The Economic Consequences of Drug Trafficking Violence in Mexico

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Abstract:

The levels of violence in Mexico have dramatically increased in the last few years due to structural changes in the drug trafficking business. The increase in the number of drug trafficking organizations (DTOs) fighting over the control of territory and trafficking routes has resulted in a substantial increase in the rates of homicides and other crimes. This study evaluates the economic costs of drug-related violence. We propose electricity consumption as an indicator of the level of municipal economic activity and use two different empirical strategies to test this. We utilize an instrumental variable regression using as exogenous variation the instrument proposed by Castillo, Mejía, and Restrepo (2013) based on historical seizures of cocaine in Colombia interacted with the distance of the Mexican border towns to the United States. We find that marginal increases of violence have negative effects on labor participation and the proportion of unemployed in an area. The marginal effect of the increase in homicides is substantive for earned income and the proportion of business owners, but not for energy consumption. We also employ the methodology of synthetic controls to evaluate the effect that inter-narco wars have on local economies. These wars in general begin with a wave of executions between rival criminal organizations and are accompanied by the deterioration of order and a significant increase in extortion, kidnappings, robberies, murders, and threats affecting the general population. To evaluate the effect that these wars between different drug trafficking organizations have on economic performance, we define the beginning of a conflict as the moment when we observe an increase from historical violence rates at the municipal level beyond a certain threshold, and construct counterfactual scenarios as an optimal weighted average from potential control units. The analysis indicates that the drug wars in those municipalities that saw dramatic increases in violence between 2006 and 2010 significantly reduced their energy consumption in the years after the change occurred.

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I. Introduction.

From the end of 2006, the levels of violence in Mexico, as measured by homicides, have soared mainly due to structural changes in the drug trafficking business and the government strategies to combat organized crime. Over 50,000 drug-trafficking-related deaths were registered by 2011. The vast majority of these deaths were caused by confrontations between drug cartels competing for control of routes and locations strategic for trafficking drugs to the world's largest market: the United States.

The violence in Mexico dramatically intensified due to three main factors: exogenous changes in the narcotics market, including above all the relative success of Colombia at counter narcotics operations and drug seizures (Mejia and Castillo, 2012); the increased fragmentation of drug cartels into numerous smaller organizations and criminal cells; and the militarized fight against drugs and drug trafficking that began during the administration of President Felipe Calderón (Guerrero, 2011a; Dell, 2012; Calderón, et al, 2013).

Most academic studies to this point have focused on the causes and escalation of violence. In our study, we measure the economic consequences of drug-related violence. Economic activity in Mexico has decelerated in recent years. During the government of Felipe Calderón, the economy grew at an average rate of 1.84%, the lowest rate of the last four administrations.[2] Although this low performance could be attributed in part to the violence, it is difficult to differentiate that effect from other factors that strongly affected economic performance. The financial crisis in the United States between 2008 and 2009 was followed by a severe contraction of the GDP in Mexico. In the same year, the government cut public spending significantly, and the country was impacted by the Influenza A(H1N1) epidemic that paralyzed economic activity for several weeks.

Drug cartels are fundamentally organized to maximize profits from trafficking drug illegally into the United States. "El Narco" is primarily an industry, and as an industry, the production and distribution of drugs is fundamental (Grillo, 2011). It is conceivable that under certain conditions the narco-traffickers operate, produce, and traffic drugs, all without using coercive strategies against citizens, and without extorting businesses. We could therefore conceive of situations in which drug trafficking is carried out under moderate levels of violence and that it therefore has little impact on economic activity.

However, as the Drug War has escalated in Mexico, the cartels and their criminal cells have diversified their portfolios of activities to include kidnapping, extortion, human trafficking, and oil theft, among other crimes (Guerrero, 2010). These criminal activities are expected to have a much more direct impact on society and therefore on economic activity.

To explore how drug-related violence affects the economy, we use the famous analogy of Mancur Olson (2000) equating drug cartels to either "stationary bandits" or "roving bandits" depending on the way in which they insert themselves into society. "Stationary bandits" are those that are capable of maintaining control over a certain territory in the long term, while "roving bandits" have temporary domain over an area. Olson argues that the former have rational incentives to restrict their ability to extract resources and use violence against the society because they wish to encourage investment and

[2] Centro de Estudios de las Finanzas Públicas de la Cámara de Diputados del Congreso de la Unión, available at http://www.cefp.gob.mx/publicaciones/nota/2012/octubre/notacefp0712012.pdf.

therefore long-term gain. In contrast, "roving bandits" extort, rob, kidnap, and murder to enhance short-term gain without regard for the long-term impacts on the area.

There is evidence that Mexican drug traffickers sometimes behave like "stationary" or "roving" bandits and this difference is expected to have a significant impact on economic activity. For example, El Cartel de Tijuana underwent an internal split between two factions, one led by Teodoro García Simental (alias *El Teo*), that apparently favored kidnappings in Tijuana,[3] and the other faction, led by Luis Fernando Sánzhez Arellano (alias *El Ingeniero*—the Engineer) with strong political and economic connections in the city, that wanted to focus primarily on drug trafficking and demanded the reduction of kidnappings as the main victims of this crime were businessmen. El Ingeniero feared that kidnappings were attracting too much attention from the government and were contributing to the destruction of businesses.[4] After the arrest of El Teo, the faction led by Arellano Féliz regained control of the cartel and tranquility was restored in Tijuana after the wave of violence between the two factions.

A similar dynamic appears to have occurred with the cartel La Familia Michoacana and the population in the Mexican state of Michoacán. In the beginning, that cartel was formed from a group of vigilantes who emphasized helping and protecting the poor against smugglers and drug traffickers. The cartel gave aide and loans to farmers, businessmen, housewives, and churches, and publicized these services in local newspapers to win social support. The group over time transformed into a criminal gang that increasingly began using violence against the population and widespread extortion against citizens.

Initially formed from a group of army deserters, Los Zetas are now one of the most powerful and violent cartels in the country. They are reputed to establish dominance in their territories through excessive force, kidnapping and extortion of any business that crosses their path. This criminal organization originally began as the strong arm of the Gulf Cartel, and, after splitting off from that group, has become not only the principal rival of the Gulf Cartel, but also the powerful Sinaloa Cartel. The presence of the Zetas has terrorized the people in the states of Tamaulipas, Veracruz, Zacatecas, San Luis Potosí, and numerous municipalities in Jalisco, Guerrero, and Michoacán, among other states.[5]

What factors lead cartels to traffic drugs on societal margins or turn against it? Diaz-Cayeros et al (2012) used list experiments and opinion surveys to investigate the dynamics of extortion in Mexico. The narco-traffickers tend to act as "stationary bandits" when they have monopolistic control over a determined territory. In this case, the authors found that the "narcos" exert lower levels of extortion and even reported that citizens resort to them for "help when facing a serious problem." Cartel behavior towards society changes in the disputed territories. In those areas, the competition for towns and drug trafficking routes is associated with greter levels of extortion and increasingly predatory behavior on the part of the cartels (Diaz-Cayeros, et al, 2012).

Another factor that seems to have contributed to drug cartels behaving increasingly like "roving bandits" are the arrests or abatements of their primary leaders (Calderón, et al, 2013). Felipe Calderón's government pursued an aggressive policy of arrests of criminal organization "kingpins," or high-level leaders, which differentiated the administration from its predecessors. Over half of the drug capos that operated in Mexico in 2008 were captured. By losing their top leaders, the cartels lost control of the smaller criminal cells, and thus lost their capacity to operate their international drug trafficking routes

[3] El Teo was arrested in January 2010 and his faction was eliminated
[4] http://covert-history.wikia.com/wiki/Tijuana_Cartel
[5] *Proceso* "Zacatecas, tierra de nadie… y de cadáveres." January 2013. Available at: http://www.proceso.com.mx/?p=329736

effectively and economically, causing them to turn against civilians to extract resources through increasingly exploitative criminal behavior (Guerrero, 2010; Calderón et al, 2013).

Corrupt law enforcement, and collapsing policing and justice systems favor the diversification of drug cartels' criminal activity. In a recent study, Magaloni, et al (2013), found that it is more common for a citizen to be extorted by the police than by narco-traffickers. The study also shows that over one third of the population believes the local police are working for criminal organizations. The fear of being a victim of a crime widespread, which induces behavioral changes in that people stop leaving their homes at night, using public transportation, or driving on highways (Diaz-Cayeros, et al, 2012). These changes in behavior can have an impact on consumption and economic activity especially in tourism, services, and commercial trade sectors.

These studies do not help us to derive hypotheses about how we expect that violence related to drug trafficking impacts economic performance. We could suppose that despite the presence of criminal organizations in a certain place, the businesses might stay open and the people might continue to perform their regular activities despite living in cartel-controlled territory. In this equilibrium we could suppose that the cartels behave like "stationary bandits" and that the local economy continues to function normally—the people investing, working, going to school, enjoying themselves, etc.—despite perhaps living with moderate levels of violence.

However, when a rival criminal organization arrives to violently dispute control of said territory, it is likely that the established equilibrium between the narco-traffickers and the society will be broken. For example, the rival organization could look to establish its domain in the location by threatening, kidnaping, extorting, and assassinating anyone who continues to cooperate with its enemies.[6] The war unleashed between members of criminal organizations is related to the government capture of leaders and lieutenants that contributes to the criminal cells in towns escaping from under the greater DTO's control and instead behaving in self-serving predatory ways through extortion and kidnapping.

Wars between drug cartel rivals have resulted in waves of violence in cities like Tijuana, Ciudad Juárez, Acapulco, Tampico, Nuevo Laredo, Culiacán, Durango, Reynosa, and more recently Monterrey and Guadalajara, to name the most violent. During these inter-cartel wars, criminal organizations frequently become *de facto* powers,[7] meaning that no one is above them. Anything that happens in the lives of these community members depends on the priorities of criminal organizations and their leadership (for example, which candidate is elected as mayor, who is named as chief of police, what news is reported, and even includes what festivals can be celebrated, just to name a few).

Under these war-like conditions, we can assume that business owners will close their shops and look to move to safer territories. The Internal Displacement Monitoring Center warned that due to drug-trafficking related violence in Mexico, some 230,000 people have been forced to leave their homes, especially in Tamaulipas, Nuevo León, Chihuahua, Baja California, Sinaloa, and Michoacán, and approximately half of those people have immigrated to the United States (IDMC, 2010). In addition, there exists sufficient anecdotal evidence that a considerable number of Mexicans have immigrated to the United States because of a lack of security in the country (Felbab-Brown, 2009). A large proportion

[6] Report: *Proceso*.

[7] After the assassination of the photographer Luis Carlos Santiago from *El Diaro de Juárez* in September, 2010, that paper published an editorial directed at criminal organizations, referring to them as the *de facto* authorities of Ciudad Juárez. The editorial, "What do you want with us?," expressed a feeling of helplessness against both the criminals and the authorities that dominates in some regions.

of the migrant population are business owners, who manage to continue their businesses from cities along the U.S.-Mexican border, like Brownsville and McAllen, Texas (The Economist, 2012). The migration caused by violence does not just harm the labor supplies but also the investment in new capital, status existing business, and creation of new businesses.

The objective of this study is to estimate the effect of drug-trafficking related violence on the economic downturn and unemployment. Given that we do not have time-series GDP data available at the municipal level, we used electricity consumption per capita measured in megawatt-hours as a proxy for economic activity. We also explore distinct variables related to the labor market, such as the proportion of people over age 14 who are working, unemployed, self-employed, and business owners, as well as the effect on average labor income.

To evaluate the impact of violence on the economy, we use two identification strategies. First, we use an instrumental variable specification to model the marginal impact of violence. In this analysis, we instrument violence, using the tool constructed by Castillo, Mejía and Restrepo (2013), which was developed from the interaction of two variables. It was designed to model the exogenous variation of violence over time using the percentage of drugs seized in Colombia with respect to production estimates. We then interact the latter with the spatial distance from Mexican municipalities to the points of entrance into the United States. With said specification, we can identify the effect of violence on employment and economic activity.

The results of our analysis with variable instruments indicates that an increase of 10 homicides per 100,000 inhabitants generates: a decrease in the proportion of people working in the municipality by about two and three percentage points in the current and next quarter respectively; an increase in the proportion of unemployed people by about a half a percent; a decrease in the proportion of people owning a business in a municipality by about four-tenths of a percentage point; and a decrease in the proportion of people self-employed in the municipality by about a half a percentage point (as defined by INEGI). An increase of one homicide per 100,000 inhabitants decreases the average municipal income by 1.2% in both periods (using deflated 2002 dollars).

With the instrumental variable approach, however, we found no significant effect on energy consumption, which was our proxy for GDP. The instrumental variable strategy can identify the marginal effect of homicide rates on our economic variables—that is, how the increase of one additional homicide per 100,000 people contributed to the observed variance. It is nevertheless possible that the violence does not affect the economy in a linear form. We can think of a scenario in which drug-trafficking related violence impacts the economy in a substantive way after a certain threshold, which may reflect the beginning of a war between cartels.

To evaluate the argument that drug-related violence strongly affects the economy when it reaches a certain "war threshold," we utilize the methodology of synthetic controls (Abadie and Gardeazabal, 2003; Abadie, Diamond and Hainmueller, 2010). This methodology has been employed satisfactorily in the violence literature (Abadie and Gardeazabal, 2003; Pinotti, 2011; Calderón et al, 2013). Abadie and Gardeazabal (2003) estimate the costs of terrorist activities in the Basque country in Spain. For this study, the authors develop a methodology of synthetic controls in which they assign weight to control units to construct synthetic counterfactuals that resemble the initial conditions before the event of interest. In their paper, the event of interest is defined as the period since the late sixties, when the terrorist group ETA first appeared in the Basque country. The authors found that terrorist activities in the Basque country brought with them a fall in GDP per capita of 10 percentage points

relative to the synthetic control of the region without terrorism. Additionally, the gap in GDP per capita appears to have increased during the periods of peak terrorist activity.

Pablo Pinotti uses the synthetic control methodology to estimate the economic effects of Italian Mafia activity in southern Italy. The author estimates a decrease in GDP per capita of 16%, reflected as a net loss of economic activity, as a result of private capital with less productive investments.

In the present analysis, we define a municipality as victim to a "war between cartels" when the number of homicides year to year, in any two year pair between 2006 and 2010, increases by more than three standard deviations with respect to the historic average of annual homicides since 1998. Based on this definition, we include 84% of the 100 municipalities with the highest rates of drug-related homicides, 90% of the 100 municipalities with the highest rates of homicides, and 80% of the municipalities with the most major increases in violence.

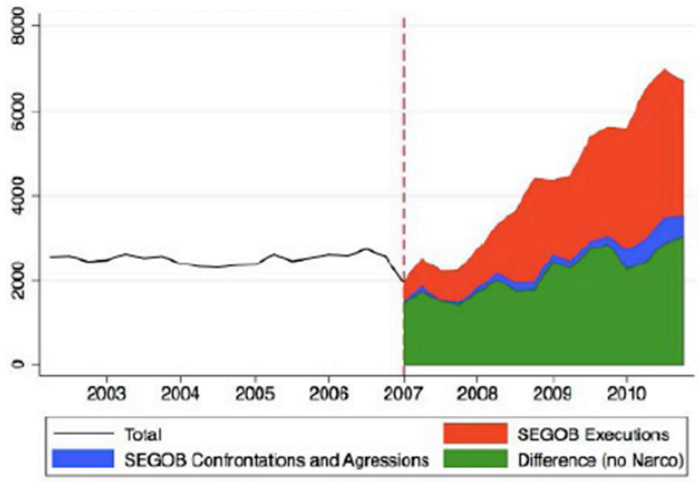
The results of the synthetic control exercise show that during the first and second year after the start of a war between cartels, the treated municipalities consumed on average 4.19% and 7.4% less electricity per capita, respectively, than the synthetic counterfactuals. In this way, our results indicate that wars between rival drug cartels for strategic routes or territories in the last six years have had a profound impact on the local economy in Mexico.

This paper is structured in the following manner: In section II we describe the structural changes in the drug trafficking business in Mexico and demonstrate the consequential changes in the patterns of violence since 2006. Section III provides a literature review on violence in Mexico and in several other Latin American countries. In the following sections, we lay out the mechanisms by which drug-trafficking related violence affects supply and demand in the labor market and the economy in general. In sections V and VI, we describe the variables of interest and justify the use of domestic electricity consumption as an indicator of economic activity. In section VII we describe the empirical strategy for identifying the marginal effect of violence on economic performance and present the results of the instrumental variable regression. Section VIII introduces the methodology of synthetic controls and demonstrates the difference between consumption of electricity between municipalities observed to have high increases in their homicide rates and their respective synthetic counterfactual scenario of a municipality without violence.

II. Violence and the Drug Trafficking Industry in Mexico

While Mexico's homicide rate falls far below that of other countries in Latin America, there is no doubt that the country is in the middle of a wave of violence that erupted in late 2005. Figure 1 below shows the total number of homicides in Mexico from 2003 to 2011. It is possible to classify the violence into two categories: that related to organized crime, and general criminal violence (manslaughter) not linked to organized crime but affecting the general population.

Figure 1. Total Homicides and Drug-Trafficking related homicides, 2003-2010:



To measure violence, we make use of two data sources. The first source of information is the data compiled by the federal government about "Deaths by Presumed Delinquent Rivalry" in which homicide is classified in three ways: death by *execution* (confrontations between criminal organizations without the involvement of authorities), as a result of *directed aggression*, and as a result of *confrontations* with law enforcement, which includes crimes against authorities and confrontations between police and criminal organizations, respectively. This database covers the period from December 2006 to September 2011.

The other data source used to measure the violence is that provided by the National Health Information System (SINAIS), which reports the total number of deaths in the country. Based on death certificates, they can calculate the number of violent deaths or homicides in the country. An advantage of using this database is that it permits us to map the total number of homicides that have occurred in the country since 1980. The total number of registered homicides in the SINAIS database between December of 2006 and December of 2010 was 80,976, where over half of the cases (approximately 53%) were homicides that affected the population between 15 and 35 years old.

Drug trafficking related violence has its own characteristics and causes that distinguish it from general violent crime (intentional homicide) which, while it does affect a larger section of the population, does not compare to the intensity or cruelty of violence connected to narco-trafficking.

Approximately 90% of the drug-trafficking related homicides are executions, allowing us to affirm that the increase in violence in Mexico is fundamentally associated with inter-cartel rivalries.

Executions are carried out to settle scores between people involved in the production, transport, and sale of drugs who do not abide by existing rules and agreements associated with the violent struggle for control of drug trafficking areas and routes. Organized crime-related violence is characterized by intentional intimidation towards those who are considered to be rivals. Dismembered, burned, hanged, and decapitated corpses are daily images of the violence associated with organized crime in Mexico.

Although the DTOs (Drug Trafficking organizations) have purely economic motivations, and no ulterior political motives, they do share many characteristics with terrorists and insurgents that utilize violence to compete for territorial control (town squares, or *plazas*, and drug trafficking routes) and also to attack and intimidate the police and civil society in general. These organizations base their business models on complex extortion and illegal trafficking rackets. What we may know of as a "cartel" is in reality composed of many smaller units, each with specific responsibilities, including drug transport, security, executions, extortion, money laundering, and many more. The cartels are understood to be vertically integrated business organizations that produce, transport, and distribute drugs with the help of other criminal groups and under the protection of corrupt and co-opted authorities.[8]

Cartels are primarily organized to maximize earnings from illegal drug trafficking into the United States and the domestic sale of the same drugs.[9] Cartels also tax subsidiary criminal organizations that pass drugs through their territories. These criminal organizations are increasingly resorting to extortion, kidnapping, and other illegal activities to cover these protection fees.

Drugs are smuggled illegally into the United States in cars, trucks, boats, trains, planes, and secret tunnels. Drugs are hidden inside shipments of other goods, and therefore it is logical that criminal organizations will have a stronger presence in places where logistics and communication channels facilitate international trade—border crossings, sea ports, railway routes, airports, and municipalities located near land with easy access to the border (Calderón et al, 2013).

Drug trafficking is violent largely because there are a finite number of ports and border crossings through which to traffic drugs. As a result, the value of controlling these territories can become exorbitant and hence the incentives to fight violently for their control increase. The border is, as it were, a "natural funnel" that the Mexican drug cartels can close off and effectively monitor all drug trafficking to the most lucrative drug market in the world, allowing them to extort smaller trafficking groups than necessarily must pass their products through the cartel territories.

The 25 most violent municipalities in Mexico contained over half of the homicides that occurred between December 2006 and December 2010. Ciudad Juárez, Culiacán, Tijuana, and Chihuahua were the most violent cities in this period, with a total 13 million drug trafficking-related deaths. Nevertheless, even though the violence has been concentrated in very few municipalities, it has become increasingly disperse over time.

[8] National Drug Intelligence Center, February 2010, Drug Trafficking Organizations, http://www.justice.gov/ndic/pubs38/38661/dtos.htm#Top

[9] Some commercial value estimates of the drug trafficking industry can be found in Ríos, 2008.

The maps in figure A.1 of the appendix show the total number of homicides for each municipality in the country based on data from the federal government. Each map shows the cumulative murders, by year, from 2006 to 2011, meaning that the final map contains data on the total number of violent deaths that occurred in this five-year period. The geographic dispersion of organized crime related violence can be clearly observed in these graphics. In 2006-2007 there were three alarming areas—Tijuana, Ciudad Juárez, and Culiacán. For 2008, the organized crime-related violence began to expand into other cities such as Mazatlán, the port city of Acapulco, Durango, and Chihuahua, among others. By 2009, the violence affected municipalities in Guerrero, the state of Mexico, Michoacán, Coahuila, and Nuevo León. For 2010, the violence expanded to Aguascalientes, Tepic, and Guadalajara, as well as Nuevo Laredo, Reynosa, and Matamoros.

The last map in appendix figure A.1 shows the total number of deaths due to alleged criminal rivalry between 2006 and 2011, wherein you can observer the existence of various alarming focuses of violence in the country: the first is the Northwest where the Sinaloa, Beltrán Leyva, Tijuana and Juárez cartels compete for territory, as well as the Gulf Cartel. The second region is the Northeast, in Tamaulipas and Nuevo León, where the primary territory wars between Los Zetas and the Gulf Cartel are carried out. The third focal point is in the area around Guerrero and Michoacán where the cartels Independiente de Acapulco, La Familia Michoacana, Knights of Templar, Los Zetas and Gulf Cartel all battle for territory. The fourth alarming area is in Jalisco and some neighboring municipalities in the states of Nayarit, Zacatecas, Morelos, and Mexico, where the Sinaloa, Beltrán-Leyva, Jalisco, Nueva Geración, and Knights Templar fight. This area separates the Sinaloa cartel, the South-Pacific cartel, the Zetas, and the Resistencia, among others.

Many factors have been mentioned as potential determinants of the structural change in the drug-trafficking business in Mexico and the exorbitant expansion of violence in the country. The first is the implementation of the North American Free Trade Agreement and the consequent increased flow of trade to the United States, which made northern border areas more lucrative in both legal and illegal trade. Drugs could move into American territory over land, air, and sea, along with the newly increased commercial flows, thus reducing transaction costs and diminishing the likelihood of seizures.

Second, at the end of the 1980s and the beginning of the '90s, the United States government began to intensify its campaign against massive trafficking of cocaine from Columbia and onto the beaches of south Florida. After years of intelligence work on the part of the Drug Enforcement Agency (DEA) to dissolve the Columbian drug cartels and implement constant interventions through Plan Colombia, the international forces were successful at closing off what was known as the "Caribbean route" into the United States (Chabat, 2010). Also, since 2007, the Colombian government has changed its own domestic strategy against drug trafficking by putting greater emphasis in combating cocaine production and exportation than in plantation coca crop destruction. One of the principal consequences of this strategy's success in Colombia was the migration of the drug trafficking business out of Colombia and into other regions (Mejía and Castillo, 2012). As a result, Mexican traffickers inherited a practical monopoly on drug trafficking routes into the United States, and the drug trafficking industry became more profitable.

Among the domestic factors mentioned in the literature and related to the increase in violence is the country's political liberalization that began at the end of the 1980s and accelerated throughout the succeeding decade. The Institutional Revolutionary Party (*Partido Revolucionario Institucional*, PRI) held a *de facto* monopoly and controlled the vast majority of popularly elected positions at all three levels of government (federal, state, and municipal). There is a belief that local and national authorities

negotiated truces with narco groups in exchange for order and peace in their regions and for other private benefits (Chabat, 2010; Astorga, 2010). According to this theory, with democratization at the end of the 1990s, the number of political actors and bodies multiplied, making it on the one hand difficult to create a credible protection and tolerance agreement and on the other hand desirable to make a federal security strategy to be implemented on a local level.

Nevertheless, the most influential explanation in the media and in the academic debate for the increase in violence has been the security strategy implemented during the presidency of Felipe Calderón. The government pursued an intensive policy of containment weakening of DTOs, and incorporated security forces at all three levels of government, and also involved the armed forces. We may consider that the official war against organized crime began in December of 2006 when the federal government launched its first "Joint Operation" in the state of Michoacán, where they sent all of the federally controlled forces (army, navy, and federal police) into the state to ensure safety and combat drug trafficking organizations. Since then they have enacted nine "Joint Operations," which has led to a historically unprecedented militarization all dedicated to the fight against criminal organizations.

Since the federal offensive began, the government has arrested or shot over 23 drug cartel leaders. Some criminal organizations, such as the Beltrán-Leyva, La Familia Michoacana, and the Gulf Cartel have been weakened, but other new groups such as the Cartel de Jalisco Nueva Generación or the Knights Templar have emerged to occupy some of these newly available territories and spaces. Guerrero (2010, 2011) argues that the policy of taking out kingpins, or "beheading" criminal organizations, has contributed to the fragmentation of these same groups, and the creation of new groups that look to compete for routes and *plazas* and the subsequent escalation of violence. The academic literature on this theme has increasingly generated new hypotheses and empirical strategies (Merino 2011, Rosas 2011, Dell 2011, Signoret, 2011).

Analysts have argued that the arrests of leaders are costly mainly because they trigger succession battles or inter-cartel conflicts. Calderón et al (2013) demonstrates, through a difference-in-difference analysis and synthetic control groups, that the principal costs of the arrests are read in terms of the common homicides that affect citizens in general. Their study suggests that the arrests of leaders have a permanent trigger effect on common crime, whereas the effect on executions between criminal organization members is shorter term.

There are many possible explanations about why common crime has changed due to cartel leader captures or abatements. In the first place, when a leader is neutralized, many of those criminal groups and the gangs working for the organizations essentially become unemployed. These gangs then turn to the activities that they know will guarantee them income: extortion, kidnapping, assault, theft, and murder, which in turn affects the civil society much more than cartel rivals.

Second, an organization's leader could directly discipline the criminal cells that work underneath him. If the criminal organization then looses its leader, it will lose its ability to control the smaller cells, thus weakening the lines of authority. The gangs and criminal cells may become free to carry out their own criminal objectives related to drug trafficking.

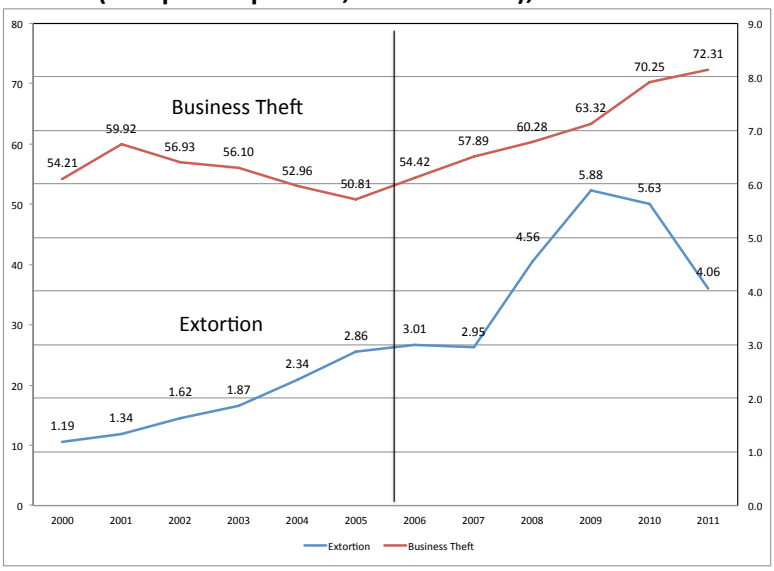
A third reason why the offensive against the drug cartels could trigger a wave of common war is that the war against drug trafficking distracts the municipal or state police from the presence of common crime, or the groups irreparably corrupt local law enforcement. This could contribute to generating a generalized climate of impunity and social breakdown. Violent quarrels among neighbors,

robberies, kidnappings, small-scale gang wars, to name a few, could increase due to perceived police impunity.

It is therefore important to emphasize that one of the primary problems that explains the Mexican crime wave has to do with the institutions for the enforcement of justice in Mexican states and municipalities. The power vacuum created by cartel beheadings is quickly flooded with gangs and criminal cells who, in order to be contained, require efficient police forces and justice institutions that instill credible sanctions against the groups. Nevertheless, these institutions are collapsing in many parts of the country. State and municipal police are frequent agents of crime and sources of extortion, rather than enforcers of security and defenders of the citizenry. The generalized climate of impunity perpetuates the process of instability and violence.

In this way, as the war on drugs has escalated in Mexico, drug cartels and their numerous criminal cells have acted increasingly as "roving bandits." Cartels have diversified into a series of illegal activities, such as kidnappings, extortion, human trafficking, petroleum theft, money laundering, arms trafficking, car theft, and drug dealing on a local level (Guerrero, 2011b). Figure 2 shows the number of reported robberies on businesses and of extortion per 1,000 inhabitants at the national level. Between 2000 and 2010, the number of reported crimes of this type has increased to an annual rate of 16.9% from an initial rate of 2.6%.

Figure 2. Events reported to prosecuting agencies (Complaints per 100,000 habitants), 2000-2010.



Source: National Exeucitve Secretary of Public Security

To measure the dynamic of extortion, Díaz Cayeros et al (2010) utilize list experiments in a national survey and encounter that 10% of the population in Mexico is extorted by the DTOs. There is a greater rate of extortion in areas where criminal organizations compete for territorial control, which in monopolistically controlled areas is just 30%.

III. The Economic Costs of Violence in the Academic Literature

The cost of violence includes both tangible and intangible cots. The tangible costs include all activities related to the prevention of and punishment for violence, such as investments, expenditures, and material losses, as well as the cost of carrying out activities that identify and punish those who commit crimes that contribute to the violence. The intangible costs are more difficult to value because they include estimates of the victims' decreased quality of life (CICAD and OAS, 2010; McCollister, French and Fang, 2010), changes in behavior, and other personal traumas (Soares, 2009), and the loss of interpersonal trust and social capital because of fear and loss of order and freedom.

Estimating the cost of violence is a complex exercise, especially for the intangible costs that cannot easily be assigned a value. The vast majority of studies only focus on the tangible costs, with a wide range of results.[10] Kahn (1999) and Velasco and Andrade (2003) use a method of accounting for estimated costs of violence in São Paulo and Belo Horizonte, Brazil. Also on Brazil, the World Bank uses a panel to study the impact of violent crime rates (approximations of the homicide rates) on the economy in general. The report estimates that a reduction of 10 homicides per 100,000 people produces an increase in the GDP per capita of between 0.7 and 2.9% during the next five years, depending on the specifications used.

Londoño and Guerrero (2000) use case studies for the countries of Brazil, Colombia, El Salvador, Mexico, Peru, and Venezuela. To analyze the estimated costs of the violence, the authors analyze four components: decreases in health, material losses, deterioration of consumption and labor, and the reduction of transactions between people. They conclude that the violence in Latin America implies a cost of 14.2% of the regional GDP, with a range from 5.1% in Peru to 24.9% in El Salvador. They also find that the factors most correlated with lower levels of violence are good quality education and equitable economic growth.

Ríos (2011) evaluates the economic impact of the narco-trafficking industry in Mexico. To calculate the cost of crime and violence related to narco-trafficking, Ríos estimates the percentage of crimes related to drug trafficking and multiplies that by the estimated cost of violence as found in Londoño and Guerrero (2000). She concludes that drug trafficking has a negative economic impact, with economic losses in the area of $4.3 million annually since 2006.

The main methodological challenge in estimating the economic consequences of violence is the problem of identification. Just as the violence has a negative effect on economic activities and unemployment, poor economic performance or low employment rates can also generate more violence. Dell (2011) is one of the more innovative studies looking to resolve the problem of identification. The researcher utilizes a regression discontinuity design in which she uses the electoral calendar at the municipal level as a source of exogenous variation. The study shows that those municipalities that elect a mayor from President Calderón's party (National Action Party, PAN) by a small electoral margin experience increased in violence in the months after the election when compared with those municipalities where the PAN lost by a similar margin.

Dell interprets these results as evidence that government action is the generator of violence, assuming that the mayors from the Pan party were more likely to implement the security policies

[10] McCollister, French and Fang (2010) use a different strategy: they estimate the intangible costs of violence through the costs of suffering and stress as manifested in legal sentencings in favor of the victims.

coming down from the central government. A second interesting result from her study is that a PAN victory causes the violence to overflow into neighboring municipalities that fall along drug trafficking routes. The author finds results that this expanded violence results in a reduction of female labor market participation and a drop in wages for men in the formal sector.

A limitation of Dell's study is that her identification strategy focuses on only a small number of municipalities that do not necessarily have high concentrations of violence. The other limitation is that her study does not measure government actions. The small margin of victory is possibly associated with municipalities that have very low capacity to carry out an arrest or a joint action precisely because the party was elected with small margins. Even more, a small margin of victory could affect the violence through other mechanisms. For example, a small victory could invite the opposition (or perhaps a DTO) to make it difficult for the municipal president to govern. Finally, Dell only observes a small window after elections and as a result she cannot estimate the medium- and long-term effects of the election results.

IV. Mechanisms

The challenge of measuring the economic cost of violence is enormous. Even if you cannot quantify the increase in total cost due to increases in extortion, kidnapping, and latent insecurity, you can measure the effects of violence on different economic variables.

In this analysis, we assume that violence does not necessarily have a linear effect on economic performance. Below a certain threshold, the effect of an additional homicide is low. Firms need to internalize some costs caused by royalty payments, robberies, need for increased security technology (such as cameras in truck trailers), bailouts, and bodyguards, among others. However, since the level of homicides and crime is not high, violence would not have a significant effect on both the labor supply and demand. Smaller businesses could cease to operate, creating a decrease in the demand for labor. However, big firms will not be affected. As far as labor supply, groups more vulnerable in the face of crime—such as women—may decrease their offers of work because of fear of falling victim to crime in their areas.

However, it is likely that there is a violence threshold, which we name *"turf war threshold",* above which we would expect to see a much more severe impact on economic activity. The inter-cartel war for control of certain drug trafficking routes and *plazas* generally comes paired with a substantial increase in executions between members of rival criminal organizations. Extortion, kidnapping, and common crime also rise.

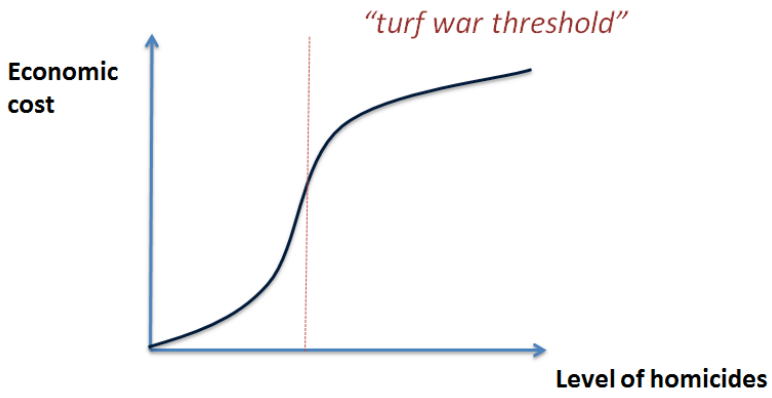
There are many reasons why we believe that other types of crime rise when inter-cartel wars erupt: 1) the need of stronger cartels to sustain the armed conflict, 2) the reduced probability of punishment for crimes as government resources get absorbed into the primary conflict, which increases crimes of opportunity, 3) the desire to punish and intimidate any person suspected of cooperating with enemy cartels, and 4) the capture or assassination of leaders, which causes cartels to lose control of their subsidiary groups and criminal cells.

The escalation of violence generates daunting conditions for authorities unprepared and under resourced to deal with the crimes. In addition to this, many police agencies and other authorities are in the pockets of organized crime, which contributes to a considerable widening of impunity (Blancornaleras, 2002; Chabat, 2006; Grillo, 2011; Ríos, 2012).

As it approaches the *"turf-war threshold"*, the drug-trafficking related violence profoundly impacts economic performance in the country. Under these conditions, it is likely that a considerable number of businessmen will decide to close their businesses and move with their families to more secure areas. When many businesses decide to cease operations, we can expect to see a reduction in the total production of goods and services, as well as investment, and therefore a sharp decrease in the GDP.

Nevertheless, the marginal effect should be low in a situation where there is a level of violence above the "tur*f-war threshold*". Our claim is that, an additional homicide in a municipality that has high levels of violence shouldn't affect drastically the economic outcomes. The relation between economic cost and violence is not linear. Most of the cost is incurred in a municipality in the moment in which it experiences a turf-war (see Figure 3).

Figure 3. Relation between the Levels of Homicides and Economic Cost



V. Domestic Consumption of Electricity as a Proxy for GDP

This study aims to estimate the effect of increases in violence in Mexico as measured by homicides on the economic activity and employment rates of the country. We measure this at the municipal level, yet there is no official information about GDP rates in a high frequency at this level of aggregation[11]. Our proposal in this study is to approximate the municipal level GDP indicator using domestic electricity consumption as a dependent variable.

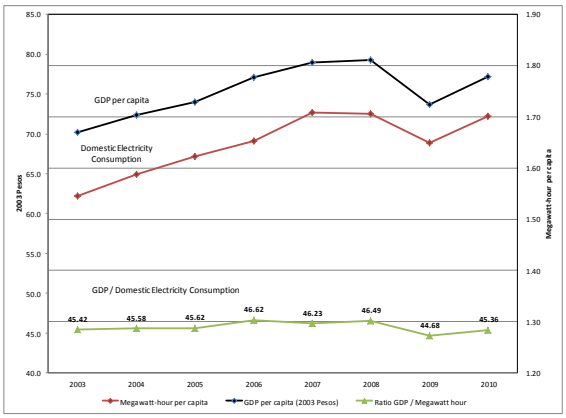
Figure 4 compares the time series of real national GDP per capita with the domestic consumption of electricity per capita measured in megawatt hours from 2003 to 2010. It can be seen that the two series present similar tendencies over time. Moreover, the ratio of GDP with respect to internal electricity consumption has remained constant with an average of MX$45.75 per megawatt-hour and a standard deviation of 0.61. Approximately 60% of the internal electric consumption comes from the industrial sector, while homes consume approximately 25%. Figure 5 shows the quarterly

[11] Economic Censuses in Mexico are carried out every five years.

series between GDP per capita and domestic electricity consumption. It can be seen that the series shows not just the same tendencies over time but also the same variation.

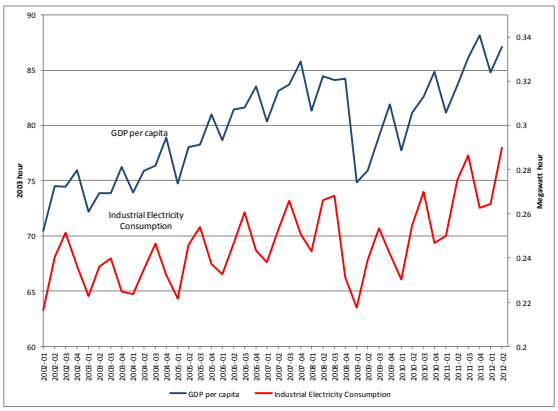
Under the assumption that the internal consumption of electricity provides a good approximation of economic activity, our estimations of the effects of violence on the internal consumption of electricity can be equated to economic activity and GDP.

Figure 4. GDP per capita and Domestic Consumption of Electricity per capita



Source: Instituto Nacional de Geografía y Estadística

Figure 5. GDP per capita and Industrial Electricity Consumption per capita, Quarterly



Source: Instituto Nacional de Geografía y Estadística.

Another advantage of using electricity consumption as our dependent variable is that it allows us to infer not only the formal economic activity, but also all general economic activity, including the informal sector that is not accounted for in the GDP time series. This is particularly relevant in the case of Mexico, where the informal sector accounts for an estimated 29.1% of all employment.[12] Moreover, if the increase in criminal activities and the violence leads to a movement from the formal economy to the informal economy, a negative sign in the GDP series may indicate only a change the composition of the economy, but not a decrease in the economy overall (Pinotti, 2011). Using electricity consumption as our indicator of economic activity also allows us to capture informal economic activity.

VI. Description of the Data

The annual data on electricity are provided by the National Institute of Geography and Statistics (Instituto Nacional de Geografía y Estadísticas, INEGI). The constant base of annual observations in the domestic consumption is measured in megawatt-hours at the municipal level from 1994-2010. This information is available for the majority of the years during the period of study for the majority of the municipalities.[13] The study, based on the electricity data, contains observations for 1,308 municipalities for which there is complete and constant data from 2002 to 2010.[14]

[12] Data frim the first quarter of 2012. Instituto Nacional de Geografía y Estadística.

[13] Most of the observations that are missing correspond to municipalities located in the states of Chiapas and Oaxaca. These municipalities are primarily in rural locales and have not shown incrases in violence of the same

For this sample, the average consumption of electricity per capita between 2002 and 2010 is 1 megawatt-hour per person with a standard deviation of 1.288 per year. The distribution is slightly skewed to the right and around 10% of the municipalities show consumption per capita of over 2 megawatt-hours.

Table 1. Descriptive Statistics

	Mean	Standard Deviation	Min	25%	50%	75%	Max
Yearly data from 2002 to 2010 (n = 1,308 municipalities)							
Electricity consumption per capita per year	1.00	1.29	0.01	0.40	0.64	1.13	22.58
Homicide rates (100 thousand inhab.)	12.69	23.65	0.00	0.00	7.17	15.93	769.84
Average number of homicides per year	8.54	62.52	0.00	0.00	1.00	5.00	3,965.00
Observations	14,388						
Quarterly Data from 2005 to 2010 (n= 1183 municipalities)							
Homicide rates (100 thousand inhab.)	4.22	18.29	0.00	0.00	0.00	3.19	1,498.64
Average number of homicides per year	1.81	14.57	0.00	0.00	0.00	1.00	1,279.00
Percentage of People Working*	56.04	5.86	12.28	53.36	56.35	59.05	100.00
Percentage of Unemployed People*	2.52	1.72	0.00	1.37	2.48	3.56	25.00
Percentage of Business Owners*	2.63	1.63	0.00	1.75	2.55	3.34	30.19
Percentage of People who are Self-Employed *	12.68	5.94	0.00	9.37	10.79	13.98	78.72
Monthly Labor Income	4,614.98	1,568.25	48.82	3,555.30	4,757.92	5,737.25	56,705.73
Logrithm(Monthly Labor Income)	8.36	0.42	3.91	8.18	8.47	8.65	10.86
Observations	58584						

*: The percentage is calculated over the total population older than 14 years old.

Besides electricity consumption, in this study we will focus on the proportion of people working, unemployed, self-employed, with their own business, and the average labor income. This data comes from the National Survey on Employment and Occupation, which is a representative survey at the national level, that contains information about the labor market of Mexico and which is generated in conjunction with INEGI. The data collected has a rotating panel structure. They followed a single family for a series of five quarters. The target population was all citizens over the age of 14.

We follow the definitions used by INGEI to define employment, unemployment, self-employment, and business owners (see INEGI, 2007). The variation in the proportion of workers will be a good indicator to see if in equilibrium the quantity of workers is shrinking due to homicides. The variation in the proportion of unemployed in a municipality will give us a better perception of whether the violence is affecting businesses with respect to labor demand. Variation in the proportion of self-employed and business owners will indicate what sector of the market is primarily affected by the homicides related to drug trafficking.

magnitude as in other localities, and as such we do not expect their omission to affect the results in any significant way.

[14] As an exclusionary rule, we have eliminated all municipalities in which the internal consumption of electricity from one year to the next varied by more than 10. While some municipalities dramatically increase their consumption of electricity before the opening of new businesses and industries, there are reasons to suspect that such temporary increases in size are due more to registry errors than the growth of the industry.

To identify whether the drug-related violence harms employed people we will analyze the variation in the proportion of people employed over the total number of people over 14 and not over the total economically active population, as is generally the practice. This is because it may be that a large part of the population that remains unemployed does not actively pursue work if the economic conditions are not good. In this way, to measure the proportion over the total number of people over 14 allows us to observe people's entrance and exit from the workforce even when in the next period they do not actively pursue work. The same can be seen with other variables.

For the violence variables, we use data from SINAIS in our estimations. A disadvantage of the data on drug-related homicides produced by the federal government is that no data exists before December 2006. Given that the data on drug trafficking homicides from the government could misclassify the deaths, the use of the SINAIS database helps us improve measurement errors and evaluate a longer period of time.

Table A.1 in the appendix shows the correlations between selected variables and electricity consumption at the municipal level by quintiles of distribution. We observe that energy consumption is negatively correlated with violence, particularly in the years after the eruption of violence. Indicators of industrial activity are strongly correlated, as expected, especially those related to the manufacturing sector. The table also shows that marginalized areas consume less electricity than rich areas. Finally, the municipalities in the north and west of the country, and those near airports and seaports consume more electricity per capita than the rest of the municipalities.

Included in the analysis are socioeconomic variables drawn from the Census of Population and Housing in 2000, 2005, and 2010, as well as the Economic Census in 2004 and 2009. The education, poverty, and Human Development Index variables come from the population census. Information in the Economic Census includes, at a municipal level, estimations of the number of employed people and gross output per employee in the commercial and manufacturing sectors. Population variables were drawn from the projections of the National Population Council (Consejo Nacional de Población, CONAPO). The information on municipal incomes comes from the Databsase of Public Finance and Municipal System Database (Base de Finanzas Públicas del Sistema Estatal y Municipal de Bases de Datos, SIMBAD). Information about land, air, and sea communications was provided by the United States Department of Transportation.

VII. Methodology: Instrumental Variables

In this section we describe the empirical strategy that we will use to identify the marginal effect of an increase in the homicide rate on various economic variables. Initially we used two types of variation to identify the effect of violence on the economy: time (measured in quarters, except for the variable of energy consumption) and space (measured in municipalities). The most basic equation from which we worked to capture the effect of homicides on economic variables is:

$$Y_{mt} = \alpha_m + \gamma_t + \beta \text{HomRate}_{mt} + \varepsilon_{mt} \qquad (1)$$

The unit of observation in the econometric specification is the municipality, indicated by the variable *m*, observed through different time periods, *t*, measured in all specifications on a quarterly basis (except when the dependent variable is electricity consumption which is measured on an annual basis). Given the panel structure of the data, we will use municipality fixed effects (α_m) and time fixed

effects (γ_t), which will control for observable and non-observable characteristics in each municipality that does not change over time, and the economic shocks that affect the entire country over the period.

The dependent variable is represented by y_{mt} which in our study will be measured by: the average of energy consumption per capita, the proportion of people working, unemployed, self-employed, or owning their own business over the total number of people over 14 years of age in a municipality and the natural log of the average labor income in the municipality. The independent variable of greatest interest is *HomRate*, which represents the total homicide rate per 100,000 people in municipality *m* during period *t*. The error is measured by ε_{mt} and, to make inferences for the parameter β, we assume robust errors and perform clusters for each municipality.

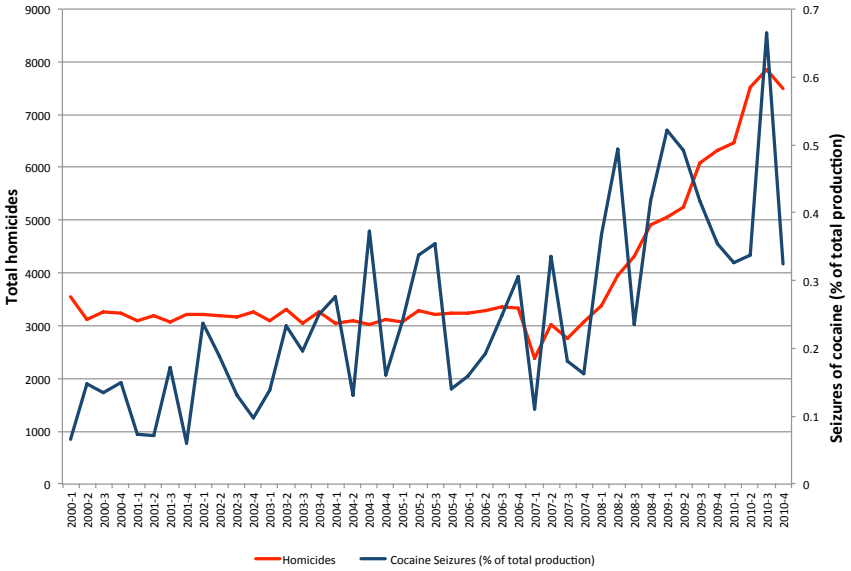
There are two potential important identification problems if we use a simple OLS, as in equation (1). The first is about omitted variables and the second is about the problem of inverted causality. In relation to the first, we can imagine that there are a series of unobservable characteristics in the municipality that could cause greater levels of violence and common crime and therefore lower economic outcome. With relation to the second problem, one would expect higher levels of violence based on a rift between cartels over control of a *plaza* where better economic conditions due to greater commerce with the United States and greater expectations of growth. This is to say that many strategic locations for DTOs happen to be prosperous areas for international trade, and therefore already have very strong economies.

Given the possible challenges of identification, we use an instrument to isolate the variation in homicide from factors that could affect the homicide rates and the economy at the same time, or from economic variations that could affect homicides. We implement the instrument from Castillo, Mejía and Restrepo (2013), which was developed from the interaction of two variables: the proportion of cocaine seized in Colombia and the distance of a Mexican municipality from the border.

Castillo, Mejía and Restrepo (2013) explain that when Colombia seizes large quantities of cocaine, the price of the drug surges (due to the drop in supply) so much that it augments the market value of the drugs, especially in places close to the border. In this way, municipalities that are closer to the border are the ones that increase their market value the most, as they have a comparative advantage in the market due to their strategic geographic location. It can be assumed that it will be these same municipalities that will also see increased violence because their control is more valuable to the trafficking groups. In figure 5 we can observe the high temporal correlation between the trends in the proportion of seizures and homicides.

The exclusion restriction is satisfied as long as the change in the proportion of cocaine seizures in Colombia jointly with the distance to the nearest border affects only the variable of violence.

Figure 6. Violence in Mexico and Percentage of Drug Seizures in Colombia



Source: SINAIS and Castillo, Mejia and Restrepo (2013)

In this way, the equation of the first stage of the two stage least squares specification is presented by the following equation:

$$\text{HomRate}_{mt} + \alpha_m + \gamma_t + \theta \text{DistBorderXCocaineSeizure}_{mt} + \varepsilon_{mt} \qquad (2)$$

where the distance to the nearest border is represented by DistBorder, and the proportion of the cocaine seizure in Colombia is represented by CocaineSeizure. It is important to mention that for all of the estimations we use weights that correspond to the size of the municipal population.

Table 2 shows that the results of the instrumental variables, as described in equations (1) and (2). The first result suggests that an increase of one homicide per 100,000 inhabitants does not generate a statistically significant change in energy consumption. On the other hand, an increase of one standard deviation in the homicide rate per 100,000 inhabitants (i.e. an approximate rate of 18.29 homicides) generates an approximate drop of four percentage points (pp) in the proportion of workers, an increase in 2.7 pp in the proportion of unemployed, a decrease of 0.73 pp in the proportion of business owners and a decrease of 22% on labor income. We do not find a statistically significant effect on the self-employed.

Between 2009 and 2010 on average there was an increase of 5.98 homicides per 100,000 people,[15] which represents a reduction of 1.32 pp in the proportion of workers equal to a reduction of 2.37% over the observed proportion of workers (56.07% of the total population over 14 years old). Therefore we can conclude that on average the workers in general are not highly affected by marginal changes in the average homicide rates.

An increase in the homicide rate of 5.98 diminishes the proportion of business owners by 0.24 pp, which represents a decrease of approximately 9% of the proportion observed in 2005 to 2010 (we

[15] The homicide rate per municipality is weighted by population size for the change in the national average rate.

observed 2.63% of the total business population over 14 years of age). To take a more general perspective, the increase in the homicide rate of 5.98 generates a substantial reduction in the average labor income of 7%. In other words, if a citizen earns an average of $4,615 (2002 pesos), their income in the second period will diminish by approximately $330 pesos.

To measure whether the increase in the homicide rate has a temporary effect, we examined the dependent variable in a later period. In Table 3 we can see that the effects of violence are a little more pronounced in those economic variables for which we had already observed a significant immediate effect. We also tried to measure the effect of violence in several previous periods in order to capture more accurately the long-term effect. However, when trying to estimate the effect on the homicide rate observed in different periods of time (through a lag in the dependent variable) we are not able to obtain sufficiently strong instruments. In order to estimate the long-term effects of violence, we need to use a different methodology.

Table 2: Effects of an increase in the homicide rate over economic variables

Dependent Variable:	(1) Electricity per capita	(2) Working (% population)	(3) Unemployed (% population)	(4) Business Owners (% population)	(5) Self-Employed (% population)	(6) Ln(labor income)
Homicide Rate	-0.002	-0.222***	0.148**	-0.040**	0.048	-0.012*
(per 100,000 inhab.)	(0.002)	(0.068)	(0.059)	(0.019)	(0.030)	(0.007)
Observatiobns	14,073	25,182	25,182	25,182	25,182	25,166
Number of Municipalities	1,308	1,183	1,183	1,183	1,183	1,183
F-test	695.45	650.47	650.47	650.47	650.47	651.72

Nota: The percentage of people working, unemployed, business owners or self employed
was computed considering as a total the population older than 14 years old. Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Effects of an increase in the homicide rate over economic variables in the previous quarter

Dependent Variable:	(1) Electricity per capita in t + 1	(2) Working (% population) in t + 1	(3) Unemployed (% population) in t + 1	(4) Business Owners (% population) in t + 1	(5) Self-Employed (% population) in t + 1	(6) Ln(labor income) in t + 1
Homicide Rate	-0.001	-0.293***	0.153**	-0.036**	0.023	-0.012*
(per 100,000 inhab.)	(0.002)	(0.097)	(0.070)	(0.015)	(0.024)	(0.007)
Observatiobns	13,030	23,973	23,973	23,973	23,973	23,957
Number of Municipalities	1,308	1,177	1,177	1,177	1,177	1,177
F-test	318.55	700.03	700.03	700.03	700.03	700.39

Nota: The percentage of people working, unemployed, business owners or self employed
was computed considering as a total the population older than 14 years old. Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1

The instrumental variable regression analysis shows that the labor market is affected by changes in the homicide rates. We note that small businesses were one of the most affected groups, and also identified a significant decrease in the average labor income of citizens. However, this specification fails to capture the effect that violence may have had on electricity consumption, which is our proxy for economic performance.

As we have argued, it is feasible that violence does not impact the economy in a linear fashion, but after a certain threshold, produced by the onset of an inter-cartel war, creates spiraling waves of violence. The following section uses the synthetic control group methodology to explore the effect of wars between cartels on economic performance and whether violence has a long-term effect on the economy.

VIII. Synthetic Controls

In this section we evaluate the impact of wars between drug cartels over economic performance. The inter-cartel wars generally begin abruptly and due to breaks or disagreements between criminal groups. For example, one of the most violent wars in recent years began due to a division between Sinaloan drug traffickers after the arrest of leader Alfredo Beltrán Leyva "El Mochomo," which placed the leaders of that cartel group into two irreconcilable factions: the Sinaloan cartel and the Beltran Leyva cartel.[16] The fighting began with numerous executions, and built so that even the institutional protection safety nets were affected.[17]

Another one of the most violent wars in the police began with the separation of the Zetas from the Gulf Cartel in 2010. The Zetas functioned at first as the strong arm of the Gulf Cartel and were primarily comprised of former Mexican Army officers. Due to internal conflicts within the organization and the superior training of its members, the Zetas could contest control of the Gulf Cartel, resulting in a significant increase in violence in the cities in northeastern Mexico.[18]

We consider the initiation of a war between cartels and an increase in the intensity of violence as having three effects. First, before the beginning of a violent conflict between DTOs, the cartels with existing control over a territory have greater pressure to increase the level of extortion and extraction of resources from the community that they control in order to finance the impending armed struggle. The rival cartel that is competing for the trafficking routes and *plazas* also has incentives to terrorize and threaten anyone suspected of cooperating with its enemies—police, business people, politicians and authorities, and journalists, among others.

Second, the war between cartels generally goes hand-in-hand or is immediately preceded by the capture of capos. By the cartels being beheaded (loosing their leader), the subordinate gangs and

[16] Note published in the newspaper la Jornada on May 13, 2008. Available at: http://www.jornada.unam.mx/2008/05/13/index.php?section=politica&article=006n1pol
[17] For example, see note "Cayeron 25 funcionarios por Operación Limpieza: PGR." Available at: http://www.eluniversal.com.mx/notas/579907.html
[18] For example, see note "Disputa entre zetas y el cártel del Golfo en Tamaulipas ha dejado decenas de víctimas." Published in the newspaper La Jornada and available at http://www.jornada.unam.mx/2012/05/05/politica/003n1pol

criminal cells sit unemployed and without central control, and their members begin to occupy their time with any type of delinquent or criminal activity.

Finally, an increase in the violence and other types of crimes occupies the security resources of the local and federal authorities. This reduces the probability of punishment for crimes and leads to an increase in opportunistic crime. Common quarrels can easily escalate into violent crime because there is little chance that these crimes will be detected and punished. The law enforcement institutions generally collapse and the cartels become the *de facto* powers.[19]

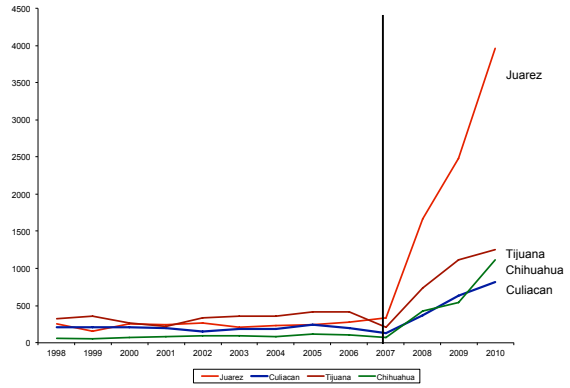
This class of inter-cartel wars is expected to have a profound economic effect. For example, the employers are likely to be extorted and their family members kidnapped, which could induce them to migrate to safer areas; the businesses suffer from robberies and attacks on their facilities; and the workers feel afraid to go outside and go to work. It is common that the parents are afraid to send their children to school. There is also evidence that violence creates higher school dropout rates, especially among boys who may look to join gangs or criminal organizations (Franco and Magaloni, 2013).

A dramatic increase in the homicide rate indicates the presence of the beginning or escalation of an armed conflict between rival gangs from organized crime. Thus, for the purpose of this analysis, we look at waves of violence as indicative of the presence of a war between rival criminal groups. To evaluate the impact of this war-like situation on the economy, we define a municipality as having had a "treatment" when the number of homicides from one year to another, in any pair of years from 2006 to 2010, increases by more than three standard deviations with respect to the historic mean number of annual homicides since 1998.

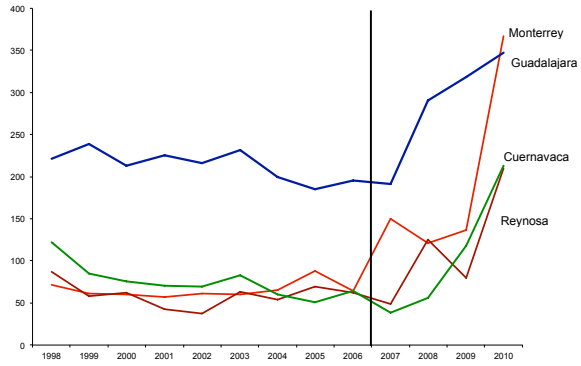
An advantage of using this definition for the treatment group is that it identifies municipalities by dramatic changes in their levels of violence. Changes of this magnitude are more strongly correlated with violent conflicts between criminal organizations (see table A.2 of the Appendix) meaning that by using this definition we are selecting for the municipalities that are most affected by the drug-trafficking violence. One simple observation of the data shows that the violence series presents abrupt increments in the cities with greater numbers of homicides due to narco-trafficking and in the economic centers most affected by disputes between cartels. The following figure shows these tendencies for selected cities:

[19] After the assassination of the photographer Luis Carlos Santiago from *El Diaro de Juárez* in September, 2010, that paper published an editorial directed at criminal organizations, referring to them as the *de facto* authorities of Ciudad Juárez. The editorial, "What do you want from us?," expressed a feeling of helplessness against both the criminals and the authorities that dominates in some regions.

Figure 7. Total Homicides for Selected Municipalities: 1998-2010



Source: SINAIS



Source: SINAIS

Using this definition, we consider 642 out of 2441 municipalities in the country as "treated" (26.3% of the total).[20] This proportion of municipalities is similar to that used in other studies. Coscia and Ríos (2012) identify the territorial and temporal activity of the drug trafficking organizations using available information in news media, blogs, and websites. The authors found that between 1991 and 2010, approximately 13 drug trafficking organizations had operated in 713 municipalities in the country (29.2% of the total). Moreover, they found that of these multiple criminal organizations operated simultaneously in only 444.

Based on this definition of our treatment group, we classify 340 municipalities as having substantial increases in violence. This group covers the 100 most violent municipalities, 90% of the municipalities with the highest homicide rates, 84% with high homicide rates related to drug trafficking, and 80% with the greatest increases in the average annual homicide rate between the period of 2002-2005 and 2006-2010.[21] Said coverage grows under less strict measurements of treatment, for example, increases of 1 or 2 standard deviations with respect to the historic time series. Nevertheless, under these definitions, we include a large number of additional municipalities with minimal levels of homicides that are predominantly rural and not disputed by drug traffickers (see table A.2 in the Annex).

Estimating the causal effect of drug-related violence on economic activity is a complicated task as it is difficult to estimate a counterfactual scenario for comparison purposes. One challenge to identification could arise due to the fact that drug trafficking violence is predominantly an urban phenomenon. Drug trafficking organizations are fighting against each other and the government to establish control over *plazas* for distribution and trade routes, which are regularly found in the major economic centers of the states. Therefore, a simple extrapolation between the treated and control

[20] We consider the Federal District (Mexico City) as one single municipality.
[21] These proportions are with respect to the sample of municipalities for which information is complete and consistently covers electrical consumption. The proportion for all municipalities are similar.

municipalities will not result in a reliable estimate due to significant observable and unobservable differences between the two groups.

To control for this identification problem we use the synthetic control methodology proposed by Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010). The synthetic control methodology follows the same principle as in the econometric method of *matching*. However, instead of matching a treatment unit to a control unit with similar characteristics in the period prior to treatment, the method allows us to optimize the control units by creating a "synthetic" unit (an optimal weighted average of the potential controls) for each treated one. In addition, it gives higher weight to those units that best resemble the behavior of the treated one. As a result, the method assigns greater weights to those units with observable characteristics that are similar to the treatment group during the pre-treatment period.

The optimization problem consists on finding the set of synthetic weights for the control units that best reflect the initial conditions and the pre-treatment tendencies of the variables of interest for each municipality in the treatment group. Once the weights are found, it is possible to estimate the treatment effect as the difference, in the post-treatment period, in the variable of interest, between the treatment unit and the synthetic control.

More formally, let X_1 be a vector of dimension *k x 1* of observable variables during the pre-treatment period for the treated unit and let X_0 be a matrix of dimension *k x J* of the variables corresponding with the *J* control units. Then, the estimation problem of the synthetic controls methodology is to find the *j x 1* vector of weights *W* that solves:

$$\mathrm{W}^* = \operatorname{argmin} \| \mathrm{X}_1 - X_0 \mathrm{W} \|$$

Such that:

$$W^* = (w_1, w_2, w_3, \ldots, w_J), \; w_j \geq 0 \, , \sum w_j = 1.$$

Once the weights are found, the treatment effect is calculated as:

$$\mathrm{Y}_1 - \mathrm{Y}_0 \, \mathrm{W}^*,$$

Where Y_1 is a vector of dimension *T x 1* and the variable of interest during the period before treatment and Y_0 is a *T x J* matrix of the variables of interest for the *J* control units. In this way, *T* is the total number of periods for which the prediction is made; i.e. total number of periods after the treatment.[22]

Our estimation was developed using a package in the R statistical program called *Synth* developed by Abadie, Diamond, and Hainmuller (2010). This program in particular finds the optimal synthetic weights *W** that optimize this function:

$$W = argmin ||X_1 - X_0 W||_V = \sqrt{(X_1 - X_0 W')V(X_1 - X_0 W')}$$

[22] Abadie and Gardeazabal (2003), and Abadie, Diamond, and Hainmueller (2010) provide a more detailed description of the synthetic control groups methodology.

where *V* is a positive semi-definite matrix *k x k* to allow different weights between predictor variables and to minimize the mean square error of the synthetic weights vector.

An additional complication in this analysis is that the treated municipalities show a substantial increase in violence in different years. For example, cities such as Tijuana, Ciudad Juárez and Chihuahua observed dramatic increases in the number of homicides in 2008, while cities in the Northeast were affected in later years. The following table shows descriptive statistics of the treatment units for treatment year. In general you will see that the treated municipalities from 2006 had a lower average consumption of electricity than the other treated municipalities. Also, the treated municipalities in 2008 showed greater homicide rates in the period before treatment than the other treated units.

Table 4. Descriptive statistics by year of treatment

	Antes del Tratamiento				Post - Tratamiento			
Variable	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
Municipios Tratados en 2006 (obs = 50)								
Consumo de electricidad per capita, 2002-2010	0.72	0.40	0.21	2.14	0.82	0.55	0.19	3.18
Total de Homicidios, 2002-2010	4.49	9.09	-	41.25	6.59	11.21	0.20	52.40
Tasa de Homicidios por 100 mil habitantes, 2002-2010	10.29	16.49	-	76.70	21.53	21.51	3.78	125.51
Municipios Tratados en 2007 (obs = 29)								
Consumo de electricidad per capita, 2002-2010	1.38	1.22	0.19	5.42	1.38	1.48	0.21	6.52
Total de Homicidios, 2002-2010	1.53	3.42	-	15.20	11.59	37.68	0.25	198.00
Tasa de Homicidios por 100 mil habitantes, 2002-2010	3.98	6.47	-	27.24	23.20	21.97	3.26	104.48
Municipios Tratados en 2008 (obs = 70)								
Consumo de electricidad per capita, 2002-2010	1.48	1.43	0.08	8.45	1.48	1.33	0.13	6.78
Total de Homicidios, 2002-2010	19.05	57.44	-	348.50	89.90	352.11	0.33	2,705.67
Tasa de Homicidios por 100 mil habitantes, 2002-2010	11.00	9.25	-	43.49	61.45	64.26	2.57	331.26
Municipios Tratados en 2009 (obs = 82)								
Consumo de electricidad per capita, 2002-2010	1.10	0.94	0.10	5.06	1.13	1.11	0.11	6.31
Total de Homicidios, 2002-2010	8.97	29.42	-	238.86	21.24	50.41	0.50	392.00
Tasa de Homicidios por 100 mil habitantes, 2002-2010	11.75	12.38	-	72.79	56.69	68.02	6.56	348.14
Municipios Tratados en 2010 (obs = 109)								
Consumo de electricidad per capita, 2002-2010	1.32	1.27	0.04	8.61	1.41	1.66	0.03	12.82
Total de Homicidios, 2002-2010	7.44	16.32	-	138.38	26.19	39.85	1.00	242.00
Tasa de Homicidios por 100 mil habitantes, 2002-2010	11.20	12.51	-	74.00	64.68	74.04	6.86	470.51
Muestra* (obs = 1296)								
Consumo de electricidad per capita, 2002-2010	0.95	1.05	0.01	11.39	1.02	1.33	0.05	27.63
Total de Homicidios, 2002-2010	7.21	42.99	-	1,352.50	10.16	67.36	-	1,745.80
Tasa de Homicidios por 100 mil habitantes, 2002-2010	10.67	11.24	-	120.03	14.66	19.64	-	208.12

* Se muestran las estadísticas de 2002 a 2005 y de 2006 a 2010

Synthetic controls for the 340 treated municipalities were constructed from 956 control municipalities. We use the following socioeconomic variables related to economic activity and consumption of electricity to construct the synthetic control weights:

- Average annual per capita electricity consumption from 2002 to the year before the treatment
- Log of total population in 2005
- Private housing density per square kilometer, 2005
- Percentage of people employed in the manufacturing sector with respect to the population between the ages of 15 and 70 in 2003
- Percentage of people employed in the commercial sector with respect to the 15-70 population, 2003
- Human Development Index, 2005
- Average annual years of schooling, 2005
- Geographic latitude

Table 5 below shows the demographic characteristics in the pre-treatment period for the treated municipalities and the synthetic controls. It can be noted that, in comparison with the unweighted control group, the synthetic control group better approximates the average consumption of electricity of the target group during the period before treatment. Additionally, the synthetic control group shows more similar socioeconomic characteristics during the pre-treatment period to the treatment group.

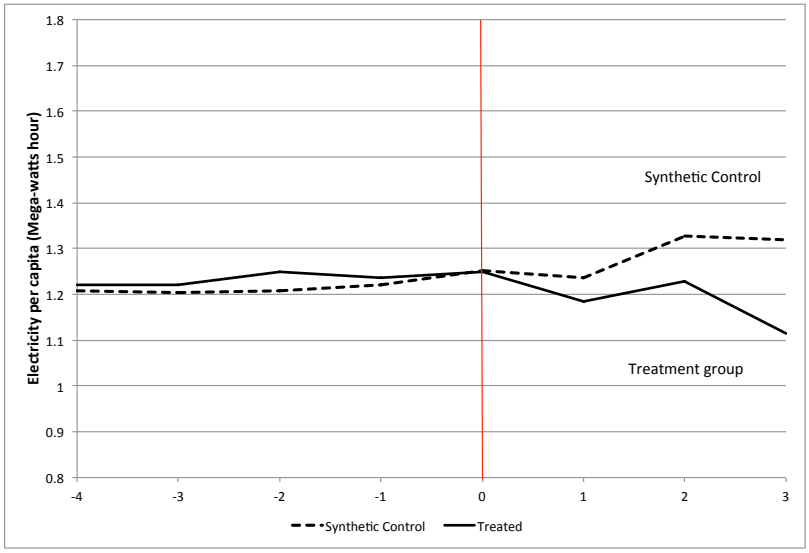
Table 5. Socio-demographic characteristics for the control and treatment groups

	Tratamiento		Control Sintético	Control	
Variable	Media	Desviación Estándar	Media	Media	Desviación Estándar
Consumo de electricidad per capita (Megawatts-hora), 2002-2005	1.202	(1.153)	1.209	0.860	(0.993)
Volumen consumido de electricidad (Megawatts hora), 2002-2005	137,756.2	(435,140.4)	194,728.7	66,953.4	(472,526.1)
Tasa de homicidios por 100 mil habitantes (2002 - 2005)	10.020	(11.763)	13.570	10.906	(11.039)
Log Población (2005)	80,322.1	(209,595.7)	125,341.6	50,932.5	(299,268.0)
Densidad de poblacion (habitantes por km cuadrado), 2005	337.8	(1,427.2)	368.8	278.3	(839.6)
Densidad de vivienda (viviendas particulares por km cuadrado), 2005	79.6	(337.8)	87.8	64.4	(201.4)
Personal ocupado en comercio (% de la población de entre 15 y 70 años), 2003	0.050	(0.029)	0.049	0.045	(0.031)
Personal ocupado en manufacturas (% de la población de entre 15 y 70 años), 2003	0.045	(0.074)	0.039	0.036	(0.062)
Produccion Bruta Total por personal ocupado Sector Comercio, 2003	0.083	(0.058)	0.081	0.065	(0.060)
Produccion Bruta Total por personal ocupado Sector Manufacturas, 2003	0.284	(0.578)	0.275	0.262	(0.688)
Ingresos Totales per Capita, 2002 - 2005	1,827.9	(739.7)	2,182.3	1,814.3	(985.1)
Escolaridad, 2005	6.500	(1.661)	6.548	6.160	(1.538)
Analfabetismo, 2005	0.145	(0.091)	0.152	0.159	(0.094)
Indice de Marginacion, 2005	(0.520)	(0.862)	(0.406)	(0.211)	(0.789)
Índice de Desarrollo Humano, 2005	0.783	(0.062)	0.779	0.763	(0.056)
Dummy Urbano	0.544	(0.499)	0.460	0.507	(0.500)
Superficie	1,497.7	(2,904.1)	3,265.9	591.5	(2,099.7)
Altitud	1,352.0	(841.3)	1,240.0	1,307.5	(906.4)
Número de Puertos	0.024	(0.202)	0.117	0.016	(0.147)
Número de Aeropuertos	0.074	(0.293)	0.112	0.032	(0.177)
Zona Noroeste	0.176	(0.409)	0.213	0.020	(0.140)
Zona Noreste	0.212	(0.382)	0.117	0.089	(0.285)
Zona Centro	0.232	(0.423)	0.269	0.349	(0.477)
Zona Sureste	0.138	(0.346)	0.250	0.335	(0.472)
Zona Suroeste	0.241	(0.428)	0.151	0.207	(0.405)

Figure A.2 in the Appendix shows the trends in electricity consumption per capita for selected cities and their control group. Due to the high number of municipalities in the control sample, it was possible to construct synthetic controls that closely replicate the trends in electricity consumption of the municipalities covered in the years before treatment.[23]

Below is the average electricity consumption per capita between the treatment group and the control group as weighted by the synthetic control estimates. The graph is normalized to show the first four years before and after the treatment year, which is indicated as period zero. We observe that the synthetic controls closely reflect the electricity consumption behavior during the period before treatment. The treatment group municipalities consume on average less electricity per capita than their respective synthetic control during the years after treatment. Said difference is close to zero during the treatment year itself but increases in the years following the intervention, especially during the second and third year after the intervention.

Figure 8. Average electricity consumption for treatment group



In table 6 below we show the differences in the average consumption of electricity per capita of the treated municipalities and their respective synthetic controls. We see that the municipalities that show drastic increases in violence between 2006 and 2010 consumed on average 4.2% less electricity per capita in the year after treatment than their counterfactual scenarios. Said difference increases to 7.2% for the second year after treatment and 15.5% in the third year.

In the aggregate, we see that the treated municipalities consumed on average 4% less electricity per year, from the treatment year through the following years with respect to their specific scenario, without any further increases in violence. This difference is greater for longer periods, reaching 6.8% less consumption on average by year during the four years after the treatment occurs.

[23] We exclude from the analysis some municipalities at the extreme top of the electricity consumption distribution (over the 98th percentile) for which there was no suitable synthetic control (12 cases).

Table 6. Average electricity consumption by treatment group and year

Period	Electricity Consumption			Homicide Rate		
	Treated	Synthetic Control	Diff.	Treated	Synthetic Control	Diff.
Pre-treatment (t-4 a t-1)	1.232	1.209	1.88%	11.06	13.57	-18.49%
Year of Treatment, t	1.250	1.253	-0.21%	59.01	14.71	301.09%
Year t + 1	1.184	1.235	-4.19%	34.50	11.54	199.04%
Year t + 2	1.229	1.327	-7.40%	46.35	14.72	214.78%
Year t + 3	1.115	1.319	-15.50%	19.43	17.07	13.84%
Yearly average from t to t+1	1.217	1.244	-2.19%	46.76	13.13	256.24%
Yearly average from t to t+2	1.221	1.272	-4.00%	46.62	13.66	241.34%
Yearly average from t to t+3	1.194	1.284	-6.95%	39.82	14.51	174.44%

IX. Conclusion

One of the greatest challenges for governments in Latin America is to ensure order and provide security. The levels of violence and crime in the region have increased in the last years with Mexico as one of the most affected countries by this crime wave.

The dramatic change in the patterns of violence, especially the increased murder rate, is clearly related to structural changes in the drug trafficking business since 2006. External factors such as the increased flow of trade with the United States, the greater availability of weapons, and the reduced cocaine supply from Colombia increased profitability substantially and attracted new competitors and suppliers into the drug trade.

The increase in the market size also changed the operation and internal organization of drug trafficking organizations from being family businesses to hierarchical organizations stratified into regional units. The interaction of the DTOs with local and national governments has also changed with the liberalization of politics in the country and the entry of multiple political actors and several parties, making more complex the operation of the business. Finally, the intense policies of President Calderón to combat and contain organized crime have fragmented the cohesion and organization of the narco-trafficking groups.

As a result of profound domestic and structural changes, the number of people involved in drug trafficking has grown. However, unlike the market of other products that operate in a legal arena, drug cartels do not compete for prices but instead compete directly to monopolize the means of distribution into the United States through the use of force. The growing rivalries between drug trafficking factions have resulted in an unprecedented increase in the levels of violence in the country.

To estimate the impact of the increasing levels of violence on economic activity is a complex activity because the drug related violence is different in nature than common crime. Most killings correspond to strategic assassinations of members of rival organizations or clashes with authorities. Besides being focused, the drug-related violence is sporadic and has a higher volatility than common criminal violence.

Moreover, there is an identification problem as this type of violence is not seen in all municipalities with drug production, distribution, or trafficking ties. This makes it difficult to isolate the economic effect of increased levels of violence on the business activities of drug trafficking organizations.

This study argues that the violent competition between rival drug organizations has a negative effect on the economy. To understand the mechanism, we use the analogy of Olson (2001) to imagine the cartels as “stationary” or “roving bandits” depending on how they decide to integrate themselves into society. “Stationary bandits,” or benefactors, have the ability to maintain control over their territories over the long term and therefore have incentives to reduce predatory behavior as they look towards greater long-term gains. “Roving bandits” have temporary or uncertain control over their territory, which induces them to extract rents and resources from the community at the highest rate possible through extortion, robbery, and other crimes, to maximize short-term gain.

The main argument of this study is that the war between cartels for control over certain trafficking routes has been matched by a substantial increase in violence and petty crime, including

theft, extortion, and kidnapping. Faced with increased competition, cartels have incentives to turn against society due to the need for greater resources to maintain their armed conflicts, and because of a need to intimidate or punish members of rival organizations, as well as to exploit new opportunities for opportunistic crime.

Following the above argument, and due to the nature of drug-related violence, we can assume that this type of violence has no linear effect on economic performance, but instead that there is a threshold after which violence causes economic activity to significantly shrink. Below *this turf-war threshold*, many individuals and companies can internalize any increased costs resulting from the need for enhanced security and protection depending on their economic size and capacity. However, said adjustments have effects on the labor market, both in the supply and demand, and we can expect to find a marginal effect of violence on this area. Once the violence levels have passed into the war threshold, companies and individuals begin to change their actions in both the medium and long term, including their location, investments, and production, in the case of commercial enterprises, and their participation in the labor market and choice of profession, in the case of individuals. We can expect a significant contraction in economic activity in this range of violence that might not be adequately captured with a linear relationship model between economic activity and violence.

In our study we used two empirical strategies to estimate both the marginal effects and the "threshold" effects of violence on economic activity and labor. To estimate the marginal effects, we did an instrumental variable regression utilizing exogenous variation of cocaine seizures in Colombia to instrument for violence. This variable was interacted with the distance of a municipality from principle points of entry. We found substantial negative effects on labor market participation, unemployment, decision to start a company, and income.

To estimate the short-term and medium-term effects of crossing the *turf-war threshold* on the economy, we made use of synthetic control group methodology consisting of building counterfactual scenarios by creating optimal weighted units of control. We used the close correlation between GDP and electricity consumption to estimate the effect of violence on economic activity at the municipal level. We found that those municipalities that saw dramatic increases in violence between 2006 and 2010 significantly reduced their energy consumption in the years after treatment.

By analyzing the "threshold" effect, rather than a linear effect of violence on economic activity, the present study provides a baseline for future research to model and estimate in a more sophisticated way the relationship between violence and economic performance, in particular when we study drug-related violence.

X. References

Abadie, A., A. Diamond, and J. Hainmueller (2010): "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program,'' Journal of the American Statistical Association, Vol. 105 No. 490.

Abadie, A., and J. Gardeazabal (2003): "The Economic Costs of Conflict: A Case Study of the Basque Country'' American Economic Review, Vol. 93, No. 1.

Astorga, Luis (2005). El Siglo de Las Drogas. México: Plaza y Janés.

Astorga, Luis (2010) "A Pax Mafiosa in Mexico?" Project Syndicate. Disponible en: http://www.project-syndicate.org/commentary/a-pax-mafiosa-in-mexico-

Blancornaleras, Jesus (2002). "Los Arellano Félix: La mafia más poderosa en la historia de América Latina," Plaza Janés. Mexico City.

Calderón, Gabriela, Alberto Díaz-Cayeros, Beatriz Magaloni y Gustavo Robles (2013). "The Temporal and Spatial Dynamics of Violence in Mexico". Working paper. Stanford University.

Castillo, Juan Camilo, Mejía, Daniel y Restrepo, Pascual (2012). Illegal drug markets and violence in Mexico: The causes beyond Calderón. Mimeo, Universidad de los Andes.

Castillo, Juan Camilo y Daniel Mejía (2012). "Narcotráfico y violencia en México: las razones más allá de Calderón". Blog Foro Económico. Publicado el 23 de octubre de 2012. Disponible en: http://focoeconomico.org/2012/10/23/narcotrafico-y-violencia-en-mexico-las-razones-mas-alla-de-calderon/ .

Chabat, Jorge (2006). "Mexico: The security challenge," Centro de Investigación y Docencia Económicas.

Chabat, Jorge (2010). "Combatting Drugs in Mexico under Calderon: The Inevitable War,'' Working Paper 205. CIDE.

CICAD (Inter-American Drug Abuse Control Commission) and OAS (Organization of American States). 2004. "Programa de Entrenamiento de Formadores en materia de Normas y Técnicas de Lucha contra el Lavado de Activos y Financiamiento del Terrorismo. Manual del Instructor." CD ROM. Washington D.C.: CICAD/CICTE/OAS.

Coscia, Michele and Rios, Viridiana (2012). Knowing Where and How Criminal Organizations Operate Using Web Content. In CIKM'12, October 29–November 2, 2012, Maui, HI, USA. Copyright 2012 ACM 978-1-4503-1156-4/12/10.

Dell, Melissa (2011). "Trafficking Networks and the Mexican Drug War,'' Job Market Paper. Economics Deparment. Massachusetts Institute of Technology.

Díaz-Cayeros, Alberto, Beatriz Magaloni, Aila Matanock, and Vidal Romero (2012). "Living in Fear: Mapping the Social Embeddedness of Drug Gangs and Violence in Mexico". Working Paper, Stanford University.

Escalante, Fernando (2011). "Homicidios 2008-2009: La Muerte Tiene Permiso,'' In Nexos (03/01/2011) . Available at: http://www.nexos.com.mx/?P=leerarticulo\&Article=1943189.

Franco Vivanco, Edgar. "The Economic Impact of Mexico's War on Drugs: A Cost-Benefit Analysis." Unpublished work.

Felbab-Brown, Vanda (2009). "The Violent Drug Market in Mexico and Lessons from Colombia," Foreign Policy at Brookings. Policy Paper, Number 12, March 2009.

Grillo, Ioan (2011). "El Narco: Inside Mexico's Criminal Insurgency," Bloomsbury Press. 1st edition.

Guerrero Gutierrez, Eduardo (2010). "Como reducir la violencia en México," Nexos, 3 noviembre 2010. Disponible en: http://www.nexos.com.mx/?P=leerarticulo&Article=1197808

Guerrero Gutierrez, Eduardo (2011a). "La raíz de la violencia," Nexos, 1 junio 2011. Disponible en: http://www.nexos.com.mx/?P=leerarticulo&Article=2099328

Guerrero Gutierrez, Eduardo (2011b). Security, Drugs, and Violence in Mexico: A Survey, 7th North American Forum, Washington DC.

Guerrero Gutierrez, Eduardo (2012). "2011: La dispersión de la violencia," Nexos, 1 febrero 2012. Disponible en: http://www.nexos.com.mx/?P=leerarticulo&Article=2102543

Guerrero Gutierrez, Eduardo. (2012). "Epidemias de Violencia," Nexos, 1 julio 2012. Disponible en: http://www.nexos.com.mx/?P=leerarticulo&Article=2102772

Internal Displacemente Monitoring Centre, IDMC (2010). Briefing paper by the Norwegian Refugee Council's Internal Displacement Monitoring Centre on forced displacement in Mexico due to drug cartel violence". IDMC and NRC. Geneva.

Imbens, G.W., Lemieux (2007) "T., Regression discontinuity designs: A guide to practice", Journal of Econometrics, doi:10.1016/j.jeconom.2007.05.001

Kahn, T. 1999. "Os Custos da Violência – Quanto se Gasta ou Deixa de Ganhar por Causa do Crime no Estado de São Paulo."

Londoño, Juan Luis, and Rodrigo Guerrero. 2000. "Violencia en America Latina: Epidemiología y Costos." Guerrero, Rodrigo, Alejandro Gaviria and Juan Luis Londoño (eds.) Asalto al Desarrollo: Violencia en América Latina. Washington, D.C.: Inter-American Development Bank.

McCollister, Kathryn, Michael French, and Hai Fang. 2010. "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation." Drug Alcohol Depend, vol. 108, pages 98-109.

McDonald, James (2005). ``The Narcoeconomy and Small-town, Rural Mexico,'' Human Organization. ABI/INFORM Global.

Merino, Jose (2011). ``Los operativos conjuntos y la tasa de homicidios: una medicion". In Nexos (01/06/2011). Available at: http://www.nexos.com.mx/?P=leerarticulo\&Article=2099329

Olson, Mancur (2000). "Power and Prosperity: Outgrowing Communist and Capitalist Dictatorships", Oxford University Press

Pinotti, Pablo (2011). "The Economic Consequences of Organized Crime:Evidence from Southern Italy". Working paper. Available at: http:// www.tcd.ie/Economics/ Seminars/Paolo \%20Pinotti\ %20paper. pdf

Poire, Alejandro and Teresa Martinez (2011). " Los homicidios y la violencia del crimen organizado". In Nexos (01/02/2011). Available at: http://www.nexos.com.mx/?P=leerarticulo \& Article=2047020

Poire, Alejandro y Martínez, Teresa (2011a). " La caida de los capos no multiplica la violencia. El caso de Nacho Coronel ". In Nexos (01/05/2011). Disponble en: http://www.nexos.com.mx/?P=leerarticulo\&Article=2099273

Pfizer. 2001. “Responding to the Global Public Health Challenge of Violence.” The Pfizer Journal, Global Edition, 11(1).

Rios, Viridiana. “Evaluating the Economic Impact of Mexico’s Drug trafficking Industry.” Manuscript, Spring 2008.

Rios, Viridiana (2011). "Why are Mexican mayors getting killed by traffickers? Corruption Dynamics in Mexico". Working paper. Available at: http://www.gov.harvard.edu/ files/Rios2011 WhyKilled.pdf

Rios, Viridiana (2012). “Evaluating the economic impact of drug traffic in Mexico” Working Paper. Harvard University, Department of Government.

Rosas, Guillermo (2011). " Los numeros de la guerra: error de calculo politico o error de cálculo estadistico? " Available at: http://polisci.wustl.edu/grosas

Sheridan, M.B. (2010), ``Mexico's Calderon tells Congress he needs U.S. help in fighting drug wars''. Washington Post, May 21, 2010. Source: http://www.washingtonpost.com/ wp-dyn/ content/ article/ 2010/05/20/AR2010052002911.html

Signoret, Patrick (2011). "Captura de Jefes del Narcotrafico y Niveles de Violencia en Mexico". Tesis de Licenciatura. Instituto Tecnologico Autonomo de Mexico (ITAM).

Soares, Rodrigo. 2009. “Welfare Cost of Crime and Common Violence: A Critical Review.” In: World Bank, The Cost of Violence. Washington D.C.: The World Bank.

Stratford (2012). ``Polarization and Sustained Violence in Mexico's Cartel War,'' January 24, 2012.

The Economist (2012). “The ebbing Mexican wave: The world´s biggest migration has gone into reverse”. The Economist. November 24th 2012.

Villarreal, A. (2002). ``Political Competition and Violence in Mexico: Hierarchical Social Control in Local Patronage Structures,'' American Sociological Review. Vol 67, No. 4

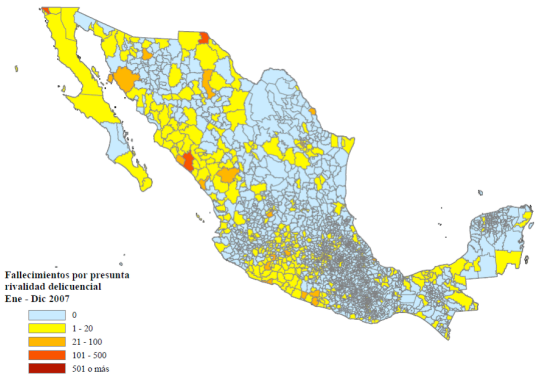
Velasco Rondon, V. and M.V. Andrade. 2003. “Custos da criminalidade em Belo Horizonte.” Economía, vol. 4, issue 2, pages 223-259.

WHO. 2004. The Economic Dimension of Interpersonal Violence. Geneva, Switzerland: WHO.

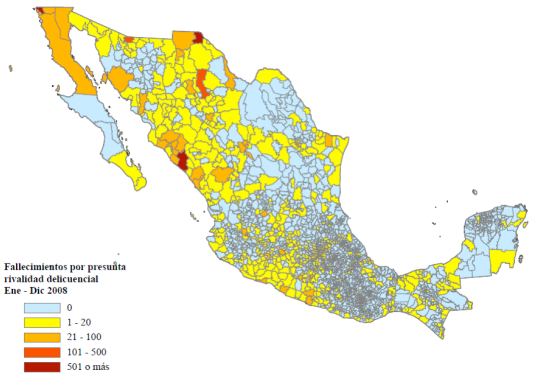
XI. Appendix.

Figure A.1. DTO-related homicides

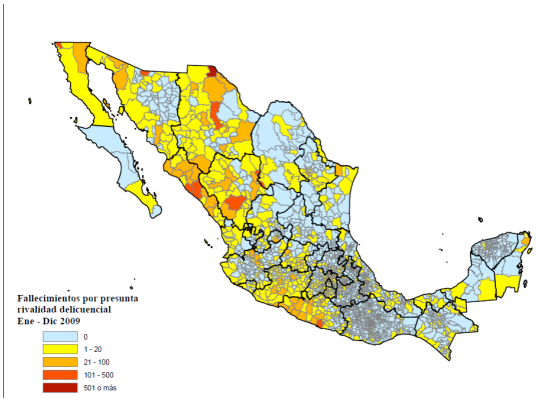
2007



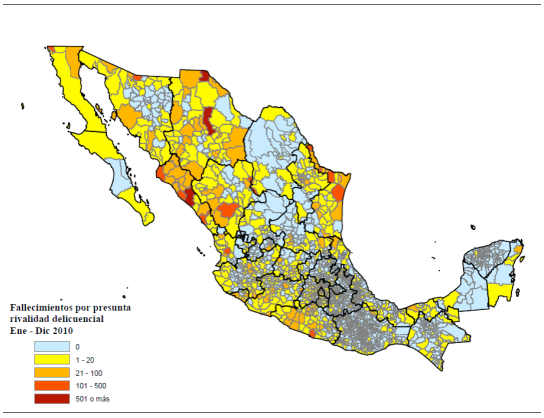
2008



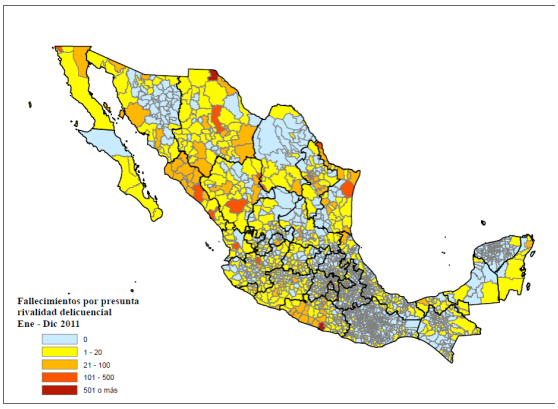
2009



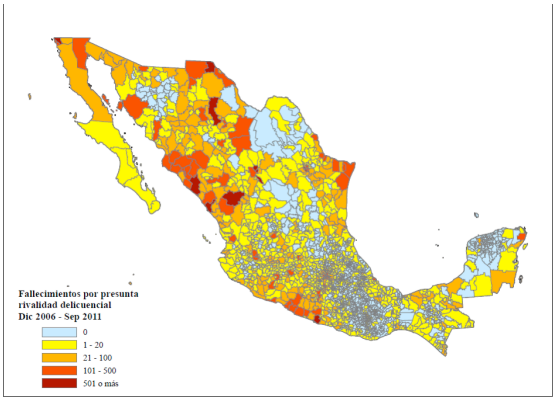
2010



2011



Dec 2006 – Sep 2011



Fuente: Procuraduría General de la República.

Table A.1. Correlations between economic and selected variables
2000, 2005, 2010

VARIABLES	(1) Electricidad per capita	(2) Proporción de Trabajadores	(3) Desempleo	(4) Proporción con negocio propio	(5) Porcentaje Auto Empleo	(6) Ln(Ingreso)
Homicidios por 100 mil hab, 2002-2005	-0.001	-0.005	-0.009**	0.009*	0.024	0.003***
	(0.003)	(0.022)	(0.004)	(0.005)	(0.018)	(0.001)
Log Población 2005	-0.073*	-0.435**	0.089**	-0.116**	-0.605***	0.029***
	(0.039)	(0.203)	(0.045)	(0.056)	(0.163)	(0.010)
Densidad de vivienda, 2005	-0.000*	-0.000	0.000	-0.000**	0.001***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy urbano	-0.158**	1.102**	0.115	0.124	-0.131	-0.037*
	(0.078)	(0.510)	(0.091)	(0.129)	(0.408)	(0.022)
Porc pob entre 15 y 70 sector comercio, 2003	-0.066	26.624***	-2.388	8.117***	22.958***	0.183
	(1.385)	(8.145)	(1.455)	(2.320)	(5.893)	(0.257)
Porc pob entre 15 y 70 sector manufacturas, 2003	4.896***	6.619**	-1.404*	-0.700	2.624	-0.211**
	(0.485)	(2.999)	(0.718)	(0.732)	(1.837)	(0.102)
Producción por persona ocupada comercio, 2003	1.262**	7.091*	0.829	0.158	-9.826***	0.558***
	(0.638)	(3.627)	(0.841)	(0.846)	(2.774)	(0.182)
Producción por persona ocupada manufacturas, 2003	0.257***	-0.722***	0.122***	-0.105**	-0.458***	0.026***
	(0.049)	(0.201)	(0.043)	(0.048)	(0.132)	(0.008)
Ingresos municipales per capita, 2002-2005	-0.060	-0.176*	0.011	0.045*	0.315***	-0.007
	(0.040)	(0.090)	(0.024)	(0.024)	(0.072)	(0.005)
Índice de Desarrollo Humano, 2005	2.368	14.359	-0.433	4.026	25.064***	0.475
	(1.704)	(11.489)	(2.106)	(2.557)	(8.683)	(0.558)
Escolaridad, 2005	0.044*	0.107	0.048	-0.020	0.023	0.004
	(0.023)	(0.173)	(0.031)	(0.047)	(0.115)	(0.007)
Índice de Marginación, 2005	-0.190	1.192	-0.561***	-0.138	6.370***	-0.304***
	(0.135)	(0.886)	(0.160)	(0.190)	(0.651)	(0.043)
Altitud, Km	-0.160***	-0.508*	0.168***	-0.121*	0.164	-0.057***
	(0.054)	(0.285)	(0.061)	(0.063)	(0.224)	(0.014)
Número de puertos	0.712***	0.492	-0.161	-0.210*	-0.533	-0.009
	(0.200)	(0.788)	(0.147)	(0.127)	(0.342)	(0.029)
Número de aeropuertos	0.594***	0.924*	-0.101	0.163	0.024	0.012
	(0.165)	(0.493)	(0.139)	(0.135)	(0.344)	(0.019)
Zona Centro	0.460***	1.295*	0.166	-0.228	-0.372	0.077**
	(0.117)	(0.683)	(0.123)	(0.145)	(0.524)	(0.032)
Zona Noreste	0.545***	-0.362	0.297**	-0.204	0.170	0.071**
	(0.120)	(0.702)	(0.140)	(0.164)	(0.461)	(0.031)
Zona Noroeste	0.876***	-0.769	-0.447***	0.220	0.634	0.063**
	(0.154)	(0.927)	(0.151)	(0.192)	(0.514)	(0.032)
Zona Sureste	0.343***	2.046***	-0.040	0.574***	-0.311	0.076**
	(0.114)	(0.697)	(0.119)	(0.181)	(0.503)	(0.030)
Constante	-0.728	45.879***	0.169	0.039	4.767	7.172***
	(1.384)	(8.821)	(1.631)	(1.977)	(6.410)	(0.412)
Observaciones	1,301	1,048	1,048	1,048	1,048	1,048
R-squared	0.294	0.124	0.546	0.241	0.624	0.765

Errores Estándar entre paréntesis
*** p<0.01, ** p<0.05, * p<0.1

Figure A.2. Synthetic Controls for Selected Cities

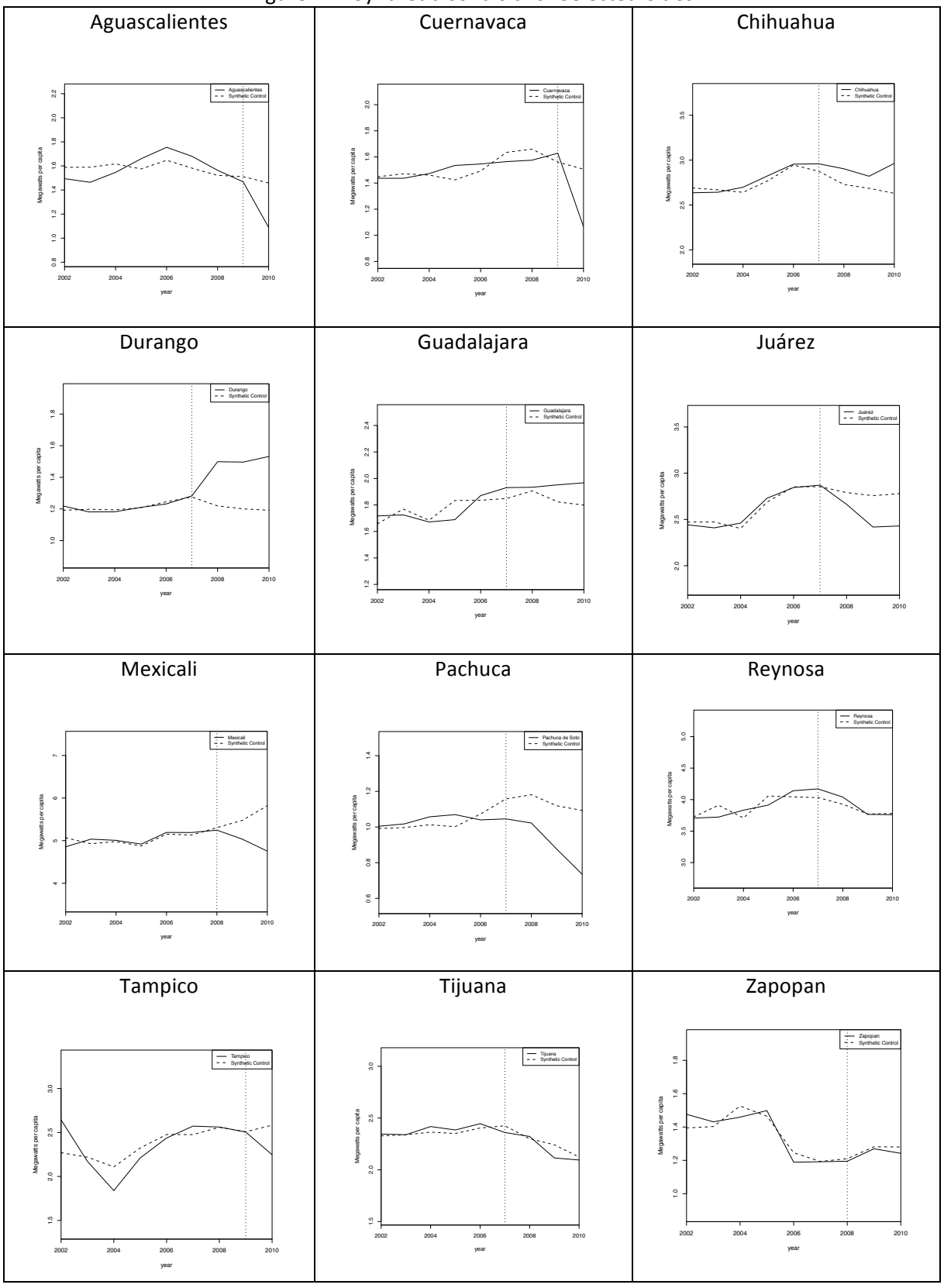


Table A.2. Cobertura de las definiciones de tratamiento para los controles sintéticos

	Desviaciones estándar respecto a la media		
Tratamiento	1 desv.est.	2 desv.est.	3 desv.est.
Total de Municipalidades	2441	2441	2441
Municipios Tratados	1468	982	642
Municipios de Control	973	1459	1799
Tasas por 100 mil habitantes de homicidios relacionados con el narcotráfico, 2006-2010	Cobertura de la definición del tratamiento		
Top 50 municipios con mayores tasas	96.0%	90.0%	86.0%
Top 100 municipios con mayores tasas	97.0%	90.0%	84.0%
Top 200 municipios con mayores tasas	92.5%	80.5%	67.0%
Top 50 municipios con menores tasas	0.0%	0.0%	0.0%
Top 100 municipios con menores tasas	1.0%	1.0%	1.0%
Top 200 municipios con menores tasas	24.0%	12.5%	4.0%
Tasas por 100 mil habitantes de homicidios totales 2006-2010	Cobertura de la definición del tratamiento		
Top 50 municipios con mayores tasas	100.0%	98.0%	98.0%
Top 100 municipios con mayores tasas	99.0%	96.0%	90.0%
Top 200 municipios con mayores tasas	98.5%	89.5%	79.0%
Top 50 municipios con menores tasas	34.0%	2.0%	2.0%
Top 100 municipios con menores tasas	9.0%	1.0%	1.0%
Top 200 municipios con menores tasas	22.5%	4.5%	1.5%
Incremento en la tasa promedio anual de homicidios entre 2002-2005 y 2006-2010	Cobertura de la definición del tratamiento		
Top 50 municipios con mayores incrementos	98.0%	90.0%	88.0%
Top 100 municipios con mayores incrementos	96.0%	86.0%	80.0%
Top 200 municipios con mayores incrementos	92.5%	78.5%	68.0%
Top 50 municipios con menores incrementos	0.0%	0.0%	0.0%
Top 100 municipios con menores incrementos	1.0%	1.0%	1.0%
Top 200 municipios con menores incrementos	20.5%	10.5%	4.0%

Nota: La proporciones están calculadas con respecto de la muestra de municipios con los que se cuenta información completa y consistente de consumo de electricidad.