Cross-Border Spillover: U.S. Gun Laws and Violence in Mexico*

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Abstract

Does access to arms promote violent crime? We exploit a natural experiment induced by the 2004 expiration of the U.S. Federal Assault Weapons Ban to examine how the subsequent exogenous increase in the availability of lethal weaponry affected violence in Mexico. The expiration relaxed the permissiveness of gun sales in border states such as Texas, Arizona and New Mexico, but not California, which retained a pre-existing state-level ban. Using mortality statistics over 2002-2006, we show that homicides, gun-related homicides and crime gun seizures increased differentially in Mexican municipios located closer to entry ports in these other border states, relative to entry ports in California. Our estimates suggest that the U.S. policy change caused at least 239 additional deaths annually in municipios near the border during post-2004 period. The results are robust to controls for drug trafficking, policing, unauthorized immigration, and economic conditions in U.S. border ports, as well as drug eradication, military enforcement, and trends in income and education in Mexican municipios. Our findings suggest that U.S. gun laws have exerted an unanticipated spillover on gun supply in Mexico, and this increase in arms has fueled rising violence south of the border.

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1 Introduction

Violence perpetrated by organized crime besieges many states around the globe. Nations as diverse as Russia, Mexico, South Africa, Brazil and El Salvador face very high homicide rates owing to the growing potency of drug traffickers, human smugglers and criminal gangs. Homicides arising outside of war zones far exceed conflict-related casualties, constituting two-thirds of the global burden of violent deaths. Globally, 60% of all homicides are committed with firearms, and this figure is as high as 70% in South America and 77% in the Caribbean (Geneva Declaration, 2010). Armed, non-conflict violence also imposes substantial economic and political costs on societies, curbing legal economic activity, while weakening the state: territory is either defended using valuable budgetary resources, or de facto ceded to criminal entities. As such, it is essential to understand the determinants of criminal warfare, and examine the role of arms availability in shaping the dynamics of violent crime. Yet, previous studies on guns and crime have singularly examined the U.S. context, primarily by assessing how local gun laws affect local crime rates. This approach is both narrow in its focus, and faces the methodological challenge that regulations arise endogenously in response to criminality, as well as political and economic conditions.

This paper evaluates how access to arms has affected violence in Mexico, which has experienced a total of 139,000 homicides over the past ten years—in part due to the dramatic escalation of the drug war (INEGI, 2011). The near doubling of the homicide rate over this period underscores the importance of examining this question in the Mexican context. Yet, it is difficult to identify the causal relationship since guns tend to flow to high crime regions, where they are in demand, or to regions with characteristics such as poverty and a thriving drug trade, which may also be correlated with criminality. Our analysis employs a novel approach to circumvent these potential confounding factors: we exploit a major change in U.S. policy governing the sales of assault weapons domestically, and use the resulting cross-border spillover on gun supply in Mexico to assess its effect on violence south of the border.

In particular, we focus on the 2004 expiration of the U.S. Federal Assault Weapons Ban

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1In 2011, the global average homicide rate was 6.9 per 100,000. In contrast, equivalent homicide rates were 15 in Russia, 18 in Mexico, 22 in Brazil, 35 in South Africa, and 65 in El Salvador (UNODC, 2011).

2For example, in 2004, 490,000 violent deaths arose globally from non-conflict contexts, while direct and indirect conflict resulted in 249,900 deaths (Geneva Declaration, 2010).

3Economic losses resulting from lethal non-conflict violence have been estimated to be 95 billion annually (Geneva Declaration, 2010).

4For example, Bergman and Whitehead (2010) and Manwarning (2007) provide accounts of how the rise of organized crime has resulted in criminal-run enclaves with little state presence in various countries within Latin America and the Caribbean region.

5Estimates of deaths that are explicitly drug-war related vary across sources and are not available from one consistent time series. However, a combination of data from the National Human Rights Commission and the Office of the President presented in Ríos and Shirk (2011) indicate the figure may be as large as approximately 43,400 for the 2001-2010 period.
(FAWB), which lifted the prohibition on sales of military-style firearms and high-capacity magazines within the United States. Given the extent of gun trafficking across these two nations, we posit that the expiration served as an exogenous shock to the supply of assault weapons in Mexico. For example, as of 2006, over 90% of Mexican crime guns seized and traced were linked back to the United States (GAO, 2009).

Two features of this policy change enable us to develop a credible empirical strategy. First, the timing of the expiration was pre-determined by a 10-year sunset provision in the original 1994 legislation banning assault weapons, which ensures that it did not arise in response to violence in Mexico. In addition, it did not affect all U.S. states equally: some—including California (CA)—retained their own state-level bans on assault weapons sales, while others—including Texas (TX), Arizona (AZ) and New Mexico (NM)—had no equivalent state-level laws. The lifting of the federal ban thus made it plausibly easier to obtain assault weapons in Mexican municipios located closer to ports of entry into this latter group of states, providing geographic variation across Mexican municipios in terms of resultant arms flows.

Our research design takes advantage of both sources of variation: we use the timing of the policy change, and Mexican municipios’ proximity to entry ports in non-California border states, to examine the impact of the FAWB expiration on Mexican homicides over 2002 to 2006. Using this difference-in-differences type strategy, we find that after 2004, total homicides and homicides tied specifically to guns increased differentially in municipios located closer to entry ports in AZ, NM and TX, as compared to entry ports in CA. These increases occurred almost immediately—within a quarter of the ban’s expiration—and appear to have persisted. The estimates suggest that the policy change induced 60% more homicides in municipios at the non-California entry ports, as compared to municipios 100 miles away, and caused at least 239 additional deaths annually in the municipios located within 100 miles of all border ports. Notably, we are able to show that the policy shock increased crime guns seized by the Mexican military, specifically for the gun category that includes assault weapons, but not handguns, providing additional evidence that the FAWB expiration increased violence through its effect on assault weapons supply.

The estimation strategy employs municipio fixed effects, which control for all time-invariant characteristics potentially correlated with violence and the municipality’s exposure to the 2004 policy change. Moreover, we are able to control for other drug, economic and enforcement-related characteristics, including: drug seizures in U.S. ports and Mexican municipios; drug-crop eradication and drug-war related detentions in Mexico; trends by income and schooling levels in Mexican municipios; as well as employment, earnings, undocumented immigration and policing patterns in the nearest U.S. ports. To better isolate the effect of the gun law change relative to enforcement factors, we focus tightly on the time horizon around 2004, specifically excluding the post 2006 period, when the government of Felipe Calderón sent the military into
various border areas. This is important because, as shown by Osorio (2011), the start of the 2006 campaign led to a major escalation of the drug war, including an intensification of violence among drug traffickers, and between drug traffickers and the state.

A recent working paper by Chicoine (2011) also attempts to assess how the FAWB’s expiration affects violence in Mexico, but by comparing homicides across drug cartel states versus non-cartel states, using annual data over 1995-2008. However, this comparison is problematic for identifying the causal effect of the policy, since differences in homicides in states with and without cartels is unlikely to be related solely to changes in U.S. gun policy. This is particularly true given the dramatic intensification of the Mexican drug war over this time period. In contrast, we utilize finer-grained municipal variation in proximity to particular border states, which better corresponds to arms flows. Additionally, we look precisely at the quarters before and after the law change, which enables a cleaner identification of the effect of the policy.

The analysis presented here fits into the broader literature on drug war violence in Mexico. Díaz-Cayeros et al. (2011) highlight the pervasiveness of drug gang activity, using list experiments to show that substantial parts of the population face extortion by drug traffickers or rely on them for assistance. Their estimates also reveal that gun ownership rates are as high as 14 percent among Mexican citizens. Ríos and Shirk (2011) show that violence has increasingly become politically targeted, as reflected in the rising homicide of politicians and journalists in the post-2000 period. Dell (2011) shows that violence responds to political conditions, rising after mayors from the conservative PAN political party are elected to office, and induces economic costs that are manifested in the labor market. The socio-economic consequences of the narco-economy has also been documented ethnographically by McDonald (2005).

Our paper also relates to the broader literature on the determinants of conflict. Although it is conceptually useful to distinguish criminal violence from violence aimed at overthrowing the state, increased political targeting by criminal networks, and state destabilization resulting from large-scale homicides, suggests a blurring of lines between these forms of violence. Indeed, the threat to the state imposed by drug-traffic organizations have led to the term "criminal insurgencies" as a descriptor of these groups in the Latin American context (Killebrew and Bernal, 2010). Although some scholars posit that violence in Latin America need not represent regime failure (Arias and Goldstein, 2010), others argue that crime poses a direct challenge to the consolidation of democracy and rule of law in the region, as security-free zones emerge in which gangs and drug traffickers are the only recognized authorities (Bergman and Whitehead, 2009). The centrality of state weakness in predicting conflict has been highlighted by Fearon.

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6Our papers were written independently.
7In addition, Chicoine (2011) designates states as cartel states if the leadership of a major cartel was based there before 2004. But this classification can turn out to be quite coarse, as states such as Baja California Sur, Nayarit and Durango do not include a leadership base but experienced extensive drug-trafficking even prior to 2004, which we discuss further in the data section.
and Laitin (2003), who suggest that lower per capita income increase a nation’s risk of civil war by reducing state capacity.\(^8\) Although a comprehensive review of the civil war literature is beyond the scope of this paper, the in-depth overview provided by Blattman and Miguel (2010) suggests that common factors such as poverty and access to illicit drugs influence both criminality and conflict.

In relating guns to criminality, our paper builds on the literature examining the effect of U.S. gun laws on U.S. crime rates. Studies of the original 1994 FAWB enactment either find small crime-reducing effects within America (Koper and Roth, 2001), or mixed results (Lott, 1998). However, these studies utilize pre-enactment variation in state-level assault weapons bans, which may be correlated with changes in local crime rates, and confound the estimates. We improve on this identification strategy by examining the impact of the FAWB expiration on violence outside of national boundaries, in a neighboring nation where it represents an exogenous policy shock.\(^9\)

Duggan et al. (forthcoming) examine the localized effect of gun shows, which allows vendors to sell firearms without background checks in some U.S. states, and find that these events do not increase homicides within three weeks, in or near the zip code where shows take place. Our paper presents a complementary approach by examining effects of weapons when they are transported away from sale locations. We also analyze effects at the quarterly and annual level, since guns are durable goods and may promote mortality over a longer window.

The proximity-based effects we document are consistent with the idea that there are substantial costs associated with weapons smuggling. In part, these costs arise from the risk of detection entailed in transporting illegal weapons. Evidence of such transport costs has been shown in Knight (2011), for crime gun movements across U.S. states. In Mexico, smuggling costs also arise from the spatial segmentation of the drug-trafficking organizations (DTOs): particular Mexican cartels control certain ports of entry, which makes it costly to obtain weapons via border areas in rival cartel territory. Finally, while the results in our paper highlight the conflict-related consequences of arms trafficking, DellaVigna and La Ferrara (2010) shows its profitability, pointing to the economic benefits accruing to weapons-making companies.

The remainder of the paper is structured as follows. In Section 2, we provide further information on U.S. gun laws and weapons trafficking to Mexico, detailing the nature of transport

\(^8\) In contrast, Collier and Hoeffer (1998 and 2004) interpret the negative relationship between conflict and income, in growth and levels, as arising from lower opportunity costs or earnings foregone from joining a rebellion. Miguel et al. (2004) establish that this negative relationship is robust to instrumenting growth with rainfall shocks.

\(^9\) An evaluation of the Brady Handgun Violence Prevention Act, which required background checks on gun purchases also found small crime-reducing effects in the U.S. (Ludwig and Cook, 2000). Analyses of laws that give individuals the right to carry concealed weapons (CCW) were reported to reduce crime rates by Lott (1997) and Moody (2001), but these results were subsequently challenged by Ayres and Donohue (1999 and 2003) and Black and Nagin (1998). Other studies have also found that CCW laws do not reduce criminality, based on empirical analyses (Ludwig, 1998 and Duggan, 2003), and theoretical models (Donohue and Levitt, 1998).
costs in the context of the U.S.-Mexico border. Sections 3 and 4 describe the data and empirical strategy, respectively. Section 5 presents the results and Section 6 concludes.

2 Background on Gun Laws and Weapons Trafficking

2.1 Assault Weapons Ban

On September 13, 1994, the United States Congress passed the Violent Crime Control and Law Enforcement Act, which placed a first time restriction on the manufacture, transfer and possession of semi-automatic weapons. The law focused on a group of firearms considered particularly dangerous for their capacity to rapidly fire multiple shots, which makes them useful for criminal applications.\textsuperscript{10} The act was signed into law by then President Clinton for 10 years. However, as a consequence of a sunset provision, it was set to—and did—expire in September 2004.

During the decade the law was in place, a handful of U.S. states had their own restrictions on assault weapons. This included California, which already had an assault weapons ban prior to 1994 that remained in place after the federal law sunsetted. (We provide greater detail on California’s ban and gun control laws in an Online Appendix). Thus, while other states bordering Mexico experienced a change in the assault weapons control regime, the same was not true for California.

We can assess the extent to which CA gun control laws were binding, and the degree to which the FAWB affected the gun control regime in TX, AZ and NM by evaluating gun sales and production data.\textsuperscript{11} Panel A of Figure I shows that there was approximately a 15\% increase in combined gun sales in AZ, TX and NM as compared to a 5\% rise in CA after 2004. The divergence is larger when we are able to look specifically at rifles, the gun category that includes assault weapons. For example, firearms production data from the U.S. Bureau of Alcohol, Tobacco and Firearms (BATF) is displayed in Panel B, and shows that rifles production more than doubled after 2004 in the non-California states, while remaining unchanged in California. While we cannot attribute increases in TX, AZ and NM entirely to the policy change, the differential increase compared to CA indicates that the FAWB expiration had an impact on gun sales and production.

\textsuperscript{10}In particular, it barred 19 specific semi-automatic firearms deemed "assault weapons" (including the Automat Kalashnikov or AK-series and the Colt AR-15 series), as well as any semi-automatic rifle, pistol or shotgun capable of accepting a detachable magazine, which also had two or more of the following features: telescoping or folding stock, pistol grip, flash suppressor, bayonet lug, or grenade launcher. Notably, the act also banned magazines that could hold more than 10 rounds, which affected an even wider group of assault weapons.

\textsuperscript{11}Gun sales are tracked in the National Instant Criminal Background Check System (NICS), for purchases that take place in federally licensed firearms dealers. A limitation of this data is that private sellers, including those at gun shows, are not included, and the numbers are not disaggregated by gun type.
2.2 Gun Flows to Mexico

The combination of tough gun laws in Mexico, weak gun laws in the United States, and proximity across the border makes it optimal for Mexican drug cartels and crime syndicates to source their firearms to the U.S. In contrast to the United States, Mexico has highly restrictive gun laws. Possession of high-caliber guns is essentially prohibited for citizens.\textsuperscript{12} In addition, there is only one legally authorized retail outlet for firearms in Mexico, which is operated by the Ministry of National Defense. As a comparison, there were 7,240 federally licensed firearms outlets in California, Arizona, New Mexico and Texas in 2010, the earliest year for which this data is available (BATF, 2010). The number of outlets by ZIP code in these four border states is mapped in Figure II.

Indeed, the vast majority of crime guns seized in Mexico originate from the United States. As displayed in Figure III, as of 2006, around 90\% of the weapons confiscated in Mexico and submitted to BATF’s eTrace program could be linked back to the U.S.\textsuperscript{13} The fraction traced to the U.S. also rose between 2004 and 2006, suggesting increased U.S. sourcing over this period. While traced gun data would be ideal for examining how gun flow patterns respond to policy changes, they do not exist for the pre-2004 period, and neither the BATF nor the Mexican authorities have released the data for the post-2004 period. Given these constraints, in this section, we instead utilize publicly available statistics from eTrace and other sources to examine spatial patterns and likely changes in gun trafficking over this period.

Figure III indicates that most of the guns traced to the U.S. come from the border states, and to a greater degree from the non-California states. For example, between 2004 and 2008, 49\% of guns traced to the U.S. originated from either Texas or Arizona. In contrast, 20\% were traced to California. If we normalize these flows by the states’ population (31.5 million in Texas plus Arizona and 37.2 million in California in 2010), this suggests that the "export rate" of the other two states are nearly three times as large as that of California.\textsuperscript{14}

A Hearst newspaper survey of guns trafficked to Mexico from 44 court cases filed in the U.S. also found similar patterns: of 1,600 guns identified in the court documents, 50\% came from Texas, 29\% came from Arizona, while 3\% came from California (Freedman, 2011a). The article reporting on these figures notes that California’s strict gun laws appear to have "had the unintended consequence of making California gun stores unattractive to purchasers buying weapons for the Mexican drug cartels (\textit{ibid})." While we do not have information about exports

\textsuperscript{12}Articles 9 and 10 of the Mexican Federal Law of Firearms allow possession and carrying of pistols of only calibers .380 (9mm) or less, and revolvers of calibers .38 special or less.
\textsuperscript{13}Since 2004, the Mexican government has sent about a quarter of its seized guns to eTrace to trace the origin of these weapons (GAO, 2009).
\textsuperscript{14}The flows from New Mexico are relatively low as it is a small state. The data from BATF (used to generate Figure II) reveals that the number of guns shops in border counties normalized by population is actually higher in NM (3.6) relative to either TX (2.0) or AZ (3.3).
by state going back to the pre-2004 years, the combination of larger sales in the non-California states after 2004, along with the pattern of aggregate flows to Mexico suggests that there was a sizeable increase in gun flows owing to the FAWB expiration. The empirical analysis in our paper builds on these suggestive patterns and examines this hypothesis directly, by assessing effects of the gun law change on both violence and gun seizures in Mexico.

2.3 Why Proximity Matters: Drug Cartels, Entry Ports and Limited Arbitrage

Our empirical strategy tests for differential effects of gun access on violence, based on the variation in geographic proximity to non-CA states across Mexican municipios. A key part of this argument is that gun price differentials across the municipios are not fully arbitraged away through the transport of illicit weapons. In this section, we detail why this might be the case, focusing on the nature of the demand for these weapons, the trafficking networks, the smuggling technology, and the spatial control of various segments of the border by various cartels.

First, Mexican drug-trafficking organizations are heavily involved in gun smuggling across the U.S.-Mexico border. The BATF reports that these DTOs increasingly send enforcers across the border to hire surrogates (or straw purchasers) who buy military style firearms from gun dealers in the U.S. and traffic them across (Chu and Krouse, 2009). Notably, semi-automatic weapons are a common choice among cartels for straw purchases. For example, an analysis of 21 federal criminal cases of illegal gun trafficking to Mexico from Arizona, California, Nevada and Texas over 2006 to 2009 found that of 492 firearms, 43% were assault weapons and another 30% were semiautomatic guns (Violence Policy Center, 2009).

Second, cross-border smuggling of illegal weapons is costly in all places along the U.S.-Mexico border; and these costs rise when guns have to be transported over a greater distance on the U.S. side. While time and material transport costs increase with distance for shipping all products (including legal products), these costs are compounded with the movement of illicit goods, as each additional mile travelled raises the likelihood of apprehension by the authorities. The aim of minimizing detection risk can also enhance trafficking costs. For example, the preferred technology for gun smuggling across the U.S.-Mexico border is to take multiple trips transferring one to three weapons at a time in what are called "ant" runs (Chu and Krouse, 2009). To obscure weapons amidst other legal merchandise and high traffic flows, guns are transported via personal or commercial vehicles through major ports of entry (rather than tunnels in the desert or across the Rio Grande by boat). In particular, "firearms are generally

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15In addition, the analysis found that of 226 rifles, 90% were either of the AK-47 or AR-15 series. The Hearst survey also reported that the two most frequently trafficked guns were the AK-47 and the Bushmaster .223 AR-15, which are both semi-automatic rifles (Freedman, 2011b).
trafficked along major U.S. highways and interstates and through border crossings into Mexico (GAO, 2009, p.22).\footnote{16}

The combination of high-frequency smuggling methods and enforcement-related risks underscore why proximity to ports of entry is an important determinant of the street price of guns. Ultimately, the costs associated with trafficking manifest in the large profit margins of 300% to 500% associated with transporting guns across the U.S.-Mexico border (Chu and Krouse, 2009; Freedman, 2011b). Moreover, qualitative evidence confirms that the margins do in fact vary by distance. For example, the New York Times reports that a $125 handgun in San Diego sells for three times this amount in Tijuana, which is right across the border, but sells for $500 or more further south in Mexico (Weiner and Thompson, 2001).

Third, our empirical strategy, which tests for differential effects based on proximity to states where it became legal to sell assault weapons after 2004 (namely, Texas, Arizona, and New Mexico), posits that the extent of transport costs should also vary based on proximity to these non-California ports after 2004. Thus, we next detail why the extent of arbitrage can be expected to vary across different parts of the U.S.-Mexico border.

We expect variation within the U.S. because of state laws: the price of purchasing assault weapons should be higher in CA, where it is illegal to do so, compared to other border states. While there is no data source tracking illicit weapons purchases in America, anecdotal evidence indicates that there are substantial price differentials for illegal guns that vary across states based on the stringency of gun laws. Interviews with traffickers suggest premia between 300% and 600% for illegal sales in New York of guns originally purchased in states such as Georgia and Virginia, which have laxer gun laws (Mayors Against Illegal Guns, 2008).\footnote{17} Relatedly, Knight (2011) shows that there are cross-state spillovers in gun flows from states with strong gun laws to those with weak gun laws, and gun flows are larger between states that are geographically close. Enforcement risks related to state law explain why it would be costly to source guns from other states, transport them west within American territory, and bring them across the border into Mexico via California entry ports.\footnote{18} Ultimately, regardless of whether it is Mexican

\footnote{16}The centrality of ports in border trafficking was recently highlighted by Richard Cortez, the mayor of the border city of McAllen, Texas, who noted: "According to the Department of Justice, 90 percent of the drugs smuggled into the U.S. enter through the land ports...There is no data on firearms, but anecdotally, the ports are where they too traverse the border." (Testimony of Richard Cortez, Mayor of McAllen, TX, before the House Committee on Homeland Security Subcommittee on Border and Maritime Security "Using Resources Effectively to Secure Our Border at Ports of Entry Stopping the Illicit Flow of Money, Guns and Drugs", April 5, 2011.)

\footnote{17}Virginia and Georgia both have weak gun laws, ranking 8 and 12, respectively, on the Brady Center’s scale of gun control stringency. New York has strong gun laws, reflected in a ranking of 62. While we do not have equivalent anecdotal accounts for CA, we expect similar price differentials between CA and the other border states, since CA’s Brady Center score is 81, while Arizona earns 0, and New Mexico and Texas earn 4 on this scale.

\footnote{18}For example, the Roberti-Roos Assault Weapons Control Act, enacted in California in 1989, explicitly
or American traffickers moving weapons, distance within the U.S. matters, as reflected in the fact that gun price differentials have not been arbitraged away across different U.S. states. If assault weapons are more costly to obtain in California, they will be purchased from other border states, resulting in larger transport and enforcement costs, and thus higher prices for obtaining these weapons in southwestern Mexico. Of course, there will be some assault weapons smuggling that occurs near California, in part due to spillovers from nearby gun shops in Arizona. However, as shown in Figure II, this spillover is likely to be limited since gun shops are more concentrated in eastern Arizona, owing to greater population density in that part of the state. Moreover, it is worth noting that this type of spillover near CA would lead our empirical strategy to underestimate the true effect of how the expiration affects violence based on proximity to non-CA ports.

Finally, geographic segmentation among Mexican drug traffickers, with particular cartels controlling key entry ports, also add turf-based costs for cartels to arbitrage arms availability across different segments of the border. This is important given the central role of cartels in gun trafficking. Figure IV shows the approximate areas of influence and headquarters locations of the Tijuana, Sinaloa, Juárez, and Gulf cartels over the 2002-2006 period. As indicated by the map, enforcers from the Tijuana cartel would have to cross into Juárez or Gulf cartel territory to obtain weapons from border ports in Arizona, New Mexico, or Texas. Entering rival cartel territory can have direct violence-related costs by initiating clashes. Moreover, Mexican cartels work with particular U.S. street gangs on the American side of the border, suggesting that it is costlier to smuggle weapons across ports that are not under a cartel’s control, where such alliances are missing. (More details on the cartels are provided in the Online Appendix.)

3 Data

3.1 Data Sources and Construction of Key Variables

We estimate the impact of the 2004 FAWB expiration by analyzing a number of different violence-related dependent variables in Mexican municipios. We utilize mortality statistics from the Instituto Nacional de Estadística y Geografía (INEGI), which lists the location and causes of death for the universe of officially registered deaths in Mexico. These individual-level records are aggregated at the municipio level to generate annual and quarterly counts of killings over the 2002-2006 period. The cause of homicide is disaggregated further, allowing us to discriminate between different types of violence.

19 More details on this segmentation and the cartels is provided in the online appendix.

20 For example, the National Drug Threat Assessment (2010) reports that Barrio Azteca, a major gang operating in Texas, is closely aligned with the Juárez cartel. Similarly, the 18th street gang from California is linked to the Tijuana cartel.
to generate counts of homicides tied specifically to guns. While gun-related homicide is a more
direct measure of violence arising from gun law changes, it may also under-estimate actual gun
killings, since the specific cause is unknown for 15% of the homicides in our sample. Thus, we
view both total and gun-related homicides as key outcomes of interest. We also generate counts
of non-gun homicides and non-homicide deaths.

The mortality statistics record demographic information about the deceased, including age,
education, and gender. Using observations that contain these data (representing 88% of the
sample), we create homicide and gun-related homicide counts of sub-groups, including individ-
uals 18 and older without a high school degree, and young males between 18 and 30 without a
high school degree.

We also analyze data on crime gun seizures from the Mexican military, the Secretariat of
National Defense (SEDENA), defined as the number of guns seized in the campaign against
drug-traffickers and in violation of Mexico’s gun laws. These data present a partial picture of
gun seizures, since the Office of the Mexican Attorney General (PGR, by its Spanish acronym),
also seizes crime guns, but has not made the municipal level data publicly available. Aggregate
numbers indicate that over the 2002-2006 period, SEDENA accounted for approximately 30%
of total seizures. However, both agencies operate throughout the country so the data are not
systematically missing for any particular region, such as municipios near California.

The SEDENA data is disaggregated by weapons type, allowing us to analyze handguns
separately from rifles, the gun category that includes assault weapons. We generate annual
counts of handguns and rifles seized. Because seizures are coded at the daily level, we are also
able to create annual counts of guns seized in events where more than one gun was seized in a
given municipio in a given day.

To assess whether the 2004 policy change had larger effects in Mexican locations closer to
Texas, New Mexico and Arizona versus California, we construct several measures of a munici-
pio’s proximity to various parts of the border. First, an indicator variable codes if municipios
lie along the California segment of the U.S.-Mexico border (the "CA segment"), versus Texas,
Arizona and New Mexico (the "non-CA segment"). A second variable measures a municipio’s
proximity to ports of entry that straddle the border. As discussed in section 2.3, most guns
transported from the U.S. into Mexico arrive via major highways that run through port cities.

Table I shows how we classify border crossings into 18 ports of entry. A border crossing is
considered a separate port if it is at least 20 miles away from another major border crossing.21
Otherwise, they are considered part of the same port, and named after the border crossing
with greater traffic, measured by higher annual average truck flows. The 18 ports are: San
Diego, Tecate and El Centro in CA; Yuma, Lukeville, Sasabe, Nogales, Naco and Douglas in

21Straight-line distances were calculated based on distance from the actual border crossing, rather than the
center of the port city, though the classification remains the same if we use driving distances.
AZ; Columbus in NM; and El Paso, Presidio, Del Rio, Eagle Pass, Laredo, Rio Grande City, McAllen and Brownsville in TX. We refer to the ports in AZ, NM and TX as either non-CA or treatment ports.\textsuperscript{22} Figure V shows the location of all ports, along with the highways in Mexico. The blue-shaded areas demarcate the set of municipios at the U.S. border which also have a major highway.\textsuperscript{23}

To create a measure of a municipio’s proximity to non-CA ports, we take the centroid-to-centroid distance between a given municipio and the nearest of the treatment ports, and subtract this distance (in thousands of miles) from 1. We refer to this variable as "Proximity NCA." We also generate an equivalent "Proximity border" variable, based on distance to the nearest of any of the 18 ports on the border.

Since the drug trade and associated crime levels may also be correlated with proximity to non-CA ports, we obtain SEDENA data on drugs seized by the military during drug-war operations in each municipio, and county-level data on drugs seized in the U.S. from the Drug Enforcement Agency, the U.S. Customs and Border Protection and the Department of Homeland Security (DHS). For both types of seizures, we use international prices from the United Nations Office of Drugs and Crime to aggregate the value of the four major drugs traded across the two countries – marijuana, heroin, cocaine and methamphetamine.\textsuperscript{24} Assigning drug values to the nearest port yields a municipio-level variable representing the value of drugs seized in the nearest port. In addition, data from the Mexican authorities provides us with the hectares of marijuana and heroin poppies eradicated within each Mexican municipio. Given the fraction of municipios with zero eradication or drug seizure, we take the log of one plus these variables, and use these log transformations as controls in the analysis.\textsuperscript{25}

SEDENA data on the number of individuals detained by the Mexican military during drug war operations (scaled by population) provide us with an important measure of enforcement

\textsuperscript{22}As shown in Table VIII, our main results are robust to alternative port definitions with no distance restrictions and a distance restriction of at least 30 miles between border crossings. They are also insensitive to more restrictive definitions of "major ports," based on minimum annual truck flow criteria, of at least 1000 or 5000 trucks per year.


\textsuperscript{24}12 of the 18 ports are situated in different U.S. counties, and in these cases a unique county-level value of drug seizures is assigned to each port. However, San Diego and Tecate are both situated in San Diego county (CA); Lukeville and Sasabe belong to Pima County (AZ); and Naco and Douglas are part of Cochise county (AZ).

\textsuperscript{25}Nestares (2004) has also developed a proxy measure of drug traffickers and offenders in each municipio, based on PGR reports of convictions of possession, sale and trafficking of drugs, in the top 100 municipios involved in the drug trade. This data precedes the period of our study as it is available only for 1998 to 2001. However, analysis of this measure shows the extent to which classifying areas as cartel states on the basis of cartel leadership as in Chicoine (2011) yields a coarse grouping. For example, Baja California Sur, Nayarit and Durango are classified as non-cartel states prior to 2004 by the leadership base definition, but when the Nestares variable is aggregated to the state level, these states are found to rank 5th, 6th and 8th of 32 states in terms of the density of drug traffickers and offenders.
at the municipal level. On the U.S. side, the Federal Bureau of Investigation (FBI) Uniform Crime Reports provide information on the number of police officers stationed in each port (in per capita terms).\textsuperscript{26} Since unauthorized immigration also varies with proximity to ports, and Mexican drug cartels increasingly traffic migrants across the border, we control for the extent of unauthorized immigration in the nearest port. DHS data gives the number of undocumented immigrants apprehended in each border patrol sector.\textsuperscript{27}

Finally, since economic conditions in Mexican municipios and proximate U.S. ports may also affect criminal activity, we obtain data on a number of economic variables from both sides of the border. The 2000 Mexican Census compiled by INEGI gives cross-sectional measures of log income per capita in 2000 and the school enrollment ratio, defined as the fraction of the population attending school between the ages of 6 and 24, also for the year 2000. INEGI data also gives population and total municipal expenditure. For the U.S., the Quarterly Census of Employment and Wages from the Bureau of Labor Statistics provides county-level measures of average earnings and employment, which we combine with population from the U.S. Census Bureau to generate the employment-to-population ratio in the nearest port.

We focus our analysis on the 2002 to 2006 period, when the dynamics of the Mexican drug war remained relatively constant, after the head of the Sinaloa cartel unleashed a wave of violence in 2001, but preceding the major military operations and cartel destabilization that occurred in 2006 (see the online appendix for more details). Since gun law changes in the U.S. are likely to affect violence differentially in regions close to the border, we also define two distance-based samples. The border sample includes 38 municipios that lie along the U.S.-Mexico border, of which 35 fall along the non-CA segment and 3 along the CA segment. The 100-mile sample includes municipios whose geographic centroids lie within 100 miles of the nearest of the 18 ports. There are 106 municipios in this sample, shaded in green in Panel A of Figure VI.

### 3.2 Descriptive Statistics of Key Variables

Table II presents the descriptive statistics of our key variables, for municipios within the 100-mile sample (denoted "Proximity to border port $\leq$100 miles") and for the municipios beyond (denoted "Proximity border port $>100$ miles"). We show the key dependent variables in per capita terms since our estimation strategy essentially scales the outcome variables by population. The average per capita homicide rate is 0.135 in the 100-mile sample, and lower (0.109)

\textsuperscript{26}This data is available at the city level for 11 ports, and we assign the county-level equivalent for Tecate, CA; Columbus, NM; Presidio and Rio Grande in TX; and Lukeville, Naco, and Sasabe in AZ.

\textsuperscript{27}The border patrol sector is a DHS-defined geographic unit. Nine ports are uniquely assigned to one of these sectors. However, Douglas, Lukeville, Naco, Nogales, and Sasabe belong to the same sector (of Tucson). Likewise, Tecate, Columbus, and Eagle Pass are a part of the San Diego, El Paso, and Del Rio sectors, respectively. And, Rio Grande City, McAllen, and Brownsville are assigned to Rio Grande Valley’s sector.
further out, which corroborates that violence levels are higher closer to the border. The mean
gun-related homicide rate in the 100-mile sample is 0.095, demonstrating that at least 70%
of total homicides on average are gun-related. Finally, 77% of the closer municipios have a
highway, as compared to 55% of the municipios further away.

4 Empirical Strategy

Our empirical strategy exploits the natural experiment induced by the 2004 expiration of the
U.S. Federal Assault weapons ban and proximity to the U.S.-Mexico border. The 2004 legisla-
tive change in the U.S. represents an exogenous shock that increased the availability of weapons
transported into Mexico. However, the ban relaxed the permissiveness of gun sales differentially
in the border states of Texas, Arizona and New Mexico relative to California, which retained
a previous state-level ban. Thus we examine whether measures of violence increased more in
Mexican municipios closer to the non-California ports, relative to municipios closer to California
ports, after 2004.

As discussed in Section 2.3, arms smuggling varies by proximity due to three types of costs.
Transport costs and enforcement costs related to greater risk of detection by law enforcement
both vary by distance. In addition, Mexican cartels based out of regions south of California
face high turf-costs for operating along routes and ports near Texas, Arizona and New Mexico,
which are controlled by rival cartels.

We focus our analysis on Mexican municipios near the border, which are most likely to
be affected by an influx of weapons from the U.S. In Figure VII, we plot over time the sum
of total homicides and gun-related homicides in the border municipios that lie along the CA
segment, versus the non-CA segment. This figure captures the essence of our empirical strategy:
total homicides along the CA segment essentially stayed constant over the 2002 to 2006 period,
but increased sharply in the non-CA segment after 2004 (Panel A). A simple difference-in-
differences of the mean across the pre and post-2004 period, and two types of segments suggests
a differential increase of 166 homicides in Mexican municipios closer to TX, NM and AZ after
the gun law change. Panel B shows that the same pattern holds for homicides specifically tied
to guns. The analogous difference-in-differences suggests a differential rise of 128 gun-related
homicides in the post-2004 period. However, these raw mean calculations are merely suggestive,
as they do not account for municipal characteristics or other changes correlated with the FAWB
expiration and violence near the border.

Our empirical strategy builds on this simple comparison in a number of ways. We estimate
a difference-in-differences type specification which employs municipio fixed effects to sweep out
time-invariant characteristics correlated with homicide rates and proximity to various border
areas, as well as year fixed effects to control for year-to-year differences in killings common across
all municipios. Panel A of Figure VIII shows the distribution of homicides in our sample. It indicates that counts of homicides are bunched around a few integers: 47% of observations have no homicide, while 81% have 5 or fewer. This bunching makes OLS an unattractive option in smaller samples, and makes count regressions a more appropriate alternative. Panel B of Figure VIII shows that homicides per 10,000 population also displays left-censoring, and comparing this distribution against the normal density further demonstrates why OLS is inappropriate.

To account for the limited nature of the dependent variable, we instead employ a conditional fixed effects Poisson model. Population is used as an exposure variable in all specifications, to account for population differences in determining the extent of violence. Finally, we use cluster-robust standard errors as recommended by Cameron and Trivedi (2009) to control for possible violations of the assumption that the mean and the variance are equal.\footnote{We opt to use the Poisson model with cluster-robust standard errors for two reasons. First, although the Negative Binomial allows for over-dispersion in the data while the Poisson model assumes that the conditional mean equals the variance, this weakness can be overcome by estimating robust standard errors in Poisson regressions (Cameron and Trivedi, 2009). In addition, the consistency of the coefficients in Negative Binomial estimation is more sensitive to the distributional assumption of the error term, relative to Poisson estimation.}

The log of the expected counts is specified as follows:

$$\ln E(y_{jt} | Z_{jt}) = \alpha_j + \beta_t + (\text{segmentNCA}_j \times \text{post}_t) \lambda + X_{jt} \phi + \ln (\text{pop}_{jt}) \quad (1)$$

where $y_{jt}$ are homicide counts in municipio $j$ and year $t$, $\alpha_j$ are municipio fixed effects, $\beta_t$ are year fixed effects, $\text{pop}_{jt}$ is the municipal population in a given year, and $\text{segmentNCA}_j$ equals 1 if the municipio lies along the non-CA segment of the U.S.-Mexico border. $\text{post}_t$ is a dummy variable that equals 1 for each year after the policy change in 2004. $\lambda$ is the coefficient of interest and measures the log point increase in expected homicide counts differentially in municipios along the non-CA segment. $X_{jt}$ is a vector of time-varying controls. $Z_{jt}$ is the full set of explanatory variables, i.e., $Z_{jt} = [\alpha_j, \beta_t, \text{segmentNCA}_j \times \text{post}_t, X_{jt}, \ln(\text{pop}_{jt})]$.

Since a municipio’s exposure to the gun law change should vary according to its proximity to major ports in CA vs. TX, NM and AZ, we also utilize a specification that exploits our continuous measure of proximity. In this case, the log of the expected counts is defined as:

$$\ln E(y_{jt} | Z_{jt}) = \alpha_j + \beta_t + (\text{proximityNCA}_j \times \text{post}_t) \theta + (\text{proximityborder}_j \times \text{post}_t) \gamma + X_{jt} \delta + \ln (\text{pop}_{jt}) \quad (2)$$

where $y_{jt}$ are various counts of violence, including homicides and gun seizures in municipio $j$ and year $t$. $\text{proximityNCA}_j$ is the proximity of municipio $j$ to the nearest port in the non-California border states—Arizona, New Mexico or Texas. $\theta$ captures the extent to which violence rises differentially in municipios closer to treatment ports relative to California ports, in the post-2004 period. In Poisson estimation, this coefficient should be interpreted as indicating that a one unit change in $x$ leads to a $\theta$ log point change in expected $y$. If drug war violence increased differentially in areas closer to the border in the post-2004 period, and proximity to non-CA
ports is correlated with distance to the border, this would generate potential upward bias on \( \theta \). To account for this, in our preferred specification we also control for \( \text{proximityborder}_j \times \text{post}_t \), which is a municipio’s proximity to any port on the U.S. Mexico border, interacted with the post-2004 indicator.

Panel A of Figure VI shows the source of variation employed in estimating equation (2), the proximity to ports in AZ, NM and TX, controlling for the overall distance to border ports. It is worth noting that this differs from the simple proximity to these three states, since there are some municipios located close to these state borders that do not have a port nearby. This distinction is important since the account we put forward relies on gun flows across the border, which take place via major highways through port cities. Our empirical strategy effectively asks whether the darker green municipios witnessed larger increases in violence in the post-2004 period. Panel B of Figure VI provides visual evidence of an affirmative answer: darker red municipios saw greater increases in homicide rates after 2004, corroborating differential increases in violence near non-CA entry ports following the FAWB expiration. The figure also highlights how these increases occurred near ports along the entire non-California border, suggesting that the effects are not concentrated along any particular state or border port.

5 Results

5.1 Baseline Effects on Homicides

In this section, we build on the suggestive evidence shown in Figures VI and VII, and assess the effect of the FAWB expiration on violence by estimating equations (1) and (2) using a Poisson model. All specifications include municipality and year fixed effects with robust standard errors clustered at the municipality level. Panel A of Table III presents these results for total homicides, with column (1) showing estimates of equation (1). The coefficient indicates that Mexican municipios lying along the non-California segment of the U.S.-Mexico border experienced an additional 0.34 log point (or 40%) increase in homicides after 2004, compared to municipios along the California segment. The average annual homicides in the non-CA segment during the post-treatment period (2005-2006) was 655. The 40% estimate thus implies that the counterfactual number of deaths that would have prevailed in the absence of the 2004 FAWB expiration is 468. Subtracting 468 from 655 suggests that the policy change resulted in an additional 187 deaths per year in the border segment near Texas, Arizona and New Mexico. This is very similar to the simple estimate of 166 differential deaths calculated on the basis of Panel A in Figure VII.

Panel B of Table III presents the results for gun-related homicides. The coefficient of 0.40 in column (1) implies a 49% larger increase in gun-related murders. Given average gun deaths
of 420 in the post-treatment period, the counterfactual gun-related murders would have been 282, demonstrating that there were an additional 138 gun-related deaths in the non-California border segment due to the policy change. Again, this is quite similar to the simple calculation of 128 additional deaths based on Panel B of Figure VII.

Columns (2)-(4) present estimates of equation (2) using the sample of municipios that lie within 100 miles of ports on the U.S.-Mexico border.\footnote{These baseline results are qualitatively similar with the use of a Negative Binomial specification. See the Empirical Strategy section for reasons why the Poisson model is preferred relative to the Negative Binomial.} Here, the key treatment variable is the continuous measure of proximity to a non-California port interacted with the post-2004 indicator. Column 3 includes controls for overall proximity to the border ports, hence accounting for other factors which may be correlated with our treatment and with violence near the border.

Column 4 includes a battery of additional controls. To account for the possibility that the homicide effects are driven by a differential increase in the drug trade near the non-California ports, we include the value of major drugs seized in the nearest U.S. port of entry and in Mexican municipios. We also control for municipal level marijuana and heroin eradication, which likely reflects both drug crop cultivation and Mexican government enforcement, either of which may lead to greater violence. Figure IX shows a larger fall in eradication in municipios proximate to CA between the pre and post-2004 periods, suggesting why it may be important to include these additional controls. We account for economic conditions in Mexican municipios with log per-capita municipal expenditures, which controls for differential changes in the provision of basic services such as health, education and local security, as well as the interaction of municipal income per capita and the school enrollment ratio in 2000 with post-2004 indicators. Also, we control for the employment ratio and average earnings in the nearest U.S. port to account for the possibility that worsening economic conditions in non-CA ports may have increased crime rates in these U.S. cities, leading to more gun-running or exerting spillovers on homicides in Mexico through cross-border links in crime syndicates. Finally, we include the log of the number of unauthorized immigrants apprehended in the nearest port, which may be correlated with violence as drug cartels are increasingly involved in trafficking migrants.

The magnitude of the coefficient of interest is quite similar across alternative specifications in columns (2)-(4), although the precision of the estimate improves with additional controls. For our preferred specification with the full set of controls (Panel A, column (4)), the coefficient is 4.7. Given our proximity scale, this estimate suggests that going a 100 miles toward the U.S.-Mexico border is associated with a 0.47 log point (or 60%) increase in homicides. The mean distance to the nearest border port in the 100-mile sample is 57 miles, implying a proximity value of 0.43 (=1.00 - 0.57). Multiplying 0.60 by 0.43 suggests that homicides increased by 0.258 or 26% on average in the sample municipios due to the 2004 assault weapons ban expiration.
For this distance band, the actual average number of homicides in the post-2004 period was 1,158. Since the implied counterfactual deaths is 919, the estimates indicate that the policy change resulted in an additional 239 deaths per year in the set of municipios within 100 miles of the border.

For gun-related homicides, the relevant coefficient is 6.86 (Panel B, column (4)), implying a 43% ($0.99 \times 0.43$) rise in gun deaths in the average municipio within the 100 mile-sample. Given an annual average of 737.5 gun-related homicides in the post-2004 period, we estimate an additional 218 gun-related murders due to the U.S. policy change in this sample. The similarity of the effect on total homicides (239) and gun-related homicides (218) verifies that most of the killings attributable to the FAWB expiration were gun-related, bolstering the internal validity of our estimates.

Figure X shows the effects of the change in law by year. To generate this graph, we interact $proximityNCA$ with year dummies (instead of $post$) using 2004 as the omitted category, and plot the annual coefficients. The controls include overall proximity to border interacted with year. For total homicides we see a clear sharp rise between 2004 and 2005 and the effect mostly persists through 2006. The results for gun-related homicides is noisier, but the pattern of a large increase between 2004 and 2005, and persistence through 2006 is reproduced here as well.

Our main estimates use annual data, since most of our control variables are only available at the yearly level. However, we generate counts at the quarterly level, which allows us to define the timing of treatment and appropriate sample period more precisely. Since the expiration of the FAWB took effect in September 2004, we re-assign the last quarter of 2004 to the post-treatment period. In addition, since major government military operations began in December 2006, we eliminate the last quarter of 2006 to ensure that we isolate the effect of gun law changes rather than rising drug war violence unleashed in the aftermath of these operations. Since the post-treatment sample period extends forward to the third quarter of 2006, we specify a symmetric pre-treatment period which extends backward to the fourth quarter of 2002, estimating quarterly effects over a 16-period window. We also impute quarterly values for our annual controls using linear interpolation across quarters.

To assess the timing of the response, we estimate a version of equation (2) with quarterly data, but additionally include 4 leads and lags in the treatment variable ($proximityNCA \times post$).\(^{30}\) Figure XI traces the time path of the outcomes in response to the treatment, obtained by successively summing the leading and lagging terms. The figure clearly shows that for both total and gun-related homicides, there was an unmistakable jump in the treatment effect in the quarter following the expiration of the assault weapons ban. The last coefficient (labeled "4+")

\(^{30}\)The coefficients from estimating equation (2) using quarterly data (not presented) are quite similar to the annual results: 4.02 and 4.89 for homicides and gun-related homicides, respectively. Both are significant at the 5% level.
represents the long term effect of the policy, and confirms that the increase in violence was persistent.

5.2 Violence across Demographic Groups

Rising homicides may reflect increases in different types of murder, some connected to organized crime, and others carried out by individuals acting independently. If homicide increases are driven by members of crime syndicates targeting one another, then the effects should be larger for deaths of young men from a lower socioeconomic stratum, as this is the demographic group most likely to be involved with drug cartels. To explore this question, we disaggregate the counts of total homicides into sub-groups based on age, gender and educational attainment, which we use as a proxy for socioeconomic status.

Since 12 percent of the individual-level mortality observations were missing data on one of these characteristics, and we aim to compare effects on sub-groups directly to effects on overall homicides, we begin by re-generating municipio-level counts of killings for observations that are not missing any one of these characteristics. Column (1) of Table IV presents these results, which are similar in magnitude to the baseline effects in Table III. The coefficients in columns (2)-(3) show that the treatment effects are substantially larger for the sub-group of individuals above the age of 18 who have not completed high school, relative to everyone else (the complementary set). Reassuringly for our interpretation, this is particularly true for gun-related homicides (Panel B). Columns (4)-(5) show that the difference in estimated effects for the sub-group versus its complementary set are even larger for young men (between the ages of 18 and 30) who have not completed high school. For example, for gun-related homicides, the coefficient for all non-missing killings in column (1) is 6.5. The coefficient for young men without high school in column (4) is 13.9 and significant at the 1% level, while the coefficient for everyone else in column (5) is 5.1. The larger effects for young men with relatively low educational attainment is consistent with the idea that the expansion of organized crime has made a larger contribution to the rise in killings.

5.3 Effects on Homicides away from the Border

To examine whether our findings hold in larger distance-based samples, in Table V, we re-estimate equation (2) in the 100-mile distance band, and then expand the sample to include municipios in additional 100-mile bands. The estimates continue to hold with this distance.

31 For example, data from the Mexican presidency indicates that between 2006 and 2010, men comprised over 92% of drug-war related killings, and the age decile which represented the largest fraction of deaths were those between the ages of 21 and 30.

32 Our approach is similar to Owens (2011) who also uses age-specific changes in homicide rates to detect organized criminal activity following criminalization in U.S. alcohol markets.
expansion, confirming that the choice of the 100 mile threshold does not drive our results. However, the coefficient becomes smaller as the sample expands, which supports the idea that spillover effects are larger in border areas. This is also consistent with the fact that most of the variation in our treatment stems from the 100-mile sample. In fact, the proximity to the nearest non-CA port is perfectly collinear with the proximity border variable for the sample beyond 100 miles, which underscores why our analysis focuses primarily on the closest band.

5.4 Influence of Specific Border Segments

In this sub-section, we address the concern that other violence-promoting shocks to particular border municipios near TX, AZ and NM may confound our estimated effects. It is possible to find specific events that occurred in these areas around the time of the FAWB expiration. For instance, the killing of the brother of the head of the Sinaloa cartel led to an increase in violence in Nuevo Laredo (on the Texas border) in 2004.\textsuperscript{33} To assess the sensitivity of our findings to such shocks, Table VI reports the estimates when we drop all the municipios from the sample that are closest to a TX port (columns 1 and 2), to a AZ port (columns 3 and 4), and to a NM port (columns 5 and 6). We show the results both with and without our full set of controls.

We find that our key findings continue to hold even when we drop specific border segments. Dropping the AZ and NM segments do not affect any of the results. Dropping the TX segment is a particularly tough test, since this eliminates 60% of our sample. Even so, the effect on gun-related homicide continues to be quantitatively large and statistically significant. Overall, this sensitivity analysis indicates that localized events do not drive our results that the expiration of the FAWB led to an increase in gun-related killings. These checks are also corroborated by the map in Panel B, Figure VI, which clearly shows that municipios along the entire non-California border witnessed differential increases in homicides per capita across the pre and post-treatment periods.

5.5 Robustness Checks

5.5.1 Additional Controls and Samples

In Table VII, we test the robustness of our baseline results to additional controls for spatial trends and alternative samples. Column (1) reproduces the baseline results from column (4) of Table III. We begin by including linear time trends by municipio. The maximum likelihood

\textsuperscript{33}There are also specific violent events that took place on the Mexican side of the California border. For example, the Gulf and Tijuana cartels ended their year-long alliance in January 2005, and the head of the Gulf cartel dispatched their deadly enforcers, "Los Zetas," to seize smuggling routes in Baja California from the Tijuana cartel (STRATFOR, 2005). But such violence promoting events would bias the estimated effects downward.
estimates do not converge with the inclusion of linear trends in a specification with municipio and year fixed effects. However, in column (2) we show that the coefficient is similar when we replace year effects with a post-2004 indicator, and column (3) shows the results including linear trends along with the post-2004 indicator. The coefficients of interest are actually larger in magnitude with trend controls, and remain significant for both homicides and gun homicides, indicating that underlying trends in homicides are not confounding our estimates.

Since most guns are trafficked along major highways even once they reach Mexico, column (4) restricts the sample to those municipios that have at least one major highway, which eliminates 9 municipios from our sample in the homicide specification. The coefficients are almost identical as the baseline, confirming that the results are not driven by some idiosyncratic feature of the few regions lacking highway access.

If a rise in homicides is correlated with factors that also promote other types of mortality, then our estimates may be biased upward if we do not control for these omitted factors or the ensuing increase in other deaths. For example, political destabilization, natural disasters or an economic downturn may result in greater non-murder deaths through a rise in poverty and erosion of basic services, while increasing violence and crime by reducing the opportunity cost of participating in illicit activities. In column (5), we control for other non-homicide deaths, as well as non-gun related murders, and find that the results for homicides and gun related homicides remain nearly identical.

In column (6) we add two enforcement related measures to the previous set of controls. First, for each municipio, we control for the contemporaneous number of drug-related detentions per capita by the Mexican military. This helps capture the effect of government military operations, which are also potentially correlated with our treatment. Second we account for differential enforcement levels across U.S. ports cities by controlling for the number of police officers per capita in the nearest port. It is important to note that these enforcement controls are likely to respond positively to increased criminal activity induced by the policy change. As such, including contemporaneous values of the enforcement variables is a form of over-controlling, and represents a particularly tough hurdle. Even so, we find that the coefficients remain statistically significant at conventional levels and large in magnitude—especially those that are gun-related.

Finally, if the violence fueled by the FAWB expiration is posited to increase gun-related homicides, the expected effect on non-gun related homicides is ambiguous. Added gun supply may have led to a substitution away from the use of other weapons, lowering these other types of homicides. On the other hand, it may have increased non-gun murders by expanding the drug war more generally, which has increasingly involved killings by other means such as beheadings and mutilations. Panel C of Table VII shows the FAWB expiration did not affect non-gun homicides in any of the specifications, even while there is a strong impact on gun-related homicides (in Panel B). This demonstrates that there was little substitution away from
other types or murders and also provides additional validity to the causal channel proposed for our findings.

5.5.2 Definition of Entry Ports

Our proximity measure is based on defining major ports of entry on the U.S.-Mexico border. The primary definition employed in this paper consolidates border crossings within 20 miles of each other into single ports, but does not impose any traffic-related restrictions.

In Table VIII we show that our findings are not driven by the choice of port definitions. We consider alternative distance cutoff rules for assigning border crossings to the same port, and also impose two truck traffic criteria, of at least 1000 or 5000 trucks per year. These are meaningful restrictions since substantial traffic flows imply that these locations are major transportation hubs. We find quantitatively similar and statistically significant effects of the expiration of the FAWB on violence in all 9 cases, demonstrating the robustness of our results to alternative port definitions.

5.6 Gun Seizures

In this sub-section, we present supporting evidence on the proliferation of arms in Mexico following the FAWB expiration in the U.S., using data on SEDENA crime gun seizures. If the policy change is causally related to violence through assault weapons sales, we should expect to see greater increases in counts of the rifle category, but not the handgun category. We analyze two additional outcomes, "multiple rifles" and "multiple handguns", which are counts of guns on days when multiple guns of that type were seized in a given municipality. These multiple seizures are more likely to reflect gun possession by members of organized crime groups. The results in Table IX indicate that the policy shock did increase the number of rifles seized in Mexico, but not the number of handguns. Strikingly, the effect is strongest for "multiple rifles" seizures, while the "multiple handguns" seizures has the opposite sign and is not significant.

Since the FAWB did not affect the permissiveness of gun sales governing handguns, the findings on seizures of rifles—especially multiple rifles—provides strong evidence that the law change increased assault weapons supply south of the border. These results, coupled with the larger effects on homicides of young, less-educated men shown in Table IV, suggests that the killings associated with increased gun supply reflect more activity by organized crime syndicates such as DTOs, which were best positioned to take advantage of permissive U.S. gun regulations in trafficking weapons to Mexico.
6 Conclusion

The role of arms availability in facilitating violence is an issue of central importance to social scientists, given its socio-economic costs and its potential to weaken the state. Previous attempts to answer this question, which focused primarily on examining whether U.S. gun laws affect U.S. crime rates, had a narrow scope and faced a number of methodological challenges. In this paper, we have sought to overcome these challenges by examining how a major U.S. policy change governing the sale of assault weapons affected homicide rates in Mexico, a neighboring nation, over the 2002-2006 period. Given widespread arms trafficking across the U.S.-Mexico border, the 2004 expiration of the U.S. Federal Assault Weapons Ban represented an exogenous shock to weapons supply in Mexico. We take advantage of the fact that this law change weakened the gun control regime in border states such as Texas, Arizona and New Mexico more than in California, which retained a pre-existing state-level ban. Correspondingly, we exploit variation across Mexican municipios in distance to various entry ports along the border, and show that total homicides, gun-related homicides, and crime gun seizures increased differentially in municipios closer to non-California ports in the post-2004 period. Importantly, we find no significant effects on crime-related handguns seized in Mexico, but find effects on seizures of rifles, the gun category which includes assault weapons. This provides evidence that the 2004 policy change promoted violence by facilitating greater access to this particular type of weapon.

Our baseline estimates suggest that municipios neighboring the Texas, Arizona and New Mexico border ports saw total homicides rise by 60% as compared to municipios 100 miles away, implying an additional 239 homicides in each of the two years after 2004. The results are robust to controls for economic conditions, drug eradication and enforcement in Mexico, as well as undocumented immigration, policing and drug trafficking patterns in the nearest U.S. port. In addition, the impact is larger for homicides of young men with low education levels, suggesting that the rising violence involves organized crime, such as drug-traffickers who are heavily involved with gun trafficking.

Our findings hold the clear policy implication that stricter control of guns in the U.S. could help curb rising violence in Mexico, which ties directly into the current contentious debate on weapons trafficking along the U.S.-Mexico border. Within this discussion, the Mexican government has repeatedly asked for assistance from the United States in reducing assault weapons flows. In May 2010, Mexican President Felipe Calderón urged the U.S. Congress to reinstate a ban on assault weapons. He stated, "I will ask Congress to help us...and to understand how important it is for us that you enforce current laws to stem the supply of these weapons to criminals and consider reinstating the assault weapons ban (Los Angeles Times, May 20, 2010)." In July 2011, President Obama approved a new regulation that requires firearms dealers in California, Arizona, New Mexico, and Texas to inform the BATF about multiple sales
of certain types of semiautomatic rifles. However, this law has been described as "insufficient" by Mexican congressmen (El Universal, July 12, 2011) and been strongly contested by U.S. gun-rights advocates such as the National Rifle Association, which is suing the BATF to block the new rule. Frustration over the U.S. response has most recently led the Mexican government to explore suing American manufacturers and distributors of these weapons flowing into Mexico (CBS News, April 21, 2011).

Beyond this debate, it is worth noting that Mexico is not unique in facing an influx of American-made weapons. As an example, most crime guns seized in Jamaica over this past decade have been traced back to Florida (Leslie, 2010), a strong concern given the nation’s very high homicide rate of 52 per 100,000 (UNODC, 2011).

Moreover, our paper holds a broader implication, as it provides evidence of a positive relationship between guns and violent crime. This is of direct relevance to a number of countries facing the rise of organized crime, which may be fulled in part by the proliferation of firearms. For example, high-powered weapons inherited from protracted civil wars have been identified as contributing to gang violence in Central America, influencing the previously conflict-affected nations of Guatemala, El Salvador and Nicaragua (Seelke, 2011), while diffusing to the previously peaceful nations of Costa Rica and Panama (Godnick et al., 2002). The gradual encroachment of gangs over national territory has been described as a "coup d’ street" in this region, punctuating how the increased potency of these armed actors poses a direct threat to the state (Manwarning, 2007). More generally, by documenting the violent impact of cross-border spillovers, our paper has highlighted how arms supply can promote pernicious forms of violence, which may hold serious consequences for the stability of the state.

References


Cameron, A. C. and P.K. Trivedi. 2009. Microeconometrics Using Stata. College Station, TX: Stata Press.


<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>Border crossing</th>
<th>Mean truck traffic (2002-2006)</th>
<th>Distance to other nearest border crossing</th>
<th>Port</th>
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<tbody>
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<td>San Diego</td>
<td>726,866</td>
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<td>Tecate</td>
<td>65,943</td>
<td>20 miles to San Diego</td>
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</tr>
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<td>CA</td>
<td>Imperial</td>
<td>El Centro</td>
<td>295,452</td>
<td>44 miles to Yuma</td>
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<td>CA</td>
<td>Imperial</td>
<td>Andrade</td>
<td>2,207</td>
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<td>AZ</td>
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<td>Naco</td>
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</tr>
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<td>Cochise</td>
<td>Douglas</td>
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<td>Santa Teresa</td>
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<td>Starr</td>
<td>Rio Grande City</td>
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<td>McAllen</td>
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<td>TX</td>
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<td>Brownsville</td>
<td>236,461</td>
<td>50 miles to McAllen</td>
<td>Brownsville</td>
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</table>

Notes: Mean truck traffic is the annual average number of trucks that crossed the border during 2002-2006, based on data from the Bureau of Transportation Statistics (BTS). The distance to the other nearest border crossing is computed from the actual border crossing point versus the city center. A border crossing is considered a separate port if it is at least 20 miles away from another border crossing. If two border crossings are less than 20 miles apart, they are considered part of the same port, named after the border crossing with higher truck traffic. For instance, Andrade is less than 20 miles from Yuma and is considered to be part of the Yuma port. Following the same criteria, Santa Teresa, Roma, and Progreso are considered parts of the El Paso, Rio Grande, and McAllen ports, respectively.
Table II  
Descriptive Statistics

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<td>Non-gun homicides per 1000 pop.</td>
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<td>Log drug value seized in municipio</td>
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<td>6.403</td>
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<tr>
<td>Log marijuana eradication</td>
<td>530</td>
<td>0.195</td>
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<tr>
<td>Log poppy eradication</td>
<td>530</td>
<td>0.098</td>
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<tr>
<td>Log drug value seized in nearest port</td>
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<td>Log unauthorized immigrants in nearest port</td>
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<td>0.921</td>
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<td>Distance border (thousands)</td>
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<tr>
<td>Distance NCA (thousands)</td>
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<td>Highway</td>
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<td>Log municipal income per capita in 2000</td>
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<td>8.983</td>
</tr>
<tr>
<td>Municipal school enrollment in 2000 (percent)</td>
<td>106</td>
<td>57.775</td>
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Notes. This table shows descriptive statistics of key variables for the main sample period, 2002-2006. Distance border is a municipio’s distance to the nearest of any port on the U.S.-Mexico border, in thousands of miles. Proximity border is a municipio’s proximity to the nearest of any border port, defined as 1 – Distance border. Proximity border ≤ 100 miles is the set of municipios that lie within 100 miles of the nearest border port, and this constitutes the 100-mile sample. Proximity border > 100 miles is the set of municipios beyond the 100-mile mark. Distance NCA is defined as a municipio’s distance to the nearest of any non-California port, in Texas, Arizona or New Mexico, in thousands of miles. Proximity NCA is the municipio’s proximity to the nearest non-California port, defined as 1 – Distance NCA. Segment NCA is an indicator of whether the municipio lies on the non-California segment of the U.S.-Mexico border, adjacent to either Texas, Arizona, or new Mexico. Highway is an indicator for whether a municipio has a highway. Log municipal income per capita is the natural log of 2000 municipal GDP per capita measured in U.S. Dollars. Municipal school enrollment is the fraction of the population aged 6-24 attending school in 2000. Log poppy and marijuana eradication are the natural log of hectares of each drug crop eradicated plus 1. Log drug value seized in each municipio is the natural log of the value of heroin, cocaine, marijuana and methamphetamines plus 1 seized in each municipio.


### Table III

Expiration of the FAWB and Violence in Mexican Municipios

<table>
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<th>(4)</th>
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<tr>
<td><strong>Panel A: Homicides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment NCA x post</td>
<td>0.336*</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>(0.175)</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Proximity NCA x post</td>
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<td>4.383*</td>
<td>4.117**</td>
<td>4.702***</td>
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<td></td>
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<td>(2.354)</td>
<td>(1.927)</td>
<td>(1.789)</td>
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<td>185</td>
<td>420</td>
<td>420</td>
<td>409</td>
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**Panel B: Gun-related Homicides**

<table>
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<th>(4)</th>
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<td>Segment NCA x post</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>(0.231)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Proximity NCA x post</td>
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<td>5.099*</td>
<td>4.706**</td>
<td>6.863***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.059)</td>
<td>(2.392)</td>
<td>(2.370)</td>
</tr>
<tr>
<td>Observations</td>
<td>185</td>
<td>395</td>
<td>395</td>
<td>384</td>
</tr>
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</table>

Proximity border x post control? | Y       | Y       |         |         |
Income, immigration and drug controls? | Y       |         |         |         |

<table>
<thead>
<tr>
<th>Sample</th>
<th>Border</th>
<th>100-mile</th>
<th>100-mile</th>
<th>100-mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes. All estimates are based on Poisson regressions using population exposure. Variables not shown include municipio and year fixed effects. Robust standard errors clustered at the municipio level are shown in parentheses. Segment NCA x post interacts an indicator of whether the municipio lies on the CA segment of the U.S.-Mexico border with a post-2004 indicator. Proximity NCA x post interacts the proximity of a municipio to the nearest port in Arizona, New Mexico or Texas with a post-2004 indicator. Proximity border x post interacts the proximity to the nearest of all ports with a post-2004 indicator. Income, immigration and drug controls in column (4) include: log municipal per capita income in 2000 and the schooling ratio in 2000, interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port. The border sample includes the set of municipios that are located along the U.S.-Mexico border. The 100-mile sample includes the set of municipios that lie within 100 miles of the nearest port. *** is significant at the 1% level; ** is significant at the 5% level; and * is significant at the 10% level.</td>
<td></td>
<td></td>
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Table IV

The FAWB Expiration and Violence across Demographic Groups

<table>
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<tr>
<th>Panel A: Homicides</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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</thead>
<tbody>
<tr>
<td>Proximity NCA x post</td>
<td>3.991***</td>
<td>4.935***</td>
<td>3.833**</td>
<td>7.720***</td>
<td>3.341**</td>
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<td></td>
<td>(1.478)</td>
<td>(1.713)</td>
<td>(1.870)</td>
<td>(2.331)</td>
<td>(1.522)</td>
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<td>364</td>
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<td>399</td>
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<table>
<thead>
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<th>Panel B: Gun-related Homicides</th>
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<tbody>
<tr>
<td>Proximity NCA x post</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Proximity border x post control? | Y | Y | Y | Y | Y |
Income, immigration and drug controls? | Y | Y | Y | Y | Y |

Sample | All | Aged 18+ w/o HS | All but 18+ w/o HS | Males 18-30 w/o HS | All but males 18-30 w/o HS |

Notes. All estimates are based on Poisson regressions using population exposure. Variables not shown include municipio and year fixed effects. Robust standard errors clustered at the municipio level are shown in parentheses. Proximity NCA x post interacts the proximity of a municipio to the nearest port in Arizona, New Mexico or Texas with a post-2004 indicator. Proximity border x post interacts the proximity to the nearest of all ports with a post-2004 indicator. Income, immigration and drug controls include: log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. The "All" sample in column (1) includes all homicides for which the observations are not missing information about age, gender and education. The sample in column (2) refers to homicides of those 18 and older who do not have a high school degree while the sample in column (3) refers to the remaining homicides. The sample in column (4) refers to homicides of those between the ages of 18-30 without a High School degree, while the sample in column (5) refers to the remaining homicides. *** is significant at the 1% level; ** is significant at the 5% level; and * is significant at the 10% level.
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<th>Homicides</th>
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<th>Gun-related Homicides</th>
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<tr>
<td>0-100 miles</td>
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<td>4.702***</td>
<td>(1.789)</td>
<td>6.863***</td>
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<td>0-200 miles</td>
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<td>3.893***</td>
<td>(1.223)</td>
<td>5.105***</td>
<td>(1.641)</td>
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<td>0-300 miles</td>
<td></td>
<td>3.212***</td>
<td>(1.053)</td>
<td>4.238***</td>
<td>(1.410)</td>
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<tr>
<td>0-400 miles</td>
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<td>2.970***</td>
<td>(0.988)</td>
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<tr>
<td>0-500 miles</td>
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<td>2.465**</td>
<td>(1.048)</td>
<td>3.105**</td>
<td>(1.431)</td>
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</table>

Proximity border x post control?  Y  Y
Income, immigration and drug controls?  Y  Y

Notes. All estimates are based on Poisson regressions using population exposure. Variables not shown include municipio and year fixed effects. Robust standard errors clustered at the municipio level are shown in parentheses. Sample refers to the set of municipios that lie within the designated distance bands. Proximity NCA x post interacts the proximity of a municipio to the nearest port in Arizona, New Mexico or Texas with a post-2004 indicator. Proximity border x post interacts the proximity to the nearest of all ports with a post-2004 indicator. Income, immigration and drug controls include: log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. *** is significant at the 1% level; ** is significant at the 5% level; and * is significant at the 10% level.
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<th>(6)</th>
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<td></td>
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<td>(2.294)</td>
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<td>295</td>
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<td>399</td>
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<td><strong>Panel B: Gun-related Homicides</strong></td>
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<td></td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
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**Sample**

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<th>100-mile with nearest port in</th>
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<th>100-mile with nearest port in</th>
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<td>CA, TX, NM</td>
<td>CA, TX, NM</td>
<td>CA, AZ, TX</td>
<td>CA, AZ, TX</td>
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</tbody>
</table>

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Notes. All estimates are based on Poisson regressions using population exposure. Variables not shown include municipio fixed effects. Robust standard errors clustered at the municipio level are shown in parentheses. Proximity NCA x post interacts the proximity of a municipio to the nearest port in Arizona, New Mexico and Texas with a post-2004 indicator. Proximity border x post interacts the proximity to the nearest of all ports with a post-2004 indicator. Income, immigration and drug controls include: log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. All specifications include year effects except columns (2)-(3) which include a post-2004 indicator. Column (3) also includes linear time trends at the municipio level. Column (4) restricts the sample to municipios that have a highway. Column (5) controls for counts of non-homicide deaths and non-gun related homicides. Current enforcement controls in column (6) include military drug-war detentions per capita in Mexican municipios, as well as police officers per capita in the nearest U.S. port. *** is significant at the 1% level; ** is significant at the 5% level; and * is significant at the 10% level.
### Table VIII  
Robustness to Different Treatment Definitions

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**Notes.** Variables not shown include municipio and year fixed effects. Robust standard errors clustered at the municipio level are shown in parentheses. Proximity border x post interacts the proximity to the nearest of all ports with a post-2004 indicator. Income, immigration and drug controls include: log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. *** is significant at the 1% level; ** is significant at the 5% level; and * is significant at the 10% level.
Figure I
Gun Sales and Production – California versus Other Border States

Panel A: Estimated Annual Total Gun Sales

Panel B: Annual Total Production of Rifles

Notes. In Panel A, the total number of gun sales (in thousands) is approximated by the number of FBI NICS firearm background checks originating in the relevant state. The NICS data is available at: [http://www.fbi.gov/about-us/cjis/nics/reports/state_totals_2011](http://www.fbi.gov/about-us/cjis/nics/reports/state_totals_2011). In Panel B, data on the annual production of rifles comes from the BATF’s Annual Firearms Manufacturing and Exportation Reports (AFMER). The dashed vertical line marks 2004, the year in which the federal assault weapons ban expired.
Figure II
Licensed Firearms Dealers in the Border States

Notes. This figure uses data from the BATF to map graduated circles representing the number of licensed firearms dealers by ZIP code in California (CA), Arizona (AZ), New Mexico (NM) and Texas (TX) as of January 2010, the earliest date for which this information is publicly available. This data can be accessed from: [http://www.atf.gov/about/foia/ffl-list.html](http://www.atf.gov/about/foia/ffl-list.html). The black lines represent highways in Mexico.
Figure III
Mexican Crime Guns Traced to the United States

Panel A: Overall Fraction Traced to U.S. Over Time


Notes. Both figures are from the GAO (2009) Report and based on BATF data. Mexican authorities send a quarter of seized firearms to BATF for tracing the location of the last legal transaction. The underlying data has not been made available to the public or researchers by BATF.
Figure IV
Cartel Presence along the U.S.-Mexico Border (2002-2006)

Notes. This map shows the approximate geographic location of Mexican Cartels in border states over 2002-2006, based on information from La Jornada (2002), La Jornada (2005, CRS (2007), and STRATFOR Global Intelligence (2008). The shaded areas denote the areas in which various cartels operate. Circles with a dot inside represent the headquarter cities of each cartel, with the relevant cartel written in parentheses. The U.S. border states include California (CA), Arizona (AZ), New Mexico (NM) and Texas (TX).
Figure V
Ports of Entry and Highways on the U.S.-Mexico Border

Notes. The black lines represent highways. Municipalities in blue constitute the sample of municipalities on the border with highways. Port cities in California (San Diego, Tecate, and El Centro) are marked in blue. Port cities in other states are marked in red: Yuma (AZ), Lukeville (AZ), Sasabe (AZ), Nogales (AZ), Naco (AZ), Douglas (AZ), Columbus (NM), El Paso (TX), Presidio (TX), Del Rio (TX), Eagle Pass (TX), Laredo (TX), Rio Grande (TX), McAllen (TX), and Brownsville (TX).
Figure VI
Proximity to Ports and Change in Violence in Sample Mexican Municipios

Panel A: Continuous measure of Proximity of Municipios to non-CA Ports of Entry

Panel B: Change in Homicide per Capita – 2005-2006 versus 2002-2004

Notes. Panel A shows the “residual proximity” of each municipio. This is constructed by first regressing “proximity” (i.e., 100 miles – distance) to the nearest non-California port on proximity to the nearest of any border ports for the municipios in the 100-mile sample, and then generating residuals from this regression, which represent the identifying variation in our research design. The magnitudes of these residuals are represented by the four shades of green so that darker shades signify proximity to a non-CA port, holding overall proximity constant. Panel B shows the change in the average homicide per 100,000 people in a municipio between the pre-treatment (2002-2004) and post-treatment (2005-2006) periods. Darker red signifies greater increase in homicides rates. All municipios beyond 100 miles of the ports are shown in light gray in both panels.
Figure VII
Total Homicides in Municipios Bordering California versus Other Border States

Panel A: All Homicides

Panel B: Gun-related homicides

Notes. Panel A plots the total number of homicides in the border municipios adjacent to California (the CA segment), versus the border municipios adjacent to Arizona, New Mexico and Texas (the non-CA segment). Panel B plots the equivalent numbers of homicides specifically tied to guns. The dashed line denotes 2004, the year in which the federal assault weapons ban expired.
Notes. Panel A reports the histogram of homicide counts in the sample, along with a fitted Normal density, for the sample of municipios within 100 miles of a border port, over 2002-2006. Counts of 40 or more homicides are aggregated into the category “40”. Panel B reports the kernel density estimate of homicides per 10,000 population in each municipio over the same time period, along with a fitted normal density estimate.
Figure IX
Changes in Drug Eradication in Mexican Municipios


Panel B: Change in Hectares of Poppy Eradicated – 2005-2006 versus 2002-2004

Notes. This figure shows the change in hectares of marijuana and poppy eradicated in each municipio between the pre-treatment period (2002-2004) and post-treatment period (2005-2006) for the set of municipios within 100 miles of an entry port, the 100-mile sample. Lighter colors indicate larger decreases in eradication over this period.
Figure X
Effects on Violence by Year

Panel A: All Homicides

Panel B: Gun-related Homicides

Notes. The solid blue line plots the Poisson regression coefficients for Proximity NCA interacted with each year regressed on the outcome (annual counts of homicides in Panel A, and counts of gun-related homicides in Panel B). 2004 is the omitted category. Controls include municipio and year fixed effects; Proximity Border x post; log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. Population is used as exposure. Município-cluster-robust standard errors are used to calculate the 95% confidence intervals indicated by the blue dashed lines.
**Notes.** The solid blue line plots the running sum of quarterly lags and leads of Poisson regression coefficients for \( \text{Proximity NCA} \times \text{Post} \) regressed on the outcome (quarterly counts of homicides in Panel A, and quarterly counts of gun-related homicides in Panel B). 4 leads, 4 lags, and the contemporaneous \( \text{Proximity NCA} \times \text{Post} \) are included in the regressions. Treatment date is 4th quarter of 2004. All regressions include municipio and quarter fixed effects and \( \text{Proximity Border} \times \text{Post} \). Additional controls include quarterly-interpolated annual values of: log municipal per capita income in 2000 and the schooling ratio in 2000 interacted with a post-2004 indicator; log municipal expenditures per capita; log value of municipal drug seizures plus 1; log hectares of marijuana and heroin poppies eradicated in each municipio plus 1; as well as the employment ratio, log average earnings, log unauthorized immigrants and log value of drugs seized in the nearest U.S. port of entry. Population is used as exposure. Municipio-cluster-robust standard errors are used to calculate the 95% confidence intervals indicated by dashed lines.
A Online Appendix: Institutional Background

A.1 California’s Assault Weapons Ban and Gun Control Regime

In California, the control of assault weapons began with the passage of the Roberti-Roos Assault Weapons Control Act of 1989. The Act defined assault weapons in a manner similar to the federal ban. In particular, all weapons listed in section 12276 of California’s Penal Code were (and continue to be) designated an assault weapon.\(^1\) Such firearms were designated controlled and as such could not be legally purchased, kept for sale, offered for sale, exposed for sale, given, lent, manufactured, distributed or imported as of 1991. Moreover, all pre-existing weapons were required to be registered as assault weapons with the Department of Justice. Banned weapons in California also include the AK and AR-15 weapons series.

California’s weapons ban was subsequently strengthened between 1989 and 2002. The Roberti-Roos Act was challenged on constitutional grounds, but upheld by the State Supreme Court. The ruling found that effective August 16, 2000, firearm models that are variations of the AK or AR-15 with only minor differences from those two models are also considered assault weapons and are controlled. Weapons that were not registered before January 23, 2001 also had to be surrendered to law enforcement. In addition, CA Senate Bill 23, passed in 1999, and implemented in 2000 and 2002, broadened the reach of the ban. This bill introduced specific characteristics (such as flash suppressors, forward pistol grip, and the capacity to accept more than 10 rounds) that designate a gun an assault weapon. Since 2002, CA’s gun law regime has remained relatively uniform.

Our empirical strategy posits that the lifting of the FAWB made gun laws more permissive in TX, AZ and NM. However, the ban would only represent a differential change in stringency compared to CA if CA’s legislation was sufficiently strong to control assault weapons sales, and this control was retained in the post-2004 period. One piece of evidence indicating the relative ease of obtaining assault weapons in New Mexico, Texas and Arizona versus California comes from the advocacy group The Brady Center to Prevent Gun Violence, which ranks states on the restrictiveness of their gun control laws on a 100 point scale. California has consistently ranked number 1 on this list, most recently with 81 points. Specifically with reference to assault weapons, California gets a 10 out of 10 in this category. In contrast, Arizona, New Mexico and Texas scored less than 10 points in total, earning zero each in the assault weapons category.\(^2\)

Another piece of suggestive evidence comes from BATF Firearms Trace data from 2006, the earliest year available, which indicates that the flow of seized guns from California to Arizona,

\(^1\)Details about the California assault weapons ban can be found at: http://ag.ca.gov/firearms/forms/pdf/awguide.pdf

New Mexico and Texas (358) was less than half of the reverse flow (943).³

A.2 Cartels and the Mexican Drug War

Within Mexico, there is geographic segmentation to where each of the cartels operate, and particular cartels are dominant in particular ports of entry into the U.S. As shown in Figure IV, the Tijuana cartel is headquartered in Tijuana, directly south of San Diego, and operates only in the part of Mexico adjacent to California. Similarly, the Juárez cartel is headquartered in and dominates the port of Ciudad Juárez, which is directly South of El Paso, though its activities extend into parts of Mexico bordering both Arizona and Texas. The headquarters of the Gulf Cartel does not lie at the border, but it is dominant in the eastern part of Mexico, in the region bordering Texas. The Sinaloa Cartel held the broadest reach, since it was pursuing an aggressive campaign to contest territory over this period. However, it is dominant in the part of Mexico adjacent to Arizona. These patterns of control indicate that there will be high turf-based costs for smugglers from the Tijuana cartel to operate along routes controlled by rival cartels near Texas and Arizona, and analogously, it would be costly for the Juárez and Gulf cartels to operate in the border region of California.

Figure IV also shows that the extent to which Mexican states are contested by cartels over this period is approximately the same across different parts of the border. For example, there are at least two large cartels present in each of the Mexican states, including those adjacent to California as well as Texas, Arizona and New Mexico. This uniformity of cartel structure is important in comparing violence based on proximity to non-California ports, since the presence of multiple cartels within a given area may be associated with higher levels of violence.

Finally, the relationship between drug cartels and gun trafficking also raises a potential challenge to attributing rising violence to changes in gun supply – violence may instead be related to intensification in drug trafficking patterns along different parts of the border. Although drug trafficking in Mexico has been a concern for many years, the fighting between cartels has risen dramatically over the past decade. There have been two major turning points in the Mexican drug war. First, in 2001, Joaquin "El Chapo" Guzman, the leader of the Sinaloa cartel, escaped from prison and attempted to take control of Mexico’s drug trade. In particular, he attempted to take over important drug routes along the Texas and California borders. Violence increased throughout the country, but particularly in drug production areas, and in crossing points along the U.S.-Mexico border (Wall Street Journal, 2009). Second, in December of 2006, the president of Mexico, Felipe Calderon, initiated a new aggressive war on the cartels by using the military to fight organized crime. The military campaign was phased in differentially in various regions: it began with Michoacán and Baja California in December of 2006, and was

³http://www.atf.gov/statistics/trace-data/
extended to Chihuahua, Durango, Sinaloa, Nuevo Leon and Tamaulipas in 2007. In 2008, operations began in Jalisco and Guerrero. In 2009, there was a dramatic escalation in the drug war, and spiking violence in Juárez (bordering Texas) led President Calderon to send 10,000 additional soldiers to that city (Nexos, 2011). The year 2010 saw numerous arrests and deaths of cartel leaders, assassinations of politicians, and a reinforcement of the Mexican government’s military operations. Given the importance and the staggered nature of the military operations, we exclude all years after 2006 from our primary sample. We also avoid comparing across the pre and post 2001 period by limiting attention to the years between 2002 and 2006, which constitutes a relatively homogenous phase of the Mexican drug war.

References
