

Income Inequality and Violent Crime

Evidence from Mexico's Drug War

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Abstract

The relationship between income inequality and crime has attracted the interest of many researchers, but little convincing evidence exists on the causal effect of inequality on crime in developing countries. This paper estimates this effect in a unique context: Mexico's Drug War. The analysis takes advantage of a unique data set containing inequality and crime statistics for more than 2,000 Mexican municipalities covering a period of 20 years. Using an instrumental variable for inequality that tackles problems of reverse causality and omitted variable bias, this paper finds that an increment of one point in

the Gini coefficient translates into an increase of more than 10 drug-related homicides per 100,000 inhabitants between 2006 and 2010. There are no significant effects before 2005. The fact that the effect was found during Mexico's Drug War and not before is likely because the cost of crime decreased with the proliferation of gangs (facilitating access to knowledge and logistics, lowering the marginal cost of criminal behavior), which, combined with rising inequality, increased the expected net benefit from criminal acts after 2005.

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Income Inequality and Violent Crime: Evidence from Mexico's Drug War

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1. Introduction

The question of what is the effect of inequality on crime has been a matter of interest among many researchers and policy analysts. While most of the literature on this topic finds a positive effect of inequality on crime, the empirical evidence has fallen short in establishing an unambiguous direction of causality (see Pridermore, 2011), as well as on whether the effect holds for different types of violent crime. Moreover, when focusing on developing countries the available evidence is weaker given that reliable and comparable crime statistics tend to be scarce. In addition, scholars have faced other major challenges when delving into this subject. For example, cross-country studies are usually biased by measurement error and omitted variables problems, and they are also limited by small-sample sizes. Reverse causality is a matter of concern, since increasing crime rates might also affect inequality by, for example, encouraging richer residents to move out of violent locations.

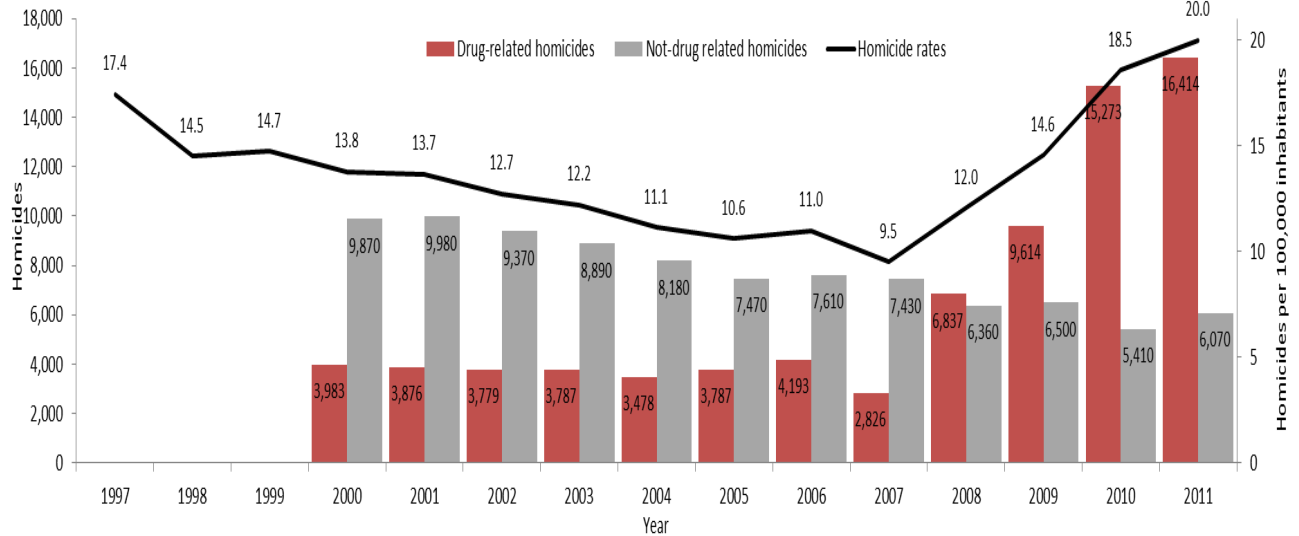
Neumayer (2005) points out that focusing on within-country variation could be a remedy to the difficulty to control for confounding factors at the country level and to the small-sample problem that arises in cross-country analysis. Nonetheless, even when those problems have been addressed, the reverse causality problem remains. In this paper, we take a step forward seeking to tackle the aforementioned challenges by focusing on within-country variation at the municipal level in crime and inequality in Mexico and proposing an instrumental variable that is related to changes in local income inequality levels but uncorrelated with changes in local crime rates.

We focus our attention on Mexico as it represents a unique case among developing nations. First, in terms of crime rates, while the total rate of homicides in Mexico followed a downward pattern for the 1990-2005 period, the picture is totally different for the period from 2005 to 2010. For example, in 2005 the total rate of homicides was close to 11 deaths per 100,000 individuals, while by 2010 it was 18.5 deaths (Mexico's National Public Security System, SNSP, 2011). This sharp increase in the rate of total homicides is mainly due to the rising number of violent crimes associated with drug-related activities e.g., in 2005 there were more than 7,000 deaths related to non-drug crimes, nearly double the number of deaths caused by drug-related homicides; by 2010 the situation had completely turned around, that is, the number of drug-related homicides more than tripled the number of non-drug related homicides (see Figure 1). To illustrate the economic implications of this matter, victimization surveys estimate that in 2010 crime cost victims losses valued at US\$12.9 billion. In addition, for that same year, 42.8 percent of Mexico's firms paid for private security, spending about 2.2 percent of their annual sales on these services (IFC and WB, 2012); and reductions in economic activity and growth were found at the municipal level between 2006 and 2010 (Robles et al., 2013, and Enamorado et al., 2013).

Second, while there have been major advancements in reducing income inequality in Mexico over the last fifteen years—with a decline from 0.547 to 0.475 of the Gini coefficient for the distribution of household per capita income (Lustig et al., 2012)—heterogeneity across regions remains. Between 1990 and 2005, about 90 percent of the municipalities in Mexico registered a decline in income inequality, while between 2005 and 2010 about 78 percent of the municipalities experienced a reduction of their Gini coefficient. Despite an overall decrease in the Gini coefficient at the national

level, many municipalities experienced an increase in inequality during these periods and Mexico is still one of the countries in Latin America where low-income mobility is a widespread problem (see Cuesta et al., 2011; Bourguignon 2004).

Figure 1: Number of homicide cases and homicide rates by type (1997 – 2011)



Source: SNSP, 2011 and 2012; Rios, 2012.

Our results from linear regression models that do not account for reverse causality and omitted variables predict that, in the case of Mexico, an increase in inequality is linked to a decrease in homicides. We argue that this result might be driven by selective outmigration of richer residents to safer municipalities and by other channels through which crime might affect the distribution of income. Nonetheless, when we use our proposed instrument to tackle the endogeneity problem, we find that for the period that goes from 2005 to 2010, an increase of one unit in the Gini coefficient (our income inequality measure) translates in more than 4 additional deaths per 100,000 individuals when focusing on the total homicide rate. Moreover, this effect is larger if we focus just on drug-related crimes, where an increase in the Gini coefficient of one unit is associated with an increase of more than 10 deaths. On the other hand, in the case of non-drug related homicides solely we do not find any evidence that changes in inequality play a role in determining those types of crimes before or during Mexico’s Drug War. This finding shows the importance of the lower costs of criminal activity brought about by the expansion of drug trafficking gangs after 2005, in shaping the effects of income inequality on criminal activity. The results presented are unaffected by alternative specifications and different robustness checks.

The rest of this paper proceeds as follows. Section 2 presents a literature review of the theoretical and empirical evidence on this subject; Section 3 presents long and medium-run trends of subnational income inequality and facts on Mexico’s Drug War and the associated spike in violent crime rates. Section 4 describes methodology and data; Section 5 lays out the empirical strategy, with a special focus on how we recover income inequality measures at the municipal level in Mexico and

how our proposed instrument was constructed. Section 6 presents our main findings, and Section 7 concludes.

2. Previous Literature on the Links between Income Inequality and Crime

Within the literature on the effects of inequality and poverty on crime there are two distinctive and complementary approaches. First, we have the sociological theories of crime, which center their attention on the emotional feelings that cause people to become delinquents. In these theories, poverty and inequality cause social tension, anxiety, and strain, which lead people to become more violent (recent empirical work presenting evidence supporting those theories can be found in Fajnzylber, Lederman, and Loayza [1998, 2002a, 2002b], and Whitworth, 2012). The second approach includes the concept of criminal behavior as a cost-benefit calculation, introduced to the economics literature by Becker's (1968) seminal work. In a nutshell, Becker proposes that crime is a function of an individual's calculations in weighing the expected utility of crime against the utility of using the same time and resources to pursue legal activities. Thus, it is not difficult to see that in this theory poor individuals living in an unequal setting will be more prone to recur to illegal activities, as their outside options (i.e., legal activities) do not offer higher benefits in the short term (Freeman, 1999). These calculations behind are influenced by the deterrence mechanisms and penalties put in place to prevent crime. Conversely to the case described above, the poor may find non-criminal activities preferable if the net benefit of crime (after discounting penalties) is lower than their poverty status.

Regardless of the mechanism(s) behind (rational calculation vs. emotional motivations originated by social exclusion), both set of theories strongly suggest that inequality and poverty foster crime. Many authors have tried to test these theories empirically obtaining mixed results. For example, Ehrlich (1973) finds that in the United States (1940-1970), inequality and income are positively correlated with both property (robbery, burglary, larceny, and auto theft) and violent crimes (murder and rape). Blau and Blau (1982), argue that economic inequalities are the root of violent crime in the United States. In their findings, when explaining crime, the role of variables such as poverty is outweighed by the predicting power of inequality. In this same line of work, Kelly (2000) finds that in urban areas in the United States poverty and police activity are significantly correlated with property crimes, while inequality has no effect on such types of crimes. On the other hand, when focusing on violent crimes, inequality is the main driver.

Contrasting Kelly's (2000) results, Fajnzylber, Lederman, and Loayza (2002b) find, in their analysis of data on homicides and robberies in a cross-section of both industrialized and developing countries, that inequality and poverty increase *both* robberies (here, a proxy for property-related crimes) and homicides (a proxy for violence). Neumayer (2005) directly calls into question Fajnzylber, Lederman, and Loayza's (2002b) results; arguing that by increasing the sample size of countries, inequality—measured as the Gini coefficient—is no longer statistically significant when

predicting violent crime.¹ Moreover, Pridemore (2011) criticizes the large cross-country literature that studies the link between inequality and homicide rates as most of those fail to control for poverty rates, which is the most consistent predictor of area homicide rates in the US empirical literature. Pridemore replicated previous cross-country studies that found a statistical significant relation between inequality and homicides, finding that when the models controlled for poverty rates, such relationship was not significant anymore.

Brush (2006) finds mixed results in terms of the effect of income inequality on crime rates using county level data for the United States. Using cross-sectional analysis he does find that income inequality promotes crime, although when centering his attention on a time series analysis he finds that income inequality reduces crime. Poveda (2011) finds that poverty and inequality both have positive impacts on the rate of homicide in seven major Colombian cities. Similarly, using a sample of OECD, Central and South American countries, Nadanovsky and Cunha-Cruz (2009), find that low inequality leads to a reduction in homicide rates. Demombynes and Ozler (2005) find that higher inequality in South Africa is associated with higher rates of property and violent crimes at the neighborhood level. Finally, in a recent study using inequality data for the United States at the state level, Chintrakarn and Herzer (2012) find that inequality has a negative effect on crime, i.e., the more inequality there is, the less crime. Their explanation for this counterintuitive result is that the higher the inequality within a state, the larger the demand for security services, which leads to a reduction in crime.

As this succinct literature review shows, empirical evidence on the effects of inequality over crime is mixed. In order to further analyze this question, this paper focuses on within-country variation in income inequality and crime rates using a unique data set of Mexican municipalities from 1990 to 2010. Additionally, the paper uses differentiated homicide rates, thus distinguishing whether the impact of inequality over crime rates is more pronounced for common crime, organized crime, or both. In particular, we expect that the effect of inequality on organized crime would be exacerbated in the context of Mexico's Drug War. The literature has shown that the proliferation of gangs tends to increase the propensity to commit crimes as they facilitate access to knowledge and logistics associated with criminal activities (Thornberry et al. 1993; Zhang et al. 1999; Gatti et al. 2005). In other words, gangs tend to lower the marginal cost of criminal behavior. Proliferation of gangs would thus have a greater impact on crime levels in cities with a high degree of poverty and inequality, since higher costs are more likely to be a binding constraint for crime activity among individuals with less economic resources. The splintering of drug-trafficking gangs and their geographic diffusion during Mexico's Drug War might have facilitated criminal behavior disproportionately among cities that became poorer and more unequal during this period. At the same time, increasing levels of inequality associated with rich individuals becoming richer would tend to exacerbate these effects, by increasing the expected pay-off of criminal activity. In other words, if the cost of crime decreases and the income differences between the poor and the rich

¹ Neumayer (2005) used 59 countries in his sample. Fajnzylber, Lederman, and Loayza's (2002b) have 45 countries in their sample.

become larger, the expected net benefit from criminal acts such as extortion, kidnapping and theft would increase.

3. Income Inequality and Crime in Mexico: Some Stylized Facts

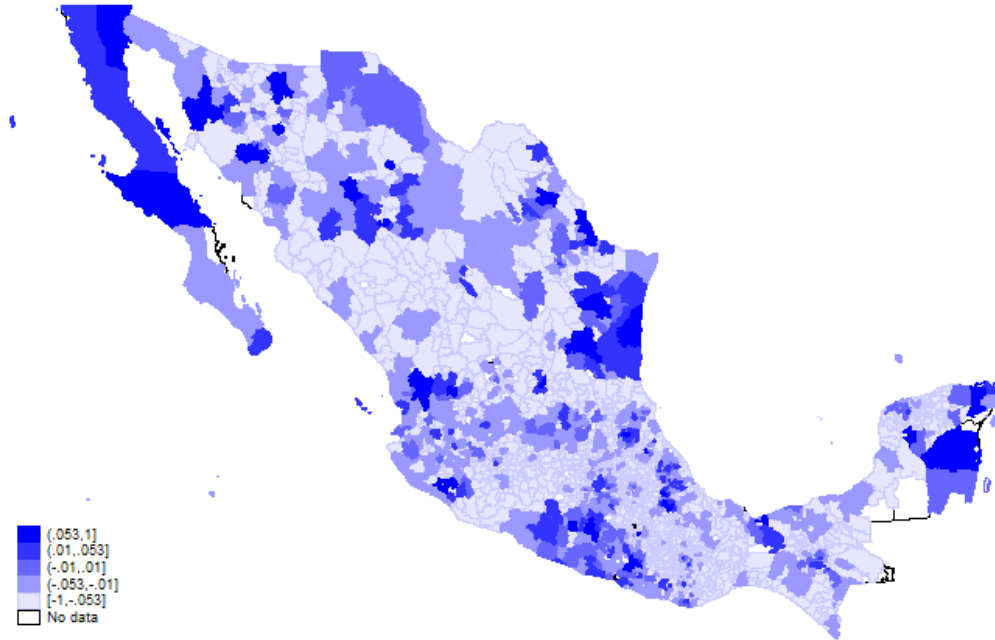
Trends in Income Inequality in Mexico

Although income inequality measured by the Gini coefficient declined by about six points from 1996 to 2010 (Lustig et al. 2012), recent figures show that this trend has slowed down for the period 2005-10, and displays a slight reversal between 2010 and 2012 (INEGI, 2013). For the same periods, there is significant within-country variability. Over the long-run (1990-2010), about 90 percent of the municipalities in Mexico observed a reduction in Gini coefficient, while over the medium-run (2005-2010) about 73 percent of the municipalities had a decline of inequality.

Figures 2a and 2b show the long and medium-run changes in the Gini coefficient at the municipality level with respect to the national average (weighted average of -5.3 Gini points for the period 1990-2010, and -3.7 for the period 2005-2010). Between 1990 and 2010, about 67 percent of the more than 2,000 municipalities in Mexico had a speed of reduction of the Gini coefficient above the national average (representing about 49 percent of total population); while 23 percent observed a decline in inequality over the same period but lower than the national average; and the remaining 10 percent experienced an increase in inequality (33 percent and 18 percent of total population, respectively). For the medium-run period of 2005-2010, about 50 percent of municipalities had a decline in inequality above the national average, and 28 percent had a decline below the national average (53 percent and 28 percent of the total population, respectively); while 22 percent of municipalities observed an increase in the Gini coefficient over this period (19 percent of total population). These numbers confirm that, although income inequality declined in the majority of municipalities in Mexico both over the long and medium-run, there is a non-trivial number of municipalities in which income inequality increased, particularly between 2005-2010, overlapping with Mexico's Drug War.

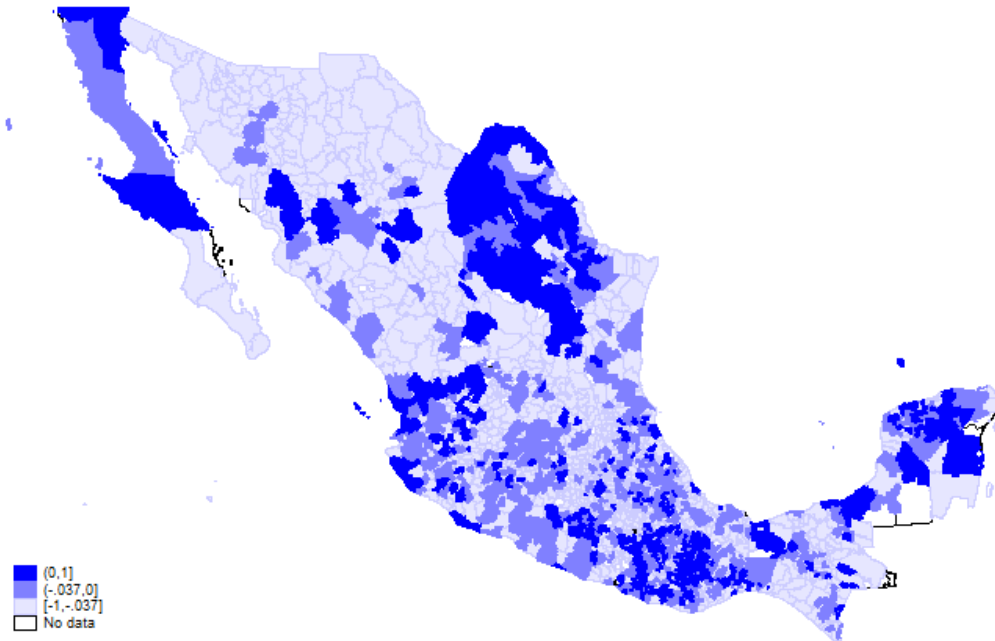
Figure 2: Long and medium-run variation in income inequality at municipal level vs. national average (1990-2010 and 2005-2010)

2.a: Change in local Gini coefficient with respect to national average, 1990-2010



Source: Author's own estimations using ENIGH and Population Census/Counts.
Note: This map reports The change in Gini between 1990-2010 by municipality. The change of -0.053 was the national change

2.b: Change in local Gini coefficient with respect to national average, 2005-2010



Source: Author's own estimations using ENIGH and Population Census/Counts.
Note: This map reports The change in Gini between 2005-2010 by municipality. The change of -0.037 was the national change

Trends in Crime and Violence in Mexico

According to statistics from the United Nations Office on Drugs and Crime (UNODC), the annual number of homicides in Mexico almost doubled between 2000 and 2010, from 12,295 to 24,374. A comparison among Latin American countries shows that Mexico moved from third place in 2000 — behind Brazil (51,804 homicides) and Colombia (26,540 homicides)—, to second place in 2010 just behind Brazil (57,271 homicides).

After a significant decline of 32 percent annually since late-1990s, the number of homicides in Mexico started to increase dramatically in 2007, soon after Calderon's administration took office in December 2006 and launched a military offensive against drug trafficking organizations through an operation that deployed 6,500 federal troops and continued to expand to approximately 45,000 troops by 2011. The striking change in the number of homicides was highly biased by the sharp increase in drug-related homicides² including those caused by battles between criminal organizations, or by confrontations between authorities and criminal groups. The number of drug-linked killings reached a cumulative figure of roughly 60,000 in 2011 (OAS, 2013). While drug-related homicides have increased 120 percent annually from 2007 to 2011, non-drug-related homicides have actually decreased by 4.6 percent annually over the same period. As a result, drug-related homicides, which represented 27.6 percent of total homicides in 2007, reached 73 percent in 2011 (Figure 3).

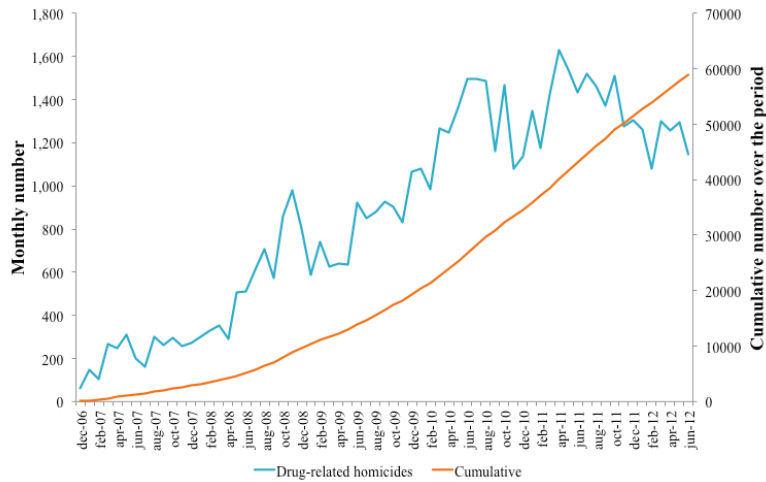
Though the drug-related violence wave was not widespread, many municipalities experienced some degree of violent unrest. According to official figures 1,032 of Mexico's 2,456 municipalities (42 percent) have had presence of a drug cartel operating within their limits in 2011. Almost half of these were concentrated in only seven out of 32 states—Michoacán, Estado de México, Guerrero, Jalisco, Chihuahua, Nuevo León, and Zacatecas. The presence of cartels and conflict also resulted in a concentration of homicides in well-identified areas of the country. In absolute terms, approximately two-thirds of all drug-related homicides in 2011 occurred in just five states:³ Chihuahua and Sinaloa account for 29 and 12 percent, respectively, while Tamaulipas, Guerrero, and Durango accounted, all three together, for almost 21 percent.⁴

² According to the National Security Council (Sistema Nacional de Seguridad Publica, SNPS), a homicide must meet two out of six criteria in order to be considered a drug-related crime: i) the victim was killed by high caliber firearms; ii) the victim presented signs of torture or severe lesions; iii) the victim was killed where the body was found, or the body was located in a vehicle; iv) the body was wrapped with blankets, taped, or gagged; v) the homicide occurred within a penitentiary and involved criminal organizations; and vi) the homicide occurred under special circumstances —e.g. victim was abducted prior to assassination (*levantón*), ambushed or chased, an alleged member of a criminal organization, or found with a narco-message (*narcomensaje*) on or near the body.

³ According to data from the SNPS, 2011 constitutes the peak in the drug-related homicides escalation with nearly 17,000 cases. April 2011 is identified as the month with the higher number of cases (1,630) registered between December 2006 and June 2012.

⁴ Out of the 1,032 municipalities that have a presence of a drug cartel, 392 experienced violent conflict, with the higher figures taking place in municipalities of the north and the Pacific coast affecting both municipalities that had historically observed high levels of violence —such as Ciudad Juárez—as well as places which had not experienced high levels of violence before —such as Monterrey. It highlights that while only 18 municipalities had more than 100 cases of drug-related homicides, a vast majority of 1,644 reported no cases at all (SNPS, 2011).

Figure 3: Drug-related homicides, monthly and cumulative number; 2007-12



Source: SNSP (2011, 2012).

Law Enforcement in Mexico

In Mexico, different levels of government are constitutionally responsible for prosecuting different crimes. As a result, prosecution efforts that target crimes which are the sole responsibility of one level of the government are not necessarily supported by the other levels. Incentives under this scheme tend to be perverse and generate much judicial inefficiency, which ultimately impacts negatively the rates of conviction and thus reduces the marginal cost of violent crime. Organized crime, for example, is not a crime that is prosecuted at the local level, which means state and municipal governments will not prosecute drug traffickers unless they commit murder (which does constitute a crime at the municipal level).

Analogous to the judiciary system, the organization of police forces in Mexico is also complex. Each police force has a different level of jurisdiction and authority, and those levels often overlap. Federal law enforcement agencies are responsible for overseeing law enforcement across the entire country. In addition, there are several police organizations at the state, metropolitan and municipal level. The distinction between crimes investigated by the Federal and the State Judicial Police is not always clear. Most offenses come under the jurisdiction of state authorities. Drug dealing, crimes against the government, and offenses involving several jurisdictions are the responsibility of the Federal Police; while preventive and municipal police forces are mainly responsible for handling minor civil disturbances and traffic infractions. The latter point is particularly relevant for this paper since we will use per capita spending on local police as a control variable. This variable is likely not endogenous to the observed crime rate since, as mentioned above, the spike in drug-related crime has been associated to the federal police and military intervention (and thus, should be closely linked to federal spending on police and security but not to local spending on citizen security).

4. Data

Data on Income, Poverty and Inequality at the Municipal Level

To construct income and inequality measures at the municipal level, we employ the small-area estimation methodology proposed by Elbers et al. 2003. The basic idea is to impute income to households in the Population Census (and Population Counts), using a model that predicts income from a household survey. Empirical evidence based on this method has proven to be precise when applied to data from nations like Ecuador, South Africa, Brazil, Panama, Madagascar and Nicaragua (see Elbers et al. 2003, Alderman et al. 2002, and Elbers et al. 2001). In addition, the small-area estimation methodology has key advantages as it benefits from the strengths of both household surveys and census and avoids their weaknesses. More specifically, whereas most household surveys are only representative at high levels of aggregation (e.g., national, regional, urban/rural), census and count data provide total coverage (universality).⁵ Typically, census data provide the inputs when welfare indicators at low levels of aggregation, such as municipalities, are needed. In Mexico, both the Census and the Population Counts are representative at the municipality level, which is the unit of interest in this study.

However, the census has its limits. First, fewer variables are available compared to the more comprehensive household surveys. Second, one of the main weaknesses of this data and the most relevant for this analysis is the lack of information on income. Census data, not designed to comprehensively measure household income, provides an incomplete picture of the household's monetary circumstances, usually underreporting total income. Alternatively, household surveys such as the National Survey on Household Income and Expenditures (ENIGH), while representative only at the national and urban/rural level, are nevertheless designed to measure more precisely household income and expenditures.

The method consists of taking the household survey as a random sample of the total population (found in the census databases) and choosing the common variables between these sources. The distribution of the chosen variables is compared, looking for variables in which the sample mean is statistically equivalent to the population mean. The variables that are not rejected are used to model income with ordinary least-squares (OLS) regressions using household survey data. It is important to note that the coefficients obtained from the model cannot be economically interpreted—as some of them are endogenous—but they are still included to reduce prediction error. Finally, the parameters obtained from these income regressions are employed as predictors to generate the household income distribution in the census and count data.⁶

⁵ Strictly speaking, Population Count data does not provide universal coverage as it consists in fact, of surveys not censuses. However, the sample size is large enough such that the data can be disaggregated to the municipal level and the level of precision of estimates is extremely high.

⁶ In order to construct poverty maps for a twenty-year period, the analysis identified fifteen common variables between the ENIGH and the Census and Population Counts, which can be used to generate around 35 indicators to construct the necessary income models. These variables include dwelling characteristics, socio-demographic characteristics and asset ownership. Moreover, to increase precision in the estimators, around 50 municipality-specific indicators were

To construct the panel of poverty maps, we used available micro data from the following sources: (i) General Population Censuses of 1990, 2000 and 2010; (ii) the Population Count of 2005; and (iii) the National Survey on Household Income and Expenditure (ENIGH) 1992, 2000, 2005, and 2010. Following Elbers et al. 2003, to produce income measures at the municipal level, we paired the ENIGH of 1992 with the 1990 Population Census; the ENIGH of 2000 with the 2000 Population Census; the ENIGH of 2005 with the 2005 Population Count; and, the ENIGH 2010 with the 2010 Census. With the exception of the 1992 ENIGH and the 2000 Population Census, the remaining matches between ENIGHs and Censuses were collected at the same time of year—which ensures that every match represents the same socioeconomic context. As of 2014 there were 2,438 municipalities in Mexico, however, for the rest of this paper we consider 2,372 municipalities for which there is comparable income, poverty and inequality data from the 1990-2010 panel of poverty maps (the 66 municipalities left out were created over the last twenty years).

Summary Statistics – Subnational Mean Income, Inequality and Poverty

As presented in Table 1, the summary statistics for the 2,372 municipalities followed over time show that mean real per capita income in Mexico in 2010 was lower than in 1990. This partly captures the effect of both the 1994-95 ‘Tequila Crisis’, the ‘dot-com bubble’ of 1999-2001, and the most recent 2008-09 global financial crisis. Alternative measures of social welfare such as the food poverty⁷ head count rate, the Gini coefficient, and literacy rates show marked improvements in 2010 (if compared to 1990). However, these positive trends are not as marked in magnitude with respect to the period that goes from 2005 to 2010.

Crime Indicators

Data on total number of homicides at the municipal level comes from official figures made public by Mexico's Technical Secretary for the National Security Council (SNPS). The SNSP compiles information through an extensive collaborative taskforce involving several state and federal enforcement agencies.⁸ Data on total homicides at the municipal level is available for the whole period under study; while monthly figures on drug and non-drug related crimes have been publicly released since 2006. In the analysis that follows, for each municipality, we have collapsed each of the

chosen, including geographical and socioeconomic variables derived from various sources (e.g., the Territorial Integration System, ITER; the National Population Council, CONAPO; and the Ministry of Social Development, SEDESOL).

⁷ The food poverty line is defined by the National Council for the Evaluation of Social Development Policy (*Consejo Nacional de Evaluación de la Política de Desarrollo Social*, CONEVAL), as lacking sufficient income to acquire a basic food basket. The Council presents income poverty estimations at the national level and in the rural and urban sectors using information generated by the National Statistics and Geography Institute (INEGI).

⁸ As described by Molzahn et al. 2012, the Center for Investigation and National Security (CISEN), the National Center for Information, Analysis and Planning to Fight Crime (CENAPI) within the Office of the Federal Attorney General (PGR), the Public Security Secretariat (SSP), Secretary of National Defense (SEDENA), the Secretary of the Navy (SEMAR), and the Secretary of the Interior (Gobernacion) are the institutions that participate in this collaborative effort.

crime variables available (total homicides rate, drug and non-drug related homicides) on a yearly basis.

Other Sources of Municipal Level Data

We have also gathered data on aggregate figures of public expenditures, literacy rates, and police expenditures at the municipal level in Mexico. The data on public expenditures was obtained from the State and Municipal System of Databases (SIMBAD) produced by the National Institute of Statistics, Geography, and Information (INEGI). The data on literacy rates (our proxy for human capital) is also obtained from public figures made available by INEGI, as is the data on public spending on police.

5. Estimation Strategy

The relationship between income inequality and crime can be described by the following equation:

$$y_{it} = \beta(Gini)_{it} + X_{it} \cdot \delta + \varepsilon_{it} \quad \text{where } \varepsilon_{it} = \mu_i + \omega_{it} \quad (1)$$

Where i indexes a municipality in Census/Count year t , y is a local crime rate indicator such as total murders per 100,000 inhabitants, $Gini$ is the Gini coefficient at the municipality level, and the coefficient β indicates the estimated effect of income inequality on local crime rate. X contains a set of time-varying municipality characteristics, such as the share of the population that is poor, the percentage of rural households, local public expenditures per capita, police expenditures per capita and median household income. The term ε_{it} captures the unobserved determinant of local crime rates, which depends on a permanent component μ_i and a transitory component ω_{it} .

Pooling four cross-sectional data from 1990, 2000, 2005 and 2010 for each municipality, we estimate:

$$\Delta y_{it} = \beta(\Delta Gini)_{it} + X_{it} \cdot \delta + \Delta \varepsilon_{it} \quad (2)$$

This first-difference specification absorbs the permanent component of the error term (μ_i). The coefficient of interest (β) indicates the relationship between changes in the Gini coefficient and changes in crime rates within a municipality over time, holding constant changes in median income and basic demographics.

Equation (2) is not sufficient to establish a causal relationship between income inequality and crime. The income distribution may affect crime through a number of channels such as lower social capital, higher returns to criminal activity, low mobility, higher distress, etc. However, higher crime rates may affect local inequality by diminishing the stock of physical capital and development of human capital, by raising segregation and eroding social capital, by affecting the capacity of local

governments and economic activity and by increasing the incentives to migrate to another municipality.

To mitigate concerns about this form of reverse causality, we construct an instrumental variable that is correlated with changes in local inequality but that is not associated with changes in local crime rates. Specifically, we follow Boustan et al. (2012) and predict the income distribution of a municipality based on the area's initial income distribution and national patterns of income growth; we then use the Gini coefficient for this predicted distribution as an instrument for the actual Gini coefficient.

In particular, we start with the initial (1990) average household income by *local* decile and municipality. We then estimate to which *national* percentile of the income distribution each *local* income decile belongs to in the initial year. For example, a household in the tenth (first) decile of a poor (rich) municipality might belong to the first (ninetieth) percentile at the national income distribution. Then, we allow the income of each local decile to grow over time as the income of its corresponding national percentile. By design, this instrument cannot be influenced by local factors such as the homicide rate or regional migration; rather, it isolates the component of change in the local income distribution (welfare variables) that is driven by national trends, such as changes in the return to skills and labor market institutions. In sum, this instrument allow us to isolate the change in the local income that is driven by national shifts and so, allows us to build 'counterfactual' welfare indicators, which should be correlated with municipal welfare indicators but not with local homicide rates or any other changes at the municipality level.

The instrumental variable approach will also help mitigate another potential source of bias. As the Gini coefficients at the local level were estimated using the poverty-mapping methodology (Elbers et al. 2003), they could be affected by measurement error, which may introduce the so-called *attenuation bias* in the OLS estimates. Since most of the time variation exhibited by our instrumental variable comes from national trends in the distribution of income, this helps mitigate measurement error biases in our municipal level income measures.

6. Results

A naïve OLS regression of equation (2), without addressing the reverse causality problem between income inequality and crime, leads one to conclude that higher inequality deters crime (see Table 2). In other words, increasing income inequality would be associated with lower crime rates in Mexican municipalities. According to the first column, a one-point increase in the Gini coefficient between 2006 and 2010 would be associated with a decrease of one drug-related murder per 100,000 inhabitants. That result holds in sign but differs in magnitude across all of our specifications. The main substantive conclusion, however, remains unchanged: i.e., increasing income inequality is correlated with lower crime rates, a counterintuitive result when compared with our hypothesized effect.

Several channels might contribute to this negative relationship between inequality and crime. For instance, if an increase in the crime rate within a municipality fosters the out-migration of richer households, then inequality might decrease as those households with less economic opportunities stay behind. In fact, there is empirical evidence that the increasing crime rates during this period have significantly raised geographic mobility among Mexican households. Rios (2013) estimates that a total of 264,693 individuals have migrated fearing organized crime activities in Mexico between 2005 and 2010. In addition, the paper presents anecdotal evidence whereby a significant number of these migrants do not belong to the lower part of the income distribution. For instance, while total immigration from Mexico to the United States declined during this period, the number of investor visas to Mexican nationals increased by 300 percent from 2000-2005 to 2005-2010.

Accordingly, a second mechanism that may be driving the negative correlation between inequality and crime is that increasing crime rates might depress home values and thereby affect the wealth and incomes of homeowners and real estate holders who do not move out. As a matter of fact, Rios (2013) shows that the number of vacant dwellings in Mexican border cities is quite high and correlates strongly with the rates of drug-related homicides.

Indeed, OLS estimates provide some interesting insights regarding the relationship between inequality and crime in Mexico. Nevertheless, they do not allow us to identify the causal effect of inequality on crime.

To identify the causal effect of inequality on crime, we estimate a 2SLS model. Table 3 shows the results of the first stage equation i.e., regressing the Gini coefficient using predicted inequality as the main explanatory variable. In Table 3, and in the rest of the 2SLS, we compute the instrumental variable using 1990 as the initial year for the 1990-2010 set of estimates, while we use 2000 as the initial year for the 2000-2010 and 2005-2010 estimates. The relationship between the predicted and actual Gini coefficients is strong and positive. In particular, the coefficient is close to 1 and its standard error is very low. The F-statistic of excluded instruments is equal to 97.53, 71.92 and 16.98 in 1990-2010, 2000-2010 and 2005-2010, respectively, all of them surpassing the conventional threshold for a strong instrument (see Stock and Yogo, 2005).

Table 4 shows our Two Stage Least Squares (2SLS) findings. Overall, our results show that for the 2005-2010 period, an increase of one point in inequality is associated with an increase of nearly five homicides. Moreover, this effect is larger if we focus solely on drug-related crimes, where an increase in the Gini coefficient of about one point is associated with an increase of more than 10 deaths. These results are a sharp contrast with our OLS estimates, suggesting that income inequality has indeed had a significant effect on drug-related murders between 2005 and 2010. The estimates are quite large in magnitude when compared to the actual changes in crime rates during this period: the number of drug-related deaths per 100,000 inhabitants increased by about 10 deaths between 2005 and 2010 in Mexico. In other words, changes in inequality within municipalities were significant at shaping the geography of drug-related crime rates during Mexico's Drug War. It is important to mention that between 2005 and 2010, many municipalities (78 percent of them) witnessed a decrease in inequality, a pattern that was also observed at the national level. In this

context, our results imply that if Mexico had not experienced such improvements in equality during this period, the increase in drug-related crimes might have been even more dramatic.

We do not find evidence that increasing inequality has had any effect on non-drug related crimes, which shows that the positive effects found on the total homicide between 2005 and 2010 are driven by drug-related crimes. In other words, the increasing social tensions and pecuniary incentives for criminal activity associated with inequality did not seem to drive the geographic pattern of crime rate changes before 2005. This result highlights the uniqueness of the Mexican situation between 2005 and 2010 as an experiment where the drop in the cost of criminal behavior facilitated the induction of individuals to the troops of drug-trafficking organizations.

It is important to mention that these models control for changes in poverty, thereby the estimated effect of inequality is mostly driven by changes in the upper portion of the income distribution. That is, the estimated positive effects of inequality on crime are more likely to stem from municipalities where rich households are becoming richer, which provide support to the pecuniary incentives mechanism discussed in Section 2. Table 4 shows that larger literate populations are associated with significantly lower crime rates across all specifications. At the same time, municipalities with higher police and public expenditures have experienced lower crime rates (although the coefficients are not always significant).

Robustness Checks

To check the robustness of the main results presented above (Table 4), we employ a variety of other specifications. These demonstrate that our main results are not driven by outliers or by the type of poverty measures used as control variables.

The first robustness exercise is to exclude outliers in our inequality measure, the Gini coefficient. To do so we remove those municipalities where the Gini coefficient falls within the following two criteria: 1. It is below the 5th percentile of the Gini coefficient distribution across municipalities, and 2. It exceeds the 95th percentile of the Gini coefficient distribution. As it can be noted, the results in Table 5 are similar in the order of magnitude and significance to the ones presented in Table 4.

In Mexico, the Technical Committee on Poverty Measurement adopted three monetary poverty measures since 2002: Food Poverty, Capacities Poverty, and Assets Poverty (these measures will be discontinued starting in 2014). The results presented in Table 4 use food poverty—the most restrictive monetary poverty indicator of the three as it measures poverty as the household’s lack of resources to afford a minimum basic diet. Therefore, to show that our results are still robust, we replace our poverty measure by the two less restrictive ones.⁹ Table 6 presents the results if we use the Capabilities Poverty rates instead of the Food Poverty ones. As shown, the main results remain unchanged in terms of magnitude and significance. If we use the Asset Poverty rates instead (Table

⁹ Capacities poverty is defined as the lack of resources within a household to afford a minimum diet, education and health expenses. Assets poverty expands the notion of capacities poverty to include households that cannot afford clothing, housing, energy, and transportation expenses.

7), we find a similar effect, although larger in terms of magnitude. For example, a unit increase in inequality increases the total number of homicides by more than 6 deaths. In the case of drug-related homicides a unit increase in inequality now leads to more than 13 deaths (instead of 10 when using Food Poverty).

Effects in Urban and Rural Areas

Scholars have shown that crime rates tend to be higher in large cities than in rural or small urban areas of the United States because the pecuniary benefits for crime are higher in the former than in the latter (Glaeser and Sacerdote, 1996). At the same time, non-pecuniary factors such as lower arrest probabilities and different family structures in large cities also tend to explain a large share of the crime rate gap across these areas; while this share varies by type of crime. Guerrero (2011) points out that drug-related organization in Mexico have broadened their scope of activities to other violent crimes (e.g., kidnapping, extortion, and vehicle theft), which in many cases are associated with increases in the homicide rate. This fact together with the lower costs associated with criminal activity during Mexico's Drug War imply that the effect of inequality on crime may have been different across urban and rural municipalities, since the change in the costs and benefits may have differed across areas as well.

Tables 8 and 9 present our results broken down by urban and rural municipalities.¹⁰ If we focus just on rural municipalities, the statistical significance of our main findings disappears across specifications (see Table 8), although in magnitude it increases. Now, when focusing on urban municipalities, we can see that our main result persists (see Table 9). However, the magnitude of the coefficients of our two main findings is reduced. In the case of urban municipalities a one unit increase in income inequality translates into an increase of more than four drug-related deaths and more than 3 total homicides for the period 2005 -2010. The fact that the main results are driven by urban municipalities is consistent with the effect of increasing inequality (and the associated increase in the expected benefits of criminal activity) on crime rates being larger in areas where arrest probabilities are lower and where the pecuniary benefits are already at a higher level.

7. Concluding Remarks

The effect of inequality on crime has been empirically addressed by many scholars but with mixed results and mostly for developed economies. This paper attempts to estimate the effect of income inequality on crime in a unique context: Mexico's Drug War. During this period, drug-trafficking organizations multiplied and expanded geographically across the country, facilitating the incorporation of individuals to criminal activities. We exploit a rich data set containing within-country variation in inequality and crime rates for the more than 2,000 Mexican municipalities

¹⁰ Urban municipalities are defined in this paper according to the National Population Council (CONAPO) definition of urban areas. In that sense, a municipality with more than 15,000 inhabitants will be considered urban; and a municipality with less than 15,000 will be considered a urban (or semi-urban) area.

covering a period of 20 years. We also use an instrumental variable for inequality that tackles problems of reverse causality and omitted variables, which would introduce biases of this effect on OLS estimates.

Our results show that for the period that goes from 2005 to 2010, an increment of one point in our income inequality measure (the Gini coefficient) represents an increase of more than 5 homicides per 100,000 inhabitants across Mexican municipalities. Moreover, when we differentiate between different types of crimes, we find that the effect is even larger for drug-related crimes, i.e., an increment of one point in the Gini coefficient translates into an increase of more than 10 drug-related homicides per 100,000 inhabitants across Mexican municipalities. The results are large when compared to the overall increase in crime rates during this period in Mexico and are robust across different specifications. An increase in the Gini coefficient did not affect crime rates before 2005. This highlights the fact that it is the combination of lower costs (associated with the expansion of drug gangs) and rising pecuniary benefits of criminal activity (associated with increasing inequality) that has a large impact on crime rates.

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Table 1. Descriptive Statistics

| Variable | 1990 | | 2000 | |
|---|----------|-----------|----------|-----------|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Real Income (MX\$ August 2010) ¹ | 18363.31 | 8890.44 | 16657.37 | 9838.59 |
| Gini Coefficient ¹ | 0.43 | 0.06 | 0.38 | 0.06 |
| Food Poverty Headcount ¹ | 0.42 | 0.21 | 0.45 | 0.25 |
| Share of Rural Population | 0.89 | 0.26 | 0.87 | 0.28 |
| Police Expenditure | | | 187.98 | 69.97 |
| Public Expenditure | 592.46 | 782.29 | 1498.23 | 1303.93 |
| Literacy Rate | 0.77 | 0.15 | 0.81 | 0.12 |
| Total Population ² | 33913.10 | 100515.40 | 40395.87 | 120041.60 |
| No. Observations | 2,372 | | 2,372 | |

| Variable | 2005 | | 2010 | |
|---|-----------|------------|-----------|------------|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Real Income (MX\$ August 2010) ¹ | 17,971.46 | 9,538.98 | 17,614.54 | 9,361.99 |
| Gini Coefficient ¹ | 0.38 | 0.05 | 0.34 | 0.04 |
| Food Poverty Headcount ¹ | 0.38 | 0.22 | 0.39 | 0.24 |
| Share of Rural Population | 0.87 | 0.28 | 0.86 | 0.29 |
| Police Expenditure | 182.46 | 68.60 | 250.14 | 90.84 |
| Public Expenditure | 2,324.52 | 1,757.12 | 3,037.27 | 2,267.26 |
| Literacy Rate | 0.83 | 0.11 | 0.86 | 0.10 |
| Total Population ² | 42,700.54 | 127,528.60 | 45,666.65 | 130,964.00 |
| No. Observations | 2,372 | | 2,372 | |

Source: ¹Author's own calculations using the ENIGH, Population Census and Population counts. ²Consejo Nacional de Población CONAPO

Table 2: OLS Estimates

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|-------------------------|-------------------------|-----------------------|------------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | -105.564** (50.081) | -31.690*** (8.040) | -8.301 (5.309) | -18.202** (8.449) | -86.240*** (21.439) |
| Log Median Income | 13.972 (40.088) | -0.575 (6.616) | 0.898 (4.518) | 1.282 (7.444) | 10.396 (14.602) |
| Poverty | -4.668 (71.892) | -4.923 (11.038) | -3.625 (8.020) | -10.691 (12.826) | 2.647 (24.679) |
| % Rural Population | -19.505 (19.326) | 1.026 (3.980) | -2.152 (2.938) | -8.324* (4.678) | -7.001 (7.811) |
| Log Public Expenditures | -9.160* (5.034) | -1.283 (1.453) | -1.756*** (0.464) | -4.349*** (0.840) | -9.432*** (2.500) |
| Log Police Spending | -56.332*** (9.884) | -10.195** (4.289) | | -5.118 (4.067) | -36.825*** (6.768) |
| Log Literate Population | -177.994*** (50.416) | -4.708* (2.599) | -15.031*** (4.583) | -35.915*** (10.784) | -74.078*** (24.271) |
| Dummy 2000 | | | -4.614 (4.778) | | |
| Dummy 2005 | | | -8.600*** (0.974) | -11.217*** (1.727) | |
| Constant | 57.377*** (15.958) | 10.144*** (2.350) | 17.972*** (1.775) | 23.048*** (2.935) | 35.354*** (5.021) |
| Number of observations | 1,872 | 1,872 | 5,991 | 3,839 | 1,872 |
| R2 | 0.064 | 0.016 | 0.026 | 0.045 | 0.062 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 3: First Stage Regressions

| | Gini 1990-2010 | Gini 2000-2010 | Gini 2005-2010 |
|-----------------------------|----------------------|----------------------|----------------------|
| Predicted Gini - Instrument | 1.360*** (0.082) | 0.909*** (0.066) | 0.883*** (0.263) |
| Log Median Income | 0.123*** (0.013) | 0.085*** (0.015) | 0.079*** (0.018) |
| Poverty | 0.233*** (0.026) | 0.214*** (0.029) | 0.206*** (0.034) |
| % Rural Population | 0.059*** (0.009) | 0.060*** (0.010) | 0.061*** (0.012) |
| Log Public Expenditures | 0.001 (0.002) | 0.004 (0.003) | 0.016*** (0.004) |
| Log Literate Population | -0.003 (0.005) | -0.002 (0.009) | -0.010 (0.012) |
| Dummy 2000 | -0.012 (0.016) | | |
| Dummy 2005 | 0.044*** (0.002) | 0.125*** (0.009) | |
| Log Police Spending | | -0.006 (0.013) | -0.030 (0.019) |
| Constant | -0.053*** (0.004) | -0.050*** (0.006) | -0.043*** (0.008) |
| Number of observations | 5,991 | 3,839 | 1,872 |
| R2 | 0.196 | 0.193 | 0.072 |

Dependent Variable: Difference in Inequality

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 4: 2SLS Estimates

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|--------------------------|-------------------------|-----------------------|------------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 1,075.731** (524.046) | -105.444 (83.444) | 19.681 (14.957) | -29.163 (21.017) | 481.147* (261.650) |
| Log Median Income | -75.096 (57.604) | 4.986 (10.219) | -1.730 (4.324) | 2.222 (7.734) | -32.384 (24.585) |
| Poverty | -242.676* (128.463) | 9.938 (21.764) | -8.330 (7.894) | -8.545 (13.675) | -111.671* (57.319) |
| % Rural Population | -93.306** (42.282) | 5.634 (6.999) | -3.925 (3.028) | -7.606 (5.058) | -42.448** (19.451) |
| Log Public Expenditures | -27.852** (10.922) | -0.116 (1.996) | -1.629*** (0.503) | -4.219*** (0.895) | -18.410*** (6.117) |
| Log Police Spending | -26.032 (25.832) | -12.087** (5.201) | | -5.316 (4.122) | -22.271 (13.639) |
| Log Literate Population | -168.811*** (52.518) | -5.281* (2.806) | -15.352*** (5.002) | -35.900*** (10.777) | -69.668*** (25.931) |
| Dummy 2005 | | | -7.898 (5.123) | -10.786*** (1.989) | |
| Dummy 2010 | | | 1.527 (4.600) | | |
| Constant | 125.368*** (38.616) | 5.899 (5.761) | 17.501*** (6.251) | 22.359*** (3.436) | 68.011*** (17.528) |
| Number of observations | 1,872 | 1,872 | 5,991 | 3,839 | 1,872 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: 2SLS Estimates trimming for outliers in Inequality

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|--------------------------|-------------------------|-----------------------|------------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 1,063.729** (427.422) | -56.199 (63.763) | 27.399* (15.126) | -10.325 (18.880) | 546.012** (224.973) |
| Log Median Income | -67.677 (55.366) | 2.637 (9.631) | -1.898 (5.497) | 1.878 (9.012) | -32.235 (23.990) |
| Poverty | -236.265** (114.170) | 1.337 (18.970) | -8.768 (9.855) | -12.085 (15.538) | -121.677** (51.843) |
| % Rural Population | -89.048** (36.934) | 2.702 (5.835) | -3.135 (3.199) | -7.505 (5.207) | -43.267** (17.313) |
| Log Public Expenditures | -24.789*** (9.381) | -0.589 (1.819) | -1.690*** (0.490) | -4.588*** (0.912) | -17.761*** (5.321) |
| Log Police Spending | -38.934 (24.498) | -10.452** (4.607) | | -6.637 (4.088) | -26.223* (13.614) |
| Log Literate Population | -184.391*** (58.708) | -5.274* (2.741) | -16.588*** (5.227) | -39.645*** (12.111) | -75.593*** (28.898) |
| Dummy 2005 | | | -1.841 (5.760) | -12.492*** (2.157) | |
| Dummy 2010 | | | -10.528*** (1.550) | | |
| Constant | 131.347*** (35.183) | 8.251 (5.043) | 20.748*** (2.597) | 24.615*** (3.855) | 74.167*** (16.544) |
| Number of observations | 1,710 | 1,710 | 5,424 | 3,480 | 1,710 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6: 2SLS Estimates using Alternative Poverty Measures: Capacities Poverty

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|--------------------------|-------------------------|-----------------------|------------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 1,074.926** (527.756) | -104.996 (84.881) | 18.077 (14.343) | -23.125 (23.958) | 490.354* (266.998) |
| Log Median Income | -56.152 (51.413) | 4.432 (8.127) | -2.422 (3.793) | -0.276 (6.342) | -18.556 (20.222) |
| Capacities Poverty | -192.962* (105.703) | 8.355 (16.236) | -9.634 (7.016) | -14.016 (11.464) | -78.361* (43.773) |
| % Rural Population | -96.386** (43.596) | 5.810 (7.081) | -3.900 (3.046) | -8.920* (5.172) | -42.699** (19.830) |
| Log Public Expenditures | -31.271*** (12.019) | 0.010 (2.200) | -1.761*** (0.467) | -4.264*** (0.897) | -20.317*** (6.823) |
| Log Police Spending | -27.801 (27.394) | -11.972** (5.250) | | -5.724 (4.109) | -22.100 (14.408) |
| Log Literate Population | -175.327*** (53.590) | -5.033* (2.786) | -15.354*** (4.679) | -35.894*** (10.760) | -73.109*** (26.190) |
| Dummy 2005 | | | -1.349 (3.967) | -11.370*** (2.103) | |
| Dummy 2010 | | | -9.906*** (1.448) | | |
| Constant | 124.212*** (37.708) | 5.896 (5.499) | 20.083*** (2.279) | 23.509*** (3.515) | 66.333*** (16.890) |
| Number of observations | 1,872 | 1,872 | 5,991 | 3,839 | 1,872 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 7: 2SLS Estimates using Alternative Poverty Measures: Patrimonial Poverty

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|---------------------|-------------------------|---------------|------------|------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 1,368.335* | -119.237 | 18.665 | -14.627 | 632.434* |
| | (752.448) | (113.135) | (15.490) | (17.116) | (378.355) |
| Log Median Income | 108.482 | -3.623 | 0.551 | 1.448 | 62.124* |
| | (70.954) | (10.030) | (2.338) | (3.213) | (37.732) |
| Patrimonial Poverty | 157.512 | -8.903 | -3.792 | -12.439 | 95.026 |
| | (137.950) | (21.672) | (7.761) | (10.415) | (72.715) |
| % Rural Population | -43.618 | 3.113 | -3.200 | -9.587** | -15.117 |
| | (30.449) | (4.405) | (3.037) | (4.815) | (14.486) |
| Log Public Expenditures | -37.095** | 0.257 | -1.733*** | -4.342*** | -22.613*** |
| | (15.183) | (2.503) | (0.473) | (0.886) | (8.372) |
| Log Police Spending | 3.058 | -13.475* | | -5.222 | -7.076 |
| | (42.749) | (7.082) | | (4.192) | (22.051) |
| Log Literate Population | -181.410*** | -4.798 | -15.390*** | -36.083*** | -75.165*** |
| | (58.636) | (2.951) | (4.714) | (10.822) | (28.246) |
| Dummy 2005 | | | -4.516* | -11.589*** | |
| | | | (2.482) | (2.052) | |
| Dummy 2010 | | | -9.809*** | | |
| | | | (1.407) | | |
| Constant | 81.520*** | 8.029*** | 19.361*** | 23.525*** | 44.755*** |
| | (21.486) | (2.316) | (1.946) | (2.977) | (9.929) |
| Number of observations | 1,872 | 1,872 | 5,991 | 3,839 | 1,872 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 8: 2SLS Estimates for Rural Municipalities

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|--------------------------|-------------------------|----------------------|-----------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 3,885.398 (4,850.315) | -467.083 (523.939) | 36.293 (22.209) | 11.976 (31.853) | 886.891 (1,277.246) |
| Log Median Income | -104.987 (209.248) | 19.104 (24.136) | 2.968 (5.346) | 12.240 (8.844) | 4.740 (48.749) |
| Poverty | -377.668 (540.208) | 48.304 (60.173) | 1.144 (9.870) | 7.741 (15.745) | -42.272 (130.372) |
| Log Public Expenditures | -96.365 (104.439) | 5.894 (11.359) | -1.260* (0.732) | -6.468*** (1.381) | -33.080 (28.355) |
| Log Police Spending | 80.715 (228.452) | -21.340 (27.252) | | 9.271 (7.707) | 21.077 (59.818) |
| Log Literate Population | -504.924** (257.004) | 18.571 (22.309) | -19.729** (8.160) | -44.640** (21.794) | -147.036 (94.176) |
| Dummy 2005 | | | -3.867 (5.766) | -5.211* (3.090) | |
| Dummy 2010 | | | -7.994*** (2.359) | | |
| Constant | 269.963 (236.578) | -15.213 (25.250) | 15.280*** (3.398) | 14.084*** (4.860) | 67.410 (62.306) |
| Number of observations | 924 | 924 | 3,175 | 1,969 | 924 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 9: 2SLS Estimates for Urban Municipalities

| | Drug related crimes | Non-drug related crimes | Homicide Rate | | |
|-------------------------|-------------------------|-------------------------|-----------------------|-----------------------|------------------------|
| | 2006-2010 | 2006-2010 | 1990-2010 | 2000-2010 | 2005-2010 |
| Gini | 474.477** (195.818) | -0.933 (80.104) | -8.645 (17.272) | 3.952 (22.152) | 375.420* (198.001) |
| Log Median Income | -40.016* (23.968) | -3.200 (10.470) | -4.781 (7.564) | -8.150 (11.767) | -40.786 (26.656) |
| Poverty | -163.079*** (57.403) | -14.249 (25.293) | -12.592 (13.317) | -26.961 (20.183) | -150.240** (62.572) |
| Log Public Expenditures | -8.906* (5.057) | 3.730 (2.924) | -1.240** (0.581) | -1.442 (1.110) | -2.700 (5.273) |
| Log Police Spending | -23.552* (14.280) | -13.199*** (5.114) | | -14.354*** (4.954) | -36.257*** (13.174) |
| Log Literate Population | -31.658** (14.074) | -10.627** (5.380) | -14.781*** (2.973) | -35.216*** (6.263) | -38.032** (15.549) |
| Dummy 2005 | | | -9.909 (8.569) | -17.464*** (2.429) | |
| Dummy 2010 | | | 0.317 (7.881) | | |
| Constant | 61.039*** (13.587) | 14.610*** (5.408) | 22.069** (10.473) | 32.004*** (4.355) | 66.232*** (13.842) |
| Number of observations | 955 | 955 | 2,838 | 1,884 | 955 |

Dependent Variable: Difference in Crime Rates.

Robust Std. Errors within parentheses

All regressions are weighted by population size.

All monetary measures are expressed in real terms as August of 2010.

Significance levels: *** p<0.01, ** p<0.05, * p<0.1