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The Impact of Violence on the Dynamics of Migration: Evidence from the Mexican Revolution
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ABSTRACT

Forced displacement from conflict has risen sharply in recent decades, yet little is known about how violence impacts migration dynamics in the short run or over a longer horizon. Using novel high-frequency data during the Mexican Revolution (1910-1917), one of history's deadliest conflicts, we find that localized violence caused a sharp but temporary 60 percent spike in migration to the US, lasting only seven months before reverting to pre-conflict levels. We do not find evidence of increased migration after the Revolution, suggesting that refugee networks did not spur significant chain migration, even during an era of relatively open borders.

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1. Introduction

The number of people forcibly displaced due to conflict has more than doubled from around forty million in 2011 to nearly ninety million in 2021 (UNHCR, 2022). At the same time, anti-migrant sentiments have risen (Deiana, Maheshri and Mastrobuoni, 2024), fueled in part by the perception that migrant flows will continue long after conflict ends, ultimately posing a fiscal burden to destination economies (d'Albis, Boubtane and Coulibaly, 2019; Hatton, 2020; Hopkins, 2010; Kaufmann and Goodwin, 2018). Despite the central role of this issue in the economic and political sphere, it remains unclear whether these large-scale displacements have reshaped migration patterns over a longer horizon. Refugees who settle in a new country may encourage friends and family to join them years later, potentially altering migration between countries permanently. Alternatively, displacement may be temporary, with migration soon returning to its pre-conflict levels. Understanding how migration flows change during and after conflict episodes is a crucial policy question, but identifying if (and if so, when) migration returns to pre-conflict dynamics is difficult due to the lack of high-frequency data that capture both migration responses and conflicts at a local level.

This paper uses novel data to estimate the impact of conflict on migration dynamics during the Mexican Revolution (1910-1917), one of the deadliest civil wars in history. The Mexican Revolution resulted in the death of approximately 1.4 million individuals, or about 10% of the population (Durand, 2016; McCaa, 2003; Moreno-Brid and Ros, 2009). Hundreds of thousands crossed the border to seek refuge in the United States, reflecting the tendency for refugees to flee to neighboring countries, as seen in modern-day crises in Ukraine, Syria, and Venezuela (Hatton, 2020; Munroe et al., 2023). Furthermore, early-twentieth-century migration from Mexico to the United States resembles migration between modern-day low- and middle-income countries, providing valuable insights since today's migrations are not exclusively to high-income destinations.[1] We collect high-frequency data on both out-migration and conflicts at the local level in Mexico to estimate short-term migration dynamics for the months leading up to and after a conflict event. The data also capture migration in subsequent years, allowing us to assess whether conflict is associated with a change to migration patterns long after the Revolution's end. We find that migration increases for only a few months after an event before returning to baseline levels, which challenges the notion that conflict and violence cause a long-run change in migration between countries (Clemens, 2021).

[1]Early-twentieth-century economic disparities between Mexico and the United States are similar to today's living standard differences between Turkey and Syria (Bolt and van Zanden, 2024).

Our migration and conflict data are unusually rich in frequency, geographical detail, and completeness. First, we collect daily migration flows from individual border crossings registered at 23 entry points along the US-Mexico border. Second, we digitize daily data on insurgency events from military reports compiled in the "Military History of the Mexican Revolution" (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983). These documents cover the most violent period (November 1910 to December 1915), characterized by generalized insurgency. From 1916, the Revolution was reduced to local guerrilla movements that lasted until 1917 and for which there are no comprehensive data available. These reports allow us to assign insurgency events to a given day and a specific location (i.e., latitude and longitude). We link migration and conflict data at the municipality level (comparable to a county in the United States) and construct a municipality-by-month panel. Ultimately, we have a unique dataset that improves upon a literature that either uses higher levels of aggregation (e.g., annual- or country-level), or examines migration in specific localities within a country.[2]

We employ a fully flexible event-study design to estimate the impact of conflict on emigration to the United States. Intuitively, we compare monthly migration rates from municipalities that experienced a conflict to municipalities that had not yet experienced or never experienced a conflict event. We find that conflict triggers a significant short-run increase in migration rates of 60% relative to pre-event levels. Remarkably, this large effect lasts only for a few months. After seven months, migration rates return to pre-conflict levels, showing no lasting impact beyond this time window.[3] Our estimates are robust across various specifications and are unlikely to be biased by pretrends, anticipatory behavior, interference between units in treatment assignment, or treatment effect heterogeneity. We also show that the migration response is larger for more violent events, which bolsters confidence that violence is the main mechanism behind our findings.

We further find that a migration response only occurs in areas with pre-existing migration networks. We define "networked" municipalities as those that had a history of migration before the first conflict. When we divide the sample by networked and non-networked municipalities, we find a large temporary increase in migration in networked municipalities, but no migration response in non-networked municipalities. This result suggests that contacts abroad were needed for being able to escape conflict, a result that aligns with research showing that networks make the migration decision feasible in contexts of armed conflict or persecution (Becker et al., 2024; Buggle et al., 2023; Spitzer, 2021). Importantly, our analysis extends

[2]As discussed later, see Bohra-Mishra and Massey (2011); Spitzer, Tortorici and Zimran (2020); Stanley (1987); Schmeidl (1997); Williams et al. (2012).

[3]Consistent with historical research (Durand, 2016), we find evidence of larger temporary effects for women and children.

these findings to settings where conflict affects the whole population, beyond targeted, ethnicity-based violence that reflects long-standing and intense animus.

In the final section, we evaluate whether there are longer-run changes to migration patterns after insurgency subsided. We find a strong persistence of spatial migration patterns over time, with a correlation of 0.83 between a municipality's percentile rank of migration rate in 1910 and 1920. We obtain a similar correlation for municipalities with violent events, suggesting that the Mexican Revolution did not cause long-lasting changes in the geography of migrant sources.[4] This finding is striking given the scale of the event and the relatively open borders at the time. Today, persistence in migrant sources might be attributed to restrictive entry policies that limit the formation of new migration chains at the community level (Hatton, 2009, 2016). Our historical context avoids this issue, offering clearer insights by examining migration dynamics in an era free from such policy constraints.

We contribute to a vast interdisciplinary literature on the relationship between conflict and migration. One of our key contributions is the use of high-frequency data that varies at the local level, which allows us to more accurately pinpoint the dynamics (magnitude, timing, and persistence) of migration in response to conflict and violence. Prior studies have often relied on cross-country and cross-year variation in conflict intensity (e.g., Davenport, Moore and Poe, 2003; Hatton, 2016; Schmeidl, 1997). Others have used within-country variation in conflict or violence but measured migration annually, potentially missing crucial dynamics surrounding conflict events (Spitzer, 2021; Orozco-Aleman and Gonzalez-Lozano, 2018). Williams et al. (2012) uses monthly data on conflict and migration during the Nepalese Civil War, but only observes temporal conflict variation for one region of Nepal. Our paper differs by having a unique dataset with high-frequency variation across *both* time and a fine level of geography. We further show that no migration dynamics can be precisely identified if one uses data at a lower frequency (semiannually instead of monthly) or at a higher level of aggregation (district instead of municipality). This result underscores the relevance of using high-frequency data to study the impact of conflict on migration.

We also contribute to the understanding of the most important migration flow of the 20th century (Borjas, 2007). The Mexican Revolution is usually considered as a key event that helped to kick start migration to the United States, which may have helped form networks that predicted migration for the

[4]This does not mean the Mexican Revolution did not have a general, macro-level impact on the migrant flow to the United States; rather, local variation in conflict did not cause a permanent change in the geography of migration.

rest of the century (McKenzie and Rapoport, 2010; Woodruff and Zenteno, 2007).[5] We are the first to provide direct, quantitative evidence on the local-level impact of this conflict on the scale and composition of migrant flows. Our findings suggest that although migration was influenced by conflict during the Mexican Revolution, it did not significantly alter the geography of migration to the United States.

2. Historical Background

At the turn of twentieth century, Porfirio Díaz's regime (1876 to 1911) faced a major crisis rooted in high land inequality, lack of democracy, and widespread economic hardship (Colegio de México, 1965; Rosenzweig, 1965; Silva Herzog, 1965). Mexico's agrarian economy was based on large estates (haciendas) owned by a small group of elite landowners since colonial times (Chevalier, 1970; Florescano, 1987; Knight, 2002). Although modern machinery and irrigation systems were used in some haciendas, productivity in the vast majority of them was contingent on the exploitation of labor and the coercive mechanisms of debt peonage that restricted internal migration and social mobility (Moreno-Brid and Ros, 2009; Sellars and Alix-Garcia, 2018; Tannenmbaum, 1935).

Discontent among the lower and middle classes influenced the creation of the Anti-Reelectionist National Party led by Francisco Madero, seeking to oust Díaz in the 1910 elections. However, Madero was jailed before the elections and Díaz claimed to be re-elected for the eighth time (Dell, 2012; Garcíadiego, 2004). As a response, in November 1910, Madero called the population to rebel and fight against the regime. By March 1911, there were numerous organized insurgency movements across the country, primarily fighting for land reform, a democratic electoral system, and better living conditions (Knight, 1986*a*; Tannenbaum, 1933). In May 1911, Díaz was defeated, and Madero briefly became president before being assassinated in a counter-revolutionary coup in 1913, sparking further insurgency until mid-1914. The Revolution then became a multi-sided conflict between different revolutionary factions until late 1915, when the Constitutionalist faction—led by Venustiano Carranza—defeated Pancho Villa's army and controlled most territories occupied by other factions. Carranza's government was recognized by the United States in October 1915, and from 1916 the Revolution was reduced to local guerrilla movements that mainly took place in the south of Mexico and lasted until 1917 (Garcíadiego, 2004; Knight, 1986*b*; Sánchez Lamego, 1983).

[5] Historian Kelly Lytle Hernandez argues, "[the] refugee population that arrived in the United States between 1910 and ... 1920 is the foundation of the growth of the Mexican American population today. So many families across the United States today can trace their origins to the Mexican Revolution," (NPR, 2022). Though, others point to growing labor market opportunities due to labor shortages during World War I as the major driver of migration (Cardoso, 1980; Gamio, 1930; McCaa, 2003).

The Revolution had a profound demographic impact. The total demographic cost is estimated at 1.6-2.1 million people, two-thirds of which correspond to an excess of deaths: war casualties mostly and deaths caused by war-related factors such as famines and diseases (Moreno-Brid and Ros, 2009). Migration to the United States is considered to largely explain the rest of the population loss (Collver, 1965; Gamio, 1930; Greer, 1966; Ordorica and Lezama, 1993), with some arguing that this large displacement shaped the migration patterns that persisted throughout the twentieth century (Cardoso, 1980; Hernández, 2022). Others estimate that refugees may account for less than 10 percent of the total loss, questioning the importance of the Revolution in the Mexico-US migration history (Gratton and Merchant, 2015; Gutmann et al., 2000; McCaa, 2003). The reason for this discrepancy is that previous research did not have access to fine-grained immigration and conflict data, which complicates the identification of conflict-induced migration dynamics, and therefore the evaluation of the Revolution's impact on Mexico-US migration patterns.

3. Data

3.1 Immigration: Border Crossing Records

The registration of Mexican immigrants along the US southern border was fully established by 1907 (US Congress, 1903, 1907). American immigration officials used diverse forms—known as Mexican Border Crossing Records (MBCRs)—to systematically record the flow of immigrants and their characteristics.[6] To study the migration dynamics induced by conflict events during the Mexican Revolution, we compile the universe of MBCRs available on Ancestry.com for 1910 to 1920, which record 280,570 individual border crossings across 23 entry ports.

These data likely provide comprehensive coverage of border crossings during this period. Before the 1915 (the ending year of our analysis), Mexican immigrants faced no legal restrictions when entering the United States (Cardoso, 1980; Henderson, 2011), which reduced the incentives to avoid official entrance ports.[7] Previous literature proposes different estimates on the total out-migration induced by the Revolution, ranging from 135-270 (Collver, 1965; Greer, 1966; Gutmann et al., 2000) to 350-400 thousand (McCaa, 2003; Ordorica and Lezama, 1993). Using these figures as a reference and considering that most Mexicans crossed into the United States via train or on foot (Clark, 1908; Durand, 2016;

[6] These records are analogous to ship manifests employed to register European migration to the United States. See Escamilla-Guerrero (2020) for a review on the MBCRs.

[7] See Figure A.1 and Table A.1 for port locations and crossings by port. Until 1921, Mexicans were exempt from literacy tests, head taxes, and visa fees (Kosack and Ward, 2014).

Woodruff and Zenteno, 2007), our raw data are likely to capture a large share (70-80 percent or more) of the Mexico-to-US migration that took place from 1910 to 1920. The MBCRs also capture well the levels and trends of Mexican immigration observed in aggregate data for the period of analysis (see Figure A.2).

For each individual, we observe information including name, age, birthplace, and crossing date. In 1910, 93 percent of the Mexican population lived in their municipality of birth (Sobrino, 2010); therefore, location of birth is a reasonable proxy for location of last residence in our setting, particularly if internal displacement caused by the Revolution influenced migration to the United States (see Clemens, 2021, pp. 4-5, for a discussion). We classify places of birth into municipalities using the 1910 Census Catalogue of Localities (Mexico Secretary of Finance, 1918) and the Mexican Historical Archive of Localities (AHL), both maintained by Mexico's National Institute of Statistics and Geography (INEGI).[8] We then collapse the individual-level data to calculate monthly migration rates by municipality, the main unit of analysis. We calculate migration rates (per 1,000 inhabitants) as the number of migrants over the municipality's population level according to the 1910 Census. We also calculate age- (1-15, 16-40, over 40) and sex-specific migration rates using the relevant denominator.[9] Finally, we limit the data to the period from January 1910 to December 1915, reflecting the temporal coverage of the conflict data, as discussed next.

3.2 Insurgency Events: Military Reports

Key to our analysis is linking migration to conflict events. To do so, we digitize the universe of military reports of all the armed forces involved in the civil war.[10] The federal army and revolutionary factions systematically recorded combat and surveillance information in reports, which were used as operational intelligence and to monitor the Revolution throughout the country. These reports are kept in the historical archive of Mexico's Secretary of Defense and were compiled by Sánchez-Lamego in eight volumes that constitute the "Military History of the Mexican Revolution" (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983). Due to the detailed information contained in the reports—usually cross-checked with telegrams and letters—Sánchez-Lamego's work is arguably the best available source to identify insurgency events at the local level.

[8]We exclude 7,094 records (2.5 percent) lacking sufficient geographic information for accurate classification, as well as duplicate entries and records of non-Mexicans who migrated to Mexico before entering the United States.

[9]While the individuals' sex was not digitized, we infer it from their first names if clearly reported.

[10]See Figure A.3 for an example.

From these reports, we identify 2,411 unique conflict events spanning from November 1910 to December 1915. For each event, we observe precise location details, allowing us to classify them into municipalities. The reports also systematically record event features, including the length (days), number of military casualties, damages to civil infrastructure (railways, telegraph offices, bridges, and town halls are the most common cases), whether the winner remained in the conflict's location, and the winning faction. Each event is also classified into a military category—shooting, combat, battle, or siege—based on the number of personnel involved, firepower used, and other conflict features. All this information captures variation over time and across space in the kind of conflict experienced by local populations (see Figure A.4 and Figure A.5), enabling us to identify migration responses to the average conflict event rather than to major events or those of public interest.

Table 1 shows that municipalities that experienced conflict were different from unaffected ones in various ways. For instance, they were more populous, closer to the US border, and had more infrastructure. However, controlling for district fixed effects (groups of contiguous municipalities, similar to State Economic Areas in the United States) eliminates many of these differences. We find virtually no differences in sex composition, illiteracy, altitude, distance to the US border (by train), or distance to the nearest train station. This suggests that both groups had similar population compositions and migration costs. However, conflict-affected areas had larger populations and direct access to communication and transportation technology, implying that conflict events were more likely to occur in municipalities with higher economic and strategic value (Blattman and Miguel, 2010; Kalyvas, 2006). We also observe that municipalities affected by conflict were more likely to be migrant sources; therefore, this preliminary evidence suggests that rather than altering the existing migration patterns, the Revolution could have deepened them.

4. Identification Strategy

To identify how conflict affects migration dynamics in the short run, we exploit high-frequency variation in the timing of conflict events. We assume staggered treatment adoption—once a unit is treated, it remains treated—and estimate a flexible event-study design that isolates the causal impact of conflict on migration at a granular level:[11]

$$y_{mdt} = \mu_m + \lambda_t + \gamma_{dt} + \underbrace{\sum_{j=-5}^{-2} \beta_j D_m \cdot \mathbb{1}\{t - T_m^* = j\}}_{leads} + \underbrace{\sum_{j=0}^{10} \beta_j D_m \cdot \mathbb{1}\{t - T_m^* = j\}}_{lags} + \varepsilon_{mdt}. \tag{1}$$

We regress migration rate y_{mdt} from municipality m of district d in month-year t on a binary indicator D_m for municipalities with a conflict event. This variable is interacted with indicators for the five months before and ten months after the first event (T_m^*), with observations beyond this window included in the lead -5 and lag 10. The β_j coefficients capture the difference in migration rate between treated and control groups relative to the month prior to the event (omitted lead -1). We use not-yet- and never-treated units as control group to avoid potential identification issues present in settings where treatment rolls out for the full sample (Callaway and Sant'Anna, 2021; Sun and Abraham, 2021). The estimated effect of the last lag $D_m \cdot \mathbb{1}(t - T_m^* \geq 10)$ provides information about the persistence of the response: whether conflict led to a transitory or "permanent" increase in migration. We include a full set of municipality fixed effects (μ_m) and month-year fixed effects (λ_t). They control for any time-invariant, municipality-specific characteristic that may influence migration (e.g., geographic features) or any time-specific shock affecting migration from all municipalities (e.g., seasonal migration patterns or turning points in the Revolution's direction).

We also include district-month-year fixed effects (γ_{dt}) to control for unobservable local changes at the district level throughout the Revolution. One caveat is that Mexico City, being both a municipality and its own district, is dropped from the estimation due to collinearity between these fixed effects and the leads and lags. We also estimate a more demanding specification that includes interactions between municipality characteristics (shown in Table 1) and month-year dummies. These additional controls capture potential dynamic effects of pre-treatment features that differentiate treated from control municipalities: population size, land ownership, distance to the US border, infrastructure, and migrant networks. However, we do not use this more demanding specification throughout the analysis, as it further requires excluding municipalities with incomplete data. Nonetheless, Appendix F shows that our main results hold under this approach. We cluster standard errors at the treatment level (by municipality) in all models and report 90 percent confidence intervals in all figures (Abadie et al., 2023).

[11] Relaxing this assumption requires information on when treatment turns off, which is not defined in our setting (Roth et al., 2023).

For our empirical strategy to estimate average treatment effects on the treated (ATT), four identifying assumptions must hold: parallel trends in baseline outcomes, no anticipatory behavior prior to treatment, treatment effect homogeneity, and no interference between units in treatment assignment (Rosenbaum, 2007; Sun and Abraham, 2021). We provide evidence supporting these assumptions as we present our results.

5. Results

Figure 1 presents the main result: migration temporarily spiked for a few months after a conflict event and then returned to pre-conflict levels. Panel A shows migration dynamics at the monthly level. Compared to the monthly baseline rate of 0.08 migrants per thousand, migration does not change significantly in the month of the event, but it increases by 60 percent in the first and second months after the event.[12] This finding is consistent with both refugees taking time to weigh the costs and benefits of moving (Engel and Ibáñez, 2007; Ibáñez, 2014)—despite having little time to plan their migration (Becker, 2023)—and the act of migration requiring time. Migration rates then decrease to a 25 percent increase in the third month. After this initial wave, migration increases again but in a smaller proportion (about 40 percent over the baseline) in the following months before returning to pre-treatment levels from the seventh month onward. The p-value of a Wald test for the last post-event coefficients (9 and +10) being equal confirms the transitory effect of conflict on migration. One potential reason we do not identify permanent changes is that most conflict events occurred at different locations (40 percent of treated municipalities experienced conflict once and 20 percent twice),[13] likely hindering the snowball effect documented by Clemens (2021): past refugee migration facilitates future migration for years due to the persistence of conflict and the creation of networks.

Panel A also shows that before the event, there is no statistically different trend in migration rates between treated and untreated municipalities. The p-value of a Wald test for all pre-treatment coefficients being equal to zero further supports the assumption that migration from treated and control municipalities would have followed parallel paths in the absence of conflict. The point estimates on the pre-treatment coefficients and our test on the lack of pre-trends also provide evidence of no anticipatory behavior, implying that conflict events were sudden and unexpected for local residents. The lack of anticipation effects is not surprising considering the fact that fighting in the Revolution was not concentrated in a few

[12] Lacking internal migration data prevents measuring internal displacement, but back-to-the-envelope calculations suggest one person fled to the United States for every four displaced within Mexico (see Appendix H).

[13] This is also true for many recent civil wars (Table A.2).

battleground areas and, instead, consisted of skirmishes popping up between factions across the country (Garcíadiego, 2004; Knight, 1986*a*,*b*; Tannenbaum, 1933). The decentralized nature of the fighting means that it would be difficult to predict whether any area would be the site of conflict in the coming months at any particular point in time.

The findings are robust to various empirical approaches. For instance, Panel A shows that they hold when using a simpler two-way fixed effect specification that includes only municipality and time fixed effects. They also hold when using the more demanding specification that includes pre-treatment controls interacted with month-year dummies. Therefore, our results are unlikely to reflect dynamics caused by local factors whose effect on migration could have varied during the Revolution, such as changes to land ownership or migration costs (traveling times). The coefficients also remain stable across specifications, suggesting that selection bias is unlikely to drive our results.

Recent research shows that in settings with staggered treatment adoption, coefficients on leads and lags can be contaminated by treatment effects in other periods (see Roth et al., 2023, for a review). This bias, known as treatment effect heterogeneity, makes lead coefficients uninformative about pretrends or anticipatory behavior, and lag coefficients unable to capture migration dynamics caused by conflict. To address this, we implement the imputation estimator of Borusyak, Jaravel and Spiess (2024), which yields robust estimates under arbitrary treatment effect heterogeneity. Figure B.1 shows that heterogeneity-robust estimates capture similar migration dynamics. These estimates also hold when using the estimators of Sun and Abraham (2021) and de Chaisemartin and D'Haultfoeuille (2020), which use alternative control groups for identification (see Figure B.2).

We also perform checks to ensure the robustness of our results. One concern is that conflict in one municipality may spur migration in a neighboring one, even if it did not directly experience violence. To assess local spillovers, we assign treatment to all municipalities belonging to the same district based on when the first municipality in the district experienced conflict.[14] Using this higher level of aggregation results in estimates close to zero and not statistically significant, suggesting spillovers were non-significant (see Figure B.3). Further checks in Appendix C show that binning multiple time periods in the -5+ lead and 10+ lag does not drive the results (Baker, Larcker and Wang, 2022), nor do outlier regions or the level at which we cluster standard errors.

[14]We assume spillovers were within districts only. Since treatment is assigned at the district level, it is not possible to include district-by-time fixed effects in this specification.

A key advantage of our data compared to previous literature is its high-frequency (monthly) and geographic granularity (municipality level). This detail allows us to examine how lower-frequency data impacts our ability to detect conflict-induced migration. To illustrate this point, Panels B and C of Figure 1 present migration dynamics at quarterly and semiannual frequencies for a time window approximately equivalent to that in Panel A. Quarterly data captures some migration but misses the precise timing of waves, while semiannual data reveals no dynamics, with larger standard errors. The standard errors around these estimates increase with aggregation as the short-run changes become more imprecisely measured (i.e., a form of measurement error). These findings highlight the importance of using high-frequency data to more precisely identify migration responses. Recall that nearly all previous studies in this literature rely on even coarser, annual-level data, potentially missing important short-run dynamics.

5.1 Heterogeneity by Population Group

Our finding of a large transitory increase in migration may mask heterogeneous responses to conflict, as individuals' ability to cope with conflict varies across demographic groups (Ibáñez, 2014; Morrison and May, 1994).[15] Figure 2 presents estimates of our preferred specification for three population subgroups. Panel A shows that conflict does not impact the migration of adult men aged 16-40. This may be due to increased enrollment into the federal army and revolutionary factions and consequently higher mortality among men (Knight, 1986*a*,*b*).[16] In contrast, women exhibit an increase in migration (up to 70% over the baseline) that dissipates after the seventh month. The migration of children aged 1-15 also increases but follows slightly different dynamics. It increases significantly in the first month after the event occurs and persists at levels of 75-100% over the baseline until the sixth month, after which migration returns to pre-treatment levels.

Our results suggest that conflict altered the sex composition of migration. Panel B confirms that the sex ratio shifted toward females between 1910-1915, but reverted back to pre-Revolution levels in 1917, when the First Bracero program was implemented.[17] This aligns with prior research documenting increased family migration during the Revolution (Durand, 2016).

[15] See Appendices J and K for heterogeneity by other dimensions.

[16] Land restitutions during the Revolution could have also affected migration among men, who typically held land ownership rights (Baitenmann, 2011).

[17] We also find evidence that conflict changed the skill composition of migration (see Appendix K).

6. Treatment Channel and Moderating Factors

Episodes of conflict may not necessarily induce migration due to (in)voluntary immobility—about 19 percent of the countries that experienced conflict events from 1990 to 2007 did not report forced displacement (Ibáñez, 2014). While previous literature tends to agree that violence is the main channel through which conflict induces migration (see, for example, Apodaca, 1998; Balcells and Steele, 2016; Davenport, Moore and Poe, 2003; Moore and Shellman, 2004; Schmeidl, 1997; Schultz, 1971), it does not provide causal evidence about this relationship. Furthermore, factors such as local economic conditions, immigration restrictions, and social networks can moderate the migration response to conflict and violence (Becker and Ferrara, 2019; Boustan, 2007; Hatton, 2016; Ibáñez, 2014; Zolberg, Suhrke and Aguayo, 1989).

Violence

To identify the importance of violence on migration, we leverage variation in the intensity violence across conflict events (see Table A.3). We use war casualties to proxy for violence intensity and restrict the analysis to municipalities that were first treated with a combat, which represent 83% of all treated units. Crucially, 40% of combats did not cause civil or military casualties, allowing us to compare migration responses between municipalities experiencing the same type of event but with contrasting degrees of violence.[18]

Panel A of Figure 3 shows that in municipalities where combats caused casualties, migration increases by 80-130% over the baseline in the six months after the event but returns to pre-treatment levels afterward. In contrast, the leads and lags for units where combats did not cause casualties are close to zero, providing causal evidence that conflicts with low levels of violence are unlikely to induce migration (Morrison and May, 1994; Bohra-Mishra and Massey, 2011). Appendix D presents results using conflict length as an alternative proxy for violence. We find that in municipalities affected by short-lived conflicts (up to one day), migration increases by 30-40% over the baseline for two months only. In contrast, in municipalities experiencing long-lasting events, migration increases by more than 60% in the first month after the event and grows over the next four months to a level representing a 125% increase over the baseline. Afterward, migration rates revert back to pre-conflict levels.[19]

[18] See Appendix I for details.

[19] Appendix D shows results for other violence proxies (military occupation and infrastructure destruction).

Both exercises show that migration responses to more violent conflicts are likely to be larger and more persistent but not necessarily permanent, so that migration patterns would remain unchanged. They are also in line with empirical evidence in Clemens (2021) showing that the relationship between refugee migration and violence is non-linear.

Migrant Networks

Migrant networks are known to reduce migration costs (McKenzie and Rapoport, 2007; Munshi, 2003; Wegge, 1998) and provide assistance for escaping conflict. One possibility is that conflict may only induce migration where the population has connections in the United States (Spitzer, 2021). To test this, we identify municipalities with pre-existing networks as those with either historical migration—observed in 1906 - 1908—or recent migration—observed just before the Revolution (Jan 1910 - Oct 1910).[20]

Panel B of Figure 3 shows the effect of conflict events on migration rates for networked and non-networked municipalities, holding the level of violence fixed.[21] We find that monthly migration rates increase by 0.10-0.20 per thousand inhabitants in the first and second months after the event in municipalities with networks–an effect more than two times greater than our baseline result (0.05). Migration rates then fall in the third month (0.13 per thousand) and effectively return back to pretreatment levels after seven months. Notably, we find zero migration response in non-networked municipalities.

In general, our findings align with prior studies demonstrating that migrant networks facilitate out-migration from conflict zones (see, for example, Becker et al., 2024; Buggle et al., 2023; Davenport, Moore and Poe, 2003; Schmeidl, 1997; Spitzer, 2021). The null effect for non-networked locations supports the hypothesis that networks are *necessary* to migrate (Spitzer, 2021). This hypothesis states that regardless of the strength of the incentive to migrate, individuals generally will not do so unless one of their close contacts has already migrated (Spitzer and Zimran, 2023, p. 1). Our analysis of high-frequency data further shows that the presence of networks did not affect the timing or persistence of migration but only its magnitude.

The mechanism for why networks condition the migration response is unclear. They may simply transmit information about conditions abroad, but such information can also be acquired in other ways, such as telegraphs or people traveling on the railroad. To study the relationship between networks and information, we collect data on the telegraph (Mendoza Vargas, 2014) and railway network (Woodruff and

[20] Immigration data for 1906-1908 come from Escamilla-Guerrero (2020).
[21] Appendix E presents results without conditioning on violence.

Zenteno, 2007) by the eve of the Mexican Revolution. This allows us to control for information access effects from telegraphs or railways, which we allow to vary flexibly over time.[22] Panel C of Figure 3 shows that migration dynamics remain similar, implying that information access was not determinant for individuals to flee northward. Moreover, we do not detect any pretrends in migration, suggesting that information access did not induce anticipatory responses. These findings suggest that the importance of networks may lie in knowing someone abroad to join, perhaps particularly for women and children.[23]

7. Did the Revolution change migration patterns?

Our finding that insurgency events only caused a transitory increase in migration is surprising, given that the thousands who left Mexico could have formed their own networks and encouraged migration decades later (Woodruff and Zenteno, 2007; McKenzie and Rapoport, 2010). It is possible that our approach misses longer-run effects. To test whether violence altered migration to the United States in the long run, we compare pre- and post-revolution migration rates. If violence changed the geography of migrant sources, there should be a low correlation in migration rates over time. To measure this correlation, we calculate migration rates by municipality between January and October 1910, before the Revolution started, and compare them to migration rates a decade later, between January and October 1920, years after the insurgency ceased. To keep outcomes consistent over time, we percentile rank the migration rate in each decade, considering only municipalities with non-zero migration.

Figure 4 shows a strong persistence of migration between 1910 and 1920. The high correlation between 1910 and 1920 percentile ranks implies that high-sending municipalities before the Mexican Revolution remained high-sending municipalities for years after the conflict ended. This holds true for all municipalities regardless of whether they experience conflict or not; further, we do not find a positive association between conflict and 1920 migration rate after controlling for baseline observables.[24] This supports the result from our event-study specification: conflict during the Revolution did not appear to alter migration rates in the long run.[25] In sum, despite the short-term exodus out of the country caused by the Revolution, our analysis suggests that the geography of migration did not substantially change (see Figure A.6).

[22] Despite widespread telegraph and railway networks, many municipalities lacked direct access to communication or transportation infrastructure (Figure G.2).
[23] All aforementioned results are robust to controlling for dynamic effects of municipality characteristics (Appendix F).
[24] See Table A.4.
[25] Similar results emerge when using 1910 and 1917 percentile ranks, thus avoiding potential effects from the First Bracero Program (Figure C.4).

8. Conclusion

The Mexican Revolution provides a unique opportunity to study the impact of conflict on migration. Using newly digitized, high-frequency data at the municipality level, this paper finds that conflict has a large but transitory impact on migration to the United States. Monthly migration rates increased by 60 percent in the first few months after a conflict but reverted back to pre-conflict levels after seven months. Despite inducing a large exodus of refugees, the Revolution did not substantially change the geography of migration in the long run. The results suggest that, even in the absence of significant migration restrictions, violent events may not produce significant chain migration after violence ends. This is perhaps because migration mostly occurs in areas with pre-existing networks, which are already encouraging migration abroad.

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Tables and Figures

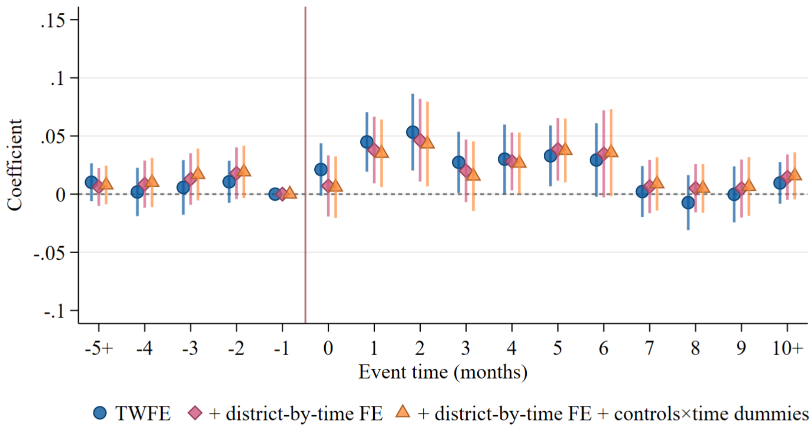
Table 1: Municipality Characteristics by Treatment Status

	1	2	3	4	5
	All units	Ever with Conflict	Never with Conflict	Difference	Conditional Difference
Population					
Population (thousands)	5.47	13.50	3.08	10.42***	6.70***
Sex ratio	1.01	1.00	1.02	−0.02***	−0.00
Population share of illiterate	0.56	0.51	0.57	−0.06***	−0.01*
Land ownership					
Large estates per thousand inhabitants	1.87	2.82	1.59	1.23***	−0.51***
Population share in large estates	0.20	0.30	0.17	0.13***	−0.00
Population share of agricultural peons	0.17	0.20	0.16	0.04***	−0.01*
Geography					
Altitude (m)	1,327.75	1,328.15	1,327.63	0.52	−17.76
Distance to the US border (km)	796.99	606.99	853.40	−246.41***	−2.71
Distance to nearest train station (km)	150.44	84.95	169.89	−84.93***	−1.39
Distance to the US border by train (km)	892.07	684.48	953.70	−269.22***	−1.52
Infrastructure					
Share with train station	0.23	0.43	0.17	0.26***	0.19***
Share with telegraph office	0.15	0.27	0.11	0.16***	0.17***
Pre-Revolution Migration to the US					
Share with recent migration	0.16	0.40	0.08	0.31***	0.13***
Share with historical migration	0.08	0.23	0.03	0.20***	0.12***
Annual migration rate (per thousand)	0.09	0.28	0.04	0.24***	0.18***
Observations	2,787	638	2,149	2,787	2,786

Source: Conflict data are from the Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983). Population and land ownership data are for 1910, except for the share of illiterate and agricultural peons that are for 1900 (Sellars and Alix-Garcia, 2018; Mexico Secretary of Finance, 1918). Distance by train and railways data are for the early 1900s (Woodruff and Zenteno, 2007). Telegraphs data are for ca. 1895 (Mendoza Vargas, 2014). Recent migration refers to the period from January 1910 to June 1910. Historical migration refers to 1908. Migration rates are for 1908 (Escamilla-Guerrero, 2020).
Note: The table presents means of municipality characteristics. We estimate differences (column 4) and differences conditional on district fixed effects (column 5) between ever with conflict and never with conflict municipalities. Mexico City does not belong to any district and therefore is excluded from specifications that include district fixed effects. * = Significant at 10% level; ** = Significant at 5% level; *** = Significant at 1% level.

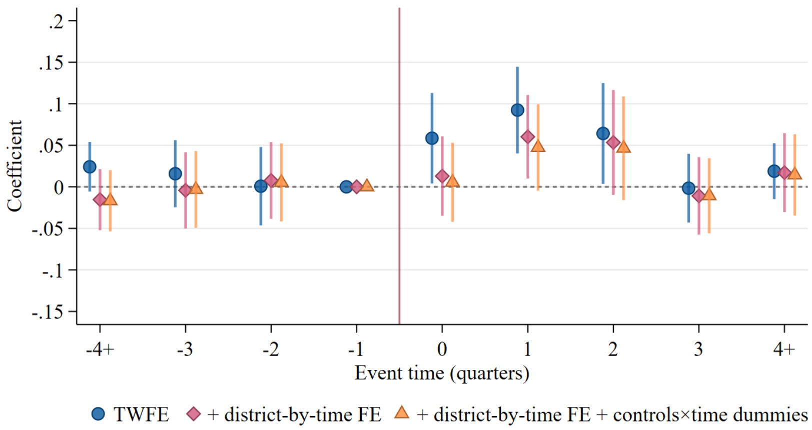
Figure 1: The Effect of Conflict on Migration

Panel A. Monthly frequency



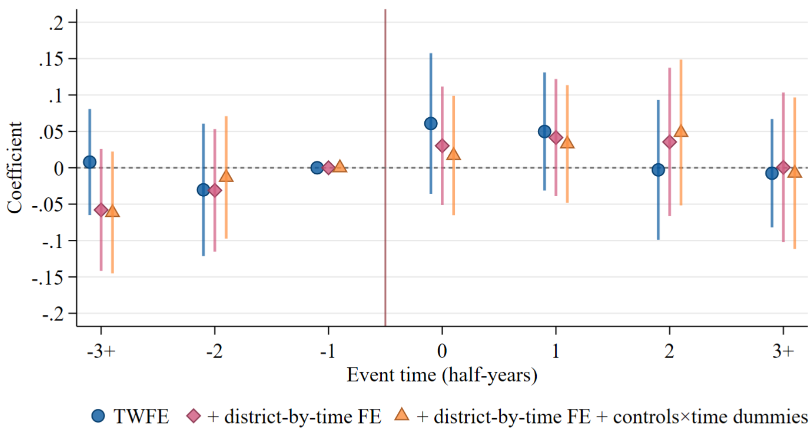
Baseline = 0.08 | Pretrends p-values = 0.62, 0.69, 0.61 | Leveling off p-values = 0.32, 0.41, 0.46

Panel B. Quarterly frequency



Baseline = 0.25 | Pretrends p-values = 0.56, 0.88, 0.87 | Leveling off p-values = 0.31, 0.24, 0.30

Panel C. Semiannual frequency

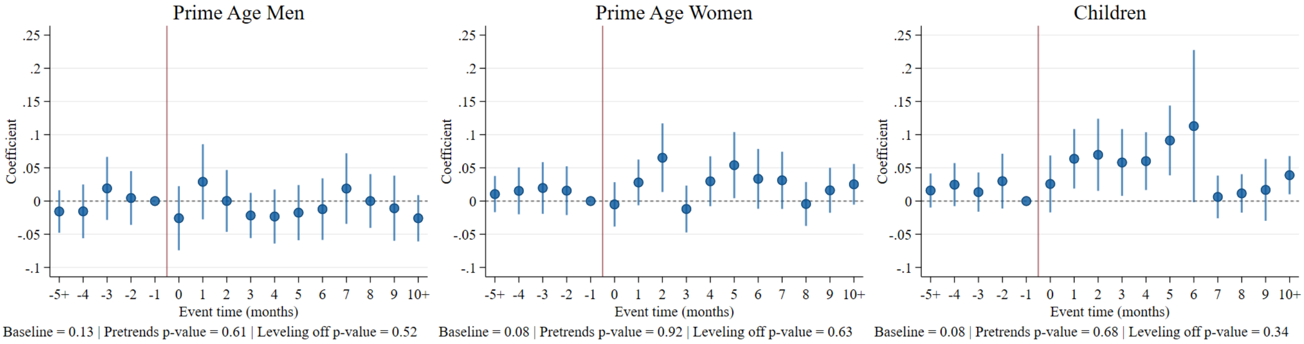


Baseline = 0.54 | Pretrends p-values = 0.58, 0.51, 0.34 | Leveling off p-values = 0.92, 0.47, 0.25

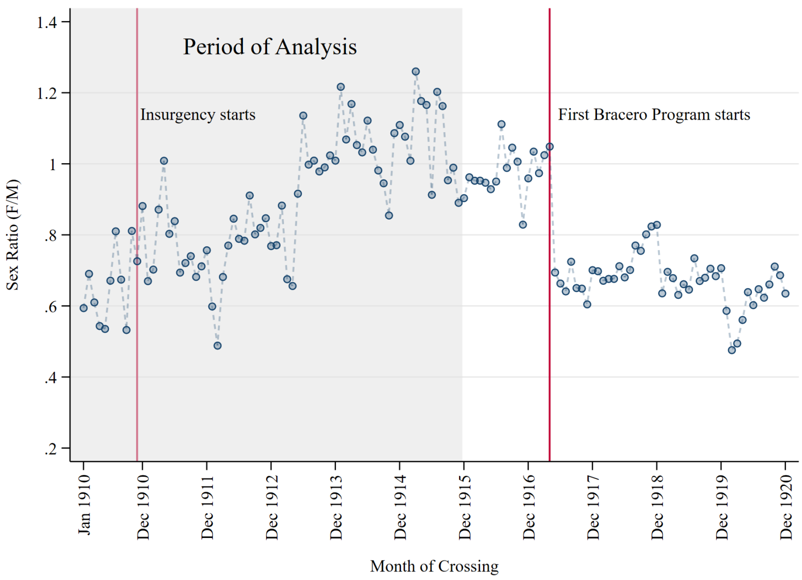
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: We present conflict-induced migration dynamics using data varying at different frequencies. Baseline is the difference in migration rates between treated and control units in t-1. For each model, we test for pretrends and permanent effects. Pretrends: Wald test for all the pre-event coefficients being equal to 0. Leveling off: Wald test for the last two post-event coefficients being equal. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure 2: Heterogeneity in the Migration Response to Conflict

Panel A. Population groups



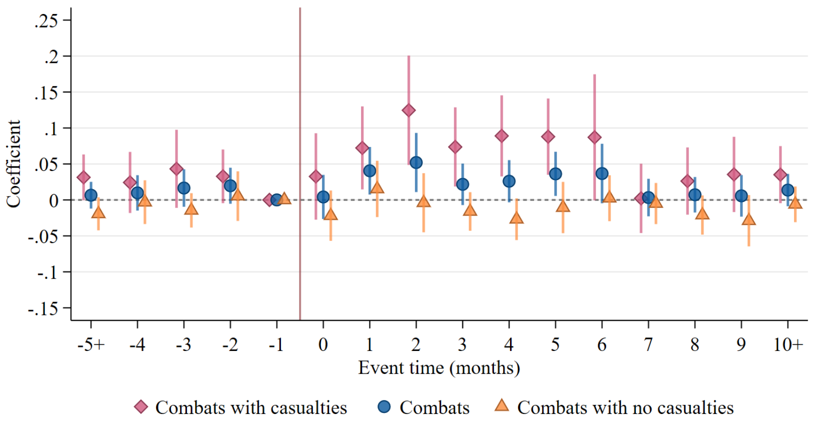
Panel B. Sex composition of the migration flow



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Panel A presents conflict-induced migration dynamics for prime age men (16-40 years old), prime age women (16-40 years old), and children (1-15 years old). For each model, we test for pretrends and permanent effects. Pretrends: Wald test for all the pre-event coefficients being equal to 0. Leveling off: Wald test for the last two post-event coefficients being equal. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals. Panel B shows that heterogeneous migration dynamics significantly changed the sex composition of the migration flow during the period of generalized insurgency.

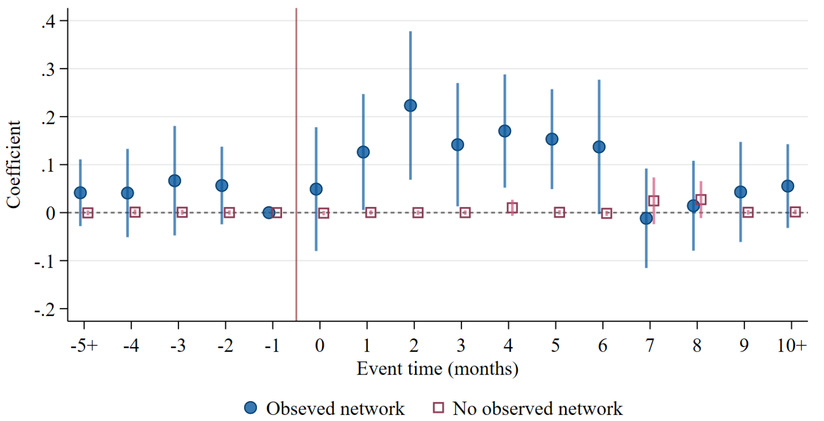
Figure 3: Treatment Channel and Moderating Factors

Panel A. Violence



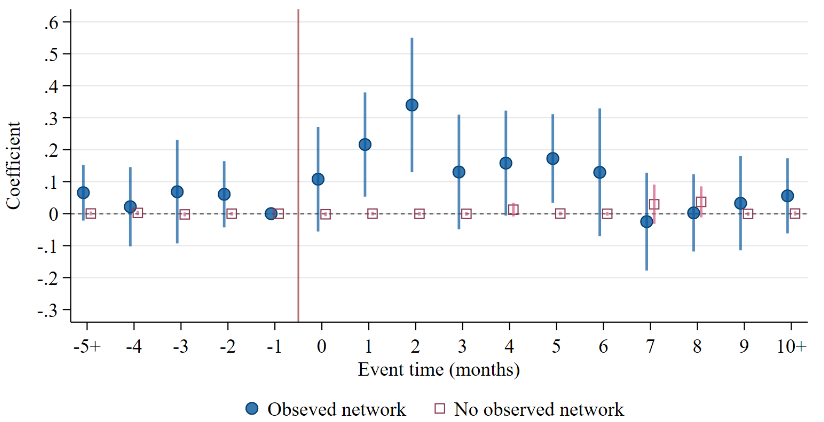
Baselines=0.10, 0.08, 0.07 | Pretrends p-values=0.52, 0.67, 0.38 | Leveling off p-values=0.99, 0.55, 0.19

Panel B. Migrant networks



Baselines = 0.20, 0.002 | Pretrends p-values = 0.76, 0.98 | Leveling off p-values = 0.82, 0.50

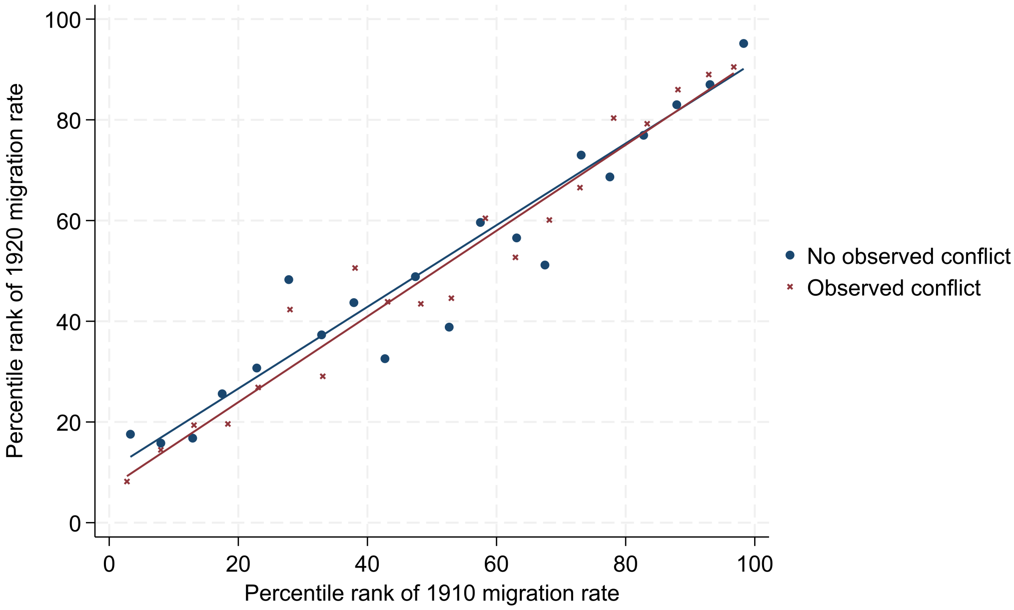
Panel C. Migrant networks and information access



Baselines = 0.21, 0.003 | Pretrends p-values = 0.63, 0.45 | Leveling off p-values = 0.68, 0.46

Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Panel A compares migration dynamics induced by violent v. non-violent events. We use military casualties as a proxy for violence. Panel B and Panel C compare dynamics (conditional on violence) from locations with v. without access to (recent or historical) migrant networks. Panel C controls for information access by including a full set of interaction terms between infrastructure (telegraph offices or train stations) indicators and time dummies. For each model, we test for pretrends and permanent effects. Pretrends: Wald test for all the pre-event coefficients being equal to 0. Leveling off: Wald test for the last two post-event coefficients being equal. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure 4: The Stability of Migration Patterns



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: This binscatter plot shows the correlation between municipality migration rates before and after the Revolution by treatment status–whether there is an observed conflict within the municipality or not. Migration rates are calculated by municipality in 1910 (January-October) and 1920 (January-October), and then percentile ranked within their respective year. The slope reflects the correlation (0.83).

Appendix for

The Impact of Violence on the Dynamics of Migration: Evidence from the Mexican Revolution

April 8, 2025

A. Additional tables and figures

Table A.1: Border Crossings by Port of Arrival

Port	1910	1911	1912	1913	1914	1915	1910-1915
Panel A: California							
Andrade	0	10	14	9	60	38	131
	(0.00)	(0.09)	(0.14)	(0.10)	(0.69)	(0.34)	(0.21)
Calexico	48	148	64	51	42	91	444
	(0.44)	(1.28)	(0.65)	(0.56)	(0.48)	(0.82)	(0.72)
Campo	0	0	6	21	25	65	117
	(0.00)	(0.00)	(0.06)	(0.23)	(0.29)	(0.59)	(0.19)
Tecate	0	0	0	1	1	0	2
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
San Diego	0	2	0	0	0	0	2
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
San Ysidro	49	9	137	47	33	2	277
	(0.45)	(0.08)	(1.39)	(0.51)	(0.38)	(0.02)	(0.45)
Panel B: Arizona							
Ajo	0	0	2	0	0	1	3
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.01)	(0.00)
Douglas	247	392	491	764	444	643	2,981
	(2.27)	(3.38)	(4.97)	(8.34)	(5.11)	(5.80)	(4.87)
Lukeville	0	0	1	0	1	3	5
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.03)	(0.01)
Naco	977	1,004	1,204	1,309	677	821	5,992
	(9.00)	(8.67)	(12.19)	(14.30)	(7.80)	(7.40)	(9.78)
Nogales	2,320	3,299	3,103	1,120	1,652	2,044	13,538
	(21.37)	(28.48)	(31.42)	(12.23)	(19.03)	(18.43)	(22.10)
Sasabe	1	0	2	0	0	0	3
	(0.01)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
Panel C: Texas							
Brownsville	845	1,800	1,404	1,195	727	1,439	7,410
	(7.78)	(15.54)	(14.22)	(13.05)	(8.37)	(12.98)	(12.10)
Del Rio	392	439	422	1,784	786	1,026	4,849
	(3.61)	(3.79)	(4.27)	(19.48)	(9.05)	(9.25)	(7.92)
Eagle Pass	3,068	2,672	2,194	1,829	1,433	1,109	12,305
	(28.26)	(23.07)	(22.22)	(19.98)	(16.50)	(10.00)	(20.09)
El Paso	2,635	1,037	771	960	2,436	3,803	11,642
	(24.27)	(8.95)	(7.81)	(10.48)	(28.05)	(34.29)	(19.01)
Hidalgo	1	4	3	3	5	3	19
	(0.01)	(0.03)	(0.03)	(0.03)	(0.06)	(0.03)	(0.03)
Laredo	259	760	50	0	0	0	1,069
	(2.39)	(6.56)	(0.51)	(0.00)	(0.00)	(0.00)	(1.75)
Presidio	0	0	0	0	359	0	359
	(0.00)	(0.00)	(0.00)	(0.00)	(4.13)	(0.00)	(0.59)
Rio Grande City	5	0	0	0	0	0	5
	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Roma	11	6	8	63	2	2	92
	(0.10)	(0.05)	(0.08)	(0.69)	(0.02)	(0.02)	(0.15)
Total	10,858	11,582	9,876	9,156	8,683	11,090	61,245
	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Source: Mexican Border Crossing Records.
Note: Border crossings classified by sex observed from January 1910 to December 1915 across 21 entrance ports. Border crossings registered at Columbus and Tucson are beyond the period of analysis. Column percentages in parentheses.

Table A.2: Conflict Occurrence in Civil Wars

Country	Period	Data available	Number of sub-national units (districts/counties) No events	1-2 events	3-4 events	5+ events	Total
Afghanistan	1992-1996	1992-1996	287	22	8	11	328
Algeria	1993-2002	1993-2002	1,286	145	25	48	1,504
Angola	1975-2002	1989-2002	59	32	10	62	163
El Salvador	1979-1992	1989-1992	252	11	1	2	266
Guatemala	1962-1996	1989-1996	326	21	4	3	354
Liberia	1989-1997	1989-1997	45	3	1	17	66
Mozambique	1977-1992	1989-1992	96	13	4	17	130
Peru	1980-2000	1989-2000	124	42	10	19	195
Sudan	1983-2005	1989-2005	53	8	1	18	80
Syria	2011-2021	2011-2014	42	7	3	8	60

Source: Authors' calculations based on data retrieved from xSub (Zhukov, Davenport and Kostyuk, 2019) and the Uppsala Conflict Data Program (UCDP).
Note: The table displays the occurrence of conflict events across sub-national units in modern-day civil wars for which complete or partial data are available. Most districts/counties never experience conflict or experience conflict once or twice. As in the Mexican Revolution, this is due to shifting fronts and various factions fighting for territorial control.

Table A.3: Violence Metrics by Military Categories

	Full Sample	Shooting	Combat	Siege	Battle
Length (days)	1.61	1.08	1.30	16.58	19.88
Average military casualties	61.79	8.64	42.77	81.21	2,585.27
Damage to infrastructure (share)	0.09	0.05	0.09	0.21	0.52
Occupation of territory (share)	0.14	0.04	0.15	0.29	0.24
Observations	2,411	361	2,001	24	25
Sample share	100	14.97	82.99	1.00	1.04

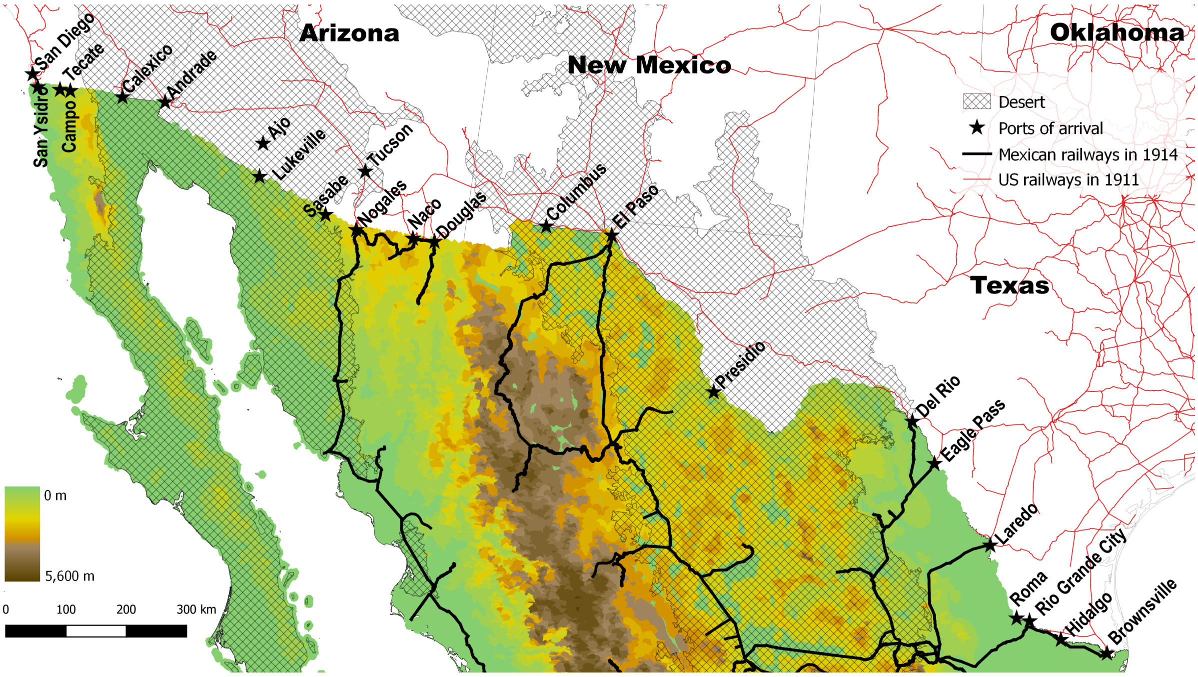
Source: Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).
Note: The table presents violence metrics for conflict events during the Mexican Revolution by military category. The average event lasted 1.6 days and caused 62 military casualties. Three percent of the events (71) reported "uncountable casualties." We assign missing values to these cases.

Table A.4: Lack of Association Between Violent Conflict and 1920 Migration Rates Rank

	1	2	3
1910 Migration Rank	0.833***	0.831***	0.817***
	(0.0206)	(0.0207)	(0.0268)
Conflict		−1.472	−0.675
		(1.514)	(1.624)
Sex Ratio 1900			−0.997
			(8.733)
Share Illiterate 1900			8.090
			(9.277)
Number of estates 1900			0.0375**
			(0.0166)
Share of pop in estates 1900			−5.549
			(3.970)
Share peon 1900			−34.77***
			(11.51)
Altitude			0.00230*
			(0.00122)
Distance from Border			0.00261
			(0.0113)
Distance to nearest train station			0.00953
			(0.0131)
Distance from Border by train			−0.00376
			(0.0118)
Train Station			−0.860
			(1.715)
Telegraph Office			−5.315***
			(1.937)
Constant	8.397***	9.363***	12.94
	(1.352)	(1.645)	(9.575)
Observations	452	452	450
R-squared	0.694	0.695	0.711

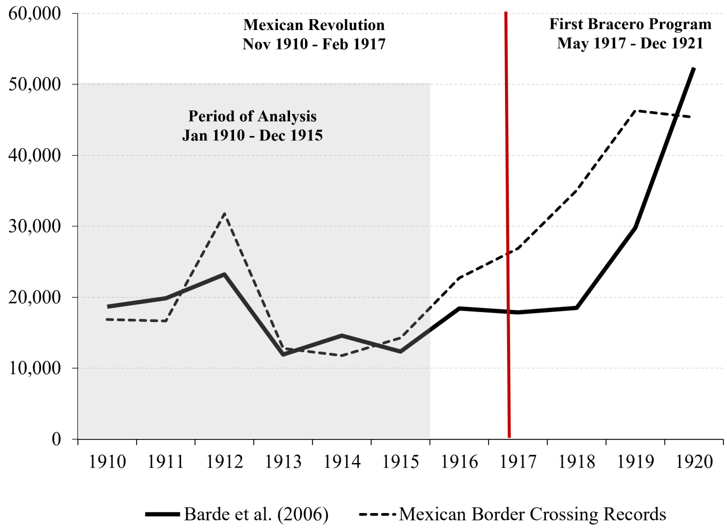
Note: The table presents results from a regression of the 1920 rank of migration rate on the 1910 rank of migration rate. The plot of the first column is shown in Figure 4. The controls are shown in Table 1.

Figure A.1: Border Region



Source: Entrance ports (Mexican Border Crossing Records), Mexican railways (Ferrocarriles Nacionales de México, 1914), US railways (Atack, 2016), deserts (United States Environmental Protection Agency). We use data from National Archives and Records Administration publication A3365 (Brownsville and Others, Texas), A3370 (Columbus, New Mexico), A3372 (Naco, Arizona), A3377 (Ajo and Others, Arizona), A3379 (Laredo, Texas), A3395 (Del Rio, Texas), A3406 (El Paso, Texas), A3412 (El Paso, Texas), A3423 (Brownsville, Texas), A3431 (Laredo, Texas), A3437 (Laredo, Texas), A3466 (Presidio, Texas), A3467 (Calexico, CA), A3492 (Hidalgo, TX), M1502 (Brownsville, TX), M1754 (El Paso, TX), M1755 (El Paso, TX), M1759 (Douglas, AZ), M1760 (Douglas, AZ), M1767 (San Ysidro, CA), M1769 (Nogales, CA), M1770 (Rio Grande City, TX), M1850 (Sasabe, AZ), M2030 (Campo, CA).
Notes: The figure shows the location of the 23 entrance ports observed in our data. Some entrance ports were also located in desert areas, which allows us to observe migration flows along the entire border. While some under-enumeration or undocumented crossings may have occurred, authorized entry points represented the most economical option for Mexican migrants during our period of study (1910-1915). These official crossing points, which typically served as railway terminals, offered a less costly and more practical route compared to dangerous desert crossings. Moreover, Mexicans faced an open-door policy in the United States. Mexicans were not considered immigrants who sought to settle permanently, but temporary aliens that moved back and forth supplying labor without immigration restrictions (Cardoso, 1980). The Immigration Act of 1917, which mandated literacy tests and an eight-dollar head tax, marked the first restriction on Mexican immigration (Kosack and Ward, 2014). However, these requirements were waved during war time and until 1921, when the US Secretary of Labor ended the waivers. The following year, a ten-dollar visa fee was added to the existing head tax, making legal entry prohibitively expensive for most Mexican workers (Abramitzky et al., 2023). These immigration restrictions created—for the first time—incentives for unauthorized border crossings. Unauthorized entry was criminalized shortly after, and the Border Patrol was established to control areas between entry stations (Escamilla-Guerrero, Kosack and Ward, 2021).

Figure A.2: Mexico-US Immigration Flow



Source: Barde, Carter and Sutch (2006) and Mexican Border Crossing Records.
Notes: The figure shows that the MBCRs capture well the levels and trends of Mexican immigration observed in aggregate data for the period of analysis. Estimates from Barde, Carter and Sutch (2006) are based on census data and reports from the US Bureau of Immigration and Naturalization. The divergence observed from 1917 may be explained by the First Bracero Program, under which over 80,000 temporary laborers arrived in the United States (Escamilla-Guerrero, Kosack and Ward, 2021).

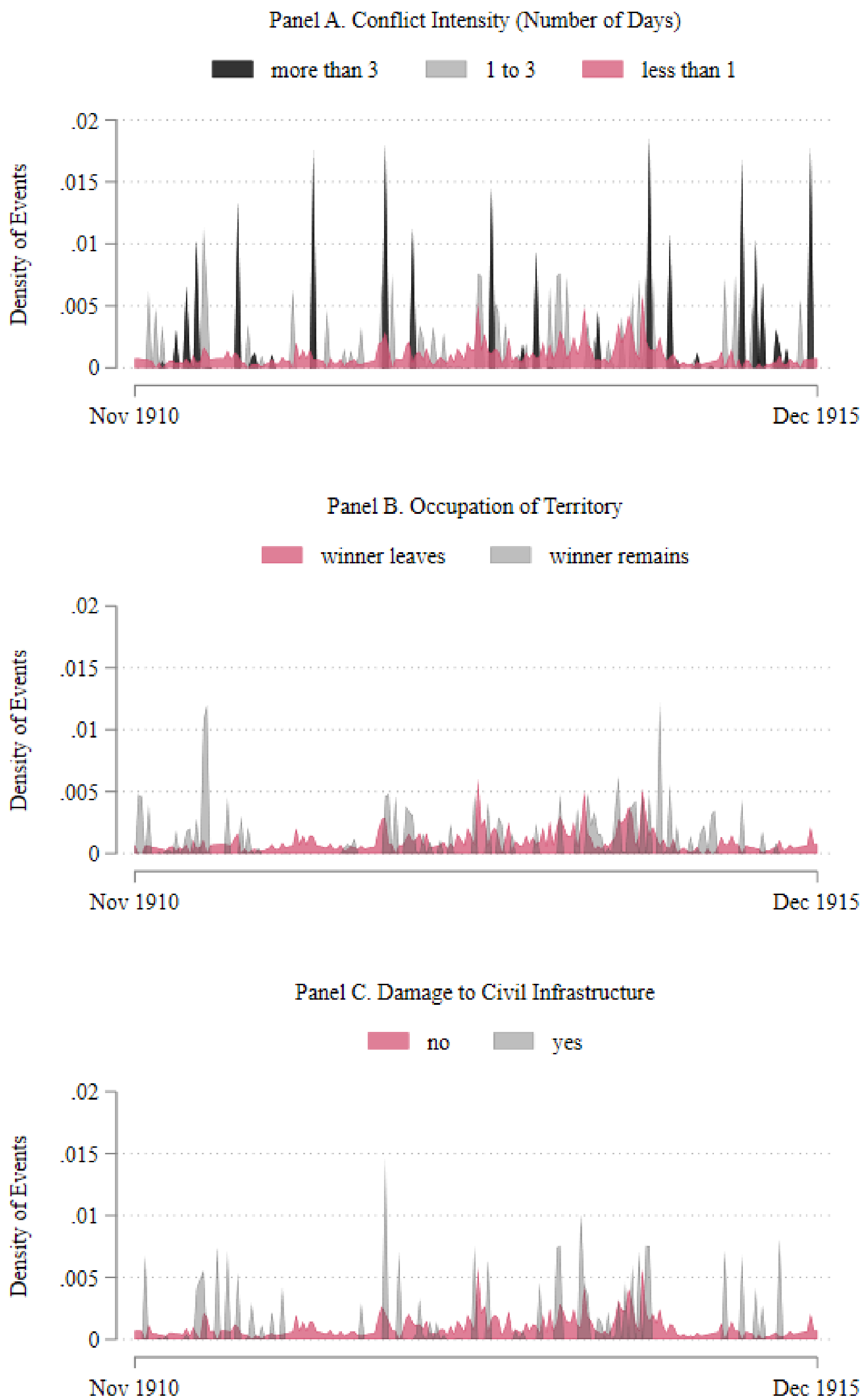
Figure A.3: Abstract of Military Report

Combat in Santa Barbara (29-30 March 1911)

Knowing that the revolutionaries had occupied Santa Barbara (27 km southwest of Parral, Chihuahua), the Lieutenant Colonel Arizmendi sent 5 officers and 65 soldiers of the 7th Regiment and 18 members of the Rural Army to this place on March 29. Upon its arrival, this force fought against the revolutionaries who were in the mountains that surrounded the town. After fighting all day, the revolutionaries moved into the town. The fighting continued on March 30, when the revolutionaries were defeated and ran away, leaving in the field 7 dead and 27 horses. The federal army had 4 death and 8 wounded (F. 1146, Exp. 62, AHSDN).

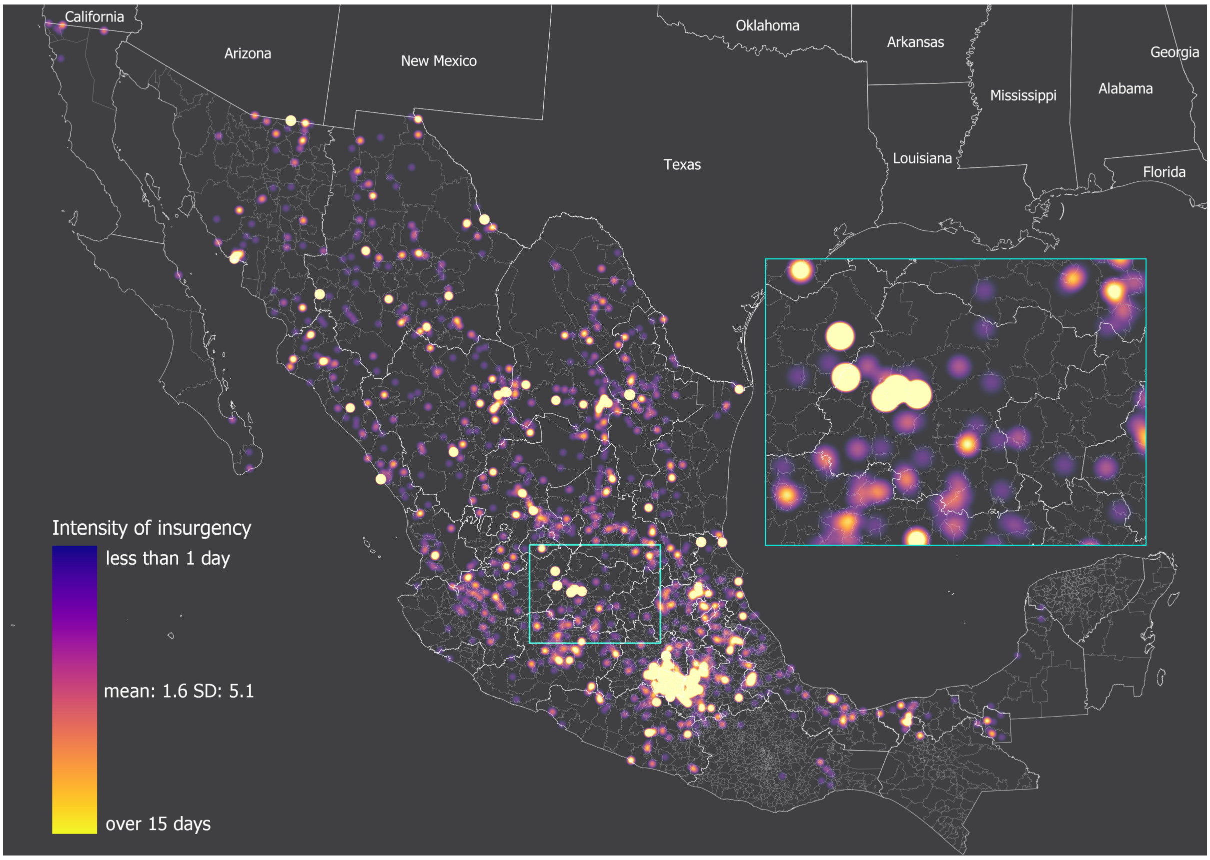
Source: Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure shows an example of the digitized military reports. Each report contains precise information on the place where the event occurred, which allows us to assign latitude and longitude coordinates to each location and classify them into municipalities. Diverse features of the event are also systematically reported, including the length of the conflict (days or hours), the number of military casualties, whether civil infrastructure was damaged during the event (railways, telegraph offices, bridges, and town halls are the most common cases), whether the winner remained in the conflict's location, and the winning faction.

Figure A.4: Distribution of Insurgency Events Over Time



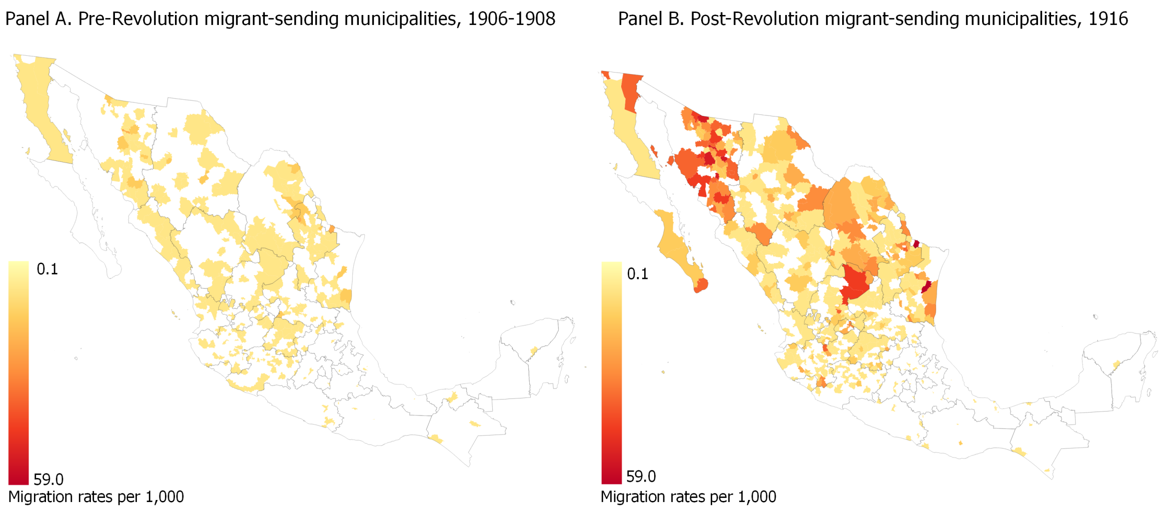
Source: Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure shows the density distribution of insurgency events (daily frequency) during the period of analysis. Although the bulk of the events occurred during the second and third year of the Revolution, their characteristics varied significantly in terms of duration (number of days), territorial control (whether the victors leaved or remained in the conflict's location), and damage to civil infrastructure (whether infrastructure such as bridges, telegraph offices, town halls, or train stations were damaged or destroyed during the event).

Figure A.5: Spatial Distribution of Insurgency Events



Source: Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).
Notes: The map shows the spatial distribution and intensity (days of conflict) of 2,411 insurgency events that occurred from November 1910 to December 1915. We assign latitude and longitude coordinates to each event and use a 15 km radius buffer. Bright colors denote longer events. Armed conflicts occurred across the country with the exception of the Yucatan Peninsula and some states in Southern Mexico. Although intense conflicts occurred in all regions, events lasting more than 15 days concentrated in Mexico City—the seat of the federal government—and nearby states.

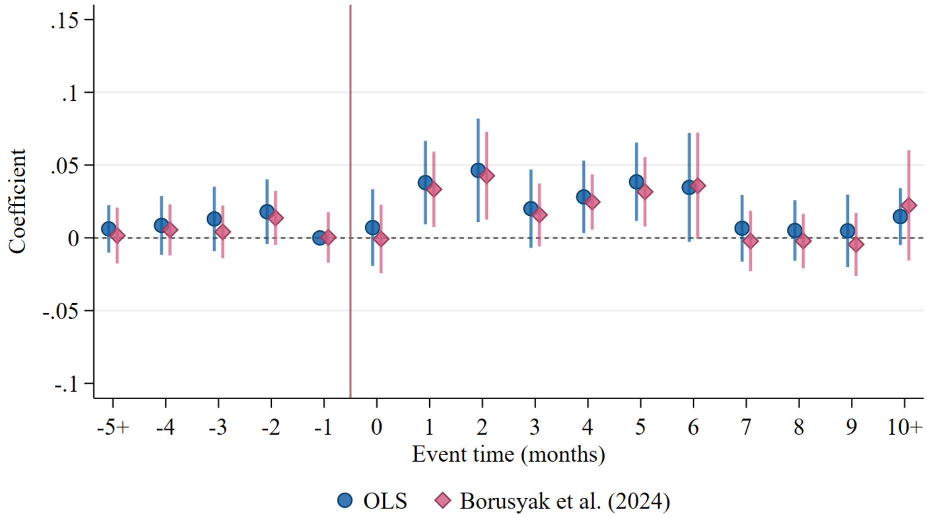
Figure A.6: Migrant Networks in Mexico



Source: Mexican Border Crossing Records and (Escamilla-Guerrero, 2020).
Notes: The maps show (average) annual migration rates per 1,000 inhabitants by municipality.

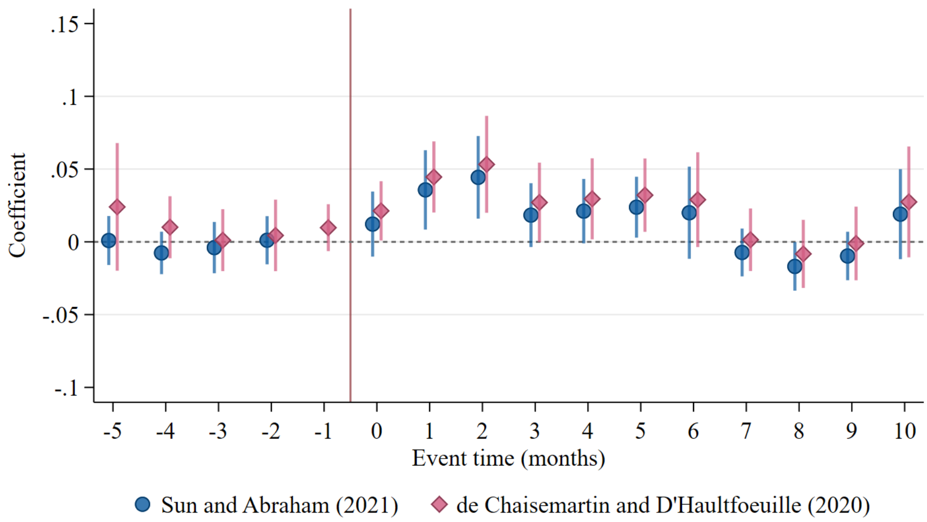
B. Identifying assumptions

Figure B.1: Estimates Robust to Treatment Effects Heterogeneity



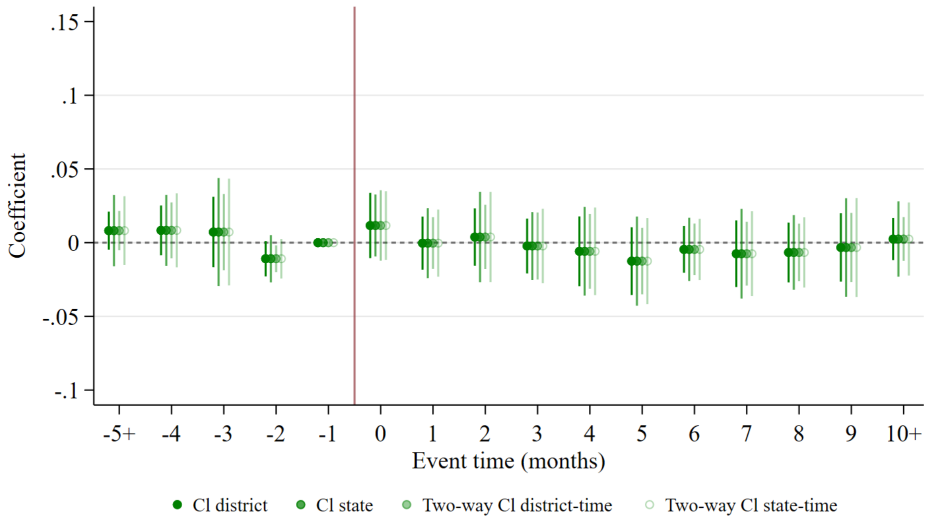
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Estimates are for our preferred specification (TWFE + district-by-time FE). The figure shows that our main results (OLS) hold after correcting for treatment effect heterogeneity using the imputation estimator of Borusyak, Jaravel and Spiess (2024). This approach estimates the effects of a binary treatment with staggered rollout allowing for arbitrary heterogeneity and dynamics of causal effects. Observations for which FE cannot be imputed are dropped from the sample. The control group consists of not-yet and never-treated (untreated) observations. Standard errors are clustered at the municipality level. Markers represent weighted averages for treatment-on-the-treated (ATT) effects by horizon (period before/after treatment) without binning. Lines indicate 90% pointwise confidence intervals.

Figure B.2: Estimates Robust to Treatment Effect Heterogeneity using Alternative Control Groups



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Our main results hold when implementing other heterogeneity-robust estimators that use alternative control groups for identification. Sun and Abraham (2021): markers capture cohort average treatment effects on the treated (CATT). *Never-treated observations are used as control group*. Lines indicate 90% pointwise confidence intervals. de Chaisemartin and D'Haultfoeuille (2020): markers capture markers capture cohort average treatment effects on the treated allowing for heterogeneous treatment paths within a cohort over time across groups. *Not-yet-treated observations are used as control group*. Lines indicate 90% confidence intervals that are valid for the entire path of dynamic effects. In settings with staggered treatment adoption corresponds to the estimator of Callaway and Sant'Anna (2021).

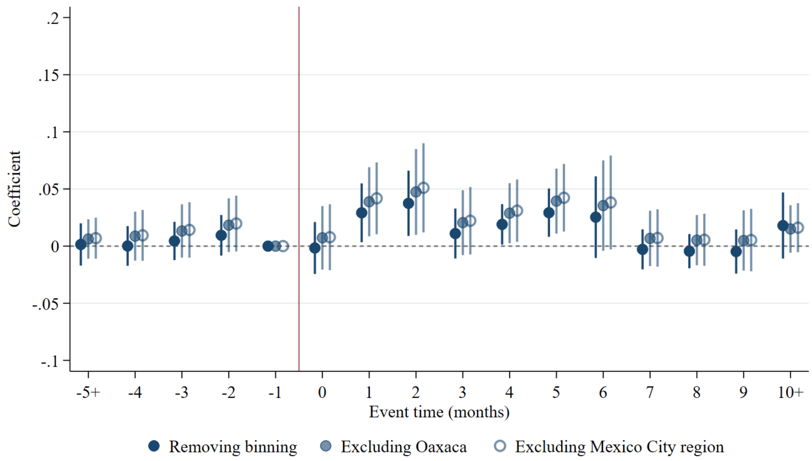
Figure B.3: Spillover Effects



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure shows the absence of spillover effects. We assign treatment to all municipalities belonging to the same district using as reference the time period when the first municipality was first treated. This approach assumes that spillovers were local and therefore experienced within districts only. Since treatment is assign at the district level, it is not possible to include district by time fixed effects in this specification. All models include a full set of interactions between municipality characteristics and time dummies. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

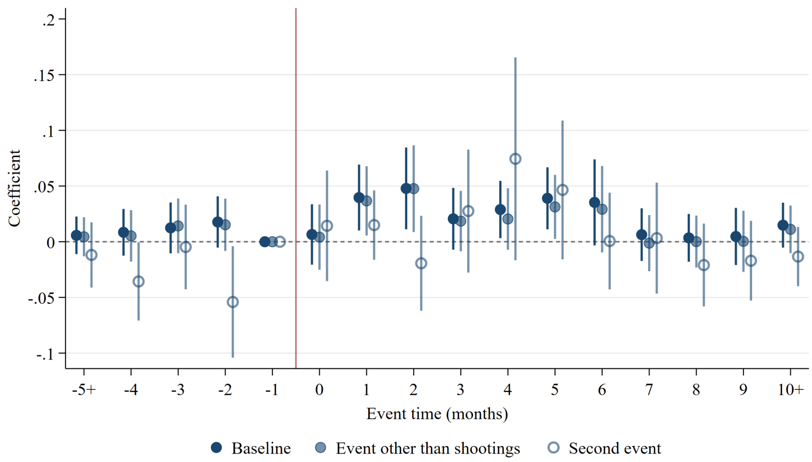
C. Robustness checks

Figure C.1: Binning, Control Group Composition, and Regional Migration Responses



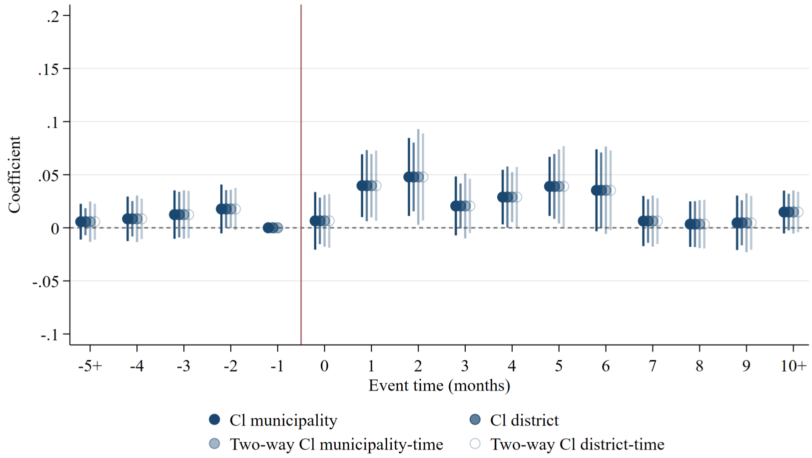
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: We perform three robustness checks to our main results. First, we estimate a "fully dynamic" specification, i.e., without grouping together estimates for distant relative-time periods. Previous literature shows that binning can significantly influence dynamic treatment effect estimates (Baker, Larcker and Wang, 2022). Second, we exclude the state of Oaxaca from the analysis. In 1910, about 40% of the municipalities belonged to this state (see Figure G.1), with the great majority not experiencing violence (see Figure A.5). This implies that municipalities in Oaxaca will be over-represented in the control group, which could be a source of bias. Third, we exclude the Mexico City region. Figure A.5 also shows that conflicts lasting more than 15 days concentrated in Mexico City and neighboring states (Mexico and Morelos). It is possible that our findings could be importantly influenced by the characteristics of the migration response in this region. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals. All specifications include district-by-time fixed effects.

Figure C.2: Alternative Treatment Assignment



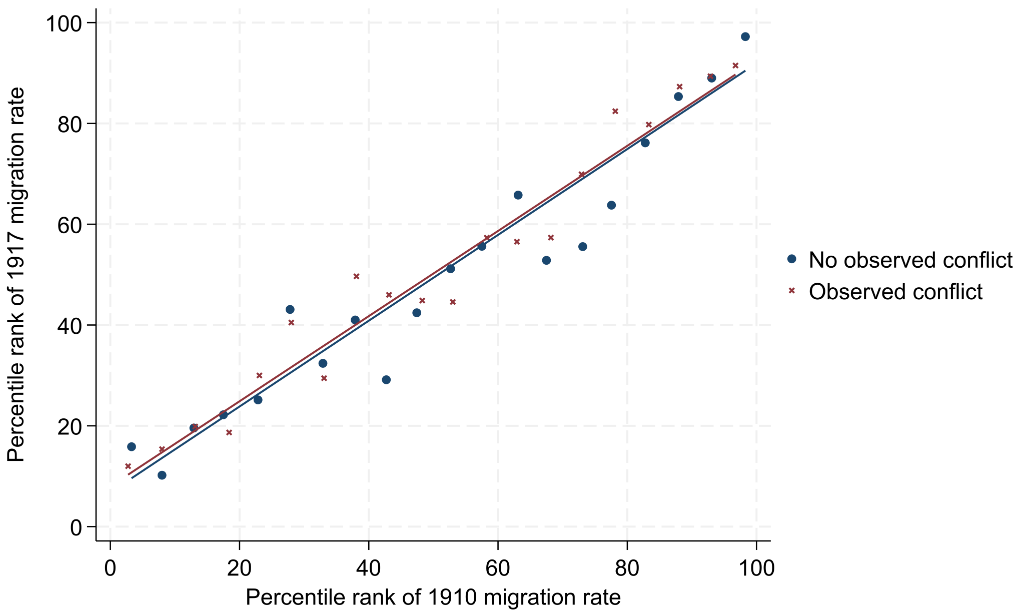
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure shows that our findings are robust to assigning treatment based on events other than shootings, which were the least violent conflicts. It also shows that conflict events experienced after the first occurrence were unlikely to induce migration. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals. All specifications include district-by-time fixed effects.

Figure C.3: Alternative Clustering of Standard Errors



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure shows that insurgency induced emigration in the first two months after the event. This finding is robust to clustering standard errors at different levels. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals. All specifications include district-by-time fixed effects.

Figure C.4: The Stability of Migration Patterns - Alternative Period



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: This binscatter plot shows the correlation between municipality migration rates before and after the Revolution by treatment status–whether there is an observed conflict within the municipality or not. Migration rates are calculated by municipality in 1910 (January-October) and 1917 (January-October), and then percentile ranked within their respective year. The slope reflects the correlation.

Table C.1: Error Correction for Temporal and Spatial Correlation

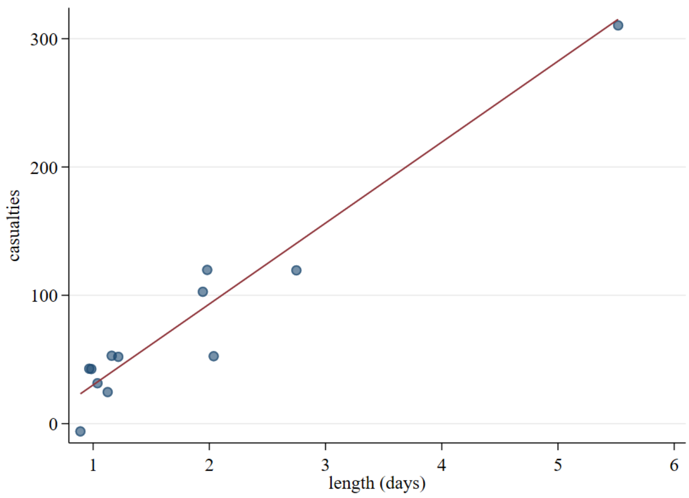
	1	2	3	4	5	6	7
	Baseline	SC 100 km	SC 200 km	SC 300 km	SC 100 km TC 6 mo.	SC 100 km TC 12 mo.	SC 100 km TC 12 mo. H
Leads							
-5+	0.010						
	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)
-4	0.002						
	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
-3	0.006						
	(0.014)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)
-2	0.011						
	(0.011)	(0.012)	(0.014)	(0.013)	(0.009)	(0.009)	(0.009)
Lags							
0	0.021						
	(0.014)	(0.014)	(0.016)	(0.016)	(0.011)*	(0.011)*	(0.012)*
1	0.045***						
	(0.016)	(0.020)**	(0.023)**	(0.023)*	(0.017)***	(0.017)***	(0.018)**
2	0.053***						
	(0.020)	(0.020)***	(0.023)**	(0.023)**	(0.021)**	(0.021)**	(0.021)**
3	0.027*						
	(0.016)	(0.016)*	(0.018)	(0.018)	(0.016)*	(0.016)*	(0.016)*
4	0.030*						
	(0.018)	(0.017)*	(0.018)*	(0.018)*	(0.019)	(0.019)	(0.018)*
5	0.033**						
	(0.016)	(0.016)**	(0.016)**	(0.017)*	(0.017)*	(0.017)**	(0.017)**
6	0.029						
	(0.019)	(0.021)	(0.022)	(0.022)	(0.021)	(0.019)	(0.020)
7	0.002						
	(0.013)	(0.015)	(0.015)	(0.016)	(0.015)	(0.014)	(0.015)
8	−0.007						
	(0.014)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)
9	−0.000						
	(0.015)	(0.013)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)
10+	0.010						
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)
Observations	199,944	199,944	199,944	199,944	199,944	199,944	199,944
R-squared	0.409	0.409	0.409	0.409	0.409	0.409	0.409

Source: 1910 Population Census of Mexico, Mexican Border Crossing Records, and Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).

Note: The table presents estimates with standard errors corrected for temporal and spatial correlation (Colella et al., 2019; Conley, 1999). Standard errors are clustered at the treatment level (municipality) in the baseline (column 1). We use different distance cutoffs (kilometers) beyond which the correlation of the error term between municipalities is assumed to be zero (columns 2-4). We also use different temporal cutoffs (months) beyond which the temporal correlation among observations of the same municipality is assumed to be zero (columns 5-6). Column 7 reports hetroskedasticity-robust standard errors corrected for temporal and spatial correlation. * = Significant at 10% level; ** = Significant at 5% level; *** = Significant at 1% level.

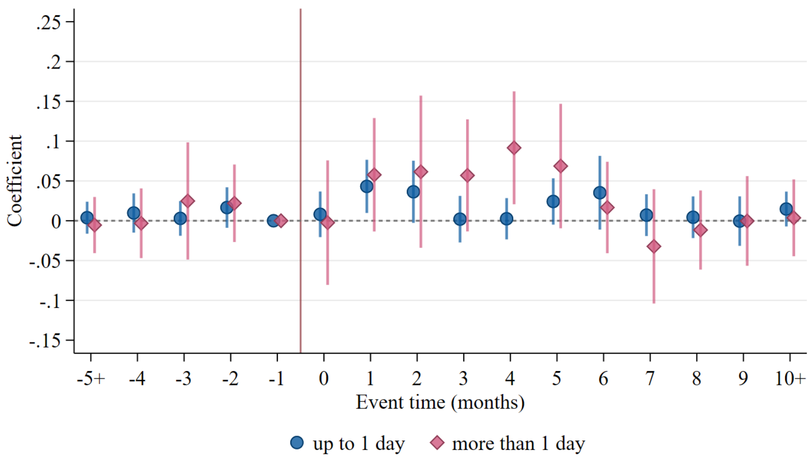
D. Treatment channel: alternative metrics of violence

Figure D.1: Binned Scatter Plot of Conflict Length and Casualties



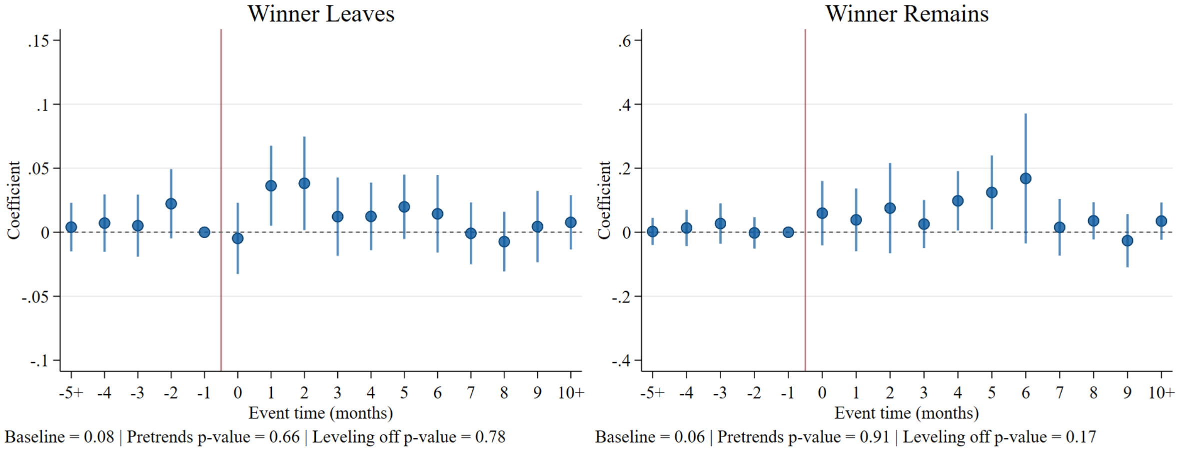
Source: Military History of the Mexican Revolution Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: The underlying regression controls for type of event (shooting, combat, siege, or battle) and region fixed effects. We exclude events with casualties reported as "uncountable" and events lasting more than ten days, which represent about 1 percent of the sample.

Figure D.2: Conflict Length and Migration



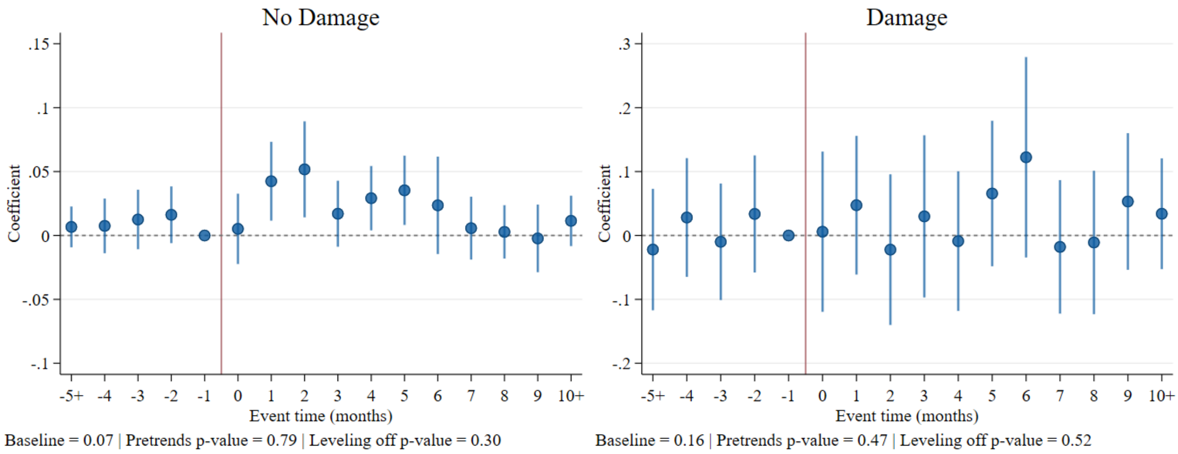
Source: Military History of the Mexican Revolution Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: The figure provides some evidence that conflict events lasting longer induced larger and more persistent migration responses. On average, events lasting up to one day caused 16 casualties, whereas events lasting more than one day caused 521 casualties. The mean length of long-lasting events was four days. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure D.3: Occupation of Territory and Migration



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Previous research shows that armed forces remaining in the conflict's location disrupts economic and social interactions, as the occupiers may expropriate resources and/or increase mistrust among the population (Cassar, Grosjean and Whitt, 2013; Rohner, Thoenig and Zilibotti, 2013). Military presence may also increase violent behavior among the population and the likelihood of future conflict (Aburto et al., 2023; Fontana, Nannicini and Tabellini, 2023). The occupation of territory by armed forces is thus a manifestation of violence that can increase lifetime uncertainty and migration (Engel and Ibáñez, 2007; Ibáñez and Vélez, 2008). We find evidence of a larger but delayed migration response in locations where the winner remained after the event. In contrast, in places where the winner always left, there was a smaller but more immediate response. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure D.4: Damage to Civil Infrastructure and Migration

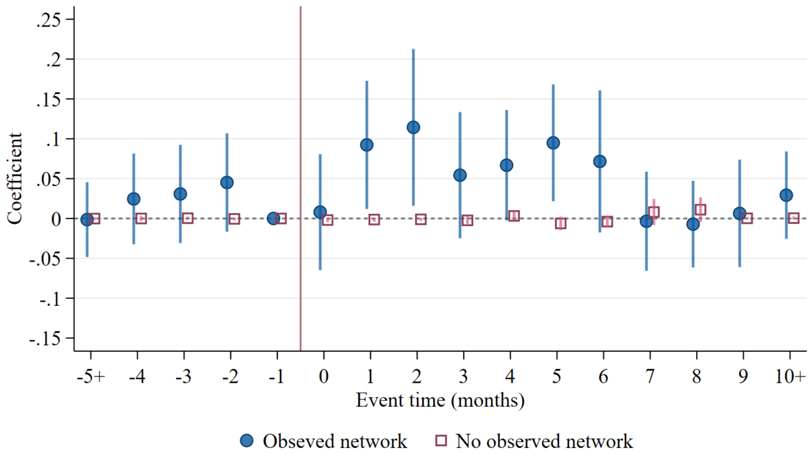


Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Higher levels of violence may also be reflected in severe damage to civil infrastructure, pushing civilians to migrate. We find inconclusive evidence about migration responses to conflict events that damaged civilian infrastructure. Although the effects are imprecisely estimated, the point estimates suggest a greater and delayed migration response. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

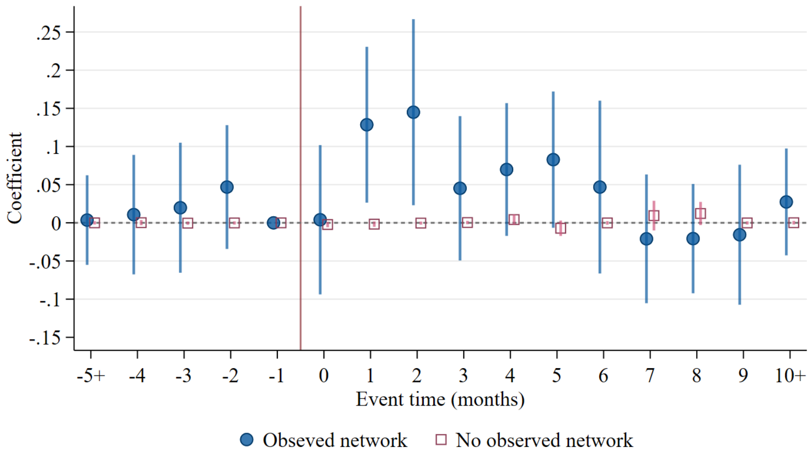
E. Moderating factors analysis without conditioning on violence in the first event

Figure E.1: Moderating Factors

Panel A. Migrant networks



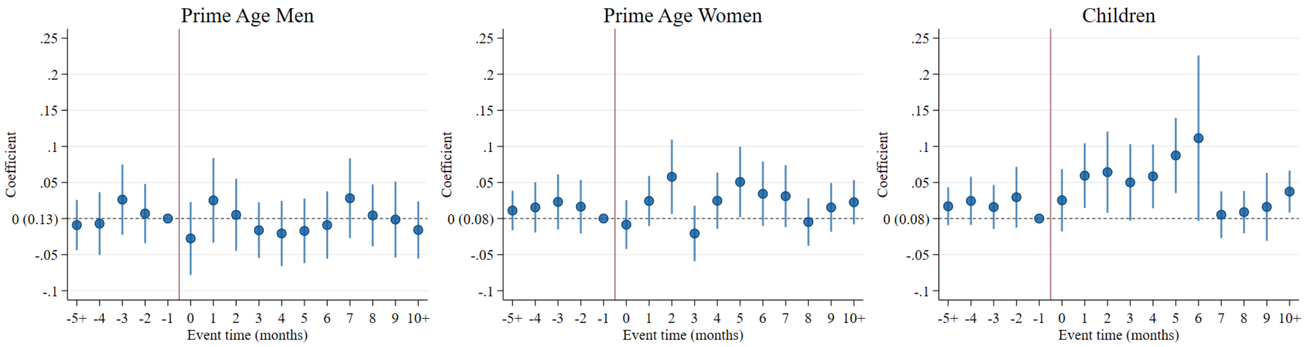
Panel B. Migrant networks and information access



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: We present migration dynamics induced by conflict events without conditioning on violence. Panel A compares migration responses from locations with v. without access to (recent or historical) migrant networks. Panel B controls for information access by including a full set of interaction terms between infrastructure (telegraph offices or train stations) indicators and time dummies. All specifications include district-by-time fixed effects. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

F. Alternative specification including municipality controls interacted with time dummies

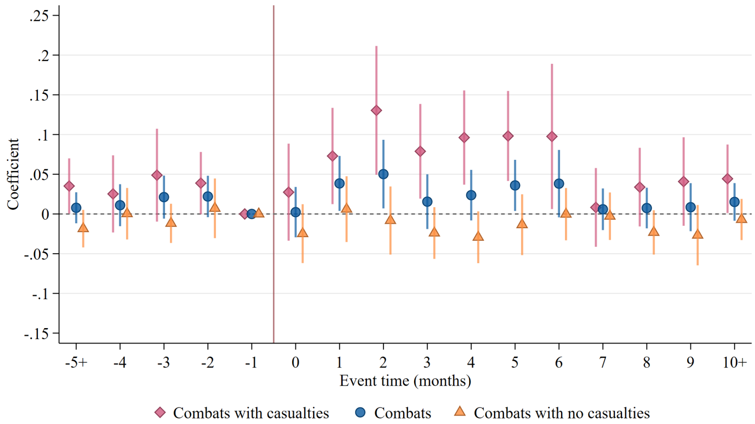
Figure F.1: Heterogeneity in the Migration Response to Conflict



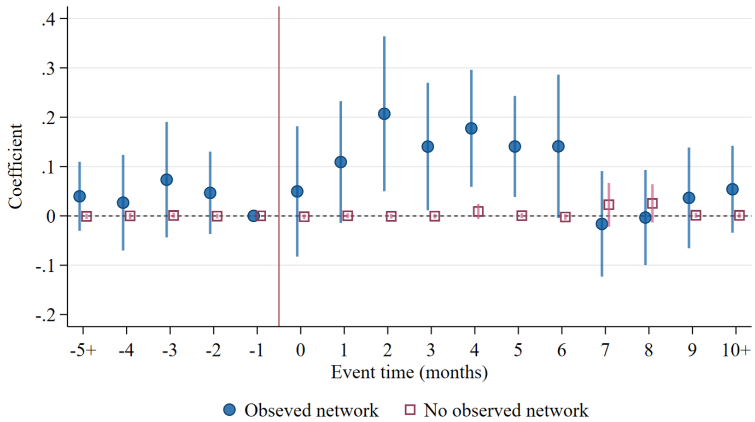
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: All models include control variables and district-by-time fixed effects. Control variables include interactions between municipality characteristics observed before the Revolution (population level, number of large estates, distance to the US border, distance to the nearest train station, and annual migration rate in 1908) and a full set of time dummies. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure F.2: Treatment Channel and Moderating Factors

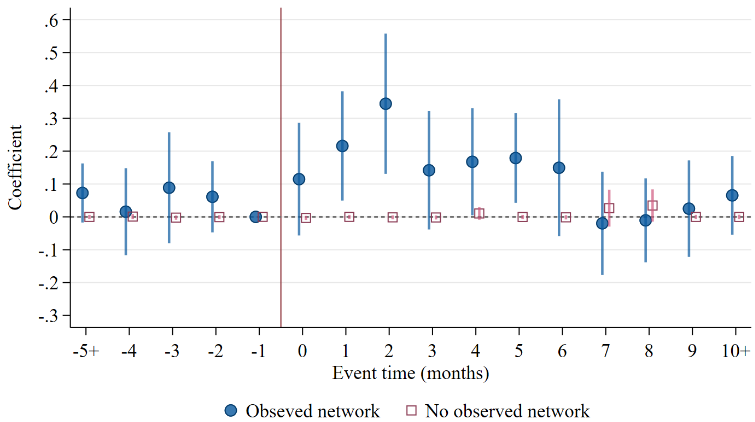
Panel A. Violence



Panel B. Migrant networks



Panel C. Migrant networks and information access



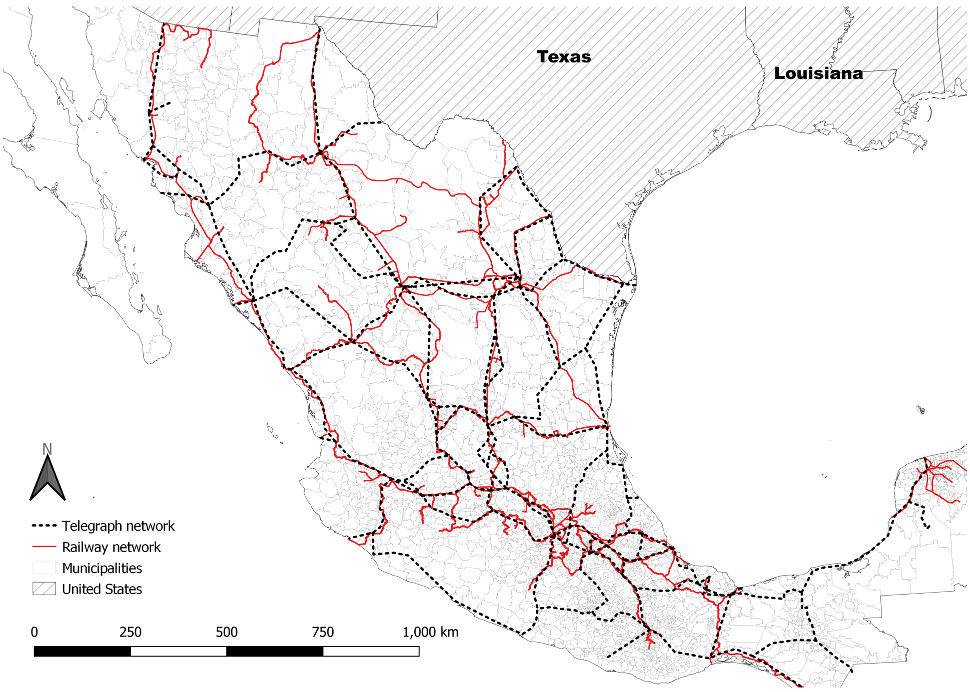
Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Panel A compares migration dynamics induced by violent v. non-violent events. We use military casualties as a proxy for violence. Panel B and Panel C compare dynamics (conditional on violence) from locations with v. without access to (recent or historical) migrant networks. Panel C controls for information access by including a full set of interaction terms between infrastructure (telegraph offices or train stations) indicators and time dummies. All models include control variables and district-by-time fixed effects. Control variables consist of interactions between municipality characteristics observed before the Revolution (population level, number of large estates, distance to the US border, distance to the nearest train station, and annual migration rate in 1908) and a full set of time dummies. Models in Panel B and C do not include interaction terms on migration rate. The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

G. Maps for Guidance

Figure G.1: Emigration Regions in Mexico

Source: Adapted from López-Alonso (2015).
Notes: The map displays the geographic regions, states, and municipalities of Mexico. It also displays the border crossing points and ports of entry covered by the immigration data.

Figure G.2: Communication and Transportation Network Before the Mexican Revolution



Source: Telegraphs data are for ca. 1895 (Mendoza Vargas, 2014). Railways data are for ca. 1910 (Ferrocarriles Nacionales de México, 1914)
Notes: The map shows that the telegraph and railway networks were quite developed before the Mexican Revolution. However, many municipalities did not have direct access to communication and/or transportation infrastructure.

H. Internal Displacement

While comprehensive data on internal displacement during the Mexican Revolution (1910-1917) are scarce, existing literature suggests significant changes in internal migration patterns during this period. These changes were primarily driven by the displacement of refugees fleeing conflict and the intensification of rural-urban migration (Balán and Liévana, 1981; Garciadiego and Kuntz Ficker, 2010). To our knowledge, Sobrino (2010, pp. 142-143) is the only study on migration within Mexico for the period. The author implements a residual method using vital statistics and census data to estimate changes in internal emigration at the *state level*. The findings suggest that internal emigration increased in 12 thousand individuals per year from 1910 to 1921 (about 13 percent).

Back-to-the-envelope calculations suggest that migration from all municipalities ever with conflict increased from 663 *monthly* border crossings before the Revolution to 930 during the period of generalized insurgency. Assuming that the flow of economic migrants remained constant over time, our findings predict about 3,200 refugee crossings per year.[26] Therefore, we can infer that for every four individuals likely displaced by conflict within Mexico, one moved to the United States, with this proportion closing (reverting) in states more severely affected by conflict, such as Coahuila or Sonora. (see Table H.1).

[26]We first multiply the average monthly migration rates—before (0.077) and during (0.108) the Revolution—by the average population size of treated municipalities (13.5 thousand inhabitants). We then multiply the product by the number of treated municipalities (638).

Table H.1: Internal Migration and Migration to the United States

	1	2	3	4	5	6	7
	Internal Migrants[a]		Border Crossings			Proportion	
	Difference[b] 1921 - 1910	Annual Average	Total Flow 1911-1915	Annual Average	Refugees[c] per Year	4/2	5/2
Mexico	**136,340**	**12,394.5**	**56,472**	**11,294.4**	**3,200.0**	**0.91**	**0.26**
Aguascalientes	3,693	335.7	623	124.6	34.9	0.37	0.10
Baja California	991	90.1	1,500	300.0	84.0	3.33	0.93
Campeche	2,638	239.8	8	1.6	0.4	0.01	0.00
Coahuila	6,780	616.4	11,139	2,227.8	623.8	3.61	1.01
Colima	2,140	194.5	112	22.4	6.3	0.12	0.03
Chiapas	2,062	187.5	6	1.2	0.3	0.01	0.00
Chihuahua	3,889	353.5	5,499	1,099.8	307.9	3.11	0.87
Durango	14,456	1,314.2	1,779	355.8	99.6	0.27	0.08
Guanajuato	17,648	1,604.4	1,503	300.6	84.2	0.19	0.05
Guerrero	3,229	293.5	36	7.2	2.0	0.02	0.01
Hidalgo	-3,753	-341.2	62	12.4	3.5	0.04	0.01
Jalisco	-698	-63.5	2,058	411.6	115.2	6.49	1.82
State of Mexico	-12,187	-1,107.9	45	9.0	2.5	0.01	0.00
Mexico City	5,954	541.3	1,277	255.4	71.5	0.47	0.13
Michoacan	7,084	644.0	515	103.0	28.8	0.16	0.04
Morelos	11,247	1,022.5	7	1.4	0.4	0.00	0.00
Nayarit	3,269	297.2	270	54.0	15.1	0.18	0.05
Nuevo Leon	13,252	1,204.7	4,502	900.4	252.1	0.75	0.21
Oaxaca	4,143	376.6	42	8.4	2.4	0.02	0.01
Puebla	8,326	756.9	114	22.8	6.4	0.03	0.01
Queretaro	1,325	120.5	50	10.0	2.8	0.08	0.02
Quintana Roo	407	37.0	0	0.0	0.0	0.00	0.00
San Luis Potosi	19,156	1,741.5	1,638	327.6	91.7	0.19	0.05
Sinaloa	5,598	508.9	2,310	462.0	129.4	0.91	0.25
Sonora	2,875	261.4	15,371	3,074.2	860.8	11.76	3.29
Tabasco	974	88.5	8	1.6	0.4	0.02	0.01
Tamaulipas	2,699	245.4	3,501	700.2	196.1	2.85	0.80
Tlaxcala	-1,251	-113.7	4	0.8	0.2	0.01	0.00
Veracruz	6,576	597.8	108	21.6	6.0	0.04	0.01
Yucatan	1,470	133.6	27	5.4	1.5	0.04	0.01
Zacatecas	-181	-16.5	2,358	471.6	132.0	28.66	8.03

Source: Sobrino (2010, pp. 142-143) and Mexican Border Crossing Records.
Note: Border crossings include observations not classified by sex for the period Jan 1911 to Dec 1915. [a]Difference in internal emigration based on the 1910 and 1921 censuses. [b]The censuses were implemented in October 1910 and November 1921, and thus we consider a time span of 11 years to estimate the annual average of internal emigration. [c]Total number of refugees per year based on municipality-level migration dynamics.

I. Variation in violence across conflict events

As many modern-day conflicts, the Mexican Revolution (1910-1917) was a multi-sided civil war in which various factions moved constantly across the country (shifting fronts) to fight each other for territorial control (Garcíadiego, 2004; Knight, 1986*a*,*b*; Tannenbaum, 1933). These conflict dynamics created substantial variation in violence across insurgency events. In Appendix A, we present the characteristics of these events by military category, which capture differences in conflict features such as personnel involved and firepower used. Shootings represent 15% of the events and are the least violent. They lasted about one day, caused 9 casualties on average, and rarely produced damages to civil infrastructure or the occupation of territory. Combats lasted slightly longer, but caused five times more casualties and were more likely to induce the occupation of territory. They represent about 83% of the events and thus can be considered as the "typical" conflict event during the Revolution. Although sieges and battles represented only 2% of the events, they were significantly more violent, causing on average 81 and 2,585 casualties, respectively. One in three sieges induced the occupation of territory by the victor and half of the battles caused damages to civil infrastructure (see Table A.3).

However, we observe substantial heterogeneity in violence within these categories. Our analysis focuses on combats due to their representativeness. Table I.1 show that 40% of combats did not cause military casualties. Below we present abstracts of military reports categorized as combats to illustrate this variation in violence.

> Example of a combat with casualties (Sánchez Lamego, 1956, p. 203).
>
> "On March 27, 1913, at approximately 8:30 AM, Federal Infantry under Captain Mayo's command encountered revolutionary forces 12 kilometers north of San Gabriel (Ocampo, Durango). Major García attempted to encircle the enemy, but due to the revolutionaries' superior numbers, the federal troops were forced to retreat. The ensuing combat was intense, with revolutionary forces pursuing the federal troops to Catalina, 90 kilometers from Durango. There, Major García realized he had lost his entire infantry and 54 cavalry soldiers—123 men out of his original force of 188. On March 28, he retreated to Pedriceña, 80 kilometers southeast of Torreón, where he reported his devastating defeat" (F. 118, Exp. D/481.5/109, AHSDN).
>
> Example of a combat with no casualties (Sánchez Lamego, 1956, p. 60).
>
> "On March 18, 1913, Lieutenant Colonel Dominguez Guevara arrived in Bustamante (Nuevo León) at 11:00 AM. Shortly after, he encountered forces under Colonel Carranza. After a brief combat, all the revolutionaries disengaged and fled toward Candela, pursued by federal cavalry. The federal forces eventually abandoned their pursuit and returned to Bustamante" (Exp. D/481.5/179, AHSDN).

Although the military reports do not document the displacement of affected civilian population, Gamio (1969) compiles oral histories of migrants that arrived in the United States during the Mexican Revolution, which provide some evidence on the link between violence and migration.

> "I worked as a servant in my youth, but I wanted to become independent. After years of hard work, I managed to open a small store in my town. I had to sell it to come to the United States because it was impossible to continue living with so many revolutions."
>
> —*Pablo Mares, Mexican refugee from Guadalajara, Jalisco.* (Gamio, 1969, p. 85)

Table I.1: Violence Metrics for Combats

	Full Sample	Casualties	No Casualties
Length (days)	1.30	1.50	1.19
Average military casualties	42.77	111.73	0
Damage to infrastructure (share)	0.09	0.13	0.05
Occupation of territory (share)	0.15	0.16	0.14
Observations	2,001	808	1,193
Sample share	100	59.6	40.3

Source: Military History of the Mexican Revolution (Sánchez Lamego, 1956, 1957, 1960, 1976, 1979, 1983).
Note: The table presents violence metrics for conflict events categorized as combats.

J. Heterogeneity by distance to the border

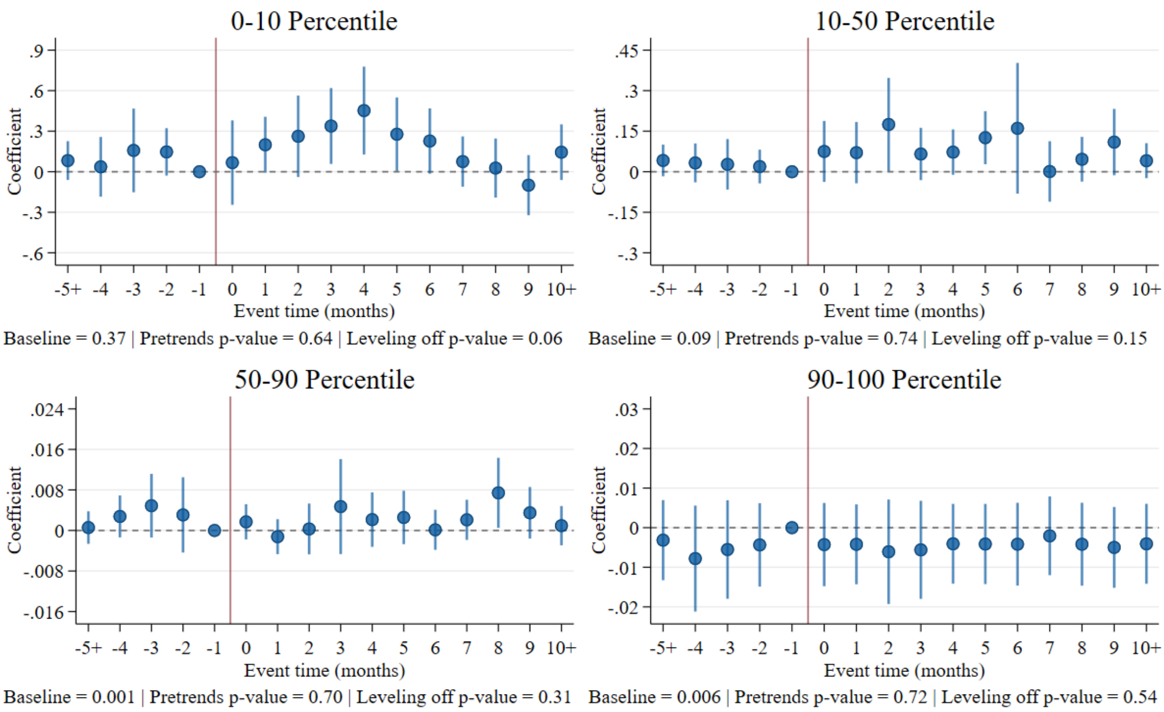
While refugee migration is influenced by factors outside the control of migrants, in many contexts individuals have some agency in the decision to migrate—that is, they weigh the benefits and costs of leaving and evaluate when to leave (Becker, Mukand and Yotzov, 2022). Hence, migration costs may moderate the response to conflict, as individuals facing high costs may choose to delay migration or stay. Previous research has documented that in contexts of conflict a greater distance between origin and destination reflects larger travel, psychological, and information costs (Hatton, 2009, 2016). We follow this literature and estimate Equation 1 for municipalities located at different distances from the US border. We perform this analysis using distance estimates from Woodruff and Zenteno (2007), who compute the distance by train from each municipality to the border according to the railway network that existed in the early 1900s. These estimates consider the distance to the nearest train station for municipalities without direct access to railroads.

Our analysis uses events categorized as combats *with* military casualties to keep the level of violence constant across specifications (see Appendix I). We also exclude municipalities from the Southeast region, as its geographic isolation combined with limited railroad access, low migration to the United States, and minimal insurgency activity are likely to bias the relationship between migration and distance to the border (see Figure G.1 and Figure G.2). Figure J.1 presents estimates for different segments of the distance distribution. Our findings reinforce our baseline results in two key aspects. First, we continue to find statistically significant *temporary* effects across distance thresholds. Second, we observe no immediate migration response in the month of the event, even in municipalities in the 10th percentile of the distance distribution (less than 299 km from the border). This lack of immediate response supports our argument that refugees require time to plan their migration despite experiencing violence. Additionally, our results provide strong evidence that distance (migration costs) moderates the magnitude and timing of the response to conflict. Municipalities farther from the border show delayed but larger responses relative to the baseline. We also observe no migration response in municipalities beyond the 90th percentile (more than 875 km from the border). Note that the aforementioned dynamics are unlikely to be identified with data varying at a lower frequency.

Since we observe refugee flows at the border, one possibility is that our findings may reflect traveling times. We believe this is unlikely, as a journey by train from central Mexico to the border took 45 to

60 hours depending on the route (De Cardona, 1892).[27] Hence, it is plausible that individuals from municipalities located far from the border had to sell assets to finance the migration process, which could have taken time considering that conflict disrupts markets. For reference, a third-class ticket from central Mexico to El Paso, Texas cost 30 pesos—roughly equivalent to three months' wage for a laborer—which confirms that migrating from distant municipalities was expensive.

Figure J.1: Migration Response to Conflict by Distance to the Border



Source: Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Distance estimates are from Woodruff and Zenteno (2007). They consider distance to the nearest train station for municipalities without direct access to railroads. The median value for each percentile group are 199 km (0-10 percentile), 646 km (10-50 percentile), 818 km (50-90 percentile), and 1040 km (90-100 percentile). The control group consists of not-yet and never-treated units belonging to the same percentile group. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

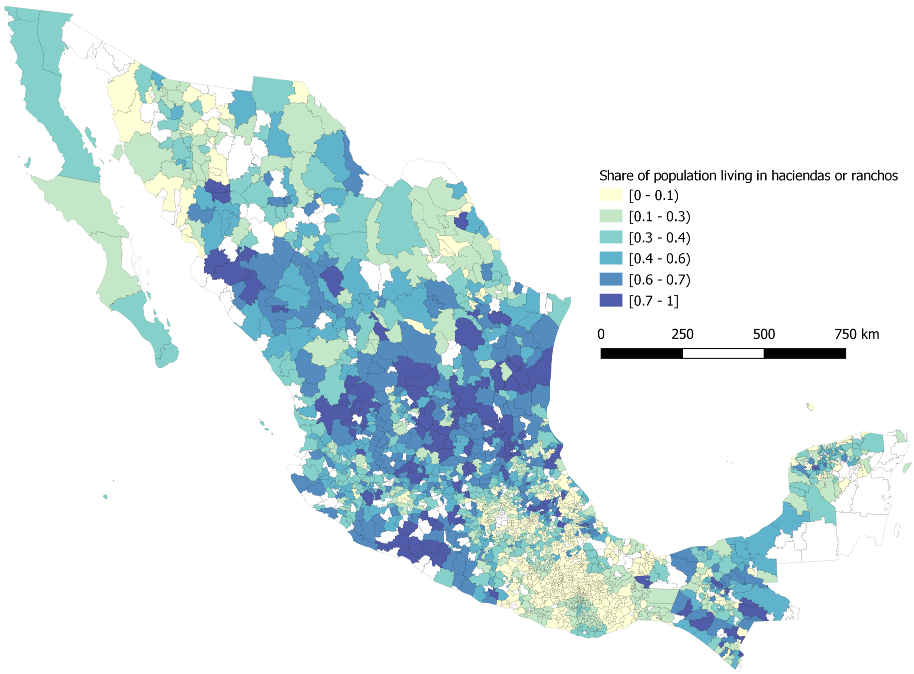
[27] Traveling times are for the routes Mexico City-Brownsville and Mexico City-El Paso, respectively.

K. Heterogeneity by land ownership and changes in skill composition

One limitation of our data is that they do not report information on the migrants' skill level (occupation) or destination in the United States, which prevents us to characterize the migrant's profile in detail. However, it is possible to use variation in migrant sources to infer changes in the composition of migration during the Revolution.

For this analysis, we focus on land ownership. We use data on land concentration in 1910 from Sellars and Alix-Garcia (2018): the share of the population living in large estates (haciendas or ranches) by municipality. In agrarian societies, a high concentration of land reflects higher shares of poorer landless, relatively unskilled individuals (Boberg-Fazlić, Lampe and Sharp, 2024). Figure K.1 below shows that land concentration varied significantly within Mexico, with several municipalities having more than 60% of their population living large estates.

Figure K.1: Land Concentration in 1910

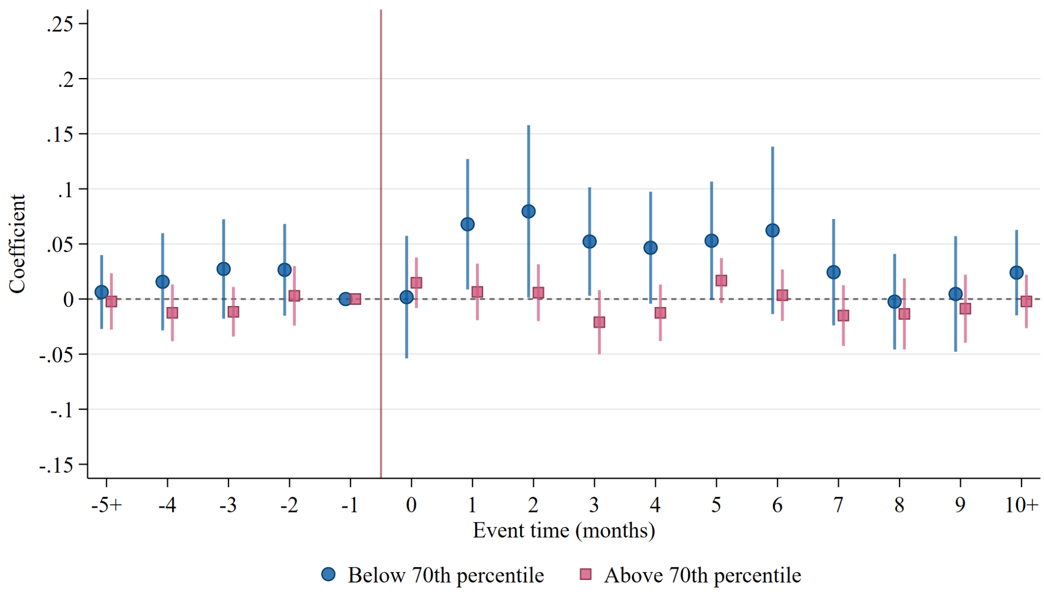


Source: Data from Sellars and Alix-Garcia (2018).
Notes: The map shows the share of population living in large states (haciendas or ranches), which proxies for land concentration at the local level.

These data allow us to examine the impact of conflict events in municipalities with different levels of land concentration, and thus provide more information about the migrants' characteristics. We estimate our baseline specification for municipalities below and above the 75th percentile of the land concentration distribution. In municipalities below the 75th percentile, on average, 10% of the population lived in large estates and private holdings had an extension of 50 hectares, while in municipalities above this threshold, 60% of the population lived in estates of 13 to 15.5 thousand hectares (Sellars and Alix-Garcia, 2018).

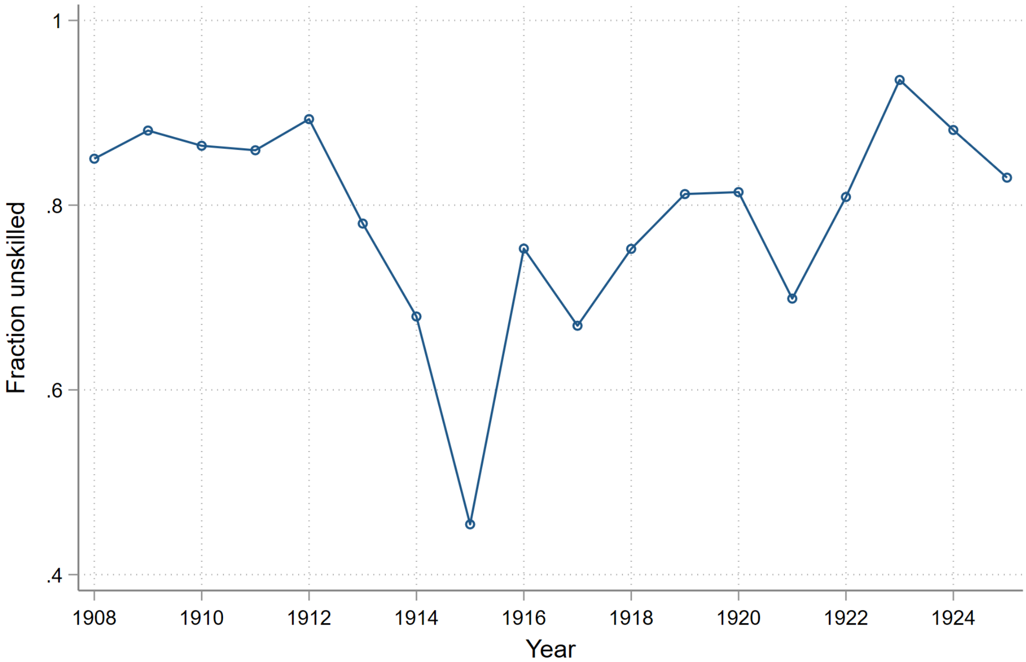
Figure K.2 below shows that conflict events had no effect on migration in municipalities with high land concentration. In contrast, in municipalities with low land concentration, we observe a large increase in monthly migration rates of 0.05-0.08 per thousand inhabitants, representing an increase of 50 to 80% over the baseline (0.099). This finding suggests that migration may have become more skilled during the Revolution. To further support this argument, we use data from the "Annual Report of the Commissioner General of Immigration," which reports annual counts of Mexican arrivals by skill from 1908 to 1930. Figure K.3 below shows that the fraction of unskilled migrants changed from more than 80% before the Revolution to less than 50% during the Revolution. Notably, the fraction of unskilled arrivals returns to pre-Revolutionary levels by 1920. Overall, the evidence suggests that conflict events changed not only the sex composition, as discussed in the manuscript, but also the skill composition: refugees were more likely to be skilled and own small landholdings.

Figure K.2: Land Concentration and Migration



Source: Mexican Border Crossing Records and Sánchez Lamego (1956, 1957, 1960, 1976, 1979, 1983).
Notes: Land concentration is measured as the share of population living in large estates (haciendas or ranches), which proxies for the share of landless population that in agrarian societies tends to be poorer and less skilled. The average land extension of haciendas and ranches was 15,500 ha and 13,500 ha, respectively, while the average private property holding was about 50 ha. Data on land concentration comes from Sellars and Alix-Garcia (2018). The control group consists of not-yet and never-treated units. Standard errors are clustered at the municipality level. Markers represent point estimates. Lines indicate 90% pointwise confidence intervals.

Figure K.3: Skill Composition during the Mexican Revolution



Source: Annual Report of the Commissioner General of Immigration.
Notes: The figure shows annual fractions of unskilled Mexican arrivals in the United States.