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"A two-sided coin: Disentangling the economic effects of the 'War on drugs' in Mexico"

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Abstract

Mexican President Felipe Calderón was sworn into office in December 2006. From the outset, his administration was to deploy an aggressive security policy in its fight against drug trafficking organizations (DTOs), in what became known as the Mexican 'War on Drugs'. The policy was strongly condemned because of the 68,000 unintentional deaths directly attributable to it. Here, we evaluate the economic effects of this 'War on Drugs'. To disentangle the economic effects of the policy, we study the effects of homicides and the rise in the homicide rate together with the impact of federal public security grants and state-level military expenditure on economic growth. Using spatial econometrics, we find that at the state-level the number of homicides reduced the Mexican states' GDP per capita growth by 0.20 percentage points, while the growth in the homicide rate increased the states' per capita GDP by 0.81 percentage points. The government's efforts to fight DTOs had a positive and highly significant impact on economic growth.

JEL classification: D74; K42; H56; R11

Keywords: Drug trafficking organizations; Militarized disputes; Security policy; Homicides; Mexico; War on Drugs

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I. INTRODUCTION

At the end of 2006, the government of Mexican President Felipe Calderón declared a 'War on Drugs' and ordered the military to take decisive action against drug trafficking organizations[1] (DTOs). The military initiated a series of operations that targeted the country's most dangerous drug criminals, which was to result in thousands of casualties (with criminals, police, the military and the civil population among the victims). The detention and eventual killing of the country's drug lords left a power vacuum that rival organizations sought to fill, with a further increase in the number of victims.

Between the 1990s and the mid-2000s, the nation's homicide rate had fallen reaching an historical low in 2007 of 8.1 homicides per 100,000 inhabitants (or a total of 8,861). Shirk and Wallman (2015) claim that if this reduction had been maintained, Mexico's homicide rate would have eventually reached similar levels to those recorded in the United States (5 homicides per 100,000 habitants). However, during Felipe Calderón's Presidency (2007-2012), the homicide rate increased dramatically reaching a high of 23.0 homicides per 100,000 habitants in 2011. The Mexican National Statistics Institute, INEGI, counted 121,603 homicides in the country during his administration. If we take the 2007 homicide rate as a baseline, then over 68,000 of these homicides can be attributed to President Calderón's Drug Crusade. Once his presidency came to an end, the homicide rate fell slightly, although government strategies remain unchanged.

Although there is almost a complete absence of studies analyzing the impact of this spiraling violence in Mexico on its GDP, evidence suggests that foreign direct investment (FDI) experienced a setback in some industries (e.g. Mining and Oil Extraction) (Ashby and Ramos,

[1] The U.S. National Drug Threat Assessment of 2010 defines drug trafficking organizations as "complex organizations with highly defined command-and-control structures that produce, transport, and/or distribute large quantities of one or more illicit drugs." (DOJ, 2010, p.10)

2013). However, this study analyses all Mexican states together, regardless of whether they present signs of the violence being perpetrated by DTOs, and so this setback in investment might be linked to other causes. Firms and individuals that have settled in violent regions have opted to move away in search of greater security. According to NRC/IDMC (2010), the number of people who fled their homes (up to 2010) is estimated at 230,000. Several countries have also issued warnings to their citizens not to visit a number of areas in Mexico (Zapata, 2011). But whether these factors have affected the GDP growth rate has yet to be analyzed.

It seems probable that economic variables are closely linked to problems of violence. Terrorist acts, such as those reported in Spain, Turkey and Israel, have been shown to represent major economic setbacks. While the terrorism-related literature can serve as a point of reference, we cannot apply its results to the case of DTO violence in Mexico, given that the violence associated with terrorism and drug trafficking are markedly different in character.

Based on the number of victims during Mexico's recent drug crusade and the opportunity costs of government spending dedicated to fighting DTOs, it is reasonable to expect that Mexico's economy experienced some impact from DTO activities. A society that suffers violent acts faces not only the costs of those of its citizens who are directly and indirectly affected by them, but also the political and institutional costs. Acemoglu et al. (2013) point out that when the relationship between the actors controlling institutions and criminals reaches certain levels, a symbiotic relationship may emerge and non-state actors are able to influence policy decisions. Events in Italy illustrate how criminal organizations like the mafia have poisoned and corrupted government at the highest levels (Alesina et al., 2016), while Colombia faced the same problem up until the end of the 20th century, when the drug cartels of Medellin and Cali were particularly strong.

A number of studies have analyzed the economic effects of drug-related violence, but what we do in this article is to analyze the impact of government policy during President

Calderon's administration aimed at fighting DTOs and drug-related violence. To do so we examine how GDP at the state level reacts (1) to violence and (2) to government efforts to fight that violence. For this purpose, we work in a well-known growth setting, using the β-convergence framework, while also considering spatial spillovers between the Mexican states.

One of our hypotheses is that violence, and perhaps government interventions to fight that violence, have spatial effects. In other words, we expect some form of spillover across state borders. In order to analyze the impact of military expenditure, we approximate state-level military budgets. To do so, we infer the state budgets based on the location of soldiers likely to participate in the fight against DTOs.

As such, we make the following contributions to the literature: 1) we provide an evaluation of the economic effects of the 'War on Drugs' policy and so contribute to the scarce economic literature on the 'War on Drugs' in Mexico. 2) We analyze, for the first time, the effects of state-level military spending on the growth of per capita GDP in the context of the Mexican 'War on Drugs'. Using the β-convergence framework to analyze the impact of violence and attempts to fight it, we link the empirical analysis of this national security policy to economic theory. 3) Our approach isolates the effects of homicide rates, the growth in homicide rates, public security grants and military spending on economic performance across the Mexican states. In this evaluation, we develop a new way of approaching military expenditure at the state level in a country in which such information is not publicly available.

II. LITERATURE REVIEW

II.1 Literature related to drug trafficking organizations

A difficulty when fighting DTOs is that the actions undertaken by governments often just shift the problem to another location. The spatial competition model developed by Rasmussen et al. (1993) suggests that higher drug enforcement in one jurisdiction simply moves the drug problem to neighboring jurisdictions, resulting in higher rates of violent crime. Their analysis concludes that “Drug enforcement increases violent crime due to the disruption of spatial equilibria in drug markets” (Rasmussen et al., 1993, pp. 229-230).

In the case of DTOs in Italy, Cracolici and Uberti (2009) examined the spatial component of mafia crime and detected spatial or spillover effects of four different kinds of crime across the country’s provinces. This suggests that actions by local governments need to be coordinated with those of their neighboring local governments. Pinotti’s (2014) results suggest that the presence of organized crime led to a 16% fall in GDP per capita and the substitution of private capital with less productive public investment.

In countries facing insurgency movements, governments seek to fight the insurgents by military means and by providing services to incentivize the community to share information. Berman et al. (2011) examined the case of Iraq and found that regional spending on public goods is violence-reducing.

The economic literature on DTOs, such as those operating in Mexico, is scarce. Some scholars have tried to characterize the violent acts perpetrated in Mexico in the same category as terrorist or counter-insurgency acts. As Williams (2012) explains, such a characterization is erroneous, since the killings in Mexico are not motivated by politics, ideology or religion. He points out that while there is some evidence of ‘careless’ violence (as some civilians have been erroneously executed or caught in the crossfire), the violence in Mexico has been quite selective.

The violence in Mexico is a complex phenomenon. Variables such as the poverty rate, unemployment and the country’s weak institutions all play an important role. For example, Levitt and Venkatesh (2000) find that criminal organizations are more successful at recruiting people with lower incomes.

In the case of Mexico, in which DTOs have been active for decades, the reasons for the rise in the homicide rate appear to be more closely associated with the increase in reprisal killings, the wars waged between rival DTOs and clashes with the armed forces. Rios (2013) claims that the violence is driven by two mechanisms: 1) the competition between DTOs to expand their drug trafficking turf, and 2) government action in the form of police and military operations to apprehend drug cartel members. These two mechanisms are obviously interconnected, since when the leaders of a dominant DTO are arrested, its competitors see an opportunity to expand into their territory, with a resulting escalation in violence.

A recent study investigating violence and the effects of DTOs in Mexico (Dell, 2015) shows that drug-related violence increases substantially after closely fought mayoral elections involving a change in the ruling party. This is in line with the findings in Snyder and Duran-Martinez (2009), Astorga and Shirk (2010) and Chabat (2010). A wave of violence following a change in the ruling party at the municipal level seems to indicate that the previous incumbent had entered into agreements with DTOs. Following the elections, these agreements are no longer binding and as police and military forces seek to detain the drug lords, violence breaks out. The Italian mafia display a similar pattern of behavior: "regions with a greater presence of criminal organizations are characterized by abnormal increases in homicides during the year before elections" (Alesina et al., 2016, p.2).

The Mexican government understood that "illicit drug prices, illicit drug crop cultivation and drug eradication and interdiction strategies are significant predictors of domestic and international terrorism" (Piazza, 2011, p. 311). Thus, they developed a strategy to deal with DTOs founded on two main pillars: first, they sought to diminish the financial ability of DTOs to bribe officials (e.g., through crop eradication and enhanced shipment searches) and to buy firearms; and, second, they sought to decapitate the DTOs' leadership structure by mounting operations that target drug lords and their lieutenants.

However, "[t]he arrest (or killing) of kingpins, bosses and leaders was particular high in the 2008-2010 period, while other actions, such as drug seizures or crop eradication either remained stagnant or declined" (Guerrero-Gutiérrez, 2011, p. 11), which led to a fragmentation of the drug cartels (Rios, 2013; Ajzenman et al. 2014).

An argument raised by Vilalta (2010) is that drug crimes are usually neither uniform nor spatially random. Moreover, the evidence of violence spreading across space is not restricted to urban agglomerations. In fact, various authors consider the presence of spatial effects to be fundamental in explaining the violence across municipalities and even across states (see Díaz-Cayeros et al., 2011; Flores and Rodriguez-Oreggia, 2014; Osorio, 2015).

Widner et al. (2011) report that DTO crimes occur primarily across Mexico's northern border states. Controlling strategic points along this border[2] has been critical for DTO success and the reason why DTOs have been at war with each other for years. Dube et al. (2015) describe substantial increases in homicide rates in the Mexican states due to a spillover in gun supply from the U.S. following changes in US gun laws.

II.2 Literature related to economic effects of drug related violence

Studies, such as Gibbons (2004) and Besley and Mueller (2012), have examined the relationship between crime and housing prices and find that property prices are higher in areas that are more peaceful. In Mexico, "crime has in fact triggered a substantial reduction in housing prices, which is concentrated exclusively in poor areas" (Ajzenman et al., 2014, p. 34), and areas where crime has been persistent experience an even higher price reduction than areas where crime has been present for shorter periods.

Other studies have examined determinants of economic growth and how the presence of organized crime affects them. For instance, Cabral et al. (2016) report that a rise in crime has negative effects on labor productivity. Ashby and Ramos (2013) find that organized crime in Mexico deters FDI in financial services, commerce and agriculture. In terms of human capital

[2] The Mexican border states with the U.S. are Baja California, Sonora, Chihuahua, Coahuila, Nuevo León and Tamaulipas.

accumulation, Marquez-Padilla et al. (2015) found barely any effect on total enrollment in schools. And, as for income inequality, Enamorado et al. (2016) find that a one-point increase in the Gini coefficient increases the number of drug-related homicides by 36%.

As far as GDP is concerned, very few studies have been undertaken of the Mexican case, with the exceptions of a) Robles et al. (2013), who use electricity bills as a GDP proxy to estimate the impact of violence on GDP and unemployment, while employing IV and synthetic control methods; b) Pan et al. (2012), who use a spatial model to estimate the impact of different violence variables on GDP; and c) Enamorado et al. (2014), who employ the β-convergence framework to estimate the impact of drug-related homicides on real income.

Using electricity bills at the municipality level, Robles et al. (2013) find that an increase of 10 homicides per 100,000 inhabitants results in a reduction of 2-3% of the municipality's working population, an increase of around 1.5% in unemployment, a 0.4% reduction in the proportion of business owners, a 0.5% reduction in the proportion of self-employed and a 1.2% reduction in average income. In addition, they use a synthetic control to estimate that electricity consumed per capita fell by 4.2% and 7.4% in the first 2 years after a conflict between two DTOs.

The spatial autoregressive model used in Pan et al. (2012) explains to a certain extent how crime and violence have a negative effect on output growth. Their results, for the period 2005-2009, show that GDP growth is negatively related to crime in the surrounding states, and positively related to crime within the state in the previous year. An interesting aspect of this study is the introduction of an aggregated variable of federal grants (education, public security, health services and social infrastructure). The model specification features an aggregate crime variable which includes fraud, rape, assault, property damage, homicide, and other crimes.

Finally, the study by Enamorado et al. (2014) makes use of the β-convergence framework to investigate the effect of crime on income-growth in Mexico. This approach finds evidence of a negative impact of drug-related homicides on income growth in Mexican municipalities in the period 2005-2010. Their model considers aggregate figures of public expenditure at the municipality level, which is found to be significant. When comparing the effects of drug-related homicides with those of non-drug-related homicides, they obtain negative and significant results for the drug-related homicide rate. The model recognizes some form of spatial interaction since it clusters the standard errors by state.

The studies conducted by Enamorado et al. (2014) and Pan et al. (2012) are particularly interesting for the case we deal with here as both approaches seek to link their empirical models to the growth literature. Here, by adopting a similar framework, and introducing a violence function (which acts as a deterrent to the economy) and spatial effects, we also succeed in establishing a link with the economic growth literature.

To avoid potential problems, e.g. those of multicollinearity, we have opted to focus on just one high-impact crime variable: homicides. Government expenditure dedicated to fighting crime is central to our model, since we wish to identify whether this spending has a positive or negative impact on a state's economy. Therefore, we concentrate solely on public security grants and an approximation of state-level military budgets.

In this study we evaluate the impact of the Mexican 'War on Drugs' on GDP per capita growth. By so doing, we address a gap in the literature and offer a new perspective on the way in which the government has sought to tackle the problems associated with DTOs operating in the country. By considering the effects of government expenditure (in the form of state-level military expenditure and public security grants) and the homicide rate and the growth in this rate, we manage to disentangle the different effects these variables have on the growth in GDP per capita.

III. THE POLICY

During the last decade of the 20th century, the number of DTOs increased following a process of cartel fragmentation, an increase in political competition, and anti-corruption reforms (Snyder and Duran-Martinez, 2009, p. 270). The growth and multiplication of DTOs across the nation weakened the government's position, despite its willingness to strike a new deal with the drug lords.

Towards the end of Vicente Fox's administration (2001-2006), DTO-related homicides grew significantly. The number of homicides rose from a low of 9,329 nationwide in 2004 to 9,921 in 2005, reaching 10,452 in 2006. According to Chabat (2010), before President Calderón entered office he came under considerable public pressure to address the escalating problem. Indeed, one of the main pillars of Felipe Calderón's presidential campaign was to strengthen the rule of law, which meant that the continuing toleration of the DTOs was simply not an option, given that the political costs would have been too high (Chabat, 2010).

In response to the wave of homicides and the presence of DTOs in almost all states, President Calderón launched the 2007-2012 Directive for the Integral Fight against Drug Trafficking (*Directiva para el Combate Integral al Narcotráfico 2007-2012)* as soon as he was sworn into office in December 2006.

While the Mexican military had long been involved in fighting the DTOs, the Directive introduced new and more aggressive guidelines against drug trafficking. It identified four strategies to support its national security policy: 1) Improving operations for the more efficient eradication of local cultivations, the interception of illegal drug trafficking and the fight against DTOs. 2) Supporting the activities organized by public security institutions to guarantee a safe environment for society and to restore public peace. 3) Helping maintain the rule of law by fighting armed criminal organizations across the nation. 4) Strengthening army and air force law enforcement against the use of firearms and explosives. This fourth point sought to identify and stop illegal firearm flows from the U.S.

With the new Directive, “[t]he federal government […] deployed thousands of federal troops to man checkpoints, establish street patrols, and oversee other domestic law enforcement functions in high drug violence states” (Shirk, 2012, p. 10). In addition, the military inspected hangars, deposits, mail delivery companies, and bus and train stations. The military also cooperated with police forces to prevent criminal activity. During Calderón’s administration, the Defense Department reported the detention of nine high-ranking drug lords as well as 149 cartel lieutenants.[3] Such military operations are very costly, so President Calderón increased the yearly Defense Department’s budget over real GDP from 0.24% in 2006 to 0.47% by the end of 2012[4]. Expenditure was increased above all in those states facing the most intense DTO violence.

President Calderón’s determination to fight the drug cartels won the support of the U.S. government. On 30 June 2008, the Merida Initiative was passed by the U.S. congress. As a result of this initiative, the U.S. government offered to support the Mexican government with a three-year, $1.4 billion U.S. Dollar aid package to be used for judicial reform, institution-building, human rights and rule-of-law issues (Shirk, 2010). In addition, the Mexican military acquired helicopters and surveillance aircrafts.

Despite this policy (or, perhaps, because of it), the number of homicides in the country rose markedly during the administration. In fact, all criminal activities related to DTOs experienced a significant increase: drug trafficking, homicides, kidnappings, racketeering and the armed robbery of vehicles.

[3] Information obtained from the Defense Department’s activities reports 2007-2012.

[4] These figures refer solely to the Defense Department’s Budget. If we consider total Military Expenditure as percentage of GDP, expenditure rose from 0.4% in 2006 to 0.6% in 2012, according to data from World Bank.

IV. THEORETICAL FRAMEWORK

We use a simple production function, in line with that proposed in Mankiw et al. (1992), and adapt it to the regional β-convergence hypothesis, as discussed in Barro et al. (1991). β-convergence refers to the negative relationship between the rate of growth of a particular variable (here GDP per capita) and the initial level of that variable. Furthermore, we enhance it with spatial spillover effects as suggested by López-Bazo et al. (2004).

By adopting this approach, we develop a regional economic growth model, where in region i during time t the economy uses labor (L_{it}), physical (K_{it}) and human (H_{it}) capital stocks, as well as the state of technology (A_{it}) to produce its output (Y_{it}). In addition, we introduce an output deterrent variable (Z_{it}), which in our context is a violence function $Z_{it} = f(V_{it}, S_{it}) \leq 1$, with V_{it} being the losses attributable to violence in our economy and S_{it} represents some form of State intervention to fight the levels of violence. If $Z_{it} = 1$, our economy is not affected by violence problems. On the other hand, if $Z_{it} = 0$, our economy is unable to function properly. Average labor productivity (y_{it}) is a function of the average levels of physical and human capital stocks:

$$y_{it} = A_{it} Z_{it} {k_{it}}^{\alpha} {h_{it}}^{\beta} \tag{1}$$

where $\alpha > 0$ and $\beta > 0$ are the internal rates of return for physical and human capital stocks, respectively. We also assume that $\alpha + \beta < 1$. The economy, as described in (1), is dependent on an exogenous technology shock and on the performance of neighboring economies. The technology shock is assumed to grow exogenously at rate g while $\Delta_{it} = \Delta_0 e^{gt}$ and, for simplicity, this factor, as well as α and β, is equal for all economies. To avoid scale effect problems, technology should be understood as a function of capital intensity.

$$A_{it} = \Delta_{it} (Z_{\rho it} {k_{\rho it}}^{\alpha} {h_{\rho it}}^{\beta})^{\gamma} \tag{2}$$

The spillovers of neighboring economies are defined by γ, which is the spillover intensity. If $\gamma = 0$, neighboring economies do not affect our incumbent economy, while if $\gamma = 1$, our economy is affected for better or for worse. Implicitly, γ also tells us something about the size of the neighboring economies with respect to that of the incumbent. When the neighboring economies are bigger than the incumbent's, the influence is likely to be greater. For simplicity, we assume all economies to have the same influence on their neighbors. The factors $k_{\rho it}$ and $h_{\rho it}$ are the per capita ratios of physical and human capital. $Z_{\rho it}$ denotes the violence function affecting the neighboring economies.

$$y_{it} = Z_{it}\Delta_{it}{k_{it}}^{\alpha}{h_{it}}^{\beta}(Z_{\rho it}{k_{\rho it}}^{\alpha}{h_{\rho it}}^{\beta})^{\gamma} \tag{3}$$

With these neighboring effects, as physical and human capital increase, the rate of return is $(\alpha+\beta)(1+\gamma)$. We then introduce the effective physical capital-labor ratio ($\widetilde{k_{it}} = \frac{k_{it}}{\Delta_{it}}$) and the effective human capital-labor ratio ($\widetilde{h_{it}} = \frac{h_{it}}{\Delta_{it}}$). After so doing, our growth rates for physical and human capital in effective units of labor can be expressed as

$$\begin{aligned} g_{\tilde{k}} &= \frac{\dot{\widetilde{k_t}}}{\widetilde{k_t}} = \frac{s_K\widetilde{y_t}}{\widetilde{k_t}} - (\delta+g+n) \\ g_{\tilde{h}} &= \frac{\dot{\widetilde{h_t}}}{\widetilde{h_t}} = \frac{s_H\widetilde{y_t}}{\widetilde{h_t}} - (\delta+g+n) \end{aligned} \tag{4}$$

The model assumes exogenous saving rates of physical (s_K) and human (s_H) capital. δ is the depreciation rate, g is the exogenous technology growth rate and n is the population growth rate (all three factors are equal for all economies).

$$\begin{aligned} \widetilde{k_t}^{*} &= \left(\frac{{s_K}^{1-\beta}{s_H}^{\beta}Z_t(Z_{\rho t}{\widetilde{k_{\rho t}}}^{\alpha}{\widetilde{h_{\rho t}}}^{\beta})^{\gamma}}{\delta+g+n}\right)^{\frac{1}{1-\alpha-\beta}} \\ \widetilde{h_t}^{*} &= \left(\frac{{s_K}^{\alpha}{s_H}^{1-\alpha}Z_t(Z_{\rho t}{\widetilde{k_{\rho t}}}^{\alpha}{\widetilde{h_{\rho t}}}^{\beta})^{\gamma}}{\delta+g+n}\right)^{\frac{1}{1-\alpha-\beta}} \end{aligned} \tag{5}$$

Substituting these optimal levels of stock into the output per unit of effective labor ($\widetilde{y_{it}} = \frac{y_{it}}{\Delta_{it}}$) equation results in

$$\widetilde{y_t}^* = \left(\frac{s_K{}^\alpha s_H{}^\beta Z_t (Z_{\rho t} \widetilde{k_{\rho t}}^\alpha \widetilde{h_{\rho t}}^\beta)^\gamma}{(\delta + g + n)^{\alpha+\beta}} \right)^{\frac{1}{1-\alpha-\beta}} \tag{6}$$

As we can see, the optimal level of $\widetilde{y_{it}}$ also depends on the capital stock factors of neighboring economies. The spillover effects grow as the returns to capital and human capital grow. Consequently, after applying the first order Taylor expansion around the steady state, the growth rate of y_{it} can be expressed as

$$g_y = g_Z + \alpha g_k + \beta g_h + \gamma\left(g_{\rho Z} + \alpha g_{\rho k} + \beta g_{\rho h}\right) \tag{7}$$

V. EMPIRICAL STRATEGY

For the empirical model, we follow the recommendations made by Fingleton and López-Bazo (2006) and connect our regional growth model with spatial spillovers to empirics by using a spatial econometric model. The matrix form of our spatial model can be generalized as

$$\boldsymbol{g_{y,t}} = \boldsymbol{c} - (1 - e^{-\beta T})\boldsymbol{log}(\boldsymbol{y_{t-1}}) + \boldsymbol{X\delta} + \boldsymbol{u} \tag{8}$$

with

$$\boldsymbol{u} = \lambda \boldsymbol{W u} + \boldsymbol{\varepsilon} \tag{9}$$

where g_y is the n×1 vector of the GDP growth rate for each state, c is the intercept, β is a measure of the speed of convergence associated to the time lag of the absolute value of GDP, while X represents the matrix of exogenous variables, δ is the vector of the regression parameters associated to X, and u is the vector associated to the disturbances. The vector u is not i.i.d., because it follows a spatially autocorrelated process, while W is the n×k binary contiguity weighting matrix of the spatially lagged error term. The contiguity matrix W has elements $w_{ij} = 1$ when two units (states) share a common border and $w_{ij} = 0$ in all other cases. This weighting matrix assumes that spillovers only take place between bordering regions. Finally, $\boldsymbol{\varepsilon}$ is an i.i.d., zero-mean vector of errors: $\boldsymbol{\varepsilon} \sim \mathcal{N}(\mathbf{0}, \boldsymbol{\sigma}^2 \boldsymbol{I})$.

The empirical specification of the theoretical model proposed in the previous section, and a more detailed form of the spatial model, can be expressed as follows for each state i:

$$\begin{aligned} g_{y,it} = \boldsymbol{c} + \phi \log(y_{it-1}) + \delta_1 Fin.Crisis_{it} + \delta_2 HR_{,it} + \delta_3 g_{HR,it} \\ + \delta_4 g_{R33,it} + \delta_5 Military_{it} + \theta_i + \lambda W u_{it} + \varepsilon_{it} \end{aligned} \tag{10}$$

In this specification, $g_{y,it}$ is the state's real GDP in per capita terms. We choose the per capita adjustment of real GDP because it corrects for population size and migration. This variable selection is in keeping with the selection made in similar studies, including those of Abadie and Gardeazabal (2003), Bilgel and Karahasan (2015) and Pinotti (2014).[5]

We also introduce the exogenous variables contained in X: the 2008-2009 financial crisis, the homicide rate per 100,000 habitants (HR), the growth in the homicide rate (g_{HR}), the growth in central government grants earmarked for public security (Ramo33 grants), and the approximate state-level military expenditure. For the model, we also use state fixed effects, denoted by θ_i. The state fixed effects should capture the individual effects of unobserved state characteristics that remain unchanged over time.

To ensure that our model is correctly specified, unbiased and efficient, we run a series of diagnostic tests to check that no important assumptions made by our spatial model are violated. First, we test for multicollinearity. To do so, we calculate the values of the variance inflection factor (VIF). VIF values above 5 indicate problems of multicollinearity in the model.

[5] The estimations were also run using real GDP in non-per-capita terms, for which we obtained very similar results. These estimation results are available upon request.

The VIF values in our model (see Table 1) lie between 1.02 and 1.19 for all variables. Therefore, we are able to reject the presence of multicollinearity.

Table 1: Variance Inflection Factors

Variable	VIF	1/VIF
Log of GDP (-1)	1.02	0.9817
Financial Crisis	1.17	0.8526
Homicide Rate	1.07	0.9320
Δ Homicide Rate	1.19	0.8420
Δ of R33 Grants	1.05	0.9487
M. Budget (Infantry)	1.02	0.9833
Mean VIF	1.09	0.9174

Since we employ panel data, we need to determine the correct form of our model. To do so, we run the Breusch and Pagan Lagrangian multiplier test for random effects, to see if there are any individual effects present in our panel model. The test rejects the null hypothesis, indicating that we should consider the presence of specific effects. After so doing, we perform the Hausman test to help us choose between fixed and random effects. By rejecting the null hypothesis, we know that a fixed effects specification is both consistent and appropriate.

We then test for heteroscedasticity. Heteroscedasticity in the model would lead to inefficient estimates. For this test, we are not able to reject the null hypothesis. To deal with this problem, we run our model using Driscoll-Kraay standard errors, which are simply robust standard errors for panel regressions with cross-sectional dependence.

By running the Wooldridge test we seek to ensure that our model is free of time autocorrelation. We accept the test's null hypothesis and conclude that there is no need to include a time lag for the dependent variable in our model, which is also consistent with the theoretical model.

In order to isolate the spatial component of the model, that is, if one region shows the influence of its neighboring regions, we run the different tests for spatial dependency. The Global Moran's I test, the Global Geary's C test, the Global Getis and Ord's G test and the Pesaran test for cross-sectional dependency, they all reject the null hypothesis of absence of spatial autocorrelation. Table 2 presents the respective test statistics. By rejecting the null hypothesis, we confirm the presence of spatial autocorrelation.

In addition, we also run the cross-sectional Moran's I tests[6] for all periods and find a significant value for some of the cross-sections. This provides additional evidence of spatial autocorrelation in the model. With the help of the local indicator of spatial autocorrelation (LISA) that indicate which states present a significant influence of GDP per capita growth from their neighboring states, we find further evidence of spatial effects[7].

To choose the correct spatial form, we run a general form of the spatial model and perform different Lagrange Multiplier (LM) tests to decide which spatial specification to choose. When both tests show significant results, we carry out the robust version of the tests, which ultimately reject the spatial lag component. This leaves us with a spatial error model (SEM).

[6] The Moran's I Test null hypothesis is the absence of spatial autocorrelation. To determine the significance of the test, we ran it with 99,999 permutations. The corresponding p-values obtained help us to determine the significance of the tests, i.e. the presence or absence of spatial autocorrelation.

[7] Significance maps can be provided upon request.

Table 2: Spatial Diagnostics Tests

Test	Statistic	P-Value
Global Moran's I	0.3987	0.0000
Global Geary's C	0.5657	0.0000
Global Getis and Ord's G	-1.6695	0.0000
Pesaran Test	31.166	0.0000
LM Lag	3.1940	0.0739
LM Error	110.7060	0.0000
Robust LM Lag	107.5165	0.9463
Robust LM Error	0.0045	0.0000

Overall, we expect a positive sign for the growth rate of GDP, since growth rates in booming states tend to be similar from one year to the next year when there are no shocks. We expect a negative sign for the lagged value of real GDP per capita. Richer economies usually have lower growth rates than those presented by poor economies. The 2008-2009 financial crisis should have a negative impact on the economy of the states. As for the homicide growth rates, it is reasonable to think they would affect the economy negatively. When it comes to government expenditure in the form of grants for public security or in that of the military budget, it is difficult to determine if the impact should be positive or negative. It might be the case that the state economy grows because investors and consumers receive the signal that the problem is being dealt with. It might also be the case that the impact is negative because public expenditure is directed away from more productive areas.

VI. DATA

For our estimations, we draw on balanced panel data for all 32 Mexican states (the *Distrito Federal*, the capital, is considered a contiguous state) for the period 2001-2013. The state-level is the smallest spatial unit for which all the variables considered here were available.

The years between 2001 and 2013 were selected as they coincide with a period of political change at the presidential level, together with a significant shift in homeland security policy. The period also incorporates the 2007-2012 Directive for the Integral Fight against Drug Trafficking (*Directiva para el Combate Integral al Narcotráfico 2007-2012*), the security strategy better known as the 'War on Drugs'.

The time series for real GDP, the respective growth rates and the population values by state were retrieved from the Mexican national statistics institute (INEGI). In Figure A2 in the Appendix, we show cross-sectional maps of GDP per capita growth from 2002-2013. The *Ramo 33* is a federal budget mechanism designed to transfer grants to states and municipalities in order to strengthen their capacity under a range of different circumstances. The purposes of these transfers vary and are reported in several subcategories, one of which is public security. Data on the Ramo 33 public security transfers were obtained from the Federal Finance Department.

Both INEGI and the Interior Department publish homicide statistics. INEGI uses administrative registers from the National Health Information System (SINAIS), which follows the classification recommended by the WHO, whereas the Interior Department compiles the data from police investigation files. Although INEGI is unable to distinguish whether a homicide was related to a drug crime, we choose this source for various reasons. First, INEGI is a more trustworthy source than the Interior Department due to its autonomy (working independently of any law-enforcement agency). Second, there have been a number of newspaper reports about police forces failing to investigate murders in some northern states due to the sheer volume of homicides being reported. According to Shirk and Wallman (2015), less than 25 percent of crimes are reported, and only 20 percent of those are investigated. And, third, some speculate that the government might manipulate data in order to improve its approval ratings and so lend support to the security strategy it has opted to implement.

As for the military budgets, this information is not made publicly available at the state level. We undertook searches of government records and budgets but were unable to find state-level budgets for military spending. We followed this up with a formal information request, but were told that this information was only available at the regional level.

Therefore, we work with the 12 regional military budgets made available in the Federation's Expenditure Budget (*Presupuesto de Egresos de la Federación, PEF*) for each year. These budgets contain information on a wide range of subjects including the funding destined to each of the 12 military regions. Each region comprises up to five states.

In order to approximate budget estimates by state, we made various attempts to weight the regional budget in line with individual state measures. We began by attempting to identify the number of soldiers stationed in each state; however, this information is deemed sensitive as it might put soldiers at risk. We also tried to use the location[8] of the different military units (e.g. battalions, regiments, etc.) and weighted the number of units per state in relation to the regional budget. We assume that the location of these military units does not change greatly over time. We then multiplied the approximate number of soldiers in each unit type by the number of corresponding units in each state. The military units considered were battalions (760 soldiers), regiments (760 soldiers), companies (250 soldiers) and groups (120 soldiers). We excluded all units that form part of the presidential guard corps as well as the units belonging to the military police corps, given that they are unlikely to be involved in the fight against the drug cartels.

[8] The location of these units was obtained from a document describing the army's organizational structure around 2006.

Since information concerning military operatives is restricted, we approximated the number of soldiers as being most likely to be deployed in DTO fighting operations. We then weighted the regional budget in line with the following models:

a) Model 1: 93 infantry and 7 light infantry battalions. Together, these 100 battalions amount to roughly 76,000 soldiers.

b) Model 2: 120 battalions [infantry (93), special forces (11), light infantry (7), parachute fusiliers (3), combat engineers (1), war materials (1), engineers' park (1), transports GP (1)] and 49 regiments [motorized cavalry (24), armored reconnaissance (9), artillery (8), mechanized (8)]. These 169 groups amount to approximately 128,440 soldiers.

c) Model 3: as in model 2 but adding a further 20 groups (canons (8), amphibious special forces (5), mortars (5), fast intervention (1), special forces (1)) and 4 combat engineer companies. These 193 units add up to approximately 133,610 soldiers.

We are aware that not all these ground soldiers were deployed in the fight against DTOs. Simply, we use the allocation of soldiers to approximate the state budgets.

In Table 3 we describe the variables used in our econometric specification of the model and in Table 4 we present the descriptive statistics for these variables.

Table 3: Description of Variables

Variable	Description	Expected Sign	Source
Δ GDP	Growth rate of real GDP per capita (in $MXN of 2008)	+	INEGI
Log of GDP (-1)	Lag of the logarithm of real GDP per capita (in $MXN of 2008)	–	INEGI
Financial Crisis	Binary variable: 1 for the years 2008-2009; 0 otherwise	–	-
Homicide Rate	Homicides rate per 100,000 habitants	–	INEGI/SINAIS
Δ Homicide Rate	Growth rate of homicides rate per 100,000 habitants	–	INEGI/SINAIS
Δ of R33 Grants	Growth rate of the per capita Ramo 33 federal transfers to be used exclusively for public security	+/–	Finance Dept.
M. Budget (Infantry)	Weighted Military budget for each State (in $MXN of 2008)	+/–	PEF
M. Budget (Inf. & Reg.)	Weighted Military budget for each State (in $MXN of 2008)	+/–	PEF
M. Budget (Many Units	Weighted Military budget for each State (in $MXN of 2008)	+/–	PEF

Table 4: Descriptive Statistics of the Model

Variable	Mean	Std. Deviation	Min.	Max.	Obs.
Δ GDP	0.0113	0.0354	-0.1403	0.1288	416
Log of GDP (-1)	11.4441	0.5847	10.4715	13.9922	416
Financial Crisis	0.1538	0.3612	0	1	416
Homicide Rate	14.0318	17.2088	1.7166	182.1419	416
Δ Homicide Rate	0.1071	0.4169	-0.8151	3.9465	416
Δ of R33 Grants	-0.0026	0.2202	-0.6651	1.0644	416
M. Budget (Infantry)	4.91E+11	6.58E+11	0	5.03E+12	416
M. Budget (Inf. & Reg.)	4.76E+11	7.19E+11	4.33E+10	6.35E+12	416
M. Budget (Many Units)	6.27E+08	9.66E+08	5.70E+07	8.73E+09	416

VII. RESULTS

The results of our policy analysis of the Mexican 'War on Drugs' are reported in Table 5. Model 1 provides a naive (in the sense that it does not consider any spatial effects) OLS estimation with state fixed effects, which we include for purposes of comparison. Models 2, 3 and 4 are the SEMs for the infantry only, the infantry and regiments, and the broader spectrum of units, respectively.

In these estimations we employ the dependent variable described above, that is, the growth rate of real GDP per capita, since this is the typical approach taken by the literature. However, we also ran these estimations without the population adjustment, but we obtained very similar results.

Most of the signs of our estimate are as expected. Although the logarithm of the absolute value of GDP per capita is not significant in this panel setting, it is negative (as predicted) for all three specifications. The negative sign is expected, as richer economies tend to have small growth rates while poorer economies tend to present larger rates.

The 2008-2009 financial crisis had a marked impact on the Mexican states. As expected, the estimates are negative and highly significant for all four models. The descriptive map (Figure A2 in the Appendix) indicates that in 2008 there were signs of the ensuing crisis but that it was during 2009 that all 32 states presented negative growth rates of their per capita output, ranging from -1.58% to -14.03%, averaging -5.62% nationwide. Therefore, a negative coefficient for this two-year dummy of -4.33% seems reasonable.

In line with Enamorado et al. (2014), the sign for the homicide rate has a negative and significant impact on GDP per capita growth. This result is intuitive if we consider that the wave of violence occurring in Mexico acted as a deterrent to the economic performance of the affected states.

Furthermore, the growth in the homicide rate per 100,000 habitants is positive and highly significant. Our interpretation of this variable is that while the homicide rate provides a snapshot of the presence of DTOs in a state, the homicide growth rate informs us about the impact of the measures taken against DTOs.

Table 5: Estimation output of the spatial error model

	(1) OLS		(2) SEM		(3) SEM		(4) SEM	
Log of GDP (-1)	-0.0298		-0.0447		-0.0433		-0.0457	
	(0.0295)		(0.0328)		(0.0330)		(0.0329)	
Financial Crisis	-0.0506	***	-0.0433	***	-0.0434	***	-0.0433	***
	(0.00530)		(0.0139)		(0.0139)		(0.0139)	
Homicide Rate	-0.00014	***	-0.000204	***	-0.000211	***	-0.000204	***
	(0.0000501)		(0.0000759)		(0.0000751)		(0.0000763)	
Δ Homicide Rate	0.0115	***	0.00811	***	0.00819	***	0.00819	***
	(0.00299)		(0.00163)		(0.00164)		(0.00165)	
Δ of R33 Grants	0.0251	***	0.0139	*	0.0139	*	0.0139	*
	(0.00722)		(0.00742)		(0.00753)		(0.00749)	
M. Budget (Infantry)	7.28e-12	***	2.75e-12	**				
	(2.41e-12)		(1.36e-12)					
M.Budget (Infantry & Regiments)					2.76e-12	**		
					(1.37e-12)			
M. Budget (Many Units)							2.96e-12	**
							(1.29e-12)	
Spatial Λ			0.120	***	0.120	***	0.120	***
			(0.0100)		(0.0100)		(0.00992)	
State Fixed Effects	YES		YES		YES		YES	
Spatial Effects	NO		YES		YES		YES	
Obs.	416		416		416		416	
Within R^2	0.2832		0.2682		0.2699		0.2693	
AIC	-1771.5		-1876.7		-1877.1		-1877.1	
Log Likelihood	891.1		945.3		945.6		945.6	
Test								
$\lambda = 0$			144.29	***	143.24	***	146.40	***

Note: For model 1 we report robust standard errors in parentheses. For models 2, 3 and 4 we report Driscoll-Kraay standard errors in parentheses. For the test, we provide the results of the test statistic. * p<0.10, ** p<0.05, *** p<0.01.

The sign presented by the homicide growth rate is surprising and not easily interpreted. However, the growth rate tells us two things: first, it signals when there are one or more DTOs operating in a state. The literature reports that DTOs seek to expand their territory and that the fragmentation of DTOs leads to violent turf disputes. These disputes increase the number of homicides of DTO members as well as those of others caught up in the turf wars. Second, it signals that violence tends to escalate when the government intervenes. When central or state governments organize operations and send in state forces to apprehend DTO members, DTOs fight back. Decapitating a DTO may result in the splintering of the organization, leading to new turf wars. Additionally, DTOs may retaliate against government officials.

In their struggle to expand their influence, DTOs need to infiltrate the social structure and attract members of the local community into the ranks that make up the drug production chain. When more than one cartel operates in a particular location, we can expect competition to increase, not only in terms of violent conflicts, but also in terms of competing for human resources and obtaining the favor of local people.

This DTO competition could have various "positive" effects on local economic growth. For instance, DTOs often invest in infrastructure. Some DTOs have been known to build hospitals or to pave streets in order to gain people's favor, while at the same time laundering their earnings. Having more than one DTO in town can lead to higher rates of employment, higher wages and more sophisticated weapons for those involved in the illegal trade. A further consequence of DTO competition may be that corrupt government agents work to the benefit of one DTO, targeting police operations on the other DTOs, thus leading to higher government expenditure. Meanwhile, the corrupt government agents have to launder their bribe money so as to avoid raising suspicions. In addition, focusing federal police or military operations within a specific state would mean federal police forces and soldiers would have to be relocated to that state with the resulting additional expenditure for the government.

From anecdotal evidence we know that the presence of DTOs can have a positive economic impact on the economies of the municipalities: "The narcoeconomy ushered certain forms of consumption into an otherwise stagnant, marginal community; it brought money back into the community in various forms of legal reinvestment activities, such as farms and businesses; and it provided many people with all manner of jobs." (McDonald, 2005, p. 121). The World Economic Forum (WEF) has surveyed business leaders regularly about their confidence in Mexican institutions and the business costs of crime. The results prior, during and after the 'War on Drugs' do not present any significant differences, with almost the same levels of confidence being reported in 2014-2015 as in 2006-2007 (WEF, 2014). The results from this report are consistent with the non-negative coefficient of our policy indicator.

Both government expenditure variables to fight violence have positive effects on output growth. Changes in the federal grants for public security present a weakly significant impact on the growth rate of GDP per capita. In the case of military spending, all three weighting alternatives for regional military budgets (based on troop location) are positive and highly significant. The magnitudes of these three alternatives are quite small though. In this regard, it should be borne in mind that Mexico assigns a very small share of its GDP to the military. Mexico's army is relatively small[9] and, therefore, requires few resources. However, the government resources dedicated to fighting DTOs have a significant impact on the growth of real GDP.

For the spatial effects, we obtain highly significant results. We perform a standard test to ensure that the spatial coefficient is different from zero. Based on the high significance of the values reported in the table, we reject the hypothesis of λ being equal to 0 for all cases. Therefore, we can conclude that spatial spillovers occur between states and their neighbors.

[9] The Mexican Defense Department reported a military personnel of 196,767 in 2006, a number which steadily increased to 213,076 in 2014.

VII.1 Robustness of the Military Budget

The weighted military budget variable adopted here might be questioned on the grounds that the location of military units is not permanent and because of the uncertainty as to whether the units selected are actually the units engaged in the operations against DTOs. In anticipation of this skepticism, we offer two alternative methods for weighting regional military budgets.

First, we weight the budget with a variable that reflects the location of an ongoing conflict, that is, the absolute number of homicides. This specification corresponds to Model 5 in Table 6. Furthermore, we also run a model that excludes the variable corresponding to the federal grants for public security. In this last specification, we weight the regional military budgets with the assignment of the Ramo 33 federal grants. The justification for this is that the federal government is in the best position to know about the level of conflict on the ground and is likely to focus its efforts on the most violent areas. This subtle specification change is depicted as Model 6 in the table below. We also include the results of the preferred specification – infantry only – of the location-weighted approach (Model 2). A comparison of the results of the three models shows that all coefficients have the same sign, present a similar magnitude and have similarly high levels of significance.

Table 6: Estimation output of the alternative military budget specification

	(2) SEM		(5) SEM		(6) SEM	
Log of GDP (-1)	-0.0447		-0.0445		-0.0458	
	(0.0328)		(0.0325)		(0.0344)	
Financial Crisis	-0.0433	***	-0.0434	***	-0.0411	***
	(0.0139)		(0.0139)		(0.0141)	
Homicide Rate	-0.000204	***	-0.000210	***	-0.000208	***
	(0.0000759)		(0.0000765)		(0.0000777)	
Δ Homicide Rate	0.00811	***	0.00820	***	0.00780	***
	(0.00163)		(0.00165)		(0.00165)	
Δ of R33 Grants	0.0139	*	0.0139	*		
	(0.00742)		(0.00745)			
M. Budget (Infantry)	2.75e-12	**				
	(1.36e-12)					
M. Budget (Homicide-Weighted)			2.72e-12	**		
			(1.35e-12)			
M. Budget (R33-Weighted)					3.30e-12	***
					(1.25e-12)	
Spatial Λ	0.120	***	0.120	***	0.122	***
	(0.0100)		(0.00986)		(0.00862)	
State Fixed Effects	YES		YES		YES	
Spatial Effects	YES		YES		YES	
Obs.	416		416		416	
Within R^2	0.2682		0.2685		0.2471	
AIC	-1876.7		-1877.3		-1876.5	
Log Likelihood	945.3		945.6		944.2	

Note: Driscoll-Kraay standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

VII.2 Alternative Crime Data

The choice of crime data may, likewise, be controversial, especially if we rely on the statistics provided by the Mexican government. As explained above, we use the homicide statistics collected by the autonomous National Statistics Institute, INEGI. In Table 7 we show the results of our analysis when using data on intentional homicides (*homicidio doloso*), kidnappings and extortion provided by the National Public Security System (SNSP). We chose kidnappings and extortion because, in common with homicides, these crimes are also associated with the activities of DTOs. The SNSP gathers data based on crime investigation files maintained by local authorities.

Table 7: Estimation output using alternative crime variables

	(7) SEM		(8) OLS		(9) OLS	
Log of GDP (-1)	-0.0441		-0.0654	*	-0.0391	
	(0.0329)		(0.0320)		(0.0244)	
Financial Crisis	-0.0420	***	-0.0461	***	-0.0478	***
	(0.0143)		(0.00644)		(0.00522)	
Homicide Rate (SNSP)	-0.000231	**				
	(0.000114)					
Δ Homicide Rate (SNSP)	0.00823	***				
	(0.00294)					
Kidnapping Rate (SNSP)			-0.000286			
			(0.00196)			
Δ Kidnapping Rate (SNSP)			0.000281			
			(0.00126)			
Extortion Rate (SNSP)					0.000217	
					(0.000414)	
Δ Extortion Rate (SNSP)					-0.00170	
					(0.00280)	
Δ of R33 Grants	0.0130	*	0.0269	***	0.0308	***
	(0.00716)		(0.00717)		(0.00804)	
M. Budget (Infantry)	2.97e-12	**	1.01e-11	***	7.50e-12	***
	(1.38e-12)		(2.53e-12)		(1.97e-12)	
State Fixed Effects	YES		YES		YES	
Spatial Effects	YES		NO		NO	
Number of States	32		26		23	
Obs.	416		313		293	
Within R^2	0.2666		0.2880		0.3360	
AIC	-1874.2		-1333.2		-1304.0	
Log Likelihood	944.1		672.6		658.0	

Note: Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

The output results for Model 7 show that both the homicide rate and the homicide growth rate are highly significant and in line with the results obtained when using homicide data provided by INEGI. The results for the models using kidnappings and extortion as crime variables (Models 8 and 9) show no significant results. The overall findings are, therefore, that homicides, but not all high-impact crime rates, affect states' GDP per capita growth rate.

VIII. CONCLUSIONS

This paper has analyzed the Mexican government's attempts to fight DTOs and drug-related violence, a policy more commonly known as its 'War on Drugs'. We study the effects of this policy on the state GDP per capita using a spatial error model based on the theoretical framework of regional convergence.

We focus on disentangling two effects: on the one hand, we examine violence generation, proxied by the growth in the homicide rate per 100,000 habitants, which we interpret as being a consequence of government policy to fight DTOs and as a sign of competition between DTOs within states. On the other hand, we study the effects of violence mitigation, defined in terms of state-level military spending and central government grants dedicated to public security. In so doing, we propose a state-level approximation of the military budget, weighting it according to the location of the military units that are most likely to be deployed in operations targeting DTOs.

The analysis reveals that the homicide rate has a negative effect on economic growth but that the growth in the homicide rate has positive effects. While the homicide rate means the country grew 0.20 percentage points less, the growth in the homicide rate increased, on average, the states' per capita economy by 0.81 percentage points. In contrast, we find that the violence mitigation actions implemented by the central government have a positive and moderate impact on economic growth at the state level. An increase of 1 percentage point in the Ramo 33 grants for public security represents a positive impact of 1.39 percentage points on the states' economic growth. All the different weighting alternatives tested for the weighting of the military budget in this study are positive and highly significant.

However, the fact that these actions have positive outcomes does not mean that Mexico should suddenly shift all government expenditure to these areas. There are many areas of investment where government expenditure would be more productive and growth enhancing. Future research needs to study the economic effects of budget changes in those areas that suffered cuts in order to fund violence mitigating operations.

During the first few years of President Enrique Peña Nieto's administration, the immediate successor to President Calderon, homicide numbers fell slightly. Though it is too early to determine the precise reasons for this, it might be that the power struggle resulting from DTO competition has reached some sort of equilibrium. Perhaps future research will be able to shed some light on this phenomenon.

Mexico needs to attend to the different dimensions of violence in the country and address the social, political, institutional, and economic consequences of it. It is critical that in addition to employing its police and military forces, the government does not ignore the country's community of citizens and that it implements social and economic programs so as to stop susceptible people from setting out on a path that leads to crime. Various anti-drug policies, including prohibitions on production and substitution programs, have been tried in several countries, but in most cases they have remained ineffective. As long as illegal drug demand in the US remains high, it will be difficult to tackle the problem. The Mexican government needs to strengthen the formal economy, improve law enforcement and reduce the incentives to initiate illegal drug production, at the same time it should even start to consider partial, or even full, legalization of drugs. Finally, it is our hope that our research can raise awareness of the problem and lead to a broad discussion of effective policies that might alleviate the conflict.

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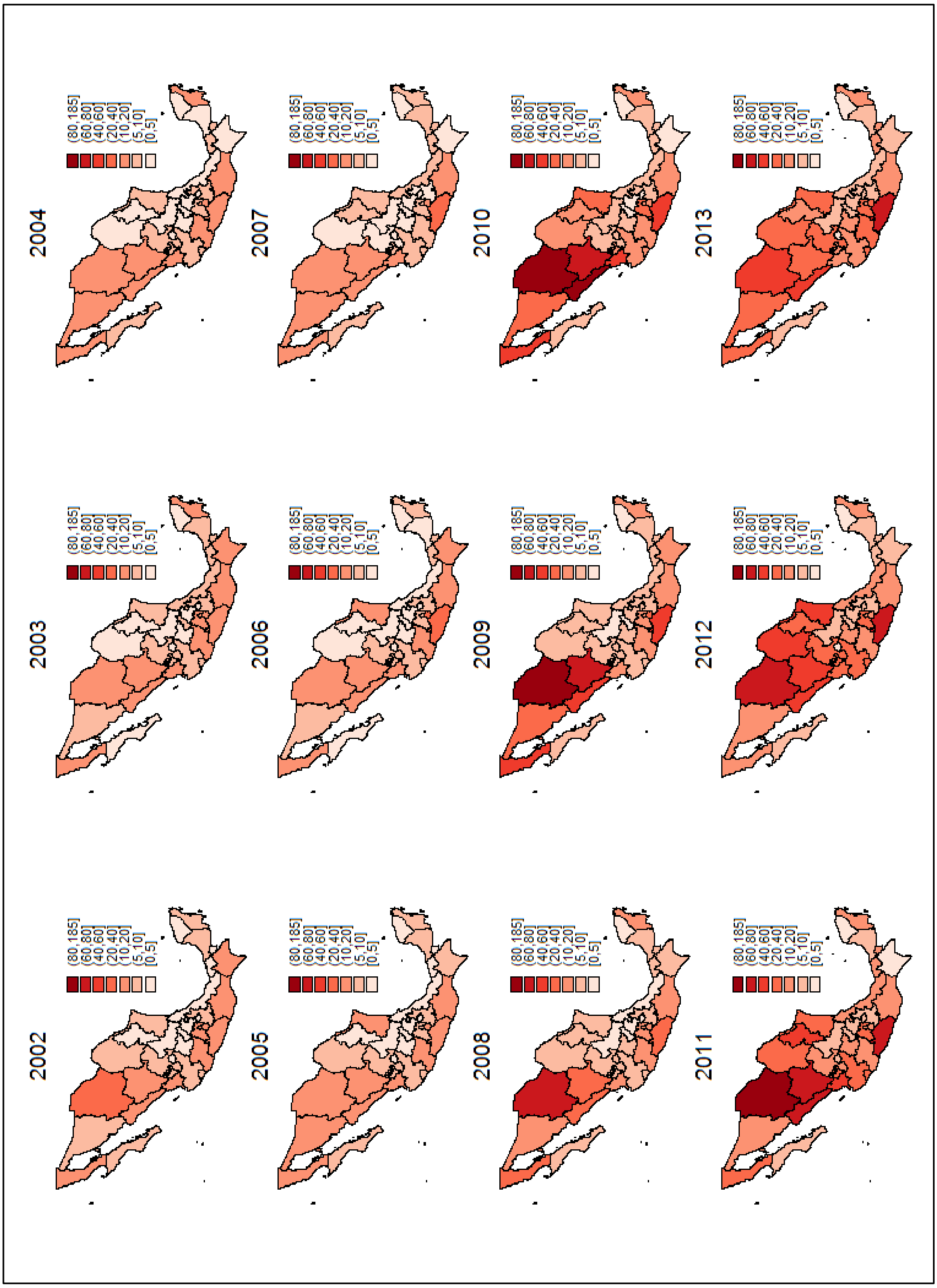
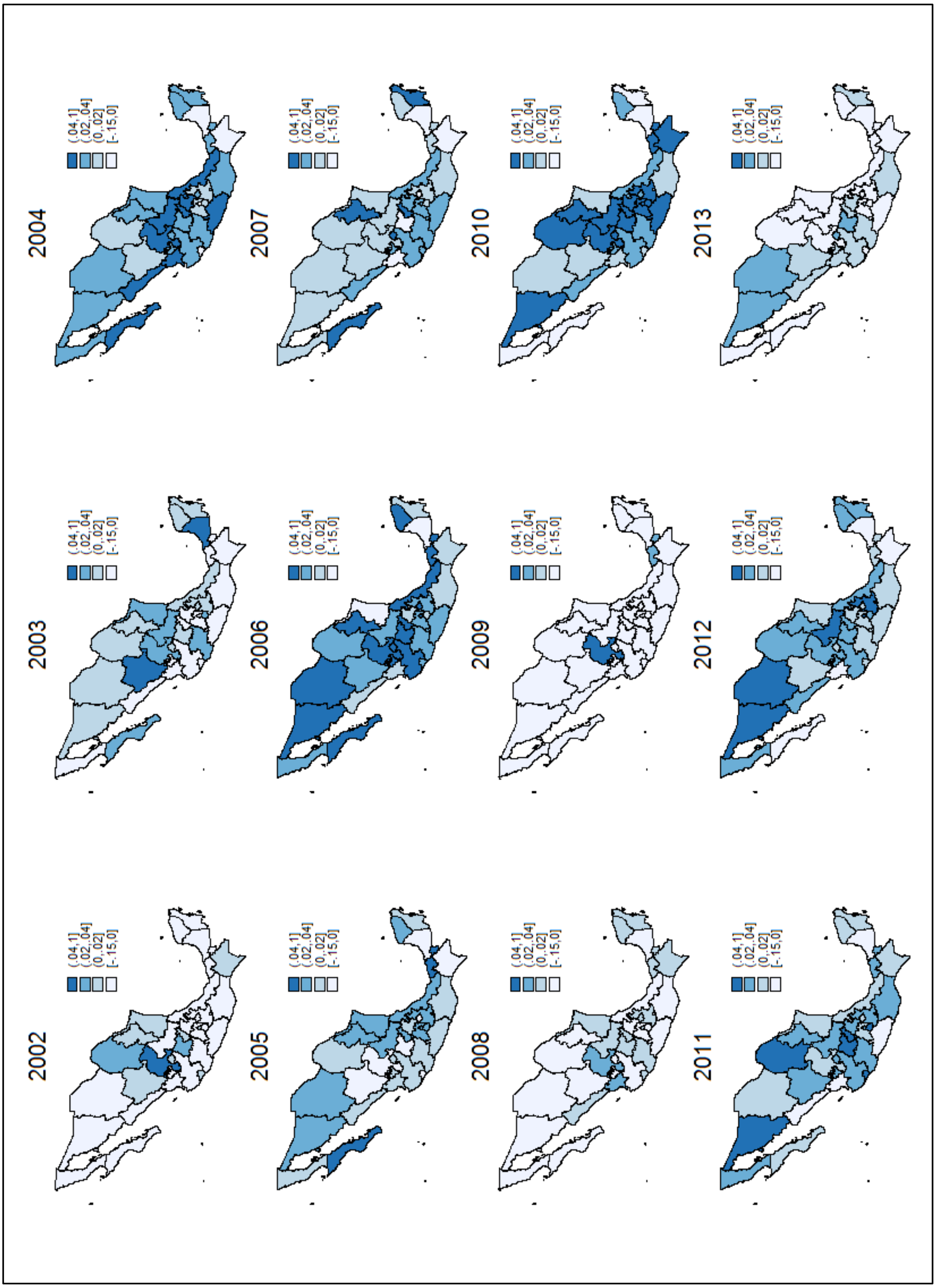
Appendix : Figure A1: Homicides per 100,000 Habitants, 2002-2013



Source: Data for the maps from INEGI, CONAPO and CONABIO

Figure A2: Real GDP per capita growth rates, 2002-2013



Source: Data for the maps from INEGI, CONAPO and CONABIO

Table A1: Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Growth of GDP p.c.	1												
2	Logarithm of GDP p.c. (lagged by 1 period)	-0.1532	1											
3	Financial Crisis of 2008-2009	-0.4561	0.0362	1										
4	Growth of the Homicide Rate	-0.0362	-0.0011	0.3156	1									
5	Growth of the Homicide Rate (Square)	-0.0149	-0.0100	0.1731	0.7246	1								
6	Homicide Rate	-0.0552	-0.0525	0.0368	0.2493	0.2452	1							
7	Homicide Rate (Square)	-0.0429	-0.0254	0.0193	0.1605	0.1599	0.8738	1						
8	Growth of R33 Grants p.c.	0.0424	-0.0028	0.2234	0.0374	0.0073	-0.0009	-0.0028	1					
9	M. Budget (Infantry)	0.0729	0.1205	0.0183	0.0247	-0.0263	-0.0373	-0.0503	0.011	1				
10	M. Budget (Infantry & Regiments)	0.0573	0.0317	0.0160	0.0036	-0.0149	0.0676	0.0178	0.010	0.5444	1			
11	M. Budget (Many Units)	0.0887	0.0665	0.0159	0.0159	-0.0111	0.0141	-0.0007	0.014	0.8912	0.6234	1		
12	M. Budget (Hom-Wighted) - Robustness	0.0305	-0.0413	0.0137	-0.0046	-0.0054	0.0894	0.0471	0.004	0.3887	0.8964	0.4399	1	
13	M. Budget (R33-Wighted) - Robustness	0.0874	0.0147	0.0172	0.0226	-0.0166	0.0130	-0.0072	0.022	0.9178	0.5114	0.9694	0.3681	1

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