature of Contact

Next, we examine whether the effects of temporary migration on cooperation depend on the context in which foreign 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.

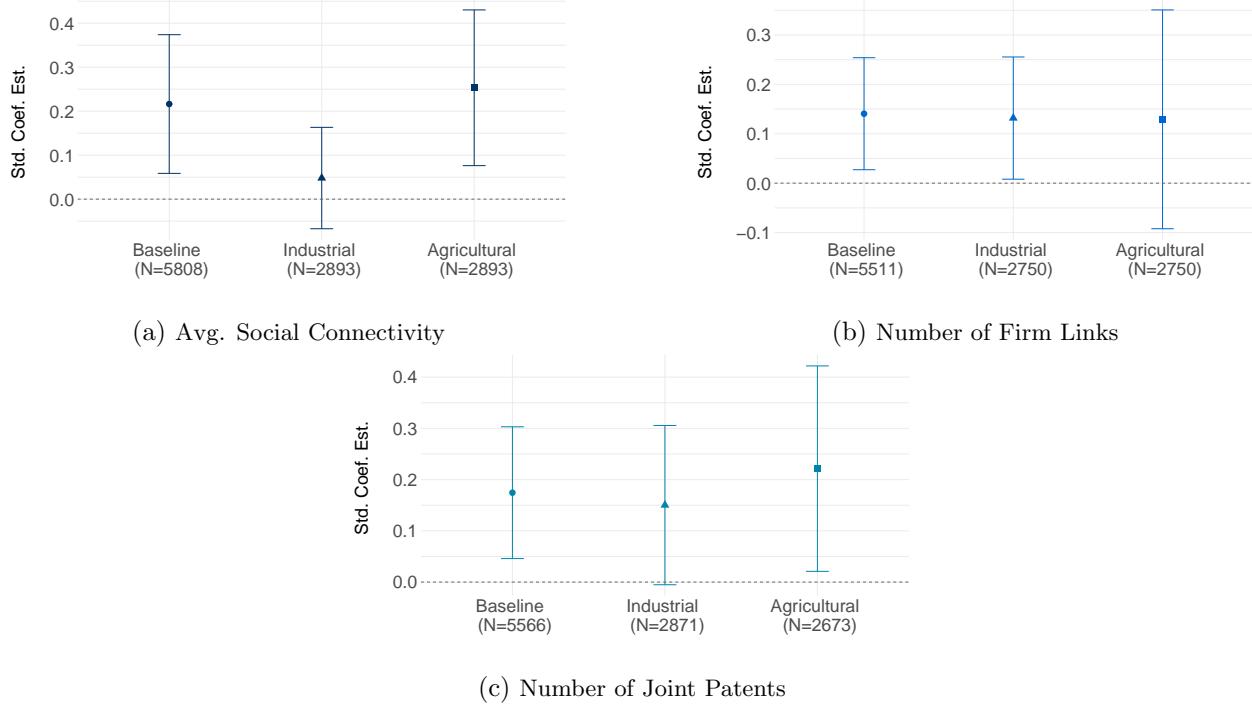


Figure 2: Heterogeneity in the Effect of Temporary Migration by Sector of Employment

Notes: This figure shows heterogeneity in the effect of forced migration on cross-border linkages, depending on the primary sector in the German county for our three main outcomes: 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). The independent variable is the number of forced migrants (ihs-transformed). The variable is 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 (ihs), as well as the log-distance between the German county and the country of origin (in 1000 km). Both the independent and dependent variables are standardized to have mean zero and unit standard deviation. See Section A.3 for variable definitions and data sources. Table XX shows the underlying regression table.

Sector of Employment. We first study heterogeneity by the sector of employment. Forced migrants employed in agriculture were often housed directly on farms, frequently 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.

Figure 2 presents subsample regressions of our baseline specification separately for counties with higher prewar 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.¹⁷ 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 several decades later. 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, 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 labor education camps (*Arbeitserziehungslager*), where workers could be detained 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 workers were especially vulnerable in heavily bombed areas: access to air-raid shelters was often restricted, and foreign workers were frequently assigned to dangerous cleanup tasks. Second, we use the distance to the nearest labor education camp, assuming that forced migrants closer to

¹⁷See Section A.3 in the Appendix for the exact variable definition.

such camps faced higher probability of being sentenced to temporary detention, indicating a more repressive treatment.

Figure ?? presents the corresponding coefficient estimates. XX

These results suggest that the nature of wartime experiences shaped whether short-term contact translated into persistent cross-border ties.

Cultural Similarity. The extent to which temporary contact translates into cooperation may depend on the degree of cultural similarity between forced migrants and the local German population. We proxy cultural similarity with religious similarity based on historical evidence showing that churches were places where forced migrants and German civilians could interact during the war. Shared religious affiliation may have facilitated trust and social proximity, thereby amplifying the impact of temporary migration on later cooperation. Figure ?? presents the corresponding coefficient estimates.

5.3 Time-varying Effects of Temporary Migration on International Cooperation

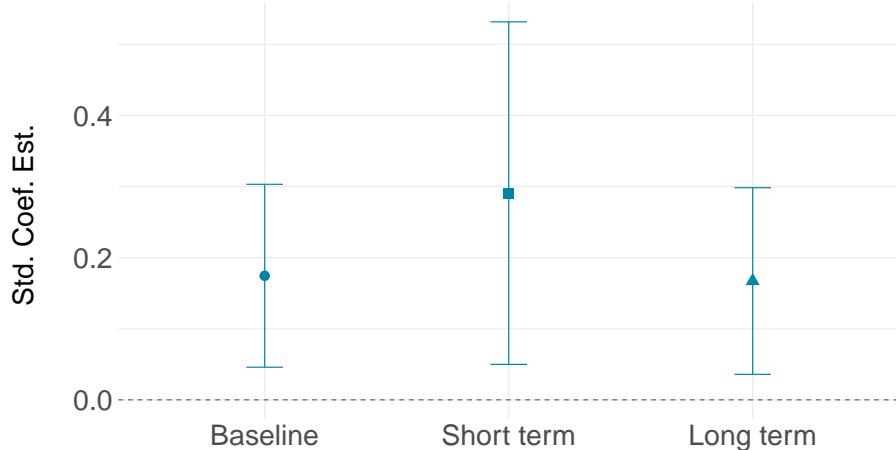


Figure 3: Time-varying Effect of Temporary Migration on Joint Patents

Notes: This figure displays standardized coefficient estimates from Poisson pseudo-maximum likelihood regressions relating the inverse hyperbolic sine (IHS)-transformed number of forced migrants during WWII to the total number of joint patents after WWII, the number of joint patents in the short-term (1946–1965), and the number of joint patents in the long-term (1966–2013). The independent variable is the number of forced migrants (ihs-transformed). The variable is 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 (ihs), as well as the log-distance between the German county and the country of origin (in 1000 km). Both the independent and dependent variables are standardized to have mean zero and unit standard deviation. See Section A.3 for variable definitions and data sources.

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 shed light on the mechanisms behind the long-term persistence.

To do so, we exploit the fact that our patent data spans several decades. This allows us to estimate time-varying effects by comparing outcomes in the short and long run. Specifically, we estimate the effect of temporary migration on cross-border patenting separately for the early and late postwar period. Figure 3 presents the resulting coefficient estimates from Equation 1. 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 short-run (1946–1965) and in the long-run (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 long run, 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 is that early interpersonal contact laid the foundation for formal institutional ties that continued to foster cross-border collaboration long after the migrants had returned home. Once established, such institutions may sustain international engagement even as 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 these partnerships, then the institutionalization of these ties may have preserved and possibly reinforced the long-term effects of that contact. To test this, we first estimate the effect of forced migration on the formation of town-twinning partnerships, see Table A8. We find positive and significant effects: A one standard deviation increase in the

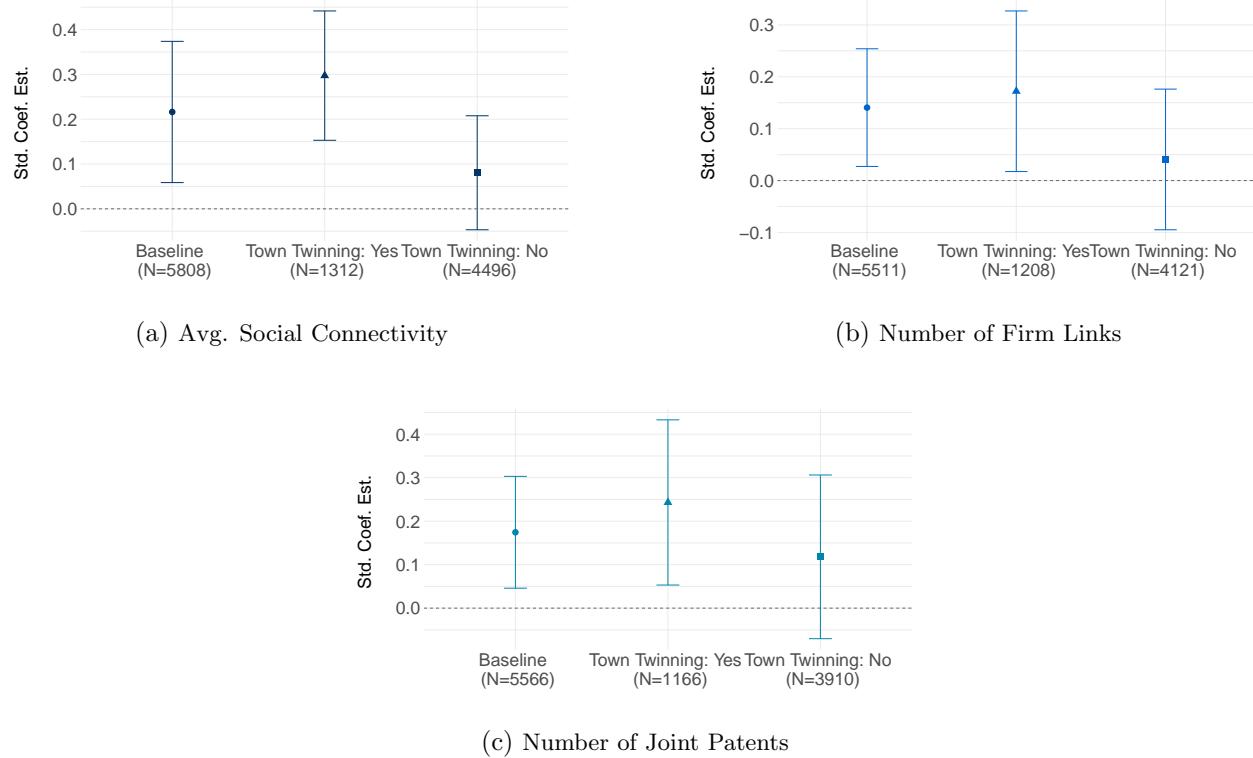


Figure 4: Heterogeneity in the Effect of Temporary Migration by Town Twinning Status

Notes: This figure shows heterogeneity in the effect of forced migration on cross-border linkages, depending on whether a formal town twinning relationship exists between the German county and the migrant-sending country, for our three main outcomes: Facebook friendship ties in Panel (a), firm links in Panel (b), and joint patents in Panel (c). The independent variable is the number of forced migrants (ihs-transformed). The variable is 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 (ihs), as well as the log-distance between the German county and the country of origin (in 1000 km). Both the independent and dependent variables are standardized to have mean zero and unit standard deviation. See Section A.3 for variable definitions and data sources. Table XX shows the underlying regression table.

number of forced migrants increased the probability of a town-twinning partnership by XX%.

Next, we estimate the effect of forced migration separately for county-country pairs with and without formal town-twinning agreements. Figure 4 presents the results. Our findings suggest that the long-term impact of temporary migration on cooperation is concentrated among county-country pairs that eventually establish town twinning partnerships. In contrast, there is no statistically significant effect in pairs without such institutionalized ties. 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 when restricting the outcome to short-term joint patenting in the immediate postwar period. As shown in Figure A7, 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 when we restrict joint patenting activity to the long-run that we see the same patterns discussed above. This suggests that interpersonal contact alone drives early cooperation, while institutionalization becomes critical for maintaining and reinforcing these ties over time.

Taken together, these findings indicate that the persistence of international cooperation is not only shaped by the nature of the initial interpersonal contact but also by whether it was subsequently formalized through institutional mechanisms. Town twinning, in this context, appears to act as a channel through which temporary experiences translated into enduring transnational 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. Our results hold across a range of alternative model specifications. We re-estimate our main results not controlling for pre-WWII levels of cooperation, relying only on the quasi-random distribution of forced migrants conditional on distance.

Alternative Variable Specifications. We confirm the robustness of our estimates when using different functional forms for the treatment variable, including levels and logs. We also do 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, 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-ended partnerships. Moreover, we investigate the intensive vs. extensive margin of effects by using binary variables for firm links and joint patents.

Alternative Sample Specifications. To ensure that our results are not driven by certain countries that shared a special relationship with Germany during WWII, we repeat our analysis, but excluding Austria as part of the *Greater German Reich*, and excluding France as an occupying force, which may both have resulted in different connections with Germans apart from the temporary migration of foreign migrants.

Taken together, these robustness checks confirm that our findings are not an artifact of specific model, variable and sample choices. The evidence supports a causal interpretation of the relationship between temporary migration during WWII and the persistence of international cooperation at the local level.

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 isolate the impact of short-term interactions between forced migrants and German civilians on the development of cooperative relationships between regions.

For our analysis, we combine archival data on the nationality composition of forced migrants at the individual level with measures of social and economic cooperation at the county level. Using a gravity model, we found that counties with greater exposure to forced migrants from a given

country had significantly stronger bilateral ties with that country after the war. Specifically, we observe substantial and statistically significant increases in social connectivity, firm links, and joint patenting activity.

Importantly, we also find that the effects depend on the nature of the initial contact. The positive impact of temporary migration on international cooperation is stronger in countries where forced migrants were more likely to interact closely with the local population and where wartime conditions were relatively less hostile. These patterns suggest that the context and quality of contact are critical in shaping international relationships.

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 linkages.

We provide evidence for personal connections rather than mere changes in attitudes towards people of foreign nationalities driving our results, by showing that cooperation arose between German places and the exact locations where forced migrants came from.

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, it is notable that the European institutions we know today emerged from a postwar context in which Germany had been the clear perpetrator. Our study underscores the importance of interpersonal contact in fostering cross-border relationships that facilitate international cooperation. In this sense, personal interaction and the subsequent cross-border institutions appear to have played a critical role in laying the foundation for the enduring European integration we see today.

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A Appendix

A.1 Additional Tables

A.1.1 Background

Table A1: Recruitment of Forced 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 probably 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 forced 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 Forced Migrants

Country	N Forced 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 summary statistics by country of origin of forced migrants during WWII. For each origin country, we show the total number of forced migrants assigned to German counties, the average bilateral social connectivity, the number of firm links, joint patenting activity, and the number of formal town twinning agreements with German counties. See Section A.3 for variable descriptions and data sources.

Table A3: 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 (Post-WWII, long-term)	5808	3.1	18	0	654
N Joint Patents (Post-WWII, short-term)	5808	0.88	9	0	496
Town Twinning (binary)	5808	0.23	0.42	0	1
Distance to Country Border (km)	5808	574	433	1.9	1793

Notes: This table reports summary statistics at the county–country level. Variables include the number of forced migrants during WWII, the social connectivity, the number of firm links, joint patents, and town twinning agreements between German counties and the origin countries of migrants. The unit of observation is a German county × origin country pair. See Section A.3 for variable descriptions and data sources.

A.1.3 Regression Tables

Table A4: Effect of Temporary Migration on Cross-Border Linkages

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

Notes: This table shows the estimation of Equation 1.

Table A5: 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*** (0.080)	0.048 (0.059)	0.253*** (0.090)	0.141** (0.058)	0.132** (0.063)	0.129 (0.113)	0.174*** (0.066)	0.150* (0.079)	0.221** (0.102)
Distance to Border	-0.663*** (0.064)	-0.528*** (0.101)	-0.735*** (0.077)	-0.527*** (0.063)	-0.451*** (0.068)	-0.730*** (0.060)	-0.334*** (0.044)	-0.325*** (0.053)	-0.362*** (0.060)
Pre-war Cooperation	-0.012 (0.019)	-0.030** (0.015)	0.011 (0.030)	-0.074*** (0.021)	-0.097*** (0.028)	-0.013 (0.022)	0.170*** (0.066)	0.158** (0.076)	0.057* (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 the estimation of Equation 1.

Table A6: 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 (1)	No (2)		Yes (4)	No (5)		Yes (7)	No (8)
Temporary Migrants	0.216*** (0.080)	0.297*** (0.074)	0.081 (0.065)	0.141** (0.058)	0.172** (0.079)	0.041 (0.069)	0.174*** (0.066)	0.243** (0.097)	0.118 (0.096)
Distance to Border	-0.663*** (0.064)	-0.393*** (0.030)	-0.736*** (0.092)	-0.527*** (0.063)	-0.500*** (0.072)	-0.542*** (0.075)	-0.334*** (0.044)	-0.166** (0.079)	-0.376*** (0.071)
Pre-War Cooperation	-0.012 (0.019)	-0.033 (0.025)	-0.026* (0.014)	-0.074*** (0.021)	0.039 (0.037)	-0.076*** (0.022)	0.170*** (0.066)	0.098 (0.077)	0.190** (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 the estimation of Equation 1.

Table A7: Heterogeneity in the Time-varying Effect of Temporary Migration by Town Twinning Status

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

Notes: This table shows the estimation of Equation 1.

Table A8: 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 the estimation of Equation 1, with a dummy variable for having any Town Twinning cooperation as the dependent variable.

Table A9: Effect of Temporary Migration on Cross-Border Linkages excluding the Netherlands

	Social Connectivity (1)	Firm Links (2)	Joint Patents (3)
Temporary Migrants	0.221*** (0.077)	0.126** (0.057)	0.152** (0.066)
Distance to Border	-0.706*** (0.069)	-0.524*** (0.079)	-0.365*** (0.061)
Pre-War Cooperation	-0.012 (0.019)	-0.077*** (0.023)	0.132** (0.065)
Observations	5,280	5,000	5,000
County fixed effects	✓	✓	✓
Country fixed effects	✓	✓	✓

Notes: This table shows the estimation of Equation 1, excluding county-country pairs with the Netherlands.

A.2 Additional Figures

A.2.1 Historical Background



(a) Source: Fernhout (1996)



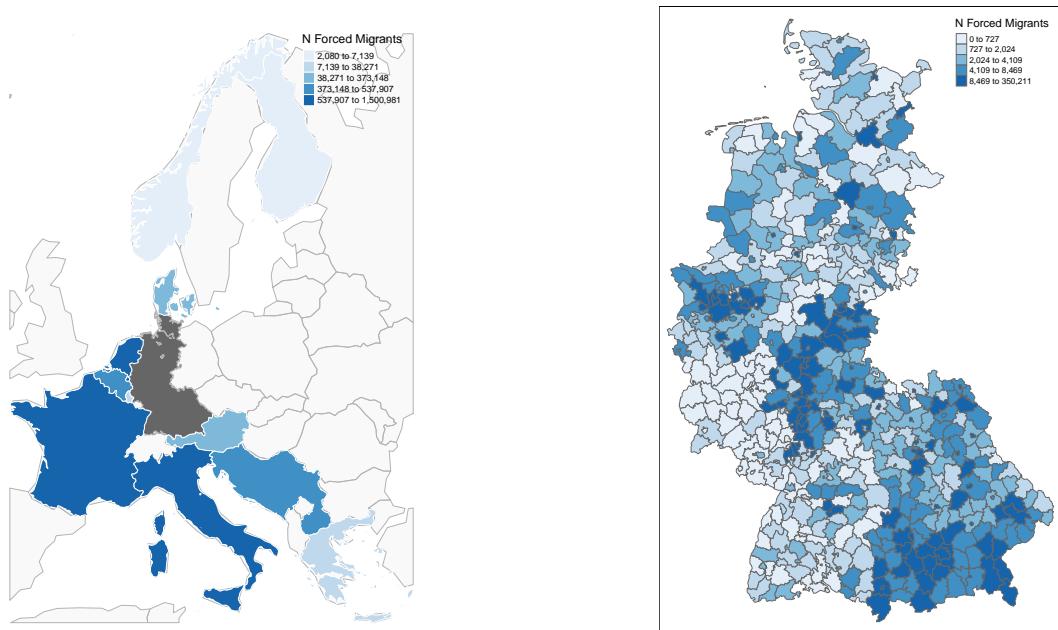
(b) Source: Beeldbank WO2 – NIOD

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



(a) Countries of Origin of Forced Migrants

(b) Geographic Distribution of Forced Migrants within Germany

Figure A2: Country Origins and Geographic Allocation of Forced Migrants

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



Figure A3: Distribution of Forced Migrants over German Counties during WWII by Country of Origin

Notes: The figure shows the distribution of forced migrants over German counties during WWII by country of origin.

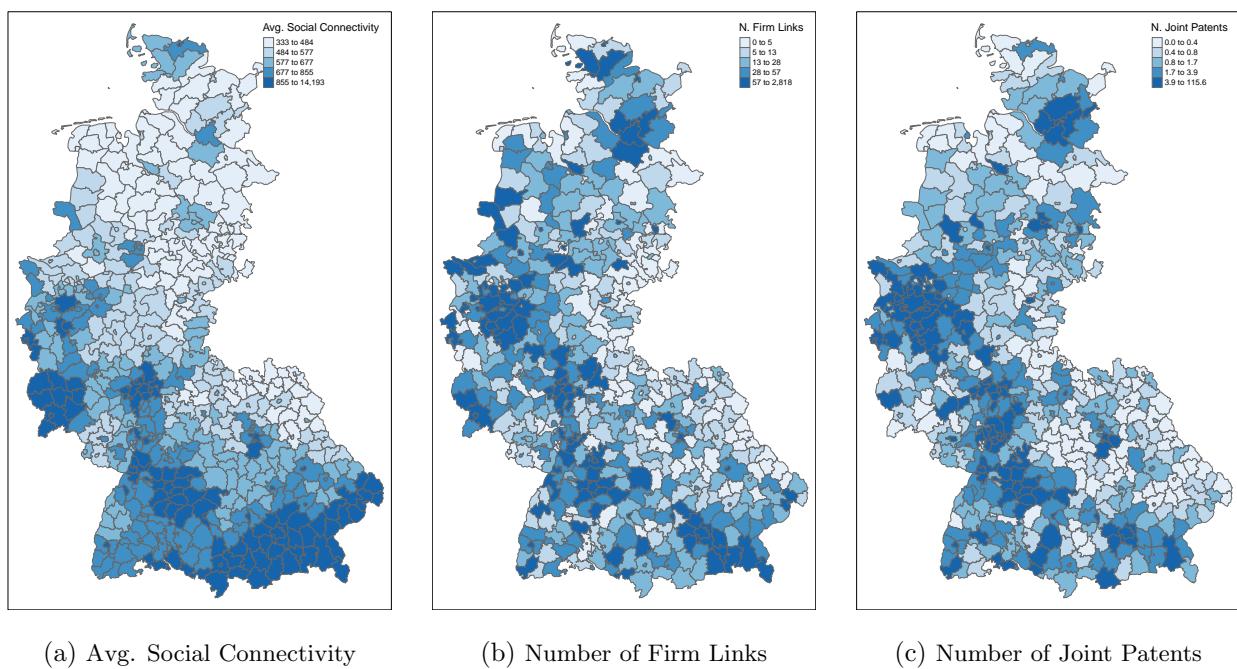
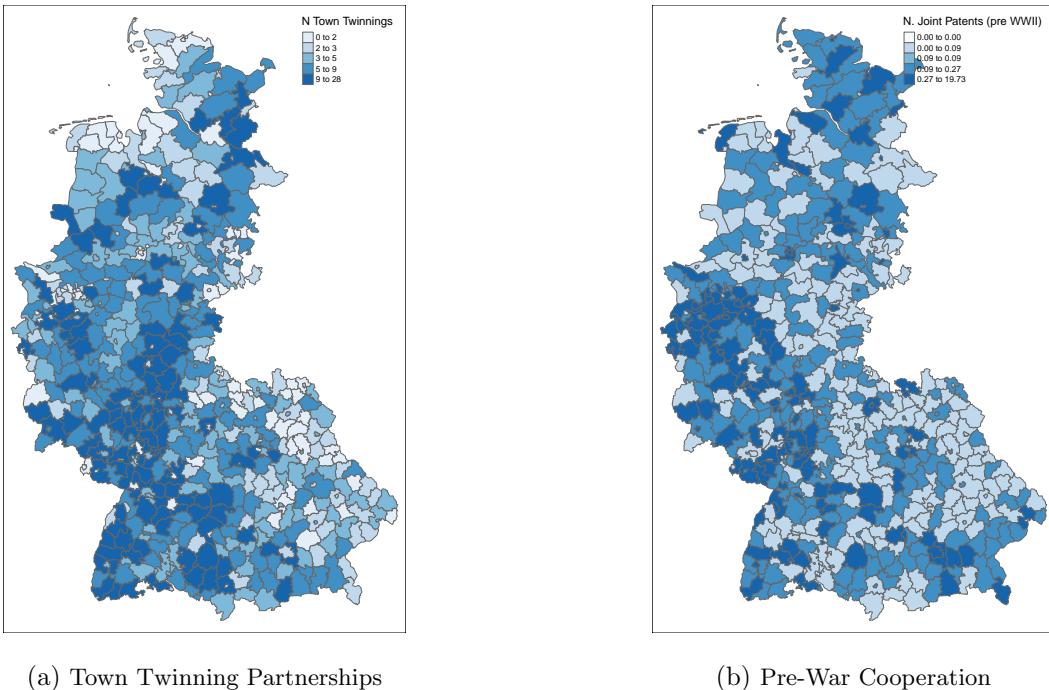


Figure A4: Cross-Border Linkages Between German Counties and Countries of Origin

Notes: These maps show the number of cross-border linkages 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). For variable definitions and data sources, see Appendix XX.



(a) Town Twinning Partnerships

(b) Pre-War Cooperation

Figure A5: 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 forced workers 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. XX

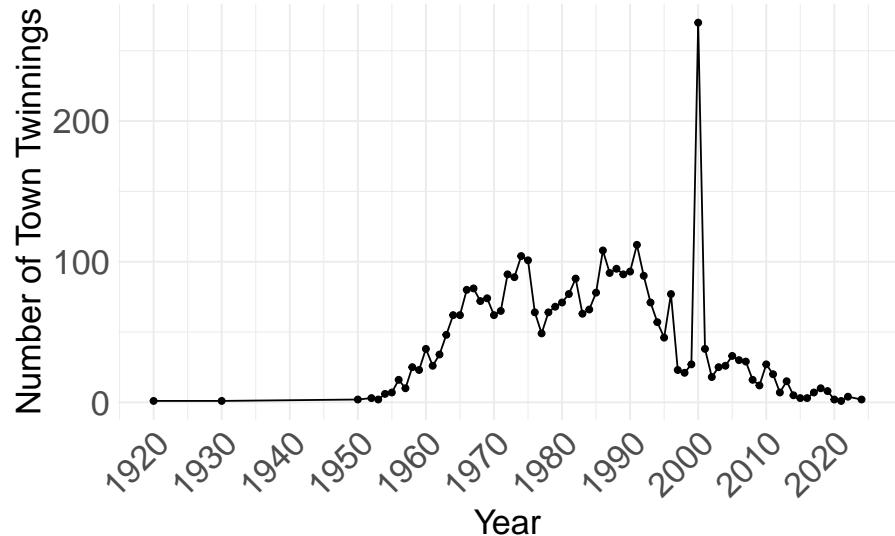


Figure A6: Establishment of New Town Twinning Relationships Over Time

Notes: The figure shows the number of new town twinning partnerships formed between German municipalities and foreign partners in each year. Most partnerships were initiated after WWII, particularly in the decades following European integration and reconciliation efforts. Data source: RGRE (2024).

A.2.4 Coefficient Plots

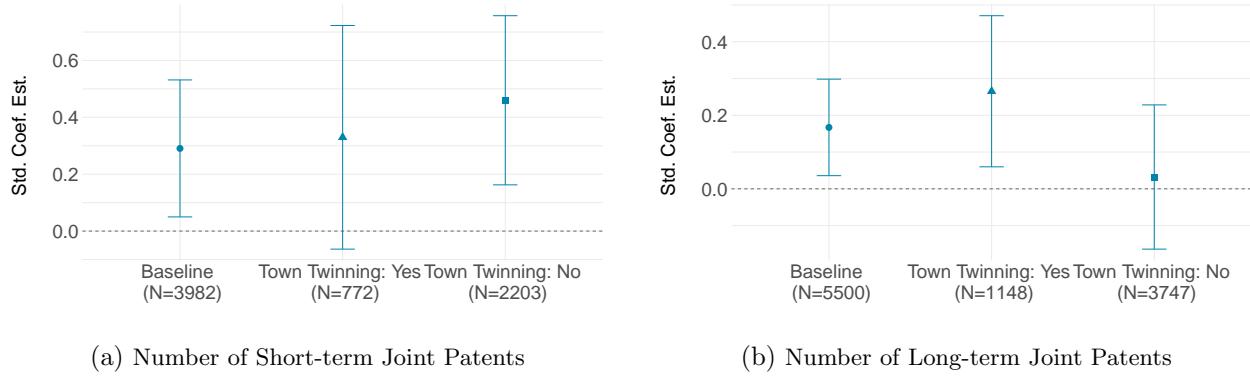


Figure A7: Heterogeneity in the time-varying Effect of Temporary Migration by Town Twinning Status

Notes: This figure shows heterogeneity in the effect of forced migration on cross-border linkages, depending on whether a formal town twinning relationship exists between the German county and the migrant-sending country, for the number of joint patents in the short-term (1946–1965) in Panel (a) and the number of joint patents in the long-term (1966–2013) in Panel (b). The independent variable is the number of forced migrants (ihs-transformed). The variable is 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 (ihs), as well as the log-distance between the German county and the country of origin (in 1000 km). Both the independent and dependent variables are standardized to have mean zero and unit standard deviation. See Section A.3 for variable definitions and data sources. Table XX shows the underlying regression table.

A.3 List of Variables and Data Sources

A.3.1 Treatment

Temporary Migrants: The number of forced foreign migrants from specific countries allocated to 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 connections. Constructed from Meta’s Social Connectivity dataset (as of 2023). Source: Bailey et al. (2018) and Facebook Data for Good (2025).

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, based on inventor-level location 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 1000 km) between the centroid of German county i and the nearest border of origin country j , calculated using geospatial shapefiles from the European Environment Agency (EEA).

Pre-War Cooperation: The number of patents co-authored by inventors located in a German county and inventors in a foreign country before WWII, constructed by aggregating inventor-level patent data at the county–country level. Patents are drawn from the database by Bergeaud and Verluise (2024) and restricted to applications filed between XX and XX. 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 (XX), we classify counties with an agricultural employment share above the national median as "agricultural" and the remainder as "industrial." This classification helps proxy the nature and intensity of migrant–civilian contact during wartime. XX

Wartime Conditions: We capture variation in wartime hardship 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). XX

Cultural Similarity: Measured by religious similarity between forced migrants and the local German population. Specifically, we construct the absolute difference in the share of Protestants and Catholics between each German county (from the 1939 census, see S. T. Braun and Dwenger (2020)) and each country of origin (from XX). A smaller difference implies higher cultural similarity. XX

A.3.5 Mechanism

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