Forced Internal Displacement in Mexico Due to Violence and Insecurity in Mining Regions

Desplazamiento interno forzado en México por violencia e inseguridad en regiones mineras

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Abstract. Forced internal displacement is a phenomenon arising from conditions of intense violence, associated with various victimizing circumstantial facts, which has led to the internal migration of social groups under extreme vulnerability conditions. This article describes an exploratory study of the relationship between forced displacement in different regions of Mexico and the presence of metal mining operations in the exploration, production, development, postponement, or closure phases. Displacement is addressed through a proxy — emigration at the municipal level associated with high incidence rates of high-impact crime. It shows correlation values of both parameters through the regionalization of the country to observe the presence and spatial distribution of both phenomena. Also, this article describes the peculiarities of each region at the national level, according to the type of mining activity and the violence profiles.

This paper addresses the methodological issues involved in the identification and spatial association of these phenomena, based on the information available in various statistical sources and official and civil society databases. The use of these sources allows for exploring the challenges related to the study and visualizing forced internal displacement, which can serve as inputs for the application of regulatory frameworks and the prevention of this phenomenon.

Resumen. El desplazamiento interno forzado es un fenómeno que se deriva de condiciones de violencia intensa, a partir de diferentes hechos circunstanciales victimizantes, que tiene como consecuencia una movilidad en el territorio de grupos sociales en condiciones de extrema vulnerabilidad. Este artículo es un estudio descriptivo exploratorio de la relación entre desplazamiento forzado y la presencia de las explotaciones mineras metálicas en diferentes regiones del país, en las fases de exploración, producción, desarrollo, postergación o cierre. El estudio aborda el desplazamiento a través de un proxy, compuesto por la emigración a nivel municipal asociada con altas tasas de incidencia de delitos de alto impacto. Muestra los valores de correlación de ambos aspectos a través de una regionalización del país, con la finalidad de observar de manera significativa la presencia y distribución espacial de ambos fenómenos. Describe las particularidades que existen en cada una de estas regiones a nivel nacional, de acuerdo al tipo de la actividad minera y de los perfiles de violencia que se presentan en éstas.

En este trabajo se abordan los problemas metodológicos asociados a la identificación y asociación espacial de estos

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fenómenos, a partir de la información disponible en diversas fuentes estadísticas, así como bases de datos oficiales y de la sociedad civil. El uso de estas fuentes permite explorar los retos relacionados con el estudio y visualización del desplazamiento interno forzado, que pueden servir de insumo para la aplicación de marcos normativos y de atención para la prevención de este fenómeno.

Palabras clave: minería metálica, desplazamiento interno forzado, migración, incidencia delictiva, violencia.

INTRODUCTION

Forced internal displacement (FID) is a phenomenon derived from various circumstantial high-impact victimization facts, which have fueled the internal migration of social groups facing extreme vulnerability conditions within the Mexican territory. Documenting the geographic perspective of FID in this country is complex given the lack of official information systems that would support the generation of systematic indicators adapted to the particular circumstances surrounding it.

FID is a multifactorial phenomenon. However, the studies currently available indicate that the affected people have coexisted or are subjected to extreme vulnerability scenarios that have deteriorated their living conditions. Some of the causes of FID relate to disasters or various types of violence arising from armed conflicts, widespread violence, organized crime, territorial disputes, and the implementation of development projects that have led to human rights violations (ACNUR, 1998). Globally, this issue has yielded 100 million displaced persons, of whom 53 million are citizens forced to internal displacement by conflict and violence, with Ukraine ranking first (8 million), followed by Syria (6.7 million), Venezuela (4 million), and Afghanistan (2.6 million) (ACNUR, 2020, 2022).

In Mexico, FID is a highly complex social phenomenon that, however, has not been studied from a geographic perspective. Whenever displacement has been addressed, it has occurred from the perspective of migration or refuge. This approach has masked the distinctive characteristics of internal displacement in the country.

In Mexico, FID is not a new phenomenon, but its configuration has changed over the past two decades. From political or religious conflicts, it has evolved to an ever-closer association with drug trafficking and organized crime (Diaz and Romo, 2019, p. 18). This criminality takes multiple forms, such as competition for exploiting natural resources, disasters, anthropogenic emergencies such as industrial pollution or discharge of toxic substances, or the struggle of criminal organizations to gain control of strategic sites (Diaz and Romo, 2019, p. 20).

According to the Internal Displacement Index report of the Internal Displacement Monitoring Centre (IDMC) prepared by Cazabat and O'Connor (2021, p. 91), there were approximately 456 000 internally displaced persons in Mexico at the end of 2020, of whom 78% (357 000) were associated with violence. This translates into an economic impact of over 132 million USD that year. It should be noted that the measurement of the actual figures of displaced population is incipient, as indicated in this report, because the Mexican government "(…) lacks a systematic data collection system on internal displacement at the national level" (p. 91). Given this context, understanding this phenomenon and its underlying factors requires exploratory research in the country to document the relevance and magnitude of these factors to guide the support to the displaced population.

According to the monthly report of the *Comisión Mexicana de Defensa y Protección de los Derechos Humanos* (Mexican Commission for the Defense and Protection of Human Rights; CMDPDH, 2021), violence in Mexico peaked in 2021 (considering 2016 as the starting point). About 44 905 persons were internally displaced in ten states of the country; in addition, 2021 recorded forty episodes of mass or collective displacement.

In the present study, we will analyze the displacements caused by conflict and violence associated with metal mining production — specifically of gold, silver, and copper — at the national level. These minerals were selected because they have concentrated an average of 72% of the value of mining production in Mexico over the past ten years (2011–2021), (INEGI, 2022). Additiona-

lly, the commercial exploitation of these minerals entails high environmental impacts (Guzmán, 2016), Also, there are several redistributive issues associated with the high concentration of income from exploitation, whose tax benefits are not applied to the affected populations, which tends to fuel conflicts in mineral exploitation sites (Saade, 2013, p. 9).

Along the same lines, the *Observatorio de Conflictos Mineros de América Latina* (Observatory of Mining Conflicts in Latin America; OCMAL) has recorded 301 mining projects and 284 conflicts. This observatory has documented 264 cases of criminalization of protest, most of which correspond to Mexico (58 conflicts), Chile (49), and Peru (46) (OCMAL, 2022).

Studies that have addressed various methodologies for estimating the impact of mining conflicts and violence in Mexico point out that these conflicts are in the order of hundreds. For instance, Smith (2014, p. 41) documented at least 103 conflicts related to mining activities or potential in 2013. In 2018, the cartography of social and environmental conflicts elaborated by Guarneros and Zaremberg (2019) as part of the *Conversando con Goliath* (Conversing with Goliath) project reported at least 879 conflicts in Mexico associated with the exploitation of natural resources over 12 years. Of these, mining ranked first with an estimated 374 conflicts related to 134 projects in the country.

Thus, in Mexico, violence is present each time mining activities in the territory are documented. Examples are the high number of assaults suffered by environmental advocates opposed to mining projects in the past ten years, which amount to eleven murders, twelve cases of injuries, and dozens of cases of threats, criminalization, forced disappearance, illegal deprivation of liberty, harassment, and intimidation (Centro Mexicano de Derecho Ambiental, 2021). According to a study by the organization Global Witness (2021, p. 12), two sectors [agro-industry and mining] "(…) have been linked to more than 30% of all murders documented by Global Witness against people who defend the land and the environment".

Considering the above scenario, this research analyzed the correlation between the extractive phases of metal mining in Mexico and some social and demographic processes associated with FID through an exploratory and descriptive approach. In this article, the authors reflect on the possible links between this type of mining — characterized by significant environmental impacts, few possibilities of restoration of the original territorial conditions, and the scarce redistribution of benefits — and violence and conflicts in different regions of Mexico. These changes emerge from factors such as natural resource degradation, intimidation, threats, or forced land appropriation associated with criminal activities.

For this reason, we explored the relationship between some violence indicators, particularly high-impact crimes, and high emigration rates. This relationship seems a suitable approach for identifying forced internal displacement (FID). From this first approximation to the phenomenon, we associated the FID with different mining exploitation phases throughout the Mexican territory (exploration, production, development, postponement, closure). This relationship was analyzed from a regional perspective to demonstrate the correlation between both territorial dynamics. This methodological procedure allowed us to identify the differences between these regions according to the type of mining activity and the incidence of FID. Our work hypothesis is that there is a link between forced internal displacement and violence (high-impact crime) in the territories where mining corporations are located and that this relationship occurs in a differential way according to the metal mining production phase.

The first section presents a brief conceptual framework summarizing some of the existing studies on the relationship between mining — especially metal mining — and the contexts of violence frequently associated with FID, covering aspects such as environmental destruction, invasions, or co-optation of communities, among others. The second section outlines the methodology applied and its scope. The third part describes the results and discusses the findings. The article concludes with a review of the work hipothesis and the extent to which the evidence answers it.

Metal Mining Exploitation and Violence as a Cause of Forced Displacement

In Mexico, the Mining Law, linked to the 1992 constitutional reform of article 27, promoted an "(…) economic orientation in favor of large mining companies, both national and transnational, at the expense of the fundamental rights of Mexicans — mainly indigenous communities and peasant populations — as well as ecological rights" (Cardenas, 2013, p 64). Thus, the promulgation of this Law facilitated mining exploitation and exploration.

The *Anuario Estadístico de la Minería Mexicana* (Statistics Yearbook of Mexican Mining; SGM, 2021, p. 6) issued by the Board of Economy states that Mexico is among the top producers of fifteen minerals worldwide, being the world's top producer of silver. This sector (including the steel industry) accounts for 8.3% of the gross domestic industrial product and 2.3% of the national GDP. Mexico is also considered one of the top destinations in Latin America for mining exploration, and some 179 Mexican companies have foreign investments from Canada, the United States, China, Japan, the United Kingdom, Australia, South Korea, India, Spain, and France. According to the Yearbook, "(…) there are 1190 mining projects spread across 26 states of the country" (p. 29). In this context, 77% of the concessions in the Mexican territory have been granted by the federal government to Canadian companies, even in biosphere reserve areas (Bastidas *et al.*, 2018; López, 2018; Cruz, 2017; Muñoz *et al.,* 2020; Secretaría de Economía, 2021).

This exploitation, which is associated with the alienation of these resources by entrepreneurs, either by themselves or in association with federal and State governments, has occurred coupled with characteristic forms of violence. In this respect, Saade (2013, p. 36) points out that the conflicts associated with mining operations are initially related to their high environmental impact, given their intensive use of water and their direct impact on the livelihoods of the local communities, especially those living in poverty.

Affectations to the local populations in these regions include the rights to prior informed consultation, rights to self-determination, or *a-posteriori* affectations to the living conditions. These include, for example, poor relocation, damage to heritage, disputes over land prices, establishment of mining companies in areas larger than those granted, or episodes of irreversible environmental affectation, among others (Saade, 2013, p. 38; OCMAL, 2022 [cartography]).

These affections give rise to internal displacement because communities are no longer able to cope with everyday life. For Oslender (2004a, p. 68), this is part of a "geography of terror," which facilitates the establishment of extractive projects through land clearing and the co-optation of communities, not only by corporations but with the assistance of state government officials. The appropriation of these resources for mineral production processes uses high-impact strategies to disrupt local land-tenure conditions, everyday life forms, and social networks. In areas where mining takes place, the local communities have frequently suffered various acts of violence due to territorial disputes, public complaints, and resistance to accepting the imposed mining projects.

Given the complex contexts just described, it is worth noting that this article does not address all the potential causes of displacement, nor its particular characteristics in each area of Mexico. The objective of the present work is to observe at a national scale, assisted by regionalization, the potential correlations between zones showing different metal mining extractive phases and some social and demographic processes associated with FID. The following section outlines the methodological process carried out to establish the existence of these relationships and their scope. In this way, possible interpretations can be defined on the intensity of FID and its relationship to the processes associated with metal mining outlined above.

METHODOLOGY

The analysis described in this article was carried out based on three main information elements: 1) data on migration, 2) data on crime incidence, and 3) data on gold, silver, and copper metal mining in Mexico. The study covers the period from 2015 to

2020, and all data sources were bracketed within this period.

The statistical construction of these data sources has a national scale, with analysis at the municipal resolution. However, to strengthen some aspects of the analysis, municipalities of several Mexican states were grouped into three major regions following the criteria in Diaz and Romo (2019) for the National Population Council.

Three aspects were identified for each municipality in the country:

- Metal mining activity.
- Migrant population in 2020 who declared having left their place of residence in 2015 for causes related to criminal insecurity and violence.
- Incidence of ordinary criminal offenses (selected offenses) at the municipal level.

The relationships between the variables studied in this article were identified through an analysis of the migration rates due to violence and insecurity per hundred thousand inhabitants, for each mining region. Significant differences in these rates between the regions were confirmed by performing an ANOVA followed by a post-hoc REGWQ test. Subsequently, the behavior of violence impacting migration associated with insecurity (forced internal displacement) and its relation to certain crimes in mining regions were identified through a matrix of Spearman's correlations (r) and their coefficient of determination, at the country level. The sources of information are listed in Table 1.

Identification of Metal Mining Activities

This analysis first regionalized the characteristics of metal mining activities in each municipality of the country (see Map 1), according to the following categories:

- Municipality with no mining activities
- Municipality with mining potential only (no concessions, projects, or mining conflicts)
- Municipality with mining concessions (no mining projects or conflicts)
- Municipality with mining projects (no mining conflicts)
- Municipality with conflicts related to mining activities (regardless of whether or not there is an active mining project).

The mining potential was determined based on information from the Mineralized Regions of the Mexican Geological Survey (Servicio Geológico Mexicano, 2021b). The information on mining concessions was obtained from the review of the Mining Cadastre of the Board of Economy,

Table 1. Sources of statistical information used.

| Topic	Data sources
Emigration rates	Microdata from INEGI's 2020 General Census on Population and Housing INEGI's 2015 Inter-Census Survey
Incidence of high-impact crimes	Database of incidence of common criminal offenses of the Executive Secretariat of the National Public Security System
Metal mining activities	Mining potential Mineralized Regions of the Mexican Geological Service Mining concessions. Mining cadastre of the Board of Economy Mining projects. Database of the Mexican Geological Survey. Main mining projects in Mexico Mining conflicts. Conversando con Goliath project database: participation, mobilization, and repression around neo-extractive versus environmental conflicts

Source: Own elaboration.
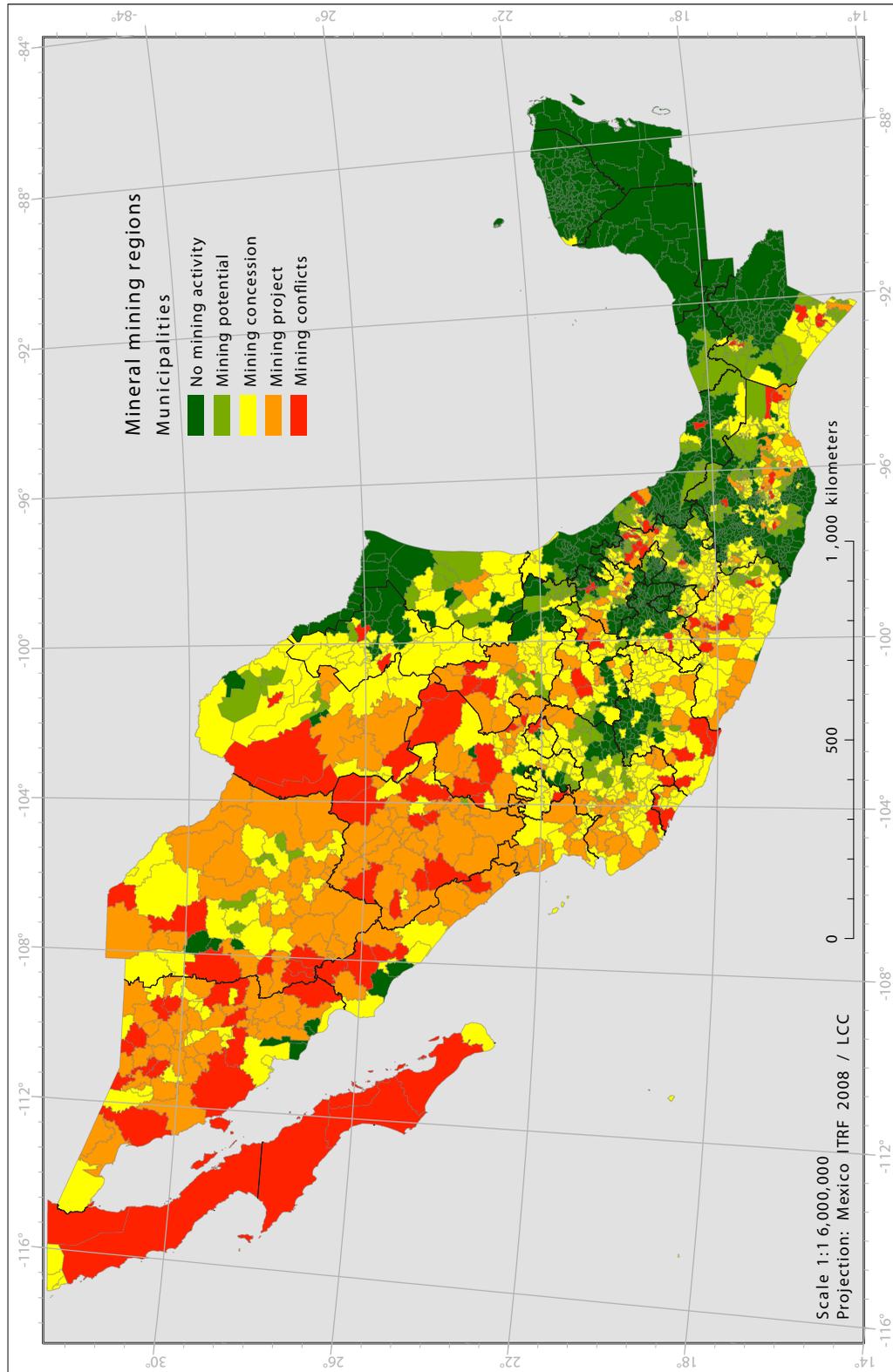
Figure 1. Regionalization of mining activities by municipality. Source: Own elaboration based on data from the Board of Economy for 2015–2019, Mexican Geological Survey (Servicio Geológico Mexicano, 2021a, 2021b), and Zaremberg *et al.* (2019).

selecting exclusively those mining concessions in force in the study period that reported the target metals of this study as relevant elements. Mining projects were obtained from the Mexican Geological Survey database corresponding to the major mining projects in Mexico (Servicio Geológico Mexicano, 2021a), again selecting only those projects reporting exploration or extraction of the target metals. Information on the incidence of mining conflicts was obtained from the database published by the *Conversando con Goliath* project: Participation, mobilization, and repression around neo-extractive versus environmental conflicts (Zaremberg *et al.*, 2019), reviewing exclusively those that occurred during the study period and related to the exploration and extraction of the target metals.

Displaced Population due to Criminal Insecurity and Violence

In Mexico, internal migration has been documented by the *Instituto Nacional de Geografía y Estadística* (National Institute of Statistics and Geography; INEGI) through population and housing censuses since 1960, although at that time the Census only recorded whether the person interviewed had previously resided in another State of the country. It was until 2000 that the Census started recording the State and municipality where the interviewee lived five years earlier. For the first time, the 2020 Census recorded in the basic questionnaire not only the State and municipality of the previous residence but also the cause of migration. Data on migration due to criminal insecurity or violence were obtained from this database. Census microdata for migration and its causes are broken down by municipality, so this was also the spatial unit used for the analysis in the present study. The total population of each municipality in 2015 was determined based on data from INEGI's 2015 Inter-Census Survey.

Incidence of Common Criminal Offenses

The incidence of common offenses was characterized by the available open data corresponding to common criminal offenses reported by the Executive Secretariat of the National Public Security System. Data on the incidence of common criminal offenses do not consider the so-called "black figures", that is, unreported crimes, since they relate to the alleged occurrence of offenses as recorded in preliminary (pretrial) inquiries either ongoing or in investigation files, reported by State Attorney General's Offices. The following high-impact

Table 2. High-impact criminal offenses considered for the present study.

Threats	Street drug dealing
Offenses against the environment	Home robbery
Offenses committed by public servants	Home theft
Dispossession	Business robbery
Extortion	Business theft
Femicide at knifepoint and others	Theft of motor vehicle
Femicide with a firearm	Robbery of four-wheeled cars
Murder at knifepoint and others	Theft of motor vehicle
Murder with a firearm	Theft of four-wheeled car
Intentional injuries at knifepoint and others	Kidnapping
Intentional injuries with a firearm	Trafficking in persons
	Rape

Source: Own elaboration based on data from the Executive Secretariat of the National Public Security System.

criminal offenses associated with violent contexts were selected from the database for the present study:

The total number of criminal offenses of each type was added up for each municipality.

Spearman's Correlation Matrix

The incidence of crime was analyzed to identify specifically which types of crimes are mostly related to migration for criminal insecurity and violence in each mining region. The correlation matrix was constructed with the municipal database on migration for criminal insecurity (standardized for the total population of each municipality), as well as the sum of the incidence of the crimes selected for each municipality in the study period (standardized for the total population of each municipality). Municipalities were grouped according to the regionalization of mining activities (creating up to five groups of municipalities: *no mining, mining potential, mining concessions, mining projects, mining conflicts*).

To construct the correlation matrix for each mining region, it was necessary to have a significant sample of municipalities in each region. Since, in some cases, a given State had only one or two municipalities within a mining region, it was determined that the State level could not be the unit of study. Therefore, States were grouped into geographic regions (North, Center, and South), according to the criteria by Diaz and Romo (2019, p. 75).

Thus, for each mining region (*no mining, mining potential, mining concessions, mining projects, and mining conflicts*) in each geographic region of the country (North, Center, and South), we calculated the correlations between the incidence of common criminal offenses and migration for criminal insecurity and violence. As the data were non-parametric, we calculated Spearman's correlation coefficient.

$$p = 1 - \frac{6 \sum d_i^2}{\text{n}(n^2 - 1)}$$

P = Spearman's Rho
n = number of cases
d_i^2 *= difference between the ranges of X and Y*

RESULTS

Linking Migration and Mining

This study sought to determine the correlation between forced internal displacement and mining activities, considering the phases of this extractive process at the national level. Table 3 shows the emigration rate according to the proposed mining regionalization. In each region (column), low and high emigration rates due to violence are marked in green and red, respectively.

At the national level, we observed a difference between regions with no mining activities and regions with mining activities and conflicts. In the sample of 2418 municipalities considered, 40.3% were found to include mining activities (974). Of these, 64.1% (624) have mining concessions; 24.2% (236), mining projects; and 11.7% (114), mining conflicts.

A significant incidence of migration due to violence is observed in areas with mining conflicts (130.9 migrants per 100 thousand inhabitants) and in zones with mining projects (122 migrants per 100 thousand inhabitants) (Table 3 and Figure 2). By State, the cases of Guerrero and Michoacan stand out for displaying migration dynamics associated with violence in the mining project and mining conflict phases, respectively. The cases of Mexico City and Quintana Roo are worth noting since they show high migration rates due to violence in areas with no mining activities. In both cases, migration is likely correlated with variables not considered in this study.

The statistical significance of the difference in rates between mining regions was explored using an ANOVA. This analysis determined that, given the *p*-value (<0.0001) associated with the *F*-statistic (7.502) with a 95% confidence interval, the information provided by the explanatory variables is significantly better than the one provided by the mean alone. The *post-hoc* REGWQ test grouped together the *mining concession*, *mining project*, and *mining conflict* regions and determined a statistically significant difference between this group and the one formed by the *no mining* and *mining potential* regions, with a 95% confidence interval.

Table 3. Migration rate due to violence and insecurity per 100 thousand inhabitants, by mining region.

Region	State	No mining	Mining potential	Mining concession	Mining project	Mining conflicts	Total
Center	Aguascalientes	82.04		38.57	49.55	40.76	47.87
Center	Mexico City	548.20					548.20
Center	Colima			168.90	281.80	149.87	174.48
Center	Guanajuato	92.05	65.61	82.57	108.65	166.86	91.41
Center	Hidalgo	51.22	41.77	33.12	48.09	40.31	44.48
Center	Jalisco	36.19	87.28	58.75	83.72	73.97	66.78
Center	Mexico	207.84	37.22	100.97	233.62	342.13	187.02
Center	Morelos	119.05	259.83	197.31	221.65	276.22	168.18
Center	Nayarit			37.62	30.16		33.52
Center	Puebla	73.80	43.30	47.04	29.56	27.07	53.27
Center	Querétaro	72.58	34.62	44.30	39.60	17.94	41.08
Center	San Luis Potosí	43.66	31.33	41.78	41.90	21.10	37.24
Center	Tlaxcala	52.19	37.43	21.75			47.93
Center	Veracruz	95.18	91.44	66.71	37.58	90.74	91.98
Center	Zacatecas	15.59	149.46	143.37	100.15	105.53	109.57
North	Baja California			107.28		36.85	79.11
North	Baja California Sur			82.38		31.93	42.02
North	Chihuahua	238.11	36.52	86.28	111.25	339.90	126.68
North	Coahuila	-	38.15	108.05	20.67	30.31	64.67
North	Durango		13.75	107.97	72.72	71.88	75.53
North	Nuevo León	120.42	8.99	98.93		65.57	101.68
North	Sinaloa	41.94		56.52	198.38	429.21	200.77
North	Sonora	29.05		78.31	74.71	71.47	72.59
North	Tamaulipas	299.81	223.71	222.66	231.56		258.90
South	Campeche	51.62					51.62
South	Chiapas	24.91	18.48	31.08	23.03	23.73	23.81
South	Guerrero	186.76	174.21	403.44	727.51	358.13	406.64
South	Michoacán	72.40	240.43	160.98	264.13	613.44	153.15
South	Oaxaca	35.49	36.28	37.85	23.51	6.95	35.05
South	Quintana Roo	349.78					349.78
South	Tabasco	77.13	236.66	76.67			114.64
South	Yucatán	16.52		26.47			16.62
	Total	82.16	60.75	103.08	122.00	130.59	90.69

Source: Own elaboration based on estimates of migration rates for violence and insecurity, 2015–2019.
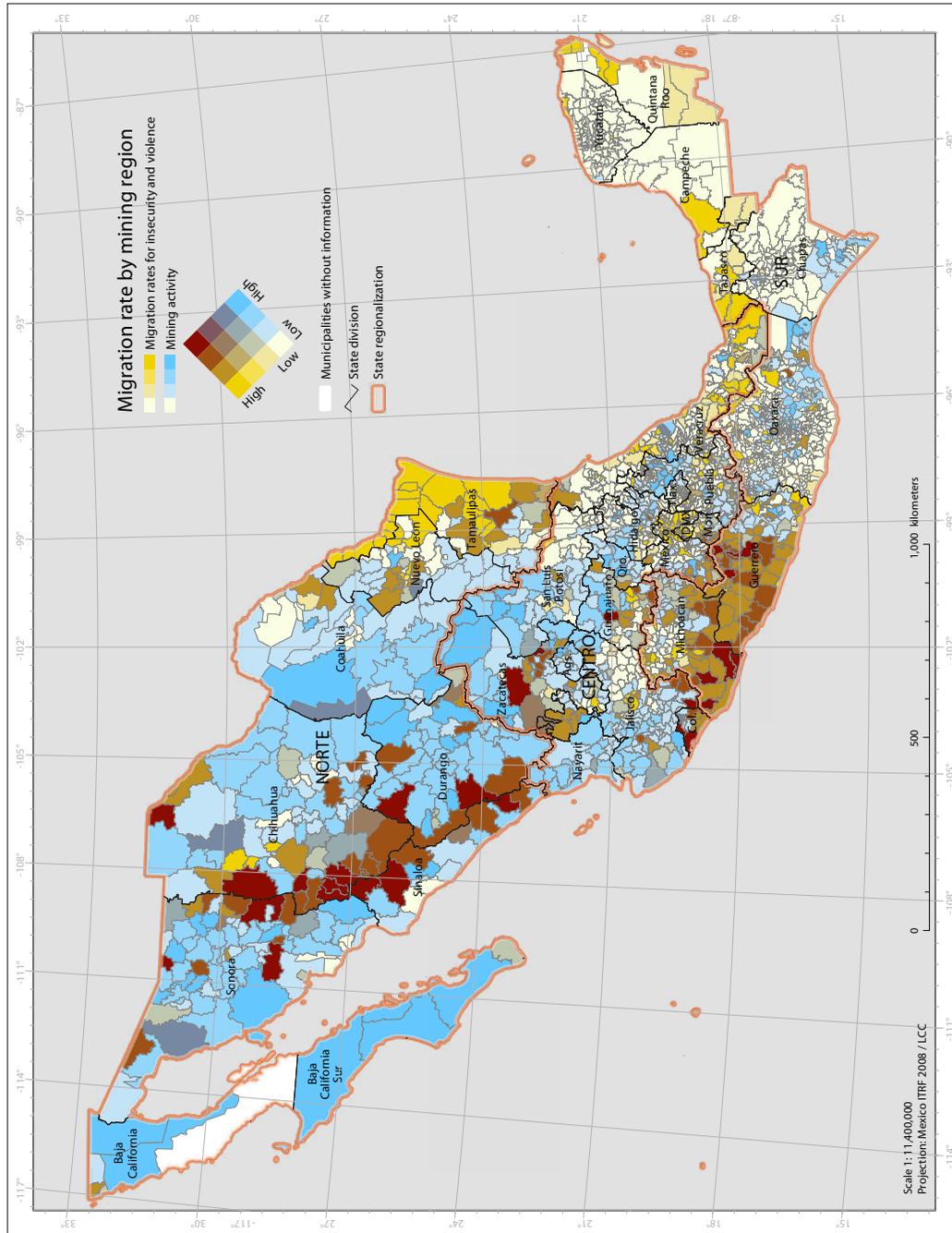
Figure 2 uses the following criteria for symbology. Mining activity axis: 1) no mining and mining potential, 2) mining concessions, 3) mining projects, 4) mining conflicts. The migration for insecurity and violence axis uses country averages of migration rates for insecurity and violence in Table 3, corresponding to 1) no mining, 2) mining concessions, 3) mining projects, and 4) mining conflicts.

Figure 2. Migration rate by mining region. Source: Own elaboration based on estimates of migration rates for violence and insecurity, 2015–2019.

In the Central Region, two States with important mining activities stand out (Estado de Mexico and Morelos). We observed high emigration rates in the mining conflict phase in Estado de México (342.13 migrants) and medium-high rates in Morelos, in territories with both mining potential and ongoing mining projects and conflicts.

In the Nort Region of Mexico, the cases of Chihuahua and Sinaloa are worth highlighting, which have a high emigration rate in territories with mining conflicts. Tamaulipas shows medium-high and high migration rates in territories, irrespective of the mining phase; therefore, it is reasonable to assume that these rates are not necessarily related to mining.

The scenario in the South Region is markedly different from the situation in the North and Center Regions. Very high emigration rates due to violence are observed in territories with mining activities, especially where there are *mining conflicts* and *mining projects*, in Michoacán (this State is located in the north-central part of the country but, according to the proposed regionalization methodology, it was included in the South Region) and Guerrero. However, it should be noted that these States have medium-high and high migration rates in municipalities with other categories of mining activity.

Relationship between the Occurrence of Criminal Offenses and Mining Activities

For Spearman's correlations (r) and their coefficient of determination by category, the following criteria were applied ($p \leq 0.05$): $r \geq 0.5$, high correlation; $0.2 \leq r < 0.5$, intermediate correlation; $r < 0.2$, low correlation. Significant differences were observed between the three regions of Mexico analyzed, as described below.

From Tables 4, 5, and 6, in the North Region, the highest statistically significant correlation is

Table 4. Spearman's coefficients of determination (r^2) by type of crime and mining activity in the North Region of Mexico.

Type of crime	General	No mining	Mining potential	Mining concession	Mining project	Mining conflicts
Intentional homicide at knifepoint and others	0.10	0.16	0.07	0.11	0.07	0.37
Murder with a firearm	0.13	0.13	0.15	0.06	0.23	0.26
Robbery of four-wheeled motor car	0.14	0.19	0.16	0.12	0.10	0.16
Intentional injuries with a firearm	0.00	0.01	0.03	0.01	0.02	0.15
Femicide with firearm	0.05	0.01	0.00	0.04	0.10	0.13
Rape	0.00	0.00	0.01	0.02	0.01	0.12
Femicide at knifepoint and others	0.01	0.01	0.04	0.02	0.01	0.06
Offenses against the environment	0.04	0.02	0.00	0.03	0.15	0.06
Trafficking in persons	0.04	0.05	0.07	0.04	0.04	0.04
Offenses committed by public servants	0.03	0.00	0.25	0.02	0.04	0.01
Robo de vehículo automotor de 4 ruedas sin violencia	0.06	0.08	0.48	0.14	0.00	0.01
Violent home robbery	0.04	0.03	0.01	0.08	0.04	0.01
Dispossession	0.02	0.11	0.00	0.03	0.01	0.01
Business theft	0.02	0.08	0.01	0.02	0.00	0.01
Non-violent home robbery	0.00	0.01	0.00	0.02	0.00	0.01
Extortion	0.04	0.00	0.10	0.09	0.01	0.01

Table 4. Continue.

Type of crime	General	No mining	Mining potential	Mining concession	Mining project	Mining conflicts
Violent business robbery	0.01	0.14	0.04	0.01	0.00	0.01
Kidnapping	0.02	0.12	0.03	0.04	0.00	0.00
Threats	0.02	0.09	0.07	0.02	0.00	0.00
Intentional injuries at knifepoint and others	0.00	0.00	0.01	0.01	0.00	0.00
Street drug dealers	0.02	0.16	0.22	0.03	0.00	0.00

Cell color in Tables 4, 5, and 6 according to the following criteria:
$r^2 \geq 0.26$ – substantial determination (red)*;
$0.13 \leq r^2 < 0.26$ – moderate determination (orange)*
$0.02 \leq r^2 < 0.13$ - weak determination (yellow)*
$r^2 < 0.02$ – very weak determination.
*$p \leq 0.05$

Source: Own elaboration based on the methodology described above.

Table 5. Spearman's coefficients of determination (r^2) for the Center Region of Mexico, by type of crime and mining activity.

Type of crime	General	No mining	Mining potential	Mining concession	Mining project	Mining conflicts
Feminicide with a firearm	0.06	0.13	0.06	0.02	0.04	0.21
Murder with a firearm	0.12	0.14	0.12	0.09	0.34	0.21
Street drug dealers	0.11	0.14	0.05	0.15	0.10	0.19
Kidnapping	0.13	0.16	0.17	0.05	0.05	0.10
Trafficking in persons	0.10	0.15	0.06	0.05	0.07	0.10
Theft of four-wheeled motor car	0.15	0.23	0.18	0.07	0.05	0.09
Intentional injuries with a firearm	0.06	0.13	0.02	0.03	0.08	0.07
Extortion	0.10	0.18	0.15	0.02	0.01	0.05
Business theft	0.12	0.22	0.22	0.03	0.02	0.05
Feminicide at knifepoint and others	0.08	0.08	0.13	0.06	0.04	0.03
Non-violent home burglary	0.12	0.23	0.15	0.03	0.02	0.02
Business robbery	0.17	0.29	0.21	0.07	0.03	0.02
Robbery of four-wheeled motor car	0.13	0.24	0.11	0.04	0.06	0.01
Offenses committed by public servants	0.04	0.09	0.06	0.00	0.00	0.01
Dispossession	0.04	0.09	0.06	0.00	0.00	0.00
Offenses against the environment	0.05	0.09	0.03	0.01	0.01	0.00
Threats	0.01	0.00	0.10	0.02	0.00	0.00

Table 5. Continue.

Type of crime	General	No mining	Mining potential	Mining concession	Mining project	Mining conflicts
Violent home burglary	0.14	0.23	0.13	0.08	0.01	0.00
Intentional homicide at knifepoint and others	0.08	0.09	0.07	0.09	0.17	0.00
Intentional injuries at knifepoint and others	0.07	0.13	0.10	0.02	0.05	0.01
Rape	0.02	0.06	0.00	0.04	0.00	0.01

Source: Own elaboration based on the methodology described above.

Table 6. Spearman's coefficients of determination (r^2) for the South Region of Mexico, by type of crime and mining activity.

Type of crime	General	No mining	Mining potential	Mining concession	Mining project	Mining conflicts
Murder with a firearm	0.21	0.22	0.02	0.16	0.28	0.27
Intentional injuries with a firearm	0.15	0.20	0.01	0.08	0.12	0.19
Murder at knifepoint and others	0.17	0.21	0.03	0.13	0.12	0.15
Feminicide with a firearm	0.06	0.07	0.02	0.03	0.07	0.12
Robbery of four-wheeled motor car	0.20	0.30	0.00	0.09	0.14	0.10
Theft of four-wheeled motor car	0.19	0.32	0.00	0.05	0.03	0.09
Kidnapping	0.16	0.24	0.03	0.08	0.07	0.07
Trafficking in persons	0.07	0.13	0.01	0.03	0.02	0.05
Business theft	0.17	0.32	0.01	0.03	0.01	0.05
Street drug dealers	0.12	0.17	0.00	0.11	0.01	0.04
Non-violent home burglary	0.13	0.24	0.00	0.02	0.01	0.04
Feminicide at knifepoint and others	0.08	0.13	0.02	0.03	0.04	0.04
Offenses committed by public servants	0.04	0.09	0.07	0.00	0.00	0.03
Extortion	0.13	0.23	0.05	0.03	0.03	0.02
Rape	0.07	0.13	0.02	0.03	0.03	0.02
Business robbery	0.17	0.31	0.01	0.05	0.04	0.01
Offenses against the environment	0.05	0.13	0.01	0.01	0.01	0.01
Dispossession	0.09	0.20	0.00	0.01	0.00	0.00
Violent home robbery	0.13	0.28	0.00	0.05	0.00	0.00
Intentional injuries at knifepoint and others	0.11	0.22	0.01	0.02	0.00	0.00
Threats	0.03	0.02	0.02	0.02	0.00	0.00

Source: Own elaboration based on the methodology described above.

observed between kidnapping and regions with mining potential. In the Center Region, the same finding is observed between murder with a firearm and zones with mining projects. The South Region shows a different pattern, as zones with mining projects and mining conflicts show very high statistically significant correlations with much broader types of crimes. Thus, the South Region shows a total of 57 moderate correlations and 16 high correlations with high-impact crimes, mainly in regions with mining conflicts.

In general, the *mining conflict* region is highly correlated with several crimes, particularly theft, intentional injuries, kidnapping, and homicide of all sorts. On the other hand, robbery of four-wheel motor vehicles and extortion stand out with a moderate correlation.

It was important to identify municipalities with mining potential that has not yet been exploited, to contrast the data versus those of municipalities with mining activities. Municipalities with *no mining* or with *mining potential* are usually territories with valleys and plains, more suitable for agriculture and urban development, which generally concentrate the largest populations, unlike areas with a more rugged landscape, less populated, where *mining potential* and *mining activities* are often found. Therefore, the best control group to contrast the data are municipalities that have *mining potential* but do not yet have *mining concessions*, *projects,* or *conflicts*.

As part of the main results, the statistical model shows that the regions with cases in the *mining project* phase are related to violent environments, since these show high correlations with crimes such as homicide, kidnapping, robbery, and intentional injuries. Regions with *mining conflicts* are highly correlated with homicide, robbery, intentional injuries, drug dealing, and kidnapping.

This evidence indicates that, as mining activities progress in a given region, there is an increasing trend in migration due to violence and insecurity. At the national level, the lowest migration rate for insecurity and violence is observed in regions with *mining potential* but with no *mining concessions* or *projects*, with 61 migrants per 100 thousand inhabitants; this figure is lower than the country average

of 91 migrants per 100 thousand inhabitants. The rate increases as mining activities progress: 103 migrants per 100 thousand inhabitants in regions with *mining concessions*, 122 in regions with *mining projects*, and 131 in regions with *mining conflicts*. On average, forced displacement more than doubles from mining-free regions to regions with intense mining activity.

The most extreme cases of migration due to insecurity and violence in regions with intense mining activity are Guerrero, Michoacán, and Sinaloa. Guerrero is the most complicated case: while municipalities with *no mining* (*mining potential* only) have a rate of 174 migrants per 100 thousand inhabitants due to insecurity (the lowest in the State), municipalities with *mining projects* show the highest migration rate associated with insecurity in the country: 728 migrants per 100 thousand inhabitants. Municipalities with *mining conflicts* in Michoacán, with 613 migrants per 100 thousand inhabitants, have the second-highest country average of insecurity migration presumably linked to mining. Sinaloa has an average rate of 429 migrants per 100 thousand inhabitants for insecurity in municipalities with *mining conflicts*, a figure ten-fold higher than the average in municipalities *with no mining* in the State (42 migrants per 100 thousand inhabitants). The cases of Chihuahua and Estado de Mexico are practically identical, with 340 and 342 migrants per 100 thousand inhabitants, respectively, for insecurity in municipalities with *mining conflicts*, compared to only 37 in municipalities with *no mining*.

CONCLUSIONS

Despite the significant limitations in the availability of official FID data, some general trends can be observed through indicators that provide indirect evidence of this phenomenon. In this study, we constructed a proxy by investigating the emigration associated with criminal incidence and by determining the correlation of this demographic phenomenon with the extent of conflicts observed in regions under different implementation phases of metal mining projects. The migration rate cau-

sed by violence and insecurity in sites with social conflicts due to mining activity is more than twice the rate in territories with no mining concessions.

The data analyzed revealed that some 251 thousand persons reported having suffered forced displacement due to the incidence of crime and violence. In this respect, the three regions of Mexico differ in the type and development of mining activities and the violence profile. The findings of this study show that emigration related to insecurity — especially in the South Region of Mexico — does occur in mining regions. This correlation shows that forced displacement occurs in these zones and can be considered a part of the impacts of insecurity, confirming the working hypothesis of the present study, with the variations just described. This relationship has not been addressed as such in studies focused on mining in Mexico, so multiple details remain to be investigated.

Although the statistical techniques used in our work are insufficient to determine a direct causality of metal mining on the potential trends in FID, the findings reported herein are a significant outcome of the exploratory exercise conducted in this study. These results set the bases to raise new hypotheses that will strengthen further explanatory research lines.

This study provides evidence of the consequences of territorial organization of extractive activities. We aim to contribute to the knowledge of a phenomenon characterized by major limitations of empirical analyses due to scarce data and poor institutional mechanisms, which restrain its quantification. Similarly, the methodology used can provide insight and approximations for regional studies on mining, violence, and the impact of the latter.

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