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How Did Things Get So Bad So Quickly? An Assessment of the Initial Conditions of the War Against Organized Crime in Mexico

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Abstract Objectives: This study explores the initial conditions of the current war against organized crime in Mexico. The theoretical framework is institutional anomie theory (IAT). Composite measures were used to summarize local initial conditions for the occurrence of organized crime deaths by gang execution, confrontation, and aggressions to authority. Spatial and temporal elements were included to assess the validity of the initial conditions approach. Evidence presented here suggests that Mexican states significantly differed in their initial conditions for organized crime deaths to have occurred. Also, although trends in gang executions and confrontations have been slowing down, aggressions to authority are speeding up considerably. The evidence presented corroborates IAT. However, the significance and direction of the relationships among institutional anomie correlates and initial conditions of the war against organized crime depended upon the type of death.

Keywords Crime policy · Drugs · Homicide · Mexico · Organized crime

Introduction

When President Calderon a few days after taking office announced the mobilization of the armed forces and federal police to confront criminal organizations, many congratulated him for this courageous decision. The strategy objectives were three: To recover the lost territory in the hands of criminal organizations, to reduce the production and the flow of illegal drugs into Mexico, and to finish with gravely detrimental crimes to Mexican society such as extortions and kidnappings, typically committed by criminal organizations. For the time being, things are now radically different evidenced by two connected events that represent the current pessimism in Mexican society with regards to this war: More than 35 thousand deaths since the strategy started, and the public feel that this war will be much longer, blooded, and perhaps lost.

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The purpose of this study is to analyze the initial conditions of the war against organized crime under the light of institutional anomie theory (IAT) (Messner and Rosenfeld, 2001). I make the argument that IAT is well-suited to prove that a profit-driven society tied with undermined non-economic institutions can lead to an anomic state, conducive to extreme violent crimes such as deaths by gang execution, confrontation, and aggressions to authority. I focus on the initial conditions of the war since it helps us understand why and which areas of the country (i.e. states)[1] could have been expected to be hit harder by this war as well as why they have had different trajectories and speeds over time. In this sense, I also argue that this theory is also well-suited to fill the void left by spatial and time-series data and, as more data continue to flow from other countries with similar organized crime problems, it can help develop comparative criminological research.

Previous institutional anomie investigations have shown mixed results. Naturally, it is a challenge to confirm a macro-level theory, as researchers with different subjectivities have offered their own operational definitions of institutional anomie. Another challenge is methodological. In all empirical applications of IAT that were reviewed for this study, crime rates in each geographic area were assumed spatially independent, implying that crime rates are the sole function of the characteristics of criminals and victims living within those geographic areas. This assumption is unrealistic. Thus although factor analysis was utilized to create a composite measure as institutional anomie correlates, I examined organized crime deaths in a way by which their varying spatial and temporal aspects could also be explored. A spatial lag of the initial conditions of the war was incorporated into models of institutional anomie for each type of organized crime death, namely executions, confrontations, and aggressions to authority. Briefly put, growth-curve intercepts (i.e. the initial conditions of the war) were regressed on composite measures of institutional anomie, controlling for the spatial autocorrelation in the dependent variables. To cope with this complex problem, factor analysis and spatial regression analyses were conducted in combination with time-series analysis.

Overall, this study presents evidence that subnational (i.e. state level) institutional anomie levels exercised an influence on the direction the war took in terms of the total number of gang executions, confrontations and aggressions to authority. However, findings are not obvious. Interestingly, institutional anomie correlates had different effects across types of deaths, suggesting the need of particular frameworks for explaining each kind of organized crime deaths. Likewise, initial conditions against organized crime across Mexican states significantly differed from each other.

Finally, in this introduction, it is important to emphasize that the need for research in this matter is timely. Many believe that the strategy was seriously flawed from the beginning as it did not account for the endemic weakness of political institutions in Mexico. In other words, they imply that the war was lost since its inception. Others think that these deaths have no justification when illegal drug prices have remained unaffected in Mexican and U.S. cities. Some even inwardly think that negotiating with criminal organizations would have been a better strategy. The evidence presented deals with these issues and suggests hypotheses for future research.

A Brief Context of Organized Crime in Mexico

The scope of criminal organizations in Mexico is wide. They can be found in the drug trade (i.e. production and trafficking), kidnapping, bribery, car theft, pirated goods, sex trade (adult and children), illicit organ transplanting, human smuggling, and credit card cloning.

[1] At the subnational level, Mexico is composed of 32 states with a wide range of crime rates.

The drug trade is by far the largest and most lucrative organized crime operation. It is also among the oldest and the most studied. To make an idea of the strength of Mexican drug cartels, scholars have estimated that around $24 billion USD are transferred every year into Mexico (Baker, 2008). Dealers transfer this money back into Mexico in cars and trucks due to the monitoring of electronic money transfers (Cook 2007).[2] Other scholars have estimated the drug trade to be worth between $10 billion and $30 USD billion annually (Bender, cited by Hanser et al. 2008). The Drug Enforcement Administration estimated some time ago that approximately 92% of the Cocaine in 2001 came through the U.S.-Mexican border (Hanser et al. 2008). Mexican heroin makes up about 29% of the U.S. heroin supply (Potter, 2008). Mexican cartels are strong competitors in the U.S. methamphetamine market as well (Liddick, 2008).

Major organizations include the Tijuana cartel, the Juarez cartel, the Gulf cartel, the Sinaloa cartel, the Zetas (former hitmen for the Gulf cartel, operating in Tamaulipas and Veracruz), La Familia (in Michoacan), and the Beltrán Leyva cartel (in Sinaloa). Some cartels have made temporal alliances. For instance, the so-called Federation was composed by the Sinaloa and the Juarez cartels in 2006. The cartels worked together, but remained independent organizations (Cook 2007). Other smaller cartels, yet still dangerous are the Colima cartel, the Sonora cartel and the *Milenio* cartel (Jalisco).[3]

Mexican criminal organizations have not developed in isolation. In the late 1980s Colombian cartels began subcontracting Mexican cartels to move their cocaine into the United States (Potter, 2008). In return Mexican organizations would take part (e.g. half) of the load as their fee and distribute it to smaller local drug organizations for street dealing (i.e. *narcomenudeo*). Before that, Mexican cartels would only produce and deal with marijuana and heroin. One boost in organized crime activity came in the 1980s as economic reforms produced social disruptions and spurred increased opium and marijuana cultivation (Liddick, 2008). It must be acknowledged as well that the Mexican war against organized crime, particularly drug cartels, is not new. Historically, there are reports from the 1980s of U.S. gun dealers selling guns to drug traffickers in Colombia and Mexico (Martin and Romano, 1992). In some cases, drugs were occasionally used instead of cash to pay for the weapons.

Drug trade has become increasingly difficult for Mexican cartels. Presidential estimates of the damage caused by government operations on the cocaine and marijuana trade show larger numbers than U.S. estimates and a dramatic increase since the first year of the Calderon presidency. The monetary damages increased eight fold between 2006 and 2007. These are of course estimates, so should be taken with caution. However, they do highlight an impressive challenge. Still, some even go further as to argue that Mexican drug cartels are on the rise (Hanser et al. 2008), particularly after the progressive weakening of the Medellin and Cali cartels in Colombia (Cook 2007).

Large numbers of drug related arrests and confiscations are not a unique feature of the Calderon presidential period. Under the Fox presidency (2000–2006) the Mexican government arrested over 79 thousand individuals on charges related to drug trafficking. These arrests were distributed in the following manner: 78 thousand plus low level drug dealers, 15 cartel leaders, 74 lieutenants, 53 financial officers, and 428 hitmen (Cook 2007). However, the massive deployment of the armed forces, their presence in major cities, the replacement of local corrupt police agencies by the federal police and armed forces, and the dramatic increase in deaths, are indeed characteristics of the current federal anti-organized crime strategy.

[2] Federal police interrogation to Edgar Valdez Villarreal (aka La Barbie). Date 8/30/2010. Video available in: http://www.youtube.com/watch?v=RJbH0fIV83U.

[3] Here I mention the cartels states of leadership residence or principal activity. However, most cartels operate across different states.

In the first days of December of 2006 President Calderon launched the war against organized crime.[4] In the view of the president, there seemed to be no single issue more important for immediate action than deploying the armed forces to fight criminal organizations. But the strategy has been more violent than probably expected and the country and the world have witnessed horrific acts directed against criminals and even innocent people. As such, there has been an ongoing debate about the rationale of this strategy. When it comes to evaluating this anti-organized crime strategy, the number of deaths associated to organized crime becomes one crucial indicator to assess the practical and moral validity of the strategy. Two other main indicators for the evaluation of any anticrime policy are the general crime incidence and the general victimization rates. Where the first has increased, the other two have also increased. In short, the objectives have not been reached, but quite the opposite, at least for the period analyzed in this study.

Theoretical Framework and Empirical Findings

The premise of this study is that organized crime will be more prevalent in areas with widespread abandonment of the ideals and standards governing social relations. Durkheim coined the term Anomie to typify these situations. This concept was reformulated by Merton 1938 to analyze the origins of deviant behaviours in the United States. For Merton, societies with difficulties in obtaining legitimate goals by conventional means fall into a state of anomie. Anomie causes some members of society to cease striving for success through institutionalized means and to drift towards illegal means. An organized crime death by execution (i.e. between rival gangs), for example, is an illegal means for the achievement of some goal: either to resolve a conflict and/or to secure the illegal market by displacing the competitor permanently, or at least, until the next contender comes along. When organized crime executions are massive, conflict resolution by murder has become the norm, and a state of institutional anomie has been reached.

Merton´s idea of a process of weakening social normative controls leading to criminal behaviors was later reformulated by Messner and Rosenfeld (2001) to put forward a theory of institutional-anomie to explain aggregated rates of criminal activity. It builds upon Merton´s reformulation of anomie by attaching crime to the dynamic relationship between cultural and social structures. This theory sees culture structures (i.e. sets of normative values) as pressing forces conducive to anomie. One example is profit-driven societies that push social relations towards utilitarian ends. Anomie surfaces when priority is given to materialistic goals over normative means (Messner and Rosenfeld, 1997). In anomic societies, the pursuit of self-interest and monetary gains become exaggerated relative to moral value-oriented institutions such as family, education and the polity (Bernburg, 2002).

Social institutions are composite elements of culture that carry out the necessary balance between goals and norms. Social institutions have four basic functions (Messner and Rosenfeld, 2001): Adaptation, goal attainment, integration, and pattern maintenance. The economy deals with adaptation (i.e. to meet the physical and material needs). Political institutions (or polity) deal with goal attainment. Religion, education, and the family deal with the integration and the maintenance of cultural patterns. The American Dream is a national ethos in which economic institutions dominate non-economic institutions. As consequence, high crime rates in the United States can be considered natural, or "normal" in Durkheimian terms, given the imbalance between the (dominant) goal of individual monetary success and (fragile) society´s core institutions (Barlow and Decker, 2010; Messner and Rosenfeld, 2001).

[4] The objectives of the strategy were already mentioned in the introduction.

Polity is a necessary condition for social equality. Anomie can arise when the rule of law is not applied equally. A weak rule of law in one place may serve as a criminogenic influence. The logic is that a weak *polity* lacks a sense of community and solidarity, facilitating anomie to arise (Messner and Rosenfeld, 2001; Bjerregaard and Cochran 2008). In such situations, cultural structures fail in their normative function. This combination of a weak rule of law and a money-oriented society lead some members of society to crime. Including white-collar crimes (Schoepfer, 2004) and other profit-related crimes (Chamlin and Cochran, 1995) such as drug trafficking.[5]

Cultural structures may also be weakened by a lack of economic opportunity. For instance, the lack of jobs, living wages, credit, public investment, economic recessions, inflation, etc. may force disadvantaged individuals to a state of anomic deprivation and psychic stress. As such, institutional anomie may develop faster in places where the economic context is not favorable to accomplish socially desirable goals. Social equality is an obstruction for goal attainment (Bjerregaard and Cochran 2008; Maume and Lee, 2003) and family disruption impedes social integration and pattern maintenance.

Social institutions are necessary but do not play equal roles (Messner and Rosenfeld, 2001). Each society gives a priority to one or another social institution, providing it with a national ethos. But when imbalance occurs, it can induce people to commit a crime in the pursuit of economic gain (Messner and Rosenfeld, 2001).

Messner and Rosenfeld (1997) empirically tested the institutional anomie theory borrowing from Esping-Andersen´s (1990) concept of "decommodification". This Marxian concept originally refers to the undermining of "… the circumstances for the fuller utilization of capital and labor" (Gamble et al. 1999: 188). In Messner and Rosenfeld´s IAT, decommodification is the sum of resources available to members of society to reduce their dependency on the market economy. The causal mechanism is that low levels of decommodification lead to high levels of crime in society (Schoepfer, 2004).

The relationship between the strength of social institutions and aggregated crime rates has been tested in different countries and for different crimes (Messner and Rosenfeld, 1997; Chamlin and Cochran, 1995; Piquero and Piquero, 1998; Savolainen, 2000; Maume and Lee, 2003; Schoepfer, 2004; Kim and Pridemore, 2005; Bjerregaard and Cochran 2008; Stults and Baumer, 2008), although not for organized crime. Table 1 summarizes previous findings. The evidence on IAT seems to depend on the unit of analysis and the analytical strategy followed. But all studies have tended to support the theory.

This set of evidence may be interpreted differently. If IAT is supported in empirical studies with small samples, which quantitative criminologists are less willing to agree to, then there could be a bias in the statistical tests themselves. Likewise, researchers who are not comfortable in going through tables of factor and regression analyses evidence, may be more interested in the sign of the coefficients rather than the magnitude of the coefficients or the significance levels. Also, if IAT is supported in comparative studies with cross-national samples, then there could be a bias in the selection of cases or in the source of information (e.g. countries with/without crime statistics).

Research Premises and Hypothesis

One theoretical premise of IAT is that homicidal violence is intrinsic to the basic cultural commitments and institutional arrangements of drug cartels. This culture of violence is often portrayed in the Narco-boss culture and music. Likewise, one quick glimpse of the video

[5] Organized crimes are more efficient and profitable than others.

Table 1 Summary of empirical findings

Author and year	Area and unit of analysis	Type of crime	Findings
Messner and Rosenfeld (1997)	Countries (n = 45)	Homicide	Decommodification affect crime rates independent of social equality
Chamlin and Cochran (1995)	United States State (N = 50)	Property crime	Religion, family and polity condition the relationship of economic deprivation with crime. Economic deprivation has no independent effect on crime
Piquero and Piquero (1998)	United States State (N = 50)	Burglary Larceny Vehicle theft Murder Forcible rape Robbery Aggravated assault	Education controls the conditions the relationship of the economic context with crime. Relationships depend on the operationalization of social institutions
Savolainen (2000)	Countries (n = 81)	Homicide	Economic equality affects crime in societies with weak social institutions
Maume and Lee (2003)	United States Counties above 100,000 inhabs. (n = n.a.)	Homicide	Measures of noneconomic institutions affect instrumental and expressive homicides
Schoepfer (2004)	United States State (N = 50)	Embezzlement Fraud Forgery and counterfeiting	Relationships vary across social institution measures and across types of crime
Kim and Pridemore (2005)	Russia Region (n = 78)	Robbery Armed robbery	Social institutions do not condition the effects of socioeconomic change (poverty) on crime
Bjerregaard and Cochran (2008)	Countries (n = 49)	Homicide Theft	Relationships vary across units of analysis and across types of crime
Stults and Baumer (2008)	United States Metropolitan areas and non-metropolitan counties (n = 74)	Homicide	Social institutions have a moderating effect on homicide. It is affected by increasing firearms, drug markets and property crimes

interrogations of organized crime suspects will clearly show that extreme violence is a daily routine and it has its place in the life of the organized criminal. Furthermore, not even one suspect seems to oppose the use of violence.

Another premise is that spatially varying degrees of institutional anomie across Mexican states may have had an effect on the initial conditions for organized crimes to occur. I test if the initial conditions for organized crime deaths to occur were partially due to spatial

variations of institutional anomie. Even if institutional anomie in Mexico was high, it surely would not be spatially uniform at the subnational level. As such, I assume that Mexican states with stronger social institutions will have been better placed at the start to weather the number of organized crime deaths. Conceivably, prior to the 2006 federal strategy, some deaths in the way of executions and confrontations among drug cartels were already occurring in different places within Mexico (Cook 2007).

Based on these premises, I hypothesize that signs of institutional anomie were associated with worse initial conditions for the occurrence of organized crime deaths. The logic is that Mexican states with signs of institutional anomie had to have worse initial conditions than others states, for deaths to have rose so exceptionally fast. Let us recall that in time series regression, the equation´s intercept represents the initial condition of the variable under study. Here, the intercept represents the estimated average number of organized crime deaths at the beginning of the current war against organized crime. This will be explained in detail in the following methods section.

In summary, while I could not identify prior research that has examined the relationship between institutional anomie and organized crime deaths, I believe there is a logical possibility for using IAT in the Mexican context. The logic is that if Mexican social institutions were strong, few deaths could be associated to organized crime, much more particularly at the beginning of the current war.

Data and Methods

Dependent Variables

In January of 2011 the Presidency of Mexico released a database with the count of organized crime deaths that can be related to the strategy against organized crime which started in December of 2006, a few days after president Calderon took office.[6] This database was generated by a group of researchers in the federal departments of Defense, Navy, Public Safety, the Attorney General's Office and the Center for Investigation and National Security.

For the purpose of analytical (not legal) treatment, the research group categorized three types of organized crime deaths: Executions, confrontations and aggressions to authority.[7] Operational definitions were the following:

- Executions: Deaths in which the victim or the offender is presumably a member of an organization linked to organized crime.
- Confrontations:
  - Deaths related to isolated and sporadic acts of violence, crimes and disruption of social peace and order against the authority, made by criminal organizations using fire weapons and military equipment.
  - Deaths in which the police or armed forces had to make use of firearms to enforce the law.
  - Deaths related to antagonisms among organized crime groups or to differences within the same criminal groups.
- Aggressions to authority: Deaths related to attacks against any government installation as well as police and armed officers committed by criminal organizations.

[6] See methodological document at: http://www.presidencia.gob.mx/?DNA=119.
[7] In Spanish: *Ejecuciones, Enfrentamientos* and *Agresiones contra la autoridad.*

Each database in this study was constructed to include 49 monthly time series in each of the 32 states. For all statistical analyses, the unit of analysis was the state (N = 32) and dependent variables were transformed to their natural logarithms.

Independent Variables

Neither Messner and Rosenfeld (2001, 1997) nor other scholars provide an explicit way to measure institutional anomie. Following Messner and Rosenfeld (1997) first empirical IAT test and Kubrin and Herting´s (2003) study on criminal growth-curves, I conducted a factor analysis (principal components) for computing and summarizing the composite measures (Table 2). Input variables were transformed to their natural logarithms prior to running factor analysis. Resulting factors with eigenvalues greater than 1.5 were considered significant and retained for regression analysis.

The polity factor is composed by variables related to crime activity and government corruption and performance. The economic opportunity factor is composed by variables that represent elementary macroeconomic conditions for the growth of personal wealth. The social equality factor is composed by variables mostly used to represent the benefits of social development and also provide evidence of social fairness. Finally, family cohesion is composed of correlates depicting sources of strain and anomie.

All factors exhibit high cumulative percentages of variance (Table 3). The highest cumulative percentage of explained variance is provided by the social equality factor.

Table 2 Composite measures, input variables and data sources

Composite measure (factor)	Input variables*	Data source
Polity	Firearms Act suspects per 100,000 inhabitants (2005)	INEGI
	% of businesses that do not pay taxes (2006)	IMCO
	% of 18+ years who feel insecure (2006)	IMCO
	Police per 100,000 inhabitants (2006)	SSP
	% of adults that have participated in solving community problems (2008)	SEGOB
Economic opportunity	Housing credits per 100,000 inhabs. (2005)	INEGI
	Public investment in housing per 100,000 inhabs. (2005)	INEGI
	GDP per capita (2005)	INEGI
	State expenditures per capita (2005)	INEGI
	International Migration Rate (2005)	INEGI
	GDP average growth (2003–2006)	INEGI
	Average inflation (2003–2006)	INEGI
Social equality	Human development Index (2000)	INEGI
	Social lag Index (2005)	INEGI
Family cohesion	% of household with migrants in the U.S. (2005)	INEGI
	% Single parent households (2005)	INEGI
	% Women headed households (2005)	INEGI
	% of household with some level of truancy (2005)	INEGI

Instituto Nacional de Estadística y Geografía (INEGI). See: http://www.inegi.org.mx

Instituto Mexicano para la Competitividad (IMCO). See: http://imco.org.mx

Secretaria de Seguridad Publica (SSP). See: http://www.ssp.gob.mx

Secretaria de Gobernacion (SEGOB). See: http://encup.gob.mx/en/Encup/

*All input variables with the exception of previously calculated indexes and the % increase in crime suspects were transformed to their natural logarithms prior to factor analysis. The latter variable was not transformed since seven states showed a negative increase in the number of crime suspects between 2000 and 2005.

Table 3 Results of factor analysis

Factors	Eigenvalue	Cumulative % of variance	Communalities*
Polity	1.587	31.7	Firearms Act suspects per 100,000 inhabs. (2005): 0.688 % of businesses that do not pay taxes (2006): 0.768 % of 18+ years who feel insecure (2006): 0.541 Police per 100,000 inhabitants (2006): 0.371 % of adults that have participated in solving community problems (2008): 0.418
Economic opportunity	3.148	44.9	Housing credits per 100,000 inhabs. (2005): 0.673 Public investment in housing per 100,000 inhabs. (2005): 0.835 GDP per capita (2005): 0.770 State expenditures per capita (2005): 0 .464 International Migration Rate (2005): 0.617 GDP average growth (2003–2006): 0.646 Average inflation (2003–2006): 0.430
Social Equality	1.890	94.5	Human development Index (2000): 0.945 Social lag index (2005): 0.945
Family cohesion	1.010	75.5	household with migrants in the U.S. (2005): 0.265 % Single parent households (2005): 0.880 % Women headed households (2005): 0.922 % of household with some truancy (2005): 0.954

*Values represent the correlation between each input variable and the overall factor. Read as Pearson correlations

Control Variables

Two control variables were in the regression analysis: Bordering state with the United States (1 = No, Yes = 2), percentage of urban population (% of population in localities with 15,000 or more inhabitants), and the spatial lag of the dependent variable, consisting of the arithmetic mean of the DV among the first-order neighbouring states (i.e. rho coefficient). The first control was included to challenge the idea that border Mexican states were more dangerous due to their proximity to the United States.[8] The second control was included in the regression model to test if the outburst of organized crime deaths was mainly an urban or rural phenomenon.

Time Series Analysis

As the distribution of organized crime deaths is unknown, I minimized the empirical uncertainty level risk by applying both parametric and non-parametric tests of difference. These tests were used to compare frequencies of deaths among months of the year.

Data were smoothed with a three month running average. I additionally took the natural log of each time point to help normalize data distributions. A one-sample kolmogorov-Smirnov test was used to check whether the data samples came from a normal distribution.[9]

Growth-curves permit estimate initial conditions and trajectories of phenomena. These models help reduce confusion between local and national initial conditions and trends. One

[8] As they serve as drug entry points.

[9] Data is normally distributed.

model was applied to each dependent variable or type of organized crime death: Executions, confrontations and aggressions to authority. OLS intercepts were later used in spatial regression analysis (SAR)[10] as dependent variables.

Spatial Analysis

In this study, spatial analysis was conducted at the subnational state level (i.e. polygons). Global and local Moran I autocorrelation coefficients were used to test for spatiality in the dependent variables. Coefficients were calculated using a first-order spatial weight matrix, meaning with the strict adjacency of spatial units. Global coefficient values cannot exceed 1 or −1 (see Appendix). Positive values suggest spatial autocorrelation (i.e. similar values are spatially clustered) and negative values suggest spatial dispersion (i.e. neighbouring values are unalike).

Local coefficient values may be above 1 and below −1 (see Appendix). This coefficient is calculated by comparing the global Moran's I value for each geographical unit to a theoretical value for each spatial unit. The theoretical value is created via Monte Carlo randomization. Local coefficients permit the detection of two basic spatial features: spatial clusters (positive values) and spatial outliers (negative values). Spatial clusters are statistically significant groups of similar geographical units, whereas spatial outliers are statistically significant groupings of dissimilar geographical units. In this study a spatial cluster of organized crime deaths is a state with similar averages to its adjacent states.

The weighted mean centres for each type of death were also calculated in order to analyze the geographical direction the war took between 2007 and 2010. These are portrayed in the thematic maps.[11]

Considering that social behaviours in spatially closer places are often more similar than behaviours in more separated places (Vilalta, 2013a), spatial autoregressive modelling (SAR) was utilized as it assumes that dependencies exist in the dependent variables (DV). In other words, organized crime deaths in one state are affected by deaths at neighbouring states.[12] In this way, the arithmetic mean of the DV in neighbouring states is used as a lag term in the regression equation (i.e. rho coefficient). This model approach accounted for spatial autocorrelation of the DV and the regression residuals. A Moran´s global I test on the residuals was performed.

Statistical significance was tested under normal distribution assumptions. Spatial autocorrelation and SAR regression tests were conducted with the S-Plus spatial statistics extension for ArcView. Factor analysis, growth-curve and OLS regressions were conducted with SPSS version 17.0.

Results

Spatial Patterns and Processes

The total number of deaths related to the war against organized crime amounts to a total of 34,612 (Table 4). Most have been concentrated in Chihuahua, Sinaloa, Guerrero and Baja California. Although the states of Tlaxcala and Baja California Sur seem to have been sorts of haven for violent organized crime, it can be said that the Yucatan peninsula, as a region (formed by the states of Yucatan, Campeche and Quintana Roo) is the safest in the country. This variation called for spatial autocorrelation analysis to identify spatial patterns in the distribution of deaths.

[10] SAR stands for spatial autoregressive model.
[11] See appendix.
[12] See appendix.

Table 4 Total number of organized crime deaths by state and type (2006–2010)*

State	Executions	Confrontations	Aggressions to authority	Total
Chihuahua	9,793	257	85	10,135
Sinaloa	4,117	229	41	4387
Guerrero	2,400	278	61	2739
Baja California	1,900	91	28	2019
Durango	1,609	268	15	1892
Michoacán	1,505	182	64	1751
México	1,461	62	15	1538
Tamaulipas	761	664	50	1475
Sonora	1,081	158	19	1258
Jalisco	942	98	33	1073
Nuevo León	683	251	37	971
Coahuila	560	89	10	659
Distrito Federal	631	22	0	653
Morelos	477	46	6	529
Guanajuato	465	43	8	516
Nayarit	339	110	4	453
Veracruz	380	68	5	453
Oaxaca	399	32	7	438
Chiapas	266	31	7	304
Tabasco	183	14	4	201
San Luis Potosí	141	31	15	187
Hidalgo	143	24	0	167
Aguascalientes	128	14	10	152
Quintana Roo	148	3	0	151
Colima	124	22	2	148
Puebla	90	8	9	107
Zacatecas	70	0	9	79
Yucatan	26	51	0	77
Querétaro	35	1	1	37
Campeche	27	3	1	31
Baja California Sur	18	1	0	19
Tlaxcala	11	2	0	13
Total	30,913	3,153	546	34,612

*December 2006 to December 2010. Source: Presidency of Mexico

Deaths by execution show a spatial concentration pattern (Table 5). Executions have concentrated in north-western states particularly Chihuahua and Sinaloa (Map 1). These two states appear as significant hotspots, particularly spatial clusters of deaths by execution, as they are significantly surrounded by similar states. The comparison between the 2007 and the 2010 weighted mean centres indicate that the "weight" of the war has shifted towards the northwest of the country, closer to the border with the United States.[13]

[13] It has reallocated approximately 152 miles towards the northwest, from Zacatecas in 2007 into the state of Durango in 2010.

Table 5 Global Moran coefficients for total organized crime deaths (2006–2010)*

	Executions (Ln)	Confrontations (Ln)	Aggressions to authority (Ln)
Moran coefficient	0.196	0.274	0.221
Sig.	0.034	0.004	0.019

*DV: Executions, Confrontations and Aggressions per state (Ln). First-order (strict contiguity) neighbour matrix

Confrontations have been the most spatially concentrated (I = 0.274). Most border states have been affected (Map 2). Confrontations in Tamaulipas have produced the highest number of deaths: 664. Zacatecas in turn, has no record of organized crime deaths by confrontation. One hotspot (spatial cluster) arises on the border, namely the state of Nuevo Leon. In this case, the weight means remain in almost the same east–west coordinates.[14]

Aggressions to authority are the least frequent, yet they also show a spatial pattern (Map 3). Most have occurred in Chihuahua, Michoacan, Guerrero and Tamaulipas. No hotspot was detected for the entire period, yet they were detected for the beginning and the end of the period (see Table 7 on the next page). The weighted mean centre barely shifted 51 miles towards the east between 2007 and 2010, yet it is still within the limits of the state of Zacatecas.

Monthly global autocorrelation coefficients help summarize the trends for the three types of organized crime deaths. I graphed the coefficients of the series, from December of 2006 to December of 2010 (Fig. 1). Not all coefficients were significant although the analysis shows some features worthy of note: For the entire series, executions were on average the most spatially concentrated, confrontations were the most variable, and aggressions to authority were the most stable in space (Table 6).

Local coefficients show important changes from the beginning of the strategy (Table 7). In the 49 month period neither spatial autocorrelation remained statistically significant nor the geography of deaths remained stable. For instance, though the state of Michoacan began as a spatial cluster for executions and aggressions to authority, by the end of the period Chihuahua became the spatial cluster for executions. Nuevo Leon also replaced Michoacan as the spatial cluster for aggressions to authority. The state of Tamaulipas is currently a spatial cluster of confrontations. Evidently the war has moved in the direction of the bordering states with the United States. Finally, for the state of Queretaro, located in the centre of the country, the war is far away from it and neighbouring states. All this suggests different initial conditions and trends at the subnational level.

Time Series

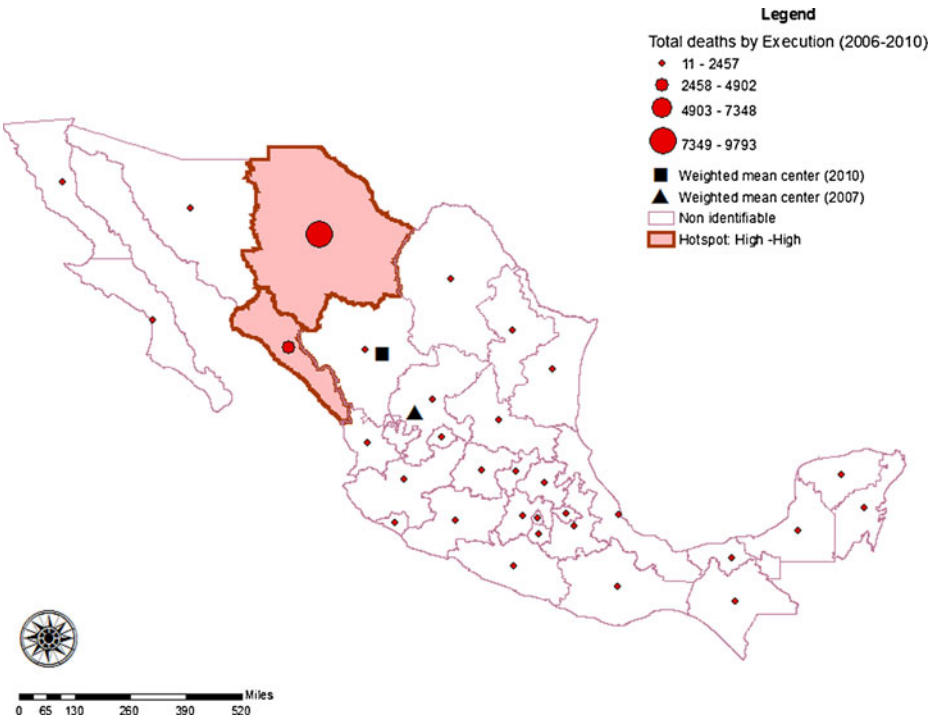
Overall, neither mean nor ranked mean significant differences were detected among months of the year for any type of death (Table 8). Apparently, frequencies are uniform across months of the year.

Results of the baseline (for all states) growth-curve regression model for each type of death were the following:

$$(In)Executions = 2.0246 + 0.0405x_1 - 0.0004x_2$$

$$(In)Confrontations = 0.7986 + 0.0421x_1 - 0.0003x_2$$

[14] The weighted mean centre for deaths by confrontation has reallocated approximately 142 miles towards the east, in this case from Durango (near the border with Zacatecas) in 2007 into the state of Zacatecas in 2010.



Map 1 Deaths by execution: Hotspots and weighted mean centres, 2006-2010*. Note: A high-high hotspot indicates a state with a high number of death by execution counts surrounded by similar states. Hotspots were calculated on a first order (strict contigüity) neighbourhood matrix

$$(In)Aggresions = 0.7865 - 0.0163x_1 + 0.0007x_2.$$

The executions model indicates that on average, executions initially increased and then continued to increase at a diminishing rate to a point where these executions began to decrease (or stabilize) on average (see Fig. 2). Confrontations indicate a similar behavior as executions, namely, that on average, confrontations initially increased and continued to increase at a diminishing rate up to a point where confrontations started to decrease (or stabilize) on average as well.[15] Aggressions to authority indicate another story: Since they started, they have accelerated over time.

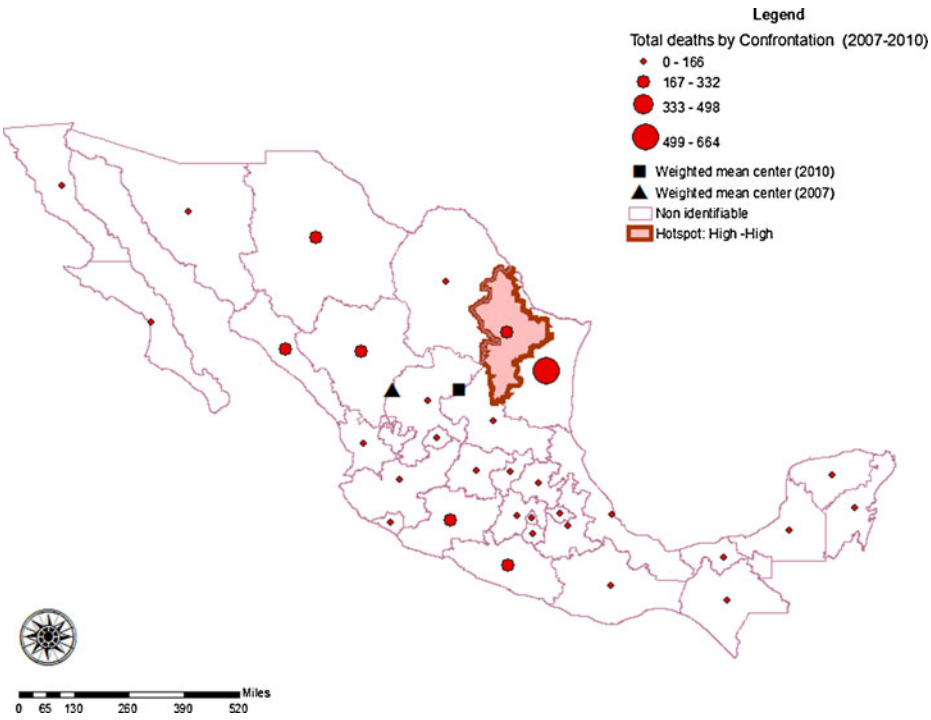
It must be noticed that each state has its own initial conditions and trends of executions. Table 9 shows growth-curve regression results for each state. Worst initial conditions are reflected in a higher intercept value. Accelerating trends are reflected in a positive b_2 value.

A national growth-curve regression model (i.e. baseline model) is probably inadequate as data is suggestive of spatial heterogeneity. Organized crime death trends clearly differ across Mexican states. Figure 3 shows four different cases (states) for which execution initial conditions and trends have been noticeably different.

I tested for statistically significant differences among states´ intercepts (see Appendix). The tests results suggest that Yucatan´s initial conditions for organized crime executions were significantly different from other selected states (Table 10).[16]

[15] Ceteris paribus, deaths of these two types should reach a peak in the near future.

[16] Difference tests were also applied on acceleration rates (b2) and results were also statistically significant, suggesting that not only initial conditions but trends are also different among states. See Vilalta (2013).



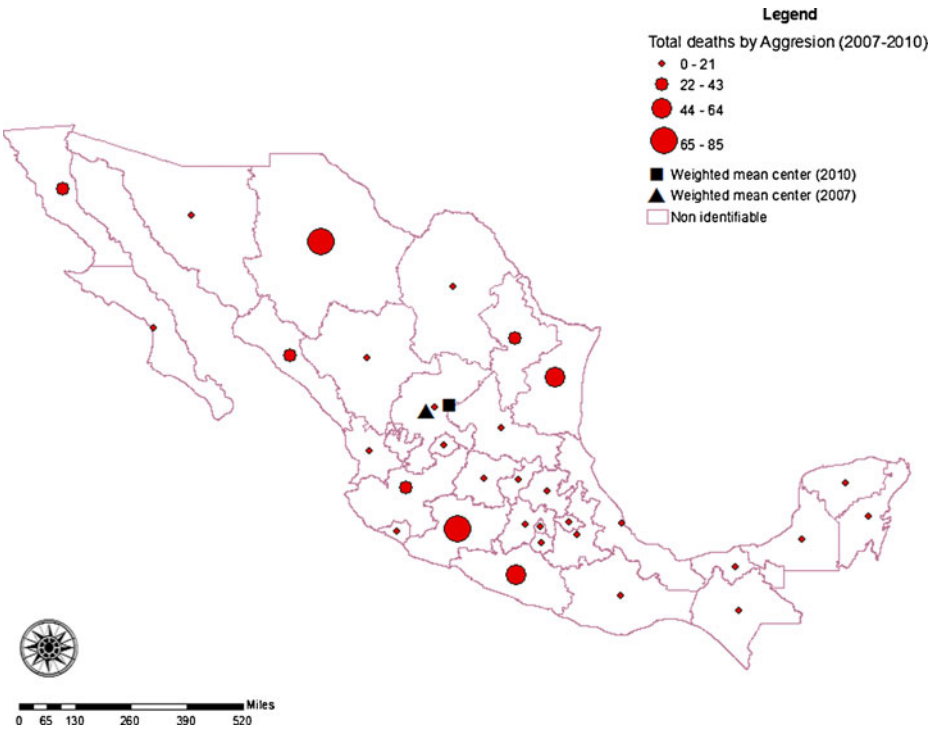
Map 2 Deaths by confrontation: Hotspots and weighted mean centres, 2007-2010*. *Note: A high-high hotspot indicates a state with a high number of death by confrontation counts surrounded by similar states. Hotspots were calculated on a first order (strict contiguity) neighbourhood matrix. There are no records of confrontations as of December 2006

Modelling the Initial Conditions

Table 11 displays the results of the spatial multivariate regression analyses for the initial conditions (i.e. states´ growth-curve intercepts as dependent variable) of deaths related to organized crime. These analyses incorporate the institutional anomie correlates as independent variables, the spatial lag (rho), and other variables as controls.

Higher levels of polity, economic opportunity, and social equality were negatively associated with the initial conditions of deaths by execution. It must be reminded that negative intercepts indicate better initial conditions in the war. Thus, states with higher anomie factor scores have better initial conditions (i.e. negative intercepts). In other words, higher levels of polity, economic opportunity, and social equality led to lower levels of deaths by execution in the initial point of the war against organized crime. On the contrary, states with higher urbanization levels had worse initial conditions in terms of deaths by execution, this further proving that deaths by execution started to occur in more urbanized states. The spatial autocorrelation test on the residuals (Moran´s I) is not significant suggesting that spatial effects were not present.

For deaths by confrontation, the only significant anomie correlate was economic opportunity. States with higher economic opportunity scores had better initial conditions. In other words, states with more economic opportunity for residents had lower numbers of deaths by confrontation in the initial point of the war (e.g. Quintana Roo or Colima). The border state control variable is



Map 3 Deaths by aggression to authority: Hotspots and weighted mean centres, 2006-2010*. *Note: No hotspot was detected for deaths by aggressions to authority counts for the entire period. Hotspots were calculated on a first order (strict contiguity) neighbourhood matrix

significant, suggesting that deaths by confrontation states occur in bordering states with the United States. The spatiality in the DV was accounted for by the model as the results of the Moran´s test on the residuals show.

For deaths by aggression to authority, only the polity anomie correlate was significant, yet not in the expected direction. Polity was positively associated with the initial conditions of deaths by aggression to authority. This suggests that aggressions started to occur in states with higher levels of polity. However, results may be misleading as this is the result of one outlier (i.e. the state of Colima). Likewise, coefficients are extremely high (in absolute values) suggesting that the effects of anomie composite measures may have been overstated in this case. In addition, the autocorrelation test on regression residuals is close to reach statistical significance. Whether these unexpected directions are due to the small number of deaths by confrontation (n = 534) or the sample size of states, cannot be answered on the basis of available data. This model must be confirmed with longer time series, possibly at the municipal level.

In sum, statistical controls did not eliminate the predictive power of IAT. However, results were uncertain with regards to the aggressions to authority model. For all models, residuals were normally distributed.[17]

[17] This was assessed via Kolmogorov-Smirnov one-sample normality tests.

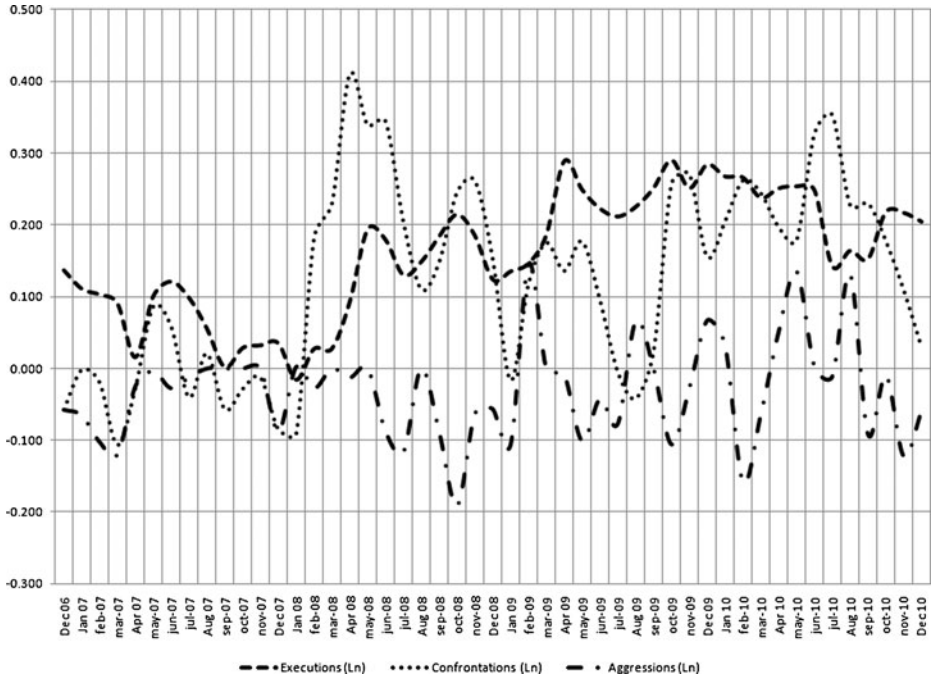


Fig. 1 Monthly trends of the global spatial autocorrelation coefficients (2006–2010)*. *DV: Executions, confrontations and aggressions to authority (Ln). First-order neighbour matrix

Discussion

Typically, the overall effectiveness of any theory is predicated on the statistical significance of its correlates. The theoretical question was if initial conditions of institutional anomie in Mexican states can be associated to organized crime deaths in Mexico, in particular, at the beginning of the war against organized crime. Results did provide partial support for IAT.

IAT composite measures partially support my hypothesis that some level of institutional anomie in Mexico was present at the beginning of the war against organized crime in 2006. Anomie measured by lack of polity, lack of economic opportunity and social inequality served to predict deaths by execution at the beginning of the war. Likewise, the lack of economic opportunities led to higher numbers of deaths by confrontation. Deaths by execution started to occur in more urbanized states, whereas deaths by confrontation started to occur in the bordering states with the United States.

Table 6 Descriptive statistics of monthly global spatial autocorrelation coefficients (2006–2010)*

	Executions (Ln)	Confrontations (Ln)	Aggressions to authority (Ln)
Mean	0.159	0.125	−0.030
Median	0.164	0.148	−0.025
Std. Dev.	0.086	0.136	0.070

*DV: Executions, confrontations and aggressions to authority (Ln). First-order (strict contiguity) neighbour matrix

Table 7 Spatial clusters and outliers at the beginning and end of period (2006–2010)

	Executions		Confrontations		Aggressions to authority	
	Dec. 2006 (t_1)	Dec. 2010 (t_{49})	Dec. 2006 (t_1)	Dec. 2010 (t_{49})	Dec. 2006 (t_1)	Dec. 2010 (t_{49})
Spatial Clusters	Michoacan ($p = 0.023$)	Chihuahua ($p = 0.039$)		Tamaulipas ($p = 0.004$)	Michoacan ($p < 0.000$)	
Spatial outliers		Queretaro ($p = 0.051$)	Michoacan ($p < 0.000$)			Nuevo Leon ($p < 0.000$) Chihuahua ($p = 0.004$)

*DV: Executions, confrontations and aggressions to authority per state (Ln). First-order (strict contiguity) neighbour matrix

The results of the aggressions to authority regression were inconclusive. Family cohesion anomie measures were also inconclusive. This of course could mean many things, among them: the need for an international standard measure of institutional anomie; the necessity of testing IAT at lower levels of analysis (e.g. municipalities, cities, etc.); the convenience of increasing sample sizes yet including power testing; the convenience too of using a variety of statistical methods; or perhaps, it simply means that IAT is unable to predict the initial conditions of a war against crime. This is an open invitation to interested academic parties.

This leads to a whole discussion of modelling correlates supported by theory and empirical evidence in other parts of the world. Without entering into lengthy discussions of purely methodological interest, it must be said that IAT model was based on theoretically

Table 8 Difference tests among months

	Executions means	Confrontations means	Aggressions means	Executions ranked means	Confrontations ranked means	Aggressions ranked means
January	490.5	30.8	8.8	19.6	16.6	24.9
February	473.5	56.0	12.0	20.0	23.8	30.6
March	542.8	77.3	7.5	23.5	24.9	21.5
April	528.5	66.3	13.8	20.0	27.8	27.8
May	631.5	65.5	8.0	24.3	30.8	22.1
June	687.5	79.0	15.8	25.8	26.6	21.9
July	691.3	73.8	13.8	25.9	23.9	28.3
August	758.5	76.5	9.0	30.5	26.0	21.0
September	653.5	71.0	6.3	26.8	27.4	16.4
October	786.3	78.3	16.8	30.8	29.0	31.1
November	724.0	55.5	8.0	28.8	22.1	22.1
December	608.4	46.8	13.6	24.4	22.0	30.9
	Parametric tests:			*Non-parametric tests:*		
	$F = 0.273$ ($p = 0.987$)	$F = 0.225$ ($p = 0.994$)	$F = 0.387$ ($p = 0.953$)	$KW = 3.212$ ($p = 0.988$)	$KW = 3.104$ ($p = 0.989$)	$KW = 5.127$ ($p = 0.925$)

*F and Kruskal-Wallis Chi-square tests; significance in parentheses

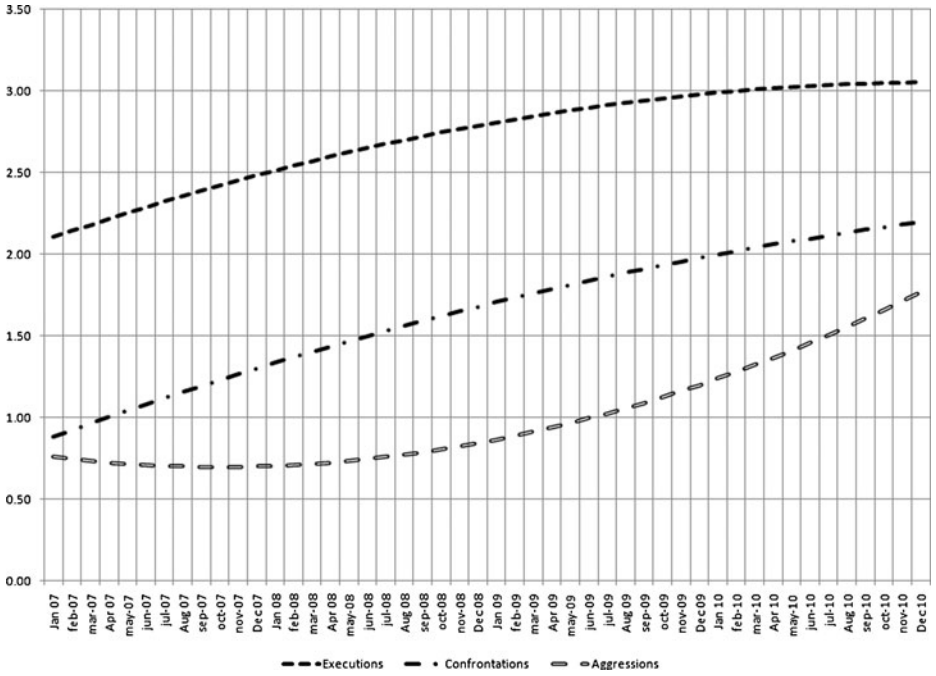


Fig. 2 Growth-curves for each type of death for all states (2007–2010)*. * VD: Executions, confrontations and aggressions per state (Ln)

sound research and anchored in the most fundamental variables.[18] This was of course a data collection and causal mechanism design challenge. It can also be thought of as a challenge of concept and measurement sufficiency. In this respect, what made the test of IAT especially complicated is that it operates at such a high level of aggregation that it only allows the study of the spatial match of initial and structural conditions of deaths associated with organized crime. Which, added to a typical situations as is the case of a total war against organized crime, it makes the already complex issue of finding causal mechanisms even more difficult.

A war against organized crime at the scale seen in Mexico is rare in the field of criminology. It could be considered lying outside the normal curve. As consequence, errors in theory-data confrontations will appear more frequently than would be expected according to the normal law of errors. This may have led to errors in the testing of the IAT model. Nevertheless, with the spatial autocorrelation of the residuals not statistically significant, indicating that the spatial dependence of the dependent variables was explained by the IAT model, the theory proved most consistent in describing the geography of the war against organized crime. But it was inadequate, however, to quantitatively predict the initial conditions of the war. Further research needs to examine other modelling approaches and suggest operationalizations of anomie factors.

The spatial and temporal analyses added interesting insights. Two hotspots (spatial clusters) for deaths by gang execution were detected in Chihuahua and Sinaloa, and one hotspot for deaths by confrontation was detected in the state of Nuevo Leon for the entire

[18] I want to thank two reviewers for their suggestions regarding the anomie factors.

Table 9 Growth-curve regression results for all states*

	Executions			Confrontations			Aggressions to authority		
	Initial conditions	Trend		Initial conditions	Trend		Initial conditions	Trend	
	Intercept	b_1	b_2	Intercept	b_1	b_2	Intercept	b_1	b_2
Aguascalientes	0.537	−0.026	0.001	0.241	−0.068	0.001	1.870	−0.140	0.002
Baja California	0.880	0.046	−0.001	0.140	0.026	−0.001	2.161	−0.113	0.001
Baja California Sur	−0.460	0.014	0.000	−5.746	n.a.	0.002	n.a.	n.a.	n.a.
Campeche	−0.248	0.005	0.000	−0.327	−0.020	0.000	−32.319	5.068	−0.203
Chiapas	0.513	0.016	0.000	−0.641	0.053	−0.001	1.825	−0.076	0.000
Chihuahua	0.690	0.094	−0.001	−1.992	0.220	−0.003	0.376	−0.039	0.001
Coahuila	−0.285	0.063	−0.001	−0.941	0.051	0.000	6.983	−0.532	0.009
Colima	−0.315	0.017	0.000	−13.332	0.829	−0.012	−201.280	8.912	−0.099
Distrito Federal	1.115	−0.004	0.000	1.329	−0.072	0.001	n.a.	n.a.	n.a.
Durango	0.451	0.057	−0.001	0.001	0.090	−0.001	−1.393	0.094	−0.002
Guanajuato	0.225	0.042	0.000	−2.084	0.189	−0.004	−0.284	−0.050	0.001
Guerrero	1.054	0.029	0.000	−1.025	0.149	−0.002	0.356	−0.062	0.002
Hidalgo	0.208	0.011	0.000	−8.106	0.470	−0.007	n.a.	n.a.	n.a.
Jalisco	0.527	0.027	0.000	0.121	−0.051	0.002	4.757	−0.304	0.005
México	0.560	0.054	−0.001	−1.997	0.139	−0.002	−1.487	0.113	−0.002
Michoacán	1.286	0.008	0.000	0.229	0.023	0.000	0.526	−0.005	0.000
Morelos	0.051	0.015	0.000	−1.031	0.057	0.000	−1.518	0.092	−0.001
Nayarit	0.143	−0.026	0.001	−3.431	0.155	−0.001	5.705	−0.416	0.006
Nuevo León	1.183	−0.042	0.001	−0.161	−0.047	0.003	0.202	−0.122	0.003
Oaxaca	0.499	0.018	0.000	−0.585	0.024	0.000	0.853	−0.124	0.003
Puebla	−0.348	0.021	0.000	0.398	−0.110	0.002	−7.918	0.431	−0.006
Querétaro	−0.357	0.002	0.000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 9 (continued)

	Executions			Confrontations			Aggressions to authority		
	Initial conditions	Trend		Initial conditions	Trend		Initial conditions	Trend	
	Intercept	b_1	b_2	Intercept	b_1	b_2	Intercept	b_1	b_2
Quintana Roo	0.452	−0.021	0.001	−18.533	2.800	−0.107	n.a.	n.a.	n.a.
San Luis Potosí	−0.212	−0.001	0.001	2.489	−0.235	0.004	−39.293	2.094	−0.027
Sinaloa	1.086	0.050	−0.001	−0.381	0.122	−0.002	−0.102	0.017	0.000
Sonora	0.676	0.032	0.000	0.344	0.017	0.000	0.903	−0.143	0.003
Tabasco	−0.087	0.032	0.000	−0.869	−0.021	0.001	0.334	−0.068	0.000
Tamaulipas	0.900	−0.038	0.001	−0.282	−0.024	0.003	−16.989	0.748	−0.008
Tlaxcala	−1.203	0.046	0.000	.	0.000	0.000	.	.	.
Veracruz	0.367	0.016	0.000	1.312	−0.126	0.003	11.349	−0.712	0.010
Yucatan	−0.333	0.035	−0.001	.	0.000	0.000	.	.	.
Zacatecas	−0.150	0.022	0.000	−1.479	0.160	−0.003	3.447	−0.211	0.002
National	2.0246	0.0405	−0.0004	0.7986	0.0421	−0.0003	0.7865	−0.0163	0.0007

*On decimal units: Values less than a thousandth part of one (i.e. 0.000) not shown

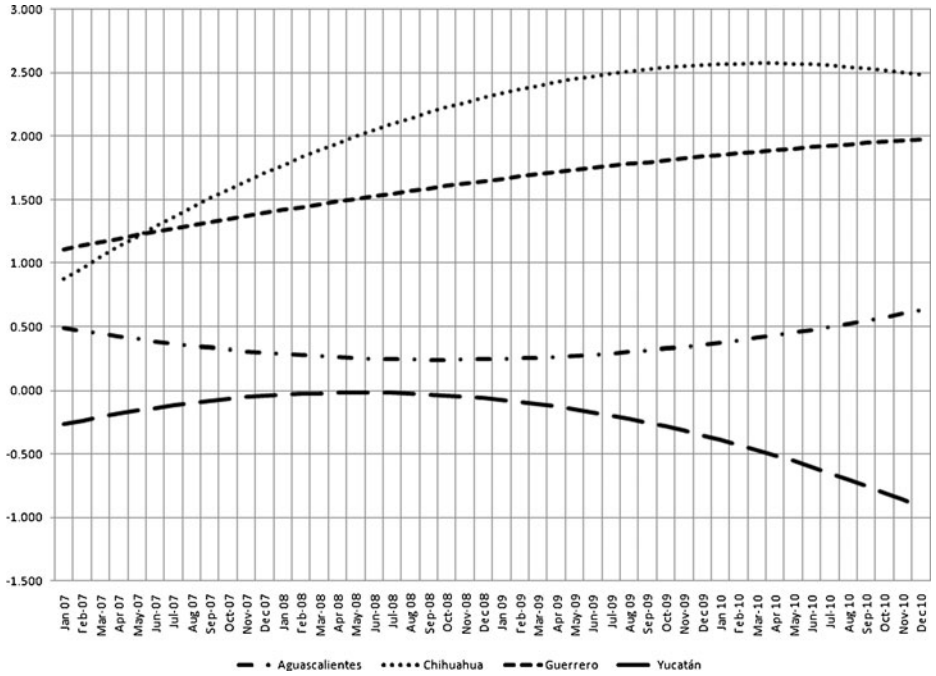


Fig. 3 Growth-curves for executions in selected states (2007–2010)*. * VD: Executions per state (Ln)

period. Other hotspots were also detected at the start and end of the period studied, which again indicates that the war was not uniformly spread across the nation. On the contrary, the war has been concentrated in a few states. Also, spatial clusters and outliers suggest that the war will continue to be concentrated in a small number of Mexican subnational level. Time series show deaths by execution and confrontation slowing down, whereas deaths by aggression to authority have been speeding up. This last finding is worrying as it suggests that criminal organizations will be attacking government forces, probably recreating a guerrilla-like type of war for the coming years.[19]

Extreme homicidal violence may be prevented by implementing a national social crime prevention strategy. According to IAT causal mechanisms, the best "mechanisms" in Mexico to prevent the start of a high rate of increase in deaths associated with organized crime would be the development of community programs and strategies to mutually empower individuals and their communities. In other words, it is necessary to increase the capacity of the polity at the subnational level, particularly by increasing the proportion of businesses and individuals that pay taxes and by reducing the number of firearms available. This strategy would require state and federal cooperation. Likewise, it is quite evident the necessity of improving access to economic opportunities, particularly by increasing public and private investment in housing, increasing the GDP per capita, and reducing the international migration rate. The strengthening of the polity and the opening of economic opportunities at the subnational

[19] This is precisely happening as this paper is being revised. Federal police are being systematically ambushed by organized crime gangs while patrolling the state of Michoacan.

Table 10 Growth-curve intercepts: tests of difference among selected states*

	Aguascalientes	Chihuahua	Guerrero
Chihuahua	−0.619 (p = 0.268)	-	-
Guerrero	−1.611 (p = 0.107)	−1.180 (p = 0.238)	-
Yucatán	3.521 (p < 0.000)	4.427 (p < 0.000)	4.486 (p < 0.000)

* DV: Executions (Ln)

levels would significantly reduce the odds of having the "best" initial conditions for a large number of deaths associated with organized crime.

With regards to future research, I would suggest the replication of this study at the cities and municipal levels (Vilalta, 2010). As Maume and Lee (2003) said, it might be that the explanatory power and analytical flexibility of the theory have been underestimated, and counties (e.g. Mexican municipalities) may serve well as social systems appropriate for the analysis of institutional anomie.

Finally, it might be that current pessimism is loaded by false choices between extreme views. This pessimism seems to blur immediate needs and ignore one key aspect: What if there was no other choice but to reinforce social institutions while confronting criminal organizations for the recovery of territory? No matter how weak initial conditions in some states may have been the recovery of territory is still a legally binding argument in favour of

Table 11 Results for initial conditions of organized crime deaths regressed on institutional anomie correlates*

	Deaths by execution	Deaths by confrontation	Deaths by aggression to authority
Intercept	−1.848***	−7.141	−65.004*
	(0.539)	(4.298)	(34.162)
Polity	−0.201*	0.334	16.450**
	(0.104)	(0.830)	(6.791)
Economic opportunity	−0.255*	−2.970**	−10.926
	(0.142)	(1.116)	(7.641)
Social equality	−0.524**	1.716	18.048
	(0.204)	(1.617)	(12.368)
Family cohesion	−0.119	0.287	6.222
	(0.123)	(0.976)	(8.113)
Border state	0.068	4.805**	70.765***
	(0.275)	(2.177)	(17.012)
Urban population	3.477***	−0.757	−49.271
	(0.950)	(7.608)	(55.463)
Spatial lag (rho)	0.065	−0.083	2.601
Diagnostics:			
Residual standard error	0.484	3.879	115.682
Residuals test (Moran´s I)	0.032	−0.033	−0.211*
Residuals normality (KS)	0.689	1.100	0.661

Standard errors in parentheses on 24 degrees of freedom

*** p < 0.01 ** p > 0.05 * p < 0.1

the federal strategy. Another issue is if the initial conditions of social institutions in some states were favourable, which the evidence presented here suggests they were not.

Appendix

The Global Moran I autocorrelation coefficient is given by the following formula (Holt, 2007):

$$I = \left(\frac{1}{s^2}\right)\frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\left(x_i - \overline{x}\right)\left(x_j - \overline{x}\right)}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}},$$

where N is the number of states (N = 32), x_i and x_j are the values of the dependent variables, deaths by execution, confrontation and aggression towards authority (Ln) in the states *i* and *j*. s^2 is the sample variance. And W_{ij} is the neighbouring matrix. The element $x_{[i,j]}$ of the resulting weight matrix X is 1 if polygon *j* is adjacent to polygon *i*, and is 0 otherwise.

The local Moran I autocorrelation coefficient is given by the following formula (Holt, 2007):

$$I_i = \left(x_i - \overline{x}\right)\sum_{j=1}^{n} w_{ij}\left(x_j - \overline{x}\right).$$

Same notation as above.

The baseline growth-curve model applied was the following (Kubrin and Herting, 2003):

$$(ln)Y_{it} = a_i + b_{1i}(Time) + b_{2i}(Time)^2 + e_{it},$$

where $(Ln)Y_{it}$ is the logged count of the number of organized crime deaths in state *i* at time *t*, ai is the estimated mean constant, b_1 is the mean effect of time on deaths, b_2 is the mean effect of time squared, and e_{it} is each observation error. The constant reflects the initial levels of organized crime deaths at the beginning of the time series, b_1 reflects the main linear trend in deaths levels, and b_2 reflects the extent to which the trend accelerates or decelerates over time.

I applied the following test (Paternoster et al. 1998; Kubrin and Weitzer; 2003):[20]

$$Z = \frac{a_i - a_j}{\sqrt{SEa_i^2 + SEa_j^2}},$$

where a_i and a_j the intercepts and *SE* the standard errors.

The weighted mean centres (*WMC*) are calculated in the following form (Vilalta, 2011):

$$WMC = \left(\overline{x}_{cmp}, \overline{y}_{cmp}\right) = \left(\frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}, \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i}\right),$$

where x_{cm} y y_{cm} are the coordinates of the centre mean, x_i y y_i are each centroid coordinates for polygon i,n is the sample size, and W_i is each polygon´s weighted variable.

[20] Although they prefer to use a Student´s t distribution to test for differences between slopes.

The spatial spatial autoregressive (SAR) model takes the form (Lesage, 1998):

$$Y = \rho \mathrm{Wy} + \mathrm{x}\beta + \mathrm{e},$$

where y contains an nx1 vector of dependent variables, X represents the usual nxk data matrix containing explanatory variables and W is a known spatial weight matrix, in this case a first-order or strict contiguity matrix. Rho (p) is the coefficient on the spatially lagged dependent variable (Wy-). Maximum likelihood estimation of this model is based on a concentrated likelihood function.

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