The Way of the Gun:

Estimating Firearms Traffic Across the U.S.-Mexico Border

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WARNING
ILLEGAL TO CARRY
FIREARMS / AMMUNITION
INTO MEXICO
PENALTY – PRISON
BY MEXICAN LAW

PHOTO: SHUTTERSTOCK

Executive Summary

The Problem

Mexico is experiencing a surge in gun-related violence since 2006. Yet Mexico does not manufacture small arms, light weapons or ammunition in sizeable quantity. Moreover, Mexico has some of the most restrictive gun legislation in the world. It is assumed that a considerable proportion of weapons in Mexico are illegal, most having been trafficked from the United States (U.S.). The volume of firearms sold in the United States and trafficked across the U.S.-Mexico border, however, is notoriously difficult to record. Previous attempts have involved multiplicative approximations based upon the quantity of arms confiscated at the border.

Our Approach

We tackle the challenge of estimating arms trafficking from the U.S. to Mexico differently. We apply a unique GIS (Geographic Information System)-generated county-level panel dataset (1993-1999 and 2010-2012) of Federal Firearms Licenses to sell small arms (FFLs), we create a demand curve for firearms based on the distance by road from the nearest point on the U.S.-Mexico border and official border crossing. We use a time-series negative binomial model paired with a post-estimation population attributable fraction (PAF) estimator. We do so controlling for determinants of domestic demand (e.g., income, political leaning, population density, and spatial auto-correlation). We are able to estimate a total demand for trafficking, both in terms of firearms and dollar sales for the firearms industry.

Preliminary Findings

Our study finds that:

- *A significant proportion of U.S. firearm dealers are dependent on Mexican demand:* 46.7% (95% C.I.: 39.4 - 52.7%) of U.S. FFLs during 2010-2012 depended for their economic existence on some amount of demand from the U.S.-Mexico firearms trade to stay in business. This percentage has steadily risen from 37.4% (95% C.I.: 28.2 - 45.0%) in 1993;

- *A sizeable and growing percentage of US firearms sales are destined for Mexico:* 2.2% (between 0.9% and 3.7%) of U.S. domestic arms sales are attributable to the U.S.-Mexico traffic. This percentage is up from roughly 1.75% (between 0.66% and 3.15%) in 1993;

- *The volume of firearms crossing the U.S.-Mexican border is higher than previously assumed:* 253,000 firearms (between 106,700 and 426,729) were purchased annually to be trafficked over 2010-2012. This number is starkly higher than the 88,000 firearms (between 35,597 and 152,142) trafficked in 1997-1999, during the federal Assault Weapons Ban (AWB);

- *The value of firearms sales destined for Mexico are significant and growing appreciably:* The trade represented annual revenues of $127.2 million (range: $53.7 - $214.6 million) for the U.S. firearms industry during 2010-2012 - nearly four times higher than during 1997-1999, when the trade ran to just $32.0 million (range: $13.0 - $55.4 million);

- *The U.S. and Mexican authorities are seizing a comparatively small number of firearms at the border:* Based on seizure reports for 2009, U.S. and Mexico authorities in recent years have been seizing just 14.7% (between 8.7% and 35.0%) of total arms bought with the intention of trafficking them. Specifically, Mexican authorities have seized roughly 12.7% of the total annual trade whilst the United States has intercepted around 2.0%.

Conclusions

Given these empirical findings, we conclude that ongoing government efforts to regulate firearms trade and trafficking across the U.S.-Mexico border are largely ineffective. Notwithstanding improvements in the efficacy of Mexican authorities in seizing illicit firearms between 2008-2009, they are still meager in relation to the overall volume of weapons likely crossing the border

The scale of the trade demonstrates that the United States is an important contributor to the global supply of firearms in illicit markets. It also draws attention to the particular function of domestic firearms regulation and the concomitant responsibilities of U.S. authorities. Taken together, smarter policies are required to combat firearms trafficking, including (1) the public disclosure of disaggregated gun sales; (2) background checks geared toward identifying straw purchasers; (3) the prohibition of cash transactions in firearms sales in border states; and (4) the creation of a Mexican database of seized firearms.

Key Words: Firearms, trafficking, demand, North America, U.S.-Mexico.

JEL Classification Codes: D74, F14, F52, K14, K42.

Introduction[1]

In the wake of decades-long secular declines in the national homicide rate, Mexico is suffering from an epidemic of gun violence. At many as 120,000 people have been violently killed since 2006, many of them with firearms (Molzahn, Rodriguez Feirrera, & Shirk, 2013, p. 13). The dynamics of violence are complex, though it is important to note that the vast majority of homicides are concentrated in just a small number of Mexico's 31 states and Federal District. The majority of reported homicides are committed not with assault rifles, but rather pistols and revolvers. Many are perpetrated by hitmen connected to narco-cartels and rival gang members, or as a result of confrontations with soldiers, police and paramilitaries. What is more, most of these weapons are made in the United States. Yet curiously, an empirically robust treatment of the scale and volume of firearms trafficking from the United States to Mexico has yet to be attempted.

The Mexican authorities are patently frustrated with the relentless flow of arms and ammunition from north of the border.[2] Over the past two decades, the media and policy communities have devoted considerable attention to the issue with literally thousands of reports setting out anecdotal evidence of instances of weapons seizures, the types of military and civilian-grade arms collected, and specific trafficking routes from the US into the country.[3] More recently, certain academics have drawn attention to the ways in which policies in the US - including the assault rifles ban - influence the dynamics of homicidal violence in Mexico (Chicoine, 2011; Dube, Dube, & García-Ponce, 2012). And notwithstanding important efforts to trace the provenance of arms retrieved in Mexico, establishing an estimate of the total flow of arms has thus far been elusive.

Most publicly recognized efforts to estimate arms flows from the United States to Mexico have tended to focus on the quantity of arms confiscated at the border. This of course begs the question of what fraction of the total they represent. Our team tackles the problem differently. Using a unique GIS (Geographic Information System)-generated county-level panel dataset (1993-1999 and 2010-2012) of Federal Firearms Licenses to sell small arms (FFLs), we create a demand curve for firearms based on the distance by road from the nearest point on the U.S.-Mexico border and official border crossing, and using a time-series negative binomial model paired with a post-estimation population attributable fraction (PAF) estimator. We do so controlling for determinants of domestic demand (e.g., income, political leaning, population density, and spatial auto-correlation). We are therefore able to estimate a total demand for trafficking, both in terms of firearms and dollar sales for the firearms industry.

Our findings suggest that the scale and volume of firearms trafficking from the United States to Mexico is much higher than widely assumed. Specifically, we find that:

- *A sizeable and growing percentage of US firearms sales are destined for Mexico:* 2.2% (between 0.9% and 3.7%)

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1 The authors gratefully acknowledge Wiebe et al. (2009) for generously sharing their data on Federal Firearms Licensees (FFLs). We also express our thanks to Tilman Brück, Paul Holtom, Neil T. Ferguson, Carlos Vilalta, Daniel Meija, David Neville, Chris Fariss, and Barbara Buckinx for their comments and suggestions on various drafts of this report. The authors bear sole responsibility for any opinions and errors of judgment, fact, or omission.

2 In one prominent example on November 5, 2010, then-President Felipe Calderón expressed his frustration to CBS News correspondent Peter Greenberg: "We seized more than 90,000 weapons...I am talking like 50,000 assault weapons, AR-15 machine guns, more than 8,000 grenades and almost 10 million bullets. Amazing figures and according to all those cases, the ones we are able to track, most of these are American weapons." See CBS News Investigates (2011).

3 See, for example, Muggah and Diniz (2013), who review some 350 articles on US-Mexican trafficking of arms since the mid-1990s.

of U.S. domestic arms sales are attributable to the U.S.-Mexico traffic. This percentage is up from roughly 1.75% (between 0.66% and 3.15%) in 1993;

- *The volume of firearms crossing the U.S.-Mexican border is higher than previously assumed:* 253,000 firearms (between 106,700 and 426,729) were purchased annually to be trafficked over 2010-2012. This number is considerably higher than the 88,000 firearms (between 35,597 and 152,142) trafficked in 1997-1999, during the federal Assault Weapons Ban (AWB);

- *The value of firearms sales destined for Mexico are significant and growing appreciably:* The trade represented annual revenues of $127.2 million (range: $53.7 - $214.6 million) for the U.S. firearms industry during 2010-2012 - nearly four times higher than during 1997-1999, when the trade ran to just $32.0 million (range: $13.0 - $55.4 million);

- *The U.S. and Mexican authorities are seizing a comparatively small number of firearms at the border:* Based on seizure reports for 2009, U.S. and Mexico authorities in recent years have seized just 14.7% (between 8.7% and 35.0%) of total arms bought with the intention of trafficking. Specifically, Mexican authorities have seized roughly 12.7% of the total annual trade while the United States has interdicted around 2.0%.

These findings suggest that the United States is a significant, albeit unintentional, contributor to the global black market in arms and ammunition (and specifically in Mexico). It underlines the point that with domestic gun rights come responsibilities. The analysis also suggests that the United States has been negligent in preventing illegal firearms trafficking and that smarter policies are likely required. The report is divided into several sections. The first section provides a background to the issues surrounding firearms trafficking, including U.S. legislation, the rise of violence in Mexico, and existing studies of the issue. Section two describes our results, including total volume estimates. The final section concludes with a discussion of caveats and policy implications. The Annexes present our methods and econometric results.

Background

The United States is no stranger to gun violence and features among the highest rates of firearm-related homicide and suicide among all industrialized countries. A recent surge in mass shootings in 2011 and 2012 has forced U.S. legislators and civil society groups to rethink the problem of gun violence. The nation was convulsed by the massacres at Sandy Hook Elementary School in Newtown, Connecticut in December 2012 with many commentators wondering if the U.S. had reached a "tipping point" and might rethink gun control. And yet as horrific these events may be, the fact is that gun violence is even more prolific in neighboring Mexico.

After experiencing more than five decades of secular decline in the national homicide rate, Mexico has witnessed a dramatic surge in intentional violence since 2006. Indeed, while estimates of intentional deaths are contested in Mexico, a recent study detected as many as 120,000 homicides in Mexico from 2007 through 2012, and an estimated 60,000 of these were organized-crime-style homicides that frequently involved the use of high-powered firearms imported illegally from the United States (Molzahn et al., 2013, p. 13). The vast majority of these killings are concentrated in just a handful of Mexico's 31 states - though the number of affected districts is rising (Molzahn et al., 2013, pp. 21, 23). It is worth emphasizing that there has also been a very steep incline in the proportion of Mexico's homicides committed

with firearms from a low of roughly 10% in the early 1990s to a high of more than 50% in 2011 (Krause, Muggah and Gilgen, 2011, p. 132).

Although there is some debate over the proportion of U.S. guns smuggled into Mexico, there is no doubt that the United States is the world's largest manufacturer and supplier of firearms. According to one recent estimate, U.S.-based manufacturers produced more than 98 million handguns and shotguns for domestic sale since the mid-1980s (Brauer, 2013, p. 10). Assuming more than 2,200 manufacturers, Brauer (2013, p. 11) counts on average 4.24 million guns produced in the United States each year. It also appears that around 40 per cent of production is concentrated in just three major companies. What is more, the U.S. has a highly permissive regulatory environment for the production, sale, purchase, and ownership of firearms. According to the 2004 national firearms survey conducted by Hepburn, Miller, Azreal, and Hemenway (2007), there are an estimated 218 million privately owned firearms in the United States. One in four U.S. citizens (26%) and two in five households (38%) owned a firearm, nearly half of all individual gun owners (48%) possessed four or more firearms, and 20% of all individual gun owners held 65% of all firearms.

While the United States is the most heavily armed country on the planet, Mexico can hardly be described as a heavily armed society. Mexico is a modest producer of firearms and ammunition.[4] With between 2.45-2.5 million registered gun owners and around 15.5 million more illegal arms in circulation (Godoy, 2013), the country has a ratio of roughly 15 guns for every 100 people.[5] This is at least six times less than the United States and well below the global average (Small Arms Survey, 2011). Described at length below, Mexico also features restrictive gun legislation. However unlike in the United States, civilian possession in Mexico is considered a privilege not a right, and is tightly regulated under federal law. Moreover, there is just one single legal firearms retailer in Mexico compared to around 51,300 retail gun shops and around 7,400 pawnshops with a license to deal in guns in the United States in 2012 (ATF, 2013).

Both the United States and Mexico have enacted legislation to strengthen firearms regulation over the past decades. Specifically, the Federal Assault Weapons Ban (AWB), or Public Safety and Recreational Firearms use Protection Act, was adopted in the United States as part of the Violent Crime Control and Law Enforcement Act of 1994. The 10-year ban went into effect on 13 September 1994, and was not renewed upon its expiration in 2004. Although some states such as California maintained the ban, most allowed the selling and ownership of previously banned weapons. As Figure 1 illustrates, the period during which the AWB was in effect was characterized by low levels of firearms manufacture and import, relative to preceding and subsequent years.[6] The period also saw the dramatic decline in FFLs, though FFL numbers did not experience a rebound in subsequent years, implying that since 2004, a growing number of firearms are on the U.S. market, sold by a dwindling number of retailers. Nor are the effects of the AWB limited to the United States: Chicoine (2011) has estimated that the expiration of the AWB is responsible for a rise of at least 16.4% in the homicide rate in Mexico over the 2004-2008 period. Moreover, homicide rates across the border from California, where assault weapons sales continued to be banned after 2004, remained relatively low (Dube et al., 2012).

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4 See http://workshop.chromeexperiments.com/projects/armsglobe/ for a review of export and import trends.

5 Mexico's national defense ministry reported in 2011 that it had 2.45 million registered weapons, including .38 pistols, rifles and shotguns for hunting and target shooting, followed by semi-automatic pistols.

6 It should be noted, however, that the anticipation of the ban taking effect caused a run on military-style weapons, causing prices and production to rise in the short-run. See Koper and Roth (2002).

Figure 1. **Number of firearms manufactured, imported, exported, and available for sale (primary vertical axis), and federal retail licenses (secondary vertical axis), 1986-2009**
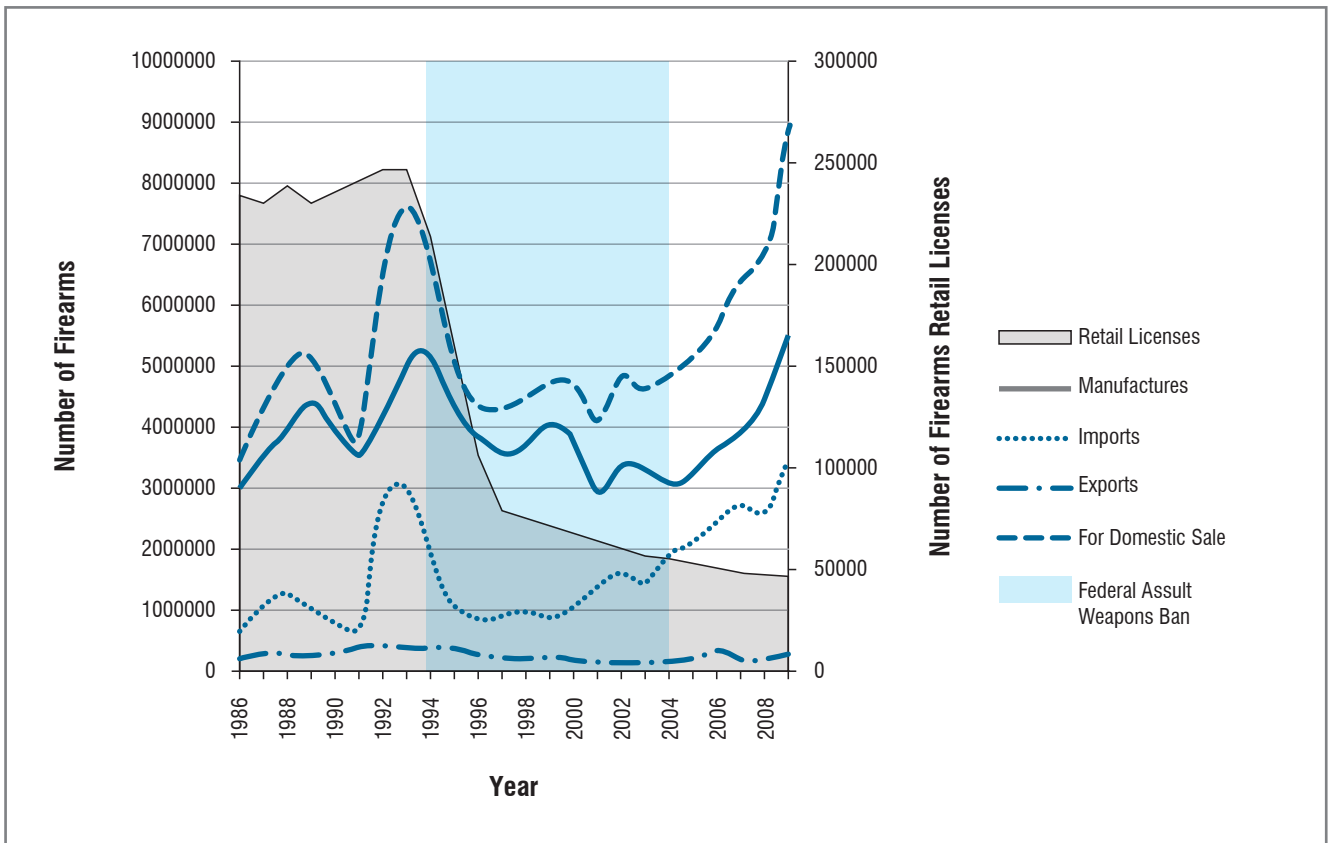
Source: ATF (2011); graph by the authors.

The U.S. domestic firearms market is also large by dollar volume of sales. Figure 2 illustrates an imputed dollar volume of the market from 1983 to 2000, based on excise taxes collected by the Internal Revenue Service (IRS) and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). In advance of the AWB taking effect, the annual volume spiked to over $2.3 billion in 1993. We project, based on sales volume, that revenues were over $4.3 billion in 2009, the last year of the data reported in Figure 1, and perhaps as high as $6.7 billion in 2012.

Figure 2. Domestic revenue volume of the U.S. firearms industry in thousands of U.S. Dollars, 1983-2000[7]
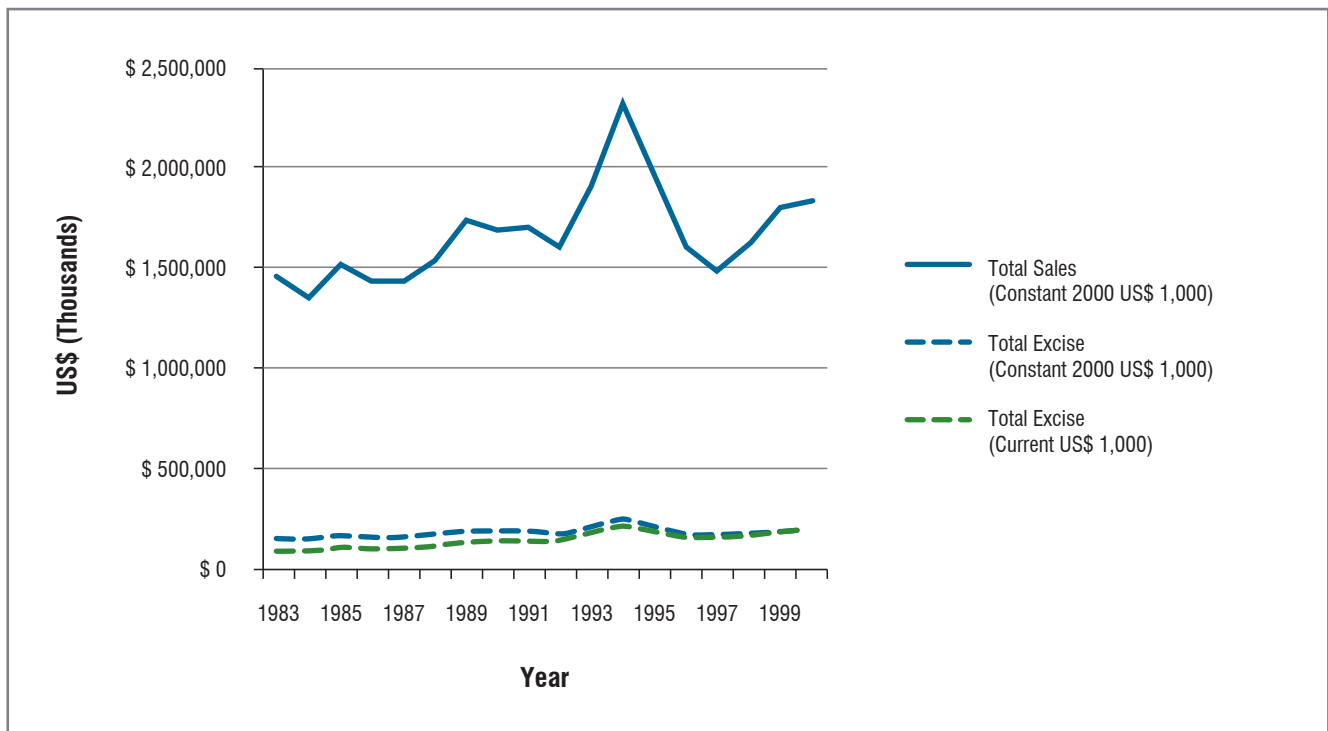
Source: ATF (2002) and the authors; graph by the authors.

The large number of guns available in the United States is facilitated by a widespread availability of retail firearm licenses, permissive import regulations, and largely unregulated, owner-to-owner "kitchen-table" sales. This ensures that many types of low- and high-caliber firearms, ammunition, and explosives are legally available for purchase in the United States. Moreover, the fact that only 5% of all registered gun dealers in the United States are inspected annually (Marks, 2006), suggests that there are few checks against illicit practices such as sales to "straw purchasers," who buy guns for the purpose of illegal resale or trafficking (Violence Policy Center, 2009). Part of the difficulty of achieving more effective firearm regulations is that powerful U.S. gun lobbies have hamstrung efforts to enforce existing laws or otherwise regulate access to deadly, high-powered weapons in the United States (Violence Policy Center, 2010, 2011).

Mexico, in contrast, maintains significant restrictions on firearms. While the Mexican Constitution allows Mexicans to carry arms, Mexico's Federal Firearms and Explosives Law and other supporting legislation strictly regulate the possession and sales of firearms, ammunition, and explosives.[8] Current restrictions on firearms in Mexico date back to the period of civil unrest in the late-1960s, which led to a tightening of regulations, and included the closure of retail firearm dealers and federal requirements for the registration of all firearms. While law enforcement and military personnel are permitted to use firearms by Article 160 of the country's federal criminal code, the Mexican army (SEDENA) oversees

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7 Excise tax rates are 10% on pistols and revolvers, 11% on other firearms and ammunition. Disaggregated volumes of excise volumes for different types of sales are based on 1996 relative percentages, as ATF stopped collecting those statistics that year. Until FY 1990, the Internal Revenue Service collected excise taxes. ATF assumed the collection in FY 1991.

8 Article 10 of the Mexican Constitution, amended in 1971, states that Mexicans have a "right to possess arms in their homes for their security and legitimate defense with the exception of those prohibited by federal law and those reserved for the exclusive use of the Army, Navy, Air Force, and National Guard. Federal law shall determine the cases, conditions and place in which the inhabitants may be authorized to bear arms."

the sale of all firearms to private individuals through the Federal Arms Registry. Indeed, person-to-person firearm sales are prohibited by Article 164 of the criminal code. There are also strict penalties under Article 162 of the federal criminal code for ordinary citizens who possess or carry firearms without authorization.[9] There are also restrictions on the caliber of firearms that ordinary citizens may possess, which is limited to .380 or less (.357 magnum and 9mm are also prohibited) and in practice the lawful possession of firearms above .22 caliber is limited by the difficulty of obtaining permits to do so. Hunters and target shooters may obtain licenses for firearm possession, and gun collecting is allowed with some exceptions.

On the other hand, despite these strict regulations, there is a large volume of illegal firearms in Mexico. Aaron Karp (2012) estimated that there are as many as 15.5 million illicit small arms held by civilians. This compares to 655,000 weapons held by law enforcement and paramilitaries and 505,000 in military hands, roughly 1.18 million in total. In what likely amounts to an overstatement, in 2012, the Mexican military estimated that only one-third of one percent of firearms in Mexico is legally registered, and 90% of all firearms are used for criminal purposes (Reyes Maza, 2012). Indeed, the Mexican federal government has seized a large number and wide array of arms in recent years (see Figure 3).[10] The federal police have also detected a growing proportion of high-powered weapons (including 9mm pistols, .38 caliber "super" pistols also known as cop killers, .45-caliber pistols, and AR-15 and AKM-type assault rifles, grenades, and rocket-propelled grenade launchers).[11]


PHOTO: STEVEN DUDLEY

9 In December 1998, the Mexican Congress enacted legislation relaxing unintentional violations involving a single gun (by tourists): first-timers are fined $1,000, but not imprisoned. Previously, they would face 5 to 30 years in jail. However, these relaxed standards do not apply for military weapons or calibers.

10 According to the authorities, some 140,000 weapons have been seized since 2006. A very similar number - 134,881 - were recovered this way during a similar campaign in 1988-1994 (Godoy, 2013).

11 From January to June 2008, 7,645 weapons were seized, compared to only 3,801 during the same period for the previous year. Particularly disturbing was the increase in the proportion of rifles (armas largas), which went from 1,877 or 49.3% of weapons seized in the first half of 2007 to 4,465 or 58.4% of weapons seized in the first half of 2008 (Calderón, 2008, p. 24).

**Figure 3.** Firearms seizures by U.S. and Mexican authorities, 2006-2009
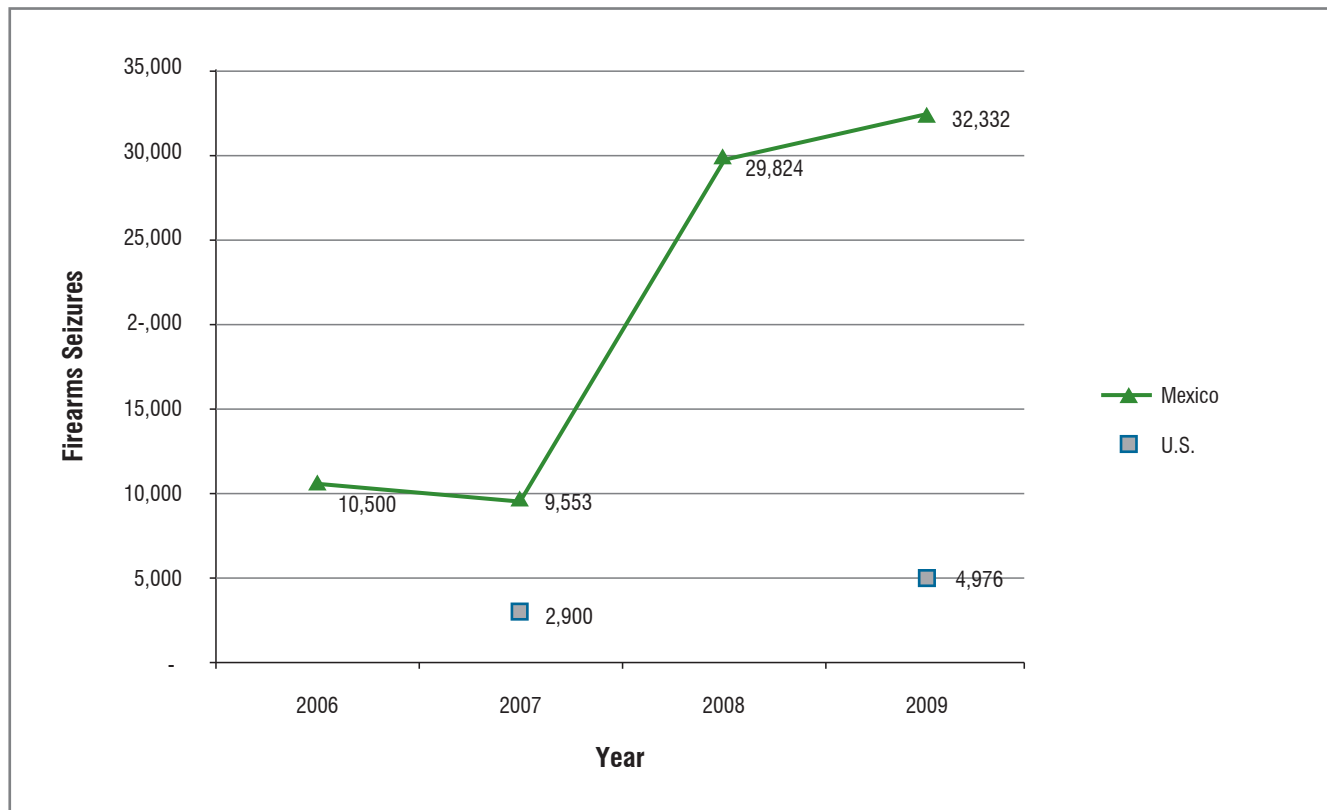
Source: Goodman and Marizco (2010, p. 170, 175-6); data on U.S. seizures are approximate for 2007, and missing for 2008.

U.S. and Mexican authorities recognize that a large quantity of firearms, ammunition, and explosives sold legally in the United States are trafficked illegally into Mexico, primarily through overland smuggling routes across the 2,000-mile U.S.-Mexico border (Goodman & Marizco, 2010; Violence Policy Center, 2009). ATF efforts to trace firearms provided in Mexico have consistently found that an overwhelming proportion of firearms - as high as 90% - came to Mexico from the United States (Serrano, 2008).[12] For example, a 2007 ATF trace of firearms confiscated in Mexico found that 1,805 (73.5%) of 2,455 firearms came from three of the four U.S. border states: Arizona, California, and Texas (Marks, 2006). Likewise, a Government Accountability Office (GAO) report found that of 4,000 weapons traced by ATF (from an original sample of 7,200 serial numbers sent from Mexico), some 3,480 (87%) could be traced to US dealers (McGreal, 2011). The accessibility of firearms in the border region is facilitated by the existence of an estimated 6,700 FFLs in the border region, which represent more than 12.5% of all registered gun dealers in the country.[13]

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12 In May of 2010, the Mexican Government claimed that around 80% of the firearms it had seized in the preceding three years had come from the U.S. (Goodman & Marizco, 2010, p. 170)

13 Estimates for the number of gun shops along the border vary. In September 2007, George Grayson estimated the number at 1,200. In January 2008, Mexican Ambassador Arturo Sarukhán criticized the availability of weapons along the border: "Between Texas and Arizona alone, you've got 12,000 gun shops along that border with Mexico. And a lot of these gun shops provide weapons that feed into organized crime in Mexico, so we really need the support of the Unites States." The figure 6,700 - three dealers for every mile along the border - has been U.S.ed in reports about the number of gun shops along the border. See: George Grayson, "Drug War Allies," San Diego Union Tribune, September 2, 2007; Alfredo Corchado and Tim Connolly, "Analyst: U.S. anti-drug aid proposal could heighten violence in Mexico," Dallas Morning News, January 3, 2008; Richard A. Serrano, "U.S. Guns Arm Mexican Drug Cartels," Los Angeles Times, August 10, 2008.

Figure 4. **Venn diagram depicting the relationship of total firearms purchased in the U.S. to various sub- and super-set of firearms**
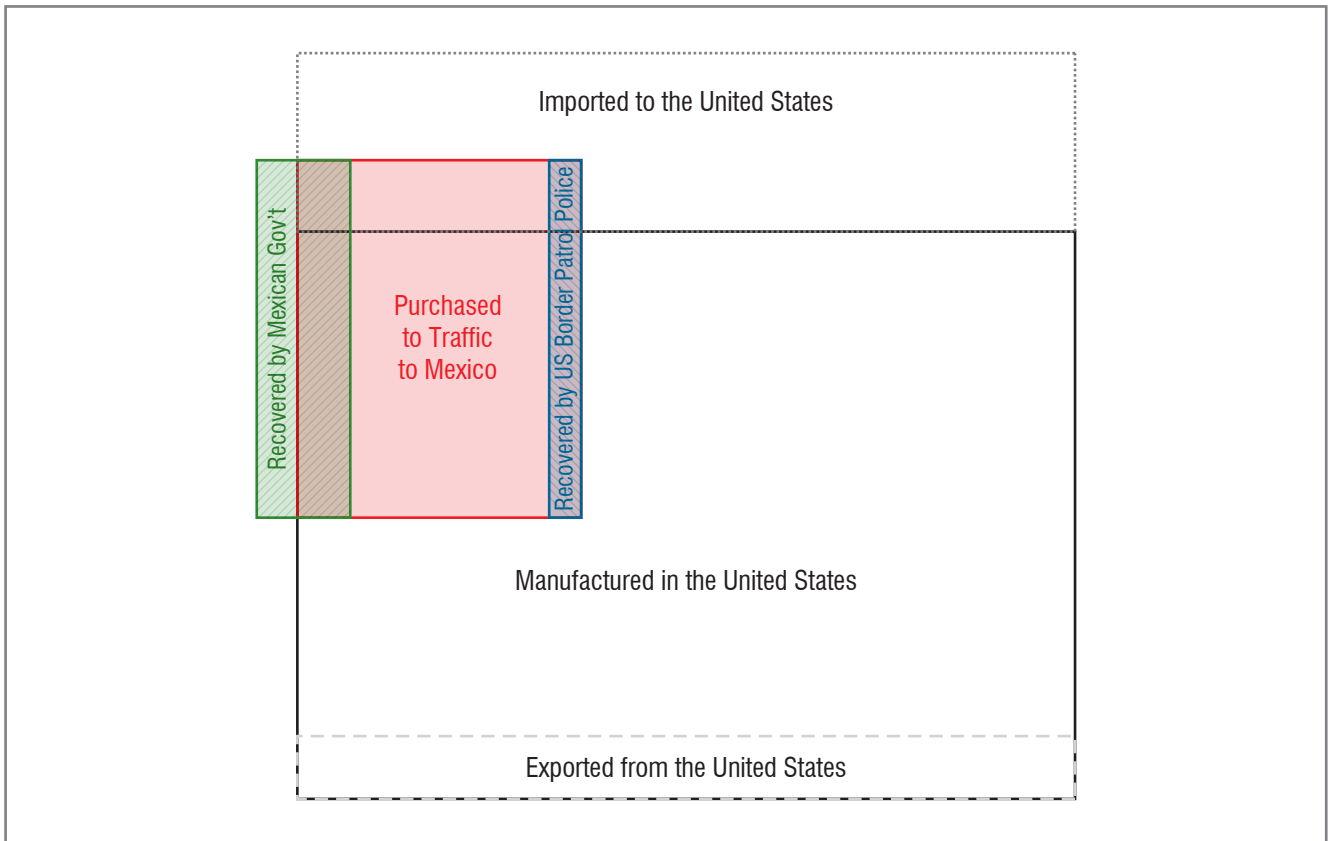
Source: The authors. For illustrative purposes only; box sizes not proportional to actual volumes.

United States and Mexican authorities have long attempted to measure the total flow of arms trafficking across the border. Two types of data are routinely examined with the expectation of determining the total size of the illicit trade: (1) firearms seizures by U.S. authorities of firearms bought or transported with the intention of being trafficked across the border; and (2) weapons seized by Mexican police and subsequetly traced back to a purchase occurring in the United States (Goodman & Marizco, 2010). Figure 4 provides a graphic representation of the relationship between the various subsets of firearms. The total volume of firearms for sale on the domestic market is taken as the total manufactured plus total imported minus total exported ($M+I-X$). Of that number, some quantity is purchased with the intention to traffic. And from this number, some subset of arms is recovered by U.S. law enforcement. Another, mutually exclusive, subset of trafficked arms is recovered by Mexican authorities, along with firearms that were acquired outside of the United States, such as Central America and elsewhere.[14]

Based on U.S. prosecutions in 2009 alone, 4,976 firearms were bought with the intention to traffic over to Mexico. This number corresponds to that part of the red box in Figure 4 marked by diagonal blue stripes. It is also much lower than the Mexican government's reported number of firearm seizures for the same year of 32,332 (Goodman & Marizco,

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14 Indeed, the U.S. State Department reported in 2009 and 2010 that roughly 90% of all heavy weaponry seized from organized crime groups in Mexico– including grenades and rocket launchers – heralded from Central America where they appeared to have been stolen fromm national armed forces and trafficked north. The Mexican Defense Ministry (SEDENA) also confirmed similar trends in relation to the Zetas (Fox, 2012).

2010, pp. 170, 176), which corresponds to the entirety of the green striped box. The Mexican government claims that of the approximately 75,000 firearms seized between 2007 and 2010, roughly 80% were trafficked from the United States (Goodman & Marizco, 2010, p. 170). Those 20,000 or so firearms per year correspond to the portion of overlap between the red and green boxes in Figure 4.

As noted in the introduction, there are comparatively few academically robust attempts exist to estimate the total volume of arms purchased for trafficking. Goodman and Marizco (2010) have perhaps the most comprehensive study available on the U.S.-Mexico firearms traffic, although their assessment is limited to a qualitative treatment of the subject. For example, rather than estimating discrete flows, they focus on the types of firearms most usually trafficked, how Drug Trafficking Organizations (DTOs) are using those firearms, the principal methods for buying and transporting the weapons, and so on. Any attempt at estimating the total traffic from firearms seizures will suffer from the obvious disadvantage of relying upon educated guesses of the percentage of total traffic that the confiscations represent. Rather than reproducing this accounting method, we have elected to use FFLs to retail as a proxy indicator for demand and attempt to isolate the effect of purchasers intending to traffic firearms across the U.S.-Mexico border on that demand.

Results

Proximity to the U.S.-Mexico border proved a significant and stable predictor of number of FFLs in each county. Table 7 (in Annex B: Econometric Results) contains the results of econometric models estimating the number of FFLs as a function of distance from the nearest border crossing (distance is broken into deciles), time period, and an interaction between distance and period. The coefficients for the categorical distance variable are uniformly highly significant, and robust and stable in both sign and magnitude under a number of different tested control models. The results of Model 3 are illustrated in Figure 5, and effectively represent a toggled demand curve, with the "price" (in decile distance) on the horizontal axis and the quantity (in FFLs) on the vertical axis. Clearly visible is the downward trend in numbers of FFLs overall, as well as the demand effect of U.S.-Mexico border proximity. Less visible, however, is the fact that U.S. FFLs are becoming increasingly dependent upon demand originating south of the border, as discussed below.

Figure 5. Adjusted predictions of number of FFLs per county, given its decile distance from the U.S.-Mexico border
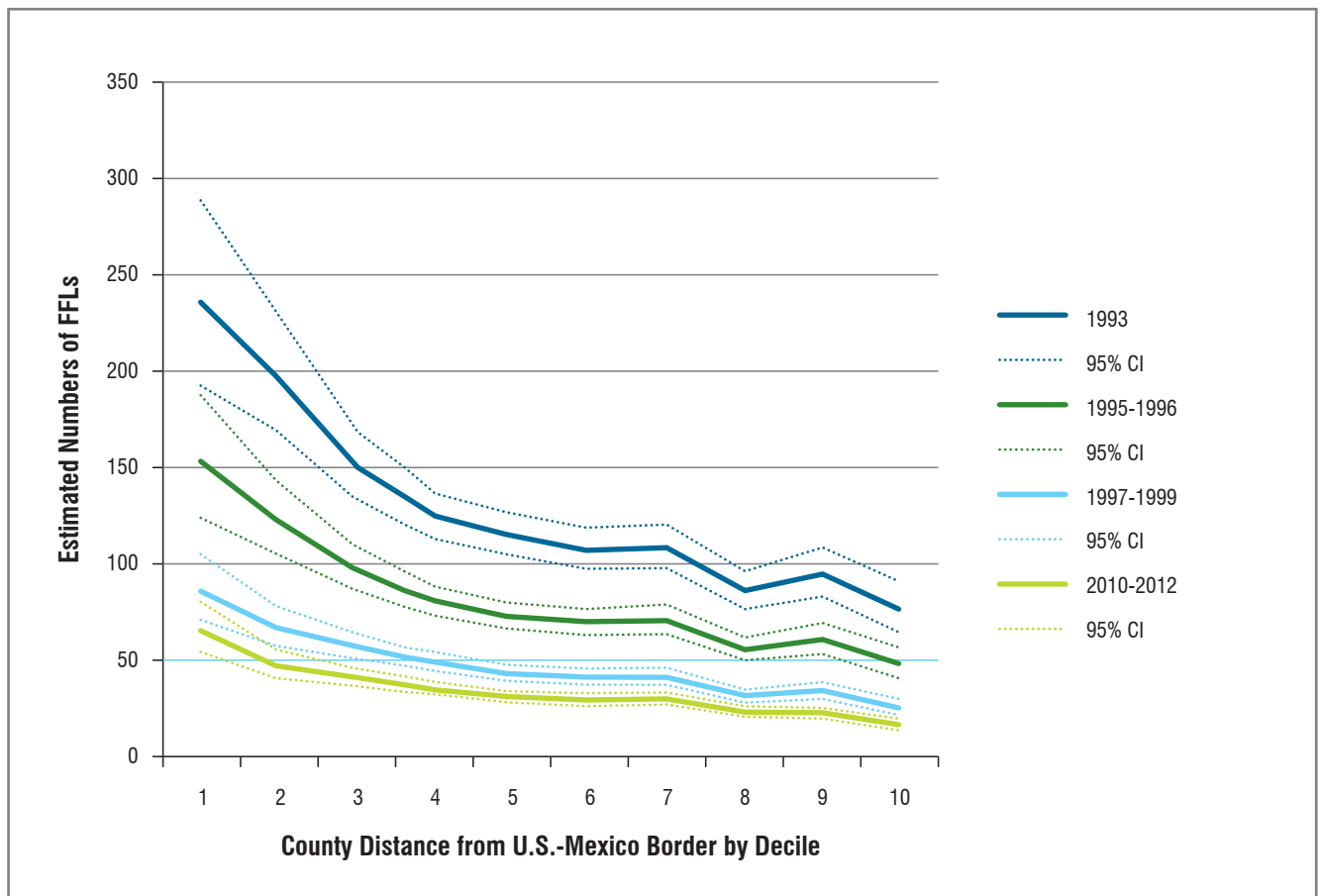
Note: Confidence interval between dashed lines; based on Model 3.

Given the regression results, the population attributable fraction (PAF; see Annex A: Methodology: Post-Estimation Analysis) of FFLs - that is, the percentage of FFLs "attributable" to the U.S.-Mexican arms trade - is given in Table 1. It is important to note that the PAF does not tell us the volume of total U.S. demand for firearms attributable to U.S.-Mexico traffic. Rather, it estimates a percentage of FFLs that would go out of business if the distance from Mexico were to be increased to the maximum within the continental United States (for more on this, see Rowe, Powell, & Flanders, 2004).

Table 1. Population Attributable Fractions of FFLs on Exposure to Mexican Demand

Period	Estimate	95% LB	95% UB
1993	37.4%	28.2%	45.0%
1994-1996	36.7%	28.1%	44.0%
1997-1999	41.8%	33.8%	48.3%
2010-2012	46.7%	39.4%	52.7%

The above interpretation of the PAF suggests that the absence of traffic demand would imply a decrease in total demand at least equal to profit margins for the corresponding number of businesses. To calculate the total volume of the U.S.-Mexico trade, we must make some basic assumptions about the profit margins in the firearms retail business.

Informal communications with gun manufacturers and retailers suggest that it is reasonable to assume a roughly 15% markup on firearms at retail outlets on the primary market, with much larger markups for accessories. Perhaps around half of the increase will then go to paying overhead costs, bringing the profit margin down to around 7%. However, the size of the retailer obviously matters a great deal, and so we have included low-end, mid-range, and high-end estimates of FFL profit margins.[15] We approximated low-end margins by averaging those of gas stations (around 1.68%) and food and beverage stores (at around 3%). We derived a mid-range estimate by averaging the profit margins of hardware stores (4.45%), electronics stores (4.68%), and general stores (4.91%). We took the 7% figure above as representing a high-end estimate. Using these estimates, we derived low-end, mid-range, and high-end estimates of U.S. domestic arms sales attributable to U.S.-Mexico traffic (see Table 2).

Table 2. Assumed Profit Margins and Resulting Estimates of Total U.S. Domestic Arms Sales Represented by U.S.-Mexico Firearms Traffic

Profit Margin	4.68%	2.34%	7.00%
Period	Mid-Range	Low-End	High-End
1993	1.75%	0.87%	2.61%
	(1.32%, 2.11%)	(0.66%, 1.05%)	(1.97%, 3.15%)
1994-1996	1.72%	0.86%	2.57%
	(1.32%, 2.06%)	(0.66%, 1.03%)	(1.97%, 3.08%)
1997-1999	1.95%	0.98%	2.92%
	(1.58%, 2.26%)	(0.79%, 1.13%)	(2.37%, 3.38%)
2010-2012	2.18%	1.09%	3.27%
	(1.84%, 2.46%)	(0.92%, 1.23%)	(2.76%, 3.69%)

Multiplying the above percentages by the total number of firearms sold on the U.S. domestic market, we can obtain the total number trafficked in each period. The results are shown in Table 3.

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15 On profit margins, see Butler Consultants (2012).

Table 3. **Estimated Total Volume of Arms Trafficked from the U.S. to Mexico by Period**

Period	Mid-Range	Low-End	High-End
1993	134,045 (101,086; 161,460)	67,023 (50,543; 80,730)	200,495 (151,197; 241,501)
1994-1996	92,001 (70,440; 110,041)	46,000 (35,220; 55,020)	137,608 (105,359; 164,591)
1997-1999	87,890 (71,194; 101,718)	43,945 (35,597; 50,859)	131,460 (106,487; 152,142)
2010-2012[16]	252,906 (213,400; 285,299)	106,700 (106,700; 142,650)	378,279 (319,188; 426,729)

We next monetized the value of these estimated volumes. We began by back-calculating the total domestic revenues of the firearms industry from the reported volume of excise taxes collected on domestic firearms and ammunition sales and their relative excise tax rates (see Figure 2 above) (ATF, 2002). We then applied the same percentages derived above to obtain the total monetary value of the U.S.-Mexico firearms traffic. We arrived at an annual dollar volume of around $127 million in 2010-2012.

Table 4. **Estimated Dollar Volume of Arms Trafficked from the U.S. to Mexico by Period (US$1,000)**

Period	Mid-Range	Low End	High End
1993	$ 33,425 (25,207; $40,261)	$ 16,713 ($12,603; $20,131)	$ 49,995 ($37,702; $60,220)
1994-1996	$ 33,724 ($25,821; $40,337)	$ 16,862 ($12,911; $20,169)	$ 50,443 ($38,621; $60,334)
1997-1999	$ 32,013 ($25,931; $37,047)	$ 16,006 ($12,966; $18,525)	$ 47,882 ($38,786; $55,415)
2010-2012[17]	$ 127,167 ($68,583; $190,207)	$ 107,302 ($53,651; $160,495)	$ 143,455 ($71,727; 214,569)

Our estimates of numbers of firearms trafficked far exceed the total volume seized by both the Mexican or American governments combined in recent years - that is, around 5,000 and 32,300 by the U.S. and Mexican authorities respectively in 2009 (Goodman & Marizco, 2010, p. 170, 176)). The mid-range estimate implies that the combined seizures of roughly 37,000 firearms by Mexican and U.S. authorities represent roughly 14.7% (between 8.7% and 35.0%) of the weapons bought for trafficking in recent years.

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16 These numbers are based upon revenue projections, which are in turn based upon sales projections for 2010-2012.

There are at least three possible ways our methodology might have over-estimated the demand arising from U.S.-Mexico trafficking. First, proximity to the Mexican border may be a proxy for domestic factors, rather than the U.S.-Mexico firearms trade. One possible example is the so-called "Minutemen" militia, a group of self-appointed citizen border patrollers who carry firearms. Law enforcement officers associated with border security - for example, ICE and CBP officers - may themselves contribute to demand. Another example of this type of unaccounted-for domestic demand, legal or undocumented immigrants may tend to settle close to the border, and may also exhibit a greater per capita demand for firearms than the American populace at large. Alternatively, border communities may also purchase more firearms in response to immigrant influxes (though large immigrant communities are hardly unique to the U.S.-Mexico border region). However, the Minutemen are a relatively small group. Moreover, we have controlled for net immigration and crime rates, and our results persist.

The second possible reason for the high numbers is that the FFL size may itself vary in response to proximity of the border. That is, the demand for firearms exerted by U.S.-Mexico trafficking demand may make it preferable for FFLs to become smaller but more numerous, and therefore harder to police for the United States authorities, in this case the ATF. A parallel from the (legal) tire trade may support this possibility. The United States exports large numbers of used and waste tires to Mexico. However, Mexican states issues quotas to restrict the total number of tires that may cross the border. Consequently, some large tire shipments may to be transported by semi to depots near the border. There, informal, unpermitted drivers in pickup trucks load them up and cross in non-commercial lanes at official ports of entry (Institute for Regional Studies of the Californias, 2009, p. 15). A similar splintering of the market to hamper the enforcement of regulations may be at work in the U.S. firearms market. As we have no records for volume of firearms sold at specific FFLs or even within specific counties, we cannot discount this possibility.

The third reason for such high numbers is that what traffic exists may include volumes en route to destinations other than Mexico, be it in Central and South America, or even elsewhere around the globe. And yet economic logic dictates that the flow of weapons is likely coming from the other direction - that is from Guatemala into Mexico - rather than the other way around. Indeed, the region experienced a succession of civil wars during the 1980s and 1990s and a sizeable stockpile of left-over materiel is known to exist. A wide variety of non-U.S. weaponry has been identified in Mexico, including Soviet-era RPG-7s, Korean fragmentation grenades, M60 machine guns, Chinese TK-56s and others suggesting alternate sources than the United States.

On the other hand, there are three strong reasons to believe that our estimates are conservative. Indeed, we assumed that the level of demand exhibited by the U.S.-Mexico firearms trade is zero in the 10% of counties situated farthest from the U.S.-Mexico border. In fact, this may not be so. We see evidence of heightened demand in the 9th decile relative to the 10th (see Figure 5 above), and there is nothing to say that if the United States stretched farther north, demand would not be felt there, as well. Mexican DTOs have operations stretching into the northernmost reaches of the United States and even Canada. The National Drug Intelligence Center (NDIC) (2009) reported the presence of DTOs over the period 2006-2008 in such northern U.S. cities as Bellingham, WA; Bismark, ND; Buffalo, NY; and even Portland, ME (cited in Finklea, Krouse, & Rosenblum, 2011, Figure 2, p. 8). Since the assumption of zero demand in the 10th decile of U.S. counties need not be the case, our estimates may not be counting a latent level of demand underlying all deciles.

What is more, our calculation of the percentage of U.S. domestic sales represented by the U.S.-Mexico traffic rested on the very minimum amount of demand decrease that could possibly cause an FFL to close. To the extent that an FFL

might run budget deficits for a number of years before finally closing, the decrease in demand required to put an FFL out of business may be larger than here assumed. Finally, our estimates derive solely from data on regulated, above-board sales occurring in ATF-licensed stores. To the extent that such venues may be under closer scrutiny by the ATF than gun shows and private sales, the population of FFLs is likely to exhibit attenuated effect sizes for U.S.-Mexico traffic demand relative to the wider group of firearms sales outlets.

If our estimates are broadly correct, Mexico presumably absorbs some proportion of the trafficked firearms, while passing on the remainder to other countries and serving as a crossroads in the international firearms trade. Shirk (2011, p. 7) reports that roughly 450,000 people depend upon the drug trade in Mexico for their livelihood. If these individuals are the only buyers of arms, on average, each of them would have to purchase 0.56 firearms per year in order generate the volume of demand we are here estimating. In fact, DTOs may not represent the entirety of Mexican demand. Illegal traffic may be going to buyers in the general Mexican population (currently estimated at 117 million) that are not affiliated with DTOs. Demand for firearms for personal protection might logically rise in an increasingly dangerous country. Moreover, legal traffic may be taking place as well, if Mexican police forces, and others purchase from FFLs in U.S. border states. Nevertheless, the possibility of a large transnational trade remains. For instance, Goodman and Marizco (2010, p. 167) report that, of 339 firearms sold by an FFL in Houston, Texas in 2007, 88 were seized by Mexican authorities, while an additional four were recovered in Guatemala. If the recovered arms in this instance are representative of the larger trends in firearms trafficking, at least 4% of arms trafficked from the United States continue to destinations other than Mexico.

Discussion

Our study has taken a first step toward assessing the magnitude of firearms trafficking from the United States to Mexico. We have suggested that the traffic represents a major source of revenue for U.S. domestic firearms retailers, without which, roughly 47% of FFLs would cease to exist. Moreover, we have suggested that current efforts to seize weapons as they are being trafficked are probably only around 15% effective.

This last point is important, as it implies that, even with the necessary investments in technology, personnel, and infrastructure at ports of entry, simply outlawing firearms trafficking may not adequately stem the illegal trade. And while outlawing straw purchases will be of key importance (s long as the ATF is trained and allowed to carry out audits and investigations of gun distributors), thinking outside of the "ban it" box may pay off. We list a small selection of possibilities below:

- **Publish disaggregated data on gun sales:** Providing data on where gun sale tax revenues are allocated by county would help to determine an approximate number of guns being sold in specific parts of the border region, thereby helping law enforcement to identify unusual activity that should be investigated.

- **Undertake more sophisticated background checks:** A "clean record" is, by definition, an unhelpful criterion when identifying possible straw purchasers. The National Institute of Justice should call for research and analysis to help develop methodologies for identifying straw purchaser profiles that could be used to trigger further investigation of illicit purchases of firearms when an individual submits an application for a background check.

- **Prohibit cash transactions for gun purchases along the U.S.-Mexico border:** Border states or the federal government should enact legislation to prohibit the use of cash to purchase firearms along the border. Requiring a check or credit card for all firearms and ammunition purchases with an FFL will help to ensure that funds used to buy guns at legitimate establishments will not originate from illicit business activities.

- **Support the development of a Mexican gun seizure database:** While current U.S. laws prevent ATF and other government agencies from storing information on firearms and traces, Mexican authorities can and should consider establishing their own database of illegal firearms seized. Such a resource could prove useful in combatting crime domestically, but would also be an asset in working with U.S. authorities to investigate illegal gun trafficking.

- **Increase ATF-FFL Cooperation:** The majority of FFLs are law-abiding businesses. They may appreciate a chance to work with the ATF to determine more effective mechanisms for government regulation, industry self-regulation, and reporting.

This paper represents the start, not the end, of an investigation into the dynamics of small arms trafficking from the United States to Mexico. The methodology applied in this assessment can also potentially be used to answer a number of related questions. Research questions that we intend to pursue include estimating the:

- Proportion of traffic that passes through official ports of entry, versus other stretches along the border;

- Respective contributions to the U.S.-Mexico firearms traffic that each state represents, both in absolute terms and relative to its population;

- Intended and unintended impacts of state-level gun (and other) legislation on the U.S.-Mexico firearms traffic;

- Implications of armed violence in Mexico, Central and South America, and elsewhere on trends in U.S.-Mexico firearms traffic;

- Consequences of the impact of the supply of firearms on U.S. markets on the occurrence of violence in Mexico, Latin America, and elsewhere; and

- Outcomes of state and federal gun control measures in the United States on U.S.-Mexico firearms traffic.

In the aftermath of mass shootings in the United States, not least Sandy Hook Elementary School where twenty children and eight adults were gunned down last year, there are signs that arms control is back on the domestic agenda. Discussion has once again turned to the re-introducing a ban on assault rifles, closing the so-called gun store loopholes, and promoting (public) research on the effects of gun violence. Vice President Biden proposed the criminalization of straw man purchases, which is a step in the right direction. But this paper demonstrates that smarter solutions are required. The fact is that the United States can no longer externalize the costs of inadequate firearms regulation. Given the sheer quantity of arms flowing across the border to Mexico, the United States must assume a shared responsibility to act.

Annex A: Methodology

Data

We begin by noting the possibility that FFLs may tend to cluster at the U.S.-Mexico border in numbers disproportionate to the local U.S. population they might serve. Figure 6, a scatterplot of FFLs in each county as a function of distance from the border, illustrates this relationship and reveals a number of elevated data points in the range of 0 - 700 Km from the border.

Figure 6. Scatterplot of FFLs in each county as a function of distance from the border
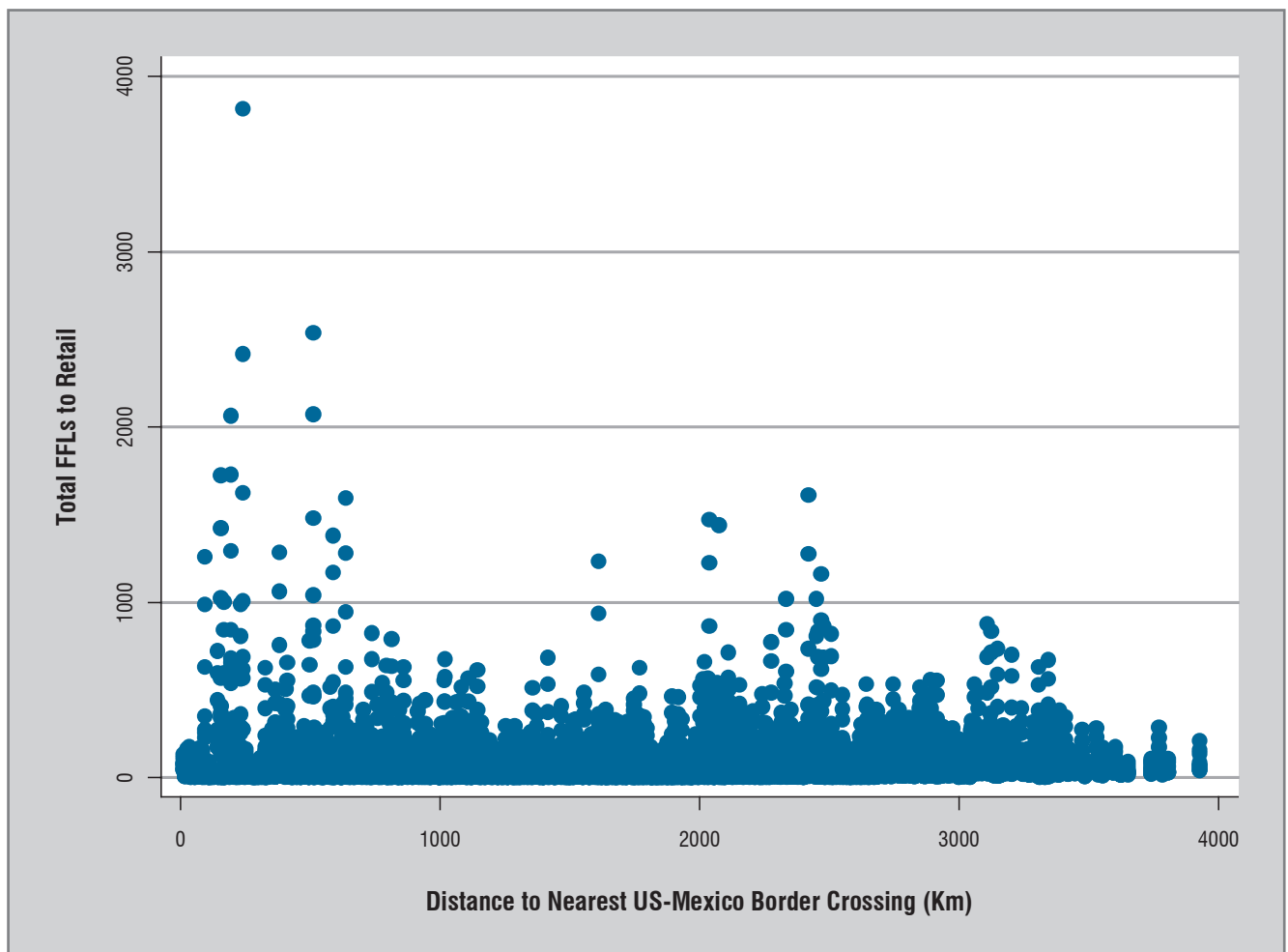

We take the presence or absence of a firearms retail outlet as a proxy for the degree of success of a local business, and therefore an indicator of demand. Such a method is supported by Della Vigna and La Ferrara (2010), who propose a similar method to detect illegal arms trades by measures of business success (though they take as their indicator stock prices of arms companies, and not the presence or absence of retail licenses). U.S.-Mexico traffickers all incur the risk of jail time and punitive fines in attempting to cross the border, and so we disregard those costs entirely. Distance from the border varies drastically by U.S. county, however, and presents two principal costs to traffickers in the form of fuel and time. Therefore, distance from the border may be regarded as giving price signals to potential firearms purchasers intending to traffic the goods across the border. The negative relationship between those price signals and the quantity of

FFLs in any given U.S. county are the basic ingredients for the construction of a demand curve for U.S.-retailed firearms sold to buyers with the intent to traffic.

We have data covering two separate, contiguous time periods: 1993-1999 and 2010-2012. We include in the outcome variable, FFLs, both "Type 1" (firearms dealer) and "Type 2" (pawnbroker) licenses issued by ATF. Following Wiebe et al. (2009), we exclude all other licenses. This is primarily because other types of FFLs do not allow for retail of firearms, but rather their manufacture, import, collection, and so on. *Figure 7* shows the number of FFLs by type over a 35-year period. Striking is the precipitous decline in dealer (Type 1) licenses, and the concomitant rise in collector (Type 3) licenses. Most others are relatively small in number.

Figure 7. **Federal Firearms Licenses (FFLs) by type, 1975-2010**
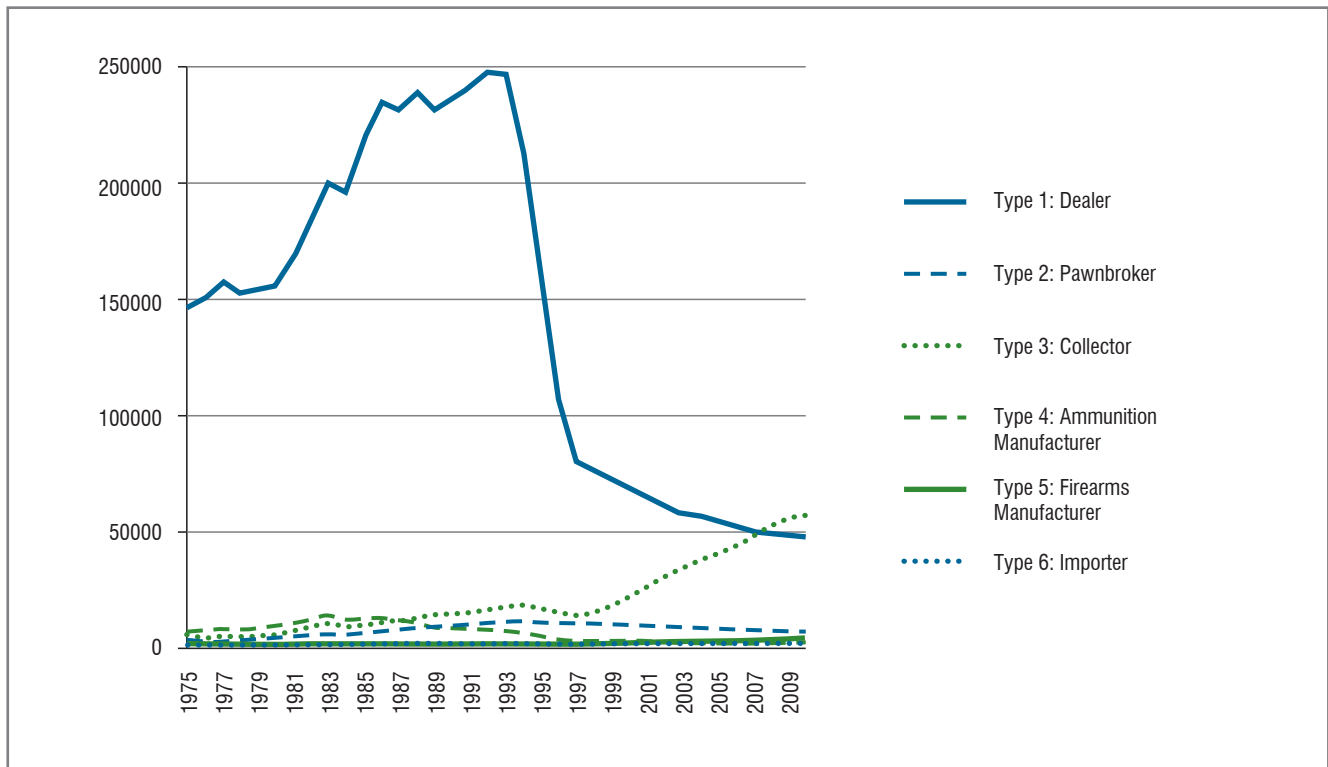
Source: ATF (2011); graph by the authors.

Of course, in order to isolate the effect of distance from the U.S.-Mexico border on level of economic demand, we must first control for the local (and other) demand for firearms. We do this with a series of variables listed in Table 5. DCB represents the distance from the Canadian border, and might be used to estimate the overland economic demand for firearms from Canada. We also split our data into four periods, manifest in the variable $Period$. $Period$ is defined as a 1 for pre-AWB 1993, and the deals with the remaining 12 years by even splits: 2 = 1994-1996, 3 = 1997-1999, and 4 = 2010-2012

Other control variables of particular interest attempt to control for the so-called "gun culture" in the United States. The first such control is simply longitude, as the farther west the county is, the more deeply the Wild West attitude may be entrenched. The second control is the year that the state was granted statehood by the federal government, as such statehood status came along with some minimum level of law enforcement from the federal government.

Table 5. Control Variables

Variable	Description	Source
Period	Time period (1 = 1993, 2 = 1994-1996, 3 = 1997-1999, and 4 = 2010-2012.	
Statehood	Year of state entering the union	
Lon	Longitude	GIS generation
Pop	Population in county i in year t	U.S. Census Bureau
FFLiDist	Control for Spatial Auto-Correlation	
DCB	Distance to the Canadian border by road from county i (Km)	GIS generation
GasDef	Inflation-adjusted gasoline prices in that U.S. state in year t	EIA (2013)
AreaKm2	Area of county i (Km2)	GIS generation
PopDens	Population density of county i in year t	U.S. Census Bureau / GIS generation
PopIDist	The inverse distance-weighted measure of all other populations in counties other than i	
DemPer	Percentage of general election vote in county i going to the Democratic presidential candidate	http://uselectionatlas.org/
RepPer	Percentage of general election vote in county i going to the Republican presidential candidate	http://uselectionatlas.org/
DemXRep	Interaction: Democratic and Republican Voting Percentages	
PersInc	Median personal income in county i in year t	U.S. Bureau
DistBIA	Distance by road from county i to the nearest Bureau of Indian Affairs lands	GIS generation
DistBLM	Distance by road from county i to the nearest Bureau of Land Management lands	GIS generation
DistBOR	Distance by road from county i to the nearest Bureau of Reclamation lands	GIS generation
DistDOD	Distance by road from county i to the nearest Department of Defense lands	GIS generation
DistFS	Distance by road from county i to the nearest U.S. Forest Service lands	GIS generation
DistFWS	Distance by road from county i to the nearest Fish and Wildlife Service lands	GIS generation
DistNPS	Distance by road from county i to the nearest National Park Service lands	GIS generation
DistMexX	Distance from Border Patrol stations along the U.S.-Mexico border	GIS generation
NAFTAYR	Years since NAFTA went into effect	
CrimdIndx	Total Crime Index	National Archive of Criminal Justice Data

$FFLiDist$ represents a control for spatial auto-correlation. We define $\mathbf{Y}$ as the vector of FFLs for all counties, $\mathbf{D}$ as the matrix of travel times D_i between each possible pair of counties, and $\mathbf{D'}$ as the matrix of inverse travel times whose

elements are $1/D_i$, unless $D_i=0$, in which case $D_i=0$. We then multiply in scalar terms $\mathbf{Y}{*}\mathbf{D}'{*}\mathbf{D}'=\mathbf{Z}$ to obtain the squared distance-weighted influence of FFLs in all counties on all counties. We then column-summed $\mathbf{Z}$ to obtain vector $\mathbf{S}$, which we then transpose to obtain $\mathbf{S}^T$, denoting the total spatial influence of all other counties' FFLs on the county i in question, such that $\mathbf{S}^T \ni S^T_i=S_j=iZ_{ij}{}^T$. A similar method is used to control for spillover effects from neighboring populations of potential clients, creating the $PopiDist$ variable.

We also tested various alternative ways of accounting for population in the model, because population coefficient estimates are crucial to controlling for domestic demand. For instance, we reran the model substituting FFLs per capita as an outcome, but that model backed up or did not converge in almost every instance. We also tried accounting for population as a relative difference from the mean term (i.e., $(Pop_i-\overline{Pop})/\overline{Pop}$), but the term seemed not to afford any greater predictive power than population alone. We also tried including a simple square term for population, which was not statistically significant.

Econometric Analysis

Because the variance of the outcome variable greatly exceeds the mean, we employed a negative binomial generalized linear regression.

Table 6. Descriptive Statistics for the Outcome and Underlying Predictor Variable, 1999

Statistic	Total FFLs	Distance to Border Crossing (Km)	Distance to Mexican Border (Km)
Minimum	1	12.02298	1.78513
Median	15	1792.648	1782.25
Maximum	787	3929.954	3905.144
Std. Dev.	37.70969	712.8791	710.5672
Mean	25.64258	1726.72	1711.911
Variance	1422.02	508196.7	504905.7
Observations	3086	3109	3109

The relationship in a negative binomial model between $E(Yit)$, the expected number of FFLs in county i at time t, and $DCBi$ and $TCBi$—respectively, the distance to the nearest stretch of border from county i and the time expected to drive that distance—can be expressed

$$E(Y_{it})=\mu_{it}=exp(\beta_0+\alpha D_i+\beta_1 X_{it1}+\beta_2 X_{it2}+\ldots+\beta_q X_{itq}+\varepsilon_{it}),$$

where α and $\beta_1,\beta_2,\ldots,\beta q$ are regression coefficients, D_i is the distance from the border to county i, and $Xit1,Xit_2,\ldots,X_{itq}$ are control variables.

The appropriateness of a negative binomial model is confirmed by the estimates of random effects dispersion parameters ln(r) and ln(s), both of which are highly significant. Moreover, the incidence rate ratios for the model hover at around 1—not nearly high enough to suggest convergence to a Poisson distribution.

Post-Estimation Analysis

In order to estimate the total volume of firearms traffic, we employ the epidemiological concept of population attributable fraction (PAF), also called the etiologic fraction. PAF is usually used to determine the proportion of disease incidence that is attributable to exposure to the risk factor (Greenland & Drescher, 1993; Last, 2001, p. 137).[17] Here we want to attribute the proportion of FFL 'incidence' that is attributable to exposure to Mexico. The PAF for adjusted predictions is often defined:

$$PAF = \Pr(E|D) * (RR_{adjusted} - 1)/RR_{adjusted}$$

where $\Pr{ED}$ represents the prevalence of exposure given the disease (in our case, the predicted distance from Mexico given the number of FFLs), and $RR{adjusted}$. represents the adjusted relative risk of disease (here, the adjusted prediction of FFLs per population with the inclusion of the Mexico variable, normalized by that without it) . Unlike in most epidemiologic applications, our exposure variable, road distance from the Mexican border, is categorical and not binary. More problematic, however, is the fact that the equation above will tend to over-estimate the adjusted PAF, as it assumes perfect additivity of effects of variables when included in a single model—i.e., $E_A + E_B = E_{A+B}$. In fact, however, it is more realistic to introduce the formulation as implemented in Stata's PUNAF module. In doing so, we assume that the decile of counties farthest from Mexico experiences no demand from Mexico at all and that any rise above that level is attributable to demand from the U.S.-Mexico traffic.

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17   There is some confusion in the epidemiologic literature regarding the difference between PAF and Population Attributable Risk (PAR). While some authors suggest that the two terms are synonymous (Bruzzi, Green, Byar, Brinton, & Schairer, 1985; Last, 2001), it is more common to see a differentiation made, such that the PAR represents the decreased risk of a disease given the removal of a single factor, while PAF is the proportion of the total number of cases that would be eliminated with that removal (Deubner, Tyoler, Cassel, Hames, & Becker, 1975; Rockhill, Newman, & Weinberg, 1988; Rückinger, von Kries, & Toschke, 2009; Steenland & Armstrong, 2006).

Annex B: Econometric Results

Table 7. **Random-Effects Negative Binomial Regression of Total FFLs against Distance from the U.S.-Mexico Border Crossings**

VARIABLES	(1) FFL12	(2) FFL12	(3) FFL12
1.DMXdec	1.339***		1.126***
	(0.179)		(0.180)
2.DMXdec	1.044***		0.941***
	(0.148)		(0.149)
3.DMXdec	0.879***		0.678***
	(0.125)		(0.126)
4.DMXdec	0.708***		0.488***
	(0.108)		(0.109)
5.DMXdec	0.622***		0.409***
	(0.0964)		(0.0984)
6.DMXdec	0.606***		0.340***
	(0.0899)		(0.0920)
7.DMXdec	0.628***		0.352***
	(0.0801)		(0.0823)
8.DMXdec	0.371***		0.122
	(0.0728)		(0.0753)
9.DMXdec	0.427***		0.217***
	(0.0652)		(0.0688)
10b.DMXdec	0		0
	(0)		(0)
2.Period		-0.0777***	-0.102***
		(0.00535)	(0.00970)
3.Period		-0.119***	-0.218***
		(0.0109)	(0.0143)
4.Period		1.393***	1.213***
		(0.0392)	(0.0408)
1o.DMXdec#1b.Period			0
			(0)
1.DMXdec#2.Period			0.0367**
			(0.0153)
1.DMXdec#3.Period			0.107***
			(0.0176)
1.DMXdec#4.Period			0.272***
			(0.0204)
2o.DMXdec#1b.Period			0
			(0)

VARIABLES	(1) FFL12	(2) FFL12	(3) FFL12
2.DMXdec#2.Period			-0.00616
			(0.0153)
2.DMXdec#3.Period			0.0329*
			(0.0176)
2.DMXdec#4.Period			0.120***
			(0.0206)
3o.DMXdec#1b.Period			0
			(0)
3.DMXdec#2.Period			0.0285*
			(0.0156)
3.DMXdec#3.Period			0.140***
			(0.0177)
3.DMXdec#4.Period			0.246***
			(0.0204)
4o.DMXdec#1b.Period			0
			(0)
4.DMXdec#2.Period			0.0397**
			(0.0157)
4.DMXdec#3.Period			0.183***
			(0.0177)
4.DMXdec#4.Period			0.283***
			(0.0205)
5o.DMXdec#1b.Period			0
			(0)
5.DMXdec#2.Period			0.00309
			(0.0157)
5.DMXdec#3.Period			0.125***
			(0.0178)
5.DMXdec#4.Period			0.227***
			(0.0205)
6o.DMXdec#1b.Period			0
			(0)
6.DMXdec#2.Period			0.0413**
			(0.0160)
6.DMXdec#3.Period			0.159***
			(0.0181)
6.DMXdec#4.Period			0.257***
			(0.0207)
7o.DMXdec#1b.Period			0
			(0)
7.DMXdec#2.Period			0.0416***

VARIABLES	(1) FFL12	(2) FFL12	(3) FFL12
			(0.0147)
7.DMXdec#3.Period			**0.142***
			(0.0167)
7.DMXdec#4.Period			**0.260***
			(0.0189)
8o.DMXdec#1b.Period			0
			(0)
8.DMXdec#2.Period			**0.0261***
			(0.0141)
8.DMXdec#3.Period			**0.107***
			(0.0161)
8.DMXdec#4.Period			**0.219***
			(0.0184)
9o.DMXdec#1b.Period			0
			(0)
9.DMXdec#2.Period			**0.0201**
			(0.0135)
9.DMXdec#3.Period			**0.0955***
			(0.0154)
9.DMXdec#4.Period			**0.101***
			(0.0179)
10b.DMXdec#1b.Period			0
			(0)
10b.DMXdec#2o.Period			0
			(0)
10b.DMXdec#3o.Period			0
			(0)
10b.DMXdec#4o.Period			0
			(0)
Domestic Demand Controls	**Yes**	**Yes**	**Yes**
Constant	2.280	**2.568***	-0.795
	(1.619)	(1.422)	(1.580)
Ln(r) constant	**0.996***	**1.256***	**1.301***
	(0.0279)	(0.0287)	(0.0290)
Ln(s) constant	**0.363***	**0.469***	**0.473***
	(0.0275)	(0.0276)	(0.0279)
Observations	30,809	30,809	30,809
Number of FIPS	3,107	3,107	3,107
Log likelihood	-101901	-100133	-99814
Pseudo R2	0.242	0.252	0.251

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