Scarcity without Leviathan: The Violent Effects of Cocaine Supply Shortages in the Mexican Drug War*

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Abstract

This paper asks whether scarcity increases violence in markets that lack a centralized authority. We construct a model in which, by raising prices, scarcity fosters violence. Guided by our model, we examine the link between scarcity and violence in the Mexican cocaine trade. At a monthly frequency, scarcity created by cocaine seizures in Colombia—Mexico's main cocaine supplier—increases violence in Mexico. The effects are larger in municipalities near the US, with multiple cartels, and with strong PAN support. Between 2006 and 2009 the decline in cocaine supply from Colombia could account for 10%-14% of the increase in violence in Mexico.

Keywords: War on Drugs, Violence, Illegal Markets, Mexico, Cocaine Trade.

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1 Introduction

Agents in illegal markets cannot rely on the rule of law. The state does not solve disputes, protect property rights, or enforce contracts. As in other environments without a centralized authority, agents use violence as a substitute for the institutions that a well-functioning state provides.[1] Illegal drug markets in countries like Colombia, Mexico, and Afghanistan constitute major examples of environments where armed groups resort to ruthless violence in order to run the illegal trade, extract rents, and protect their revenue and assets.

We study the role of scarcity—or supply shortages—as a factor that exacerbates the use of violence in markets without a centralized authority. We do so in the context of the cocaine trade in Mexico. Starting in the late 1990s, Mexico became the main point of entry of drugs into the US. The industry transformed into a vertical market with little integration, where powerful Mexican cartels purchase cocaine from producers in Colombia (and to a lesser extent Peru and Bolivia) and smuggle it across the US border.[2] As Figure 1 shows, since 2006, the expansion of the Mexican cocaine trade coincided with a vast increase in violence, driven by clashes between cartels (drug trafficking organizations), and between cartels and Mexican authorities. In 2007, there were 8,686 homicides in Mexico, out of which 2,760 were drug-related; in 2010, there were 25,329 homicides, out of which 15,258 were drug-related. Between 2006 and 2009 there were 60,000 drug-related killings in Mexico, twice the death

[1] In developing countries, local strongmen contest areas in which the state does not centralize authority (see Acemoglu et al., 2013; Fearon and Laitin, 2003; Sánchez de la Sierra, 2017) and warlords fight over the extraction and control of valuable resources (see Skaperdas, 2002).

[2] Cocaine produced in Andean countries used to be shipped to US markets through the Caribbean. Following intensified enforcement in the Caribbean by US authorities, Colombian and Mexican traffickers began to smuggle drugs through Mexico. Although Mexico also produces drugs such as cannabis, heroin and amphetamines, close to 60% of the profits obtained by Mexican cartels is generated via drug-trafficking activities, especially those related to cocaine, and not via drug production (see Kilmer et al., 2010). Grillo (2011) and Valdés (2013) provide thorough reviews of the history of drug trafficking in Mexico and its nexus with crime and violence.

toll for Afghanistan between 2001 and 2011 (see Crawford, 2011).

We ask whether the surge in drug-related violence in Mexico that started in 2006 is related to shortages in the supply of cocaine caused by larger and more frequent cocaine seizures in Colombia. In 2006, the Colombian government redefined its anti-drug strategy, emphasizing the interdiction of drug shipments and the detection and destruction of cocaine processing labs over the eradication of coca crops.[3] Cocaine seizures in Colombia went from 127 metric tons per year in 2006 to 203 metric tons in 2009. As Figure 1 shows, the net supply of Colombian cocaine fell from 522 to 200 metric tons in this period—at the same time that the homicide rate in Mexico roughly tripled. This large negative supply shock was noticeable in downstream markets. The retail price per pure gram of cocaine in the US went from about \$114 in 2006 to about \$180 in 2009—a 45% increase—and from \$40 to \$68 for wholesale purchases between 10 and 50 grams—a 53% increase.

To motivate our analysis, we present a model of conflict in illegal markets where scarcity—driven by supply disruptions in upstream markets—fuels violence along trafficking countries. In our model, cartels use violence to dispute revenue and control over factors of production (e.g., routes, land). If demand for cocaine is inelastic, as evidence for illegal drugs suggests (Becker et al., 2006), exogenous supply reductions in upstream markets increase revenue. Rapacity over the additional money flowing into the cocaine trade triggers violence. Our model predicts that scarcity has a greater effect on violence in Mexican areas that are more important for trafficking, like those near the US border, where there are at least two cartels, and where more frequent arrests and crackdowns against cartel leaders increase turnover, which precludes informal cooperation.[4]

[3]The change in strategy followed intense criticism of the Colombian government's focus on disrupting the early stages of the cocaine production chain via the eradication of coca crops. The new focus on interdiction greatly increased the efficiency of supply reduction efforts (see Mejía and Restrepo, 2016).

[4]As we discuss in our concluding remarks, there may be other mechanisms linking scarcity and violence. The purpose of our model is to show that a standard theory of conflict in which

Using monthly data for Mexico from December 2006 to December 2010, we then explore the relationship between scarcity and violence in the context of the Mexican cocaine trade. We use cocaine seizures in Colombia as an external source of scarcity. Although Figure 1 shows that the rise of violence in Mexico since 2006 coincides with the sharp decline of the cocaine supply in 2006, this low-frequency correlation could simply reflect a change in policies in both countries, such as President Calderón's war on drugs in Mexico and the emphasis on interdiction policies in Colombia. To overcome this difficulty, we exploit monthly deviations in cocaine seizures in Colombia, obtained after flexibly removing time trends. Our empirical strategy investigates whether the scarcity generated by high-frequency changes in cocaine seizures in Colombia generates violence in Mexico, and then asks which municipalities are affected the most. The key identifying assumption is that the monthly variation in seizures is exogenous to changes in enforcement in Mexico or unobserved changes in cocaine markets.

Our main finding is that, during months with supply shortages caused by large cocaine seizures by Colombian authorities, violence increases in Mexico, especially in municipalities close to the US border. The effect is stronger in municipalities with a cartel presence, but only when two or more cartels are contesting each other. The increase in violence is also larger in municipalities that have historically supported PAN, the governing party that spearheaded the crackdown on the cocaine trade between 2006 and 2012. Building on Dell (2015), our interpretation is that these municipalities were more supportive of federal government efforts to defeat cartels. As a consequence, cartel leaders were arrested, killed or removed more frequently in these municipalities, precluding non-aggression treaties between cartels and exacerbating the effect of scarcity on violence.

According to our preferred estimates, a 10% increase in monthly cocaine seizures in Colombia raises homicides in Mexico by 0.59%-0.91%. Under additional assumptions mentioned in the text, this means that the sharp decline in the cocaine supply from Colombia between 2006 and 2009 (from 520 mt to 200 mt per year) accounts for 10%-14% of the in-

cartels contest the cocaine trade revenue—a description we believe captures the main features of this market—can to explain all of our empirical findings.

crease in the homicide rate in Mexico during this period, and 25% of the differential increase in violence observed in the North of Mexico relative to the rest of the country.

Our paper relates to three strands of literature. The first one is the literature on conflict over resources. Our model builds on the economic theory of conflict (Grossman, 1991, 2001; Hirshleifer, 2001). An increase in the value of the contested resources has an ambiguous effect on violence. On the one hand, rapacity over the additional resources—the temptation to prey on others and the necessity to defend against predators —leads to more violence (Skaperdas, 2002; Collier and Hoeffler, 2004). On the other hand, resource booms may also increase wages and, hence, the opportunity cost of engaging in violence (see Becker, 1968; Grossman, 1991; Dal Bó and Dal Bó, 2011).[5] We contribute to this literature by showing that rapacity dominates in the Mexican cocaine trade: higher revenues from cocaine increase violence, especially in areas contested by multiple cartels. This adds to the empirical literature that finds a link between resource booms and violence (Collier and Hoeffler, 2004; Buonanno et al., 2015; Couttenier et al., 2017; Dube and Vargas, 2013) as well as the theoretical literature that emphasizes the role of the number of contenders (Kalyvas, 2006).

Our paper also contributes to the literature on violence in illegal markets (Goldstein, 1985). Out model relates to works that analyze the motivations behind violence between the state and cartels (Lessing, 2015) and between competing cartels (Castillo and Kronick, 2018). On the empirical side, our finding that higher revenues lead to more drug-related violence in the Mexican cocaine market is consistent with results by Angrist and Kugler (2008) and Mejía and Restrepo (2013), who find that the rise of the cocaine trade spurred violence in Colombia. (Lind et al., 2014, show evidence for a causal link in the opposite direction for opium cultivation in Afghanistan.) Similar results hold for other illegal markets (García-Jimeno, 2016; Owens, 2014; Chimeli and Soares, 2017).

Finally, our work contributes to the debate about the causes of the upsurge in violence

[5]In line with this channel, other authors find that national income and commodity prices reduce the likelihood of conflict in Africa (Miguel et al., 2004; Brückner and Ciccone, 2010) and that booms in labor-intensive commodities like coffee may actually reduce violence (see Dube and Vargas, 2013).

in Mexico since 2006. Some observers blame the upsurge on the struggle for power created by the policies implemented by Calderón, who in 2006 started an aggressive strategy of beheading cartels by killing or arresting their leaders (Guerrero, 2010; Merino, 2011).[6] Using a regression discontinuity design, Dell (2015) finds a significant increase in anti-drug crackdowns in municipalities in which PAN—Calderón's party—won local elections. Crackdowns are followed by a spike in drug-related violence. Similarly, Calderón et al. (2015), who compare the area of influence of a cartel with a synthetic control group, find that the killing of a cartel leader raises violence.[7] We emphasize the role of policy changes in Colombia. The dramatic increase in cocaine seizures in Colombia since 2006 created large and frequent shortages in downstream cocaine markets, which translated into more frequent and larger surges of violence in Mexico. This is not to say that PAN and Calderón's policies had no effect; indeed, our evidence suggests that Colombian policies and the Mexican policies interacted to cause large increases in violence.

The paper is organized as follows. Section 2 presents our model and discusses its testable predictions. Section 3 describes our data, empirical strategy and results. Section 4 concludes.

2 A model of scarcity and violence

Our model features cartels that operate in a transit country (Mexico) and buy cocaine in upstreams markets (Colombia) to traffic to a downstream market (the US). The key feature of our model is that cartels fight over the control of the cocaine trade and the revenue it commands. In particular, cartels fight for the control of municipalities, some of which are strategically more important and, thus, account for a larger share of total cocaine revenue.

When total revenue increases—as a consequence of scarcity spurred by cocaine seizures

[6]Other observers have defended this strategy, arguing that by reducing cartel entry it could decrease violence in the long term (Poiré and Martínez, 2011; Villalobos, 2012).

[7]Two recent papers shift the focus away from Calderón's policies. Dube et al. (2016) show that negative agricultural shocks facilitated the rise of the Mexican drug sector, thus, increased violence. Dube et al. (2013) find that violence in Mexico increased as a consequence of the 2004 expiration of the US Federal Assault Weapons Ban.

in Colombia—rapacity over the additional resources fuels violence. Rapacity is more severe in municipalities that are important for the cocaine trade and that command a larger share of the trade revenue, and in municipalities contested by multiple cartels.

We then introduce a dynamic version of the model where cartels take into account the threat of retaliation when they are fighting over revenue. This extension shows that *transitory* increases in revenue have a strong effect on violence because they increase the benefits of one-shot deviation while having a limited impact on the future value of cooperation. Policies that make cartel leaders more impatient, such as an increase in arrest rates, make deviations more attractive and cause violence to be more responsive to spikes in revenue.

We discuss the connection between this model and our empirics at the end of this section.

Static setting: Let Q^s be the quantity of cocaine supplied by upstream countries like Colombia, which we assume is exogenous and determined by supply-reduction policies in these countries. There are N Mexican cartels, indexed by $c \in \mathcal{C} = \{1, 2, \ldots, N\}$. Each cartel buys an amount Q^s_c of cocaine at a price P^s and traffics it to downstream markets at a cost $C(Q^s_c)$, which is increasing, convex, and satisfies $\lim_{Q\to 0} C'(Q) = \infty$ and $\lim_{Q\to\infty} C'(Q) = 0$. We abstract from seizures by Mexican authorities, which implies that cocaine trafficked is given by $\sum_c Q^s_c = Q^s$. Cartels then sell cocaine in the downstream market at a price $P^d(Q^s)$, which they take as given.[8] When deriving our results, we allow demand, $P^d(Q^s)$, to have any price elasticity. However, as we discuss in Subsection 2.1, evidence from related markets suggests that demand for cocaine traded through Mexican is inelastic.

The Mexican cocaine trade generates a total revenue $R(Q^s) = Q^s P^d(Q^s)$. Our key assumption is that, because there are no formal property rights in the cocaine market, revenue is unsecured and must be disputed with other cartels. In particular, a cartel is only entitled to a share $\eta Q^s_c P^d(Q^s)$ of the revenue it generates, leaving a share of total revenue

[8]We assume cartels are price takers. The term cartel is, therefore, misleading. The powerful Colombian drug trafficking organizations of the 1980s and 1990s called themselves *carteles* to emphasize that a few organizations controlled the whole trade, even though they did not collude to increase prices. The name stuck, and present-day Mexican organizations use the same term.

equal to $(1-\eta)R(Q^s)$ to be contested among cartels. Thus, η measures the extent to which a centralized authority can credibly protect property rights.

We formalize the dispute over the unsecured revenue as a dispute over municipalities, the control of which allows cartels to capture more of the cocaine revenue. In particular, we assume there are I municipalities, indexed by $i \in \mathcal{I} = \{1, 2, \ldots, I\}$. We denote by $I_c \subset \mathcal{I}$ the subset of municipalities where a cartel operates, and let $N_i \subset \mathcal{C}$ be the set of cartels that operate in municipality i. Municipalities are heterogeneous in how relevant they are for the total cocaine trade. For instance, municipalities close to the US or located along strategic routes have a greater importance, which allows cartels that control these areas to obtain a larger share of the disputed cocaine trade revenue. We model this heterogeneity by assuming that in municipality i a fixed share $s_i \geq 0$ of the total revenue from the cocaine trade is disputed, with the understanding that $\sum_{i\in\mathcal{I}} s_i = 1$. An alternative interpretation of s_i is that trafficking requires inputs, such as routes and land, that cannot be traded in regular markets and that, therefore, must be contested. Parameter s_i then captures the share of revenue accruing to the cartel that controls the inputs available in municipality i.

To appropriate or defend the unsecured revenue $(1-\eta)s_i R(Q^s)$ in municipality i, the cartels that operate in it engage in violent conflict. We model the dispute over revenues with a contest success function (Skaperdas, 2002). Cartels in N_i simultaneously decide amounts $g_{c,i} \geq 0$ to invest in weapons or soldiers in municipality i. As a result, cartel c is able to obtain a fraction $q_{c,i}$ of the total revenue contested in municipality i, where

$$q_{c,i} = \frac{g_{c,i}}{\sum_{c'\in N_i} g_{c',i}}.$$

This contest success function represents all the strategies by which cartels appropriate and extract drug rents. For instance, they can act as toll collectors and extort payments from other cartels operating in municipality i; they can fight for turf in order to use routes and labor for their trafficking activities; they can prey on one another by violently stealing cash, weapons, assets or other resources; or they may eliminate competition in key municipalities to increase their market share. The aggregate level of drug-related violence in municipality

i is therefore linked to the total expense in the local conflict by all cartels, $v_i = \sum_{c \in N_i} g_{c,i}$.

Our assumptions imply that a Cartel's profits are then given by

$$\pi_c = -P^s Q_c^s - C(Q_c^s) + \eta P^d(Q^s) Q_c^s + \sum_{i \in I_c} \left(q_{c,i}(1-\eta) s_i R(Q^s) - g_{c,i} \right).$$

The Online Appendix characterizes the full equilibrium of this market (including cartels' choice of quantities). In order to characterize the outcome of conflict, we note that by the time cartels dispute the control of municipalities, the amount paid for drugs, $-P^s Q_c^s$, the cost of smuggling, $C(Q_c^s)$, and the revenues not subject to appropriation, $\eta P^d(Q^s) Q_c^s$, are bygones. Thus, cartels simply care about the disputed revenue $s_i R(Q^s)$.[9] Also, because the outcomes $q_{c,i}$ are independent across municipalities, it suffices to solve the conflict in each municipality separately.[10] Cartel c's maximization problem in municipality i is thus given by

$$\max_{g_{c,i}} q_{c,i}(1-\eta) s_i R(Q^s) - g_{c,i}.$$

The Online Appendix shows that the unique Nash equilibrium of the conflict among cartels

[9] One implicit assumption behind this feature is that there is no risk sharing between Mexican cartels and suppliers in Colombia. We believe that the absence of a centralized authority precludes the possibility of this kind of vertical relations. If cartels and suppliers were able to enforce complex contracts, cartel payments to suppliers could be conditioned on the municipalities that they control, which implies that profits (revenue net of payments to Colombian suppliers) and not revenue would determine the incentives to fight over a municipality. Even if this were the case, profits and violence would still increase for a sufficiently inelastic demand, as shown by Castillo and Kronick (2018).

[10] The key simplifying assumption in our model is that conflict over municipalities only determines who owns the disputed revenue, but does not affect production and trafficking. In a more realistic and complicated model, each municipality could be endowed with inputs needed for drug trafficking, and cartels would only be able to use the inputs in the municipalities they control. This would result in more complicated strategic considerations because now the value of controlling a municipality would depend on who controls all other municipalities, and investments to control different municipalities could be strategic substitutes or complements. Modeling these considerations is beyond the scope of our paper.

operating in municipality i results in a level of violence

$$v_i = \frac{|N_i| - 1}{|N_i|}(1 - \eta)s_i R(Q^s). \tag{1}$$

This expression leads to our main proposition.[11]

Proposition 1 *If demand is inelastic ($R(Q^s)$ decreasing in Q^s), a decrease in the supply of cocaine from downstream markets increases revenue and leads to more violence, v_i. The increase in violence is greater in municipality i under the following circumstances:*

1. If third party enforcement is weaker or absent (smaller η).

2. If municipality i is more important for cocaine trafficking (greater s_i).

3. If municipality i has more cartels (greater $|N_i|$). Also, violence only changes if there are at least two rival cartels operating in the same municipality.

If demand is elastic ($R(Q^s)$ increasing in Q^s), a decrease in the supply of cocaine from downstream markets reduces revenue and violence, v_i.

Proof. The proof follows by differentiating equation (1). ■

The main result in Proposition 1 echoes a general finding in the conflict literature: when the value of contested resources increases, agents are encouraged to invest more in conflict, which ends up fueling violence. This prediction is quite general and applies to the unique symmetric equilibrium obtained when the contest success function is symmetric, homogeneous of degree zero, and has decreasing marginal returns (e.g., all ratio contest success functions described in Hirshleifer, 1989). The same comparative statics apply to the equilibrium with the least and the largest levels of violence when we use a generic contest success function such that investments in the conflict by different cartels are strategic complements.[12]

[11] This expression also helps us clarify which type of scarcity generates violence. Anti-drug policies in municipality i displace the cocaine trade and reduce s_i. From the perspective of municipality i, such policy creates a scarcity of cocaine in that municipality and could reduce violence. As this example illustrates, it is the aggregate level of scarcity, which raises prices and revenue, that generates violence. The displacement of production from one municipality to another only reallocates violence.

[12] One can also construct examples where the logic of parts 1 and 2 of Proposition 1 fail. For

Dynamic setting: We now move to a dynamic setup based on Castillo and Kronick (2018).[13] The dynamic analysis highlights two key points. First, supply shocks have an effect on violence, particularly if they are short-lived shocks like the ones we focus on in our empirical analysis. Second, beheading cartels by arresting or killing their leaders reduces the importance of retaliation, which makes violence more responsive to current scarcity.

The game described above is played out repeatedly, with an independent draw of Q_t^s in each period. Subscript t denotes time. At the end of each period, a cartel leader in municipality i is arrested or killed with probability a_i, and is then replaced by a new one. Leaders maximize cartel profits at their own discount rate $(1 - a_i)\beta$and not at the market rate β. Arrests and killings thus make cartel leaders more impatient.[14]

Just as in the static problem, the amount paid for drugs, the cost of smuggling drugs, and the revenues not subject to appropriation are bygones. Also, revenue $R(Q_t^s)$ is fully determined by the realizations of Q_t^s. Thus, in each period, cartel c operating in municipality

example, investment by one party could dissuade others from investing in the conflict, making investments by different cartels strategic substitutes. In this case, an increase in the value of the contested resources could lead one cartel to increase its investment, which might then induce a larger decrease in other cartels' investment. These forces are stronger in asymmetric equilibria where one party has a greater ex-ante chance of winning the conflict and can effectively dissuade the other parties from investing. Thus, this dissuasion mechanism could be at play in municipalities that are under the effective control of a single cartel, but is less likely to apply to municipalities contested by multiple cartels—where we expect conflict to increase with scarcity. We explore this possibility, which relates to part 3 of Proposition 1, in our empirical exercise.

[13] Castillo and Kronick (2018) build a richer model of violence between criminal groups and analyze the effects of different government policies on supply and violence. Dynamic interaction opens the possibility of more favorable equilibria under the threat of retaliation (see Abreu et al., 1990).

[14] This assumes that once a cartel leader is arrested or killed, the next leader cannot credibly compensate him for long-term investments. This could stem from the lack of enforceable contracts in environments without a centralized authority.

i chooses $g_{c,i,t}$ in order to maximize expected payoffs (excluding bygones):

$$\mathbb{E}_{t_0} \sum_{t \geq t_0} \beta^{t-t_0}(1-a_i)^{t-t_0} q_{c,i,t}(1-\eta)s_i R(Q_t^s) - g_{c,i,t}. \tag{2}$$

Let $g^N(Q^s)$ be investment in the conflict in the symmetric static Nash equilibrium in municipality i when supply is Q^s, which is the solution to the static model above. We focus on a recursive equilibrium where all cartels in municipality i spend $g^C(a_i, Q^s) \in [0, g^N(Q^s))$ and revert to $g^N(Q^s)$ as punishment if anyone deviates. This is not the most cooperative subgame perfect equilibrium (SPE), but it provides a simple way to illustrate how informal cooperation arrangements work. The following proposition characterizes this equilibrium:

Proposition 2 *If demand is inelastic ($R(Q_t^s)$ decreases in Q_t^s), the equilibrium that sustains the most cooperation under Nash reversion is recursive and has $g_{c,i} = g^C(a_i, Q^s) \in [0, g^N(Q_s))$. If $R(Q_t^s)$ is unbounded above and converges to zero as Q_t^s increases,*[15] *then the function g^C satisfies the following:*

1. There exists some finite $\overline{Q}(a_i) > 0$ such that $g^C(a_i, Q^s) = 0$ for $Q^s \geq \overline{Q}(a_i)$.

2. Wherever $g^C(a_i, Q^s)$ is positive, it is increasing in a_i, decreasing in Q^s, and the cross partial derivative is negative.

If demand is elastic ($R(Q_t^s)$ increases in Q_t^s), 1 and 2 hold with opposite signs for Q^s.[16]

Proof. See the Online Appendix. ■

We now explain the results for the empirically relevant case, when demand is inelastic. The proposition shows that in the absence of a centralized authority there is room for some *de facto* protection of property rights, sustained by the threat of future retaliation. Part 1 shows that if a_i is low and β is high, an equilibrium with no violence can be sustained—a folk theorem. As the effective discount rate decreases, participants value the future less and some level of violence must be allowed, especially when revenues are large.

[15] Our proof, in the online appendix, shows that similar results hold if the assumptions that $R(Q_t^s)$ is unbounded above and converges to zero as Q_t^s increases are relaxed.

[16] For 1, there exists some finite $\overline{Q}(a_i) > 0$ such that $g^C(a_i, Q^s) = 0$ for $Q^s \leq \overline{Q}(a_i)$. For 2, g^C is increasing in a_i and Q^s, and the cross partial derivative is positive.

Part 2 shows that when violence occurs, temporary reductions in supply Q_s increase violence for two reasons. First, they increase current revenues and, hence, the incentives to prey. Second, because of reversion to the mean, expected revenues in the future are lower, which means that the treat of retaliation is a less effective means of preventing violence (see Rotemberg and Saloner, 1986). The second effect implies that short-lived supply shocks are particularly prone to generating violence. Also, the second effect becomes stronger when the arrest rate is high, which explains why the function $g^C(a_i, Q^s)$ has a negative cross partial derivative: not only is expected revenue in the future low, but cartel leaders heavily discount the threat of future retaliation when they are likely to get arrested. The effect of scarcity (in particular, short-lived shocks) on violence is thus stronger when arrest rates are high.

2.1 Empirical predictions

In our empirical exercises we test the implications of our model when the demand for cocaine is inelastic, as suggested by the existing empirical evidence. Becker et al. (2006) summarize these results and conclude that it is consistent with an elasticity of demand of less than 1 for most drugs, with a central tendency towards 1/2, especially over the short term.[17]

The basic story that emerges from the model is that scarcity generated by temporary and large cocaine seizures in Colombia—of the type that we will explore in our empirical analysis—fosters violence in Mexico. Also, violence increases more in places that are more relevant for the drug trade (where s_i is higher). In our empirical application, we focus on distance from the US as a measure of s_i. Since the goal of cartels is to take drugs across the border, places that are close to the US are of strategic importance and, thus, command a

[17]The relevant value in our model is the short-run elasticity of demand, which is smaller than that over the long run (see Becker and Murphy (1988)). Early papers found inelastic demands for marijuana and heroin (Nisbet and Vakil, 1972; Roumasset and Hadreas, 1977; Silverman and Spruill, 1977). Wasserman et al. (1991) and Becker et al. (1994) find demand elasticities between -0.4 and -0.75 for cigarette consumption over the short term. In the case of cocaine, the results of more recent studies are consistent with an inelastic demand as well. See, for instance, Bachman et al. (1990), DiNardo (1993) and Saffer and Chaloupka (1999).

larger share of the drug trade. Consequently, the violence spikes caused by cocaine seizures in Colombia should be stronger close to the US border.

Our model also predicts differential effects depending on the number of cartels present in a municipality. Because violence results from disputes among cartels, our model suggests that scarcity only raises violence in municipalities contested by two or more cartels; there should be no effect in municipalities controlled by a single cartel or where no cartels operate.

Finally, our model suggests that supply shortages generate more violence in municipalities where cartel leaders are killed or arrested more frequently. As shown by Dell (2015), crackdowns against the cocaine trade were more recurrent in municipalities that elected PAN mayors because the policies of Calderón and PAN, beheading cartels by killing or arresting their leaders, required the cooperation of local authorities. Thus, we expect supply shortages to have a larger impact on cartel violence in municipalities in which there is a strong PAN support, which are more likely to elect PAN mayors and support their federal anti-drug policies.[18]

Proposition 2 also suggests that higher *levels* of violence should be observed when the government's main strategy is to behead or arrest cartel leaders, as was the case during Calderón's term. We do not test this prediction because we focus on the role of scarcity and how it interacted with Mexican policies. However, Calderón et al. (2015) find empirical support for this prediction.

3 Data and evidence on the role of scarcity

We focus on the period from December 2006 to December 2010, which is the period for which drug-related homicide data are available. This coincides with the period of violence and intense cartel activity in Mexico known as the *Mexican Drug War*.

[18] A simple cross-sectional regression shows that a 10% increase in the historical PAN vote share increases the likelihood of electing a PAN mayor during our period of analysis by 7.4%. Also, incumbents in these places may be under more pressure from their electorate to cooperate with PAN's national policies.

We use a monthly panel of all 2,457 Mexican municipalities (including the 16 boroughs of Mexico City). Our dependent variables are different measures of the monthly homicide rate in each municipality. Our main variable of interest is the monthly homicide rate per 100,000 inhabitants from INEGI (Mexico's *Instituto Nacional de Estadística y Geografía*), which includes all reported homicides. We also use data on drug-related homicides published by the Mexican Presidency, which only counts homicides related to the illegal drug trade. This dataset further classifies homicides into (1) *assassinations of cartel members*, which involve targeted killings of cartel members by competing cartels, (2) *confrontation deaths*, which are the result of battles either between competing cartels or between cartels and government authorities, and (3) *assassinations of government officials*, which are the result of cartels attacking government forces.[19]

We explore the effect of scarcity on violence and how it is mediated by the relative importance of trafficking, the number of cartels, and the political power of the PAN party. We use proximity to the US border as our proxy for trafficking importance. We compute it as the geodesic distance from the centroid of each municipality to the closest US entry point. Using the data from Coscia and Ríos (2012), we construct dummies for the presence of cartels in all municipalities and for the presence of at least two cartels.[20] Finally, in order to explore heterogeneity with respect to PAN political power, we compute the average voting share for PAN candidates in municipal elections from 1980 to 2000. For institutional reasons, this measure is only available for 1,998 of the municipalities in our sample.

[19]Although it comes from an official source, the classification of homicides as drug-related and into additional categories has been criticized (Hope, 2012). Because of these concerns, we use the INEGI homicide rate as our main variable of interest.

[20]Their data codes whether every major cartel operated in a given municipality. The cartels included are: Cartel de los Hermanos Beltrán Leyva, Familia Michoacana, Cartel del Golfo, Cartel de Juárez, Cartel de Sinaloa, Cartel de Tijuana and Los Zetas. We also obtained similar results if we focus on municipalities contested by rival cartels (instead of simply looking at municipalities that have multiple cartels), which are defined using the alliances described by Guerrero (2011).

Table 1 summarizes our data. It presents statistics for all of Mexico (where the average distance from the US is 763 km), for municipalities in the two quintiles closest to the US (average distance 507 km), and for municipalities in the closest quintile (average distance 333 km). The Mexican population is concentrated in the north: the first quintile includes 25% of the national population and the second quintile includes 35%.

While homicide rates were similar across Mexico in 2006, the north of Mexico (quintiles 1 and 2) became more violent subsequently than other parts of the country subsequently—a difference driven by a large increase in drug-related homicides. Consistent with the intuition that the north of Mexico is more important for cocaine trafficking, the data shows that the vast majority of homicides in the north are drug-related, whereas homicides in other areas of the country are less so. There is also more cartel activity in quintiles 1 and 2 than in the country as a whole. In 2010 cartels were active in 40% of the municipalities in the first two distance quintiles compared to 29% of all Mexican municipalities. Finally, northern municipalities are slightly more supportive of PAN, but these differences are not significant.

Our variation in scarcity comes from the vast monthly changes in cocaine seizures by Colombian authorities.[21] The data on cocaine seizures comes from the Colombian Ministry of Defense. Figure A1 in the Online Appendix presents the monthly series for seizures of cocaine in Colombia and the homicide rate in Mexico.

3.1 Time series evidence

We start by providing evidence consistent with the main prediction in Proposition 1, namely that violence increases in Mexico when cocaine becomes scarce due to cocaine seizures in

[21]We also constructed a series for the monthly cocaine supply net of seizures in Colombia, and we use it directly as a measure of the supply of drugs reaching Mexico. However, this methodology requires interpolating annual production figures (there is no information on monthly production). Because our estimates only exploit high-frequency changes, the variation that we exploit in this alternative exercise is fully driven by changes in seizures, and the obtained results are very similar to the ones reported here.

Colombia. We study the time series effect of supply shocks by estimating the model

$$\ln h_t = \beta \ln S_t + F_t(\gamma) + \varepsilon_t. \tag{3}$$

Time runs at the monthly frequency from December 2006 ($t = 0$) to December 2010 ($t = 48$). h_t is the homicide rate in Mexico, and S_t are cocaine seizures in Colombia. The term $F_t(\gamma) = \sum_{n=0}^{3} \gamma_n t^n + \eta_y$ includes both a cubic polynomial in time and year dummies to control flexibly for time trends; it absorbs low-frequency relations or secular trends that could confound our estimates, such as the upward trend in seizures in Colombia and crackdowns in Mexico that started in 2006 with President Calderón. Finally, ε_t is an error term. Our standard errors are robust to heteroskedasticity, but we assume there is no serial correlation.[22]

We interpret β as the effect of supply reductions in Colombia on violence in Mexico, which, according to our model, should be positive if demand is inelastic. The effect of cocaine seizures is identified from its high-frequency variation, which we treat as an exogenous shock to supply, Q^s. The variation is considerable. The standard deviation in monthly seizures is 8 metric tons, which is high relative to the 40 metric tons of cocaine that Colombia produced per month during the period we analyze. Thus, changes in Colombian seizures produce significant shortages of cocaine in downstream markets. We believe that this monthly variation is determined mostly by chance—for instance, by whether an interdiction operation is successful or unsuccessful, and by factors like politics or funding in Colombia that are exogenous to Mexico. We maintain this assumption throughout and discuss some potential challenges to our interpretation after presenting our results.

We present estimates of equation (3) in Table 2. Each panel has a different dependent variable. In columns 1 to 3, we focus on the homicide rate in all Mexican municipalities. In columns 4 to 6, we focus on the homicide rate in municipalities in quintiles 1 and 2 of proximity to the US, and in columns 7 to 9 we focus on the homicide rate in municipalities in the first quintile of proximity to the US.

[22]The Online Appendix shows that there is no serial correlation in the high frequency variation in homicides or seizures and that both series are stationary. This justifies the use of standard inference and allows us to abstract from more complicated dynamics in our models.

Our estimates in columns 1, 4, and 7 of the top panel suggest that a 10% increase in monthly seizures in Colombia raises homicides in Mexico by 0.59% (standard error=0.27%), by 0.82% in municipalities in quintiles 1 and 2 (s.e=0.33%), and by 1.19% in municipalities in the first quintile (s.e=0.33%). In the remaining panels we document a larger increase in drug-related homicides, which is driven by assassinations of cartel members and confrontation deaths (though the effect on confrontation deaths is not precisely estimated). We do not find any effect on assassinations of government officials (the effect is small but imprecise), which we view as supportive of the emphasis on inter-cartel violence in our model.

In columns 2, 5, and 8 we include two monthly controls for all of Mexico, the unemployment rate and the *Índice Global de Actividad Económica* (IGAE), which is a measure of economic activity. Although these controls might be endogenous, and we prefer our estimates without them, it is reassuring to see that our estimates do not change with their inclusion. Finally, in columns 3, 6, and 9 we control for Mexican weather seasons, which include a dummy for months in the rainy season and dummies for months in the hurricane season. Although our estimates are less precisely estimated in these cases, the point estimates remain roughly unchanged. These exercises suggest that the estimated effects are not driven by the Mexican business cycle or by seasonality.[23]

We also illustrate the response of violence to supply shocks using event-study figures. We estimate equation (3) including six lags and six leads of $\ln S_t$. Figure 2 plots the estimated coefficients for the homicide rate in all of Mexico, for the homicide rate in the first two quintiles of proximity to the US, and for the first quintile. The homicide rate spikes during a cocaine shortage and then reverts back to its pre-shock level with some small persistence

[23]In Table A2 of the Online Appendix, we explore variants of equation (3) with lags of the homicide rate as explanatory variables. These lags are not significant and they do not affect the estimate of our coefficient of interest. We then explore the timing of the effects by adding lags and leads of seizures in Colombia. Contemporary seizures in Colombia have the strongest effect on violence. The effect vanishes quickly, lasting only an additional month in some specifications. We do not find any significant effect of future Cocaine seizures in Colombia on Mexican violence.

(although individual coefficients are less precisely estimated in this exercise). As in Table 2, this pattern becomes more stark in the North of Mexico.

To illustrate the quantitative implications of our estimates, we compute the effect of the sharp reduction in the Colombian supply of cocaine from 2006 to 2009 on violence in Mexico. Our calculation requires two assumptions. First, we assume that short-run shocks and persistent supply shocks have the same effect on violence.[24] Second, we assume that seizures in Colombia only affect violence through their effect on the net Colombian supply of drugs—an exclusion restriction. Both assumptions imply that β is the effect of a persistent reduction in the supply of Colombian cocaine by 1%.

Between 2006 and 2009, the cocaine supply from Colombia fell by 95.6 log points (from 520 mt to 200 mt). Most of the reduction was triggered by an increase in seizures, although coca cultivation and potential cocaine production also fell. We use the results in columns 1, 4 and 7 in the top panel of Table 2, as well as the estimates in columns 4, 8 and 12 of Table A2 in the Online Appendix, where we control for the dynamics of the homicide rate. Our estimates imply that the reduction in cocaine supply increased the homicide rate by 5.6-8.7 log points in all of Mexico, which corresponds to about 10%-15% of the increase experienced during this period. They also imply that scarcity in Colombia increased the homicide rate in quintiles 1 and 2 of Mexico by 7.8-10.1 log points, and by 11.37-15.4 log points in the first quintile of proximity to the US, which also accounts for 10% to 15% of the increase in violence during this period in both regions.

[24]This is only a suggestive calculation, since in practice short-run and permanent shocks may have different effects. On the one hand, the possibility of storage implies larger effects from persistent shocks. On the other hand, the possibility of substituting cocaine from other source countries implies smaller effects from persistent shocks. Likewise, our theoretical discussion highlights the fact that temporary shocks have a larger effect than permanent ones. This is so because a temporal shortage that is soon reversed implies large revenues today and low revenues tomorrow, which makes future punishment less severe. In contrast, permanent shocks also raise the deterrence power of future punishment, and so they raise violence less.

3.2 Heterogeneity by proximity to the US

We now investigate the prediction in Proposition 1 that the effect of cocaine shortages on Mexican violence is greater in municipalities that are more important for the cocaine trade. We use distance from US entry points as a proxy for a municipality's importance for trafficking. We do this because, unlike heroin or cannabis, cocaine is not produced in Mexico, and internal consumption of cocaine in Mexico is minor when compared to revenue from exports to the US (see Kilmer et al., 2010). Thus, municipalities close to the US border have a major strategic advantage in trafficking. As shown in table 1, drug-related violence and cartel presence are concentrated in the north of Mexico, which suggests that these are the places that command a greater share of the drug trade.

To illustrate the heterogeneity in the response to seizures in Colombia as a function of distance to the US, we estimate the time series equation (3) for groups of municipalities in 901 moving windows of distance to the US, each one of which comprises 10 percent of the municipalities. Figure 3 plots the estimated effects. Near the US border, a 10% increase in cocaine seizures causes a 1.6% increase in violence. The effect vanishes gradually as we move away from the US frontier; in the south of Mexico, for example, cocaine shortages have no impact on violence.

We next examine the evidence in more detail using a regression framework. Let p_i denote proximity to the US border—the negative distance in kilometers from municipality i to the US nearest entry point. We are interested in explaining the homicide rate in municipality i during month t, $h_{i,t}$, as a function of municipality fixed effects, time effects, and the interaction between proximity to the US and cocaine seizures in Colombia $p_i \times \ln S_t$.

We present two types of estimates. First, we estimate a Poisson fixed effects model as in Hausman et al. (1984) and Wooldridge (1999), which assumes the following conditional expectation for the homicide rate:[25]

$$\mathbb{E}h_{i,t} = \delta_i \alpha_t \exp\left(\beta p_i \times \ln S_t + p_i \times F_t(\gamma)\right). \tag{4}$$

Second, we estimate the following simpler linear model

$$\ln(h_{i,t} + r) = \delta_i + \alpha_t + \beta p_i \times \ln S_t + p_i \times F_t(\gamma) + \epsilon_{i,t}, \tag{5}$$

where the left-hand side is a monotone transformation of the homicide rate that deals with the large dispersion in homicide rates and is well defined at zero. The constant $r > 0$ is the 90th percentile of the homicide rate in our sample. We choose this particular value for r because the estimated residuals resemble a normal distribution, suggesting that the transformation adequately removes the skewness of homicide rates.[26] The transformed value is approximately equal to $\frac{h_{i,t}+r}{h_{i,t}} \ln h_{i,t}$; thus, the estimates can be interpreted as elasticities after multiplying them by the sample average of $\frac{h_{i,t}+r}{h_{i,t}}$. To ease the interpretation of our findings, we report estimates obtained after this normalization.

In both models, the dummies α_t control for monthly changes that are common across Mexico and δ_i control for municipality invariant characteristics. The term $p_i \times F_t(\gamma)$ flexibly controls for differential trends in violence in the North of Mexico (recall that $F_t(\gamma)$ includes a cubic polynomial in time and year dummies). Finally, β captures the additional impact of cocaine seizures in Colombia on violence in municipalities that are located 100 km closer

[25]The Poisson model has several advantages (see Wooldridge, 2010, chapter 18): First, it is designed for applications with non-negative dependent variables with large dispersion, like homicide rates. Second, it is consistent under very general distributional assumptions. Third, it does not suffer from the incidental parameters problem, allowing us to control directly for municipality fixed effects. We also experimented with negative binomial models and obtained similar results. In this alternative exercise, instead of controlling for fixed effects, we use a wide range of municipality characteristics as controls.

[26]Experimenting with different values of r, we obtained similar results. We set r equal to different moments of the homicide rates distribution, including its minimum positive value, as well as its 10th, and 50th percentile. We also obtained similar results when we used the level of the homicide rate as the dependent variable. To save space, these results are not presented here.

to the US border. This effect is identified by comparing how high-frequency changes in cocaine seizures by Colombian authorities relate to spikes or dips in violence in Mexican municipalities at different proximities to the US.

Regarding inference, we compute standard errors that are robust to heteroskedasticity and serial correlation within municipalities over time. For the estimates presented in the main text, we assume there is no spatial correlation left in the error term, $\epsilon_{i,t}$. Time effects already take into account aggregate shocks, and although there may be correlated shocks, we believe that the differential trends by distance account for the bulk of the spatial correlation in violence. The Online Appendix shows that we obtain similar results when we compute standard errors for our estimates of equation (5) that allow for several forms of spatial correlation, as in Conley (1999) and Conley (2008), and when we allow for correlated shocks (other than aggregate) across municipalities within a month and compute standard errors with two-way clustering by municipality and month, as in Cameron et al. (2011).

Table 3 presents our results, both for municipalities in all of Mexico (columns 1 to 4) and for those in distance quintiles 1 and 2 (columns 5 to 8). The dependent variable in the top panel is the homicide rate. According to the Poisson estimates from column 1, being 100 km closer to the US implies an additional 0.31% (s.e=0.11) increase in homicide rates in response to a 10% increase in seizures in Colombia. [27] In column 2 (and the remaining even columns) we control for differential time trends in municipalities that have different levels of historical PAN support. These capture the stronger deployment of Calderón's anti-drug policies in areas where the PAN had more political power. The inclusion of these controls does not change our results.[28]

[27]The Poisson model drops municipalities that had no homicides during our period of analysis, which is the reason why in all panels we have fewer observations in columns 1 and 2 than in columns 3 and 4.

[28]We obtain very similar results (not shown here) using the presence of a PAN mayor as a control. Although this control is endogenous, it shows that our estimates are not driven by the election of PAN mayors during Calderón's administration. Because our measure of PAN support is missing

In columns 3 and 4 we estimate the model in equation (5). Being 100 km closer to the US implies an additional 0.14% (s.e=0.04) increase in the homicide rate in response to a 10% increase in seizures in Colombia. In columns 5 to 8, we estimate a larger interaction when we restrict the sample to municipalities in quintiles 1 and 2 of distance to the US.

The second panel presents results using the drug-related homicide rate as the dependent variable. We find again that seizures in Colombia have a stronger effect on Mexican drug-related violence as one moves closer to US entry points. The bottom panels show that, consistent with our time series results from Table 2, the differential effect on drug-related homicides in the north of Mexico is driven by assassinations of cartel members and confrontation deaths. As before, we find no differential effects of scarcity on the assassination of government officials.

Our results indicate that scarcity created by seizures in Colombia contributed to the sharp increase in violence in the north of Mexico relative to the rest of the country. The estimate in column 5 of the top panel implies that scarcity created by Colombian policies from 2006 to 2009 could explain up to 31 log points of the differential increase in homicides in the north of Mexico relative to the average municipality. This corresponds to 25% of the 128 log point differential increase in violence in the north of Mexico during this period.

3.3 The role of cartels and Mexican policies

In this section we investigate if the presence of cartels and Mexican anti-drug policies exacerbate the negative consequences of scarcity in cocaine markets. For our analysis, we use the INEGI homicide rate as our preferred measure of violence.

We begin by estimating equation (3) separately for the homicide rate in municipalities with no cartels, one cartel, and at least two cartels. The top panel of Figure 4—constructed in the same way as Figure 2—depicts the estimated change in the homicide rate in municipalities with different cartel presence following a 10% increase in cocaine seizures in Colombia. In line with our model, cocaine seizures in Colombia do not have an effect on violence in Mexican

for some municipalities, the models that control for these variables have fewer observations.

municipalities with zero or a single cartel. In contrast, at the time of the cocaine shortage, homicides spike in Mexican municipalities that have at least two cartels present.

We also estimate equation (3) for municipalities with an historical PAN vote share above and below 28%, which we refer to as high and low PAN support municipalities, respectively. The 28% threshold corresponds to the average PAN vote share in local elections between 1980 and 2000, but our results are robust to using different thresholds. The bottom panel of Figure 4 depicts the estimated change over time in the homicide rate of municipalities with different PAN support following a 10% increase in cocaine seizures in Colombia. Scarcity has a small effect on violence in the sample of Mexican municipalities that have low PAN support, which is not significant. In contrast, we find that scarcity has a larger effect on violence in the sample of Mexican municipalities that have high PAN support (although the effect is not precisely estimated).

Table 4 summarizes the results from Figure 4. The left panel (columns 1 to 6) presents our time-series estimates for the homicide rate in Mexican municipalities that have different numbers of cartels. The right panel (columns 7 to 10) presents our time-series estimates for the homicide rate in Mexican municipalities that have different levels of historical PAN support. For each set of municipalities—indicated at the column headers—, we present two estimates of equation (3): our baseline specification and one that controls for the dynamics of homicide rates by adding lags of the dependent variable (presented in the even columns).

To test whether the differences in the time-series responses uncovered above are jointly significant, we estimate extensions of equations (4) and (5) that also allow cocaine seizures in Colombia to affect the homicide rate differently in Mexican municipalities that have none, one or multiple cartels, and in municipalities that have a low or high historical PAN support. Let DTO_{iy} be a vector of cartel presence variables in municipality i during year y, including a dummy for the presence of at least one cartel and a dummy for multiple cartels. Also, let PAN_i be a dummy for high historical PAN support (defined as in Figure 4). We estimate equations (4) and (5) by adding the interaction terms $\ln S_t \times DTO_{iy}$ and $\ln S_t \times PAN_i$. To ensure that we only identify these interactions from the high-frequency variation in cocaine shortages, we also include a full set of terms of the form $DTO_{i,y} \times F_t(\gamma_1)$, and $PAN_i \times F_t(\gamma_3)$, which control for time trends in municipalities with a different numbers of cartels, or in municipalities with different historical support for the PAN party.

Columns 1 and 4 of Table 5 present the results from this exercise. Columns 1 to 3 present Poisson estimates of equation (4), while columns 4 to 6 present OLS estimates of equation (5). The top panel presents results using all Mexican municipalities, while the bottom panel restricts the sample to those in the first two quintiles of distance to the US.

The results in columns 1 and 4 show that cocaine shortages have a larger effect in municipalities in which there is high PAN support. For instance, the estimates in column 4 of the top panel show that a 10% increase in seizures in Colombia causes an additional increase in homicides of 0.36% in municipalities that have high PAN support relative to other municipalities. Although they are not precisely estimated, these coefficients also suggest that cocaine shortages only cause a differential increase in violence when there are at least two cartels operating in a municipality. These estimates are less precise in part because drug cartels locate in municipalities near the US border (see Table 1). As a consequence, it is hard to distinguish the effect of the interaction of scarcity with proximity to the US border from its interaction with the presence of multiple cartels. The estimates in column 4 of the top panel show that a 10% increase in seizures in Colombia causes an additional increase in homicides of 0.47% in municipalities that have multiple cartels relative to other municipalities. In line with our model, we find no difference in the effect of scarcity between municipalities that have a single cartel and those that have none.

Our models in columns 1 and 4 estimate the interaction of cocaine shortages with cartel presence and PAN support for *the average* municipality. One limitation of this analysis is that conflict among cartels and PAN policies may play a more important role in municipalities near the US, where the cocaine trade is booming. In fact, our model suggests that there should be a triple interaction between shortages, proximity to the US, and other factors that worsen the conflict among cartels.

To explore this possibility, we include in columns 2 and 5 triple interactions of the form

$\ln S_t \times p_i \times DTO_{iy}$ and $\ln S_t \times p_i \times PAN_i$, which allow us to test whether cartels and PAN policies had a differential effect in areas close to the US border.[29] In columns 3 and 6 we control for $\ln S_t \times p_i^2$ to ensure that our triple interactions are not capturing non-linearities in the relationship between scarcity and proximity to the US border. To ease the interpretation of all these models, the main effects of the double interactions are now evaluated *at border* municipalities with multiple cartels and high PAN support.

In line with our model and the above conjecture, coefficients on triple interactions involving high PAN support and the presence of multiple cartels in columns 2 and 5 are all large and positive, and most of them are statistically significant (except for the triple interaction with high PAN support in column 2, which is not precisely estimated). These triple interactions are quantitatively important. To see this, we can go back to the double interactions between cocaine seizures in Colombia and cartel presence, which are now evaluated at border municipalities where the cocaine trade is booming. The estimates in column 5 of the top panel show that when we focus on municipalities at the US border, a 10% increase in seizures in Colombia causes an additional increase in homicides of 2.42% in municipalities that have multiple cartels relative to those that have one or none. The fact that this estimate is five times larger than its counterpart in column 4 illustrates the quantitative importance of the triple interaction term for multiple cartels. The triple interaction term in column 5 indicates that the 2.42% gap narrows by 0.33% when we move 100 km further away from the US frontier, which implies that cartels had a more detrimental effect on the response of violence to scarcity in the North of Mexico. As before, the estimates in columns 2 and 5 show that there is no differential effect of scarcity on violence in municipalities controlled by a single cartel (relative to municipalities that have no cartels) *even* in the very North of Mexico (the triple interaction term is a precisely estimated zero).

Likewise, we can go back to the double interaction between cocaine seizures in Colombia

[29] To guarantee that we only exploit the high-frequency variation in cocaine shortages and homicides to identify these interactions, we also include a full set of differential time trends of the form $p_i \times DTO_{iy} \times F_t(\gamma_2)$, $p_i \times PAN_i \times F_t(\gamma_4)$.

and high PAN support, which are now evaluated at border municipalities. The estimates in column 5 of the top panel show that when we focus on municipalities at the US border, a 10% increase in seizures in Colombia causes an additional 1.64% increase in homicides in municipalities that have high PAN support relative to those that have low support (about five times the corresponding estimate in column 4). The triple interaction term indicates that this 1.64% gap narrows by 0.19% as we get 100 km further away from the US frontier. This triple interaction indicates that PAN policies had a more detrimental effect on the response of violence to scarcity in the North of Mexico.[30]

The interpretation that emerges from Table 5 is that Calderón's policies exacerbated the negative consequences of supply shortages, but this happened mostly in areas near the US border where the cocaine trade boomed. The evidence in this section supports the possibility that starting in 2006, Calderón's policies and the expansion of Mexican cartels provided a dangerous blend that amplified the response of violence in Mexico to cocaine shortages generated in Colombia. From 2006 to 2010, the percentage of municipalities that had multiple cartels increased from 5% to 17%. Before 2006, there were fewer and more isolated cartels, and informal arrangements among cartel leaders presumably kept violence and rapacity low or prevented them altogether. After 2006, the environment was very different: fragmented cartels contested multiple key locations, especially in the North of Mexico, and the policy of beheading cartel leaders may have fueled conflict and division among cartels.[31] Our model

[30]To gauge the quantitative implications of these results, consider the case of two border municipalities near US entry points with different historical levels of PAN support: Ciudad Juarez (Chihuahua) and Nueva Laredo (Tamaulipas). The historical voting for PAN in Ciudad Juarez was about 44%, whereas in Nueva Laredo it was 14%. A reduction in the supply of cocaine of 95.6 log points (observed between 2006-2009), would cause a differential increase of 15 to 30 log points in homicides in Ciudad Juarez relative to Nueva Laredo (using the estimates in column 2 or 5 of the top panel). During this period, homicides fell in Nueva Laredo by 23.4 log points and increased in Ciudad Juarez by 236.9 log points. The interaction between the decline in the net supply of cocaine and greater PAN support in Ciudad Juarez may explain 5% to 10% of this differential change.

[31]In line with this view, when we re-estimate equation (3) for all the period 2003-2010, we find

and evidence indicate that it is in this environment that the scarcity generated by Colombian anti-drug policies contributed to the increase of violence in Mexico.

3.4 Is scarcity (and the price effect it brings) the right channel?

We have documented that cocaine seizures in Colombia are associated with large spikes of violence in Mexico at a monthly frequency. We argue in our theoretical model that this occurs through an increase in cocaine revenues, which take place so long as demand is inelastic. Our interpretation relies on three key assumptions, which we now discuss.

The first assumption is that cocaine seizures by Colombian authorities are associated with periods of scarcity in transit markets. This assumption would not hold if seizures were simply increasing during periods of high cocaine productivity in Colombia or during periods of high cocaine demand in downstream markets. In both of these cases, cocaine seizures would be associated with abundance, not scarcity.

We do not believe that these concerns confound our interpretation. As Figure 5 shows, estimates of variants of equation (3) reveal that there is no high-frequency relationship between seizures and other anti-drug policies in Colombia. Seizures of chemical precursors, interdiction of solid inputs, and the destruction of cocaine labs do not increase during months in which the Colombian government seizes large quantities of cocaine. This finding suggests that the high-frequency variation in cocaine seizures in Colombia does not simply reflect changes in cocaine production (driven by demand or productivity). If that were the case, all measures of interdiction policies would respond together and would be correlated.[32]

We also estimate a large and negative elasticity of cocaine seizures in Mexico with respect to high-frequency changes in cocaine seizures in Colombia. Although it is not precisely estimated, this elasticity is telling: a 10% increase in cocaine seizures in Colombia during one month reduces cocaine seizures in Mexico by 6.8% during the same month (standard

that the effect of negative supply shocks on violence is driven by Calderón's term.

[32]Unfortunately, there are only yearly measures of gross cocaine production and productivity in Colombia. Thus, we cannot directly test if months of high seizures correspond to months of higher temporal productivity or cocaine production.

error=4.6)—an elasticity that roughly corresponds to the share of Andean cocaine supplied by Colombia. This finding suggests that during months when the supply of Colombian cocaine turns out to be lower than expected, Mexican cartels traffic less cocaine to the US market. Cartels do not appear to offset the lack of Colombian cocaine by relying on stored drugs or cocaine from other suppliers like Peru and Bolivia. This high-frequency relationship is in line with the anecdotal evidence that suggests that once a kilogram of cocaine leaves Colombia, it takes Mexican cartels 4 to 6 weeks to smuggle it and sell it in the US market (see Gaviria and Mejia, eds, 2016). Our estimates and the anecdotal evidence support the key assumption that, even at a monthly frequency, cocaine seizures in Colombia disrupt the cocaine trade downstream and generate significant scarcity.

The second assumption is that any coincidence in timing between policies or market conditions in Mexico and Colombia breaks down at higher frequencies once we flexibly control for time trends. Otherwise, changes in Mexican policies could confound our estimates. This assumption could fail if there were complementarities in enforcement or cooperation between authorities across countries. Likewise, changes in enforcement or market conditions in Mexico could raise the demand for Colombian cocaine and, hence, cocaine seizures in Colombia.

We do not believe such alternatives explain our findings. The timing of the estimated effects suggests that seizures in Colombia do not react to past violent upsurges in Mexico, which supports our view that seizures in Colombia are not driven by market conditions in Mexico. If anti-drug policies in Mexico drove up both violence in Mexico and the demand for Colombian cocaine, one would observe a positive correlation between seizures in both countries, but this is not present in the data. If anything, the opposite holds as shown in figure 5. Contrary to these alternative explanations, there is no correlation between high-frequency changes in seizures in Colombia and the seizure *rate* of cocaine in Mexico, nor is there any correlation with other anti-drug policies in Mexico, such as heroin seizures.[33]

[33] We construct the cocaine seizure rate in Mexico as total seizures over the net supply of cocaine flowing out of Colombia. Because we do not observe monthly cocaine production, we interpolate annual production figures to obtain monthly estimates. We then subtract monthly seizures in

Additionally, the effects we uncovered are specific to municipalities that have two or more cartels and high PAN support. If market conditions in Mexico affected seizures in Colombia, one would also observe a spurious correlation between seizures in Colombia and violence in Mexican municipalities that have low PAN support. If there were complementarities in enforcement across countries, one would also observe a spurious correlation between seizures in Colombia and violence in Mexican municipalities that have a single cartel, and this would be so because operations against this cartel would also induce more seizures in Colombia. Thus, the heterogeneity of the effects we uncovered is consistent with the model and it rules out other potential explanations of our findings.

The third and final key assumption is that cocaine shortages increase revenue, which is theoretically the case so long as demand for cocaine is inelastic (as the existing evidence suggests). Unfortunately, we cannot measure prices or the amount of cocaine revenue in Mexico on a monthly basis, and this precludes any direct test of this assumption. Instead, we provide some reality checks that suggest that cocaine shortages in Colombia seem to increase cocaine revenues downstream. Annual price data from STRIDE indicates that, from 2007 to 2010, cocaine prices increased dramatically as the supply of Colombian cocaine declined. While net cocaine production in Colombia went down from about 520 MT per year in 2006 to about 200 MT in 2009, the average price per pure gram of cocaine on US streets went up from about \$114 in 2006 to about \$180 in 2009, and the wholesale price went from \$40 to \$68 during the same period (the Appendix summarizes the available price data).[34] Taking into account net production from Peru and Bolivia—which increased from 340 metric tons to 390 metric tons—the total gross drug trade revenue measured using wholesale prices in the US increased from 34 billion to 40 billion dollars—a 15% increase. Using retail prices, we find that between 2006 and 2009, cocaine revenue increased from 98 to 106 billion dollars—a

Colombia to obtain an estimate of the cocaine flowing out of Colombia.

[34]There is no reliable data on cocaine prices at higher frequencies. Although quarterly prices can be constructed using the raw STRIDE data, some have expressed doubts about the quality of quarterly variation in these data (see Horowitz, 2001; Arkes et al., 2008).

7% increase. These trends support the possibility that cartels face an inelastic demand.

4 Concluding remarks

Focusing on the case of the Mexican cocaine trade, this paper investigates the role of scarcity as a determinant of violence in markets without a centralized authority. A standard conflict model in which cartels dispute unprotected revenue suggests that scarcity increases violence if the demand for cocaine is inelastic. The increase in violence should be larger in municipalities that are more important for the cocaine trade, where two or more competing cartels are present, and where, because of policies that lead to the arrest and killing of cartel leaders, cartels behave more shortsightedly and do not cooperate.

We explore the link between scarcity and violence using monthly data from Mexican municipalities from December 2006 to December 2010. In line with the predictions of our model, we find that scarcity generated by large and temporary increases in cocaine seizures in Colombia increased violence in Mexico, especially at locations close to US entry points. Most of the effect was driven by municipalities that had at least two competing cartels, while there were no effects in municipalities that had one or no cartels. Our evidence supports the view that President Calderón and the PAN's strategy of beheading cartels amplified the effect of scarcity in areas that had high PAN support.

Our results indicate that greater cocaine seizures in Colombia after 2006 raised prices and contributed to the increase in Mexican violence. The sharp decline in the supply of Colombian cocaine from 2006 to 2009 of 95.6 log points may account for 10%-14% of the increase in Mexican violence during this period, and 25% of the differential increase of violence in the North of Mexico. Our paper documents spillovers from anti-drug policies that transcend national frontiers. By generating scarcity, anti-drug policies in Latin American countries may be fostering violence—even if the burden is borne by other countries.

Throughout this paper, we have emphasized a particular mechanism that suggests that cartels use violence to secure the increases in revenue generated by scarcity. There remains the possibility that this is not the sole mechanism that explains our findings. For instance, when cocaine shortages occur, cartels might increase their efforts in an attempt to achieve a target level of sales, and this could increase violence. Moreover, if cartels cannot perfectly observe seizures, they may confound shortages with wrongdoing on behalf of other cartels or their members, and this could potentially trigger cycles of violence.

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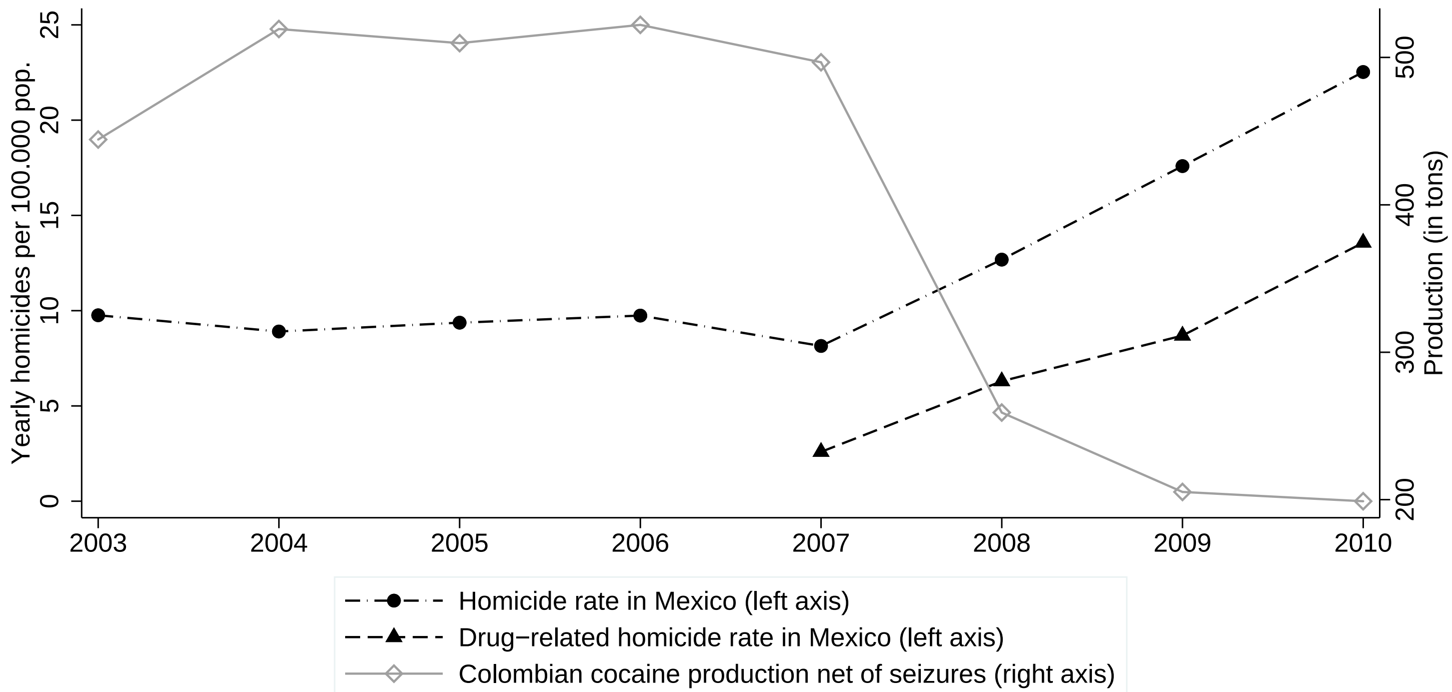


FIGURE 1: Yearly homicide rate in Mexico (from INEGI), drug-related homicide rate in Mexico (from Mexico's President's Office), and cocaine production net of seizures in Colombia (UNODC)

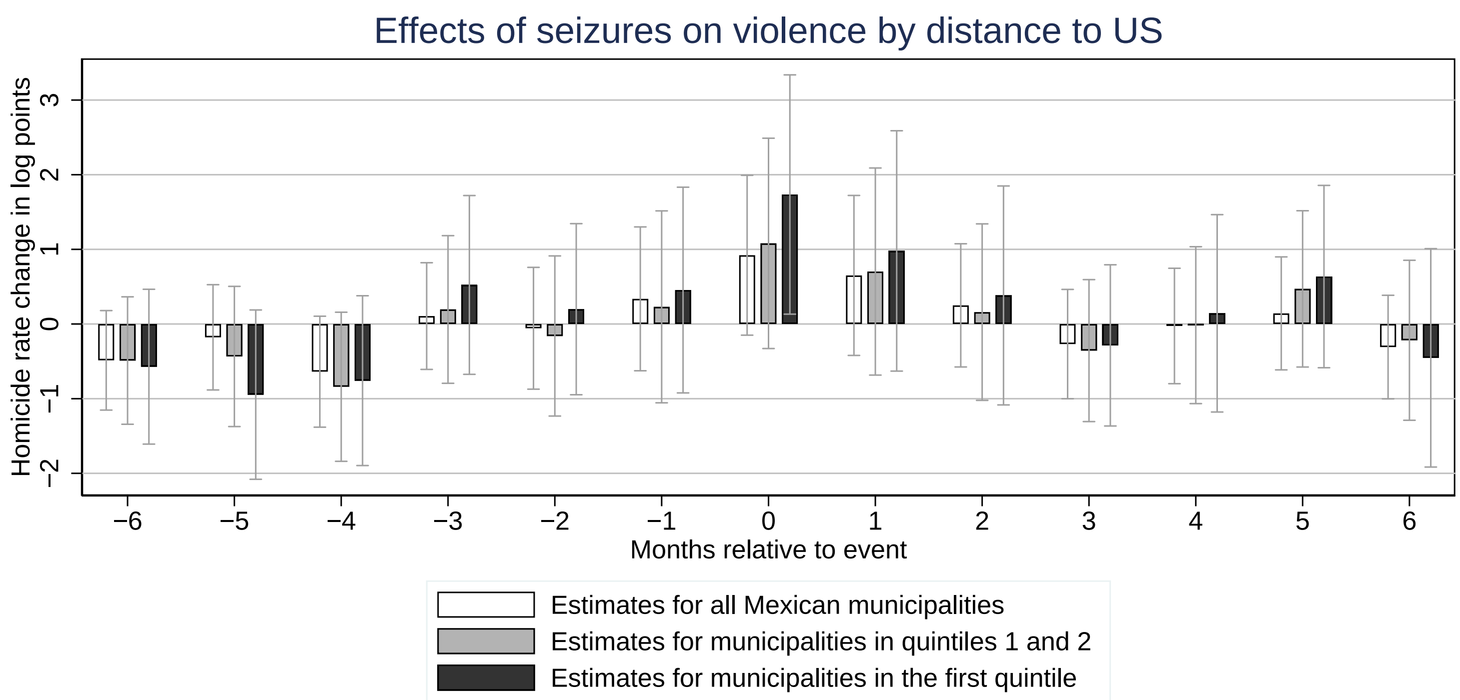


FIGURE 2: Response of the homicide rate in Mexican municipalities at different distances from the US to a 10% increase in cocaine seizures in Colombia. Bars present 95% confidence intervals.

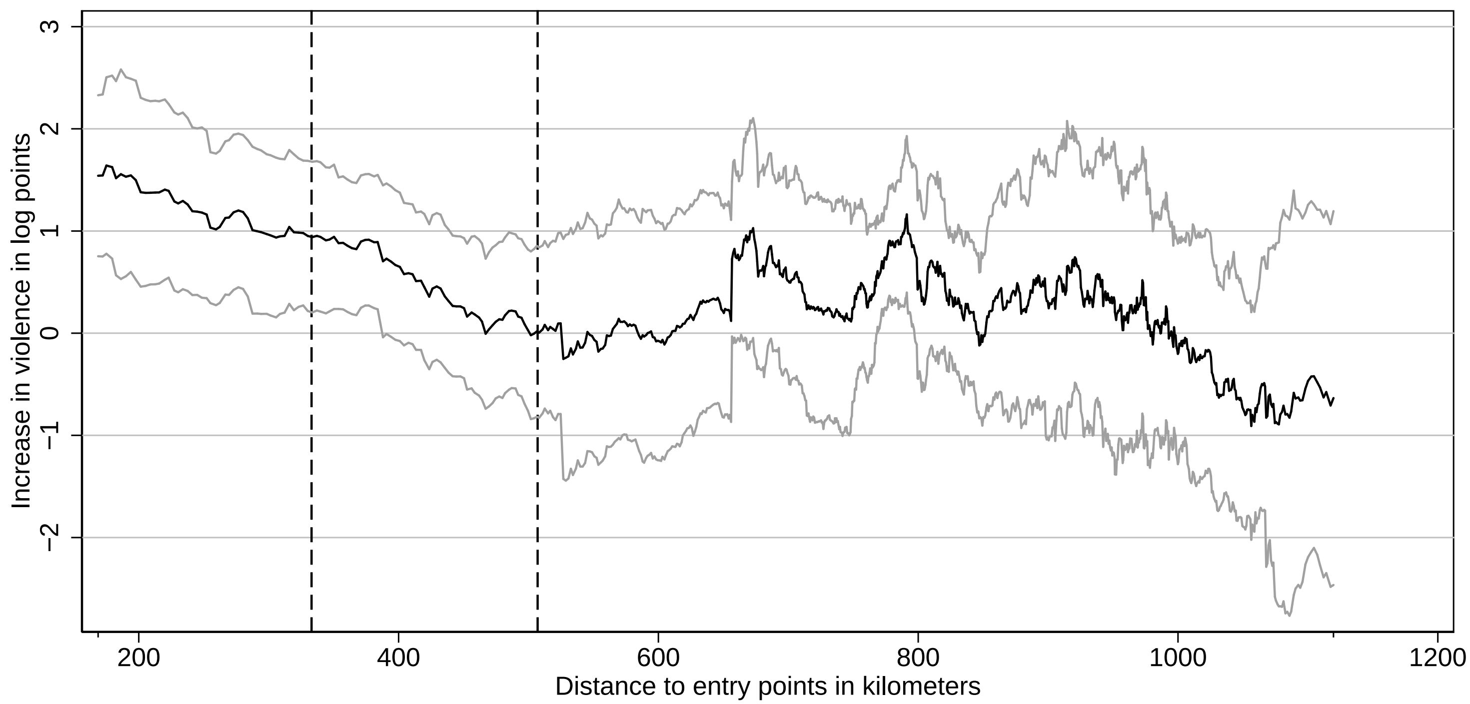
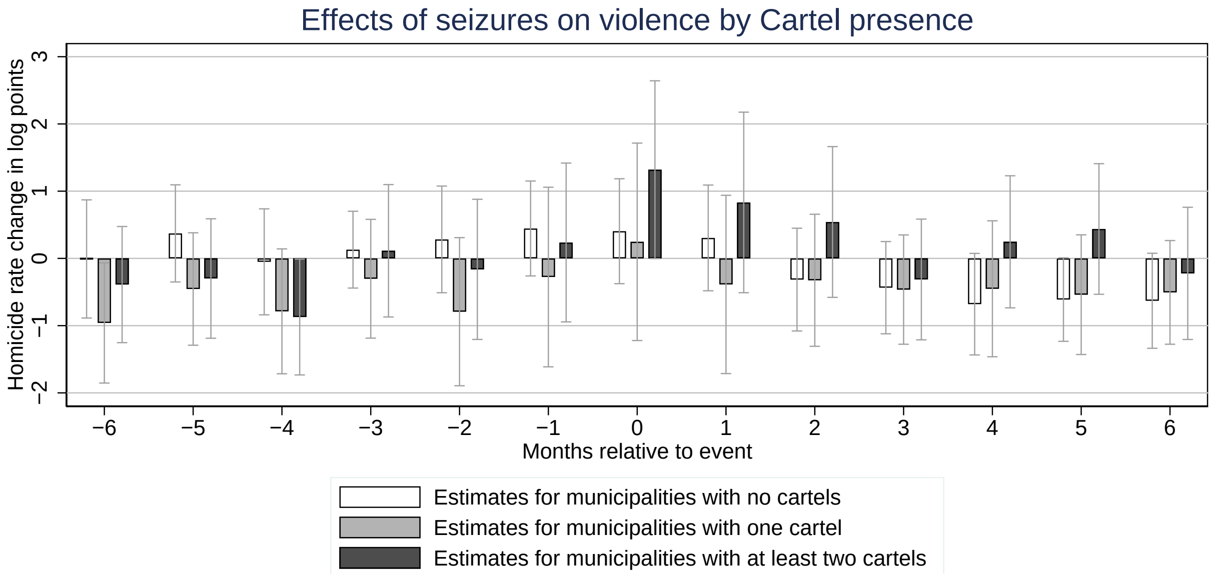


Figure 3: Response of the homicide rate in Mexican municipalities to a 10% increase in cocaine seizures in Colombia as a function of their distance to the US border. The black lines are our estimates and the gray lines are 95% confidence intervals. The vertical lines mark the thresholds defining municipalities at the top and second quintiles.



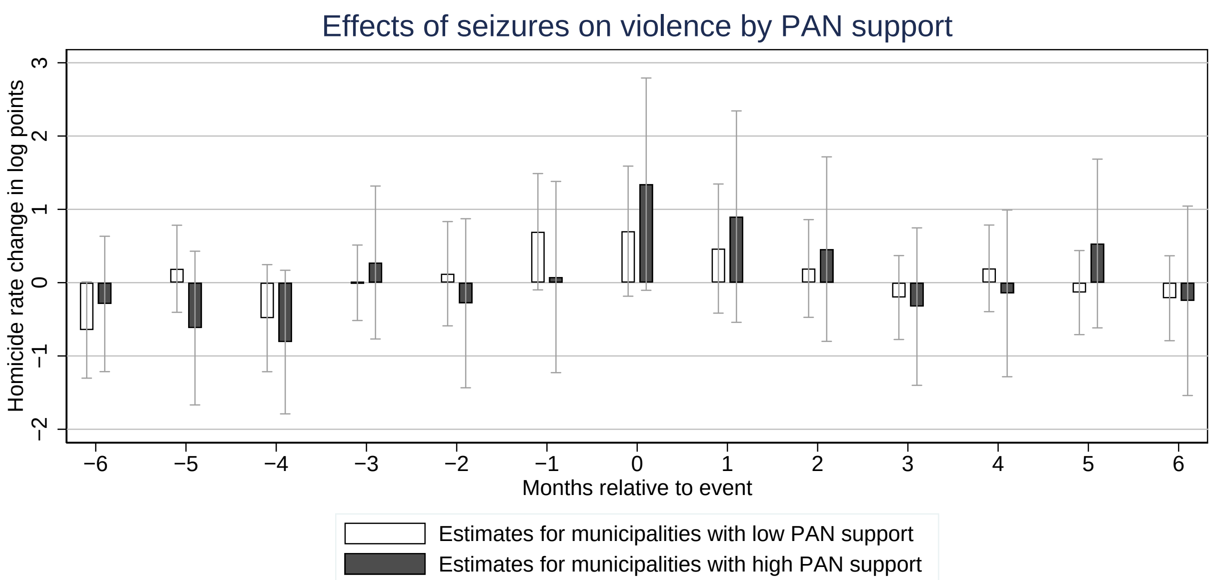


FIGURE 4: Response of the homicide rate in Mexican municipalities that have different numbers of cartels (top panel) and different levels of PAN support (bottom panel) to a 10% increase in cocaine seizures in Colombia. Bars present 95% confidence intervals.

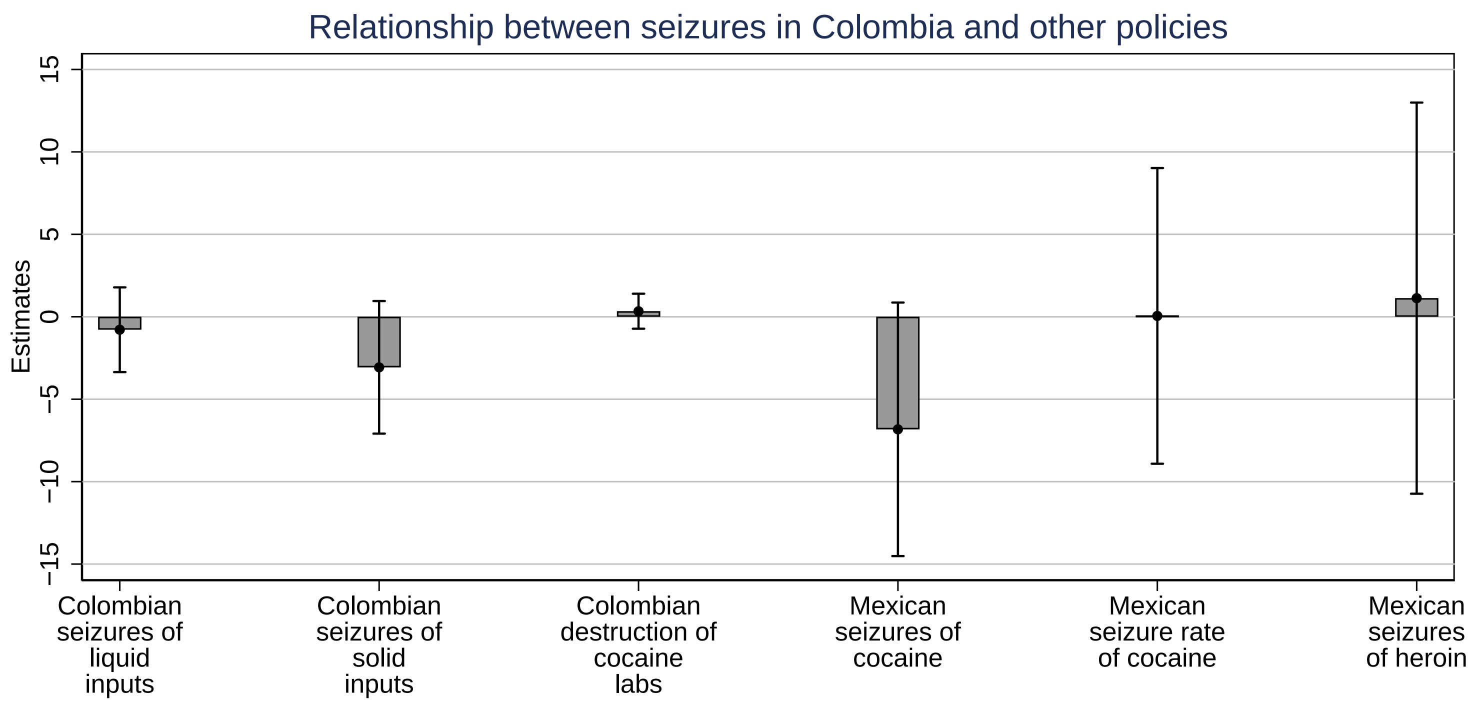


Figure 5: High-frequency relationship between a 10% increase in cocaine seizures in Colombia and other anti-drug policies in Colombia and Mexico. The bars around each estimate represent its 90% confidence interval; the capped lines represent its 95% confidence interval.

Table 1: Summary statistics.

	2006	2007	2008	2009	2010
	All Mexico: 2,457 municipalities. Average distance to the US: 763 km.				
Homicide rate (annualized)	9.74	8.15	12.68	17.59	22.53
	[22.55]	[19.40]	[28.92]	[38.17]	[50.52]
Drug-related homicide rate	0.69	2.59	6.30	8.69	13.57
	[8.63]	[18.42]	[26.26]	[34.99]	[57.78]
Share of municipalities with cartels	0.12	0.16	0.24	0.27	0.29
	[0.33]	[0.37]	[0.43]	[0.44]	[0.45]
Population (in thousands)	42.72	43.42	44.15	44.95	45.80
	[127.90]	[129.22]	[130.47]	[131.68]	[132.85]
Historical PAN vote share (time invariant)	0.25	0.25	0.25	0.25	0.25
	[0.13]	[0.13]	[0.13]	[0.13]	[0.13]
	Quintiles 1 and 2: 983 municipalities. Average distance to the US: 507 km.				
Homicide rate (annualized)	8.76	7.79	13.98	19.76	27.81
	[16.83]	[14.55]	[29.49]	[40.99]	[59.12]
Drug-related homicide rate	0.41	2.76	8.42	10.86	17.32
	[5.07]	[21.26]	[30.89]	[40.53]	[70.11]
Share of municipalities with cartels	0.17	0.24	0.35	0.37	0.40
	[0.38]	[0.43]	[0.48]	[0.48]	[0.49]
Population (in thousands)	64.35	65.32	66.35	67.45	68.62
	[167.97]	[169.61]	[171.21]	[172.76]	[174.27]
Historical PAN vote share (time invariant)	0.28	0.28	0.28	0.28	0.28
	[0.12]	[0.12]	[0.12]	[0.12]	[0.12]
	First quintile: 492 municipalities. average distance to the US: 333 km.				
Homicide rate (annualized)	9.37	8.62	19.97	28.67	44.46
	[21.14]	[18.14]	[41.17]	[56.50]	[83.54]
Drug-related homicide rate	0.77	3.64	14.03	18.90	31.40
	[7.79]	[31.64]	[42.64]	[57.47]	[103.90]
Share of municipalities with cartels	0.24	0.34	0.42	0.43	0.49
	[0.43]	[0.47]	[0.49]	[0.50]	[0.50]
Population (in thousands)	53.10	54.00	54.93	55.89	56.88
	[146.47]	[148.71]	[150.80]	[152.74]	[154.53]
Historical PAN vote share (time invariant)	0.30	0.30	0.30	0.30	0.30
	[0.13]	[0.12]	[0.12]	[0.12]	[0.12]

Note.- The table presents summary statistics for the main variables used in our empirical exercises. The data are presented separately for municipalities in all Mexico, in the first two distance quintiles to entry points in the US, and in the first distance quintile to entry points in the US. Standard deviations for each variable are reported below the corresponding mean in square brackets.

Table 2: Time series effects of cocaine seizures in Colombia on violence in Mexico.

	All of Mexico			Quintiles 1 and 2			First quintile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable: homicide rate.								
log of seizures in Colombia	0.059**	0.056**	0.050*	0.082**	0.079**	0.073**	0.119***	0.120***	0.109***
	(0.027)	(0.025)	(0.026)	(0.033)	(0.032)	(0.034)	(0.033)	(0.034)	(0.037)
Observations	49	49	49	49	49	49	49	49	49
R-squared	0.950	0.957	0.961	0.947	0.953	0.955	0.950	0.952	0.953
	Dependent variable: drug-related homicide rate.								
log of seizures in Colombia	0.120**	0.123**	0.117*	0.126**	0.126**	0.125*	0.134**	0.137**	0.141**
	(0.055)	(0.055)	(0.060)	(0.057)	(0.057)	(0.063)	(0.060)	(0.061)	(0.066)
Observations	49	49	49	49	49	49	49	49	49
R-squared	0.952	0.955	0.956	0.961	0.964	0.964	0.959	0.961	0.961
	Dependent variable: assassinations of cartel members.								
log of seizures in Colombia	0.123**	0.131**	0.126**	0.124**	0.128**	0.127*	0.122*	0.130*	0.132*
	(0.057)	(0.056)	(0.060)	(0.060)	(0.059)	(0.064)	(0.065)	(0.066)	(0.072)
Observations	49	49	49	49	49	49	49	49	49
R-squared	0.951	0.955	0.956	0.957	0.961	0.961	0.956	0.958	0.958
	Dependent variable: confrontations deaths.								
log of seizures in Colombia	0.140	0.096	0.107	0.095	0.048	0.050	0.266	0.222	0.224
	(0.221)	(0.223)	(0.228)	(0.191)	(0.196)	(0.205)	(0.184)	(0.187)	(0.194)
Observations	48	48	48	47	47	47	46	46	46
R-squared	0.720	0.731	0.734	0.733	0.747	0.747	0.720	0.739	0.740
	Dependent variable: assassinations of government officials.								
log of seizures in Colombia	-0.047	-0.043	0.001	-0.061	-0.070	-0.026	0.035	-0.018	0.026
	(0.168)	(0.175)	(0.191)	(0.151)	(0.166)	(0.178)	(0.280)	(0.256)	(0.264)
Observations	43	43	43	41	41	41	34	34	34
R-squared	0.588	0.595	0.620	0.426	0.434	0.476	0.348	0.393	0.425
Time series controls:									
Unemployment rate		✓	✓		✓	✓		✓	✓
Economic activity		✓	✓		✓	✓		✓	✓
Seasonality			✓			✓			✓

Note.- The table presents estimates of the effect of cocaine seizures in Colombia on violence in different groups of municipalities in Mexico. The dependent variable is the log of the homicide rate indicated in each panel, aggregated at the monthly level. The explanatory variable is the log of the monthly cocaine seizures in Colombia. We estimate the model for all 49 months from December, 2006 to December, 2010. All models include a cubic polynomial in time (months) and year dummies, so that only high frequency variation is exploited. Columns 1 to 3 present estimates for Mexico as a whole; columns 4 to 6 for quintiles 1 and 2; and columns 7 to 9 for the first quintile. Columns 2, 5 and 8 add the monthly unemployment rate and a measure of economic activity as controls. Columns 3, 6 and 9 control for the rainy and hurricane season in Mexico. Standard errors robust against heteroskedasticity are reported in parenthesis. Coefficients with *** are significant at the 1% level, with ** at only the 5% level and with * at only the 10% level.

Table 3: The differential effect of cocaine seizures in Colombia on violence in Mexico by distance from the nearest US entry point.

	All of Mexico				Quintiles 1 and 2			
Estimation method:	Poisson model		Dep. var. $\ln(p+x)$		Poisson model		Dep. var. $\ln(p+x)$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: homicide rate.							
Seizures in Colombia × Proximity to U.S.	0.031***	0.023**	0.014***	0.013***	0.043**	0.045**	0.022***	0.023***
	(0.011)	(0.011)	(0.004)	(0.004)	(0.019)	(0.019)	(0.008)	(0.008)
Observations	98,245	85,309	120,295	97,902	42,973	42,189	48,167	47,089
Municipalities	2,005	1,741	2,455	1,998	877	861	983	961
	Dependent variable: drug-related homicides rate.							
Seizures in Colombia × Proximity to U.S.	0.067***	0.062**	0.026***	0.026***	0.128***	0.127***	0.053***	0.054***
	(0.024)	(0.025)	(0.008)	(0.008)	(0.044)	(0.044)	(0.017)	(0.017)
Observations	56,203	53,214	120,295	97,902	27,342	27,097	48,167	47,089
Municipalities	1,147	1,086	2,455	1,998	558	553	983	961
	Dependent variable: assassination of cartel members.							
Seizures in Colombia × Proximity to U.S.	0.037*	0.029	0.016***	0.016**	0.073*	0.073*	0.031**	0.032**
	(0.021)	(0.021)	(0.006)	(0.007)	(0.039)	(0.039)	(0.014)	(0.014)
Observations	53,900	50,911	120,295	97,902	25,970	25,725	48,167	47,089
Municipalities	1,100	1,039	2,455	1,998	530	525	983	961
	Dependent variable: confrontation deaths.							
Seizures in Colombia × Proximity to U.S.	0.124*	0.124*	0.023***	0.026***	0.198*	0.197*	0.053**	0.054**
	(0.070)	(0.070)	(0.009)	(0.010)	(0.108)	(0.107)	(0.021)	(0.021)
Observations	20,090	19,943	120,295	97,902	12,348	12,299	48,167	47,089
Municipalities	410	407	2,455	1,998	252	251	983	961
	Dependent variable: assassination of government officials.							
Seizures in Colombia × Proximity to U.S.	0.041	0.042	0.001	0.001	-0.017	-0.017	0.002	0.002
	(0.124)	(0.124)	(0.002)	(0.002)	(0.221)	(0.220)	(0.004)	(0.004)
Observations	7,448	7,448	120,295	97,902	4,655	4,655	48,167	47,089
Municipalities	152	152	2,455	1,998	95	95	983	961
Covariates:								
Differential trend by distance to US	✓	✓	✓	✓	✓	✓	✓	✓
Differential trend by PAN support		✓		✓		✓		✓

Note.- The table presents estimates of the interaction between cocaine seizures in Colombia (measured at the monthly level in logs) on violence in Mexican municipalities located at different proximities to US entry points (measured in 100km). The dependent variable is the log of the homicide rate indicated in each panel. All estimates include a full set of municipality and time fixed effects, as well as a differential cubic time trend by distance from US entry points. Additional covariates are indicated at the bottom of the table. Columns 1 to 4 present estimates for all of Mexico. Columns 5 to 8 present estimates for the first two quintiles of distance to the US border. Columns 1,2,5 and 6 use a Poisson fixed effects model (the sample is the set of municipalities with a positive number of homicides in at least one month); while columns 3,4,7 and 8, use a monotone transformation of the dependent variable, $\ln(p + x)$, with p the 90th percentile of x. Standard errors robust to heteroskedasticity and serial correlation within municipalities are reported below each estimate in parenthesis. Coefficients with *** are significant at the 1% level, ** only at the 5% level, and * only at the 10% level.

TABLE 4: Additional time series estimates of the effect of cocaine seizures in Colombia on the homicide rate in different subsamples of Mexican municipalities.

	Panel A: Heterogeneity by Cartel presence						*Panel B: Heterogeneity by PAN support*			
	No cartels		One cartel		Multiple cartels		Low PAN support		High PAN support	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log homicide rate $t-1$		-0.209		-0.013		0.044		-0.135		0.181
		(0.134)		(0.127)		(0.150)		(0.128)		(0.156)
log homicide rate $t-2$		-0.187*		-0.242*		-0.016		-0.187		0.065
		(0.104)		(0.125)		(0.161)		(0.143)		(0.199)
log homicide rate $t-3$		-0.287*		-0.351		0.008		-0.351**		-0.046
		(0.144)		(0.221)		(0.208)		(0.142)		(0.222)
log of seizures in Colombia t	0.021	-0.001	0.053	0.038	0.084**	0.082**	0.028	0.009	0.102***	0.103**
	(0.023)	(0.025)	(0.039)	(0.037)	(0.032)	(0.033)	(0.028)	(0.023)	(0.034)	(0.038)
Observations	49	49	49	49	49	49	49	49	49	49
R-squared	0.809	0.847	0.913	0.935	0.943	0.943	0.926	0.943	0.943	0.946

Note.- The table presents estimates of the effect of cocaine seizures in Colombia on the homicide rate for different groups of municipalities in Mexico. The dependent variable is the log of the homicide rate. The explanatory variable is the log of the monthly cocaine seizures in Colombia. We estimate the model for all 49 months from December, 2006 to December, 2010. All models include a cubic polynomial in time (months) and year dummies, so that only high frequency variation is exploited. Each model is estimated for the subsample of municipalities in the group indicated on the top rows. Standard errors robust against heteroskedasticity are reported in parenthesis. Coefficients with *** are significant at the 1% level, with ** at only the 5% level and with * at only the 10% level.

TABLE 5: Differential effects of cocaine seizures in Colombia on the homicide rate in Mexican municipalities with different cartel presence and PAN support.

	Poisson model			Dep. var. $\ln(p+x)$		
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: All Mexico.					
Seizures in Colombia × ...						
Proximity to U.S.	0.011	0.073***	0.061**	0.011**	0.047***	0.045***
	(0.011)	(0.021)	(0.024)	(0.005)	(0.011)	(0.012)
Cartel presence	-0.025	-0.026	-0.032	-0.012	-0.034	-0.037
	(0.055)	(0.173)	(0.175)	(0.027)	(0.081)	(0.085)
Proximity to U.S. × Cartel presence		-0.003	-0.004		-0.004	-0.005
		(0.023)	(0.023)		(0.010)	(0.011)
Multiple cartels	0.096	0.400**	0.389**	0.047	0.242***	0.241***
	(0.061)	(0.172)	(0.173)	(0.033)	(0.093)	(0.092)
Proximity to U.S. × Multiple cartels		0.057**	0.056**		0.033***	0.032***
		(0.023)	(0.023)		(0.012)	(0.012)
High PAN support	0.167**	0.330**	0.301*	0.036*	0.164**	0.158**
	(0.072)	(0.161)	(0.161)	(0.021)	(0.076)	(0.079)
Proximity to U.S. × High PAN support		0.035	0.030		0.019**	0.019*
		(0.024)	(0.025)		(0.010)	(0.010)
Observations	85,309	85,309	85,309	97,902	97,902	97,902
Municipalities	1,741	1,741	1,741	1,998	1,998	1,998
Additional covariates:						
Seizures in Colombia× (Proximity to the US)^2			✓			✓
	Panel B: Quintiles 1 and 2.					
Seizures in Colombia × ...						
Proximity to U.S.	0.026	0.099***	0.088	0.018**	0.060***	0.086**
	(0.018)	(0.029)	(0.066)	(0.009)	(0.017)	(0.040)
Cartel presence	0.007	-0.104	-0.106	-0.004	-0.073	-0.061
	(0.084)	(0.216)	(0.217)	(0.042)	(0.103)	(0.109)
Proximity to U.S. × Cartel presence		-0.028	-0.029		-0.018	-0.015
		(0.040)	(0.040)		(0.017)	(0.018)
Multiple cartels	0.152*	0.490**	0.487**	0.088*	0.290***	0.296***
	(0.086)	(0.208)	(0.209)	(0.047)	(0.110)	(0.110)
Proximity to U.S. × Multiple cartels		0.094**	0.093**		0.049**	0.050***
		(0.039)	(0.039)		(0.019)	(0.019)
High PAN support	0.165**	0.371**	0.365**	0.039	0.217**	0.235**
	(0.083)	(0.188)	(0.186)	(0.032)	(0.102)	(0.104)
Proximity to U.S. × High PAN support		0.055	0.054		0.035**	0.038**
		(0.035)	(0.035)		(0.016)	(0.017)
Observations	42,189	42,189	42,189	47,089	47,089	47,089
Municipalities	861	861	861	961	961	961
Additional covariates:						
Seizures in Colombia× (Proximity to the US)^2			✓			✓

Note.- The table presents estimates of the interaction between cocaine seizures in Colombia (measured at the monthly level in logs), proximity to US entry points (measured in 100km), cartel presence, and PAN support on violence in Mexican municipalities. The dependent variable is the log of the homicide rate. All estimates include a full set of municipality and time fixed effects, as well as a differential cubic time trend by distance from US entry points, by the number of cartels and by PAN support. The top panel present estimates for all of Mexico. The bottom panel presents estimates for quintiles 1 and 2. Columns 1 to 3 use a Poisson fixed effects model (the sample is the set of municipalities with a positive number of homicides in at least one month); while columns 4 to 6, use a monotone transformation of the dependent variable, $\ln(p+x)$, with p the 90th percentile of x. Standard errors robust to heteroskedasticity and serial correlation within municipalities are reported below each estimate in parenthesis. Coefficients with *** are significant at the 1% level, ** only at the 5% level, and * only at the 10% level.