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DISCUSSION PAPER SERIES

IZA DP No. 18028

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ABSTRACT

Is Drug-Related Violence Fueling Emigration from Central America?*

We study how drug-related violence affects emigration from Central America, a region with rapidly rising migration to the United States. Using multiple data sources, we apply an instrumental variables strategy based on proximity to drug-trafficking routes and coca production in Colombia. We find that violence significantly increases intentions, plans, and preparations to emigrate—especially to the U.S.—with stronger effects among young and high-skilled individuals. Mediation analysis suggests this response is driven by declining economic activity and, more importantly, deteriorating labor market conditions caused by escalating violence.

JEL Classification: J61, O15, N96

Keywords: migration, drug trafficking, violence, economic activity, labor markets

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1 Introduction

Migration out of Central America has constituted one of the top three sources of new arrivals to the U.S. over the past decade, standing out as the most significant origin after China and India. During the 2010s, it surpassed Mexican inflows, which had historically been the largest fraction of U.S. immigrants (Pew Research Center, 2017). This shift in Latin American migration patterns has fueled policy concerns regarding potential strategies to manage and mitigate the large inflows of Central American migrants seen in recent years. In 2021, for example, U.S. President Biden appointed Vice President Harris to lead the *Root Causes Strategy*, allocating over USD 4 billion to address the drivers of irregular migration, including drug trafficking and its consequences (Rose et al., 2021).

The main drivers of recent migration from Central America to the U.S. are climate change and violence (Baez et al., 2017; Abuelafia et al., 2019; Bermeo and Leblang, 2021; Clemens, 2021; Linke et al., 2023). Climate change has reduced agricultural productivity, leading to negative income shocks that prompt people to either migrate or shift towards non-agricultural activities (Halliday, 2006; Ibáñez et al., 2022; Ceballos et al., 2024). At the same time, a sharp rise in violence has turned Central America into one of the most dangerous regions globally. Although it is home to just 0.6% of the world's population, it accounted for about 5% of global homicides in the 2010s (UNODC, 2019). This, in turn, deteriorated quality of life and intensified migration pressures (Contreras, 2022; Cutrona et al., 2023; Abreha et al., 2025). This shift can be primarily attributed to the region's role as a drug transit area between South America and the United States. Following Mexico's 2006 security strategy, which aimed to combat drug trade by reinforcing the capacity of the Mexican military and police force (Dell, 2015), trafficking routes were diverted through Central American countries. As a result, while in the 2000-2005 period roughly equal amounts of cocaine seizures were reported in Mexico and Central America, by 2011 nearly 90% of cocaine seizures occurred in the latter region (UNODC, 2012).

In this paper, we examine the causal impact of drug-related violence in Central American countries (Costa Rica, El Salvador, Honduras, and Panama) on people's emigration behavior between 2010 and 2016. We also investigate the economic and labor market mechanisms driving these effects. Using an instrumental variables strategy, we leverage exogenous temporal variation in

Colombian drug production intensity—the primary supplier of cocaine to the U.S. market (UNODC, 2012)—along with the average distance from each sub-national district to drug-trafficking routes within each country.

We utilize various data sources in our analysis. First, we estimate emigration behavior from the Gallup World Poll. This dataset allows us to assess emigration intentions at the individual level for the countries in our sample, as well as evaluate whether individuals made plans and preparations to act on those intentions. The variables used have proven significantly relevant in predicting actual migration behavior in the economic literature (Clemens and Mendola, 2024). Second, we use sub-national homicide rates for each country over time as an explanatory variable, derived from administrative records in the countries under study. Furthermore, we employ data from United Nations Office on Drugs and Crime (UNODC) that identifies drug-trafficking routes—whether through air, sea, or land—for each sub-national district in our sample. Additionally, we employ data on cocaine production in Colombia over the analysis period, sourced from UNODC.

To identify the channels through which the effects operate, we first proxy economic activity at the sub-national level by utilizing nighttime light density following established practices in the development economics literature (Henderson et al., 2012; Michalopoulos and Papaioannou, 2013; Donaldson and Storeygard, 2016; Ch et al., 2021). Second, we use subjective economic variables from Gallup World Poll to estimate the effect on people's perceptions on the economy and their living standards. Finally, we use labor market variables from the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) (2024), which allow us to analyze labor market dynamics in each economy based on actual outcomes such as labor force participation, employment, labor income, and hours worked.

Our estimates reveal three findings related to emigration from Central America. First, drug-related violence increases the desire, plans, and steps people take to emigrate, variables that according to the literature signal a substantial effect on actual migration behavior (Bertoli and Ruyssen, 2018; Tjaden et al., 2019; Clemens and Mendola, 2024). Second, we show that this effect is primarily observed in plans to migrate to the U.S., underscoring drug-related violence as a key driver of the recent surge in Central American migration to that country. Finally, we find that these emigration effects are mainly concentrated among young and high-skilled individuals. This can potentially have significant implications for economic development in the regions they leave

behind, but also for the U.S. economy.

In exploring the mechanisms behind these effects, we demonstrate that drug-related violence leads to a decline in economic activity, as measured by nighttime light density, in regions heavily impacted by drug trafficking. This economic decline deteriorates individuals' perceptions of the economy and their living standards, while also negatively affecting labor market conditions. Specifically regarding the labor market, we find that rising homicide rates due to drug-trafficking exposure reduces labor force participation, employment, and labor income in the most severely affected districts, acting as a catalyst for migration.

Finally, we perform a mediation analysis within an instrumental variables framework to disentangle the channels through which drug-related violence affects emigration (Dippel et al., 2020). We decompose the total effect into a *violence channel*—the direct impact of violence—and an *economic channel*, reflecting the deterioration of economic activity and labor market opportunities as a result of the spike in violent incidents. Our results show that the *economic channel* is the dominant one: nearly all emigration induced by drug-related violence stems from worsening labor market conditions. This highlights the urgent need for local governments in Central America to implement targeted policies that effectively address the economic and labor market challenges posed by drug-related violence to mitigate the emigration trends observed in recent years.

This paper contributes to three main strands of the economic literature. First, we advance research on the *root causes* of emigration from Central America to the U.S.—a growing yet understudied source of migration. While most U.S. immigration studies have focused on Mexico as an origin country (Chiquiar and Hanson, 2005; McKenzie and Rapoport, 2010; Kaestner and Malamud, 2014; Basu and Pearlman, 2017; Orozco-Aleman and Gonzalez-Lozano, 2018; Daniele et al., 2023), Central American migration rose by 25% between 2010 and 2019, surpassing Mexico and positioning the region as one of the main sources of U.S. immigrants (Pew Research Center, 2017). To our knowledge, this is one of the first studies to examine drug-related violence as a *root cause* of U.S.-bound migration from Central America. Related work includes Clemens (2021), who studies the impact of violence on child migration, and Abreha et al. (2025), who analyze how President Bukele's crime crackdown in El Salvador affected migrant encounters at the U.S. border.[1] Unlike previous studies, we use individual-level data from multiple countries to analyze the entire

[1] See also Ibáñez et al. (2022) on how climate shocks influence migration from El Salvador.

population and examine the economic mechanisms linking drug-related violence to emigration. This broader approach enables us to identify the most responsive sociodemographic groups and discuss potential implications for both origin and destination countries.

Secondly, this paper contributes to the literature on the socioeconomic impacts of drug-related violence (Calderón et al., 2015; Dube et al., 2016; Padilla-Romo and Peluffo, 2023). Prior studies show that violence often increases human mobility, which may yield positive effects through remittances, skill transfers, or labor reallocation (Moore and Shellman, 2006; Engel and Ibáñez, 2007; Ibáñez and Vélez, 2008; Bohra-Mishra and Massey, 2011; Basu and Pearlman, 2017; Orozco-Aleman and Gonzalez-Lozano, 2018; Clemens, 2021; Daniele et al., 2023; Leo et al., 2024; Abreha et al., 2025). Simultaneously, violence tends to reduce employment, labor force participation, and wages in affected regions (Ashby and Ramos, 2013; Enamorado et al., 2014; Dell, 2015; Rozo, 2018; Velásquez, 2020).

However, this literature focuses mainly on drug producing countries like Mexico and Colombia, overlooking the distinct dynamics of drug transit countries such as those in Central America (UNODC, 2012). In our analysis, we focus on countries that serve primarily as transit points for drug trafficking rather than producers. This distinction is critical for two main reasons. First, transit countries represent the majority of nations involved in the global drug trade: of the 22 countries identified by the U.S. Government as major drug trafficking or production hubs, only 8 are producers, while 14 are classified solely as transit countries. More broadly, approximately 75% of all drug trade–involved countries are transit-only (U.S. Department of State, 2017). Second, unlike producer economies—which may capture some economic gains from production in terms of GDP or employment—transit countries typically do not benefit economically, yet still suffer from the violence and instability associated with trafficking (Montenegro et al., 2019; DNP, 2021; Thomson et al., 2024; Marín-Llanes et al., 2024). These spillovers can substantially harm economic activity, labor markets, and ultimately influence people's decisions to migrate. In fact, our mediation analysis shows that the *economic channel* dominates over the *violence channel*: worsening economic conditions are the primary driver of violence-induced emigration.

Finally, this paper contributes to the literature on brain drain in developing countries by identifying drug-related violence as a key push factor behind the emigration of young (under 40) and high-skilled individuals—groups vital for entrepreneurship, innovation, and long-term economic

growth (Mayr and Peri, 2009; Docquier and Rapoport, 2012; Hanushek and Woessmann, 2012; Docquier et al., 2014; Jones, 2014; Liang et al., 2018; Deming, 2022; Acemoglu et al., 2022; Anelli et al., 2023). To our knowledge, this is the first study to link drug-related violence to the selective outflow of these demographic groups. If violence persists, such emigration is likely to continue, further undermining development and labor market conditions in origin countries.

Moreover, given that the U.S. is the primary destination for these migrants, our findings help anticipate future migration waves from Central America. These flows could represent valuable inputs for the U.S. economy, which is experiencing a rapid demographic change, with an aging population (Acemoglu and Restrepo, 2017; Furtado, 2022). In particular, the arrival of young, high-skilled workers may enhance productivity, support the adoption of new technologies, and help meet the increasing demand for eldercare and nursing services anticipated in the coming decades (Murphy and Welch, 1990; Acemoglu and Restrepo, 2022; Furtado and Ortega, 2023; Furtado and Jolly, 2025).

The paper is organized as follows. Section 2 provides background on migration patterns from Central America—primarily to the U.S.—and examines their connection to drug production, trafficking, and the resulting violence in the region. Section 3 describes the data sources and presents descriptive statistics. Section 4 outlines the empirical strategy, and Section 5 presents the main results on emigration decisions, along with robustness exercises. Section 6 explores the mechanisms driving these effects and performs mediation analysis to disentangle the main channels through which drug-related violence affects emigration intentions. Section 7 examines heterogeneity by individual characteristics. Finally, Section 8 concludes.

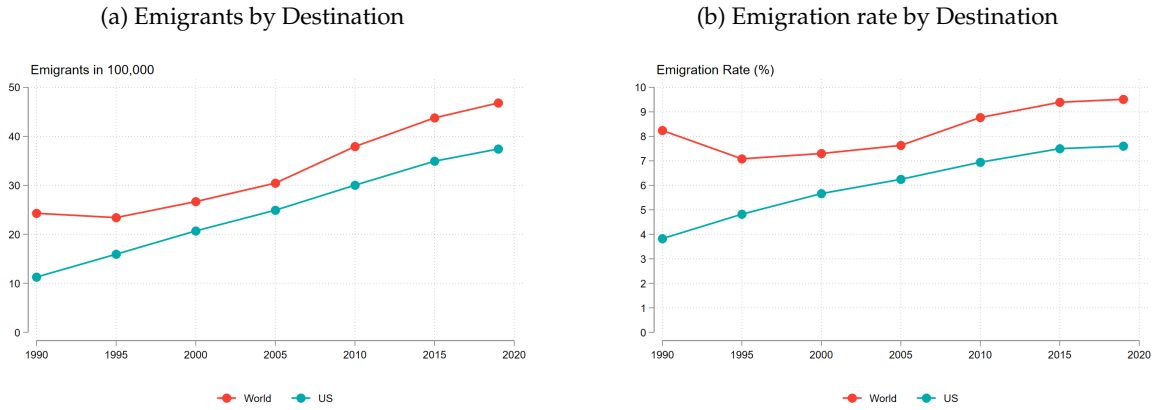
2 Context

2.1 Migration from Central America and towards the U.S.

Central America has historically experienced negative net migration, with more people leaving than settling in the region (Masferrer et al., 2019), a trend that has recently intensified. Panel (a) of Figure 1 shows that between 2005 and 2015, the number of Central American emigrants rose by approximately 44%, from 3 to about 4.4 million. When looking at specific countries, we see that there are heterogeneous patterns: 63% for Honduras, 35% for El Salvador, 18% for Costa Rica, and

15% for Panama (see Figure B.1 in Appendix B for results by countries). Panel (b) of Figure 1 indicates that the observed increase in emigration was not solely due to population growth in Central America. Our estimates show that the share of emigrants relative to the region's population rose, indicating a growing likelihood of emigration. According to our calculations, the emigration rate relative to the population of origin increased from 7.6% to 9.4% between 2005 and 2015.

Figure 1: Emigration from Central America towards the World and the U.S., 1990-2019



Panel (a) of the figure shows the number of emigrants from Central America to the world (red line) and to the U.S. (blue line). Panel (b) shows the same number of emigrants relative to the population in Central America. Source: Own elaboration based on data from UNDESA.

Figure 1 suggests that the destination preferred by most Central American migrants is the U.S. This is particularly true for countries in the *Northern Triangle* (Guatemala, El Salvador, and Honduras), as shown in Figure B.1 in Appendix B. On average, from 2005 to 2015, approximately 4 out of every 5 Central American emigrants settled in the U.S.

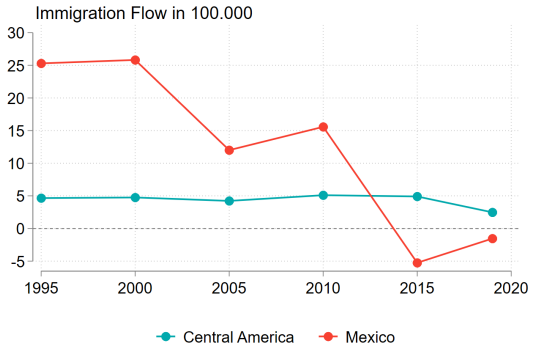
This trend resulted in the population of Central American immigrants in the U.S. growing at the fastest rate among all immigrant groups during the 2007–2015 period, surpassing traditional source countries like Mexico (Pew Research Center, 2017). According to our calculations, based on United Nations data, the number of Central American immigrants in the U.S. increased by 25% between 2010 and 2019, whereas the Mexican immigrant population decreased by 5%.

Figure 2 provides further insights into these trends. Panel (a) plots five-year immigration flows from Central America and Mexico to the U.S. over the 1995-2019 period, while Panel (b) shows the share of encounters of Central American and Mexican citizens at the U.S. border relative to

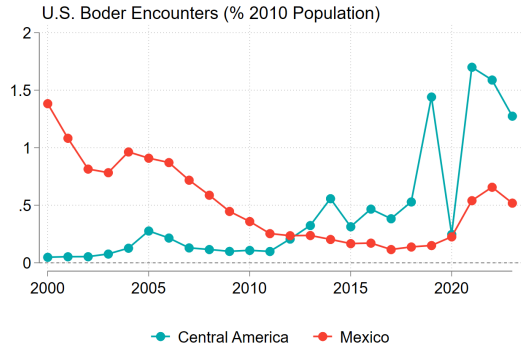
the 2010 population at origin for the 2000-2023 period.[2] Whereas Panel (a) captures the number of individuals who successfully entered the U.S., Panel (b) reflects those who attempted to enter but were apprehended or denied entry (Figure B.2 in Appendix B shows the same information as Panel (b) of Figure 2, but disaggregated by country within Central America).

Figure 2: Immigration from Central America and Mexico to the U.S.

(a) Inflow of immigrants, 1995-2020



(b) U.S. Border Encounters, 2000-2023



Notes. The figure in panel (a) shows the number of the 5-year change in the stock of migrants in the U.S. originating from Central America and Mexico. Figure in panel (b) shows the share of the number of encounters of citizens by the U.S. Customs and Border Protection (CBP) or the Office of Field Operations (OFO) relative to the 2010 population of each origin region. Encounters include the apprehension of citizens and/or a determination of inadmissibility by OFO for a person requesting admission at a port of entry (land, sea, or air) under Title 8 authority for each origin in the figure. Source: Own elaboration based on data from UNDESA and the U.S. Department of Homeland Security.

Three key insights emerge from Figure 2. First, the flow of Central Americans who successfully migrated to the U.S. has remained relatively stable over time, resulting in an increase in the stock of Central Americans in the U.S., as shown in Figure 1. However, the number of individuals attempting to migrate from Central America but being apprehended or denied entry at the U.S. border has risen sharply, particularly between 2010 and 2020. Second, immigration from Mexico has declined significantly, even becoming negative during the 2010–2019 period. This trend aligns with the substantial drop in the share of encounters at the U.S. border of Mexican citizens relative to Mexico's population, suggesting that the U.S. has become a less attractive destination for Mexican migrants over time. Finally, these contrasting dynamics highlight the growing significance of

[2] An encounter is defined as an episode in which undocumented migrants are either apprehended and expelled from the U.S. or allowed to go through specific proceedings, including seeking asylum. These encounters are conducted by the Customs and Border Protection (CBP) Office of Field Operations (OFO) or U.S. Border Patrol (USBP). They can occur under Title 8 authority, which indicates a determination of inadmissibility for individuals requesting admission at a port of entry (land, sea, or air) or for the arrest of removable noncitizens by USBP. Additionally, encounters may involve expulsion from the U.S. under Title 42 authority to prevent the spread of COVID-19.

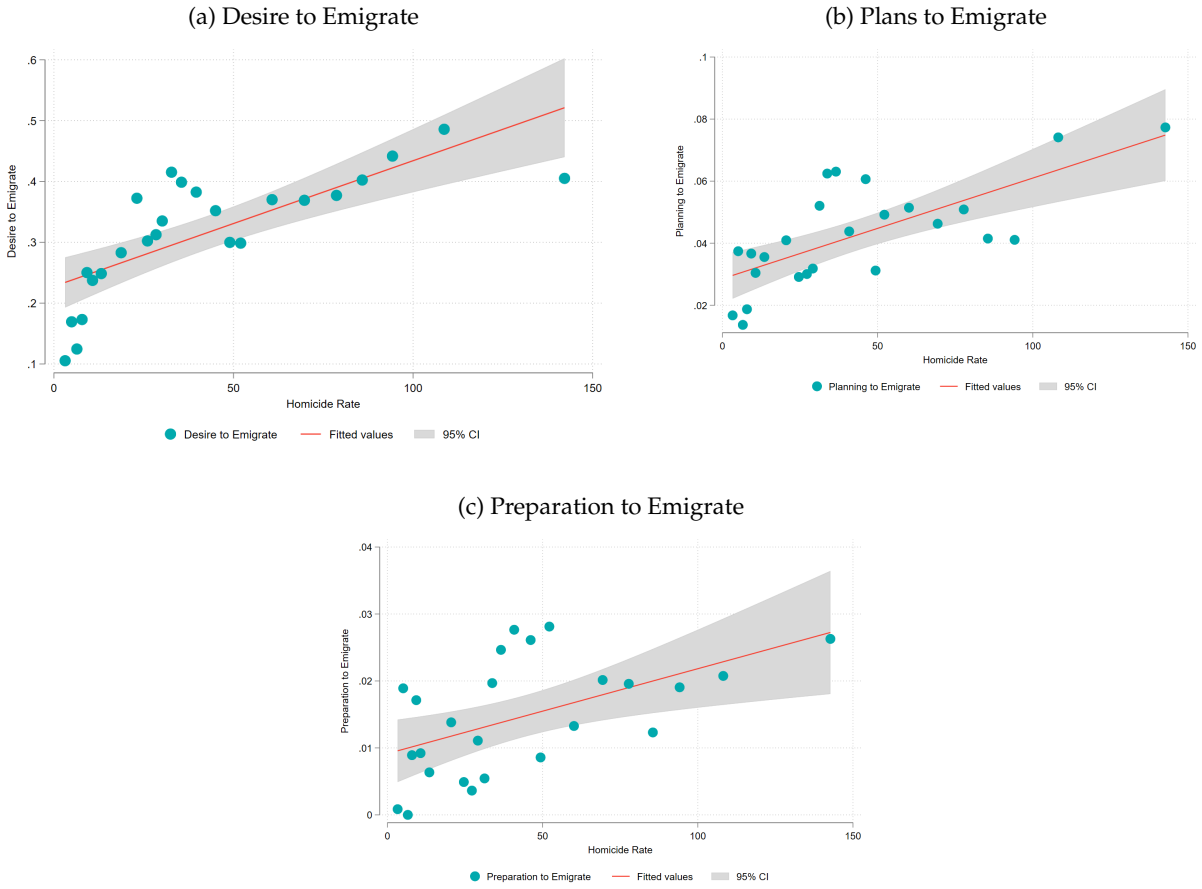
Central America as a source of immigrants to the U.S., particularly over the past decade.

The rise in migration intentions among Central Americans has been especially pronounced in regions affected by high levels of drug-related violence. Figure 3 shows the relationship between homicide rates—sourced from administrative data—and various measures of emigration behavior across Central American sub-national districts from 2010 to 2016. Specifically, it shows the reported probability of desiring to emigrate in general, the probability of planning to emigrate, and the probability of preparing to do so, all obtained from the Gallup World Poll surveys.

The scatter plots reveal a clear positive correlation: districts with higher homicide rates tend to report greater intentions, plans, and preparation to migrate. This pattern highlights violence as a powerful driver of migration decisions, consistent with broader evidence on the determinants of migration (Hatton, 2020). In fact, between 2010 and 2019, the share of encounters at the U.S. border relative to the corresponding population at origin in 2010 rose sixfold for Salvadorans and by almost twenty times for Hondurans (Figure B.2 in Appendix B)—two nationalities from countries with some of the highest levels of drug-related violence. These trends support the central hypothesis of this paper: that drug-related violence has played a significant role in shaping both the intentions and actual migration decisions of Central Americans towards the U.S.

The economic literature identifies various factors driving large-scale migration episodes such as the one from Central America, broadly categorized into two groups, namely *pull* and *push* factors. *Pull* factors primarily involve the pursuit of better economic opportunities abroad and the need of reunification with relatives or friends who migrated in the past (some papers studying *pull* factors as main determinants of migration, such as networks in the destination country or economic perspectives, are for instance: McKenzie et al., 2010; Grogger and Hanson, 2011; Elsner, 2013; Dustmann et al., 2015; Mahajan and Yang, 2020; Anelli et al., 2023).

Figure 3: Relationship Between U.S.-Bound Emigration Behavior and District-Level Violence



Source: Own elaboration based on data from Gallup World Poll data and Administrative Records.

In the case of Central America, World Bank data indicate that employment and income differentials—adjusted for purchasing power parity—consistently favor migrants from El Salvador and Honduras compared to their counterparts in their home countries. This results in significantly better living conditions in the U.S., compared to their countries of origin (World Bank, 2022). Similarly, migrants from the *Northern Triangle* living in the U.S. often identify the pursuit of better economic opportunities as the primary driver of their decision to migrate, with family reunification being the second most common reason (Abuelafia et al., 2019). These factors collectively serve as powerful incentives, encouraging individuals from Central America to seek a better quality of life in the U.S.

On the other hand, *push* factors, notably climate change and violence, play a significant role in driving Central American emigration (Halliday, 2006; Abuelafia et al., 2019; Bermeo and Leblang,

2021; Clemens, 2021; Sviatschi, 2022; Cutrona et al., 2023; Abreha et al., 2025). Climate change has intensified adverse weather events and degraded soil conditions, undermining income and livelihoods, prompting out-migration (Halliday, 2006; Ibáñez et al., 2022; Ceballos et al., 2024). Similarly, violence—largely fueled by drug trafficking through Central America from producer countries like Colombia to consumer countries such as the U.S.—has made the region one of the most violent in the world (UNODC, 2019). This violence is widely recognized in policy and academic circles as a key driver of migration towards destinations like the U.S., Canada, and Spain (Hatton, 2020; Contreras, 2022; Cutrona et al., 2023; Hanson et al., 2023; Abreha et al., 2025). In this paper, we provide causal evidence that drug-related violence is a major factor behind migration from Central America to the U.S. Specifically, we argue that deteriorating economic activity and worsening labor market conditions linked to escalating violence are pivotal for emigration decisions.

The evidence in this section suggests that there are strong incentives to emigrate from Central America, which result from several different causes. Recently, there has been greater attention on emigrants who attempt to reach the U.S. because of media coverage highlighting the challenging conditions faced during their northbound journey. Between 2018 and 2021, thousands of individuals participated in what became known as the *Caravanas*, a massive exodus of people traveling together from Central America to the U.S. by land. These episodes captured the attention of the international community due to the precarious conditions faced by these migrants (Marchand, 2021). These types of situations have intensified international policy focus on the drivers of these mass migration episodes and fueled discussions on potential policy responses in both origin and destination countries.

In response, the U.S. has increased efforts to curb rising migration from Central America. On the one hand, initiatives have focused on addressing the *root* causes of emigration by promoting investment in origin countries and encouraging migrants to stay (Rose et al., 2021). On the other hand, immigration enforcement has intensified, leading to higher deportation and detention rates of undocumented migrants at the U.S.-Mexico border (East and Velásquez, 2024). Official data and research by the Pew Research Center (2021) reveal that the total number of border encounters has surged over the past decade, increasing by approximately 400% since 2010 and reaching levels comparable to the late 1990s, which is consistent with the information presented above in Figure 2.

In 2021, non-Mexican encounters at the border hit their highest levels since 2000, with individuals from the Northern Triangle comprising about 40% of these encounters.

Although, as presented above, emigration from Central America to the U.S. has been outpacing that from Mexico, most economic studies have focused on the latter, analyzing the determinants of Mexican migration patterns (Dell, 2015; Osorio, 2015; Brown and Velásquez, 2017; Velásquez, 2020). In contrast, this paper centers on Central America, where as we have shown, these issues have become increasingly relevant.

2.2 Violence and Drugs in Central America: The Relevance of Transit Countries

The global drug trade is categorized into producer and transit countries. According to the U.S. Department of State, among the 22 major drug-producing and trafficking countries, 14 are designated exclusively as transit countries, while only 8 are engaged in production activities.[3] Notably, 75% of the 70 countries identified by the U.S. government as involved in drug trafficking, production, or consumption are classified exclusively as transit countries (U.S. Department of State, 2017). In the U.S., most drugs consumed are produced in two key countries. Colombia is the primary source for cocaine and Mexico for heroin and opium. Central America and the Caribbean serve as crucial transit routes for South American cocaine (UNODC, 2012; U.S. Department of State, 2017).

The economic impacts of drug production significantly differ between producer and transit countries. In producer countries such as Colombia and Mexico, commonly overlooked aspects are the positive economic effects and the employment opportunities that arise from illicit drug production. For example, coca cultivation in Colombia supports about 200,000 households and ranks as the third most important agricultural activity after coffee and sugar cane (Thomson et al., 2024), contributing roughly 2% to 3% of Colombia's GDP—double that of legal crops like coffee (Montenegro et al., 2019; DNP, 2021; Superintendencia Financiera de Colombia, 2024). Moreover, studies suggest that each dollar generated from coca sales can boost GDP by $1 to $2.3, particularly benefiting rural areas and regions with lower coca production (Marín-Llanes et al., 2024). Thus, while violence adversely affects economic activity, the gains from illicit drug production

[3] The U.S. Department of State identifies the following countries as transit nations: The Bahamas, Belize, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, India, Nicaragua, Pakistan, Panama, and Venezuela. On the other hand, the following countries are recognized as producer nations: Afghanistan, Bolivia, Burma, Colombia, Jamaica, Laos, Mexico, and Peru.

may partially offset the negative impacts.

In contrast, transit countries primarily suffer negative consequences from drug trafficking without experiencing its economic benefits. In Central America, drug-related organizations often rely on extortion and other activities that do not add real economic value, transferring wealth from legitimate businesses to gang members (UNODC, 2012). Therefore, studying transit countries is essential, as their economic activity and individual opportunities may be even more significantly impacted, serving as a crucial driver of overall emigration, and particularly towards the U.S. in the case of Central American countries.

Despite the prominence of transit countries in the drug market, much literature focuses on producer countries, often neglecting the unique dynamics and policy implications for transit countries (Ashby and Ramos, 2013; Dell, 2015; Basu and Pearlman, 2017; Brown and Velásquez, 2017; Rozo, 2018). This oversight constitutes an important gap since most countries involved in drug trafficking are not producers. Transit countries require different policy responses than producers.

In recent years, Central America has taken an increasingly significant role as a drug transit corridor between South and North America, resulting in a troubling surge of violence. The emergence of Central American economies within the international drug-trafficking landscape and the subsequent violent consequences can be attributed to several factors. First, U.S. demand for cocaine has declined by approximately 70% since the 1980s, largely due to shifting consumer preferences towards other drugs. This reduction in demand has constrained profits for drug traffickers, intensifying conflicts and violence among illegal groups. Additionally, the Colombian government's efforts to combat drug production, along with Mexico's 2006 anti-drug security strategy—which aimed to disrupt the drug trade by strengthening the capacity of the Mexican military and police—have disrupted traditional trafficking routes, rendering Central America an increasingly vital transit corridor. (UNODC, 2012; Dell, 2015).

The implementation of Mexico's Security Strategy in 2006 marked a pivotal shift in drug trafficking dynamics (Dell, 2015). Between 2000 and 2005, cocaine seizures in Central America averaged around 23 tons per year, but this figure surged by 280% from 2006 to 2011 (UNODC, 2012). During the former period, the amount of cocaine seized was relatively similar between Mexico and Central America; however, by 2011, seizures in Central America were 13 times those of Mexico, indicating a major shift in trafficking routes. Similarly, direct cocaine shipments to Mexico fell

from 174 to 30 between 2000 and 2011, while simultaneously, shipments to Panama, Costa Rica, Honduras, and El Salvador increased sharply, with Honduras alone experiencing a rise from 20 in 2000 to 233 shipments in 2011 (UNODC, 2012).

The relationship between drug trafficking and violence in Central America is complex and multifaceted. In the case of Central American transit countries, most violence arises from territorial disputes among gangs and rent-seeking behavior, escalating crime and violence in the most affected regions. Two primary types of organizations drive violence in the region: territorial crime groups and transnational trafficking organizations. Territorial groups exert control over specific areas and extort various local activities, through loan sharking, labor racketeering, or targeting cocaine traffickers, known as *tumbadores*. Other territorial groups, like street gangs (such as the *maras*), are often rooted in identity-based values. In contrast, transnational trafficking groups, or *transportistas*, operate primarily for economic gain, transporting illicit products, like cocaine, across different regions. These groups frequently intersect, as trafficking organizations must negotiate or submit payments to territorial groups in exchange for securing safe passage through their areas (UNODC, 2012).

Violence associated with drug trafficking often stems less from the act of trafficking itself and more from territorial disputes and power struggles, frequently ignited by changes in market dynamics, enforcement measures, or political factors. For example, Mexico's 2006 National Security Program, aimed at blocking drug trafficking routes to the U.S., inadvertently redirected those routes through Central America, resulting in conflicts over control and exacerbating violence. This intensified violence acts as a contributing factor for migration from the region, as individuals seek safety and stability (UNODC, 2012; Dell, 2015).

In this paper, we examine the relationship between drug-related violence, economic development, and emigration intentions within a relatively underexplored context: drug-transit countries. By focusing on non-producer countries, we aim to provide empirical evidence that can inform policy decisions for the majority of nations primarily involved in drug-trafficking activities. These countries serve mainly as transit points for drugs, bearing the brunt of negative spillovers such as violence and poor economic performance, while lacking the potential economic benefits associated with being producer countries like Mexico or Colombia.

3 Data and Descriptive Statistics

3.1 Data

We focus our analysis on four Central American countries: Costa Rica, El Salvador, Honduras, and Panama; from 2010 to 2016. The selection of these countries and time period is driven by the availability of comparable data across countries. It also coincides with the documented intensification of violence associated with drug trafficking. Our study is data-intensive, requiring the integration of multiple datasets from different sources to comprehensively examine how drug-related violence affects migration behavior for Central Americans and what the underlying mechanisms behind those impacts are.

We analyze the effect of drug-related violence on migration at the sub-national level, leveraging the varying granularity of available data across countries. Specifically, we work with regions in Costa Rica and departments in El Salvador, Honduras, and Panama, ensuring maximum consistency in the analysis despite these differences in the levels of disaggregation. For simplicity, we will refer to all these sub-national regions as "districts" throughout the remainder of the paper. To perform our analysis we employ information from six different sources.

First, we use individual-level data on migration intentions and decisions. Given that comparable emigration data at the sub-national level is usually not widely available for developing countries, we follow Clemens and Mendola (2024) and use data from the Gallup World Poll on emigration intentions and preparation of individuals for the four selected countries during the 2010-2016 period. The Gallup World Poll is a nationally representative opinion database carried out annually.[4] We have information on 44 sub-national districts for the four countries in our study through the Gallup World Poll. Similar to Clemens and Mendola (2024), we use three different questions from the database to measure individuals' intentions and preparation to emigrate from their home country.

The first question captures the desire of individuals to emigrate, inquiring: "*Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?*". Respondents are then asked about the country they would like to move to.

[4] Other papers that employ Gallup data to study migration behavior are Dustmann and Okatenko (2014), Dao et al. (2018), and Manchin and Orazbayev (2018).

The second question asks respondents whether or not they have plans to emigrate in the following year: "*Are you planning to move permanently to another country in the next 12 months, or not?*", and then they are asked to report the country to which they are planning to emigrate. The third question aims to capture preparation to emigrate and respondents are asked if they have done something specific to materialize those migration plans: "*Have you done any preparation for this expected move (for example, applied for residency or visa, purchased the ticket, etc.)?*". According to Bertoli and Ruyssen (2018) and Tjaden et al. (2019), data on preparations to emigrate serve as a good predictor for actual emigration[5], especially when it refers to specific and costly actions such as getting a visa or purchasing transportation. With this data, we can estimate whether or not local drug-related violence affects the willingness of people to emigrate, but also whether or not they actually plan and take steps towards their expected journey.[6]

Second, to estimate the impact of drug-related violence on economic activity, as a potential mechanism affecting the quality of life in Central American countries, we follow the development economics literature and utilize nighttime light density as a measure of economic performance at the sub-national level (Henderson et al., 2012; Donaldson and Storeygard, 2016; Ch et al., 2021). This metric serves as a proxy for both the informal and formal economy (Li et al., 2020; Bluhm and McCord, 2022; Marín-Llanes et al., 2024). Nighttime light density has been widely used in economics to proxy economic GDP and development around the world (Michalopoulos and Papaioannou, 2013; Chen and Nordhaus, 2015). For Latin America, Pérez-Sindín et al. (2021) has shown that regional domestic product (RDP) can be proxied with this variable for the case of Colombia, even within municipalities with less than 5,000 people, highlighting the relevance of this type of data when analyzing socioeconomic changes at the sub-national level. We also utilize subjective measures of living standards and economic perceptions from the Gallup World Poll among Central Americans to estimate the impact of drug-related violence on their perceived quality of life.

[5] In Figure B.4 of Appendix B, we present scatter plots of the share of people who emigrate in general (Panel a) and to the U.S. (Panel b) from 2010–2015, compared with Gallup variables related to emigration for the countries in our sample. Although differing in levels, the variables are strongly correlated, supporting the predictive power of reported intentions, plans, and preparations to emigrate relative to actual migration, as highlighted by Clemens and Mendola (2024).

[6] Variables related to the desire to emigrate—both in general and specifically to the U.S.—are available for the 2010–2016 period. In contrast, variables capturing the planning and preparation to emigrate are only available for the 2010–2015 period.

Third, we use labor market information from household surveys. Our labor market variables are derived from the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) (2024), a collaborative project between CEDLAS (Center for Distributive, Labor and Social Studies) and the World Bank, focused on Latin American countries. Given that household surveys are not uniform across countries or even within the same country over time, SEDLAC is an effort to harmonize these datasets, ensuring that variables and statistics are comparable along those two dimensions. The project draws from the National Household Survey (ENAHO), the Multiple Purpose Household Survey (EHPM), the Permanent Household Survey for Multiple Purposes (EPHPM), and the Household Survey (EH) for Costa Rica, El Salvador, Honduras, and Panama, respectively. All household surveys are nationally representative and conducted annually. We use information on labor force participation, employment, labor income, hours worked in the last month and hourly wages, for individuals between 18 and 65 years old, as well as demographic and socioeconomic attributes to document changes over time for different groups.

Fourth, we use homicide rates at the sub-national level as the explanatory variable to estimate the impact of drug-related violence on our outcomes of interest. This measure, sourced from administrative records in each country, is defined as the number of homicides per 100,000 inhabitants in each district-year. However, since homicide rates are likely to be endogenous, we employ and instrumental variable (IV) strategy to obtain causal estimates of the effect of drug-related violence on our outcomes. Our proposed approach uses cross-sectional variation based on each district's proximity to drug-trafficking routes within the country. We calculate these distances using data from UNODC collected before our study period (UNODC, 2012). UNODC identifies trafficking routes by type—air, maritime, or land. A district is classified as a trafficking route if it is located along any of these routes.

Our IV strategy also leverages temporal variation from fluctuations in cocaine production in Colombia by considering whether coca shipments were routed through the Atlantic or Pacific Ocean during the selected period. As discussed in Section 2, cocaine trafficking towards the U.S. has primarily taken place through Central America, particularly after 2006. Therefore, years with higher coca production in Colombia are likely to see intensified trafficking activity, leading to a rise in drug-related homicides in the countries examined. Data on coca production in Colombia during our analysis period is sourced through UNODC. We describe the identification assumptions of this

IV strategy in Section 4.

3.2 Descriptive Statistics

In this subsection we present descriptive statistics related to our main variables of analysis, namely homicide rates, the production and trafficking of drugs in Central America, and reported intentions to emigrate for individuals in the region. Finally, we show descriptive statistics on the socioeconomic characteristics of individuals in our labor market variables analysis for Costa Rica, El Salvador, Honduras, and Panama.

Central America has historically been one of the most violent regions in the world, partly due to lingering effects from civil wars that ended in the 1990s. Since the 2000s, violence has surged in countries like Honduras, Guatemala, El Salvador, Costa Rica, and Panama. According to UNODC (2012), during the 2000s, murder rates increased by 61%, 58%, and 8% in Honduras, Guatemala, and El Salvador, respectively. In Panama and Costa Rica, the increases were even more pronounced, at 120% and 83%, respectively.

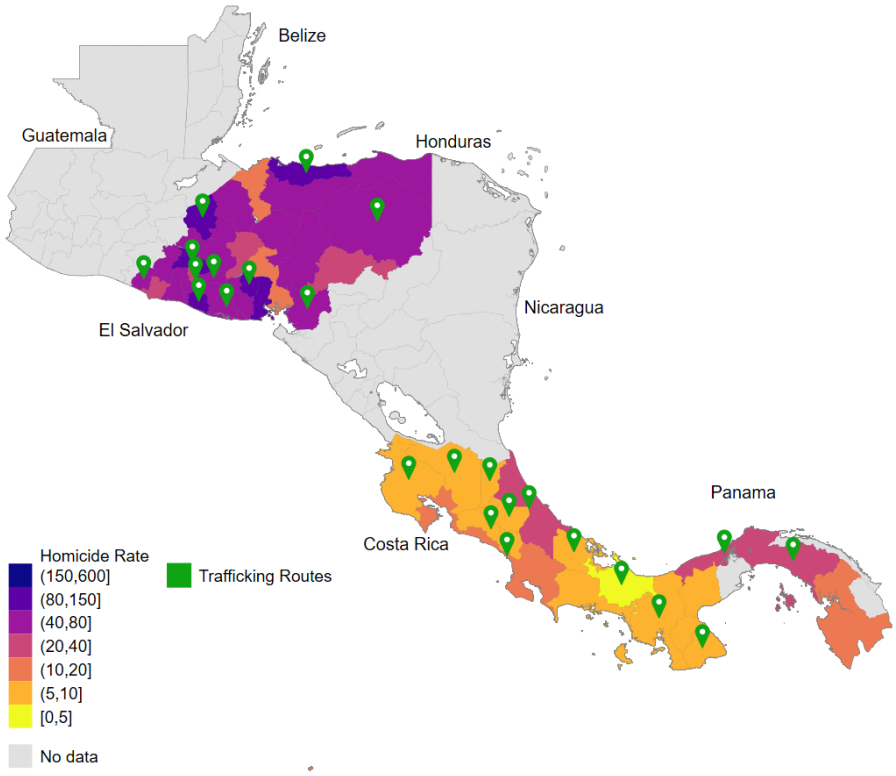
Figure 4 illustrates the average homicide rate per 100,000 inhabitants for each district in our sample, alongside pins marking districts identified as drug-trafficking routes (UNODC, 2019). The majority of homicides are concentrated in El Salvador and Honduras, where rates range between 40 to 500 homicides per 100,000 inhabitants. This aligns with UNODC (2019), which identifies El Salvador and Honduras as the countries with the highest homicide rates in 2017, within Central America.

Unlike Mexico and South America, Central America is primarily a transit region for drug trafficking, connecting production hubs in Colombia, Bolivia, and Peru with major markets in the U.S. and Mexico. While supplier and consumer countries face violence linked to eradication and consumption, Central American countries endure violence stemming from drug transit and conflicts between cartels and authorities.

Figure 4 also highlights the distribution of drug-trafficking routes across Costa Rica, Panama, El Salvador, and Honduras. The map reveals significant heterogeneity in the location of these routes, which will be central to our identification strategy. We exploit the average distance between each district and the nearest drug-trafficking routes within the same country to estimate the causal

impact of drug-related violence on emigration and economic outcomes. Notably, districts with active drug-trafficking routes, such as those in northern Honduras, northern Panama, and across El Salvador, tend to exhibit higher homicide rates.

Figure 4: Drug Routes and Homicide Rates in Central America



Notes. The figure shows the average homicide rate per 100,000 inhabitants for each sub-national district during 2010–2016. Green pins indicate sub-districts identified as drug-trafficking routes according to UNODC. Source: Own elaboration based on data from UNODC and Administrative Records

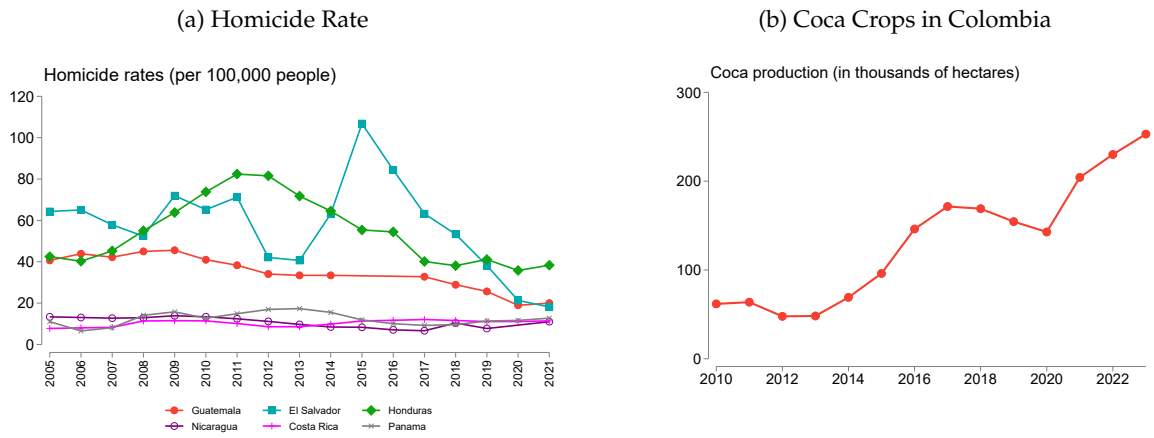
Furthermore, Panel (a) of Figure 5 shows the evolution of homicide rates in Central America over the 2005–2021 period. On average, countries such as Guatemala, El Salvador, and Honduras have historically exhibited very high homicide rates compared to Nicaragua, Costa Rica, and Panama. However, since our analysis exploits within-district variation, the relevant information for this study lies not in cross-country differences in homicide rates, but in how these rates changed over time. Figure B.3 in Appendix B presents the same information as Panel (a) of Figure 5, but expressed as an index normalized to 100 in 2005. This allows for a clearer comparison of the temporal dynamics of homicide rates across countries.

For Nicaragua and Guatemala, homicide rates appear to have declined steadily since 2005. In

contrast, El Salvador—historically one of the most violent countries in the region—experienced relatively stable rates until 2011, after which they declined sharply by about 35% relative to 2005. This drop was then reversed during the 2015–2016 period, when homicide rates rose by roughly 50%, before declining again in subsequent years.

Honduras not only had persistently high homicide levels, but also experienced a dramatic increase during 2008–2016, with rates rising by approximately 60% on average compared to 2005, before beginning to decline. Finally, although Costa Rica and Panama have historically had the lowest homicide rates in the region, both countries saw substantial increases in violence after 2008. In Costa Rica, the post-2008 period saw an average increase of about 40% relative to 2005, while Panama experienced a 35% increase between 2008 and 2015.

Figure 5: Homicide Rates in Central America (2005-2021) and Coca Crops in Colombia (2010-2023) over Time



Notes. Panel (a) shows the average homicide rate per 100,000 inhabitants for each country over time . Panel (b) shows the evolution of cultivated coca crops in Colombia over time. Source: Own elaboration based on data from World Development Indicators for national homicide rates and the United Nations Office on Drugs and Crime for coca crops.

Panel (b) of Figure 5 also shows the evolution of coca crop cultivation in Colombia during the 2010–2023 period, which provides the time variation for our IV strategy. Coca crops are the primary input for cocaine production, and Colombia has been the largest producer of coca crops for the past two decades (UNODC, 2021). Coca production in Colombia rose by about 300% over the past decade.

According to Prem et al. (2023), the surge in coca crop production in Colombia was driven by supply-side factors rather than demand. They argue that the increase was linked to the antici-

pated economic benefits promised by the Colombian government during peace negotiations with the country's oldest guerrilla group, the FARC, as an incentive for coca growers to transition to alternative crops. This anticipation likely explains the rise in coca cultivation observed after 2012.

In Table 1, we present the average probability of emigration intentions for individuals in the four countries in our sample in 2010 and 2015. Two main takeaways emerge from Table 1. First, on average, emigration intentions are highest in El Salvador and Honduras, followed by Costa Rica and Panama. Our estimates suggest that, in El Salvador and Honduras, about half the population expressed a desire to emigrate in 2015. This aligns with the fact that these countries have the highest homicide rates, as shown in Figure 4. Additionally, around half of those with emigration intentions across the sample indicated a preference for the U.S. as their destination, making it the top country for potential emigrants.

When considering more concrete variables related to planning and preparing for emigration, the probabilities are significantly lower, as expected. This reinforces the importance of using variables that more closely approximate actual migration behavior when estimating the impact of drug-related violence on emigration. Our estimates indicate that while about 7-9% of the population in El Salvador and Honduras planned to emigrate within the next year in 2015, only 2% of the populations in Costa Rica and Panama had similar plans. Furthermore, more than half of the people planning to emigrate from El Salvador, Panama, and Honduras intended to move to the U.S.

On the other hand, the probability of individuals engaging in concrete preparations for emigration, such as purchasing tickets or obtaining documentation in 2015, ranges from 1% to 3%, with El Salvador showing the highest rate. This aligns with the fact that El Salvador had the highest violence rate in our sample during the period of analysis, likely leading individuals to perceive their stay in the country as a threat to their quality of life.

Finally, across all countries, there was a significant increase not only in the share of people expressing intentions to emigrate but also in those planning and preparing to do so. This increase is present when considering overall emigration but also emigration towards the U.S. Our estimates indicate that, for instance, for Costa Rica, El Salvador, Honduras, and Panama, the share of people desiring to emigrate to the U.S., increased by 1.6 p.p., 3.4 p.p., 9.8 p.p., and 0.3 p.p., respectively, in the 2010-2015 period. It can also be seen that, for most of the countries studied, this increase

materialized in higher rates of planning and preparing to emigrate during the same period.

Table 1: Descriptive statistics of Emigration - Gallup World Poll

	Costa Rica		El Salvador		Honduras		Panama	
	2010	2015	2010	2015	2010	2015	2010	2015
Desire to Emigrate (=1)	0.174	0.190	0.394	0.504	0.353	0.458	0.119	0.132
Desire to Emigrate to the US (=1)	0.055	0.071	0.220	0.254	0.187	0.285	0.059	0.062
Planning to Emigrate (=1)	0.021	0.020	0.065	0.091	0.037	0.076	0.016	0.023
Planning to Emigrate to the US (=1)	0.005	0.004	0.048	0.052	0.016	0.052	0.005	0.011
Preparing to Emigrate (=1)	0.009	0.007	0.031	0.033	0.012	0.012	0.005	0.011

Notes. The table indicates the average of each binary variable for years 2010 and 2015. The definition of each variable is described in Appendix A. Source: Own elaboration based on data from the Gallup World Poll.

In Table 2, we present descriptive statistics for key labor market variables used in our analysis and the primary sociodemographic characteristics of individuals in our SEDLAC database sample. Overall, labor force participation and employment rates are around 75% and 65%, respectively, across all countries, with increases between 2010 and 2016 for most countries, except for El Salvador.

Table 2: Descriptive statistics on labor market outputs - SEDLAC

	Costa Rica		El Salvador		Honduras		Panama	
	2010	2016	2010	2016	2010	2016	2010	2016
Panel A: Labor Market Outcomes								
Labor force (=1)	0.70	0.71	0.71	0.68	0.68	0.70	0.73	0.75
Employment (=1)	0.65	0.66	0.67	0.64	0.65	0.65	0.68	0.71
Labor income (logs)	4.94	5.18	4.93	4.72	4.41	4.41	5.34	5.89
Hours worked	45.7	43.3	45.0	44.3	40.4	43.5	41.8	40.2
Hourly wage (logs)	8.15	8.39	7.71	7.79	7.50	7.57	8.12	8.63
Panel B: Socioeconomic characteristics								
Man (=1)	0.48	0.48	0.45	0.45	0.47	0.46	0.49	0.48
Age	37.6	38.8	36.3	37.0	35.7	35.8	38.1	38.7
Years of completed education	9.19	9.34	8.28	8.12	6.58	7.24	10.18	10.83
Urban area (=1)	0.80	0.80	0.79	0.64	0.49	0.57	0.69	0.73

Notes. Labor income is defined as the total income from labor plus one (in logs), unconditional on whether the individual is working. Hours worked and hourly wage are defined conditionally on being employed. Source: Own elaboration based on data from SEDLAC.

In terms of hours worked, the average ranges from approximately 40 to 46 hours per week. Costa Rica and El Salvador report the highest average number of hours worked in both years. Hourly wages, measured in logs, are significantly lower in Honduras and El Salvador compared to Costa Rica and Panama. Among the four countries, Panama experienced the largest increase in log hourly wages between 2010 and 2016.

Regarding socioeconomic characteristics, the sample is fairly balanced in terms of gender, with a slightly higher representation of women. The average age of individuals is around 35 to 38 years, with modest increases between 2010 and 2016. Average years of completed education remain below the secondary education threshold in all countries except Panama, where it is above 10 years in both periods. Finally, urbanization rates are high—above 70% in most countries and years—though Honduras stands out with substantially lower rates, ranging from 49% to 57%.

4 Empirical strategy

To assess the impact of drug-related violence on our outcome variables of interest, we estimate the following equation:

$$y_{idct} = \alpha + \beta H_{dct} + \theta X_{idct} + \lambda_d + \delta_t + \varepsilon_{idct} \tag{1}$$

where y_{idct} is the outcome variable for individual i living in district d in country c and year t. H_{dct} is the homicide rate of the sub-national district d in country c and year t; X_{idct} is a vector of individual controls, including sex, age, an urban dummy, and educational dummy variables; λ_d and δ_t are district and year fixed effects, respectively; and ε_{idct} is the error term. We cluster standard errors at the district-level to account for any potential correlation of the outcome variables for individuals of the same sub-national district over time and because the primary source of variation stems from these districts' proximity to drug-trafficking routes. All regressions were estimated using the corresponding sample weights. Our coefficient of interest is β, which captures the effect of an increase in the homicide rate on our outcome variables.

Although we control for time-invariant characteristics and time-varying common shocks across districts, our estimates may still suffer from endogeneity due to unobserved, time-varying factors

that are correlated with our main explanatory variable (H_{dct}). In particular, such factors may influence both local violence and migration outcomes, potentially biasing OLS estimates.

For example, districts experiencing high violence may receive increased public investment in security, potentially at the expense of social services, which could in turn affect migration decisions. In other cases, the mismanagement or diversion of public resources may both contribute to violence and limit residents' capacity to emigrate. Additionally, as documented by Uribe et al. (2025), millions of Latin Americans live under criminal governance, where gangs enforce local order and resolve disputes. Such quasi-state functions may shape local conditions in ways that are correlated with both violence and migration, further complicating causal interpretation.

To address these endogeneity concerns, we implement a shift-share instrumental variable (IV) strategy that exploits variation in exposure to transnational drug-trafficking dynamics. The instrument is based on the idea that, in years of intensified coca production in Colombia (the *shift*), districts located closer to known trafficking routes (the *share*) and to the ocean—either the Pacific or the Atlantic—through which a larger volume of drugs is shipped are, on average, more exposed to drug-related violence than districts farther away from trafficking routes or closer to the ocean through which smaller volumes of coca are trafficked. For instance, consider a district located near the Atlantic Ocean during a year of high coca flows through the Atlantic coast of Colombia, but far from any known trafficking routes. Our instrument would predict lower exposure to trafficking-related violence compared to a district that is both close to the coast and surrounded by trafficking corridors.

Formally, the instrument is defined as:

$$Z_{dct} = \left[\frac{1}{K} \sum_{j \in K} D_{djc} \right]^{-1} \times CC_{dct} \tag{2}$$

Where K is the total number of sub-national districts within country c that have a drug-trafficking route according to UNODC; and D_{djc} is the distance between each sub-national district d from country c in our sample and the districts $j \in K$ that are known routes.[7] Therefore, the part of the equation within square brackets is simply the average distance of each sub-national district to all the drug-trafficking routes within the country, of which we take the inverse.

[7] For the case in which sub-national districts d are themselves drug-trafficking routes, the value of the distance is simply 0.

In our main sample, the proportion of districts with at least one identified drug-trafficking route varies significantly across countries: 100% in Costa Rica, 60% in Panama, 50% in El Salvador, and 25% in Honduras. Overall, 7% of districts have at least one air route, 23% have at least one land route, and 32% have at least one sea route. Figure B.5 in the Appendix illustrates the average distance to drug-trafficking routes for each district, as defined by the squared bracket term in equation (2). The figure also includes green pins to indicate districts that contain at least one trafficking route. As shown, districts that are located along trafficking routes and are surrounded by other similarly connected districts tend to have shorter average distances to drug routes in our IV construction. In contrast, districts without any trafficking route—or those with a route but that are spatially isolated—tend to exhibit lower values of our cross-sectional measure of exposure to drug trafficking.

On the other hand, CC_{dct} is the distance-weighted average of the total volume of coca produced in Colombia for each year t, which is given by the following expression:

$$CC_{dct} = [\omega_{dct} CP_t + (1 - \omega_{dct}) CA_t] \qquad \text{where,} \qquad \omega_{dct} = \frac{P_{dc}^{-1}}{P_{dc}^{-1} + A_{dc}^{-1}} \tag{3}$$

Where CP_t and CA_t capture the volume of coca crops produced in Colombian municipalities that are more likely to be trafficked through the Pacific and Atlantic coasts of Colombia, respectively, based on their proximity to each ocean; and ω_{dct} is a weight that is proportional to the share of the inverse of the horizontal distance from each district d to each of the Pacific (P_{dc}) and Atlantic oceans (A_{dc}).

The instrument defined in equation (2) follows a shift-share structure. In this context, the share component is the inverse of the average distance from each district d to all known drug-trafficking route districts $j \in K$ within the country—i.e., $\left[\frac{1}{K}\sum_{j \in K} D_{djc}\right]^{-1}$. This term captures the exogenous exposure of each district to trafficking routes based on its geography, which is assumed to be time-invariant. The shift component is CC_{dct}, the time-varying intensity of coca shipments from Colombia's Pacific and Atlantic coasts. This reflects exogenous changes in drug supply pressure driven by fluctuations in coca crop flows, which vary over time. By interacting a fixed spatial exposure measure (the *share*) with a time-varying shock (the *shift*), the instrument isolates plausibly exogenous variation in local violence that is not driven by unobserved, time-varying district-level

confounders.

As a first piece of evidence of the relevance condition, we can see in Figure B.6 of Appendix B that there is a strong first-stage relationship between our proposed IV and homicide rates at the sub-national district level. In Tables B.1, B.2, and B.3 of Appendix B, we show that this relationship remains unchanged even when controlling for individual covariates mentioned in equation 1. The F-statistic of the first-stage in our specification is above the standard values considered in the literature.

Finally, it is important to clarify how we interpret the causal effect of violence in our IV framework. While our endogenous variable is the overall homicide rate at the district-year level—without distinguishing between drug-related and non–drug-related homicides—our instrumental variable captures exogenous variation in homicides that is driven specifically by exposure to drug trafficking. In our main specifications, the first-stage relationship (reported in Panel A Table B.1) shows that approximately 80% of the variation in homicide rates is explained by our instrument, as reflected in the first-stage R^2. Therefore, we interpret our IV estimates as capturing the causal effect of drug-related violence—i.e., the component of violence that is induced by drug-trafficking exposure—on our outcomes of interest.

5 The Effect of Drug-related Violence on Migration Intentions

Table 3 presents our estimations of the effect of drug-related violence on the desire, planning, and preparation to emigrate using OLS and our IV approach. The OLS estimates indicate that, although not always statistically significant, all coefficients are positive. This suggests that higher homicide rates are associated with an increased probability of both general and U.S.-specific migration intentions, plans, and preparations.

Given the concerns that may arise in an OLS setting, we implement the IV approach described in section 4. From this point onward, we will focus primarily on the IV estimates as our preferred specification. The IV results of the overall effect of drug-related violence on emigration behavior for individuals from Costa Rica, El Salvador, Honduras, and Panama are shown in the second row of Table 3. We find a statistically significant effect of violence on the desire of individuals to emigrate based on their answers in the Gallup World Poll. Our estimates indicate that an increase

in violence of 1 homicide per 100,000 inhabitants in a specific district increases the probability of individuals desiring to emigrate by 0.22 p.p.[8] According to our dataset, about 29% of all surveyed individuals expressed their desire to emigrate from their place of residence, which implies that our estimated effect represents an increase of 0.8% from this reference point. For illustrative purposes, moving from the homicide rate of a district at the 10th percentile to that at the 90th percentile—equivalent to an increase of 88 units in the independent variable—is associated with an average increase of 19.4 percentage points (p.p.) in the desire to emigrate.

More importantly, when considering the impact on the desire of individuals to emigrate to the U.S., we can observe that it drives almost 33% of the overall effect on the desire to emigrate. Our estimates indicate that an increase in the homicide rate of 1 per 100,000 inhabitants increases the probability of wanting to emigrate to the U.S. by 0.07 p.p. In terms of the previous example, going from a homicide rate of a district at the 10th percentile to one at the 90th percentile could implied a rise in the desire of emigrate to U.S of 6.2 p.p.

Table 3: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration

	Desire	Desire US	Plans	Plans US	Preparation
Homicide rate (OLS)	0.0008***	0.0002	0.0003*	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Homicide rate (IV)	0.0022***	0.0007**	0.0008***	0.0004**	0.0003**
	(0.0005)	(0.0004)	(0.0002)	(0.0002)	(0.0001)
Mean Dep. Variable	0.29	0.14	0.04	0.02	0.01
F-statistic	37.78	37.78	53.67	53.67	53.67
Observations	24,877	24,877	21,185	21,185	21,185
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Next, we examine variables that go beyond individuals' desire to emigrate, specifically captur-

[8] Note that the coefficients of the OLS specification are smaller compared to the IV estimates, suggesting that estimating our equation with OLS underestimates the effect of increasing homicide rates on emigration, as the omission of relevant variables biases our estimates toward zero as discussed previously in section 4.

ing whether they have made concrete plans to do so—both for any destination and for the U.S. in particular. We view these variables as more accurate measures of migration intentions and predictors of the materialization of actual migration behavior as they record whether or not individuals have made any specific plans to move permanently from their place of residence to a different country in the following 12 months.

Our estimates yield two main findings. First, for both outcomes—making plans to emigrate in general, and specifically to the U.S.—the estimated effects are positive. This suggests that drug-related violence not only increased individuals' desire to leave their country, particularly for the U.S., but also led them to concretely plan to emigrate within the 12 months following the interview. Second, our estimates indicate that a one-unit increase in the homicide rate (per 100,000 inhabitants) at the sub-national district level is associated with a rise in the probability of planning to emigrate, both overall and to the U.S. Specifically, both estimates represent an effect of approximately 2% relative to the baseline mean. Moreover, when considering a change from the 10th to the 90th percentile in the distribution of district-level homicide rates, the probability of planning to emigrate rises by 7 p.p. overall, and by 4 p.p. for emigration to the U.S. These results underscore the substantial influence of violence on migration intentions, particularly in motivating individuals to actively plan for emigration in pursuit of improved quality of life abroad.

As previously discussed, the desire to migrate to the U.S. accounts for approximately 50% of total emigration sentiment in the country of residence. According to the Gallup survey, other common destinations include Canada, Spain, Mexico, and various Latin American countries. Table B.4 in Appendix B replicates the estimates from Table 3 focusing on these alternative destinations. The results indicate that, the desire to migrate to Canada and other Latin American countries in response to drug-related violence is also positive and statistically significant, although the magnitude is about half that of the estimated effect for migration to the U.S.

A similar pattern emerges for emigration plans: while the effect remains statistically significant for Spain and Canada, the estimates for Mexico and other Latin American destinations are not statistically significant. Overall, although both the intentions and the plans to emigrate increase in response to violence, the U.S. remains the preferred destination for individuals considering emigration from Costa Rica, El Salvador, Honduras, and Panama, even compared to Mexico, the closest country for Central Americans willing to relocate.

Lastly, we estimate the impact of violence on the probability of individuals actually preparing to emigrate, namely purchasing tickets, applying for residence, visa, etc. As was mentioned above, according to Bertoli and Ruyssen (2018), Tjaden et al. (2019), and Clemens and Mendola (2024), this variable can be seen as the closest proxy to capture real emigration behavior of individuals, as it predicts actual emigration flows quite well. Our estimates on this variable are shown in the last column of Table 3. The estimated coefficient is positive and statistically significant, indicating an increase of 0.03 p.p. in the probability of preparing to emigrate, given a increase in the homicide rate at the local level of 1 per 100,000 homicides. Furthermore, our estimates suggest that a shock of this magnitude increases the probability of preparing to emigrate by 3% relative to the baseline mean. This effect is almost 50% larger compared to the relative impact on the planning-to-emigrate variable (whether to any country or specifically to the U.S.) and between four to six times greater than the effect on variables capturing the desire to emigrate (whether to any country or specifically to the U.S.), both measured relative to their respective baseline means.

Our results highlight the critical role of drug-related violence as a primary driver of increased emigration from Central America during the study period, particularly towards the U.S., due to the intensification of drug trafficking.

To assess the robustness of the results presented in this section and to support their causal interpretation, we conduct a series of complementary analyses, explained in detail in Appendix C. First, we test the sensitivity of our findings to an alternative definition of the instrument. Instead of constructing the shift component using coca production by Colombian coast—where production was allocated to a specific coast based on the municipalities in which it occurred—we use total coca crop production, regardless of the likely exit route. The resulting estimates remain consistent in magnitude and significance.

We also assess the internal validity of our shift-share instrumental variable. Following the approach proposed by Goldsmith-Pinkham et al. (2020), we address concerns that the share component—the inverse distance to trafficking routes—may be correlated with unobserved trends in migration outcomes. While our data do not allow for a formal pre-trend analysis, we mitigate this concern by controlling for a rich set of predetermined district-level characteristics from SEDLAC database (e.g., poverty, employment, inequality, informality, and economic activity proxied by nightlights) interacted with time dummies. The results remain virtually unchanged when these

controls are included.

In addition, we explore an alternative measure of drug-related violence using individuals' perceptions of gang presence from the Gallup World Poll. This binary variable serves as an independent proxy for local criminal activity. Specifically, individuals report whether gangs are present where they live—an indicator expected to reflect drug-trafficking activity and, consequently, exposure to drug-related violence. Two main results emerge from this robustness exercise. First, our instrumental variable strongly predicts the presence of gangs in Central American districts, reinforcing the interpretation that it captures violence, crime, and illicit activity linked to drug trafficking. Second, our IV estimates using gang presence as the independent variable support our main findings, indicating that increased exposure to drug-related violence raises the probability of desiring, planning, and preparing to emigrate.

Finally, we implement leave-one-out regressions and placebo tests. The former show that no single district drives our main results, and the latter demonstrate that the relationship between our instrument and migration outcomes does not emerge when distance exposure is randomly reassigned. Both exercises reinforce the robustness and specificity of our identification strategy.

6 The role of local economic activity and the labor market

In this section, we present the main mechanisms driving the effects on emigration behavior. First, we will demonstrate that drug-related violence reduces economic activity, as indicated by nighttime light density. Furthermore, we will show that drug-related violence negatively impacts Central Americans' perceptions of the economy and their living standards. Next, we will illustrate how this reduction in economic activity directly affects labor market opportunities for individuals in the region.

6.1 The Effect on Economic Activity

In Table 4 we show the estimated effect of an increase in the homicide rate by 1 per 100,000 inhabitants on our dependent variables of nighttime light density (in logs) which proxies economic activity at the sub-national level. When controlling for the endogeneity of the homicide rate variable by utilizing our IV approach, our estimates indicate a reduction of about 0.58% in economic

activity .

Our estimates suggest that violent episodes resulting from drug trafficking in Central American countries may have negatively affected economic activity in the region. These disruptions likely weakened the ability of the economy to absorb labor and provide economic opportunities, pushing individuals to seek better prospects abroad, particularly in the U.S.

These negative impacts in terms of economic activity are in line with the findings in the economic literature. For instance, for the case of Italy, Pinotti (2015) finds that the presence of *mafias* in southern Italy reduces GDP per capita by 16%. They are also consistent with previous work on drug-related homicides and economic growth in Latin America that finds a negative effect of this type of crime on the economic performance of Mexican municipalities, or studies analyzing the impact of violence on the economic performance of Colombian firms (Enamorado et al., 2014; Rozo, 2018).

Table 4: Effect of Drug-Related Violence on Economic Activity
Nighttime Light Density (in logs)

	(1)	(2)
Homicide rate	-0.0055**	-0.0058**
	(0.0024)	(0.0024)
F-statistic	34.09	32.10
Observations	308	308
District FE	Yes	Yes
Year FE	Yes	Yes
Sociodemographic controls	No	Yes

Notes. Sociodemographic controls include the share of individuals living in urban areas, the proportion of men, the average years of education, and the average age of the population in each district. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. Source: Own elaboration based on data from administrative sources.

Furthermore, we use an alternative approach to estimate the way in which drug-related violence can have an effect on the economic activity. To do so, we asses the effect that drug-related violence has on the perception about the economic performance of the regions Central Americans live in. We rely on individual data from the Gallup World Poll, where individuals are asked whether or not they are satisfied with their standards of living, namely all the things they can

buy or do, but also whether they believe the national economy is getting better or not (refer to Appendix A for a more detailed definition of these variables). We view these two variables as a reflection of the economic activity measured by the nighttime light density as they capture how people in Central America actually perceive changes in the economy of their countries.[9] The results of these estimates are presented in Table 5.

Table 5: Effect on Subjective Measures of Economic Activity and Quality of Life

	Good living standards	Economy Opinion
Homicide rate	-0.0023***	-0.0044***
	(0.0004)	(0.0010)
Mean Dep. Variable	0.76	0.49
F-statistic	37.70	33.62
Observations	25,480	21,825
District FE	Yes	Yes
Year FE	Yes	Yes
Sociodemographic controls	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

As can be seen, our estimates are in line with the effects found previously in terms of nighttime light density. We find that an increase of 1 homicide per 100,000 inhabitants, reduces the probability that individuals are satisfied with the way they live and the probability of them thinking the economy is getting better by 0.23 and 0.44 p.p., respectively. These results indicate that the reduction in economic activity caused by the violence emerging from drug-trafficking did translate into a negative experience of individuals in terms of their quality of life and their expectations about the economy in general. These results support the idea that this type of violence might be acting as a push factor through the economic performance of Central American countries.

[9] Although the question regarding the perception about whether or not the national economy is getting better asks about the country as a whole, it is arguably plausible that individuals perception are mainly driven by their local experience and the local economic performance. Therefore it could be a good proxy of the economic activity in the districts where they are located.

6.2 Effects on Labor Market outcomes

We now estimate equation 1 using our IV strategy to assess the impact of drug-related violence on labor market outcomes. We focus on three key variables: labor force participation, employment rates, and monthly labor income (hyperbolic sine). These three variables are defined unconditionally for the working-age population. Additionally, we also estimate the effect on hours worked in the past month (hyperbolic sine), and hourly wages (hyperbolic sine), which are only defined for individuals who are employed.[10] Although these latter variables provide valuable insights into labor market dynamics, they may suffer from selection bias: as employment and labor force participation decline, the observed wages may disproportionately reflect those of less-skilled or lower-paid workers who remain employed. This non-random selection into employment can distort the interpretation of wage trends. Therefore, we will pay special attention to the first three outcomes.

Table 6 shows that drug-related violence has a significant and negative effect on key labor market indicators across our sample of Central American countries. An increase in the homicide rate by 1 per 100,000 inhabitants leads to an average decrease of 0.06 p.p. in labor force participation and a reduction of 0.04 p.p. in the employment rate, which are equivalent to an effect of 0.09% and 0.06% relative to the baseline mean. The effect on labor income is also negative and on average about 0.25%. In contrast, the number of hours worked per month increases by 0.07% in response to rising homicide rates. This observation supports the hypothesis that individuals concerned about the potential adverse effects of violence may opt to increase their labor market engagement to build a savings buffer (Fernández et al., 2011). Alternatively, small entrepreneurs in areas with a high gang presence may need to augment their incomes to meet the rents demanded by these groups (International Crisis Group, 2018). Lastly, hourly wages are negatively impacted, with an average decline of 0.09% corresponding to an increase in the homicide rate of 1 per 100,000 inhabitants.

These results, presented in terms of labor market outcomes and economic activity, are consistent with evidence from Abuelafia et al. (2019). The authors identify the primary reasons Central

[10] We apply the hyperbolic sine transformation to account for cases where monthly labor income (unconditional on working), hours worked, and hourly wage (conditional on working) take a value of zero. As a robustness check, we also use the logarithmic transformation of the outcomes plus one, and the results remain unchanged. These latter results are available upon request.

American immigrants cite for migrating to the U.S. About 70% of immigrants from El Salvador, Guatemala, and Honduras reported economic factors as a main motivation for their migration. Among those who indicated economic reasons, approximately 49% identified unemployment as their primary challenge, 19% noted insufficient work to meet their family's needs, and 14% expressed concerns about inadequate wages. These findings suggest that crime-related violence not only reduces labor market participation and employment but also exerts downward pressure on labor income.

Table 6: Effect of Drug-Related Violence on Labor Market Outcomes

	Unconditional on Working			Conditional on Working	
	Labor force	Employment	Labor income	Hours	Wages
Homicide rate	-0.0006***	-0.0004***	-0.0025***	0.0007**	-0.0009**
	(0.0001)	(0.0001)	(0.0007)	(0.0003)	(0.0004)
Mean Dep. Variable	0.69	0.65	4.81	4.32	7.85
F-statistic	72.34	72.34	72.34	75.37	74.99
Observations	726,613	726,613	726,613	471,142	444,943
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank) and administrative sources.

6.3 Disentangling the Effects of the Economy and Violence

To better understand the channels through which drug-related violence affects emigration intentions, we perform a mediation analysis that decomposes the total effect into two components: one that operates through deteriorating economic and labor market conditions (the *economic channel*) and another that reflects a direct response to violence and insecurity (the *violence channel*). This approach follows the framework proposed by Dippel et al. (2020), and full methodological details are provided in Appendix D.

The main intuition behind this mediation analysis is that when a treatment—drug-related vio-

lence in our case—affects an outcome variable (emigration behavior) both directly and indirectly through a mediator—local economic activity and labor market conditions—the total effect can be decomposed into two components: a direct effect and an indirect effect. In our context, these correspond to the *violence channel* and the *economic channel*, respectively. Part of the effect of drug-related violence on emigration behavior is attributable solely to increased insecurity in affected districts, while the remaining portion operates through the impact of violence on local economic conditions, which in turn influence individuals' decisions to emigrate.

We apply this framework using emigration outcomes from the Gallup World Poll and multiple mediators, including proxies for economic activity (nighttime light density), labor market variables (labor force participation, employment, income), and subjective economic perceptions (living standards and national economic conditions).

Given that the labor market outcomes, such as labor force participation, employment, and labor income, and the main migration outcomes are derived from different data sources, we must collapse our datasets at the district level to merge them and perform the analysis. For the subjective mediators from the Gallup World Poll, the analysis can be conducted directly at the individual level, as they originate from the same data source. The results of the mediation analysis are presented in Tables D.1 and D.2 in Appendix D and summarized in Table 7.

In Tables D.1 and D.2, we display the coefficients along with their corresponding standard errors and levels of significance for the *total effect*, the *violence channel*, and the *economic channel*. Several results emerge from our analysis. First, even when working at the district level for the labor market outcomes as mediators, the total effect of drug-related crime on the migration outcomes remains quite similar to our main specification, which is reassuring. Second, in general, the first-stage F-statistics of the mediation analyses exceed the standard values suggested by the literature (Dippel et al., 2020). Finally, and most importantly, it can be observed that the largest share of the *total effect* is primarily driven by the *economic channel* as opposed to the *violence channel*. This is evident as the coefficients of the *economic channel* essentially mirror those of the *total effect*.

A simpler way to visualize this is provided in Table 7. In this table, we show the fraction of the *total effect* explained by the *economic channel*. As observed, regardless of the outcome considered or the mediator analyzed, a significant fraction is attributable to the *economic channel*. When using nighttime light density, this share ranges from 44% to 60%. When labor market outcomes or

subjective perceptions are used as mediators, the *economic channel* explains nearly the entire effect. These findings suggest that deteriorating economic opportunities are a key driver of emigration decisions in Central America.

Table 7: Mediation Analysis of the Effect of Drug-Related Violence on Emigration Intentions

	Desire	Desire US	Plans	Plans US	Preparation
Night Light Density	59.50	61.79	55.82	44.80	58.66
Labor Force Participation	95.93	99.62	109.18	87.63	114.74
Employment	87.25	90.61	106.42	85.42	111.84
Labor Income	74.44	77.31	92.26	74.05	96.96
Observations	301	301	257	257	257
Economy Perception	93.48	132.95	129.31	115.68	136.99
Observations	21,306	21,306	17,615	17,615	17,615
Living Standards	88.79	112.30	92.24	90.69	101.05
Observations	24,878	24,878	21,187	21,187	21,187

Notes. Each value represents the percentage of the total effect explained by the *economic channel*, as defined in equation D.6 in Appendix D. Source: Own elaboration based on data from Gallup World Poll, the Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank), and administrative sources.

These results support our hypothesis that the primary channel through which drug trafficking and crimes related to illicit activities affect the emigration decisions of individuals in Central America—and motivate them to leave their homes, particularly to move towards the U.S.—is driven by the deterioration of their quality of life, economic, and labor market opportunities.

These findings also carry important policy implications. Since most of the effect appears to operate through economic deterioration rather than violence alone, efforts to reduce emigration should prioritize improving economic and employment conditions in violence-affected regions. This is especially relevant for transit countries that have limited ability to influence international drug flows but greater leverage over domestic labor market conditions.

7 Who is migrating?

In this section we explore heterogeneous effects in terms of the emigration variables by individual characteristics in our sample. Particularly, we study how the effects found in the previous sections vary by age, education, gender, and whether individuals reside in urban or rural areas. We also

discuss the potential implications that these effects can have for both the sending and the main receiving countries.

7.1 Heterogeneous Effects on Emigration

First, we identify age and skills as the main heterogeneity characteristics. We focus on these traits for two main reasons. On the one hand, because they are crucial determinants of economic development and entrepreneurial activities worldwide, particularly in developing countries like those we are examining (Duflo, 2001; Parker, 2004; Hanushek and Woessmann, 2012; Jones, 2014; Liang et al., 2018; Rossi, 2020; Deming, 2022). In particular, both economic and non-economic literature show that younger individuals—especially those under 40—possess specific traits that make them more likely to start businesses and create new firms, particularly in highly innovative sectors. When combined with high levels of human capital, this entrepreneurial potential can boost economic growth and expand employment opportunities (Velez, 2009; Acemoglu et al., 2014; Aboal and Veneri, 2016; Liang et al., 2018; Zhang and Acs, 2018; Acemoglu et al., 2022; Anelli et al., 2023).

On the other hand, understanding the emigration dynamics from Central America—in particular the characteristics of those emigrating—is crucial for the U.S. economy, which remains the primary destination for Central American migrants. It is important to characterize the potential labor supply shock the U.S. may face if current emigration patterns driven by drug-related violence persist, especially given the rapid aging of the U.S. workforce. This demographic shift raises significant concerns about long-term economic growth, the creation of innovative firms, and labor shortages in critical sectors such as eldercare and nursing services (Acemoglu and Restrepo, 2017, 2022; Furtado and Ortega, 2023; Heimbuch et al., 2023; Furtado and Jolly, 2025).

To analyze this matter in greater depth, we split our sample into two groups: individuals below and above 40 years of age, and low- and high-skilled individuals.[11] Additionally, we consider heterogeneous effects by gender and whether individuals live in urban or rural areas. The results of our analysis are presented in Figure 6.[12] As can be seen, the effect on the desire to emigrate is heterogeneous based on age and education. Younger individuals (ages 18–40) and high-skilled individuals experience an effect that is approximately twice as strong as that observed for indi-

[11] High-skilled individuals are defined as those with complete secondary education or higher, whereas low-skilled individuals are those who have not completed secondary education.
[12] The corresponding coefficients are detailed in Tables B.5 to B.8 in Appendix B.

viduals older than 40 and those who are low-skilled. When examining the probability of wanting to emigrate specifically to the U.S., high-skilled individuals exhibit an effect that is about four times greater than that of low-skilled individuals. Similarly, the estimated effect on the desire to emigrate to the U.S. for young individuals is approximately 1.3 times that of older individuals.

We analyze the heterogeneous effects on the probability of making emigration plans in general (Panel c of Figure 6) and specifically to the U.S. (Panel d of Figure 6). Our results indicate that high-skilled individuals overwhelmingly drive the observed effects. For this group, the estimated effect on the probability of making emigration plans—both in general and specifically to the U.S.—is between four and nine times greater than that for low-skilled individuals. When considering young and older individuals, our estimates show that most of the effect is driven by younger Central Americans for whom the estimated coefficients are about five times those for older individuals.

Next, we examine the variable most closely related to actual migration behavior: the preparation to emigrate. The results, presented in Panel (e) of Figure 6, reflect a similar pattern to our previous findings. High-skilled individuals exhibit an effect on the probability of preparing to emigrate that is more than twice as strong as that for low-skilled individuals. Younger individuals show an effect on the probability of preparing to emigrate that is about five times greater than that of older individuals.

Next, we estimate the effects of drug-related violence on emigration behavior, analyzing heterogeneity by gender and place of residence (urban or rural). As shown in Figure 6, the estimated effects tend to be slightly larger for men than for women, and for individuals living in urban areas relative to those in rural areas. However, no consistent pattern emerges across outcomes, suggesting that both genders and both types of areas are similarly affected overall. One notable exception is the effect on preparation to emigrate, which is approximately eight times larger for individuals in urban areas compared to those in rural areas.

Several lessons emerge from these heterogeneity estimates. First, the educational patterns we observe contrast with findings on the self-selection of Mexican migrants in the economic literature. Studies on Mexican migration to the U.S. generally report low-to-moderate self-selection in terms of education or skill proxies such as wages (Chiquiar and Hanson, 2005; Ibarraran and Lubotsky, 2007; McKenzie and Rapoport, 2010; Fernández et al., 2011; Kaestner and Malamud, 2014). In contrast, our results indicate that individuals migrating or preparing to migrate from Central America

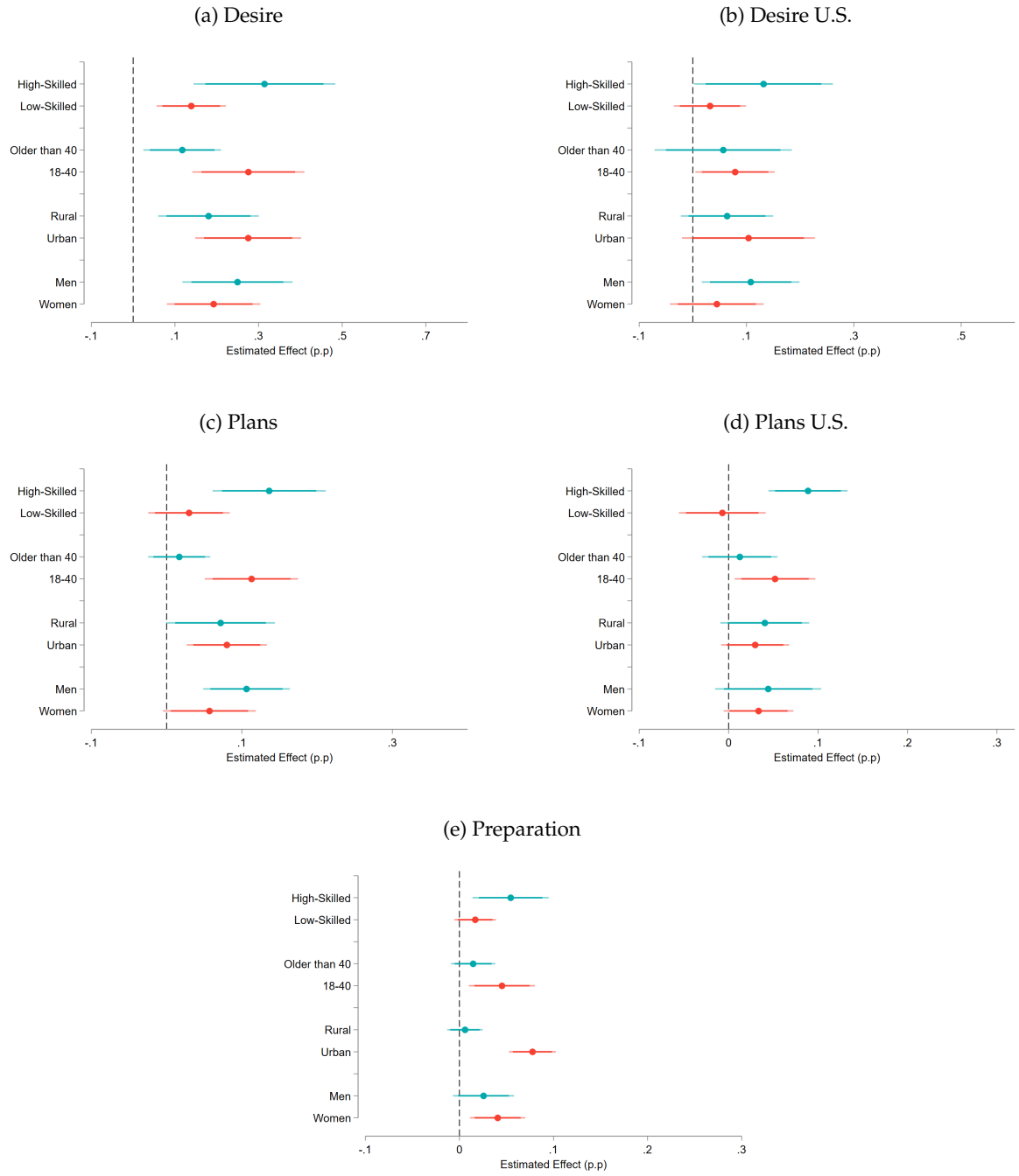
due to drug-related violence are positively selected in terms of education.

Secondly, these heterogeneous emigration effects, varying by skill level and age, have significant implications for the development of middle-income countries in Central America. As was mentioned above, economic research emphasizes the critical role that skilled and young individuals play as drivers of entrepreneurial activity, innovation, and economic growth (Liang et al., 2018; Acemoglu et al., 2022). For instance, Anelli et al. (2023) document that the emigration of young, high-skilled individuals from Italy during the 2008 Great Recession significantly reduced firm creation, with two-thirds of the effect attributed to emigrants' selection characteristics, such as education and age, and the remainder to the loss of population.

Similarly, increased emigration from Central American countries may undermine their innovation potential and long-term economic growth by depleting human capital, which is critical in the development process. This could potentially exacerbate the effects we presented above, as a lower supply of skilled and young individuals can inhibit economic growth and, in turn, deteriorate labor market conditions, causing higher emigration in the future. Consequently, our findings contribute to the brain drain literature by identifying drug-related violence as a key factor fueling this phenomenon (Mayr and Peri, 2009; Docquier and Rapoport, 2012; Docquier et al., 2014).

Finally, the fact that much of the emigration response to drug-related violence from Central Americans aiming to migrate to the U.S. is driven by high-skilled, young individuals has significant implications for the U.S. labor market. In particular, given the rapid aging of the U.S. population highlighted in the economic literature, this inflow can complement technological advances and support economic growth (Acemoglu and Restrepo, 2017, 2022). Additionally, it can help meet rising demand in critical sectors such as nursing and eldercare services (Furtado and Ortega, 2023; Furtado and Jolly, 2025). Our findings suggest that Central American immigrants could play a crucial role in alleviating the anticipated shortage of skilled and young labor, thereby supporting the capacity of the U.S. economy to deal with the ongoing demographic shift.

Figure 6: Heterogeneous Effects of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration



Notes. All regressions control for district fixed effects, year fixed effects, age dummies, an urban dummy, a gender binary indicator, and education dummies. The figure presents the estimated heterogeneous effects on the following outcomes: desire to emigrate (Panel a), desire to emigrate to the U.S. (Panel b), probability of making plans to emigrate in general (Panel c) and to the U.S. (Panel d), and probability of preparing to emigrate (Panel e). For the heterogeneous effects by education, individuals are classified by skill level: those with less than a complete secondary education are categorized as low-skilled, those with complete secondary education or more as high-skilled. All coefficients were multiplied by 100 to express the values as percentage points. The bars represent confidence intervals at the 95% level (light bars) and 90% level (dark bars). All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from the Gallup World Poll and administrative sources.

8 Final Remarks

Central America has increasingly become a primary origin of immigrants to the U.S. over the past two decades, surpassing traditional origin countries like Mexico. This trend has raised significant policy concerns in the U.S. regarding how to address and mitigate the inflow of migrants, especially undocumented ones. Despite this shift, much of the existing literature has concentrated on Mexico, leaving a gap in our understanding of the drivers of emigration from Central America and the characteristics of the individuals more likely to migrate, particularly towards the U.S.

In this paper, we investigate the impact of drug-related violence on the emigration of individuals from Costa Rica, El Salvador, Honduras, and Panama from 2010 to 2016, a timeframe marked by some of the highest violence rates in the world. We also explore the economic and labor market mechanisms that drive these emigration patterns. To do this, we utilize exogenous variation in drug production intensity in Colombia and the average distance from sub-national districts to established drug-trafficking routes within each country, applying an instrumental variable strategy. This method allows us to estimate the causal impact of drug-related violence on emigration outcomes.

Our estimates indicate that drug-related violence significantly increases the desire, planning, and preparation for emigration among Central Americans, with many of these individuals aiming to move to the U.S. When we analyze the underlying mechanisms, we find that drug-related violence negatively affects economic activity in the most impacted districts, adversely affecting labor market conditions, including labor force participation, employment, and income levels. It also negatively influences individuals' perceptions of their living standards and the economy.

A mediation analysis reveals that the effects on emigration are primarily driven by the economic repercussions of violence, rather than by violence and insecurity themselves. This suggests that individuals in Central America often choose to leave their homes in response to a deteriorating quality of life, rather than solely due to rising insecurity or violent incidents. These findings offer important insights for policymakers, indicating that expanding economic opportunities and improving labor market conditions could be key strategies for mitigating emigration from the region.

For the first time, we characterize the emigration patterns driven by drug-related violence in

terms of skill and age composition. Our findings suggest that the main emigration effects identified in this paper predominantly involve high-skilled and young individuals. This has significant implications for both sending countries and the U.S. The fact that most emigrants are young and highly skilled, primarily seeking to settle in the U.S., helps us better understand the potential labor supply shock the U.S. economy may face if violence in Central America persists. On the one hand, given the aging U.S. population and the urgent need for skills to address automation and technological advancements across various industries, these emigrants could serve as valuable assets capable of boosting economic productivity. On the other hand, the inflow of young, skilled individuals could help meet the rising demand for eldercare and nursing services required by the increasing number of Americans over 65 years old, potentially alleviating one of the main concerns associated with this aging process.

Furthermore, the outflow of young, high-skilled individuals from Central America can lead to brain drain, potentially hindering entrepreneurial activities, particularly the creation of innovative firms, which could have significant repercussions for economic growth and development in these countries. This potential negative effect could lead to a worsening quality of life for those who remain in Central America, further motivating more individuals to migrate in the future.

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A Appendix: Technical Appendix

The variable *Desire to Emigrate* is a dummy variable that takes a value equal to 1 if individuals answered yes to the question “Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?", and 0 otherwise.

The variable *Desire to Emigrate to the U.S.* is a dummy variable that takes a value equal to 1 if the individuals answered yes to the Desire to Emigrate variable an additionally indicated that they want to migrate to the U.S., and 0 otherwise.

The variable *Planning to Emigrate* is a dummy variable that takes a value equal to 1 if individuals answered yes to the question “Are you planning to move permanently to another country in the next 12 months, or not?", and 0 otherwise.

The variable *Planning to Emigrate to the U.S.* takes a value equal to 1 if individuals answered yes to the Planning to emigrate variable an 0 otherwise.

The variable *Preparing to Emigrate* is a dummy variable that takes a value equal to 1 if individuals answered yes to the question “Have you done any preparation for this move (for example, applied for residency or visa, purchased the ticket, etc.)?", and 0 otherwise.

The variable *Good living standards* is a dummy variable that takes a value of 1 if individuals answered "Getting better" or "The same" to the question “Right now, do you feel your standard of living is getting better or getting worse?", and 0 otherwise.

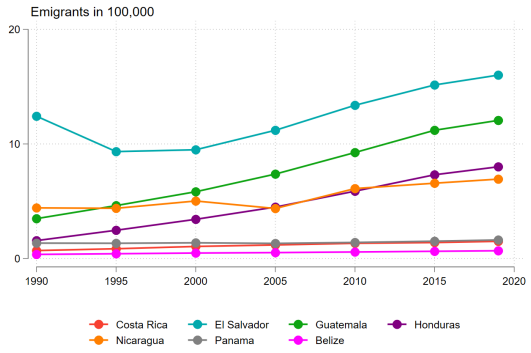
The variable *Economy Opinion* is a dummy variable that takes a value of 1 if individuals answered "Getting better" or "The same" to the question “Right now, do you think that economic conditions in this country, as a whole, are getting better or getting worse?", and 0 otherwise.

The variable *Presence of Gangs* is a dummy variable that takes a value of 1 if individuals answered "Yes" to the question “Are there gangs in the area where you live?", and 0 otherwise.

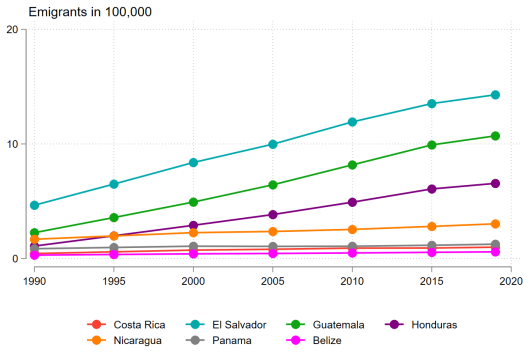
B Appendix: Tables and Figures

Figure B.1: Emigration from Central America towards the U.S. and the World by Country of Origin, 1990-2019

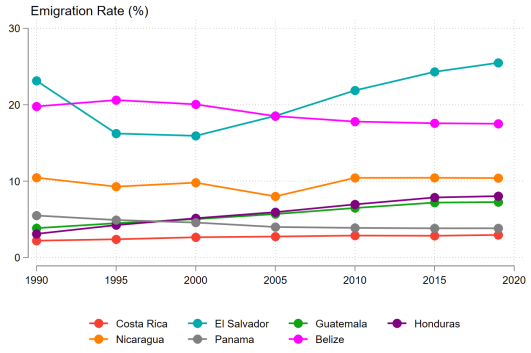
(a) World



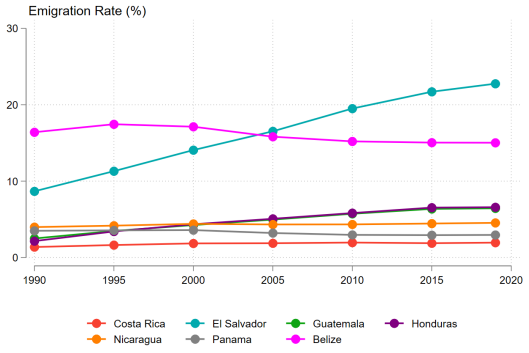
(b) U.S.



(c) World

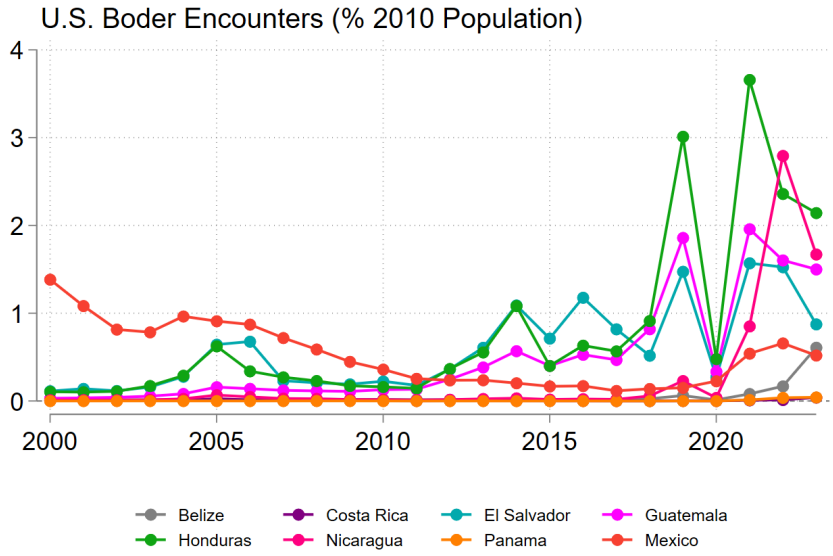


(d) U.S.



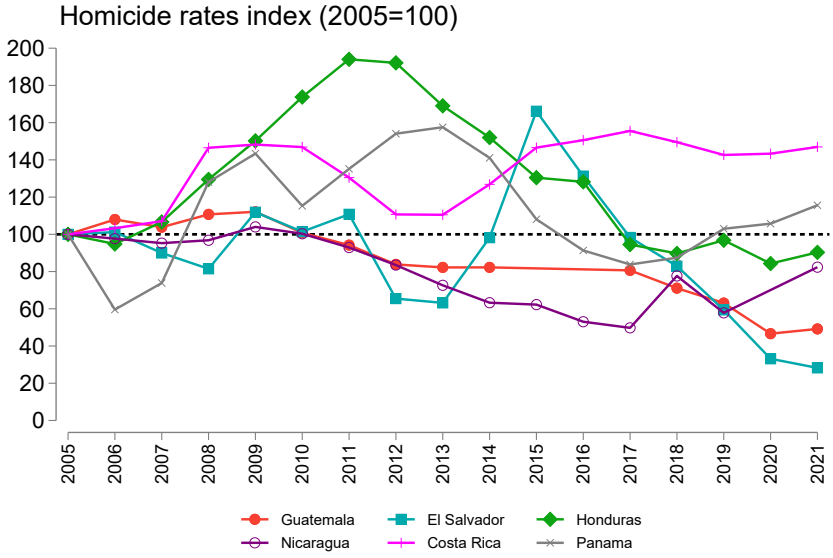
Notes. The figure shows the share of the 5-year change in the stock of migrants in the U.S. originating from each country, expressed relative to the population size of the respective origin country. Source: Own elaboration based on data from UNDESA.

Figure B.2: U.S. Border Encounters, 2000-2020



Notes. The figure shows the share of the number of encounters of citizens by the U.S. Customs and Border Protection (CBP) or the Office of Field Operations (OFO), relative to the 2010 population of each origin country. Encounters include the apprehension of citizens and/or a determination of inadmissibility by OFO for a person requesting admission at a port of entry (land, sea, or air) under Title 8 authority for each country in the figure. Source: Own elaboration based on data from the U.S. Department of Homeland Security.

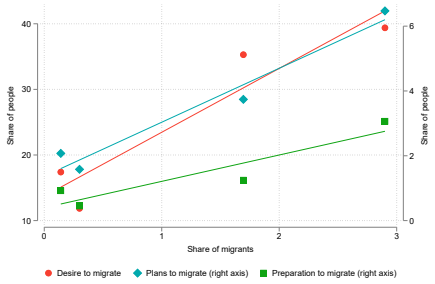
Figure B.3: Homicide Rate Index in Central America over Time (2005=100), 2005-2021



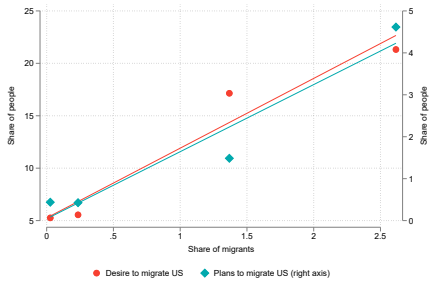
Notes.The figure shows an index of the average homicide rate per 100,000 inhabitants, normalized to 2005 = 100, for each country over time. Source: Own elaboration based on data from World Development Indicators.

Figure B.4: Relationship between Emigration Intentions, Plans, and Preparation and Actual Emigration Rates

(a) Overall migration

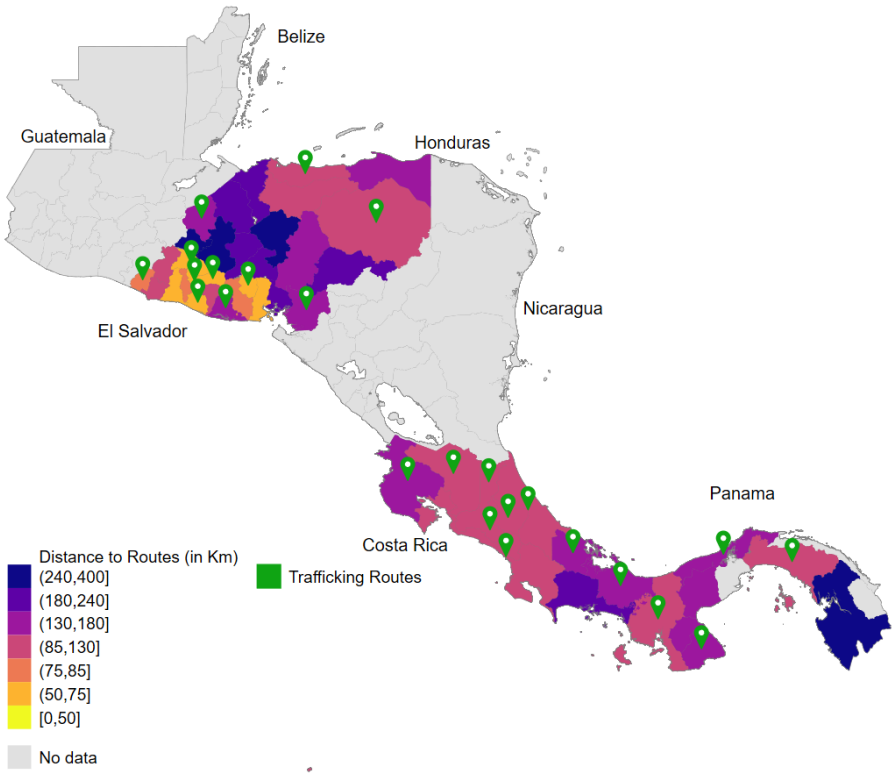


(b) Migration towards the U.S.



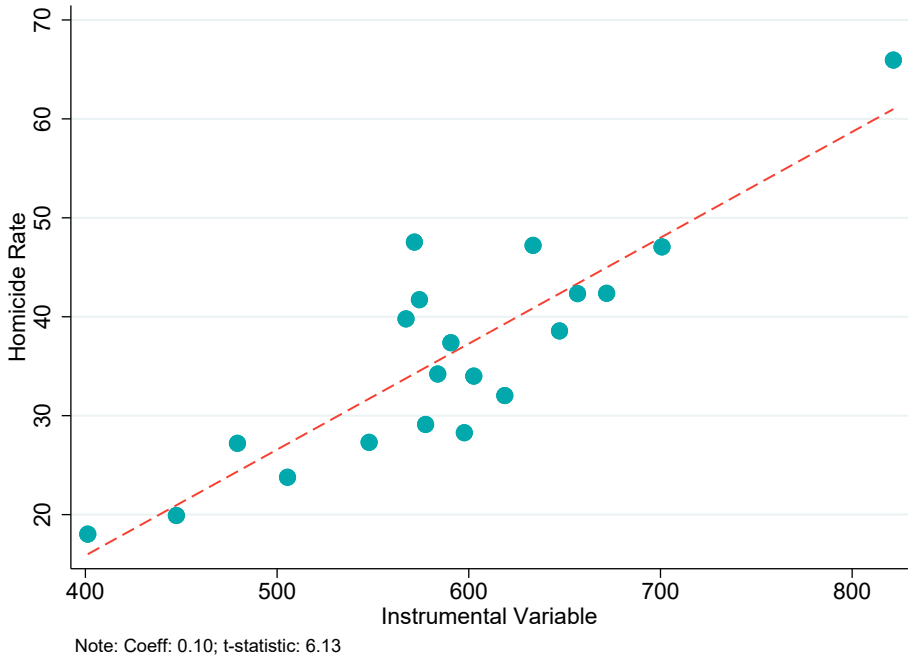
Notes. Source: Own elaboration based on data from Gallup and UNDESA.

Figure B.5: Drug Routes and Average Distance to Trafficking Routes in Central America



Notes. The figure shows the average distance to all drug-trafficking routes within a country for each sub-national district according to the square bracket in equation (2). Green pins indicate districts identified as drug-trafficking routes according to UNODC. Source: Own elaboration based on data from UNODC and Administrative Records

Figure B.6: First Stage



Notes. The figure shows the binscatter of the first-stage regression of the homicide rate (per 100,000 inhabitants) and the instrumental variable defined in equation 2. The regression controls for district and year fixed effects and was estimated using the corresponding sample weights. Source: Own elaboration based on data from United Nations and administrative sources.

Table B.1: First stage - Emigration Outcomes

	Desire		Plans/Preparation	
Panel A: Gallup main sample				
Instrumental Variable	0.104***	0.104***	0.120***	0.120***
	(0.017)	(0.017)	(0.016)	(0.016)
F-statistic	37.67	37.78	53.39	53.67
Observations	24,878	24,877	21,187	21,185
R^2	0.79	0.80	0.80	0.80
Panel B: Presence of Gangs Independent Variable				
Instrumental Variable	0.033***	0.032***	0.026***	0.026***
	(0.006)	(0.005)	(0.008)	(0.008)
F-statistic	34.96	35.38	10.41	11.22
Observations	24,878	24,877	21,187	21,185
R^2	0.08	0.09	0.08	0.09
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sociodemographic controls	No	Yes	No	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.2: First stage - Subjective Measures of Economic Activity and Quality of Life / Nighttime Light Density

	Nighttime Lights		Good Living Standards		Economy Opinion	
Instrumental Variable	0.103***	0.101***	0.104***	0.104***	0.106***	0.106***
	(0.018)	(0.018)	(0.017)	(0.017)	(0.018)	(0.018)
F-statistic	34.09	32.10	37.58	37.70	33.49	33.62
Observations	308	308	25,481	25,480	21,826	21,825
R^2	0.75	0.77	0.79	0.80	0.79	0.79
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	No	Yes	No	Yes	No	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.3: First stage - Labor Market Outcomes

	(1)	(2)
Outcomes: Labor Force, Employment, and Labor Income		
Instrumental Variable	0.102***	0.102***
	(0.012)	(0.012)
F-statistic	71.98	72.34
Observations	726,613	726,613
R^2	0.80	0.80
Outcomes: Hours		
Instrumental Variable	0.102***	0.101***
	(0.012)	(0.012)
F-statistic	74.99	75.37
Observations	471,142	471,142
R^2	0.80	0.80
Outcomes: Wages		
Instrumental Variable	0.101***	0.101***
	(0.012)	(0.012)
F-statistic	74.60	74.99
Observations	444,943	444,943
R^2	0.80	0.80
District FE	Yes	Yes
Year FE	Yes	Yes
Sociodemographic controls	No	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank) and administrative sources.

Table B.4: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration. Canada, Spain, Mexico, and LAC countries

	Desire Canada	Plans Canada	Desire Spain	Plans Spain
Homicide rate	0.0004**	0.0002*	0.0000	0.0004**
	(0.0002)	(0.0001)	(0.0002)	(0.0002)
Mean Dep. Variable	0.02	0.00	0.04	0.02
F-statistic	37.78	53.67	37.78	53.67
Observations	24,877	21,185	24,877	21,185
	Desire LAC	Plans LAC	Desire Mexico	Plans Mexico
Homicide rate	0.0002**	-0.0000	0.0001	-0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Mean Dep. Variable	0.01	0.00	0.00	0.00
F-statistic	37.78	53.67	37.78	53.67
Observations	24,877	21,185	24,877	21,185
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.5: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration by Sex

	Desire	Desire US	Plans	Plans US	Preparation
Gender: Women					
Homicide rate	0.0019***	0.0004	0.0006*	0.0003*	0.0004***
	(0.0006)	(0.0004)	(0.0003)	(0.0002)	(0.0001)
Mean Dep. Variable	0.27	0.14	0.03	0.02	0.01
F-statistic	38.37	38.37	50.13	50.13	50.13
Observations	13,631	13,631	11,474	11,474	11,474
Gender: Men					
Homicide rate	0.002***	0.001**	0.001***	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Mean Dep. Variable	0.30	0.15	0.05	0.03	0.02
F-statistic	37.26	37.26	56.56	56.56	56.56
Observations	11,242	11,242	9,707	9,707	9,707
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.6: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration by Age

	Desire	Desire US	Plans	Plans US	Preparation
Age: 18-40					
Homicide rate	0.0028***	0.0008**	0.0011***	0.0005**	0.0005**
	(0.0007)	(0.0004)	(0.0003)	(0.0002)	(0.0002)
Mean Dep. Variable	0.36	0.18	0.05	0.03	0.02
F-statistic	39.79	39.79	54.35	54.35	54.35
Observations	13,748	13,748	11,945	11,945	11,945
Age: Older than 40					
Homicide rate	0.0012**	0.0006	0.0002	0.0001	0.0001
	(0.0005)	(0.0006)	(0.0002)	(0.0002)	(0.0001)
Mean Dep. Variable	0.20	0.10	0.02	0.01	0.01
F-statistic	33.84	33.84	48.98	48.98	48.98
Observations	11,129	11,129	9,240	9,240	9,240
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.7: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration by Education

	Desire	Desire US	Plans	Plans US	Preparation
Skill: Low					
Homicide rate	0.0014***	0.0003	0.0003	-0.0001	0.0002
	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0001)
Mean Dep. Variable	0.26	0.16	0.03	0.02	0.01
F-statistic	49.21	49.21	62.47	62.47	62.47
Observations	11,226	11,226	9,616	9,616	9,616
Skill: High					
Homicide rate	0.0031***	0.0013**	0.0014***	0.0009***	0.0005***
	(0.0008)	(0.0006)	(0.0004)	(0.0002)	(0.0002)
Mean Dep. Variable	0.31	0.13	0.04	0.02	0.02
F-statistic	25.48	25.48	37.19	37.19	37.19
Observations	13,643	13,643	11,562	11,562	11,562
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Table B.8: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration by Urban and Rural

	Desire	Desire US	Plans	Plans US	Preparation
Urban					
Homicide rate	0.0028***	0.0010*	0.0008***	0.0003	0.0008***
	(0.0006)	(0.0006)	(0.0003)	(0.0002)	(0.0001)
Mean Dep. Variable	0.31	0.14	0.04	0.02	0.02
F-statistic	19.80	19.80	57.18	57.18	57.18
Observations	10,466	10,466	8,189	8,189	8,189
Rural					
Homicide rate	0.0018***	0.0006	0.0007*	0.0004	0.0001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Mean Dep. Variable	0.27	0.15	0.03	0.02	0.01
F-statistic	44.63	44.63	41.69	41.69	41.69
Observations	14,410	14,410	12,993	12,993	12,993
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at department level in parenthesis. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

C Appendix: Robustness Checks

In this appendix, we present robustness checks to support the causal interpretation of our estimated coefficients.

Alternative definition of Coca Crops flow: First, we modify the instrumental variable definition such that, instead of considering the flow of coca corresponding to the Atlantic and Pacific coasts, we only consider the total amount of coca shipped from Colombia, regardless of the coast of shipment. The IV is then defined as follows:

$$Z_{dct} = \left[\frac{1}{K}\sum_{j\in K} D_{djc}\right]^{-1} \times CC_t \tag{C.1}$$

Here CC_t is the total stock of Colombian coca crops. The results of the estimates on migration decisions and intentions are presented in Table C.1 and are very similar to the main estimates.

Table C.1: Robustness check: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration with Alternative definition of Coca Flow

	Desire	Desire US	Plans	Plans US	Preparation
Homicide rate	0.0023***	0.0009**	0.0008***	0.0004*	0.0004***
	(0.0006)	(0.0004)	(0.0003)	(0.0002)	(0.0001)
Mean Dep. Variable	0.29	0.14	0.04	0.02	0.01
F-statistic	20.42	20.52	24.71	24.65	24.71
Observations	24,877	25,480	21,185	21,736	21,185
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Shift-Share Instrumental Variable Internal Validity: The instrumental variable we implement to address the concerns of endogeneity regarding the independent variable of the homicide rate is a shift-share instrument. The shift is defined by the total production of coca crops in Colombia, which provides time variability to the instrumental variable. The shares are determined by the inverse of the average distance of each district from trafficking routes within each country.

According to Goldsmith-Pinkham et al. (2020), the identifying assumption in this type of setting relies on the exogeneity of the shares. This means that there should not be differential trends in our outcome variable influenced or correlated with the share component of our instrumental variable, based on predetermined characteristics of our units of analysis. Such correlations would violate the exclusion restriction. For instance, one might argue that districts with higher informality rates are more exposed to drug trafficking. Consequently, changes in the labor market over time might be correlated with this characteristic through channels unrelated to drug-related violence.

In cases where there is a specific post-period, one could test this assumption by plotting the reduced-form trends of the outcome variables based on the share component across municipalities over time, prior to the treatment shock. However, this is not feasible in our case, as we lack a specific period for the shock and do not have sufficient historical data to plot pre-trends of the outcomes.

To mitigate this concern, we control for a variety of predetermined district characteristics derived from SEDLAC. Specifically, we estimate our main migration results while controlling for economic activity (as proxied by nighttime light density), poverty rate, Gini coefficient, informality rate, and average employment rate for each district, all calculated during the period from 2005 to 2009 and interacted with time dummies. This approach enables us to non-parametrically control for any changes in our outcome variables that may be correlated with these district characteristics. The results of this analysis are virtually the same as those of our main estimates and are presented in Table C.2.

Table C.2: Robustness check: Effect of Drug-Related Violence on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration with Pre-determined District Controls

	Desire	Desire US	Plans	Plans US	Preparation
Homicide rate	0.0028***	0.0011*	0.0011***	0.0005**	0.0004*
	(0.0008)	(0.0006)	(0.0003)	(0.0002)	(0.0002)
Mean Dep. Variable	0.29	0.14	0.04	0.02	0.01
F-statistic	34.52	33.91	43.38	42.29	43.38
Observations	24,877	25,480	21,185	21,736	21,185
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes
Past Controls $\times$ Year FE	Yes	Yes	Yes	Yes	Yes

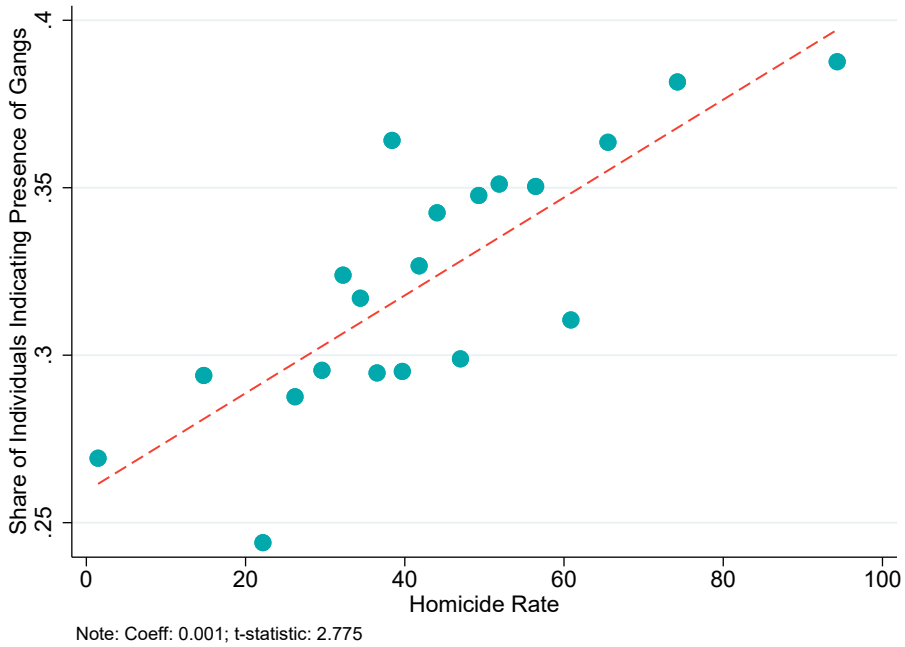
Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Additional controls include predetermined district characteristics interacted with time dummies. The district characteristics considered were the poverty rate, Gini coefficient, informality rate, average years of education, and average employment rate, all calculated during the 2005-2009 period. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

Alternative definition of drug-related violence: As an additional robustness exercise, we modify our main specification by substituting the homicide rate, which serves as our measure of drug-related violence with a dummy variable sourced from the Gallup World Poll. In this poll, respondents indicate whether or not gangs are present in their area of residence. Given the crime dynamics associated with drug trafficking activity in Central America, we anticipate that a higher exposure to coca trafficking will correlate with a greater presence of gangs in the region. This, in turn, is expected to be correlated with high levels of violence and, consequently, an increase in the emigration intentions of Central Americans.

As shown in Figure C.1, there appears to be a strong relationship between the presence of gangs and the homicide rate in each district, supporting the inclusion of this additional variable

in our robustness exercise.

Figure C.1: Relationship between the Presence of Gangs and the Homicide Rate



Notes. The figure shows the binscatter of the regression of the proportion of individuals in each district indicating that there is presence of gangs coming from the Gallup World Poll data on the homicide rate (per 100,000 inhabitants) . The regression controls for district and year fixed effects. Source: Own elaboration based on data from United Nations and Gallup World Poll and administrative sources.

The first-stage results of these estimates are presented in Panel C of Table B.1, while the instrumental variable estimates of the effect of gang presence as a proxy for drug-related violence on the emigration intentions of individuals are provided in Table C.3. Two main takeaways arise from this exercise. First, the first-stage estimates in Table B.1 demonstrate that our instrumental variable is a robust predictor of gang presence in Central America. This finding reassures us that our instrumental variable effectively captures the presence of violence, crime, and illicit activities in these areas, which are likely to influence the migration behavior of local individuals.

Secondly, the instrumental variable estimates regarding the presence of gangs and the emigration behavior of Central Americans, as presented in Table C.3, are statistically significant and align in direction with our main estimates using the homicide rate. Notably, as the presence of gangs is represented as a dummy variable—unlike the continuous measure of the homicide rate—the interpretation of the magnitudes differs. Specifically, our estimates suggest that the presence of gangs increases the probability of Central American individuals preparing to emigrate by 16 p.p. compared to areas with no gang presence.

Table C.3: Robustness check: Effect of the Presence of Gangs on the Probability of Having Desires to Emigrate, Planning to Emigrate, and Preparing for Migration

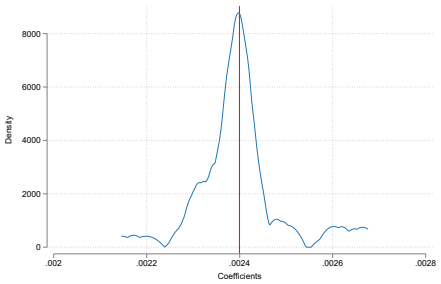
	Desire	Desire US	Plans	Plans US	Preparation
Presence of Gangs	0.708***	0.227**	0.382***	0.175*	0.162**
	(0.137)	(0.102)	(0.132)	(0.095)	(0.062)
Mean Dep. Variable	0.29	0.14	0.04	0.02	0.01
F-statistic	35.38	36.99	11.22	12.28	11.22
Observations	24,877	25,480	21,185	21,736	21,185
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Sociodemographic controls include age dummies, an urban dummy, a gender binary indicator, and education dummies. Clustered standard errors at the district level are in parentheses. The F-statistic corresponds to the Kleibergen-Paap rk Wald statistic. ***, **, * denote significance at the 1, 5, 10 percent significance level. All regressions were estimated using the corresponding sample weights. Source: Own elaboration based on data from Gallup World Poll and administrative sources.

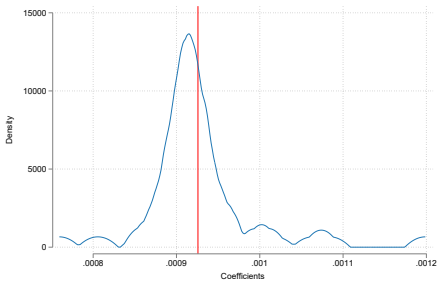
Leave-one-out estimations: Moreover, we re-run all main regressions related to emigration in a leave-one-out fashion. Specifically, we sequentially exclude each sub-national district from the sample to ensure that results are not driven by any particular district in the countries studied. Figure C.2 display the results of this exercise. As shown, the distribution of the estimated coefficients is strongly concentrated around the original estimates (red line).

Figure C.2: Leave-one-out Robustness Checks

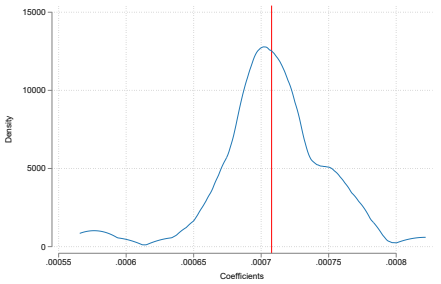
(a) Desire to Emigrate



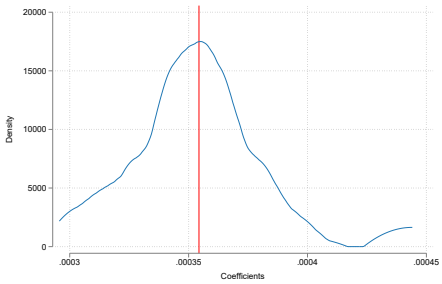
(b) Desire to Emigrate to U.S.



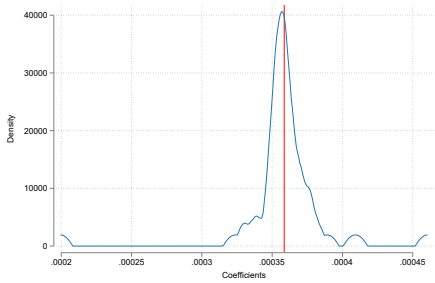
(c) Plan to Emigrate



(d) Plan to Emigrate to U.S.



(e) Preparation to Emigrate

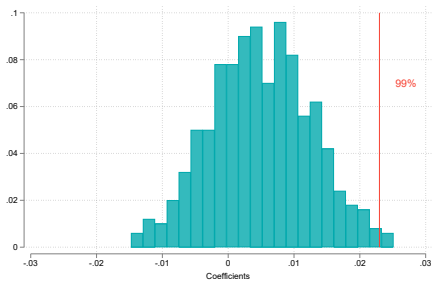


Notes. All regressions control for district fixed effects, year fixed effects, age dummies, an urban dummy, a gender binary indicator, and education dummies. Additionally, all regressions were estimated using the corresponding sample weights. Source: Own elaboration based on Gallup data and administrative sources.

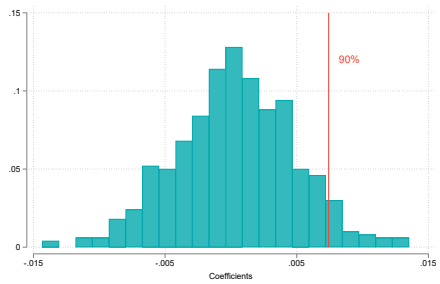
Placebo exercises: Next, we conduct placebo exercises to ensure that our results do not simply capture specific trends in the outcome variables but, rather, reflect the actual impact of proximity to drug-trafficking routes on emigration behavior. Specifically, we re-run our reduced-form estimates, regressing the dependent variables of interest against the IV while randomly reassigning the instrument's distance component across districts. Figure C.3 displays these results. As shown, our original estimated coefficients are, in most cases, larger (in absolute terms) than nearly all placebo coefficients, suggesting that our original estimates are not capturing trends in the outcome variables correlated with coca production in Colombia.

Figure C.3: Placebo Exercises

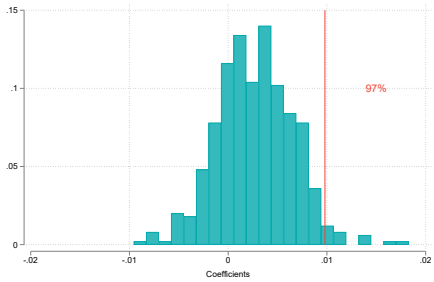
(a) Desire to Emigrate



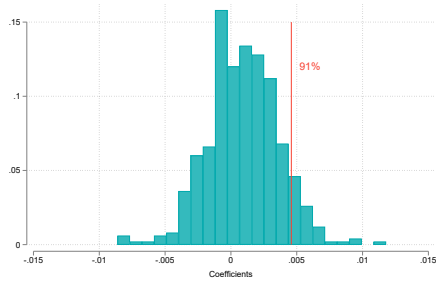
(b) Desire to Emigrate to U.S.



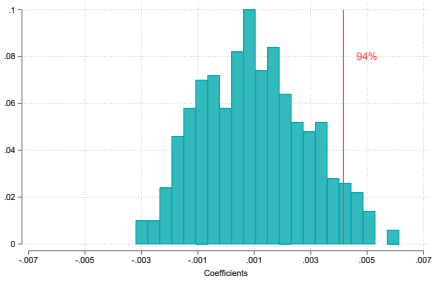
(c) Plan to Emigrate



(d) Plan to Emigrate to U.S.



(e) Preparation to Emigrate



Notes. All regressions control for district fixed effects, year fixed effects, age dummies, an urban dummy, a gender binary indicator, and education dummies. Additionally, all regressions were estimated using the corresponding sample weights. Source: Own elaboration based on Gallup data and administrative sources.

D Appendix: Mediation Analysis

The analytical framework is straightforward. Assume we have a treatment variable T (in this case, drug-related violence) that affects both a mediator M (which corresponds to the *economic channel* outcomes, such as labor market variables) and the outcome variables Y (the emigration variables). Additionally, we assume that T is not randomly assigned with respect to the outcomes and mediators, meaning that $\varepsilon_T \not\perp \varepsilon_Y$ and $\varepsilon_T \not\perp \varepsilon_M$. However, suppose there exists an instrumental variable Z that satisfies the conditions for exogeneity relative to M and Y (i.e., $\varepsilon_Z \perp \varepsilon_Y$ and $\varepsilon_Z \perp \varepsilon_M$), and is a strong predictor of T.

Following the framework proposed by Dippel et al. (2020), we can express the relationships as follows: $M = f_M(T, \varepsilon_M)$ and $Y = f_Y(T, M, \varepsilon_Y)$. This indicates that the mediator is influenced by our treatment T, and the outcome variables—the emigration outcomes—are affected by drug-related violence T both directly and indirectly through the mediator M. Consequently, our analysis of mediation will facilitate an understanding of the fraction of the total effect on Y that is directly attributable to T versus the portion that operates through M.

In this context, as long as the endogeneity between T and M arises from confounders that influence both variables, and when treatment T is endogenous in a regression of Y on T due to the same confounders that affect Y mainly through M, we can implement a two-step procedure. This procedure will allow us to estimate the proportions of the total effect on our primary outcomes of interest that are driven directly by T and those explained through the effect of T on M—specifically, the indirect effect represented by the *economic channel*.

Under this setting, we have that our framework is given by the following:

$$Z = \varepsilon_z \tag{D.1}$$

$$T = \beta_T^Z Z + \varepsilon_T \tag{D.2}$$

$$M = \beta_M^T T + \varepsilon_M \tag{D.3}$$

$$Y = \beta_Y^T T + \beta_Y^M M + \varepsilon_Y \tag{D.4}$$

Where β_Y^T captures the direct effect of the treatment on the outcome variables (in our case, the *violence channel*), and $\beta_Y^M \times \beta_M^T$ captures the indirect effect of T on Y through M, representing the mediator effect or, in our context, the *economic channel*. Therefore, $\beta_Y^T + \beta_Y^M \times \beta_M^T$ constitutes the total effect of drug-related violence on emigration intentions, which was estimated in the main results section of the paper.

According to Dippel et al. (2020), we can recover β_M^T from an instrumental variable regression of M on Z, and β_Y^T and β_Y^M from the following regression:

$$Y = \beta_Y^T T + \beta_Y^M \hat{M} + \varepsilon_Y \tag{D.5}$$

Where $\hat{M}$ is the instrumented M with Z. Based on this, we can calculate the proportion of the total effect that is driven by the *economic channel* with the following simple calculation:[13]

$$\textit{Economic channel} = \frac{\beta_Y^M \times \beta_M^T}{\beta_Y^T + \beta_Y^M \times \beta_M^T} \tag{D.6}$$

The results of the mediation analysis are presented in Tables D.1 and D.2, and summarized in

[13] Given that it is plausible for the terms β_Y^T and $\beta_Y^M \times \beta_M^T$ to have opposite signs, the ratio referred to as the *Economic channel*—which represents the share of the total effect driven by the mediator—can take values greater than 1 (Dippel et al., 2020).

Table 7 in Section 6 of the main body of the paper.

Table D.1: Mediation Analysis of the Effect of Drug-Related Violence on Emigration Intentions - Objective variables

	Desire	Desire US	Plans	Plans US	Preparation
Mediator: Labor Force Participation					
Total effect	0.0023***	0.0010***	0.0008***	0.0004**	0.0004***
	(0.0006)	(0.0004)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0001	0.0000	-0.0001	0.0000	-0.0001
	(0.0004)	(0.0003)	(0.0002)	(0.0001)	(0.0001)
Indirect effect	0.0022**	0.0010**	0.0009**	0.0003	0.0004**
	(0.0009)	(0.0005)	(0.0004)	(0.0003)	(0.0002)
F-statistic (T on Z)	26.70	26.70	23.79	23.79	23.79
F-statistic (M on Z | T)	20.52	20.52	24.67	24.67	24.67
Mediation Effect (%)	95.93	99.62	109.18	87.63	114.74
Observations	301	301	257	257	257
Mediator: Employment					
Total effect	0.0023***	0.0010***	0.0008***	0.0004**	0.0004***
	(0.0006)	(0.0004)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0003	0.0001	-0.0001	0.0001	-0.0000
	(0.0004)	(0.0003)	(0.0002)	(0.0001)	(0.0001)
Indirect effect	0.0020**	0.0009*	0.0009**	0.0003	0.0004**
	(0.0009)	(0.0005)	(0.0004)	(0.0002)	(0.0002)
F-statistic (T on Z)	26.70	26.70	23.79	23.79	23.79
F-statistic (M on Z | T)	14.72	14.72	21.70	21.70	21.70
Mediation Effect (%)	87.25	90.61	106.42	85.42	111.84
Observations	301	301	257	257	257
Mediator: Labor Income					
Total effect	0.0023***	0.0010***	0.0008***	0.0004**	0.0004***
	(0.0006)	(0.0004)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0006	0.0002	0.0001	0.0001	0.0000
	(0.0004)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Indirect effect	0.0017**	0.0008*	0.0008*	0.0003	0.0004*
	(0.0008)	(0.0005)	(0.0004)	(0.0002)	(0.0002)
F-statistic (T on Z)	26.70	26.70	23.79	23.79	23.79
F-statistic (M on Z | T)	11.26	11.26	12.21	12.21	12.21
Mediation Effect (%)	74.44	77.31	92.26	74.05	96.96
Observations	301	301	257	257	257
Mediator: Nighttime light density					
Total effect	0.0023***	0.0010***	0.0008***	0.0004**	0.0004***
	(0.0006)	(0.0004)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0009***	0.0004	0.0004**	0.0002**	0.0001**
	(0.0003)	(0.0003)	(0.0002)	(0.0001)	(0.0001)
Indirect effect	0.0014*	0.0006*	0.0005	0.0002	0.0002
	(0.0008)	(0.0004)	(0.0003)	(0.0001)	(0.0002)
F-statistic (T on Z)	26.70	26.70	23.79	23.79	23.79
F-statistic (M on Z | T)	10.16	10.16	8.20	8.20	8.20
Mediation Effect (%)	59.50	61.79	55.82	44.80	58.66
Observations	301	301	257	257	257
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Clustered standard errors at the district level are in parentheses. Source: Own elaboration based on data from Gallup World Poll and the Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank).

Table D.2: Mediation Analysis of the Effect of Drug-Related Violence on Emigration Intentions - Subjective variables

	Desire	Desire US	Plans	Plans US	Preparation
Mediator: Economy Opinion					
Total effect	0.0019***	0.0008**	0.0007***	0.0003	0.0003***
	(0.0004)	(0.0003)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0001	-0.0002	-0.0002	-0.0000	-0.0001
	(0.0005)	(0.0004)	(0.0003)	(0.0001)	(0.0001)
Indirect effect	0.0017**	0.0010*	0.0009*	0.0003	0.0004*
	(0.0008)	(0.0005)	(0.0005)	(0.0002)	(0.0002)
F-statistic (T on Z)	37.69	37.69	51.71	51.71	51.71
F-statistic (M on Z | T)	11.60	11.60	12.25	12.25	12.25
Mediation Effect (%)	93.48	132.95	129.31	115.68	136.99
Observations	21,306	21,306	17,615	17,615	17,615
Mediator: Good living standards					
Total effect	0.0021***	0.0007**	0.0007***	0.0003*	0.0003***
	(0.0004)	(0.0003)	(0.0002)	(0.0002)	(0.0001)
Direct effect	0.0002	-0.0001	0.0001	0.0000	-0.0000
	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Indirect effect	0.0018**	0.0008**	0.0006*	0.0002	0.0003**
	(0.0007)	(0.0004)	(0.0003)	(0.0002)	(0.0002)
F-statistic (T on Z)	37.72	37.72	51.77	51.77	51.77
F-statistic (M on Z | T)	10.36	10.36	15.30	15.30	15.30
Mediation Effect (%)	88.79	112.30	92.24	90.69	101.05
Observations	24,878	24,878	21,187	21,187	21,187
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sociodemographic controls	Yes	Yes	Yes	Yes	Yes

Notes. Clustered standard errors at district level in parenthesis. Source: Own elaboration based on data from Gallup World Poll and the Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank).