NAFTA and drug-related violence in Mexico *

Eduardo Hidalgo
University of Cologne †

Erik Hornung
University of Cologne ‡

Pablo Selaya
University of Copenhagen §

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Abstract

We study how NAFTA changed the geography of violence in Mexico. We propose that this open border policy increased trafficking profits of Mexican cartels, resulting in violent competition among them. We test this hypothesis by comparing changes in drug-related homicides after NAFTA's introduction in 1994 across municipalities with and without drug-trafficking routes. Routes are predicted least cost paths connecting municipalities with a recent history of detected drug trafficking with U.S. land ports of entry. On these routes, homicides increase by 2.1 per 100,000 inhabitants, which is equivalent to 26% of the pre-NAFTA mean. These results cannot be explained by changes in worker's opportunity costs of using violence resulting from the trade shock.

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† University of Cologne, Albertus-Magnus-Platz, 50923 Cologne, Germany; hidalgo@wiso.uni-koeln.de

‡ University of Cologne, Albertus-Magnus-Platz, 50923 Cologne, Germany; hornung@wiso.uni-koeln.de

§ University of Copenhagen, Øster Farimagsgade 5, 26.2.25, 1353 Copenhagen, Denmark; pablo.selaya@econ.ku.dk

1 Introduction

Trade agreements can create economic shocks that may result in criminal activity and violence. The literature proposes two potential channels for this: an opportunity cost effect and a rapacity effect.[1] If shocks negatively affect labor markets, the resulting worker displacement can lead to increases in violence because of a decline in the opportunity costs of criminal activity. If shocks positively affect the demand for natural resources, the resulting increase in income derived from their ownership can increase violent conflict due to higher returns from appropriating the resources.

This paper highlights a novel mechanism according to which trade shocks trigger the rapacity effect. The proposed mechanism is rooted in the complementarity between trade in legal and illegal goods that results from the clandestine cross-border transportation of illegal goods hidden in legal goods. We suggest that trade liberalization agreements, by facilitating the unchecked exchange of legal goods, unintentionally increase the profits from smuggling illicit goods. When experiencing such shocks, firms in the illicit goods sector compete over profits by using violence, due to the absence of legally enforced property rights. Therefore, according to our hypothesis, trade-induced positive shocks to illicit markets incentivize firms to invest in conflict and capture strategically important locations such as production sites or smuggling routes using violence.

We provide evidence for our hypothesis by exploiting the positive income shock to the drug-trafficking industry induced by Mexico's accession to the North American Free Trade Agreement (NAFTA). NAFTA came into force in 1994 and eliminated most barriers to trade between Mexico and the United States. Cross-border flows of legal goods massively increased as a consequence: Mexican exports to the U.S. as percent of GDP more than doubled between 1993 and 1995. At the same time, the number of trucks crossing the border with cargo almost doubled, whereas inspection rates declined. NAFTA thus lowered the cost of smuggling illegal drugs into the U.S. (Andreas, 1996, 2012). This arguably increased profits in the Mexican drug-trafficking sector and thereby the value of controlling this illicit sector.

NAFTA arguably increased profits of Mexican drug-trafficking organizations (DTOs) because their main expenses derive from the cost of transporting illegal drugs across the U.S. border into consumer markets. Next to trafficking locally produced cannabis and opium, since the mid-1980s, Mexican DTOs provided cocaine trafficking services to cartels in Colombia which preferred Mexican overland routes. Mexican cartels thus were able to negotiate a 50% cut of the transported cocaine from Colombia and became major players in the cocaine business themselves (Cockburn and Clair, 1998).

Empirically, we test the hypothesis that Mexican regions traversed by drug-trafficking routes saw larger increases in drug-related violence after the introduction of NAFTA than other regions. To test this hypothesis, we combine municipal-level panel data on drug-related homicides with predicted optimal drug-trafficking routes. Optimal drug-trafficking routes are predicted by connecting pre-NAFTA locations of major drug eradication and seizures of illegal drugs in Mexico with all

[1] For important contributions to this literature see, e.g., Becker (1968), Collier and Hoeffler (2004), Dal Bó and Dal Bó (2011), Dube and Vargas (2013), and Dell, Feigenberg and Teshima (2019).

U.S. land ports of entry using Dijkstra's algorithm (Dijkstra, 1959). Using the full extent of the road network, we predict which Mexican municipality is located on a drug-trafficking route.

Our empirical strategy exploits the fact that the introduction of NAFTA in 1994 increased the value of controlling the corridors for transporting illegal drugs into the U.S. for DTOs. We thus expect that municipalities located on a drug-trafficking route experience an increase in drug-related violence after the implementation of the trade agreement. To analyze the consequences of NAFTA for drug-related violence, we use difference-in-differences models that compare the number of drug-related homicides per 100.000 inhabitants in municipalities with and without a drug-trafficking route before and after 1994.

The results confirm that the introduction of NAFTA is associated with an increase in drug-related homicides by approximately 2.1 per 100.000 inhabitants in municipalities on predicted drug-trafficking routes. The increase in homicides is economically sizable, i.e., NAFTA is associated with 26% more homicides compared to the pre-NAFTA mean. Heterogeneity analyses reveal that violence increased more in municipalities with longer segments of trafficking routes and in segments where the hold-up problem is more severe, as cartels can extract higher rents in downstream locations where access to alternative routes is limited. We argue that DTOs concentrated violent activity in these places, which became more strategically valuable after NAFTA's introduction. Further supporting this notion, we find that violence only increased in municipalities traversed by routes connecting ports of entry with substantial trade volumes and trade growth, but not in those linked to less active ports. This finding reinforces the idea that illicit goods are smuggled alongside legal trade, benefiting from reduced inspection risks in high-volume ports of entry.

We corroborate the validity of our identification strategy in several ways. First, using an event-study design, we show that trends in drug-related homicides did not differ across municipalities with and without routes prior to NAFTA.[2] Second, we show that our effects are not driven by coinciding events such as the Mexican peso crisis, the Zapatista uprising, or the Mexican general elections of 1994. Third, using falsification tests, we show that the introduction of NAFTA is neither associated with changes in homicides of demographics that are typically not involved in the trafficking business, such as women and older people, nor with other causes of deaths, such as suicides and traffic fatalities. Fourth, using regions that predominantly produced maize that arguably suffered the strongest from import competition due to NAFTA as origins to generate placebo routes, we find no change in drug-related homicides in municipalities traversed by such a route after 1993. These checks confirm that the estimated increase in drug-related homicides in municipalities with a predicted drug-trafficking route is triggered by an increase in illegal-drugs trade due to NAFTA and is not confounded by the detrimental effects of import competition in maize.

Clearly, NAFTA affected the Mexican economy in ways that potentially constitute alternative explanations for our estimated effects on violence. For example, Mexican producers faced increased trade competition leading to job losses, especially in the agricultural sector and particularly for

[2] Our results are also confirmed when using a synthetic difference in-differences approach.

maize farmers. This may have reduced the opportunity costs of using violence for farmers due to lower agricultural incomes. Hence, if there is a spatial correlation between our predicted drug-trafficking routes and the local exposure to a negative trade shock, our results might not be driven by an increase in profits for Mexican cartels.

To rule out that our results are explained by the shock to legal trade directly, we introduce several control variables that aim to account for trade competition. First, we use night-time luminosity to confirm that the estimated route effect is not confounded by local changes in aggregate economic activity. Second, we examine whether regional exposure to the trade shock, measured through local employment shares in agriculture, manufacturing, and export manufacturing, affects our findings, and find no evidence that it does. Third, following Kovak (2013), we interact local industry-level employment with industry-level NAFTA-induced tariff changes to test whether regional exposure to tariff reductions influences our results, again finding no confounding effect. Finally, we control for potential effects on agriculture by including interactions between local maize suitability and national maize prices, as well as between maize-dependent small farms (ejidos) and maize prices. Taken together, the results suggest that while opportunity cost effects may be present, they do not confound the rapacity effect of violent competition over rents from trafficking routes.

To study changes in the spatial distribution of drug-related violence after NAFTA's introduction, we first confirm the presence of spillover effects to neighboring regions within 40 km of routes. Using local polynomial regressions to inspect differential changes depending on distance to trafficking routes, we further find that violence was diverted from regions further away to those in close proximity of routes. Rather than increasing aggregate violence, NAFTA may have led to a reallocation of violence, especially in the long run.

Finally, using homicides from the period 1995–2010, we inspect whether homicides on trafficking routes were indeed a result of inter-cartel competition and whether NAFTA had lasting consequences on the geography of violence. In cross-sectional regressions we show that municipalities traversed by routes experienced comparatively higher levels of drug-related homicides throughout the 2000s. Furthermore, route location is significantly related to homicides resulting from inter-cartel conflict in any period but not to homicides resulting from confrontations or aggression between cartels and the military or police forces. This aligns with our hypothesis that DTOs use violence to compete over trafficking routes.

We contribute to several branches of the literature. In its broadest sense, this paper contributes to the literature on income shocks and civil conflict. This literature studies how exactly income shocks are related to violence and conflict, i.e., by changing the opportunity costs of using violence and insurrection or by increasing the value of resources usually owned by the state and thereby increasing the incentives to seize the state (see, e.g., Collier and Hoeffler, 1998, 2004; Miguel, Satyanath and Sergenti, 2004; Angrist and Kugler, 2008; Dal Bó and Dal Bó, 2011; Dube and Vargas, 2013; Bazzi and Blattman, 2014; Berman and Couttenier, 2015; Berman et al., 2017; Sánchez De La Sierra, 2020). We add to this literature by highlighting that due to the complementarity between legal and illegal trade, as proposed by Russo (2014) and recently explored in the context of fentanyl smuggling (Moore, Olney and Hansen, 2023), shocks to legal trade spill over into illicit markets.[3] In the absence of enforced property rights, such shocks increase competition and trigger a rapacity effect as criminal organizations violently contest control over trafficking routes to capture increased profits.

Furthermore, our paper contributes to the growing literature on the consequences of trade liberalization for labor markets and crime. This research examines how trade shocks change labor market conditions, ultimately inducing violence and property crime through an opportunity costs channel (see Iyer and Topalova, 2014; Deiana, 2016; Dix-Carneiro, Soares and Ulyssea, 2018). Focusing on Mexico's trade liberalization period (1986–2000), Atkin (2016) studies the expansion of export manufacturing under the maquiladora system and its impact on educational attainment. He finds that the growth of low-skill, export-oriented jobs raised the opportunity cost of schooling, leading to an increase in high-school dropout rates. Our findings complement this result by showing that regions with expanding employment in export industries or reduced investment in education due to low-skill job opportunities did not experience differential increases in drug-related violence after NAFTA. Since these regions likely saw higher opportunity costs of engaging in violence, this suggests that changes in labor market conditions alone do not explain the increase in drug-related violence. On the other hand, Dell, Feigenberg and Teshima (2019) demonstrate that trade-induced job losses in Mexico's manufacturing sector, driven by competition with China, led to increased cocaine trafficking and violence. They argue that deteriorating labor market conditions lowered the opportunity cost of criminal activity, pushing more individuals into drug trafficking and fueling violence. Some of our findings align with this mechanism, as we show that regions with a larger agricultural sector experienced higher levels of violence in response to the phase-out of Mexican agricultural tariffs, whereas regions with a larger manufacturing sector experienced lower levels of violence in response to the phase-out of U.S. manufacturing tariffs. Beyond demonstrating how trade liberalization increased drug-related violence through a rapacity effect, our study contributes to the literature by disentangling this mechanism from the labor market channel, showing that NAFTA's impact on trafficking routes operated independently of labor market disruptions.

More narrowly, the intensity of the Mexican drug war has drawn the attention of economists. Between 2007 and 2010, the National Security Council registered over 50,000 drug-related homicides. In 2021 alone, Mexico registered more than 29,000 intentional homicides, equivalent to almost 23 intentional homicides per 100.000 inhabitants (IISS, 2022). Most of these homicides were arguably caused by conflicts between DTOs competing for the control of territories and by government interventions (Calderón et al., 2015; Dell, 2015; Osorio, 2015; Castillo and Kronick, 2020), an increase in the drug-profits for drug trafficking organizations (Castillo, Mejía and Restrepo, 2020; Sobrino, 2020), or increases in unemployment (Dell, Feigenberg and Teshima, 2019). There are few studies that explore the early development of the drug industry in Mexico during the 1990s,

[3]When studying the smuggling of illicit goods, the literature often implicity assumes such complementarities between legal and illegal trade. For examples, see Fisman and Wei (2009) on cultural property or Dube, Dube and García-Ponce (2013) on illegal weapons.

the golden years of Mexican cartels that may have paved the path for current conflicts.[4] Dube, García-Ponce and Thom (2016) analyze how international commodity-price fluctuations, driven by the introduction of NAFTA in 1994, affect illegal drug production in Mexico. Their findings imply that a decrease in maize prices increased the cultivation of cannabis and opium, leading to more intense activity of Mexican cartels and violence. Trejo and Ley (2018) show that Mexican cartels increasingly resorted to violence after they lost government protection due the increase in political competition starting in the 1990s. We contribute to this literature by providing evidence that the introduction of NAFTA is associated with a lasting increase of drug-related violence in places that were of strategic importance for drug trafficking.

The consequences of NAFTA's introduction have been largely discussed in the economic literature. By combining trade data with post-NAFTA survey studies, Burfisher, Robinson and Thierfelder (2001) find that both the U.S. and Mexico benefited from the trade agreement, with much larger relative benefits for Mexico. Choi et al. (2024) estimate that NAFTA reduced employment in U.S. counties most exposed to Mexican import competition and leading to a local decline in voting for the Democratic party.[5] By inspecting the consequences of NAFTA for an illegal market, we add a hitherto neglected perspective to this literature.

The rest of the paper is organized as follows. Section 2 provides the necessary context on Mexican DTOs, their use of violence, and the introduction of NAFTA before describing conceptual considerations. Section 3 presents the data. Section 4 introduces the empirical strategy, the main results, and the robustness checks. Section 5 inspects spillover and displacement effects. Section 6 provides evidence on inter-cartel competition over trafficking routes. Section 7 concludes.

2 Background

2.1 The rise of DTOs and violence in Mexico

Throughout the 1970s and 1980s illegal drugs, especially refined cocaine and heroin, were typically shipped from Latin American producers to U.S. consumer markets via maritime routes through the Caribbean.[6] Mexico was the world's largest producer of cannabis (more than 50% of worldwide production) and also a source country for opium and methamphetamine consumed in the U.S. The U.S. was the world's largest market for the consumption of cocaine, which assumes approximately two thirds of U.S. total expenditures on illicit drugs (The White House, 1992, p. 78).

After the interdiction efforts of the mid-1980s, Colombian drug-lords shifted their operations from maritime to Mexican overland routes. Colombian cartels teamed up with Mexican DTOs, experienced in trafficking cannabis into the U.S., and relied on their trafficking services for cocaine.

[4] Murphy and Rossi (2020) show that the location of cartels in the 2000s can be traced to Chinese immigration of the early 20th century.

[5] Studies of NAFTA's effects on labor markets also include Robertson (2000) who finds that the U.S.-Mexican labor market was highly integrated prior to NAFTA. Juhn, Ujhelyi and Villegas-Sanchez (2013) study the relationship between trade liberalization and gender equality, and provide evidence that the introduction of NAFTA increased relative wages and employment of women in blue-collar jobs, but not in white-collar jobs.

[6] Colombia, Peru, and Bolivia account for virtually the total worldwide coca leaf cultivation.

The extensive land border with many ports of entry into the U.S. allowed Mexican DTOs to cross the border with small amounts at high frequency, thereby hedging the risk of detection and seizure as compared to large maritime shipments. Trafficking service became extremely profitable for Mexican cartels that exploited the bargaining power bestowed on them by their geographic location. In the early 1980s, they negotiated a 50% cut of the transported cocaine and moved from providing pure logistical services to becoming a major supplier of cocaine to U.S. markets (Cockburn and Clair, 1998, p. 361). The shift to Mexican routes is apparent in the data of the U.S. State Department, i.e., the percentage of cocaine entering the U.S. from Mexico shifts from negligible in the mid-1980s to 70% in 1995 (Andreas, 1996).[7] From 1992, the Southwest border also accounted for the majority of cocaine seized annually (DEA, 1995, p. 6).[8]

In the 1980s, the Mexican trafficking market was dominated by the Guadalajara Cartel under the leadership of Miguel Ángel Félix Gallardo, only competing with the Gulf cartel on the east coast. In 1987, Gallardo created the so-called *Federation* and divided his territory into "plazas", i.e., specified territories and trafficking corridors to the U.S. border, each controlled by individual drug lords that operated independently but were loyal to Gallardo. Following the arrest of Gallardo in 1989, the Federation was dismantled and broke into independent DTOs. Disputes and competition among the plazas led to an increasing use of violence. Table 1 shows the development of homicides and drug-related homicides (i.e. homicides of males age 15–39) in Mexico in the 1990s. This period marks the emergence of violent conflicts among drug cartels whose levels were surpassed only later during the massive outbursts of violence starting in 2006.

2.2 NAFTA and drug trade

In the 90s, Mexican drug traffickers primarily use private and commercial land vehicles to transport illegal drugs into the United States (DEA, 1995, p. 6). In 1990, a White House report acknowledged that such vehicles are "all but lost in the tremendous volume of legitimate trade and commerce between the two countries" (The White House, 1990, p. 69). From January 1st, 1994, the North American Free Trade Agreement between Canada, the United States, and Mexico entered into force and eliminated most tariff and non-tariff barriers to free trade between the three countries. Negotiations started in 1991 and ended in December 1992 with the signing of the treaty. As shown in Table 1, the value of exports to the U.S. as percentage of Mexican GDP more than doubled with the introduction of NAFTA.

[7] This number is based on 'intelligence estimates' and can be found in the National Drug Control Strategy reports as early as 1994 (The White House, 1992, p. 55). Such estimates are largely based on the amount of seizures which declines after 1994, likely to the lower frequency of inspections under the free trade agreement (Dermota, 1999, p. 17). Today the share of cocaine entering from Mexico is estimated at 90 percent.

[8] The UNODC (2010, p. 103) estimates that gross profits in the U.S. cocaine market amounted to 35 billion USD in 2008. 0.5 billion (1.5% of gross profits) went to farmers in the Andean regions. 2.9 billion USD (8% of gross profits) went to traffickers moving cocaine across the southern U.S. border, mostly Mexican cartels. U.S. wholesalers and U.S. mid-level dealers capture 85% of gross profits. Due to the fact that Mexican cartels also participate in the selling of cocaine in the U.S., they hold substantial stakes in the U.S. cocaine market.

Table 1: The development of trade and violence in the 1990s

	Mexico to U.S. exports to GDP ratio	Homicides			
		all		male, ages 15-39	
		total	per 100k	total	per 100k
1990	7.1%	11,475	14.04	5,414	6.63
1991	6.0%	12,646	15.17	6,290	7.54
1992	10.3%	13,760	16.18	7,103	8.35
1993	8.6%	13,510	15.57	6,862	7.91
1994	9.7%	15,656	17.69	7,974	9.01
1995	18.4%	15,386	17.10	7,733	8.60
1996	19.4%	14,350	15.67	7,276	7.95
1997	18.6%	13,363	14.34	6,598	7.08
1998	19.4%	13,490	14.23	6,396	6.75
1999	20.1%	12,068	12.51	5,593	5.80

Notes: The table shows intentional homicides and intentional homicides of males (ages 15–39) per year as total sum and per 100,000 population, linearly interpolating population censuses in 1990, 1995, and 2000. Column 5 shows the worth of Mexican exports to United States in (2016) USD as a fraction of Mexican GDP in the respective years.

According to Andreas (1996), NAFTA facilitated and encouraged the exports of illegal drugs via Mexico into the United States. Dermota (1999, p. 15) confirms that anything NAFTA did to promote regional trade also encouraged the trade of illicit drugs. For example, NAFTA led to a decline in inspections to avoid hampering commerce while at the same time the number of trucks crossing with cargo went from 1.9 million in 1993 to 2.8 million in 1994 to 3.5 million in 1996 (Andreas, 1996, p. 58; Dermota, 1999, p. 17). Indeed, the DEA confirms that detection rates at the ports of entry decline in the volume of trade (DEA, 2016). Thus, NAFTA most likely decreased the cost of concealing drug smuggling. Furthermore, NAFTA massively increased capital flows which made it easier to route drug profits out of the U.S. via Mexico (Dermota, 1999, p. 21).

Anecdotal evidence suggests that policy makers were aware of these potential unintended consequences. Assistant U.S. Attorney Glen MacTaggart said in 1993, "If Nafta provides opportunity for legitimate businesses, it may clearly provide opportunities for illegitimate businessmen," [...] "It's almost common sense" (Andreas, 1996, p. 57). A U.S. official involved in the fight against drug traffickers stated: "The free-trade agreement makes the United States more accessible and convenient for traffickers" [...] "It gives these people better opportunities to smuggle drugs" (Weiner and Golden, 1993, p. 1). However, in the NAFTA agreements there is no section addressing potential concerns about the impacts of the trade agreement on illegal markets. "This was in the 'too hot to handle' category" according to Gary Hufbauer (Weiner and Golden, 1993, p. 1).

In Dermota (1999, p. 15), a Colombian trafficker describes how free trade agreements allow him to increase profits by reducing shipping costs. In anticipation of NAFTA, he expected to cut costs further once able to ship through Mexico.[9]

[9] According to Scott Stewart, Vice President of Tactical Analysis of Stratfor, the price of cocaine "increases considerably once it leaves the production areas and is transported closer to consumption markets". The same kilogram of cocaine that can be purchased in Colombia's jungle for $2200 will cost between $5500 and $7000 in Colombian maritime ports, $10.000 in Central America, $12.000 in southern Mexico, $16.000 in northern Mexico, and ultimately between $24.000 and $27.000 in U.S. wholesale markets (Stewart, 2016).

2.3 Conceptual considerations

Following the sequence of events described above, we expect that the introduction of NAFTA increased the profits of Mexican DTOs. There are at least four mechanisms through which NAFTA could have contributed to higher DTO profits. First, revenues may have increased because the amount of drugs trafficked into the U.S. increased. However, Table A.1 in the Appendix shows that, except for methamphetamine, volumes of U.S. drug consumption are stable or slightly declining in the 1990s, while prices are mostly declining. Second, trafficking revenues may have increased because the share of drugs entering the U.S. via Mexico increased. While there is some evidence for this (see, e.g., Watt and Zepeda, 2012, p. 105), estimates of trafficking market shares are hard to obtain and we cannot conclude with certainty that this is the main channel. Thirdly, costs of trafficking may have declined because Mexico-U.S. ports of entry were less policed and seizures became less likely. Following the above mentioned example by the Colombian trafficker, NAFTA clearly lowered the unit costs of trafficking due to a decline in the risk of detection and kickbacks paid to officials. Combining two and three, the overall net profits of trafficking and selling drugs accruing to Mexican DTOs may have increased. Fourth, the cost of money laundering likely declined because it was easier to conceal drug money in the increased capital flows from the U.S. to Mexico. Examples of the Mexican president Carlos Salinas using Citibank branches in New York and Mexico to transfer drug money to branches in London and Switzerland support this notion.

Drawing on theoretical considerations in the literature (Sobrino, 2020; Castillo and Kronick, 2020), we hypothesize that the drug profit shock induced by NAFTA intensified violent competition among DTOs over trafficking routes into the U.S. Control over these routes provided a steady stream of income, as DTOs—whether acting as drug producers, traffickers, or both—could tax rival shipments and extract rents from traffickers moving through their controlled territories. Since shipments must pass through all segments of a route to reach the border, rents may vary depending on the availability of alternative routes. Consistent with holdup theory, DTOs can extract higher rents as drugs move downstream, with the greatest profits captured at border crossings, where switching to alternative routes is very costly (see Olken and Barron, 2009). Meanwhile, drug producers seek to minimize costs for transportation and extortion payments. When optimizing their routes, they may be more willing to use alternative paths in upstream locations but become locked into specific corridors further downstream, while DTOs violently compete for control over these valuable locations.

In the absence of interference by a formal legal system, cartels use violence to compete for profits or territory, aiming to capture locations where they can extract the highest revenues (Goldstein, 1985; Reuter, 2009; Jacques, 2010). Building on Sobrino (2020) and Castillo and Kronick (2020), we argue that the increase in profits due to NAFTA led to more violent competition among DTOs. This altered the geography of drug-related violence in Mexico by concentrating the conflict on strategically important drug-trafficking routes. Castillo and Kronick (2020) develop a (repeated) contest model in which increases in drug-related profits break low violence agreements and fuel violence among traffickers. Here, interdiction such as seizures of large drug shipments lead to violence if drug profits increase in the presence of an inelastic demand. If revenues increase by more than costs, i.e., the revenues generated from owning trafficking routes increase by more than the cost of acquiring the routes, cartels will invest in conflict. Similarly, in the theoretical framework of Sobrino (2020) positive demand shocks in illegal markets increase violence because they increase the value of controlling drug production and trafficking routes. In her model, the demand shock incentivizes cartels to invest into military capacity and to enter into violent competition over more valuable production sites.

We combine the evidence accumulated in this section with the recent theoretical consideration in the literature to argue that NAFTA's open border policy increased profits of Mexican DTOs, resulting in increased returns to owning trafficking routes, leading to more violent competition over territories containing these routes.

3 Data

To estimate the reduced form effect of the NAFTA-induced increase in drug-trafficking profits on violence in Mexico, we exploit panel data at the municipality level. Municipalities are the second-administrative level beneath the 31 states. Our sample includes all 2,398 municipalities that were part of the 1990 census. If a municipality was divided after this year, we aggregate the data to the administrative boundaries as of 1990.

We restrict the panel to the period 1990–1999 for two reasons. First, data on homicides at the municipality level are available only from 1990. Second, the geography of violence in Mexico may have changed after 2000 when the National Action Party (PAN) formed the new government after 70 years of the Institutional Revolutionary Party (PRI) in power. Summary statistics are presented in Table A.3 in the Appendix.

Drug-related homicides. In the absence of a direct measure of drug-related homicides, we use the number of male homicides between the age of 15 and 39 per 100,000 inhabitants for the period 1990–1999 from the Mexican *Instituto Nacional de Estadística y Geografía* (INEGI) as a proxy.[10] [11] In doing so, we follow Calderón et al. (2015, p. 1462) who argue that homicides in this gender-age cohort group in Mexico best resemble drug-related homicides.[12]

[10] In robustness checks, we refine this variable to male homicides by guns or explosives between the age of 15 and 39 per 100,000 inhabitants.

[11] The only available administrative data that specifically distinguishes drug-related homicides was collected by the Federal Mexican Government and measures the "Deaths presumably related to Drug Trafficking Organizations (DTOs)" from December 2006 to December 2010. We use these data in Section 6 to distinguish between conflict parties. The spatial correlation between post-NAFTA introduction male homicides between the age of 15 and 39 (1994–1999) and drug-related homicides (2006–2010) is 0.15.

[12] The authors reach this conclusion after comparing the minimum mean squared error of drug-related homicides in the period 2006–2010 and of all homicides in combinations of 5-year age cohorts between 15 and 64 years in the period 2006–2010.

The map in Figure A.1 in the Appendix shows the change in drug-related homicides comparing the periods 1990–93 and 1994–1999, before and after the introduction of NAFTA. Changes in drug-related homicides have substantial spatial variation and are not concentrated in specific regions.

Drug-trafficking routes. We predict the location of drug-trafficking routes using Dijkstra's algorithm (Dijkstra, 1959) similar to Dell (2015). Using this algorithm, we identify optimal paths based on distance between origins and destinations within the Mexican network of main roads and highways drawn from The Digital Chart of the World (DCW). For simplicity we assume that each origin ships one unit of "drug" to the closest destination following the road network.

Destinations consist of all 22 Mexico-U.S. land border-crossings, as the majority of drug trafficking into the U.S. occurs at these ports of entry (see DEA, 2016). To select origins, we expand the approach of Dell (2015) who focuses only on drug-producing municipalities, by also including drug-trafficking municipalities. Specifically, drug-producing municipalities are those above the 95th percentile of cannabis and opium poppy eradication (hectares per area) between 1990 and 1993, excluding zeros. Drug-trafficking municipalities are those where a positive amount of cocaine was seized during the same period. In total, we identify 76 origin municipalities. We rely on pre-NAFTA eradication and seizures, to avoid endogenous changes related to routing and law enforcement changes following NAFTA's implementation. For the same reason, we abstain for using time-varying routes. The data on eradication and seizure are obtained from Dube, García-Ponce and Thom (2016).

This procedure yields 73 individual routes, each connecting an origin to its nearest port of entry. Figure A.2 in the Appendix visualizes the predicted drug-trafficking routes. We use this information to construct our main explanatory variable—an indicator that equals one if a municipality is traversed by at least one predicted trafficking route. Alternatively, we measure the length of the route in a municipality in km. This allows us to assess whether municipalities hosting longer segments of trafficking routes experienced higher levels of violence due to their greater strategic value to DTOs.

Figure A.2 also illustrates that routes converge as they approach ports of entry. To capture this, we create a variable that counts the number of routes, representing the number of origins shipping drugs through each municipality. This allows us to test whether NAFTA's impact on violence differed between upstream and downstream locations along trafficking routes.

Since we lack direct data on actual trafficking routes, we cannot formally validate our predictions. We assume that deviations from true routes occur at random, resulting in classical misclassification of the binary route indicator. Such misclassification would lead to attenuation bias. However, it is possible that our predictions systematically underestimate the true number of trafficking routes. A systematic underclassification implies that certain municipalities, which are genuinely traversed by routes would be misclassified as non-route municipalities. This would bias the estimates downward. In any case, since our predictions rely only on pre-NAFTA data, we avoid capturing endogenous shifts in route location that could arise in response to escalating violence after the introduction of NAFTA.

Baseline control variables. In our preferred specification, the empirical analysis includes several control variables. These aim to exclude potentially confounding factors at the municipality level that may affect their location on a predicted drug-trafficking route but also deferentially affect violence after the introduction of NAFTA. All baseline control variables are time invariant but will be allowed to have time varying effects in the analysis.

A first set of controls aims at excluding confounding geographical characteristics. These include temperature, precipitation (Fick and Hijmans, 2017), and the soil pH (IGBP-DIS, 1998).

We further add controls for the potential cultivation of cannabis and opium poppies. For legal reasons, FAO-GAEZ crop suitability indices are not available for illegal crops. Therefore, we create separate suitability measures based on the optimal conditions for the cultivation of *papaver somniferum* (opium poppy) and *Cannabidaceae* (cannabis) based on the FAO EcoCrop database. This procedure follows Sviatschi (2022) and Daniele, Le Moglie and Masera (2023) and measures the optimal conditions for cultivating illegal crops. We define optimal suitability in terms of precipitation, temperature, and soil pH.[13]

While it is conceivable (and results confirm) that any location closer to the U.S. border became more violent after the introduction of NAFTA, we are not interested in the effects of pure proximity. Hence, our set of baseline control variables includes the geographic distance to the U.S. border. Additionally, since municipalities with more roads are more likely to contain a route, we include road density as a baseline control. Finally, we account for municipal population size in 1990 (INEGI) to capture demographic differences.

Map Figure 1 depicts the main variables and the source of variation in our analysis in a single map. The fact that changes in drug-related homicides after 1993 seem to cluster alongside our predicted trafficking routes provides visual support of our subsequent econometric analysis. Figure A.3 in the Appendix shows average drug-related homicides by municipalities with and without routes over time. A discernible jump in violence occurs in treated municipalities right after the introduction of NAFTA in 1994 and 1995. The resulting gap persists until the end of our study period despite the decline in both types of regions.

[13]According to EcoCrop, the optimal temperature to grow opium poppies (cannabis) is between 15 and 24 (15–28) degrees Celsius; annual precipitation should be between 800 and 1200 (600–1200) mm; and soil pH between 6.5 and 7.5 (6–7). To define which areas of Mexico are suitable for growing opium poppies, we collect temperature and precipitation data from the WorldClim database (Fick and Hijmans, 2017) and soil pH data from the Atlas of the Biosphere (IGBP-DIS, 1998). Second, we divide Mexico's area into grid cells of 0.05 x 0.05 degrees of latitude by longitude and create an indicator variable that takes the value one if cell i falls within the optimal intervals for growing opium poppy and 0 otherwise. Finally, we calculate the share of cells within each municipality suitable for cultivating poppies and cannabis.

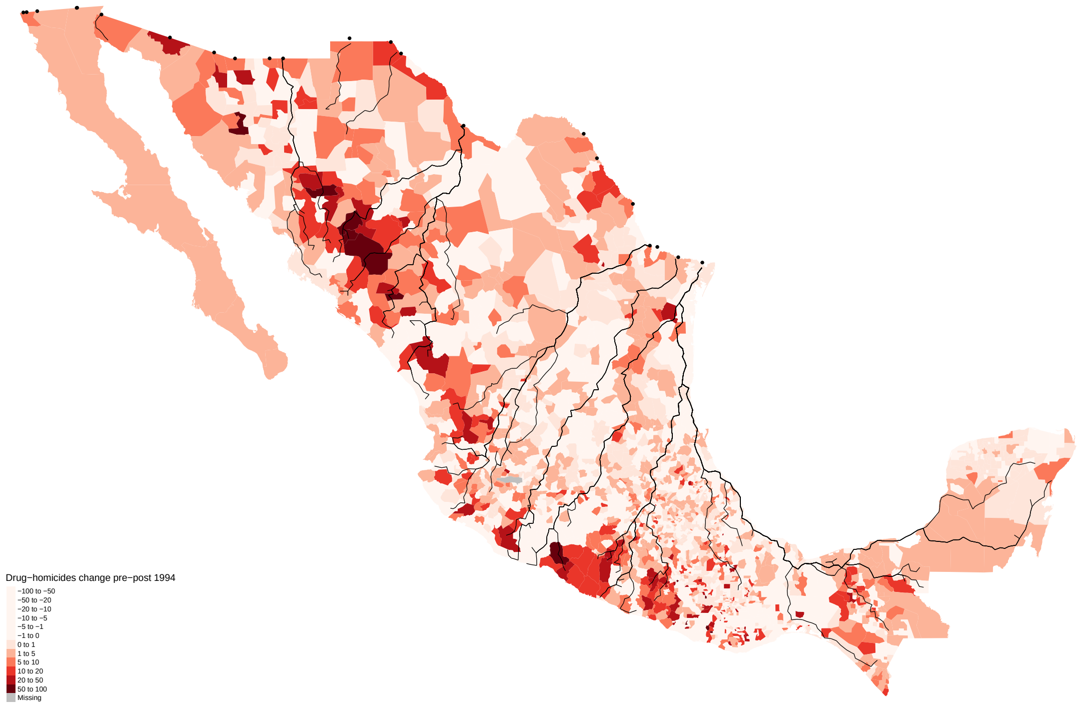


FIGURE 1: Predicted drug trafficking routes and changes in drug-related homicides

This figure relates changes in drug-related homicides across Mexican municipalities to predicted drug trafficking routes. Darker shades of red indicate higher positive changes in drug-related homicides, i.e., homicides of males aged 15–39 per 100,000 inhabitants, comparing the periods 1990–93 and 1994–1999. Optimal predicted drug-trafficking routes are shown as black lines. Black dots depict the 22 land ports of entry on the Mexico-U.S. border.

4 Empirical analysis

4.1 Empirical framework

Our main hypothesis is that NAFTA's open border policy resulted in higher profits for DTOs, leading to an increase in violent competition over trafficking routes. To test our hypothesis, we use a difference-in-differences (DiD) strategy and compare the change in drug-related homicides per 100.000 inhabitants after 1994 between municipalities with and without a predicted optimal drug-trafficking route. We apply the following specification:

$$Drug\,homicides_{it} = \alpha_i + \delta_t + \beta(Route_i \times post\,NAFTA_t) + \Gamma(X_i' \times post\,NAFTA_t) + \epsilon_{it} \qquad (1)$$

where the dependent variable $Drug\,homicides_{it}$ is the number of drug-related homicides per 100.000 inhabitants in municipality i during years t ($t \in 1990 - 1999$). α_i are municipality-fixed effects that control for time-invariant characteristics. δ_t are year-fixed effects that control for common shocks to all municipalities in a specific year t. $Route_i$ is an indicator variable that takes the value one if municipality i is traversed by a predicted drug-trafficking route and 0 otherwise. In alternative specifications, this measure is replaced with either the route length within a municipality or indicators for the number of routes passing through it.[14] The indicator $post\,NAFTA_t$ assumes the value one for all years after 1994 and 0 otherwise. The time-invariant baseline control variables captured in the vector X_i' are allowed to have differential effects following NAFTA's introduction via the inclusion of an interaction with the indicator $post\,NAFTA$. In all of our panel regressions standard errors are clustered at the municipality level.[15]

The coefficient of interest β captures differences in the change in drug-related homicides between municipalities with and without a predicted drug-trafficking route after the introduction of NAFTA. The validity of our identification strategy relies on the assumption that in the absence of NAFTA, drug-related homicides would have followed parallel trends between municipalities with and without drug-trafficking routes. We provide evidence for the absence of diverging trends prior to NAFTA using an event-study type specification following equation 2:

$$Drughomicides_{it} = \alpha_i + \delta_t + \sum_{t=1990}^{1999} \beta_t (Route_i \times D_t) + \sum_{t=1990}^{1999} \Gamma_t (X_i' \times D_t) + \epsilon_{it}. \tag{2}$$

Equation 2 expands equation 1 by replacing the simple $post\,NAFTA_t$ indicator with time indicators (D_t). This specification allows us to observe whether drug-related homicides vary between municipalities with and without routes each year relative to the omitted baseline year 1993, the year before NAFTA's introduction.

4.2 Main results

4.2.1 Simple DiD results

Table 2 presents the results from estimating equation 1. Column 1 shows results when including only municipality- and time-fixed effects whereas column 2 adds the baseline control variables described in Section 3. Our coefficient of interest is positive and statistically different from zero in both specifications. The β coefficient in our preferred specification in column 2 shows that the introduction of NAFTA is associated with an increase of approximately 2.1 homicides per 100,000 inhabitants in municipalities on a drug-trafficking route. This reflects a substantial increase relative to the pre-NAFTA mean of approximately 8.2 homicides per 100,000, i.e., an increase of 26% with respect to the mean.

Our main hypothesis in this paper posits that cartels invest in violence to seize control of strategically important locations. In the remainder of the table, we examine heterogeneity in route characteristics to test whether more valuable segments experience higher levels of contestation.

In column 3, we replace the route indicator with the length of the route within a municipality, standardized with zero mean and unit standard deviation. The coefficient indicates that a

[14] In Section 5 we also explore how the geography of violence changed in distance to the route.

[15] Appendix Table C.4 shows results when adjusting standard errors for spatial autocorrelation using the method introduced by Conley (1999).

Table 2: Drug trafficking routes and the increase in drug-related homicides after NAFTA

Dep. var.:	Drug-related homicides per 100.000 inhabitants					
	(1)	(2)	(3)	(4)	(5)	(6)
Route × post NAFTA	2.378***	2.142***				
	(0.574)	(0.576)				
Length of route × post NAFTA			1.195***			
			(0.360)			
# Routes (*1st* q33)× post NAFTA				2.516**		
				(1.018)		
# Routes (*2nd* q33)× post NAFTA				3.395***		
				(1.061)		
# Routes (*3rd* q33)× post NAFTA				1.075**		
				(0.488)		
Entry ports × post NAFTA				5.566***		
				(1.166)		
Route × post NAFTA (ports > med. trade 93)					1.807**	
					(0.724)	
Route × post NAFTA (ports < med. trade 93)					-0.135	
					(0.763)	
Route × post NAFTA (ports > / < med. trade 93					0.670	
					(1.177)	
Route × post NAFTA (ports > med. Δ trade 94–99)						2.151***
						(0.685)
Route × post NAFTA (ports < med. Δ trade 94–99)						0.353
						(0.520)
Route × post NAFTA (ports > / < Δ trade 94–99)						-0.080
						(1.010)
Baseline controls	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean homicides pre-NAFTA	8.218	8.218	8.218	8.218	8.218	8.218
Observations	23,980	23,980	23,980	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Column 3: *Length of route* is a continuous variable, standardized with zero mean and unit standard deviation. Column 4: *# Routes* are three indicators that represent terciles of the distribution (excluding zeros) of a variable counting the number of origins that transport through a given municipality. *Entry ports* is an indicator variable that is one for municipalities with a U.S.-Mexican land port of entry. In this column, baseline controls exclude distance to the U.S. border. Column 5: *Route* are indicators based on two sets of newly predicted least-cost paths that restrict destination ports to those with (i) above-median trade volumes in 1993, (ii) below-median trade volumes in 1993. The third indicator captures municipalities traversed by both types of routes. Column 6: As in column 5, but ports are classified by above- or below-median trade growth between 1994 and 1999. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

one-standard-deviation increase in route length is associated with approximately 1.2 additional homicides per 100,000 inhabitants, equivalent to a 15% increase relative to the pre-NAFTA mean. This finding suggests that violence was more pronounced in municipalities containing longer route segments, while accounting for road density. A plausible explanation is that longer segments almost mechanically increase violence if profits increase with the introduction of NAFTA and DTOs extract rents per kilometer.

Column 4 examines whether violence increased more in strategically important locations. As outlined in our conceptual considerations in Section 2.3, we argue that DTOs extract higher rents and invest more in violence in route segments that handle larger volumes of drug shipments, with the highest rents occurring at key choke points–particularly the border. To test this, we divide municipalities traversed by routes into terciles based on the number of routes (i.e., the number of origins shipping drugs through a given location). Upstream locations fall into the lowest tercile, while downstream locations belong to the highest tercile. Additionally, we include an indicator for ports of entry.[16]

The results show that homicides significantly increased across all segments of trafficking routes after 1993. Consistent with our considerations, violence rises when moving from the lowest to the middle tercile but declines in the highest tercile–a somewhat counterintuitive pattern that we note with caution. As expected, the largest increase occurs at ports of entry, where DTOs can extract the highest rents from shipments that are locked into a border crossing.

Next, we examine evidence supporting our hypothesis that NAFTA increased violence by altering the profitability of drug trafficking through reduced detection rates. Specifically, we argue that illegal goods trade benefits from larger trade volumes because detection becomes less likely when concealed within legal shipments. This complementarity between legal and illegal trade implies that violence would increase more along routes connected to ports of entry handling larger trade flows. To test this hypothesis, we use trans-border commodity trade flows by truck from the Bureau of Transportation Statistics (BTS, 1999). The 22 U.S. land ports of entry are categorized in two ways: first, based on their trade volume in 1993, prior to NAFTA, and second, based on their average annual trade growth between 1994 and 1999. For each categorization, ports are divided into groups of above- or below-median trade levels and above- or below-median growth rates. For each of these groups, we predict new sets of optimal drug-trafficking routes, restricting the analysis to routes connecting to the relevant subset of ports. Appendix Table A.2 provides detailed information on this categorization.

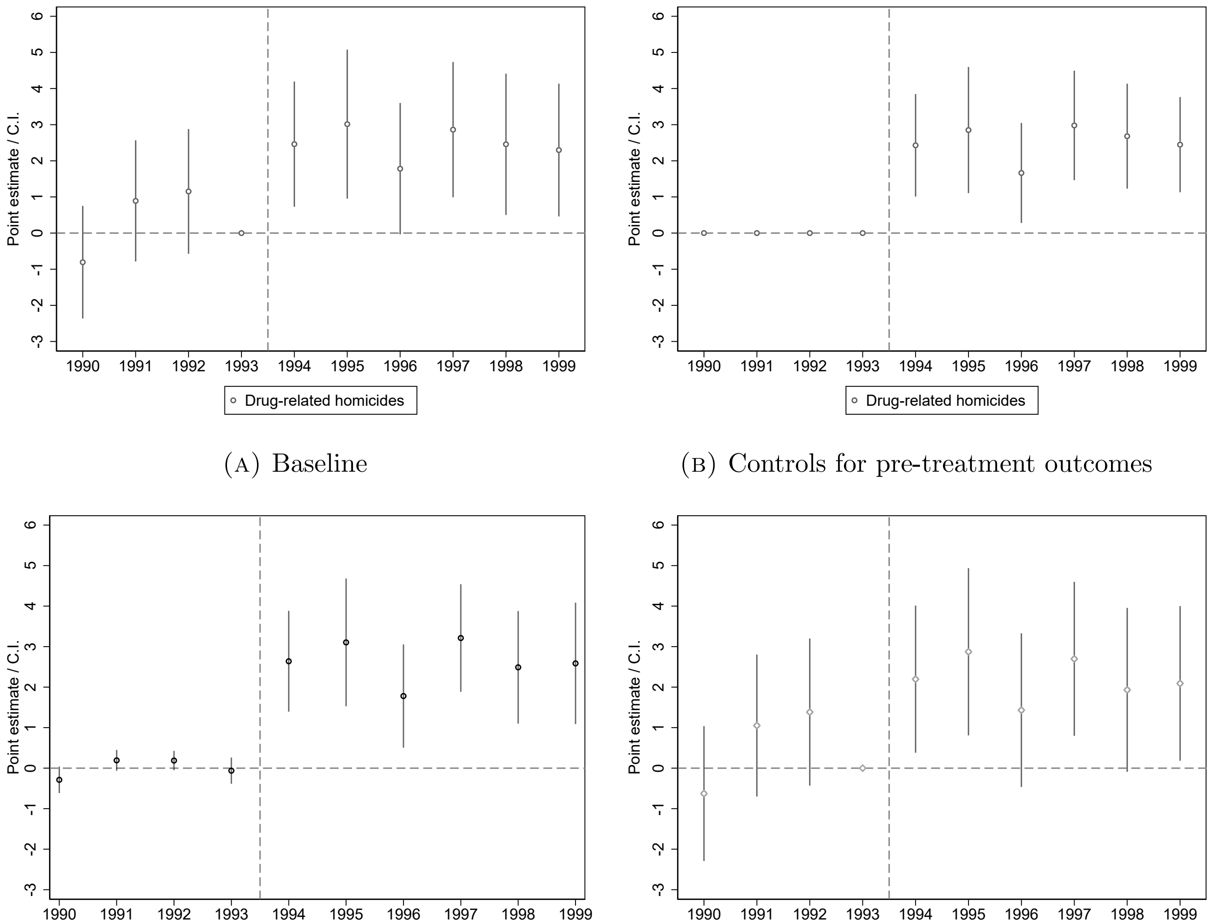
In column 5, we present results using two indicators for municipalities traversed by predicted drug-trafficking routes that connect to U.S. ports of entry with either above- or below-median trade volumes in 1993, along with their interaction. The findings show that only municipalities on routes to the busiest ports experienced a significant increase in violence from 1994, while those on routes to low-volume ports did not show statistically significant effects. We find no statistically significant differential effect for municipalities that are crossed by both types of routes. This pattern is corroborated in column 6, where we distinguish routes by their connection to ports with high or low trade growth during 1994–1999. Again, we find that only municipalities on routes to ports with high growth rates faced significant increases in violence. These findings align with our hypothesis, as they suggest that the strategic value of controlling the busier routes increased due to NAFTA.

4.2.2 Event-study results

The validity of our DiD identification strategy relies on the common trends assumption, which requires that in the absence of the free trade agreement, violence would have followed parallel trends in treated and untreated municipalities. To inspect the validity of this assumption, we

[16] This regression does not control for distance to the U.S. border to prevent the main effects from being absorbed by this variable. By construction, municipalities closer to the U.S. border tend to have more predicted routes, making distance to the border mechanically correlated with the number of routes.

estimate the relationship of interest using an event-study design. This further allows us to study the dynamics of violence after the policy was introduced.



(A) Baseline

(B) Controls for pre-treatment outcomes

(C) Synthetic difference-in-differences

(D) Heterogenous treatment effects

FIGURE 2: Main results: dynamic effects of drug-trafficking route location on violence

Figures plot β_τ coefficients estimated from equation 2 with 95% confidence intervals. The omitted year is 1993. The dependent variable measures drug-related homicides per 100,000 inhabitants. The main explanatory variables are indicators that assume the value one if a municipality is traversed by a predicted optimal drug-trafficking route interacted with year dummies. Figures 2a–2d show results conditional on baseline control variables, including temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Figure 2b adds interactions between municipality-level drug-related homicides in each pre-NAFTA year (1990–1993) and a full set of time dummies. Figure 2c is estimated using the Stata command 'sdid', applying the synthetic difference-in-differences procedure by Clarke et al. (2023) to generate the control group. Figure 2d is estimated using the Stata command 'did_multiplegt_dyn', accounting for heterogenous treatment effects based on De Chaisemartin and d'Haultfoeuille (2024). Standard errors are clustered at the municipality level. Corresponding results can be found in Table E.1 in the Appendix.

Figures 2a–Figure 2d plot β_t coefficients from estimations of equation 2 over time. Each subfigure shows differences in drug-related homicides between municipalities with and without a drug-trafficking route for each year with respect to 1993. Figure 2a conditions on all baseline control variables interacted with year dummies. Coefficients for all years after NAFTA's introduction are positive and significantly different from zero. This jump in violence occurs immediately in 1994 and remains of roughly the same magnitude (ca. 2.5 homicides per 100.000 inhabitants) until the end of our study period in 1999. This was a period of relative stability without major shocks to the drug trafficking business until PAN assumed power in 2000, potentially explaining coefficient stability.[17]

The three pre-treatment coefficients are statistically indistinguishable from zero. The absence of diverging trends corroborates the common trends assumption and thereby the validity of our identification strategy.

Nevertheless, one may still be concerned that drug-trafficking municipalities saw stronger increases in drug-related violence already before NAFTA. We address this concern in two ways. First, in Figure 2b, we flexibly control for pre-NAFTA differences in drug-related homicides across municipalities. We add interactions between the outcome variable in the four years 1990–1993 and all time dummies to equation 2. All pre-NAFTA coefficients become zero by design. Resulting post-NAFTA introduction coefficients reflect differences in homicides across municipalities with the same level of violence before 1994. Reassuringly, the patterns observed in Figure 2a are fully preserved in Figure 2b.

Second, we further address concerns regarding the violation of the parallel trends assumption by relaxing this assumption using the synthetic difference-in-differences approach introduced by Arkhangelsky et al. (2021). This approach creates a synthetic control group of municipalities without drug-trafficking routes by re-weighting municipality-year observations to closely match the treatment group (also see Appendix Figure C.2). The resulting pre-NAFTA coefficients in Figure 2c are small and precisely estimated. Again, the event-study pattern of coefficients for the period after NAFTA's introduction is close to the estimates found in the standard difference-in-differences approach.

In Figure 2d, we use the alternative DiD estimator introduced by De Chaisemartin and d'Haultfoeuille (2024) to account for heterogeneity in treatment effects. Again, the pattern of plotted coefficients remains very similar.

Results in this section support our findings and suggest that violence jumped to another level immediately after the introduction of NAFTA, whereas the absence of diverging pre-trends mollifies the concern of anticipatory effects.

4.3 Robustness checks

4.3.1 Alternative versions of dependent and treatment variable

In this section, we demonstrate that our main results, estimated using equation 1, are robust to alternative definitions of the dependent variable, the treatment variable, and sample restrictions.

[17] We discuss major events that may have affected trafficking profitability in the period 1994 to 1999 and thus could lead to a differential increase in violence along trafficking routes in Section 4.3 below.

First, we address potential skewness in the dependent variable, caused by many municipalities reporting zero homicides, using alternative statistical transformations. Appendix Table C.1, columns 1–3, presents results using the logarithmic transformation, the inverse hyperbolic sine transformation, and the transformation proposed by Castillo, Mejía and Restrepo (2020).[18] The coefficient of interest is positive and statistically significant in all cases, indicating that our findings are not driven by skewness in the dependent variable.

Second, we restrict the sample to ensure that our results are not systematically driven by specific observations. In columns 4 and 5, we exclude potential outliers by removing municipalities in the top 1% and top 5% of pre-NAFTA drug-related homicides, respectively. The estimated coefficients remain stable, confirming that outliers do not drive our main findings. In column 6, we exclude drug-trafficking origin municipalities to test whether our results are driven by violence in drug-producing regions. While homicide rates in origin municipalities (3.3 per 100,000) are indeed higher, our main results remain qualitatively unchanged, indicating that the observed effects are specific to trafficking routes rather than just production areas.

In Appendix Table C.2, we explore different definitions of drug-related homicides using mortality data from INEGI that can be restricted to 'homicides by discharge of firearm or explosives'. We present results for the following measures: all homicides (column 1), all homicides of men aged 15–39 (column 2), homicides by firearm or explosives (column 3), and homicides by firearm or explosives of men aged 15–39 (column 4). Across all definitions, the results are consistent, with an increase relative to the pre-NAFTA mean of 24% (column 1), 27% (column 2), 26% (column 3), and 26% (column 4). These findings validate the robustness of our primary outcome variable as a reliable measure of drug-related violence.

In Appendix Table C.3, we test the robustness of our results when systematically varying the thresholds for defining origin municipalities used in the calculation of trafficking routes. For cannabis and opium in columns 1–3, thresholds at or above the 90th percentile yield qualitatively similar results. Lowering the threshold to the 85th percentile (column 4) reduces the eradication area threshold from 66 to 15 hectares, adding many origin municipalities with small-scale production. This likely adds noise, leading to attenuation bias in the estimate. For cocaine seizures (columns 5–6), we compare routes excluding municipalities with below- and above-median seizure levels as origins. Both approaches yield similar results, but routes based on above-median cocaine origins show slightly larger coefficients, suggesting these areas are more strategically important for trafficking routes.

4.3.2 Contemporaneous events

Any policy or event coinciding with the introduction of NAFTA that differentially affected violence along trafficking routes could bias our estimated coefficient of interest. Relatedly, shifts in

[18] Castillo, Mejía and Restrepo (2020) use the following transformation: $ln(h_{it} + r)$, where h is the homicide rate in municipality i at time t and r is the homicide rate at the 90th percentile of distribution.

profitability of controlling the predicted drug trafficking routes after 1993 may result in biased estimates. We address such concerns in Table 3.

Table 3: Robustness to contemporaneous events

Dep. var.:	Drug-related homicides per 100.000 inhabitants				
	(1)	(2)	(3)	(4)	(5)
Route × post NAFTA	2.033***	2.103***	2.108***		2.118***
	(0.569)	(0.602)	(0.576)		(0.578)
Sh PAN votes 1994 × post NAFTA			0.693**		
			(0.276)		
Route × cocaine seizures in Colombia				-0.017	
				(0.235)	
Sh highly-educated urban in 1990 × post NAFTA					0.129
					(0.208)
Baseline controls	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	8.369	8.350	8.218	8.218	8.218
Observations	23,090	22,870	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Column 1 excludes municipalities within 100 km of the U.S. border. Column 2 excludes municipalities in the state of Chiapas. Control variables introduced in columns 3–5 are standardized with zero mean and unit standard deviation. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

NAFTA coincided with the implementation of border enforcement operations such as Operation Gatekeeper (San Diego, 1994) and Operation Hold the Line (El Paso, 1993). These operations increased financial and personnel resources to deter illegal entry, targeting known migration routes and shifting migration to less secure routes (Hing, 2001). While these efforts had local effects, we do not expect them to affect violence beyond the border. To address this empirically, we drop all municipalities within 100 km of the U.S.–Mexico border in column 1. The results remain robust to this exclusion.

NAFTA also coincided with the Mexican general election of August 1994, which was influenced by several major events. One notable event was the Zapatista Army of National Liberation (EZLN) uprising, which began in January 1994 in response to economic policies, including NAFTA. This uprising briefly seized six towns in Chiapas but was quickly suppressed by the military, leading to localized and short-lived violence. To ensure this conflict does not bias our estimates, column 2 excludes all municipalities in Chiapas. The results remain unchanged.

Additionally, during his campaign, PRI presidential candidate Luis Donaldo Colosio Murrieta was assassinated in March 1994. While there have been suggestions of cartel involvement, prevailing evidence points to an internal conflict within the PRI under outgoing president Salinas. The election ultimately resulted in an increase in support for the PAN party, which opposed the government responsible for the ratification of NAFTA. To account for political opposition to the PRI, that may reflect the dissatisfaction with recent economic and social changes, we control for the municipality-level share of votes for PAN in the 1994 election in column 3. While this variable is positively associated with drug-related homicides, our results for trafficking routes remain qualitatively unchanged.

In response to increased interdiction efforts in the early 1990s, the Andean drug industry shifted cocaine cultivation from Peru and Bolivia to Colombia, intensifying violence among Colombian cartels as they competed over production sites (see Angrist and Kugler, 2008). If this shift in production influenced cartel profits and violence in Mexico, similar to the pattern documented by Castillo, Mejía and Restrepo (2020) for 2007–2010, then our findings might be capturing this effect rather than the impact of NAFTA. To test this, we interact the route indicator with annual data on cocaine seizures in Colombia and report results in column 4. We find no evidence that fluctuations in Colombian seizures had a significant differential effect on violence in route municipalities, suggesting that our findings are not driven by external supply-side shocks.

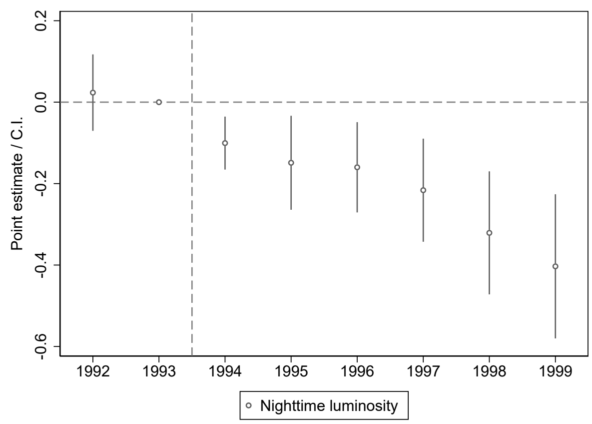
In late 1994, political instability following the Colosio assassination and the Chiapas conflict, combined with economic pressures, contributed to the Mexican peso crisis. In December 1994, the central bank devalued the peso and eventually allowed it to float freely, leading to massive capital flight, inflation, and a severe recession lasting until late 1996. This economic downturn significantly increased unemployment and poverty. McKenzie (2003) shows that real income declines were strongest for highly educated household in metropolitan areas, whereas rural agricultural workers were less affected. To account for the potential reduction in the opportunity cost of violence within this demographic, we control for the share of highly educated men (15–64) living in urban localities in 1990, interacted with the post-NAFTA indicator (column 5). The results show no evidence of a significant effect, and our main findings remain unchanged.

Arguably, the peso crisis influenced regional economic activity through various channels, affecting the opportunity cost of engaging in criminal activity or violence. To better capture these aggregate changes, we resort to inspecting dynamics in nighttime luminosity, an indicator of local economic activity that is expected to respond quickly to economic shocks and captures various dimensions of economic hardship or gains stemming from the peso crisis (Henderson, Storeygard and Weil, 2012; Michalopoulos and Papaioannou, 2018).

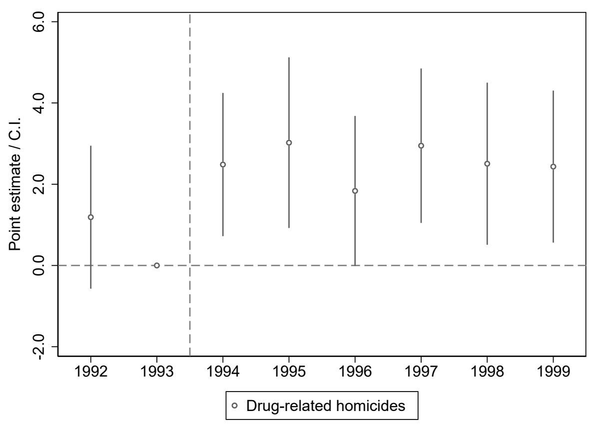
Figure 3a presents results using nighttime lights as the dependent variable. The results indicate that municipalities traversed by drug-trafficking routes experienced a steady decline in economic activity relative to 1993. This suggests that these municipalities may have faced economic hardship following the peso crisis, potentially lowering the opportunity costs of engaging in violence. However, the cumulative effect appears small: until 1999, luminosity declined by only 3.6% of a standard deviation on route locations. Importantly, when luminosity is included as an additional explanatory variable in equation 2, it does not significantly affect drug-related violence. The main effect for trafficking routes (3b) remains qualitatively unchanged and, if anything, violence seems to become more intense in economically more active municipalities (3c). We conclude that contemporary events are unlikely to explain our main findings and that the relevant shock to violence was indeed the free trade agreement.

4.3.3 Trade shocks, economic activity, and employment

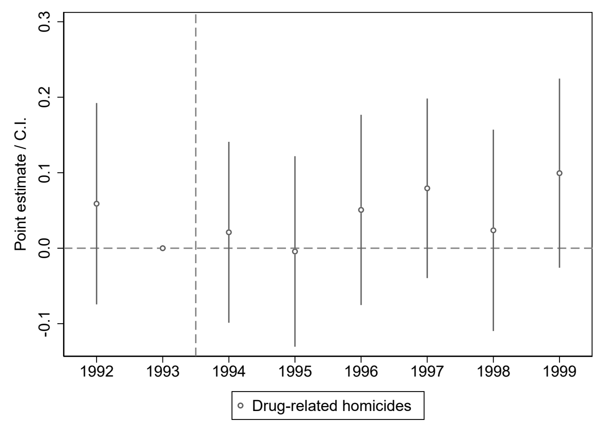
We interpret our results as evidence that rising drug-trafficking profits led to increases in drug-related homicides. However, due to the complementarity between legal and illegal trade, it is conceivable that our routes overlap with general trade routes resulting in an omitted variable



(A) Luminosity and route location



(B) Violence and route location, cond. on luminosity



(C) Violence and luminosity, cond. on route location

FIGURE 3: The dynamic effects of economic activity as proxied by luminosity

Figure 3a plots β_τ coefficients on route location, estimated from equation 2, with 95% confidence intervals. Figures 3b and 3c plot β_τ on route location and Γ_τ coefficients on luminosity from the same regression, with 95% confidence intervals. The dependent variables are night-time luminosity in Figure 3a and drug-related homicides per 100,000 inhabitants in Figures 3b and 3c. The omitted year is 1993. Route location is an indicator that assumes the value one if a municipality is traversed by a predicted optimal drug-trafficking route interacted with year dummies. Figures 3a– 3c show results conditional on baseline control variables, including temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. Corresponding results can be found in Table E.2 in the Appendix.

bias if NAFTA-induced changes in legal trade differentially affected regions along these routes. For example, if regions along the predicted routes were disproportionately affected by import competition from U.S. producers, rising unemployment and falling opportunity costs of violence could potentially bias our estimated coefficients upward.

To address this concern, we refine our analysis by focusing on sectors and industries that were affected by trade liberalization. This ensures that predicted routes are not simply located in municipalities disproportionately harmed by import competition. For example, prior research by Dell, Feigenberg and Teshima (2019) had shown that increased Chinese exports to the U.S. weakened Mexico's manufacturing sector, leading to job losses and thereby increasing cocaine trafficking and violence in the 2000s. A similar mechanism could apply here if NAFTA-driven increases in U.S. exports to Mexico displaced Mexican workers, pushing some into drug trafficking and fueling violence.

Table 4 presents several robustness checks testing this possibility within our simple DiD framework. Across columns, we add variables capturing (time-invariant) employment levels in specific sectors or industries prior to NAFTA from the 1990 Census (INEGI), focusing on the male population aged 15–39. These employment shares, interacted with a post-NAFTA dummy, allow us to examine whether the impact of trade liberalization on different industries influences drug-related violence and confounds our main trafficking route effect. Appendix Table C.5 presents the effects of NAFTA-related trade liberalization on local economic activity, measured by nighttime luminosity. The results suggest that post-NAFTA changes in economic activity differed systematically across regions depending on their employment structure, providing further motivation for our robustness checks.

Table 4: Robustness to the shock in legal trade due to NAFTA

Dep. var.:	Drug-related homicides per 100.000 inhabitants					
	(1)	(2)	(3)	(4)	(5)	(6)
Route × post NAFTA	2.096***	2.141***	2.136***	2.154***	2.117***	2.104***
	(0.579)	(0.577)	(0.575)	(0.578)	(0.574)	(0.575)
Sh agriculture in 1990 × post NAFTA	-0.436					
	(0.414)					
Sh manufacturing in 1990 × post NAFTA		0.527**				
		(0.234)				
Sh export manufacturing in 1990 × post NAFTA			0.304			
			(0.195)			
Sh unemployed in 1990 × post NAFTA				-0.634		
				(0.454)		
RTC agriculture (MX import tariffs)					-0.244*	
					(0.143)	
RTC manufacturing (US import tariffs)						0.621***
						(0.222)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	8.218	8.218	8.218	8.218	8.218	8.218
Observations	23,980	23,980	23,980	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. All control variables introduced in this table are standardized with zero mean and unit standard deviation. Employment shares used in columns 1–4 reflect men aged 15–39 in the 1990 census. RTC (region-level tariff change) measures in columns 5–6 are calculated according to equation 3. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Column 1 of Table 4 focuses on the agricultural sector, which experienced significant import competition following NAFTA. A large number of small farms were no longer able to compete with U.S. maize after tariffs were abolished. We find that municipalities with a larger agricultural sector experienced an insignificant decrease in violence. This contradicts the idea that NAFTA's removal of agricultural tariffs disproportionately impacted the Mexican farmers.

Column 2 examines the manufacturing sector, finding that municipalities with larger manufacturing employment shares saw a significant increase in homicides. This result may suggest that import competition with U.S. manufacturers contributed to violence, echoing findings by Dell, Feigenberg and Teshima (2019) on the effects of trade competition with China. To further refine the analysis, Column 3 focuses on export-oriented manufacturing industries, which arguably benefited from NAFTA (see Atkin, 2016). In this case, we find no significant changes in violence, supporting the interpretation that the observed effects in column 2 are primarily driven by import competition rather than export expansion. However, given that these coefficients are not statistically different from each other, these conclusions should only be drawn with caution.

We also examine the potential role of unemployment in driving the observed changes in violence directly. Column 4 includes the share of unemployed men aged 15–39 in 1990 as a control variable. Given that annual unemployment data at this level of granularity are unavailable, this measure captures pre-NAFTA trends in unemployment that could interact with post-NAFTA shocks. The results indicate that pre-existing unemployment levels are not significantly associated with post-1993 changes in drug-related homicides.

Finally, we examine the regional effects of tariff changes more directly using a shift-share approach in the spirit of Kovak (2013). We construct a measure of regional-level tariff changes (RTC) for each municipality i in year t as:

$$RTC_{it} = \sum_k \frac{L_{ik,1990}}{\sum_k L_{ik,1990}} \ln(1 + \tau_{kt}). \tag{3}$$

In this approach, the number of male workers aged 15–39 employed in industry k in municipality i from the 1990 census is weighted by the national share of employment in that industry and multiplied by time-varying industry-level tariff rates τ. We generate two separate RTC measures, one for agriculture and one for manufacturing. The agricultural RTC measure relies on Mexican import-tariff reductions, reflecting the expectation that Mexican agricultural producers experienced the strongest negative impact from increased import competition. The manufacturing RTC measure relies on U.S. import-tariff reductions, reflecting the expectation that Mexican manufacturers benefited the most from expanding export opportunities. Mexican agricultural tariffs for 1991 (obtained from UNCTAD-TRAINS tariffs via WITS) are held fixed in the pre-NAFTA period and then decline according to product-specific phase-out schedules, while U.S. manufacturing tariffs are from 1992 and decrease based on their respective phase-out schemes.[19]

The results in columns 5 and 6 confirm our expectations: Municipalities more exposed to declining agricultural tariffs experience increases in violence, likely due to falling agricultural incomes, which lowered the opportunity cost of violence. In contrast, municipalities more exposed to declining U.S. manufacturing tariffs saw reductions in violence, likely driven by improved employment opportunities that raised the opportunity cost of engaging in violence.

[19] We are grateful to Brett McCully for providing us with the phase-out schedules.

Across all specifications, the interaction term $Route \times post\,NAFTA$ remains positive and statistically significant, with a magnitude that is not statistically different from our preferred specification in Table 2. These findings suggest that the rise in drug-related homicides along predicted trafficking routes after NAFTA was not driven by changes in legal trade or employment shocks. Instead, they support our hypothesis that the observed violence was linked to increased drug-trafficking profits facilitated by the trade agreement.

4.3.4 Other omitted variables

This section addresses additional potential drivers of violence in Mexico derived from the literature. To mitigate concerns about omitted variable bias, we again include these factors as control variables in our preferred specification. The results of these robustness tests are displayed in Table 5.

Table 5: Robustness to alternative mechanisms

Dep. var.:	Drug-related homicides per 100.000 inhabitants				
	(1)	(2)	(3)	(4)	(5)
Route × post NAFTA	2.170***	2.104***	2.042***	2.049***	1.315**
	(0.584)	(0.582)	(0.577)	(0.572)	(0.519)
Maize suitability × post NAFTA	0.333				
	(0.434)				
Maize suitability × maize prize		1.246			
		(0.797)			
Ejidos area × maize prize			-0.021		
			(0.858)		
Years of schooling (m16)				-0.130	
				(0.139)	
Municipality alternation					-0.619*
					(0.333)
State alternation					2.359***
					(0.640)
Baseline controls	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	8.218	8.218	8.068	8.153	6.830
Observations	23,980	23,980	21,770	23,864	19,610

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Control variables introduced in columns 1–3 are standardized with zero mean and unit standard deviation. Column 3 has fewer observations due missing ejidos data. Column 4 has fewer observations due missing schooling data in municipality-years with no 16-year-olds in the 2005 census. Column 5 does not include municipalities in Oaxaca where mayors are selected through indigenous customary practices. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Columns 1 and 2 account for the potential impact of NAFTA-induced shocks on maize farmers specifically, inspired by Dube, García-Ponce and Thom (2016), who demonstrate that declining maize prices led farmers to shift toward cultivating illegal crops in municipalities suited for maize production. NAFTA's trade liberalization led to a significant decline in maize prices due to increased competition from U.S. producers, which may have increased the cultivation of illegal crops. To test whether this shift confounds our results, we allow the municipal-level maize suitability (derived from the FAO-GAEZ database) to have differential effects post NAFTA (column 1) and to change with annual fluctuations in national maize prices (column 2). The second specification specifically mimics the approach by Dube, García-Ponce and Thom (2016). Among other things, they show that regions more suitable to maize cultivation saw higher levels of violence when the maize price declined, using data for the period 2007–2010. Our results, using the 1990–1999 data, suggest that, if anything, a declining maize prices decreased violence, albeit insignificantly, while the coefficient on the interaction term $Route \times post\, NAFTA$ remains stable.

In column 3, we aim to account for the fact that the decline in maize prices may have especially affected small farms called *ejidos*, created under communal land reforms since 1930. De Janvry, Sadoulet and De Anda (1995) argue that these farms were often unproductive and operated with obsolete technology. In 1992, Mexico passed legislation for their privatization potentially confounding our effects on violence (see Murphy and Rossi, 2016). We include an interaction term between the cumulative area of ejidos by 1990 (per municipality area) and annual maize prices to account for this potential confounder.[20] The results indicate that municipalities with larger ejido areas did not experience changes in violence in response to declining maize prices, leaving our main findings unchanged.

Column 4 addresses changes in the opportunity cost of schooling due to NAFTA. Atkin (2016) finds that the creation of new manufacturing jobs post-1993 led to increased school dropout rates, especially among 16-year-olds. To account for this, we include a time-varying control for completed years of schooling among male cohorts that turned 16 each year (using information from the 2005 census). The results indicate no significant relationship between educational attainment and violence, leaving our main findings unchanged.

In column 5, we aim to control for the fact that the political landscape started to change for the first time during the 1990s in Mexico. Trejo and Ley (2018) argue that political alternation from the PRI to opposition parties during the 1990s undermined the informal networks of protection that facilitated cartel operations under the one-party rule, leading to increased inter-cartel violence. We use indicators for state and municipal political alternation from their dataset, which excludes the state of Oaxaca where majors are selected through indigenous customary practices.[21] The variable *state alternation* (*municipality alternation*) switches from zero to one after an incumbent governor (mayor) from the PRI was replaced by a candidate from a different party. The results align with Trejo and Ley (2018) who show that state-level alternation is associated with increased drug-related homicides, while municipal-level alternation is not. Crucially, our key coefficient, which is smaller due to the exclusion of Oaxaca, remains positive and significant.

4.4 Falsification tests

We conduct two falsification tests to check the validity of our results. These either use homicides that are expected to be unrelated to drug trafficking as outcomes or use optimal routes for legal trade as the treatment variable.

[20] We thank Aldo Elizalde for sharing these data from the *"Padron e Historial de Nucleos Agrarios" (PHINA)*, originally collected by the *Mexican Secretaría de Desarrollo Agrario, Territorial y Urbano (SEDATU)*. This institution provides information about the number of hectares reformed through the ejido system by municipality in intervals of 10-years between 1930 and 1990.

[21] Information on party alternation is only provided for the time period 1995–2006. However, since we are interested to exclude a confounding effect that coincides with NAFTA, this shortcoming seems less crucial.

Drug-unrelated deaths In line with our hypothesis, we expect that the introduction of NAFTA is only associated with drug-related homicides which predominantly occur among males at the age of 15 to 39. Hence, inspecting the effect of NAFTA's introduction on homicides in other demographic groups constitutes a valid falsification of our hypothesis. We do not expect routes to predict changes in homicides of women and older people, or deaths from suicides or traffic fatalities. To conduct these falsification tests, we estimate event study models as embedded in equation 2 and replace the dependent variable for homicides of young females (15–39 years), homicides of older males or females (55–64 years), deaths from suicides, and traffic fatalities. Figure C.3 in the Appendix plots the point estimates of the different falsification tests over time. None of the plots show a pattern of higher post-NAFTA increases in placebo deaths in municipalities on a route. These results support our interpretation that the estimated increases in drug-related homicides in our main specification reflect competition over trafficking routes.

Placebo routes An alternative interpretation of our results suggests that violence increases on routes that are used for trade in general. In a second falsification test, we again exploit the fact that maize was Mexico's primary export commodity which was especially affected by the introduction of NAFTA. If municipalities alongside trade routes that connected maize producing regions with the U.S. suffered more strongly from the trade shock, these might have experienced a stronger decrease in the opportunity costs of using violence. To address this issue, we estimate the event-study model embedded in equation 2 substituting our predicted optimal drug-trafficking route indicator with a predicted optimal maize-trading route indicator. To create such optimal placebo routes, we use Dijkstra's algorithm (Dijkstra, 1959) to connect U.S. land ports of entry with maize producing municipalities as origins, i.e., municipalities above the 90th percentile of attainable maize yields.[22] Figure C.4 in the Appendix plots the point estimates when using the placebo routes as the dependent variable. The plot does not indicate a differential increase in drug-related homicides across municipalities with and without optimal maize-trading routes after the introduction of NAFTA. These results support our interpretation of predicted routes as actual trafficking routes.

5 Spillover and displacement effects

This section investigates how NAFTA affected the spatial distribution of drug-related violence.

Spillover effects DTOs typically strive to control large, contiguous territories and plazas rather than scattered pockets of land. This may lead to violence in regions that are not traversed by a trafficking route simply because DTOs try to conjoin territory. To study such spillovers, we analyze the impact of NAFTA's introduction on municipalities geographically close to trafficking routes.

[22] Results are robust to using municipalities above the median and above the 95th percentile of attainable maize yields as origins.

Table D.1 in the Appendix presents estimates from equation 1, adding indicators for municipalities in the vicinity of a trafficking route after the introduction of NAFTA. Column 1 adds a dummy for neighbor, defined as a municipality j that shares a side or an edge with a municipality i with a predicted drug-trafficking route. The results indicate that neighboring municipalities experienced an increase of approximately 2.2 homicides per 100,000 inhabitants, relative to municipalities farther away. At the same time, compared to our baseline specification, the estimated coefficient for municipalities traversed by a trafficking route increases from 2.1 to 3.0, suggesting that violence spilled over into adjacent municipalities. This result implies that our main results may underestimate the effect of routes due to contamination of the control group.

To inspect the dynamics of both the direct and spillover effects, we estimate equation 2 including the $Neighbor_j$ indicator interacted with time dummies (D_t). The event study results are visualized in Figure D.1 in the Appendix. Panel A presents estimates (β_t) for municipalities on a trafficking route, while Panel B reports estimates for neighboring municipalities. Both panels reveal no discernible pre-trends in violence between treated and control municipalities. Upon the introduction of NAFTA, both route and neighbor municipalities experience a lasting shift in violence, though the effect is statistically significant only for municipalities on trafficking routes. The smaller and slightly declining effect in neighbor municipalities suggests that these regions are less contested.

In column 2, we follow Butts (2023) and estimate spillover effects using distance bins. We introduce indicators for municipalities whose centroids fall within 0–20 km, 20–40 km, and 40–60 km from a trafficking route but are not directly traversed by one. The results indicate that spillover effects dissipate after 40 km. Moreover, incorporating this specification increases the estimated effect of route location to 3.3 homicides per 100,000 inhabitants, equivalent to 40% of the pre-NAFTA mean.

Displacement effects Figure A.3 in the Appendix shows that municipalities on routes saw an increase of violence after NAFTA whereas municipalities off routes eventually saw a decrease, compared to pre-NAFTA levels. Hence, we aim to understand whether NAFTA induced a reorganization of violence in Mexico such that violence was diverted from low trafficking regions and concentrated on regions that were strategically more valuable to traffickers. Note that spillover effects and displacement effects are not mutually exclusive. DTOs may expand their territorial control into neighboring municipalities while also abandoning low-value regions.

Figure D.2 in the Appendix shows local polynomial regressions of the (conditional) change in violence before and after NAFTA on distance between a municipality's centroid and the closest predicted optimal drug trafficking route. The estimated coefficient on homicides is positive for distances up to ca. 80 km with explicit humps for municipalities located directly on the route (around 2 km) and for those in 40–50 km distance. Results show a significant reduction in violence for municipalities further away than 150 km from a route. This figure illustrates that NAFTA generated substantial displacement effects at the local level. Violence was diverted from remote regions to municipalities in close proximity to trafficking routes.

In combination with the evidence in Table 1, these results suggest that NAFTA primarily changed the spatial distribution rather than increasing the aggregate level of violence. Similarly, Figure A.3 depicts a pattern according to which homicide rates first increase in route locations but then decline to pre-NAFTA levels, whereas homicide rates first stagnate and then decline in non-route locations. This pattern may emerge when total demand for drugs remains stable, as was the case with U.S. narcotics consumption during the 1990s (see Appendix Table A.1). Under these conditions, higher trafficking profits may temporarily incentivize DTOs to use violence to cpture strategically valuable locations. Once control is consolidated, violence may decline to pre-NAFTA levels or lower, particularly in less-contested areas, thereby altering the geographic distribution without necessarily changing the overall magnitude of drug-related violence in the long run. The point estimates displayed throughout the paper thus may capture an equilibrium effect consisting of both the increase in violence along trafficking routes and the decline in regions farther away.

6 Evidence for lasting competition between DTOs

In this section, we present evidence that the differential increase in drug-related violence after 1993 stems from intensified competition among DTOs. For this purpose, we use data that specifically measure inter-cartel violence, abstracting from other types of drug-related homicides. Unfortunately, these data are only available starting in 1995, leading us to adopt the following cross-sectional specification:

$$Drug\,homicides_{i,t} = \alpha + \beta Route_i + \delta Drug\,homicides_{i,1990-93} + X_i'\Gamma + \epsilon_i \tag{4}$$

where, $Drug\,homicides_{i,t}$ reflects the number of inter-cartel homicides per 100.000 inhabitants in municipality i during period t, where t=1995–2000, 2001–2006, 2007–2010. For the 2007–2010 period, the dependent variable is alternatively replaced by homicides resulting from cartel aggression against state forces or from confrontations initiated by state forces against cartels. All dependent variables are standardized to have zero mean and unit standard deviation for comparability. $Route_i$ is the indicator established in Section 4 that equals one if a municipality is traversed by a predicted optimal drug-trafficking route. $Drug\,homicides_{i,1990-1993}$ captures pre-NAFTA levels of violence, measured as the number of male homicides (ages 15–39) during 1990–1993 per 100.000 inhabitants in 1990. X_i' represents our baseline set of control variables. We use robust standard errors in all specifications.

Table 6 presents the results from estimating equation 4 across the different periods. Columns 1 and 2, focus on intercartel murders from the database of Criminal Violence in Mexico (CVM) by Trejo and Ley (2018), which compiles municipality-level data on drug-related violent events reported by three major Mexican newspapers: Reforma, El Universal, and El Financiero. According to the dataset, 4,275 murders are directly attributable to drug cartels. We aggregate these data into two six-year periods and standardize them per 100,000 inhabitants.

Table 6: Distinguishing violence among DTOs or between DTOs and the state

Dep. var.:	Inter-cartel murders per 100,000		Drug-related homicides per 100,000 due to:		
			inter-cartel conflict	aggression towards state	confrontations with state
	1995–2000	2001–2006	2007–2010	2007–2010	2007–2010
	(1)	(2)	(3)	(4)	(5)
Route	0.169***	0.095*	0.269***	0.081	0.066
	(0.054)	(0.050)	(0.056)	(0.055)	(0.053)
Drug-related homicides 1990–93	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.04	0.12	0.17	0.02	0.11
Observations	1,961	1,961	2,398	2,398	2,398

Notes: The table shows results from estimating equation 4. The unit of observation is a municipality. Columns 1 and 2 exclude municipalities in Oaxaca for which data on the dependent variables from Trejo and Ley (2018) are not available. Dependent variables are standardized with zero means and unit standard deviations. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Robust standard errors in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

The results show that municipalities along predicted drug-trafficking routes experienced significantly higher inter-cartel murders. For the 1995–2000 period, municipalities on these routes reported 0.17 standard deviations more inter-cartel murders. This difference persists during the 2001–2006 period, albeit with a smaller magnitude of 0.10 standard deviations. These findings indicate that NAFTA had lasting effects on the spatial distribution of cartel competition.

Columns 3–5 shift the focus to the 2007–2010 period, using official data on drug-related homicides from the Office of the Mexican Attorney-General. These data are unique in distinguishing between inter-cartel homicides, i.e., those resulting from rivalries between DTOs, homicides resulting from cartel aggression against state forces, and homicides arising from state forces confronting cartels. The period marks the escalation of violence following newly elected President Felipe Calderón's deployment of the military to combat the cartels, an initiative that resulted in unprecedented levels of violence, with 50,000 drug-related homicides reported during his term.

The results confirm that predicted drug-trafficking routes are positively associated with all categories of cartel violence. However, we find that drug-trafficking routes are only significantly related to inter-cartel conflict (column 3), whereas they are not significantly related to aggression from cartels toward state forces (column 4) or confrontations of cartels by state forces (column 5). Municipalities traversed by a route experience 0.27 standard deviations more inter-cartel homicides. These findings support our hypothesis that DTOs use violence primarily to compete for control of trafficking routes. Moreover, they suggest that regions whose strategic importance increased due to NAFTA continue to experience comparatively higher levels of drug-related violence well into the first decade of the 2000s.

7 Conclusion

This paper investigates the consequences of NAFTA's introduction in 1994 on drug-related violence in Mexico. We argue that due to the complementarity between trade in legal and illegal goods, NAFTA's open border policies increased profits in the Mexican drug-trafficking sector. This triggered a novel aspect of the so-called rapacity effect (Collier and Hoeffler, 2004; Dal Bó and Dal Bó, 2011; Dube and Vargas, 2013), according to which criminal organizations violently compete to appropriate profits from trafficking by controlling strategically valuable locations, such as smuggling routes. In 1990s Mexico, this reshaped the geography of violence.

Using a flexible difference-in-differences approach, we compare drug-related homicides in municipalities with and without an optimal drug-trafficking route, before and after NAFTA's introduction. Trafficking routes are identified using least-cost paths between U.S. points of entry and regions suitable for drug production or known for trafficking activity. Our results show that after NAFTA's introduction, municipalities on predicted trafficking routes experienced an increase of 2.1 homicides per 100,000, equivalent to a 26% rise relative to the pre-NAFTA mean. When accounting for spillover effects in nearby regions, this increase may be as large as 40%. Further analyses confirm that violence became particularly concentrated in the most strategically valuable segments of routes leading to the busiest ports of entry, where drugs are easier to conceal within growing cargo volumes. It is important to highlight, however, that our results point to a spatial reallocation of violence rather than an increase in overall levels: a pronounced gap in violence between trafficking and non-trafficking regions emerged following NAFTA and persisted even as aggregate drug-related violence declined in the late 1990s.

We believe that our findings generalize beyond Mexico, applying to all forms of illicit trade that rely on legal commerce for concealment, including human trafficking. When evaluating the benefits of trade liberalization, policymakers need to consider the unintended consequence of lower smuggling costs, which can fuel criminal violence through intensified competition. However, we also recognize that these dynamics are highly context-dependent, and the rapacity effect is likely strongest in countries with weak institutions, where corruption provides government officials with incentives to accommodate organized crime.

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Appendix A Descriptives

Table A.1: The size of the U.S. illegal drugs market

	Cocaine		Heroin		Cannabis		Methamphetamine	
Year	Consum.	Expen.	Consum.	Expen.	Consum.	Expen.	Consum.	Expen.
1990	447	69.9	14	22.5	837	15.0	16	5.7
1991	335	57.1	12	20.3	793	14.0	10	3.7
1992	346	49.9	12	17.2	761	14.6	14	4.8
1993	331	45.0	11	13.8	791	12.0	19	5.1
1994	323	42.8	11	13.2	874	12.2	34	7.6
1995	321	40.0	12	13.2	848	10.2	54	9.2
1996	301	39.2	13	12.8	874	9.5	54	10.1
1997	275	34.7	12	11.4	960	10.5	35	9.3
1998	267	34.9	14	11.1	952	10.8	27	8
1999	271	35.6	14	10.1	1028	10.6	18	5.8

Notes: Table shows size of the U.S. drug market based on prices and quantities. *Consum.* is annual quantity of consumption in metric tons. *Expen.* is annual expenditures in Billions of 2000 USD. Source: The White House (2003).

Table A.2: U.S.-Mexico land ports of entry by size

U.S. land ports of entry			
Commodity value of imports in 1993		Annual Δ of commodity value of imports in 1994–99	
Above median	Below median	Above median	Below median
Brownsville-Cameron, Tx.	Andrade, Cal.	Brownsville-Cameron, Tx.	Andrade, Cal.
Calexico, Cal.	Columbus, N.M.	Eagle Pass, Texas	Calexico, Cal.
Del Rio, Texas	Fabens, Texas	El Paso, Texas	Columbus, N.M.
Douglas, Ariz.	Lukeville, Ariz.	Hildago, Texas	Del Rio, Texas
Eagle Pass, Texas	Naco, Arizona	Laredo, Texas	Douglas, Ariz.
El Paso, Texas	Oroma, Texas	Naco, Arizona	Fabens, Texas
Hildago, Texas	Presidio, Texas	Nogales, Ariz.	Lukeville, Ariz.
Laredo, Texas	Rio Grande City, Texas	Oroma, Texas	Otay Mesa, Cal.
Nogales, Ariz.	San Luis, Ariz.	Rio Grande City, Texas	Presidio, Texas
Otay Mesa, Cal.	Sasabe, Ariz.	San Luis, Ariz.	San Ysidro, Cal.
San Ysidro, Cal.	Tecate, Cal.	Tecate, Cal.	Sasabe, Ariz.

Notes: Table categorizes the 22 U.S.-Mexico land ports of entry included in the analysis by their commodity trade value (in U.S. dollars) into above and below median levels in 1993 (columns 1 and 2) and above and below median annual growth rates from 1994 to 1999 (columns 3 and 4). Trade flows considered are imports from Mexico into the U.S. that were transported using trucks obtained from the TransBorder Freight Database (BTS, 1999).

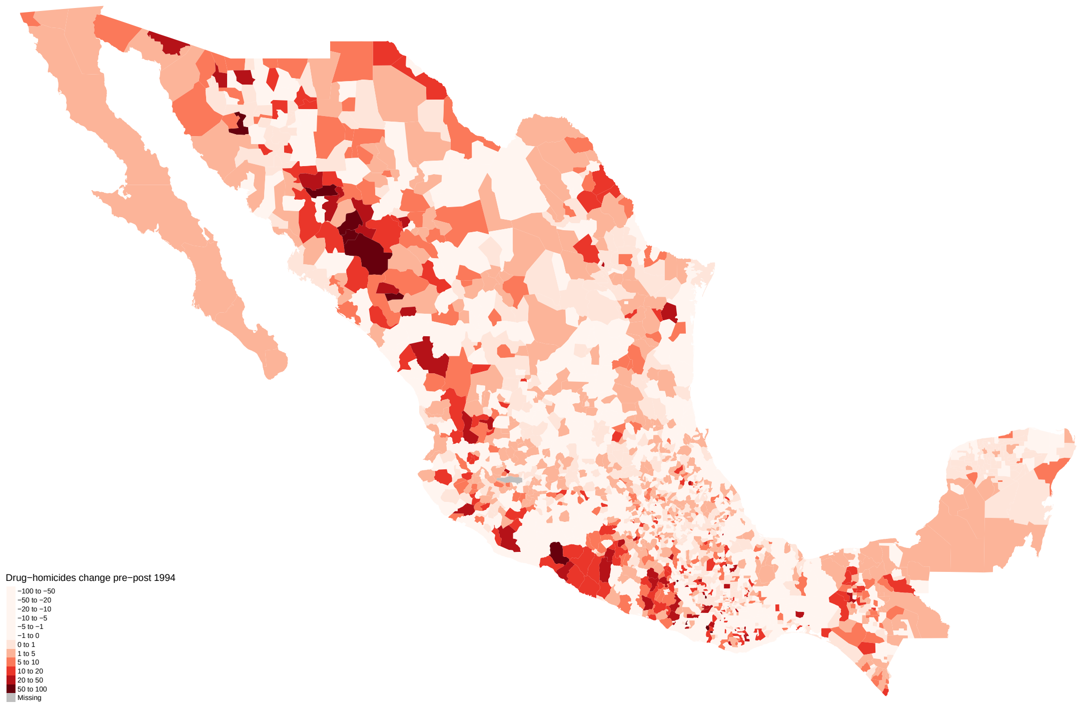


FIGURE A.1: Change in drug-related homicides after NAFTA's introduction

This figure illustrates average changes in drug-related homicides, i.e., homicides of makes aged 15–39 per 100,000 inhabitants, comparing the periods 1990–93 and 1994–1999. Darker shades of red indicate higher increases after 1994.

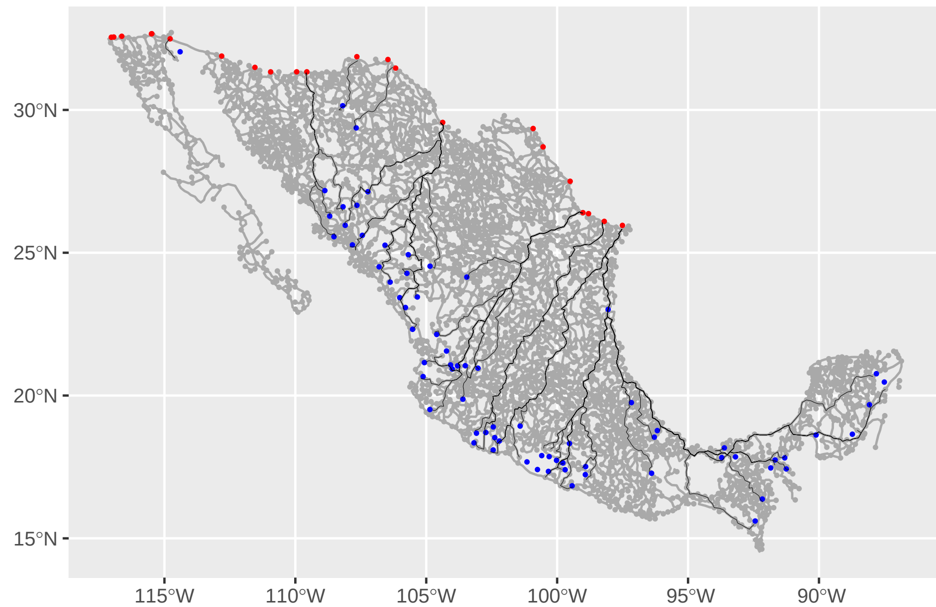


FIGURE A.2: Predicted drug-trafficking routes

This figure shows the optimal predicted drug-trafficking routes as black lines. Grey lines indicate the full road network in Mexico as of 1993. Red dots depict the 22 land ports of entry on the Mexican-U.S. border. Blue dots depict major known drug-producing and drug-trafficking municipalities (see Section 3 for details).

FIGURE A.3: Drug-related homicides by routes in the 1990s

This figure depicts the evolution of drug-related homicides by municipality with (solid) and without (dashed) a predicted drug-trafficking route over time.

Table A.3: Descriptive Statistics

Variable	Mean	St. Dev.	Min	Max	N
Dependent variables (panel data)					
Drug-related homicides (1990–1999)	8.17	(20.07)	0.00	607.29	23,980
Drug-related homicides (1990–1993)	8.22	(21.67)	0.00	571.43	9,592
Drug-related homicides (1994–1999)	7.94	(18.70)	0.00	607.29	11,990
All homicides	17.59	(36.44)	0.00	1473.14	23,980
Gun-related homicides	11.45	(31.51)	0.00	1473.14	23,980
Gun-related homicides (men 15–39)	6.86	(20.04)	0.00	571.43	23,980
Female homicides (15–39)	0.33	(1.70)	0.00	48.50	23,980
Older male homicides (55–64)	2.43	(7.01)	0.00	170.94	23,980
Older female homicides (55–64)	0.24	(2.60)	0.00	283.29	23,980
Suicides	0.38	(2.28)	0.00	109.65	23,980
Traffic fatalities	8.75	(17.04)	0.00	636.94	23,980
Luminosity (1992–1999)	6.56	(11.32)	0.00	63.00	19,184
Dependent variables (cross-sectional data)					
Inter-cartel murders (1995–2000)	1.05	(6.14)	0.00	115.41	1,961
Inter-cartel murders (2001–2006)	2.50	(12.96)	0.00	321.40	1,961
Inter-cartel conflict homicides (2007–2010)	5.79	(17.38)	0.00	368.93	2,398
Aggression deaths (2007–2010)	0.15	(1.37)	0.00	39.96	2,398
Confrontation deaths (2007–2010)	1.39	(11.40)	0.00	271.45	2,398
Treatment variables (cross-sectional data)					
Route	0.25	(0.43)	0.00	1.00	2,398
Origins	0.03	(0.17)	0.00	1.00	2,398
Destinations	0.01	(0.09)	0.00	1.00	2,398
Length of route	13.22	(27.81)	0.00	239.24	2,398
Number of routes	1.20	(3.43)	0.00	35.00	2,398
Route (ports > med. trade 93)	0.26	(0.44)	0.00	1.00	2,398
Route (ports < med. trade 93)	0.25	(0.43)	0.00	1.00	2,398
Route (ports > med. Δ trade 94–99)	0.26	(0.44)	0.00	1.00	2,398
Route (ports < med. Δ trade 94–99)	0.26	(0.44)	0.00	1.00	2,398
Distance to route	41.62	(42.02)	0.00	369.00	2,398
Route within 0–20km	0.16	(0.36)	0.00	1.00	2,398
Route within 20–40km	0.20	(0.40)	0.00	1.00	2,398
Route within 40–60km	0.16	(0.36)	0.00	1.00	2,398
Neighbor	0.28	(0.45)	0.00	1.00	2,398
Placebo routes (maize)	0.28	(0.45)	0.00	1.00	2,398
Baseline control variables (cross-sectional data)					
Temperature	19.93	(3.94)	10.68	27.93	2,398
Precipitation	1025.31	(550.71)	77.99	3925.58	2,398
Soil pH	6.49	(0.97)	0.13	8.57	2,398
Cannabis suitability	0.24	(0.32)	0.00	1.00	2,398
Opium suitability	0.06	(0.15)	0.00	1.00	2,398
Distance to U.S. border	733.15	(272.20)	0.00	1334.99	2,398
Total population 1990	33857.04	(100953.09)	149.00	1650205.00	2,398
Road density	0.12	(0.15)	0.00	1.93	2,398
Other control variables (panel data)					
RTC agriculture (MX import tariffs)	0.01	(0.02)	0.00	0.35	23,980
RTC manufacturing (US import tariffs)	0.03	(0.16)	0.00	4.31	23,980
Years of schooling (m16)	7.77	(1.89)	0.00	16.00	23,864
Municipality alternation	0.14	(0.34)	0.00	1.00	19,610
State alternation	0.07	(0.26)	0.00	1.00	19,610
Other control variables (cross-sectional data)					
Share PAN votes 1994	0.16	(0.12)	0.00	0.62	2,398
Share highly-educated urban 1990	0.02	(0.03)	0.00	0.29	2,398
Share agriculture in 1990	0.54	(0.27)	0.00	1.00	2,398
Share manufacturing in 1990	0.12	(0.12)	0.00	0.91	2,398
Share export manufacturing in 1990	0.04	(0.07)	0.00	0.80	2,398
Share unemployed in 1990	0.11	(0.11)	0.00	1.00	2,398
Maize suitability	4.86	(1.80)	0.00	7.66	2,398
Eijidos per area	0.32	(0.25)	0.00	1.00	2,177

Notes: The table shows summary statistic for all variables included in the empirical analysis.

Appendix B Variable description

B.1 Dependent variables: homicides, deaths, and luminosity

Drug-related homicides. The number of homicides of males between the age of 15 and 39 per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

All homicides. The number of homicides per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Gun-related homicides. The number of homicides by fire arm or explosives (X930-X969) per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Gun-related homicides (men 15–39). The number of homicides of males between the age of 15 and 39 by fire arm or explosives (X930–X969) per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Female homicides (15–39). The number of homicides of females between the age of 15 and 39 per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Older male homicides (55–64). The number of homicides of males between the age of 55 and 64 per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Older female homicides (55–64). The number of homicides of females between the age of 55 and 64 per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Suicides. The number of suicides per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Traffic fatalities. The number of deaths due to traffic accidents per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1990–1999. Data obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Luminosity (1992–1999). Nighttime stable lights averaged at the municipality level, based on satellite observations from the Defense Meteorological Satellite Program's (DMSP) Operational Linescan System (OLS) collected by US Air Force Weather Agency. We use the stable lights product, an index taking values from 0 to 63, that "contains the lights from cities, towns, and other sites with persistent lighting, including gas flares. Ephemeral events, such as fires have been discarded. Then the background noise was identified and replaced with values of zero." From 1992 to 1994, the data is sourced from the F10 satellite, while from 1995 to 1999, it is sourced from the F12 satellite. Image and data processing was done by EOG, Colorado School of Mines (2024), Payne Institute for Public Policy, Colorado School of Mines. Data, last accessed on 11/11/2024, available here.

Inter-cartel murders (1995–2000). The number of inter-cartel murders per 100,000 inhabitants in 1990 in each Mexican municipality for the period 1995–2000. Data obtained from the database of Criminal Violence in Mexico (CVM) by Trejo and Ley (2018).

Inter-cartel murders (2001–2006). The number of inter-cartel murders per 100,000 inhabitants in 1990 in each Mexican municipality for the period 2001–2006. Data obtained from the database of Criminal Violence in Mexico (CVM) by Trejo and Ley (2018).

Inter-cartel conflict homicides. The number of homicides related to drug-trafficking organization rivalry per 100,000 inhabitants in 2005 in each Mexican municipality for the period 2007-2010. Data obtained from Empirical Studies of Conflict (ESOC). Total population in 2005 obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Aggression deaths. The number of deaths related to DTO attacks against military and police forces per 100,000 inhabitants in 2005 in each Mexican municipality for the period 2007-2010. Data obtained from Empirical Studies of Conflict (ESOC). Total population in 2005 obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

Confrontation deaths. The number of deaths observed during a government intervention per 100,000 inhabitants in 2005 in each Mexican municipality for the period 2007-2010. Data obtained from Empirical Studies of Conflict (ESOC). Total population in 2005 obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

B.2 Treatment variables: routes for drug-trafficking

Route. Indicator that takes value 1 if municipality i is traversed by a predicted optimal drug-trafficking route, created using Dijkstra's algorithm (Dijkstra, 1959). Dijkstra's algorithm creates optimal transportation paths from origins to destinations following a network. The network is the main roads and highways in Mexico as of 1985, drawn from The Digital Chart of the World (DCW).

Origins. Origins are municipalities of drug production or transit. We classify municipalities as origins if they are above the 95th percentile of cannabis and opium poppy eradication in hectares per area between 1990 and 1993 (excluding zeros), or if there was a positive amount of cocaine seized between 1990 and 1993. These amount to 76 origin municipalities. Data are obtained from Dube, García-Ponce and Thom (2016).

Destinations. Destinations consist of all 22 Mexico-U.S. land ports of entry collected from the Bureau of Transportation Statistics. Also see Table A.2.

Route (ports > med. trade 93). Route indicator using only destinations (ports of entry) with above median trade, measured in commodity value (U.S. dollars) from April to December 1993. See '*Routes*' for prediction of routes.

Route (ports < med. trade 93). Route indicator using only destinations (ports of entry) with below median trade, measured in commodity value (U.S. dollars) from April to December 1993. See '*Routes*' for prediction of routes.

Route (ports > med. Δ trade 94–99). Route indicator using only destinations (ports of entry) with above median annual trade growth, measured in commodity value (U.S. dollars) from January 1994 to December 1999. See '*Routes*' for prediction of routes.

Route (ports < med. Δ trade 94–99). Route indicator using only destinations (ports of entry) with below median annual trade growth, measured in commodity value (U.S. dollars) from January 1994 to December 1999. See '*Routes*' for prediction of routes.

Length of route. This variable measures the length of the predicted drug-trafficking route in kilometers in each municipality. See '*Routes*' for prediction of routes.

Number of routes. This variable counts the number of origins that ship drugs through a municipality when connecting to a port of entry. See '*Routes*' for prediction of routes.

Distance to route. This variable measures the euclidean distance from a municipality centroid to the nearest predicted drug-trafficking route in kilometers. See '*Routes*' for prediction of routes.

Route with 0–20km Indicator that takes value 1 if the centroid of a municipality i is within 0–20 km distance of by a predicted optimal drug-trafficking route.

Route with 20–40km Indicator that takes value 1 if the centroid of a municipality i is within 20–40 km distance of by a predicted optimal drug-trafficking route.

Route with 40–60km Indicator that takes value 1 if the centroid of a municipality i is within 40–60 km distance of by a predicted optimal drug-trafficking route.

Neighbor. Indicator that takes value 1 if municipality j shares a side or an edge with a municipality i with a predicted drug-trafficking route. See '*Routes*' for prediction of routes.

Placebo routes (maize). Indicator that takes value 1 if municipality i is traversed by a predicted optimal route using as origins municipalities that lie above the 95th percentile of maize suitability. See '*Routes*' for prediction of routes and '*Maize suitability*' for maize suitability.

Route $\times$ cocaine seizures in Colombia. Interaction term between the route indicator (which takes the value 1 if municipality i is traversed by a predicted optimal trafficking route) and annual cocaine seizures in Colombia, measured as the ratio of cocaine hydrochloride (HCl) to cocaine base in metric tons. See '*Routes*' for prediction of routes. Seizure data are obtained from the U.S. State Department's International Narcotics Control Strategy Reports (INCSR) for 1998 and 1999.

B.3 Baseline controls

Temperature. The average temperature in degrees Celsius in a municipality, calculated as the average temperature of all grid-cells in the municipality during the 1970—2000 period, constructed by temporally and spatially aggregating time series information on mean monthly temperature at a geospatial resolution of 30 arc seconds, obtained from WorldClim (version 2) by Fick and Hijmans (2017).

Precipitation. The average precipitation in hundreds of millimeters in a municipality, calculated as the average precipitation of all grid-cells in the municipality during the 1970—2000 period, constructed by temporally and spatially aggregating time series information on mean monthly precipitation at a geospatial resolution of 30 arc seconds, obtained from WorldClim (version 2) by Fick and Hijmans (2017).

Soil pH. The average soil pH in a municipality, calculated as the average soil pH of all grid-cells in the municipality, constructed information at a geospatial resolution of 30 arc seconds. The pH scale runs logarithmically from 0 to 14, where 0 is a highly acidic value, 14 is highly alkaline, and 7 is neutral. Data obtained from the Atlas of the Biosphere by IGBP-DIS (1998).

Cannabis suitability. Index which captures the suitability of a municipality to grow cannabis. To create this index, we divide Mexico's area into grid cells of 0.05 x 0.05 degrees of latitude by longitude and create a dummy variable that takes a value 1 if cell i falls within the optimal intervals for growing cannabis and 0 otherwise. We define the optimal suitability for growing cannabis in terms of precipitation, temperature, and soil pH (see variable descriptions above). According to

FAO EcoCrop, the optimal temperature to grow cannabis is between 15–28 degrees Celsius; annual precipitation should be between 600–1200 mm; and soil pH between 6–7. Using this information, we calculate the share of 0.05 x 0.05 grid cells within each municipality that potentially could grow cannabis.

Opium suitability. Index which captures the suitability of a municipality to grow opium poppies. To create this index, we divide Mexico's area into grid cells of 0.05 x 0.05 degrees of latitude by longitude and create a dummy variable that takes a value 1 if cell i falls within the optimal intervals for growing opium poppies and 0 otherwise. We define the optimal suitability for growing opium poppies in terms of precipitation, temperature, and soil pH (see variable descriptions above). According to FAO EcoCrop, the optimal temperature to grow opium poppies is between 15 and 24 degrees Celsius; annual precipitation should be between 800–1200 mm; and soil pH between 6.5–7.5. Using this information, we calculate the share of 0.05 x 0.05 grid cells within each municipality that potentially could grow opium poppies.

Distance to U.S. border. The euclidean distance in kilometers from a municipality centroid to the nearest Mexico-U.S. land port of entry.

Total population 1990. Total population in 1990 at the municipality level obtained from Mexican Instituto Nacional de Estadística y Geografía (INEGI).

B.4 Other controls

RTC agriculture (MX import tariffs). Region-level (municipality) tariff change (RTC) calculated following equation 3. The ratio of number of male workers aged 15 to 39 employed in agricultural industry k (using the 5-digit code of the North American Industry Classification System–NAICS) in municipality i from the 1990 census is weighted by the national share of employment in that industry and multiplied by time-varying industry-level tariff rates. Individual-level employment data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international. Mexican agricultural tariffs for 1991 (obtained from UNCTAD-TRAINS tariffs via WITS) are held fixed in the pre-NAFTA period and then decline according to product-specific phase-out schedules.

RTC manufacturing (US import tariffs). Region-level (municipality) tariff change (RTC) calculated following equation 3. The ratio of number of male workers aged 15 to 39 employed in manufacturing industry k (using the 5-digit code of the North American Industry Classification System–NAICS) in municipality i from the 1990 census is weighted by the national share of employment in that industry and multiplied by time-varying industry-level tariff rates. Individual-level employment data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international. U.S. manufacturing tariffs for 1992 (obtained from UNCTAD-TRAINS tariffs via WITS) are held fixed in the pre-NAFTA period and then decline according to product-specific phase-out schedules.

Years of Schooling (m16). The municipality-level average completed years of schooling for individuals who turned 16 in each year between 1990 and 1999, i.e., those beyond the mandatory schooling age, based on data from the 2005 Mexican Census (INEGI). Data are capped at 16 years of schooling. Data obtained via IPUMS International.

Municipality Alternation. Indicator variable assuming the value 1 if the major of the municipality is not affiliated with the PRI and 0 if the PRI candidate maintained power at the municipality level from 1995 to 1999. Data obtained from Trejo and Ley (2018).

State Alternation. Indicator variable assuming the value 1 for all municipalities in a state if the state governor is not affiliated with the PRI and 0 if the PRI candidate mantained power from 1995 to 1999. Data obtained from Trejo and Ley (2018).

Share PAN votes 1994. The ratio of votes for the Partido Acción Nacional, PAN, over the total number of votes in the 1994 Mexican general election. Data obtained from Instituto Nacional Electoral (INE).

Share highly-educated urban 1990. The ratio of men with at least some college or university education, living in a locality with more than 2,500 inhabitants over men aged 15 to 64 in a municipality. Individual level data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international.

Share agriculture in 1990. The ratio of men aged 15 to 39 that report being employed in agriculture over men aged 15 to 39 in the labor force in a municipality. Individual level data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international.

Share manufacturing in 1990. The ratio of men aged 15 to 39 that report being employed in manufacturing over men aged 15 to 39 in the labor force in a municipality. Individual level data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international.

Share export industry in 1990. The ratio of men aged 15 to 39 that report being employed in export oriented industries (Apparel; Footwear; Leather and Leather Products; Wood and Cork Products; Petrochemical Refinement; Metal Products; Electronic and Mechanical Machinery; Electrical Machinery; Transport Equipment; Scientific and Optical Equipment) as classified by

Atkin (2016), over men aged 15 to 39 in the labor force in a municipality. Individual level data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international.

Share unemployed in 1990. The ratio of men aged 15 to 39 that report being unemployed or in unpaid work over men aged 15 to 39 in the labor force in a municipality. Individual level data, aggregated to the municipality level, obtained from the 1990 census (INEGI) accessed via iPUMPS international.

Maize suitability. The average agroclimatic attainable yield for maize at the municipality level at a geospatial resolution of 30 arc seconds. We calculate the average of low-input-level, intermediate-input-level, and high-input-level rain-fed for maize at the municipality level. Data obtained from from FAO-GAEZ V3.

Ejidos per area. The cumulative area of the land redistributed under the *ejido* system divided by total area of a municipality in 1990. Data obtained from Elizalde (2020).

Maize price. National maize price in 2010 thousand Mexican pesos, obtained from Dube, García-Ponce and Thom (2016) originally collected by *Servicio de Información Agroalimentaria y Pesquera (SIAP)*.

Appendix C Robustness checks

Table C.1: Robustness to alternative transformations and sample restrictions

Dep. var.:	Drug-related homicides per 100.000 inhabitants					
	(1)	(2)	(3)	(4)	(5)	(6)
	Ln+1	Arcsinh	Ln+q.90	Top 1%	Top 5%	Origins
Route × post NAFTA	0.098***	0.109**	2.142***	2.156***	2.371***	1.853***
	(0.038)	(0.045)	(0.576)	(0.580)	(0.590)	(0.584)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,980	23,980	23,980	23,740	22,820	23,250

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Column 1 transforms the dependent variable using the natural logarithm, adding 1; column 2 uses the inverse hyperbolic since transformation; column 3 uses the natural logarithm, adding the value at the 90th percentile of the homicides distribution. Columns 4 and 5 drop municipalities in the top 1% and top 5% of the homicides distribution. Column 6 drops municipalities that are identified as origins for the routes. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Robust standard errors in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table C.2: Robustness to restricting homicides by gun and explosives

Dep. var.:	Drug-related homicides per 100.000 inhabitants			
	All	All (men 15–39)	Gun	Gun (men 15–39)
	(1)	(2)	(3)	(4)
Route × post NAFTA	4.116***	2.142***	2.844***	1.710***
	(0.971)	(0.576)	(0.843)	(0.569)
Baseline controls	Yes	Yes	Yes	Yes
Mean homicides pre-Nafta	17.52	8.22	11.64	7.03
Observations	23,980	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. The dependent variable in uses homicides of: men and women of all ages (column 1), men age 15–39 (column 2), men and women of all ages by firearm or explosives (column 3), men age 15–39 by firearm or explosives (column 4). Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table C.3: Robustness to alternative cutoffs in the definition of origin municipalities

Dep. var.: Drug-related homicides per 100.000 inhabitants	Canabis and Opium				Cocaine	
	(1)	(2)	(3)	(4)	(5)	(6)
	perc 99	perc 95	perc 90	perc 85	< median	> median
Route × post NAFTA	1.701***	2.142***	1.225**	0.784	2.150***	2.276***
	(0.567)	(0.576)	(0.543)	(0.535)	(0.575)	(0.651)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean homicides pre-NAFTA	8.218	8.218	8.218	8.218	8.218	8.218
Observations	23,980	23,980	23,980	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Each column uses a route indicator variable that relies on a different set of origin municipalities. Columns 1–4 leave cocaine origins unaltered but change the percentile threshold of hectares of cannabis and opium eradicated. Columns 5–6 leave cannabis and opium origins unaltered but either only uses below or above median cocaine seizure municipalities as origins. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table C.4: Correcting for spatial autocorrelation

Dep. var.:	Drug-related homicides per 100.000 inhabitants				
	(1)	(2)	(3)	(4)	(5)
	50km	100km	250km	500km	1000km
Route ×	2.142***	2.142***	2.142***	2.142***	2.142***
	(0.443)	(0.473)	(0.545)	(0.511)	(0.265)
Baseline controls	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Mean homicides pre-NAFTA	8.218	8.218	8.218	8.218	8.218
Observations	23,980	23,980	23,980	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors, in parenthesis, are adjusted for spatial autocorrelation using the method introduced by Conley (1999) with radii as indicated in the column heads. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table C.5: Trade liberalization and economic activity

Dep. var.:	Luminosity					
	(1)	(2)	(3)	(4)	(5)	(6)
Route × post NAFTA	-0.338***	-0.256***	-0.259***	-0.250***	-0.255***	-0.256***
	(0.059)	(0.058)	(0.060)	(0.059)	(0.061)	(0.061)
Sh agriculture in 1990 × post NAFTA	-0.772***					
	(0.053)					
Sh manufacturing in 1990 × post NAFTA		0.489***				
		(0.045)				
Sh export manufacturing in 1990 × post NAFTA			0.186***			
			(0.039)			
Sh unemployed in 1990 × post NAFTA				-0.263***		
				(0.025)		
RTC agriculture (MX import tariffs)					0.004	
					(0.038)	
RTC manufacturing (US import tariffs)						0.020
						(0.078)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	8.861	8.861	8.861	8.861	8.861	8.861
Observations	19,184	19,184	19,184	19,184	19,184	19,184

Notes: The table shows results from estimating equation 1, replacing violence with luminosity as dependent variable. The unit of observation is a municipality, observed from 1992 to 1999. All control variables introduced in this table are standardized with zero mean and unit standard deviation. Employment shares used in columns 1–4 reflect men aged 15–39 in the 1990 census. RTC (region-level tariff change) measures in columns 5–6 are calculated according to equation 3. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

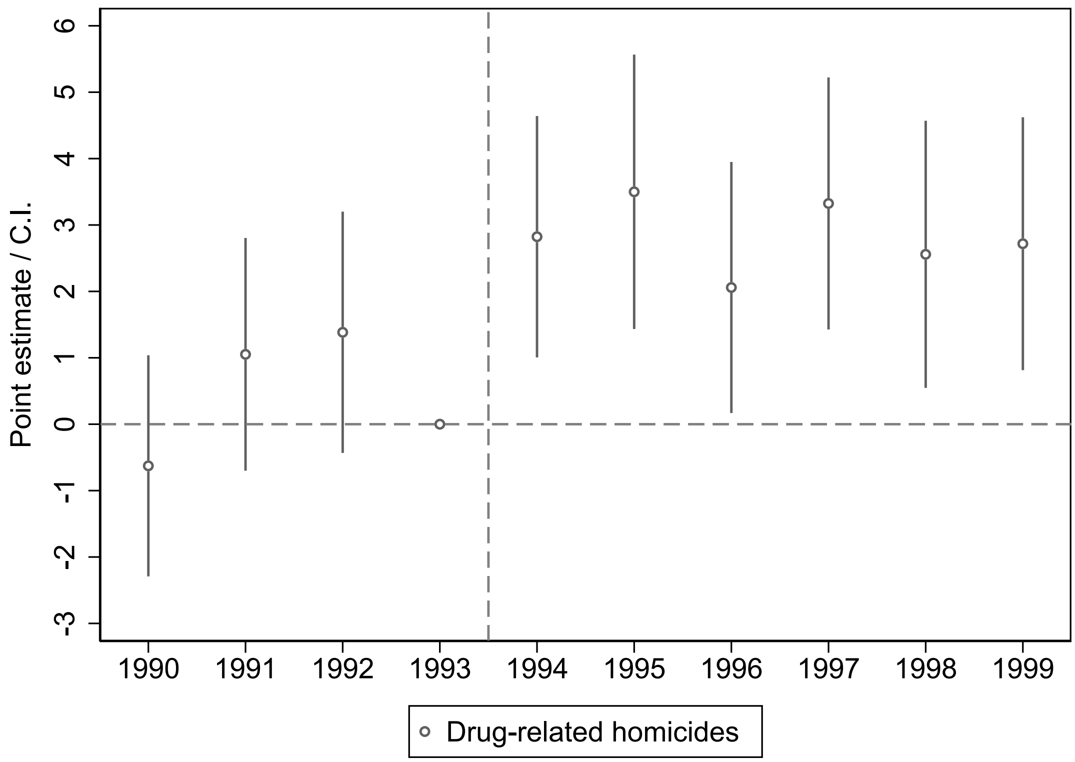


Figure C.1: Dynamic effects without controls

The figure plots β_τ coefficients estimated from equation 2 with 95% confidence intervals. The omitted year is 1993. The dependent variable measures drug-related homicides per 100,000 inhabitants. The main explanatory variables are indicators that assume the value one if a municipality is traversed by a predicted optimal drug-trafficking route interacted with year dummies. For this estimation none of the control variables were included. Standard errors are clustered at the municipality level. Corresponding results can be found in Table E.1.

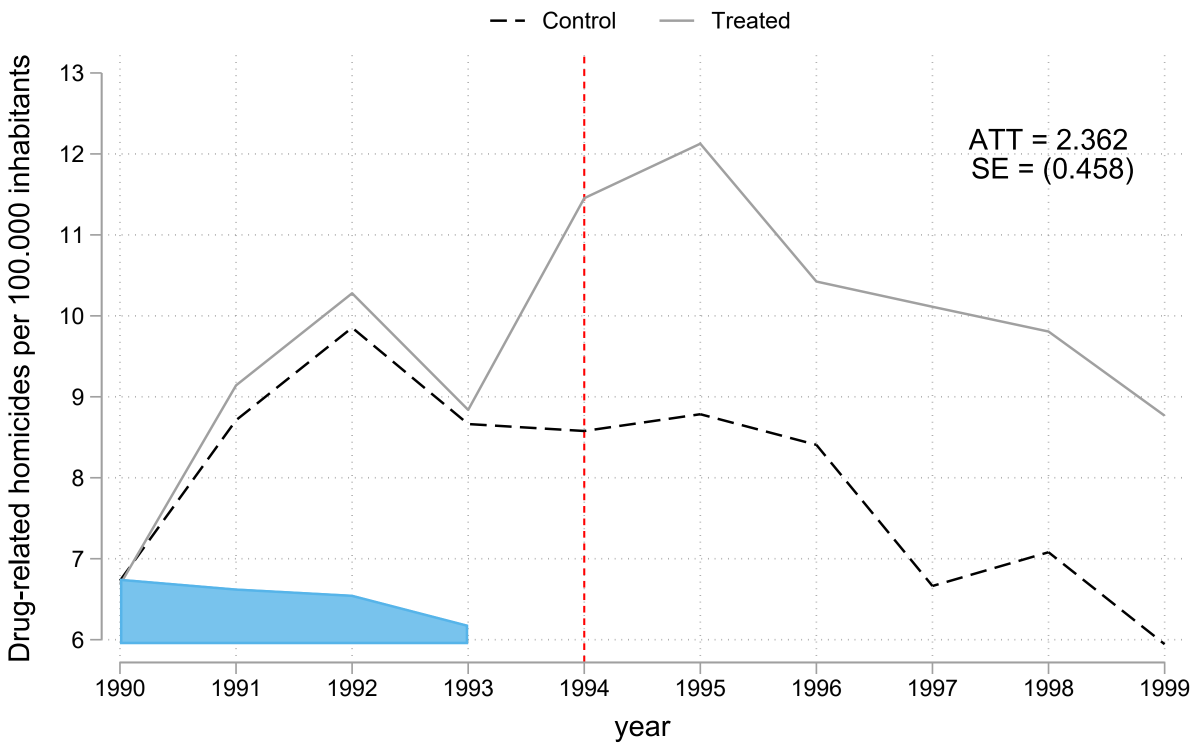
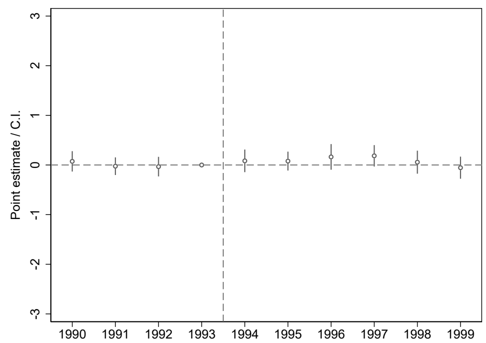
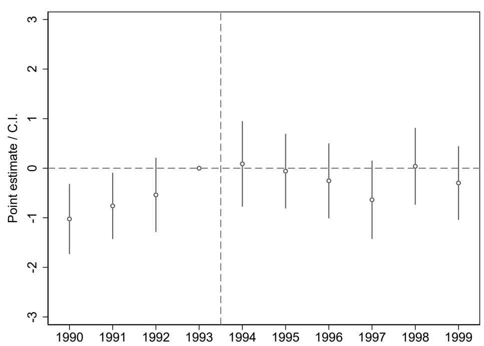


Figure C.2: Trends in outcomes from synthetic difference-in-differences approach

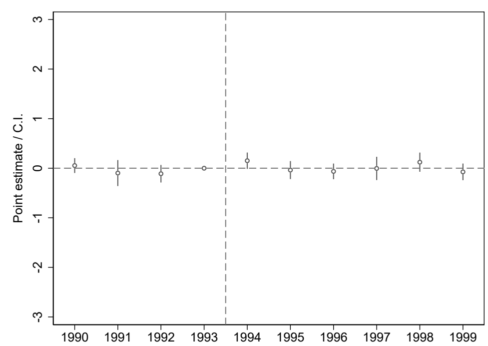
The figure depicts average trends in drug-related homicides across municipalities with (treated) and without (control) predicted drug-trafficking routes when applying a synthetic control group approach. The trends are weighted averages across municipality-year observations derived using the Stata command for synthetic difference-in-differences estimation 'sdid' (Pailañir and Clarke, 2022). Point estimate (2.362) and standard error (0.458) displayed in the graph are estimated using the same command and seed. The procedure to generate the event-study graph closely follows (Clarke et al., 2023).



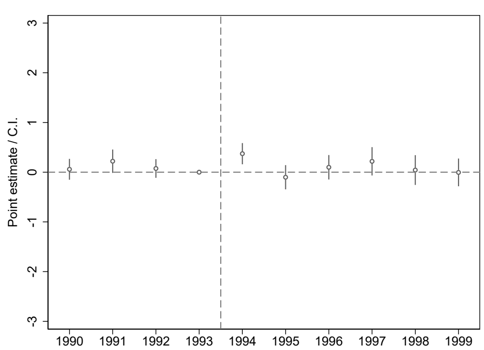
(A) Female (age 15–39) homicides



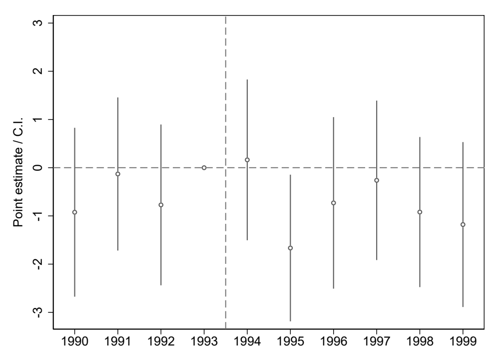
(B) Older male (55–64) homicides



(C) Older female (55–64) homicides



(D) Suicides



(E) Traffic fatalities

Figure C.3: Falsification test: drug-unrelated deaths

These figures show event-study estimates based on equation 2 using (arguably) drug-unrelated death rates as outcomes for falsification purposes. Panel A uses homicides of females aged 15–39; Panel B uses homicides of males aged 55-64; Panel B uses homicides of females aged 55-64; Panel D uses all suicides, Panel E uses traffic fatalities. The unit of observation is a municipality, observed annually from 1990 to 1999. Controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. 95% confidence band shown. Corresponding results can be found in Table E.3.

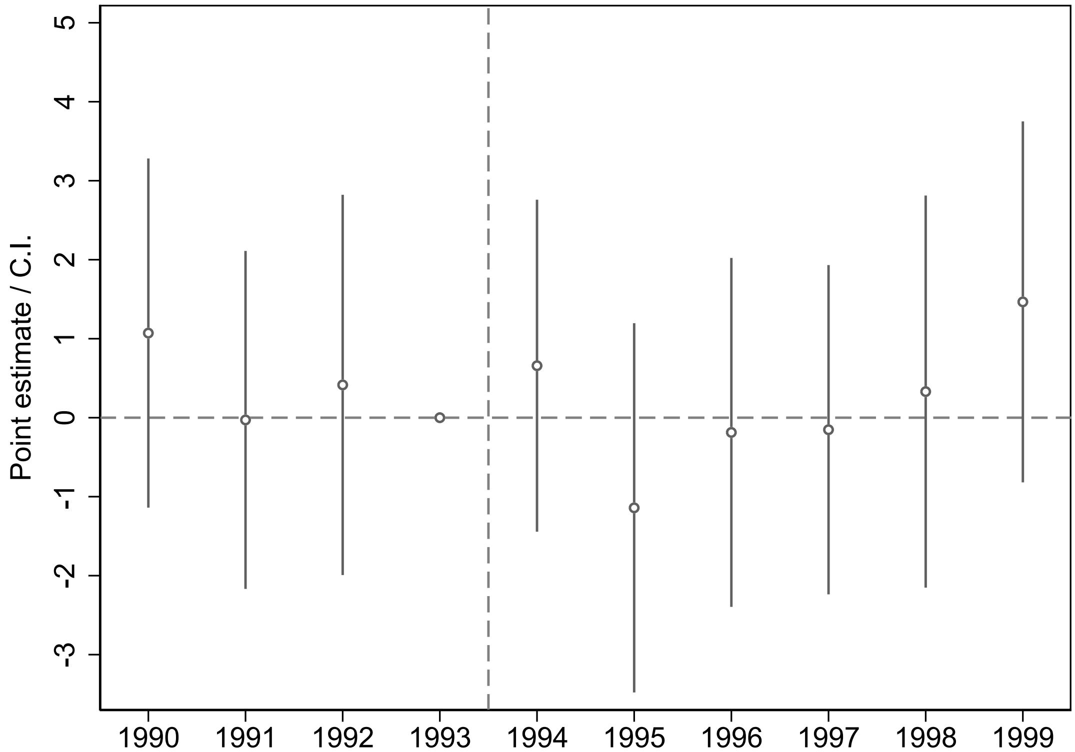


Figure C.4: Falsification test: optimal maize trading routes

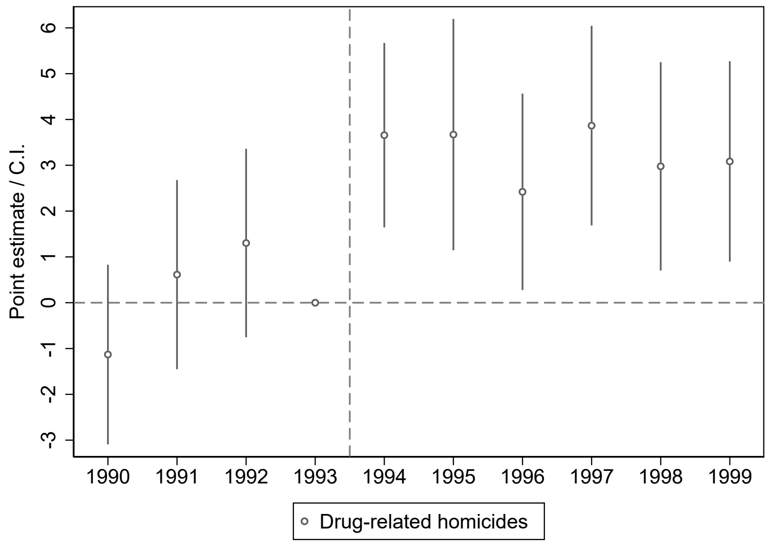
This figure shows event-study estimates based on equation 2 using predicted optimal maize-trading routes as placebo treatment indicators. Optimal maize-trading routes are predicted least cost paths using municipalities among the 90th percentile of maize production as origins instead of (known) drug-producing or drug-trafficking regions. The unit of observation is a municipality, observed annually from 1990 to 1999. Controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. 95% confidence band shown. Corresponding results can be found in Table E.4.

Appendix D Spillovers and displacement

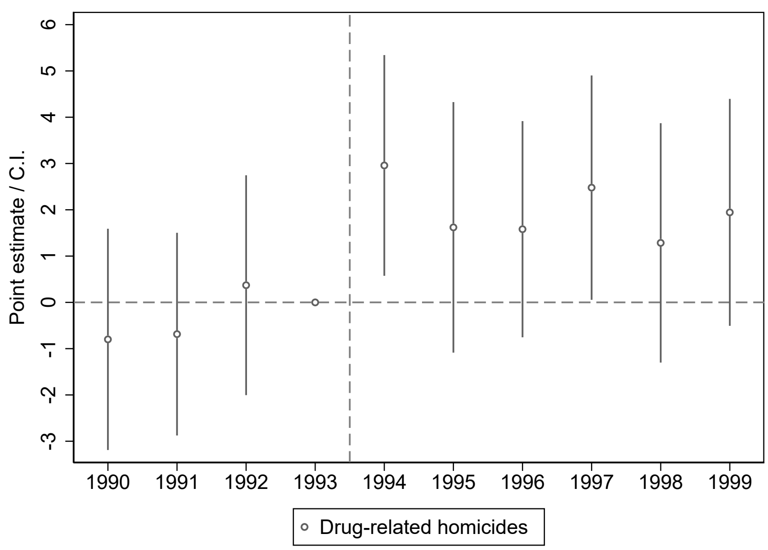
Table D.1: Spillover effects for neighbor municipalities

Dep. var.:	Drug-related homicides per 100.000 inhabitants	
	(1)	(2)
Route × post NAFTA	3.014***	3.298***
	(0.654)	(0.878)
Neighbor × post NAFTA	2.192***	
	(0.547)	
Route within 0–20km × post NAFTA		1.640*
		(0.984)
Route within 20–40km × post NAFTA		2.641***
		(0.870)
Route within 40–60km × post NAFTA		0.485
		(0.867)
Baseline controls	Yes	Yes
Municipality FE	Yes	Yes
Time FE	Yes	Yes
Mean homicides pre-NAFTA	8.218	8.218
Observations	23,980	23,980

Notes: The table shows results from estimating equation 1. The unit of observation is a municipality, observed annually from 1990 to 1999. *Neighbor* is defined as a municipality that shares a side or an edge with a municipality with a predicted drug-trafficking route. *Route within X km* is an indicator that is equal to one if the centroid of a municipality is within the given distance to a route. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.



(A) Route municipalities



(B) Neighbor municipalities

FIGURE D.1: Event study of spillover effects

These figures show event-study estimates based on equation 2 adding an indicator for being a neighbor of a trafficking municipality. Panel A shows the dynamic effect for municipalities that are traversed by a route; Panel B shows the dynamic effect for neighbor municipalities from the same regression. The unit of observation is a municipality, observed annually from 1990 to 1999. Controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. 95% confidence band shown. Corresponding results can also be found in Table E.5.

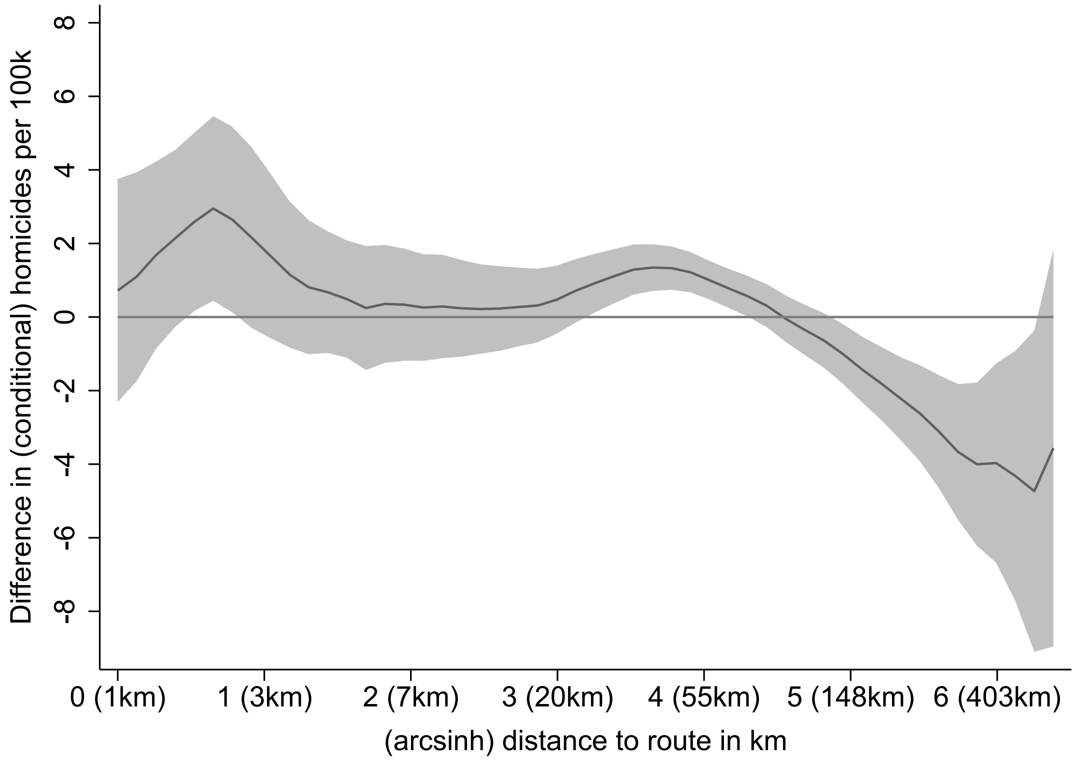


FIGURE D.2: The displacement of violence

This figure shows results from local polynomial regressions of the residual change in drug-related homicides of males (15–39) between the periods 1990–1993 and 1994–1999 on the inverse hyperbolic sine (arcsinh) transformed distance in km between a municipality's centroid and the closest predicted optimal drug-trafficking route. The residual change in homicides is calculated from the difference in residual homicides drawn from regressions of homicides on the baseline control variables (temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990.), separately for the periods 1990–93 and 1994–1999. 95% confidence band shown.

Appendix E Event-study results in table format

Table E.1: Main results: dynamic effects of drug-trafficking route location on violence

Dep. var.:	Drug-related homicides per 100.000 inhabitants				
	(1)	(2)	(3)	(4)	(5)
	No controls	Baseline	Pre-1994 violence	SDiD	Heterogenous treatment
Route × 1990	-0.627	-0.807	0.000	-0.288*	-0.627
	(0.849)	(0.794)	(0.000)	(0.167)	(0.849)
Route × 1991	1.052	0.891	0.000	0.193	1.052
	(0.894)	(0.855)	(0.000)	(0.131)	(0.894)
Route × 1992	1.384	1.153	0.000	0.188	1.384
	(0.926)	(0.880)	(0.000)	(0.123)	(0.926)
Route × 1993				-0.062	
				(0.165)	
Route × 1994	2.823***	2.460***	2.429***	2.638***	2.196**
	(0.927)	(0.884)	(0.723)	(0.635)	(0.926)
Route × 1995	3.500***	3.015***	2.852***	3.104***	2.873***
	(1.054)	(1.052)	(0.890)	(0.805)	(1.053)
Route × 1996	2.058**	1.782*	1.664**	1.780***	1.432
	(0.964)	(0.927)	(0.706)	(0.650)	(0.968)
Route × 1997	3.324***	2.862***	2.979***	3.212***	2.698***
	(0.968)	(0.954)	(0.773)	(0.678)	(0.970)
Route × 1998	2.559**	2.457**	2.681***	2.489***	1.933*
	(1.026)	(0.997)	(0.740)	(0.709)	(1.032)
Route × 1999	2.718***	2.297**	2.447***	2.585***	2.091**
	(0.971)	(0.937)	(0.672)	(0.764)	(0.974)
Baseline controls × D_t	No	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Mean homicides pre-NAFTA	8.218	8.218	8.218	8.218	8.218
Observations	23,980	23,980	23,980	23,980	2398

Notes: The table replicates Figures C.1 and 2 in table format. The table shows β_τ coefficients estimated from equation 2. The omitted year is 1993. The unit of observation is a municipality, observed annually from 1990 to 1999. The dependent variable measures drug-related homicides per 100,000 inhabitants. *Route* is an indicator that assumes the value one if a municipality is traversed by a predicted optimal drug-trafficking route, interacted with year dummies. Columns 2–5 show results conditional on baseline control variables, including temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990, interacted with year dummies. Column 3 adds interactions between municipality-level drug-related homicides in each pre-NAFTA year (1990–1993) and a full set of year dummies. Column 4 is estimated using the Stata command 'sdid', applying the synthetic difference-in-differences procedure by Clarke et al. (2023) to generate the control group. Column 5 is estimated using the Stata command 'did_multiplegt_dyn', accounting for heterogenous treatment effects based on De Chaisemartin and d'Haultfoeuille (2024). Standard errors are clustered at the municipality level. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table E.2: The dynamic effects of economic activity as proxied by luminosity

Dep. var.:	Luminosity	Drug-related homicides
	(1)	(2)
Route × 1992	0.023	1.189
	(0.048)	(0.897)
Route × 1994	-0.101***	2.484***
	(0.033)	(0.899)
Route × 1995	-0.149**	3.023***
	(0.059)	(1.071)
Route × 1996	-0.160***	1.835*
	(0.057)	(0.941)
Route × 1997	-0.216***	2.948***
	(0.065)	(0.969)
Route × 1998	-0.321***	2.505**
	(0.077)	(1.018)
Route × 1999	-0.403***	2.434**
	(0.090)	(0.954)
Luminosity × 1992		0.059
		(0.068)
Luminosity × 1994		0.021
		(0.061)
Luminosity × 1995		-0.004
		(0.064)
Luminosity × 1996		0.051
		(0.064)
Luminosity × 1997		0.079
		(0.061)
Luminosity × 1998		0.024
		(0.068)
Luminosity × 1999		0.099
		(0.064)
Baseline controls × D_t	Yes	Yes
Municipality FE	Yes	Yes
Time FE	Yes	Yes
Observations	19,184	19,184

Notes: The table replicates Figure 3 in table format. Column 1 plots β_τ coefficients on route location, estimated from equation 2. Column 2 adds Γ_τ coefficients on luminosity. The dependent variables are night-time luminosity in column 1 and drug-related homicides per 100,000 inhabitants in column 2. The omitted year is 1993. The unit of observation is a municipality, observed annually from 1992 to 1999. *Route* is an indicator that assumes the value one if a municipality is traversed by a predicted optimal drug-trafficking route interacted with year dummies. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

TABLE E.3: Falsification test: drug-unrelated deaths

Dep. var.:	Deaths per 100.000 inhabitants				
	(1) Females	(2) Older males	(3) Older females	(4) Suicides	(5) Traffic fatalities
Route × 1990	0.073	-1.024***	0.054	0.058	-0.924
	(0.105)	(0.361)	(0.076)	(0.107)	(0.893)
Route × 1991	-0.024	-0.760**	-0.098	0.221*	-0.130
	(0.090)	(0.341)	(0.134)	(0.120)	(0.810)
Route × 1992	-0.033	-0.538	-0.111	0.075	-0.771
	(0.100)	(0.382)	(0.090)	(0.096)	(0.851)
Route × 1994	0.083	0.088	0.151*	0.372***	0.163
	(0.116)	(0.440)	(0.084)	(0.109)	(0.850)
Route × 1995	0.078	-0.059	-0.037	-0.102	-1.665**
	(0.097)	(0.384)	(0.093)	(0.124)	(0.776)
Route1 × 1996	0.163	-0.254	-0.064	0.099	-0.730
	(0.132)	(0.385)	(0.081)	(0.125)	(0.907)
Route × 1997	0.185*	-0.637	-0.004	0.219	-0.262
	(0.110)	(0.403)	(0.120)	(0.145)	(0.843)
Route × 1998	0.056	0.039	0.122	0.043	-0.920
	(0.118)	(0.395)	(0.099)	(0.153)	(0.794)
Route × 1999	-0.055	-0.298	-0.074	-0.004	-1.179
	(0.113)	(0.379)	(0.086)	(0.142)	(0.872)
Baseline controls × D_t	No	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Mean homicides pre-NAFTA	0.273	2.206	0.237	0.292	8.616
Observations	23,980	23,980	23,980	23,980	23,980

Notes: The table replicates Figure C.3 in table format. The table shows results from estimating equation 2, using (arguably) drug-unrelated death rates as outcomes for falsification purposes. *Route* is an indicator that assumes the value one if a municipality is traversed by a predicted optimal drug-trafficking route, interacted with year dummies. Column 1 uses homicides of females aged 15–39; Column 2 uses homicides of males aged 55-64; Column 3 uses homicides of females aged 55-64; Column 4 uses all suicides, Column 5 uses traffic fatalities. The unit of observation is a municipality, observed from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors clustered at the municipality level in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table E.4: Falsification test: optimal maize trading routes

Dep. var.:	Drug-related homicides per 100.000 inhabitants
	(1)
	fc5
Maize placebo route × 1990	1.071
	(1.127)
Maize placebo route × 1991	-0.028
	(1.091)
Maize placebo route × 1992	0.415
	(1.227)
Maize placebo route × 1994	0.658
	(1.072)
Maize placebo route × 1995	-1.141
	(1.192)
Maize placebo route × 1996	-0.187
	(1.126)
Maize placebo route × 1997	-0.152
	(1.063)
Maize placebo route × 1998	0.330
	(1.266)
Maize placebo route × 1999	1.466
	(1.165)
Baseline controls × D_t	Yes
Municipality FE	Yes
Time FE	Yes
Mean homicides pre-NAFTA	8.616
Observations	23,980

Notes: The table replicates Figure C.4 in table format. The table shows event-study estimates based on equation 2 using predicted optimal maize-trading routes as placebo treatment indicators. Optimal maize-trading routes are predicted least cost paths using municipalities among the 90th percentile of maize production as origins instead of (known) drug-producing or drug-trafficking regions. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table E.5: Event study of spillover effects

Dep. var.:	Drug-related homicides per 100.000 inhabitants
	(1)
	fc5
Route× 1990	-1.130
	(1.000)
Route× 1991	0.613
	(1.053)
Route× 1992	1.303
	(1.049)
Route× 1994	3.657***
	(1.026)
Route× 1995	3.670***
	(1.287)
Route× 1996	2.421**
	(1.093)
Route× 1997	3.865***
	(1.111)
Route× 1998	2.977**
	(1.159)
Route× 1999	3.084***
	(1.115)
Neighbor× 1990	-0.799
	(1.219)
Neighbor× 1991	-0.686
	(1.116)
Neighbor× 1992	0.371
	(1.211)
Neighbor× 1994	2.958**
	(1.216)
Neighbor× 1995	1.620
	(1.380)
Neighbor× 1996	1.581
	(1.191)
Neighbor× 1997	2.478**
	(1.236)
Neighbor× 1998	1.285
	(1.319)
Neighbor× 1999	1.945
	(1.250)
Baseline controls × D_t	Yes
Municipality FE	Yes
Time FE	Yes
Mean homicides pre-NAFTA	8.616
Observations	23,980

Notes: The table replicates Figure D.1 in table format. The table shows event-study estimates based on equation 2 adding an indicator for being a neighbor of a trafficking municipality. The unit of observation is a municipality, observed annually from 1990 to 1999. Baseline controls include temperature, precipitation, soil ph, optimal conditions for cannabis and opium production, distance to U.S. border, road density, and population size in 1990. Standard errors are clustered at the municipality level. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.