The impact of crime and violence on economic sector diversity

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Abstract

Literature has focused attention on identifying whether crime and violence impact growth via changes in economic factor accumulation, i.e. reducing labor supply or increasing capital costs. Yet, much little is known as to how crime and violence may affect how economic factors are allocated. Using a unique dataset created with a text-analysis algorithm of web content, this paper traces a decade of economic activity at the subnational level to show that increases in criminal presence and violent crime reduce economic diversification, increase sector concentration, and diminish economic complexity. An increase of 9.8% in the number of criminal organizations is enough to eliminate one economic sector. Similar effects can be felt if homicides rates increase by more than 22.5%, or if gang-related violence increases by 5.4%. By addressing the impact that crime has on the diversification of production factors, this paper takes current literature one step forward: It goes from exploring the effects of crime in the demand/supply of production factors, to analyzing its effects on economic composition.

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Violence increasingly mutates and spreads. France has become pray of its most cruel terrorist attack since WWII: over 130 casualties. Honduras has seen homicides increase to rates similar to war areas: 90 per a hundred thousand inhabitants. Philippines has turned into the non-war country with the largest number of journalists assassinated: a murder every 45 days(CPJ, 2015). Spain has become a regular target of political violence: extremists groups have attacked the country 14 times since 2001 (The-Economist, 2015). Mexico has seen the emergence of violent battles for turf between drug cartels: the toll has been 51 thousand casualties from 2007 to 2010 (Ríos, 2012; Rios, 2015).

Yet, as urgent as properly understanding the impact of crime and violence in the economy has recently become, much empirical evidence is still needed to properly identify concrete mechanisms under which conflict and violent crime may negatively affect economic performance (Mihalache-O'Keef and Vashchilko, 2010; Blattman and Miguel, 2010; Driffield et al., 2013; Enamorado et al., 2014; Amodio and Di Maio, 2014; Cook, 2014; Maher, 2015a,b).

We contribute to economic literature by presenting a subnational study that provides evidence of a previously unexplored mechanism under which crime and violence affect the economy: by reducing economic diversification. Rather than concentrating on how crime changes factor accumulation, we explore how it affects factor allocation. In other words, we present evidence of changes in economic composition rather than on economic activity.

This paper shows that increases in violent crime reduce the number of sectors that operate in an area, limiting economic diversification, increasing market concentration, and diminishing economic complexity. Our more conservative specification, which instruments homicide rates with its lag, shows that increases of 22.5% in the rate of homicides reduces by one the number of different sectors that produce in an area. Our more innovative specification, which relies on a big data exercise of text analysis to identify where criminal organizations operate, shows that increases of 9.8% in criminal presence is enough to eliminate one economic sector.

The following discussion is divided in four sections. First, we discuss what we know about the impact of violence in economic performance, and how this paper fits into such literature. Then, we explain the main argument behind this paper and the unique data that we used to test it, including the unusual challenges involved in gathering it. A third section lays out the strategy for analysis, reports results and conducts several robustness tests to debunk alternative hypothesis. Finally, we conclude by discussing the relevance of the results, and exploring next avenues of research.

The impact of crime and violence in the economy

Our understanding of the effects of violence on the economy has been greatly sharpened over the last decade. Studies showing a negative relationship between violent crime and aggregate economic activity (Bannon and Collier, 2003; Gaibulloev and Sandler, 2008), have given way to more nuanced analysis showing how the effects of crime are heterogeneous across industries, sectors and even gender. Recent evidence shows, for example, that violence seems to affect the most the informal sector (Bozzoli et al., 2012), women (BenYishay and Pearlman, 2013; Dell, 2015; Velásquez, 2014), younger and smaller firms (Camacho and Rodriguez, 2013), smaller urban areas (Enamorado et al., 2014), firms whose inputs are predominantly imported (Amodio and Di Maio, 2014) and non-extractive industries (Mihalache-O'Keef and Vashchilko, 2010; Ashby and Ramos, 2013; Driffield et al., 2013; Maher, 2015a,b) . Yet, even if the literature has been able to accumulate growing evidence of the heterogeneous effects of violent crime on the economy, much little is known with respect to the channels through which these effects take place, and to understand within-country variation (Mihalache-O'Keef and Vashchilko, 2010; Blattman and Miguel, 2010; Driffield et al., 2013; Enamorado et al., 2014; Amodio and Di Maio, 2014; Maher, 2015a,b).

First, within country variation and micro studies are rare. Due to the difficulties of data collection, studies rely mostly on cross-country evidence to illuminate any discussion about conflict, crime and its impact on economic variables (Organski and Kugler, 1977; Alesina and Perotti, 1996; Alesina et al., 1996; Collier, 1999; Imai et al., 2000; Hoeffler and Reynal-Querol, 2003; Murdoch and Sandler, 2004; Blomberg and Mody, 2005; Busse and Hefeker, 2007; Abadie and Gardeazabal, 2008; Cerra and Saxena, 2007). It is not until recent that we have started to see the emergence of subnational (Enamorado et al., 2014), firm-level (Amodio and Di Maio, 2014) and other micro-oriented studies (Maher, 2015a,b).

Second, the channels that have been explored mostly concentrate on understanding how crime and violence affect factor accumulation or productivity, leaving other prominent areas of economic analysis, such as factor allocation, mostly unexplored. We have evidence of impacts on human capital flows (Ríos, 2014; Maher, 2015a,b), human capital accumulation (Barrera and Ibánez, 2004; Rodriguez and Sanchez, 2012; Shemyakina, 2011; Leon, 2012; Márquez-Padilla et al., 2015; Orraca Romano, 2015), labor (BenYishay and Pearlman, 2013; Dell, 2015), rates of self-employment (Bozzoli et al., 2013), unemployment (Arias and Esquivel (2012) cited by Enamorado et al. (2014)), per capita income (Enamorado et al., 2014), firm investment ((Fajnzylber et al., 1998, 2002; Londoño et al., 2000; Powell et al., 2010; Pshisva and Suarez, 2010), FDI (Ashby and Ramos, 2013; Driffield et al., 2013), firm-exit (Camacho and Rodriguez, 2013), productivity (Amodio and Di Maio, 2014) and changes in prices and household expenditure (Velásquez, 2014).

Yet, besides (Amodio and Di Maio, 2014) neither of these studies address factor allocation and economic diversification, two concepts that have become fundamental for current analysis of economic growth.

This paper presents the first subnational study to explore a new channel through which violent crime may affect the economy: factor allocation. We depart from studying factor accumulation and, instead, incursion on studying how crime affects the composition of the economy, particularly its number of sectors, diversity and complexity. Our focus is unique in talking to economic research that tries to understand economic development, not only as a function of factor accumulation and productivity, but as a function of economic composition, allocation and capital distortions. It connects with the literature that analyzes misallocation of resources (Wasmer and Weil, 2000; Guner et al., 2008; Restuccia and Rogerson, 2008; Hsieh and Klenow, 2010; Bartelsman et al., 2013; David et al., 2014; Hausmann et al., 2014; Hopenhayn, 2014) and tries to understand crime as a form of market distortion that induces such misallocation.

Research question and data collection

Our testable hypothesis is that violent crime and criminal presence reduces economic diversification, limiting the number of sectors that operate in a territory, favoring concentration, and inhibiting the development of complex industries.

We expect this result due to different levels of sensitivity that different industries have towards violence. Literature has been able to identify that some sectors are more affected by violence than others. Typically, sectors that are resource-bounded tend to be particularly resilient to crime and violence because the high profits that such sectors obtain help them internalize violence as a cost in their production function (Mihalache-O'Keef and Vashchilko, 2010). Contrary, industries that have lower obstacles to relocate to other areas, due to lacking geographic-specific inputs, are less resilient to violence, having a higher probability to leave a conflict area (Mihalache-O'Keef and Vashchilko, 2010; Ashby and Ramos, 2013; Driffield et al., 2013). The retail sector and tourism, for example, are more likely to be targets of criminal organizations, and are highly movable, which makes them not resilient to violence (Daniele and Marani, 2011). The size may also matters. Multinational companies are more resilient to violence because these companies typically have large high sunk costs, long investment horizons, and have developed an expertise to cope with difficult regions but sectors where firms are smaller tend to be less resilient to violence (Bennett, 2002; Oetzel et al., 2007; Ashby and Ramos, 2013).

To test our hypothesis, we selected Mexico as our study case. Mexico is a suitable case to conduct our subnational study because it has both, one of the most detailed economic censuses available in the developing world, and broad presence of criminal organizations. The Mexican economic census has more than 15 years of panel data for 4,231 thousand economic units along all its territory (INEGI, 2014). Each economic unit has information about yearly production, and is classified by economic sector according to the North American Industry Classification System (NAICS). The last iteration of the census was just released during the fall of 2015 making it highly updated and mostly unexplored. Furthermore, Mexico is well known for the existence of several criminal organizations that operate in its territory (Guerrero-Gutierrez, 2011; Ríos, 2012; Castillo et al., 2013; Rios, 2015; Escalante, 2011; O'Neil, 2009; Osorio, 2012; Snyder and Duran-Martinez, 2009; Astorga, 2005; Chabat, 2006; Felbab-Brown, 2009). Actually, private intelligence services have collected detailed information about the areas of operation of different drug cartels (Stratfor, 2013).

Given how suitable Mexico is for this type of studies, it is not a surprise that academia has already started to use it to study the impact that crime and violence have in the economy. Yet, all studies have concentrated on understanding the cost of violence in economic factors like employment and capital investments [1] , not on factor allocation and economic diversity like this paper proposes.

An important innovation of this paper, beyond the study of economic diversity, is the unique dataset we use to test our hypothesis. We do not only rely on homicide rates as our main independent variable, as most literature does (Fajnzylber et al., 2002; Detotto and Otranto, 2010; Forni and Paba, 2001; Cárdenas, 2007). Instead, we developed a big-data framework that uses text analysis to obtain quantitative information about where criminal groups operate by reading digitalized news content, blogs and Google-News indexed content. Our framework allows us to obtain information of a phenomenon that would otherwise require large scale, expensive intelligence exercises. This approach is unique, not only because of the procedure used to obtain it but because it allow us to identify, not only where violent crime happens, but where crime inhabits.

[1] Villoro and Teruel (2004), for example, estimate losses of up to 0.6% of GDP due to violence, and Ríos (2008) argues that drug trafficking causes economic losses of 4.3 million dollars per year. Others like, Dell (2015) find that female labor participation falls in municipalities where drug violence erupts after crackdowns, or that for every 10 drug-related homicides per a 100 thousand unemployment increases by 0.5% (Arias and Esquivel, 2012). Ashby and Ramos (2013) identify that violence deters FDI in financial services, commerce and agriculture, and BenYishay and Pearlman (2013) show an increase in 10 in homicide rates (per 100 thousand) declines 0.3 weekly hours worked. Enamorado et al. (2014) also contributes by finding that a one standard deviation increase in the number of drug-related homicides decreases income growth by 0.2 percentage points. Robles et al. (2013) finds a negative effect of violence on labor participation. Most recently, Rozo (2014) estimates consumption among white and blue-collard workers is reduced by 2.8% and 6.3% when homicide rates increase 10%, Velásquez (2014) finds that elevated violence leads self-employed women to leave the labor market, and Yepes et al. (2015) finds that crime shocks are responsible for 0.25% reductions in GDP per capita.

Data on the areas of operation of drug cartels was obtained by crawling online newspapers and blogs. We used unambiguous query terms to perform text analysis on content extracted from Googles servers. The crawler was created entirely in Python to extract JSON objects, and the data was cleaned using an hyper-geometric cumulative distribution function. The final list of queries includes 2,449 locations, and 178 actor terms associated with traffickers and drug trafficking organizations. Each actor was classified according as part of 13 criminal organizations and a residual category. A more detailed description of the methodology can be found at (Coscia and Rios, 2012).

(Figure 1 about here)

Our dataset of criminal operations gives information of 13 trafficking organizations in Mexico for 19 years (1991 - 2010). As figure 1 shows, the disaggregation up to the municipal level allows us to challenge the widespread assumption that drug traffickers control vast regions of Mexicos territory, and that criminal organizations operate in oligopolistic markets. Actually, drug trafficking organizations only operate in 713 of 2,441 municipalities in Mexico. Large areas the country completely lack of the presence of a drug trafficking organizations. Furthermore, as of 2010, 444 (62 %) of all municipalities with trafficking operations had more than one criminal organization operating simultaneously.

In the following section, we describe the empirical specification used to test our hypothesis using as main independent variables traditional statistics of violent crime and the results of our big data exercise, as out dependent variable the information of Mexican longitudinal economic census.

Empirical specification, results and robustness checks

Testing is conducted using first a simple OLS, and then an instrumental variables (IV) specification. We use IV because reverse causality is a matter of concern. Economic diversification may affect crime and violence by, for example, creating conditions for the existence of more violent-prone locations.

Data is disaggregated by year, municipality and economic sector. There are 2,456 municipalities i; three years j, where j=[2004, 2009, 2014]; and 23 industries (see appendix for a list of each of them).

The main independent variable, V, is crime and violence. This is operationalized by either (a) average homicide rate (homicides per a 100,000 inhabitants) in i during the five years preceding j (INEGI, 2012), or (b) the number of criminal organizations that operate in i during j (Coscia and Rios, 2012). Homicide rates were used to proxy crime following criminology literature best practices (Fajnzylber et al., 2002), and were logarithmically transformed according to equation (1). This transformation was made because ceros are considered valuable information about criminal violence.

$$\ln(\nu_{ij}) = \begin{cases} \ln(\nu_{ij}+1) & \text{if } \nu_{ij} \geq 0 \\ -\ln \mid \nu_{ij} \mid & \text{if } \nu_{ij} < 0 \end{cases} \tag{1}$$

The main dependent variable, D, refers to the number of different economic sectors that exist in municipality i during year j (INEGI, 2014). We consider an economic sector exists in i if its local value added was reported be positive during j. D was always transformed following a similar procedure than equation (1).

All models include controls C, that are (a) the natural log of added value (pesos, transformed according to equation (1)) (INEGI, 2014), (b) the number of hours worked (INEGI, 2014), (c) rates of employment (INEGI, 2014), and (d) road-distance to the border (calculated in kilometers) (Ríos, 2014). Table 1 descriptive statistics for all variables.

(Table 1 about here)

The simplest OLS model is specified in equation (2).

$$D_{ij} = \beta_0 + \beta_1 \ln(\nu_{ij}) + \sum_{k=1}^{l} \beta_l C_{ijl} + \cdots + e_{ij} \tag{2}$$

Results are presented in Table 2. Column (1) shows the simplest specification. To control for unobserved time invariant state and year effects column (2) adds fixed effects by state, and (3) fixed effects by state and year. Results are solid in showing a strong and negative correlation between increases in homicide rates and changes in the number of industries that exist in a municipality. A 10% in homicide rates is correlated with reductions of (1) 0.32, (2) 0.34, (3) 0.34, in the number of industries.

(Table 2 about here)

The IV model is specified in equations (3) and (4). Equation (4) is the first stage of a 2SLS model containing an instrument I.

$$D_{ij} = \beta_0 + \beta_1 \widehat{ln(\nu_{ij})} + \sum_{k=1}^{l} \beta_l C_{ijl} + \cdots + e_{ij} \tag{3}$$

$$\widehat{ln(\nu_{ij})} = \alpha_0 + \alpha_1 I_{ij} + \sum_{k=1}^{l} \alpha_l K_{ijl} + \cdots + u_{ij} \tag{4}$$

All models were instrumented with two different instruments. First, homicide rates during the nineties (INEGI, 2012), a variable that is correlated with current crime and violence, but not associated with current number of economic sectors. In addition, as robustness check, we used as alternative instrument the extension of hectares of marihuana eradicated from 1998 to 2010 in municipality j (Dube et al., 2014). There is a strong correlation between criminal violence and drug-trafficking operations (Dell, 2015; Ríos, 2012, 2013; Robles et al., 2013; Rios, 2015) but not between drug trafficking operations and the number of different economic sectors.

The preferred specification is presented in Table 3, Column (1). It uses as main independent variable logged rates of homicides, and is an IV model. Results show that to reduce in one the sectors that operate in a municipality general homicide rates must increase by 21%.

(Table 3 about here)

Alterative independent variables for IV models are presented in other columns of Table 3. Column (2) uses the number of criminal organizations operating in a municipality, as extracted with our text-analysis algorithm. Column (3) uses as independent logged rates of drug-related homicides, and (4) the logged rates of drug-related targeted executions[2]. Results show that any significant increase in the number of criminal organizations causes economic sectors to diminish in number, and that an increase of 5.9% in the number of either drug related homicides or executions is enough to eliminate one economic sector.

[2]Unlike any other country, during 2007-2010 Mexico divided its murder statistics in two types of homicides, general homicides and drug-related homicides. According to Mexican authorities, a homicide needed to meet six criteria to be considered drug-related. These were (i) victim was killed by high-caliber firearms,(ii) victims with signs of torture or severe lesions, (iii) victims found at the crime scene or in a vehicle, (iv) victims whose bodies were taped, wrapped or gagged, (v) if the murder happened in a prison and involved criminal organizations, and (vi) if one of several special circumstances occurred, including if the victim was abducted prior to assassination (levantón), ambushed or chased, if the victim was an alleged member of a criminal organization, or if a narco-message was left on or near the body. A sub-classification inside drug-related homicides was created for homicides that were targeted executions, meaning the victim was an alleged member of a criminal organization (Molzahn et al., 2012).

To control for unobserved time invariant, state and industry effects, Table 4 replicates the results of Table 3 with time, state and industry fixed effects. Column (1) shows year fixed effects, (2) state and year fixed effects, and (3 to 6) state, year and industry fixed effects. In columns (1-3) independent variables are logged rates of (1 to 3) general homicides, in (4) is drug-related homicides (SNSP, 2011), in (5) is drug-related targeted executions (SNSP, 2011), and in (6) is number of criminal organizations. Results holds strongly and with similar magnitudes. In column (3), for example, the model with the most traditional independent variable and the more fixed effects controls, an increase in 22.5% in homicide rates causes the extinction of an economic sector.

(Table 4 about here)

To discard alternative hypothesis and conduct robustness tests we created specifications of Table 5, 6 and 7.

As robustness checks, Table 5 presents similar specifications than in previous tables but using data sub-samples. All columns present 2SLS specifications with fixed effects by state, year and sector. The dependent variable is always the number of sectors operating in a municipality. The independent variable is always logged rates of general homicides. Column (1) presents a sub-samples for municipalities with more than 10K inhabitants, (2) for municipalities with at least one homicide during the nineties, (3) for municipalities where drug is not produced (Dube et al 2013), (4) for municipalities without criminal organizations (Coscia and Rios, 2012), and (5) for municipalities with monopolistic criminal organizations (Coscia and Rios, 2012).

(Table 5 about here)

Alternative hypothesis discarded in Table 5 are, for column (1), that the process is driven by rural areas where homicide rates are larger because population denominator is smaller; for column (2), that the process only applies to non-violent municipalities turning violent; for columns (3 to 4), that process only applies to municipalities where drug traffickers operate, and for column (5), that process only applies to municipalities where criminal organizations are fighting for turf.

Results hold for all models in Table 5 but the effect is diminished. In sample (1), for example, to reduce in one the sectors that operate in a municipality, general homicide rates must increase in 34%. Overall, the models show that in rural areas, and in areas that have become violent more recently, the economic effects of increments in crime and violence are larger.

To further check for the strength of the models presented, in Table 6 and 7, we created alternative, more complex versions of the dependent variables. The goal is to identify whether the negative effects that crime and violence have for the number of economic sectors, can also be felt on the concentration of the economy, its diversity[3] , and its complexity[4].

Table 6 and 7 present 2SLS models with fixed effects by state, year and sector. The dependent variable is always the rate of homicides logged for Table 6, and the number of criminal organizations for Table 7. All odd columns use added value as the input variable to perform calculations, and all even columns use total production. Both added value and production were transformed according to equation one. In both tables, the dependent variable is, for column (1-2) Herfindahl-Hirschman Index (HH); for column (3-4) economic diversity (Hausmann and Hidalgo, 2009), and for (5-6) economic complexity (Hausmann and Hidalgo, 2009). Results hold in all specifications. When using homicides rates (Table 7), an increase of 9.3% in the rates of homicides reduces concentration (a larger and positive HH) by 57.7, diversity by 0.87, and complexity by 0.23. When using number of criminal organizations, any significant increase in the number of criminal organizations causes reductions in concentration, diversity and complexity.

(Table 6 about here)

(Table 7 about here)

Conclusion

Literature has focused attention on identifying how crime and violence impact economic factor accumulation, not on how crime and violence affect factor allocation, particularly the diversity and complexity economies. This is the gap in the literature this paper addresses. Using a IV specification that allow us to address problems of reverse causality, and relying on a unique dataset created with a text-analysis algorithm of web content, this paper shows that increases in criminal presence and violent crime reduce economic diversification, increased sector concentration, and diminished economic complexity.

The results here presented are strong, consistent, significant, and hold over a variety of specifications and robustness tests. Overall, it can be argued that, according to the

[3]Diversity is calculated following Hausmann and Hidalgo (2009) as the number of economic sectors in which municipality i has a relative comparative advantage ($RCA > 1$).

[4]Complexity is a measure of the sophistication of the economy. It is calculated following Hausmann and Hidalgo (2009).

preferred specification, an increase of 9.8% in the number of criminal organizations is enough to eliminate one economic sector. Similar effects can be felt if homicides rates increase by more than 22.5%, or if gang-related violence increases by 5.4%.

By addressing the impact that crime has on the diversification of production factors, this paper takes current literature one step forward: It goes from exploring the effects of crime in the demand/supply of production factors, to analyzing its effects on economic composition. Furthermore, our results talk directly to scholars who have analyzed the effects of criminal violence on growth, and provides a first building block towards better understand why highly violent areas do not always exhibit diminished growth in the short term. If, as argue, the negative effects of violence in economic growth are not only explained by reductions in investments, outflows of human capital, or increased production costs, but by changes in the productive composition of an area, it follows that, in the short time, violence may not necessarily reduce economic growth, but just change the sources of it.

Further work will need to be developed to address whether growth may continue in the short term even if the economy is less diverse. In other words, while violence will most probably reduce economic growth in the long term via diversification reductions, in the shorter term, violence may leave growth unaffected. The effects of violence in the longer term, and its differences with short term effects is a promising agenda that would need to be explored.

Tables and Figures

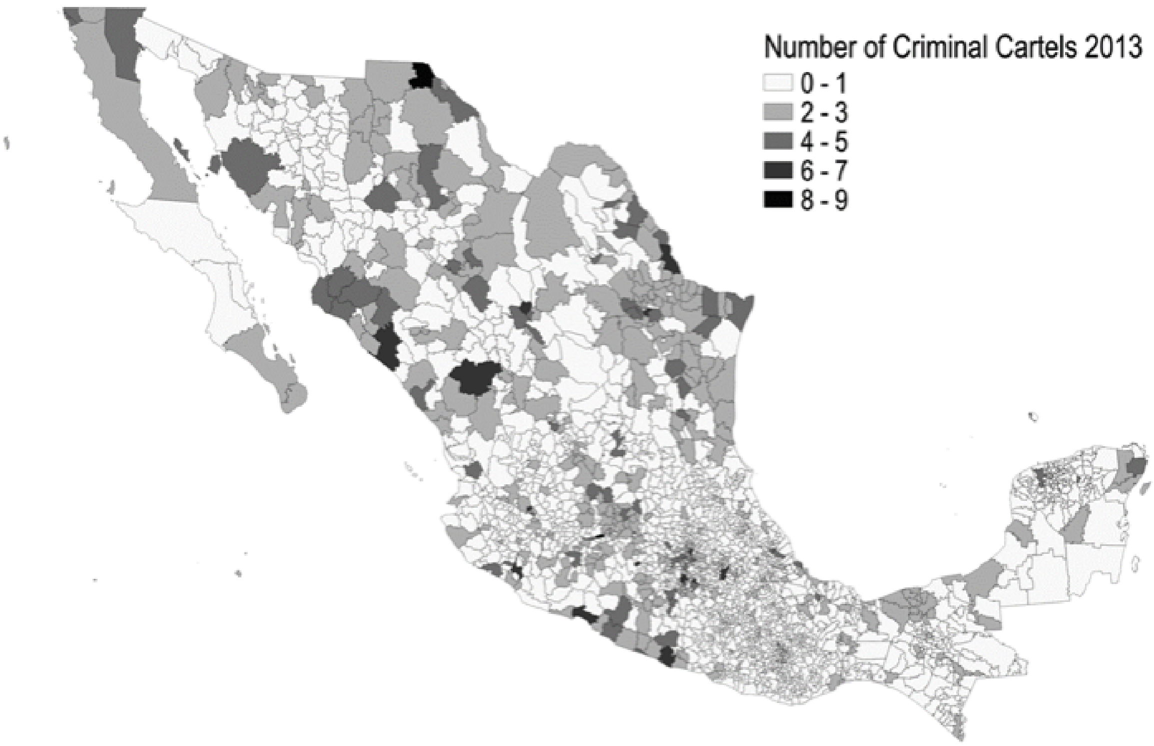

Figure 1: Presence of Criminal Organizations

Table 1: Descriptive Statitsics

Statistic	N	Mean	St. Dev.	Min	Max
Rate, Homicides	115,138	26.44	43.13	0.78	1,358.1
Rate, Homicides 1990	148,212	7.551	22.243	1	419.2
Rate, Drug Related Homicides	56,488	8.558	31.934	0	636.2
Rate, Drug Related Excecutions	56,488	6.782	23.871	0	631.5
Population	169,073	44,699.4	131,543.9	91.2	1,830,289
Employed Population	169,464	341.8	2,746.7	0	242,934
Hour Worked	169,464	821.7	6,766.8	0	659,020
Margination Index	112,884	−0.001	1	−2.37	4.5
Road Distance	169,395	951.2	407.7	1.37	2,308.0
Production (P, billons of pesos)	169,464	0.202	3.88	0	755
Added Value (AV, billions of pesos)	169,464	0.095	2.82	0	649
Economic Sectors	169,464	17.725	9.430	0	42
Diversity (AV)	169,464	5.648	2.697	1	23
Complexity (AV)	169,464	0	1	−2.296	8.587
Diversity (P)	169,464	6.008	2.722	1	23
Complexity (P)	169,464	0	1	−2.266	7.996

Table 2: Simple OLS

	Dependent variable:		
	Industries		
	(1)	(2)	(3)
Homicide Rate	-3.337^{***}	-3.611^{***}	-3.575^{***}
	(0.022)	(0.022)	(0.024)
Added Value	0.113^{***}	0.105^{***}	0.081^{***}
	(0.009)	(0.008)	(0.008)
Worked Hours	-0.498^{***}	-0.404^{***}	-0.304^{***}
	(0.029)	(0.028)	(0.026)
Employment	2.234^{***}	2.102^{***}	1.757^{***}
	(0.034)	(0.033)	(0.031)
Border Distance	-0.002^{***}	-0.002^{***}	0.001^{***}
	(0.0001)	(0.0001)	(0.0002)
Constant	27.103^{***}	26.676^{***}	25.393^{***}
	(0.090)	(0.092)	(0.259)
Observations	115,115	115,115	115,115

Note: OLS specification. Dependent variable is the number of industries operating in a municipality. Model (1) shows simplest specification, (2) with state fixed effects, (3) with state and year fixed effects. An increase of 10% in homicide rates is correlated with reductions of (1) 0.32, (2) 0.34, (3) 0.34 in the number of industries.* $p<0.1$; ** $p<0.05$; *** $p<0.01$. Standard errors in parentheses.

Table 3: Instrumental Variables, Several Independent Variables

	Dependent variable:			
	Industries			
	(1)	(2)	(3)	(4)
Homicide Rate	-5.247^{***}			
	(0.034)			
Criminal Org		-896.281^{*}		
		(524.824)		
Drug Homicide Rate			-17.520^{***}	
			(0.529)	
lDrug Targeted Homicide Rate				-17.633^{***}
				(0.516)
Added Value	0.098^{***}	-10.134^{*}	0.598^{***}	0.537^{***}
	(0.009)	(6.130)	(0.058)	(0.056)
Worked Hours	-0.494^{***}	-70.800^{*}	-1.011^{***}	-0.964^{***}
	(0.030)	(41.290)	(0.190)	(0.184)
Employment	2.047^{***}	213.327^{*}	3.806^{***}	3.814^{***}
	(0.035)	(123.419)	(0.221)	(0.215)
Border Distance	-0.002^{***}	-0.372^{*}	-0.020^{***}	-0.016^{***}
	(0.0001)	(0.217)	(0.001)	(0.001)
Constant	33.341^{***}	467.905^{*}	47.277^{***}	43.077^{***}
	(0.124)	(265.463)	(1.020)	(0.874)
Observations	109,641	145,820	48,990	48,990

Note: 2SLS specification. Instrument is average homicide rate during the nineties (logged). Dependent variable is the number of sectors operating in a municipality. Independent variables are logged rates of (1) general homicides, (3) drug-related homicides, and (4) drug-related targetted excecutions, and (2) number of criminal organizations. To reduce in one the sectors that operate in a municipality (1) general homicide rates must increase by 21%, (3-4) drug related homicides and excecutions by 5.9%. Any significant increase in the number of drug cartels leads to the elimination of at least one sectors. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors in parentheses.

Table 4: Instrumental Variables, Several Independent Variables

	Dependent variable:					
	Industries					
	(1)	(2)	(3)	(4)	(5)	(6)
Homicide Rate	-5.275^{***}	-6.457^{***}	-4.951^{***}			
	(0.033)	(0.044)	(0.039)			
Criminal Org				-73.355^{***}		
				(5.052)		
Drug Homicide Rate					-28.563^{***}	
					(1.575)	
Drug Targeted Homicide Rate						-35.142^{***}
						(2.249)
Added Value	0.088^{***}	0.064^{***}	0.102^{***}	-0.708^{***}	0.382^{***}	0.378^{***}
	(0.009)	(0.008)	(0.007)	(0.096)	(0.070)	(0.081)
Worked Hours	-0.375^{***}	-0.270^{***}	1.127^{***}	3.225^{***}	1.778^{***}	1.981^{***}
	(0.029)	(0.028)	(0.029)	(0.320)	(0.262)	(0.306)
Employment	1.914^{***}	1.528^{***}	1.033^{***}	11.790^{***}	2.639^{***}	2.937^{***}
	(0.035)	(0.033)	(0.032)	(0.791)	(0.298)	(0.350)
Border Distance	-0.002^{***}	0.002^{***}	0.001^{***}	-0.013^{***}	0.010^{***}	0.016^{***}
	(0.0001)	(0.0002)	(0.0002)	(0.002)	(0.001)	(0.002)
Constant	31.875^{***}	31.673^{***}	29.439^{***}	18.163^{***}	38.018^{***}	34.283^{***}
	(0.121)	(0.306)	(0.270)	(2.707)	(2.495)	(2.805)
Observations	109,641	109,641	109,641	145,820	48,990	48,990

Note: Prefered model (3) shows that an increase in 22.5% in the rates of homicide will reduce in one the number of sectors. 2SLS specification. Instrument is average homicide rate during the nineties (logged). Dependent variable is the number of sectors operating in a municipality. Independent variables are logged rates of (1-3) general homicides, (4) drug-related homicides, (5) drug-related targetted excecutions, and (6) number of criminal organizations. Model (1) shows year fixed effects, (2) with state and year fixed effects, (3-6) state, year and industry fixed effects. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Standard errors in parentheses.

Table 5: Instrumental Variables, Different Samples

	Dependent variable:				
	Industries				
	(1)	(2)	(3)	(4)	(5)
Homicide Rate	-3.384^{***}	-4.951^{***}	-4.618^{***}	-5.007^{***}	-4.308^{***}
	(0.055)	(0.039)	(0.049)	(0.042)	(0.145)
Added Value	0.076^{***}	0.102^{***}	0.120^{***}	0.117^{***}	0.115^{***}
	(0.007)	(0.007)	(0.009)	(0.009)	(0.020)
Worked Hours	1.357^{***}	1.127^{***}	1.189^{***}	1.005^{***}	1.131^{***}
	(0.030)	(0.029)	(0.035)	(0.033)	(0.082)
Employment	0.863^{***}	1.033^{***}	0.960^{***}	0.976^{***}	0.704^{***}
	(0.033)	(0.032)	(0.039)	(0.037)	(0.090)
Border Distance	0.002^{***}	0.001^{***}	0.001^{***}	0.003^{***}	-0.0004
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)
Constant	27.287^{***}	29.439^{***}	29.903^{***}	29.479^{***}	32.346^{***}
	(0.279)	(0.270)	(0.331)	(0.317)	(0.643)
Observations	80,569	109,641	65,550	81,926	11,109

Note: 2SLS specification, fixed effects by state, year and sector. Instrument is average homicide rate during the nineties (logged). Dependent variable is the number of sectors operating in a municipality. Independent variable is logged rates of general homicides. Includes only sub-samples for (1) muncipalities with more tan 10K inhabitants, (2) municipalities with at least one homcide during the nineties, (3) municipalities where drug is not produced, (4) municipalities without criminal organizations, (5) municipalities with monopolistic criminal organizations. In sample (1), to reduce in one the sectors that operate in a municipality general homicide rates must increase in 34% in sample. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Standard errors in parentheses.

Table 6: Instrumental Variables, Several Dependent Variables, Homicidios

	Dependent variable:					
	Concentration A	Concentration B	Diversity A	Diversity B	Complexity A	Complexity B
	(1)	(2)	(3)	(4)	(5)	(6)
Homicide Rate	605.835***	240.560***	−0.914***	−0.549***	−0.242***	−0.220***
	(11.927)	(12.844)	(0.017)	(0.018)	(0.007)	(0.007)
Added Value	−11.567***	−5.301**	0.001	0.005	0.002*	0.0001
	(2.268)	(2.443)	(0.003)	(0.003)	(0.001)	(0.001)
Worked Hours	3.638	−12.115	−0.067***	−0.029**	0.006	−0.0003
	(7.561)	(8.142)	(0.011)	(0.011)	(0.004)	(0.004)
Employment	−89.326***	−47.959***	0.302***	0.196***	0.031***	0.043***
	(8.978)	(9.668)	(0.013)	(0.013)	(0.005)	(0.005)
Border Distance	−0.336***	−0.107**	0.001***	0.001***	−0.0004***	−0.00004
	(0.048)	(0.052)	(0.0001)	(0.0001)	(0.00003)	(0.00003)
Constant	2,727.058***	3,482.636***	6.118***	5.899***	1.317***	0.941***
	(82.162)	(88.479)	(0.117)	(0.123)	(0.046)	(0.049)
Observations	109,641	109,641	109,641	109,641	109,641	109,641

Note: 2SLS specification, fixed effects by state, year and sector. Dependent variable is the rate of homicides loged. Instrument is average homicide rate during the nineties (logged). Dependent variable is (1) herfindahl-hirschman index (HH) of added value, (2) HH of total gross production, (3) diversity as calculated by (Hausmann et al., 2014) using added value, (4) diversity using gross production, (5) complexity as calculated by (Hausmann et al., 2014) using added value, and (6) complexity using gross production). An increase of 9.3% in the rates of homicides reduces concentration by 57.7, diversity by 0.87 and complexity by 0.23. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Standard errors in parentheses.

Table 7: Instrumental Variables, Several Dependent Variables, Cartels

	Dependent variable:					
	Concentration A	Concentration B	Diversity A	Diversity B	Complexity A	Complexity B
	(1)	(2)	(3)	(4)	(5)	(6)
Criminal Org	8,551.101***	4,366.805***	−10.707***	−7.883***	−1.876***	−1.646***
	(652.076)	(338.406)	(0.770)	(0.586)	(0.151)	(0.140)
Added Value	76.372***	37.542***	−0.104***	−0.071***	−0.017***	−0.017***
	(11.785)	(6.406)	(0.015)	(0.011)	(0.003)	(0.003)
Worked Hours	−373.105***	−224.217***	0.469***	0.375***	0.113***	0.099***
	(38.814)	(21.445)	(0.049)	(0.037)	(0.010)	(0.009)
Employment	−1,264.921***	−627.952***	1.769***	1.254***	0.285***	0.266***
	(100.398)	(53.009)	(0.121)	(0.092)	(0.024)	(0.022)
Border Distance		0.649***	−0.001***	−0.001***	−0.001***	−0.0004***
		(0.120)	(0.0003)	(0.0002)	(0.0001)	(0.00005)
Constant	4,931.417***	3,964.683***	4.222***	4.791***	0.691***	0.428***
	(308.487)	(181.283)	(0.412)	(0.314)	(0.081)	(0.075)
Observations	145,820	145,820	145,820	145,820	145,820	145,820

Note: 2SLS specification, fixed effects by state, year and sector. Dependent variable is number of criminal organizations operating in a municipality. Instrument is average homicide rate during the nineties (logged). Dependent variable is (1) herfindahl-hirschman index (HH) of added value, (2) HH of total gross production, (3) diversity as calculated by (Hausmann et al., 2014) using added value, (4) diversity using gross production, (5) complexity as calculated by (Hausmann et al., 2014) using added value, and (6) complexity using gross production). * p <0.1; ** p <0.05; *** p <0.01. Standard errors in parentheses.

Appendix

Code	Industries
011	Agriculture, animal breeding and production, forestry, fishing and hunting
021	Mining
023	Construction
043	Wholesale trade
046	Retail trade
048	Transportation, postal services and warehousing
051	Mass media information
053	Real estate services and tangible and intangible goods rental and leasing
054	Professional, scientific and technical services
055	Head offices
056	Business support services, waste management and remediation services
061	Educational services
062	Health care and social assistance services
071	Cultural and sporting recreation services and other recreational services
072	Temporary accommodation services and food and beverage preparation services
081	Other services, except government activities
221	Electric power generation, transmission and distribution
222	Water and gas supply through mains to final consumers
311	Food industry Beverage and tobacco industries Textile inputs manufacturing, and textiles finishing Textile products manufacturing, except apparel Apparel manufacturing Leather and hide tanning and finishing, and manufacturing of leather, hide and allied materials products
321	Wood industry Paper industry Printing and related industries Petroleum and coal products manufacturing Chemical industry Plastic and rubber industry Nonmetallic mineral products manufacturing
331	Basic metal industry Metal products manufacturing Machinery and equipment manufacturing Manufacturing of computer, communications, and measuring equipment, and other electronic equipment, components and appliances manufacturing Electric appliances, accessories and electric power generation equipment manufacturing Transportation equipment manufacturing Furniture, mattresses and blinds manufacturing Other manufacturing industries
521	Central bank Credit and financial intermediation institutions, non-stock exchange Stock market, currency exchange and financial investment activities Surety, insurance and pension companies
522	Surety, insurance and pension companies

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