The relative contribution of income inequality and imprisonment to the variation in homicide rates among Developed (OECD), South and Central American countries

Paulo Nadanovsky a, *, Joana Cunha-Cruz b

a Department of Epidemiology, Institute of Social Medicine, Rio de Janeiro State University, 7th andar, RJ, Brazil
b University of Washington, Seattle, WA, USA

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ABSTRACT

Homicide rates vary widely across and within different continents. In order to address the problem of violence in the world, it seems important to clarify the sources of this variability. Despite the fact that income inequality and imprisonment seem to be two of the most important determinants of the variation in homicide rates over space and time, the concomitant effect of income inequality and imprisonment on homicide has not been examined. The objective of this cross-sectional ecological study was to investigate the association of income inequality and imprisonment with homicide rates among Developed (OECD), South and Central American countries. A novel index was developed to indicate imprisonment: the Impunity Index (the total number of homicides in the preceding decade divided by the number of persons in prison at a single slice in time). Negative binomial models were used to estimate rate ratios of homicides for young males and for the total population in relation to Gini Index and Impunity Index, controlling for infant mortality (as a proxy for poverty levels), Gross Domestic Product per-capita, education, percentage of young males in the population and urbanization. Both low income inequality and low impunity (high imprisonment of criminals) were related to low homicide rates. In addition, we found that countries with lower income inequality, lower infant mortality (less poverty), higher average income (GDP per-capita) and higher levels of education had low impunity. Our results are compatible with the hypothesis that both low income inequality and imprisonment of criminals, independent of each other and of other social-structural circumstances, may greatly contribute to the reduction in homicide rates in South and Central American countries, and to the maintenance of low levels of homicides in OECD countries. The Impunity Index reveals that countries that show greater commitment to education and to distribution of income also show greater commitment to punish serious criminal behavior.

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Introduction

Homicide rates vary widely across and within different continents. For instance, some South and Central American countries have very high homicide rates such as Colombia, El Salvador, Venezuela and Brazil. Their homicide rates in 2000 were 54, 35, 26 and 26 victims per 100,000 persons. At the same time, Peru, Chile, Uruguay and Costa Rica had rates of 2, 5, 6 and 6 per 100,000 persons. In contrast, the country-members of the Organization for Economic Co-operation and Development (OECD), which comprises 30 of the most developed economies in the world that are committed to democracy and the market economy, had low homicide rates in 2000: Japan, Germany, UK and France had less than 1 victim per 100,000 persons. Other countries of the OECD had higher homicide rates, but they are still lower than or equal to the lowest homicide rates from South American and Central American countries. For example, the USA, Finland, Hungary and the Slovak Republic respectively had 6, 3, 3 and 2 victims per 100,000 persons. In order to address the problem of violence in these parts of the world, it seems important to clarify the sources of this variability.

Some Latin American countries are facing brutal levels of violence, reflected in their very high homicide rates. A useful question is: why are violence and criminality so high in some
Latin American countries compared to most central democracies in the world?

Income inequality has been related to crime and homicides (Babones, 2008; Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; Kawachi, Kennedy, & Wilkinson, 1999; Kennedy, Kawachi, & Prothrow-Stith, 1996; Kennedy, Kawachi, Prothrow-Stith, Lochner, & Gupta, 1998; Wilkinson, Kawachi, & Kennedy, 1998; Wilson & Daly, 1997). Kaplan et al. (1996), in one of the first reports of an association between variation in income distributions within a single country and a variety of health outcomes, found that the strongest correlation was with rate of homicide; they reported a highly significant correlation ($r = -0.74$) between the proportion of total household income received by the less well off 50% and homicide rates, adjusted for median income, among the states of the USA in 1989–1991. In a similar USA state-level study, the Robin Hood index predicted homicide, with or without adjustment for poverty, and the Gini coefficient measure was also strongly associated with homicide ($r = 0.72$; see correction in the BMJ of 11 of May 1996 page 1194) (Kennedy et al., 1996). In a subsequent analysis, Kennedy et al. argued that state-level variations (also among the states of the USA) in both income inequality (Robin Hood index) and social capital predicted firearm homicide, assault, and robbery rates independently of poverty and firearm availability; and that the effect of income inequality on violent crime, including homicide, was mediated by its effect on social capital (Kennedy et al., 1998). A further USA state-level data analysis suggested that violent crime, but not property crime, was closely related to income inequality (Robin Hood index), social trust and mortality rates, excluding homicide (Wilkinson et al., 1998). The authors argued that feeling shamed, humiliated and disrespected seem to be central to the picture and are plausibly related to the way in which wider income differences are likely to mean that more people are denied access to traditional sources of status and respect (Wilkinson et al., 1998). Similarly, violent crimes (homicide, assault, robbery) were consistently associated with relative deprivation (income inequality) and indicators of low social capital among the USA states (Kawachi et al., 1999). In comparisons among Chicago neighborhoods, homicide rates in 1988–1993 varied more than 100-fold, while male life expectancy at birth ranged from 54 to 77 years, even with effects of homicide mortality removed. This “cause deleted” life expectancy was highly correlated with homicide rates and a measure of economic inequality (Robin Hood index) added significant additional predictive value, whereas median household income did not. The Robin Hood index in this study had a strong association ($r = 0.75$) with homicide rates (Wilson & Daly, 1997). According to Babones (2008) a large literature now exists on the cross-national correlation between income inequality and population health but existing studies suffer from sparse data, poor operationalization of income inequality, and the use of low-power statistical models. He estimated the ecological correlation between income inequality and indicators of population health in a very broad panel of countries, and demonstrated that this relationship is largely non-artifactual. Gini coefficients of national income inequality in 1970 and 1995 were correlated with life expectancy, infant mortality rates, and murder rates, controlling for national income per-capita (Babones, 2008).

Recently, Pridemore (2008) criticized the fact that the cross-national ecological studies that showed strong effects of income inequality on homicide did not take into account the effects of poverty. He suggested that an appropriate way to do so was to use infant mortality rates as a proxy for poverty. When he did, the effect of inequality, measured by Gini Index, disappeared. Fajnzylber, concerned that crime prevention efforts could confound the association between income inequality and homicide rates across countries (“One such factor that could lead to a spurious correlation between income inequality and crime rates is the limited amount and the unequal distribution of crime prevention efforts that could be present in more unequal countries.”), assessed and found in a cross-national study that the homicide inducing effect of Gini remained even after controlling for the number of police per-capita and capital punishment (Fajnzylber, Lederman, & Loayza, 2002a, 2002b). However, the inequality-homicide studies usually did not consider the effect of imprisonment as a possible confounder.

Another factor influencing homicide rates is the imprisonment rates. Based almost exclusively on data from the USA, there is strong evidence that imprisonment reduces crime (and homicides) (Levitt, 2004; Marvell & Moody, 1997; Nagington 1998; Spelman, 2000). The imprisonment of criminals may be important not only for its direct incapacitating and deterrent effects, but also for its role in increasing and maintaining social cohesion. “It is reasonable to assume that even in a well-ordered society the coercive powers of government are to some degree necessary for the stability of social cooperation” (Rawls, 1971). “Models of the evolution of costly punishment suggest that societies in which costly punishment is common will exhibit stronger norms of fairness and pro-sociality, because the existence of costly punishment is what allows such norms to remain stable against invading defectors” (Henrich et al., 2006).

Despite the fact that income inequality and imprisonment seem to be two of the most important determinants of the variation in homicide rates over space and time, to our knowledge the relative contribution of one and the other has not been examined. We would like to explore the concomitant effect of income inequality and imprisonment on homicide. Our theoretical model is as follows: small income inequality increases social cohesion and reduces crime (Kawachi, Kennedy, Lochner, & ProthrowStith, 1997; Kawachi et al., 1999; Wilkinson et al., 1998), and at the same time increases the commitment/effort to punish crime (Henrich et al., 2006; Price, Cosmides, & Tooby, 2002) (Boyd & Richerson, 1992; Fehr & Gachter, 2002), consequently reducing the number of crimes not accounted for by the number of people in prison (less impunity). This scenario further contributes to the reduction in crime and the maintenance of low levels of crime. Conversely, large income inequality reduces social cohesion and increases crime. The reduction in social cohesion stimulates free-riding (crime); and the commitment/effort to punish crime also decreases. Under these circumstances it may even be the case that crime becomes an attractive alternative to legal avenues for people to meet their needs, and therefore not to punish crime also becomes an attractive alternative (more impunity). This opposed scenario would further contribute to an increase in crime and the maintenance of high levels of crime.

In a cross-sectional study, in which the number of crimes is indexed by the number of homicides, our theoretical model should be reflected in the data as follows (hypotheses): 1) lower homicide rates in countries with smaller income inequality; 2) lower homicide rates in countries with less impunity; 3) less impunity in countries with smaller income inequality.

The objective of this study was to assess the relative contribution of income inequality and impunity to the variation in homicide rates among Developed (OECD), South and Central American countries. One of our main motivations to carry out this study was to help Latin American countries that are facing brutal levels of violence, such as Brazil, Venezuela and Colombia, to consider plausible explanations of why they might be experiencing such high levels of violence compared to most central democracies in the world. To assess impunity, we developed an Impunity Index which is the ratio of the number of homicides in the preceding 10 years by the number of persons in prison in a single slice in time. As a secondary aim we assessed the association of the Impunity Index with income inequality and other country characteristics.
Methods

A cross-sectional ecological study was conducted including 41 countries from South and Central Americas and OECD. The rationale for our sample selection is as follows: South and Central American countries use modern democracies as their model of economic, political and social development and they compare themselves mainly to central economies of the modern world such as those of the OECD. Latin American countries also have strong economic and social relationships with these countries. In addition, since income inequality and incarceration of criminals were two strong candidates that could help explain differences in homicide rates between countries, we needed to identify countries that varied as much as possible regarding these two variables. Restricting the analysis to South and Central American countries could lead to a sample with not enough variation in the variables of interest (for example, the scarcity of countries with low inequality and with low impunity). At the same time, ideally the countries included should vary as little as possible regarding other variables, especially those that we would be unable to control for in the multivariate models. So, we tried to select a sample of countries as homogeneous as possible regarding unmeasured cultural attributes and as heterogeneous as possible regarding income inequality and impunity.

Our main outcome variables were homicide victimization among 15–44-year-old men in the year 2000, and total homicide victimization in the year 2000. Data on the number of homicide deaths (International Classification of Disease version 10, codes X85-Y09) and on population counts by age and gender were primarily obtained from the World Health Organization mortality statistics, and combined to derive homicide rates (http://www.who.int/whosis/en/ – accessed between April and July 2008). Population data for Peru and Nicaragua were from U.S. Census Bureau, International Database (http://www.census.gov/ipc/www/idb/ – accessed in July 2008).


The Impunity Index is a novel index based on the sum of the number of homicides from 1990 through 1999 divided by the total population count and of the young male population count. The Impunity Index was related to Gini Index and demographic and socioeconomic characteristics of the countries were examined using descriptive statistics. The Impunity Index was related to Gini Index and the other socio-demographic variables using linear regression. We used negative binomial models to estimate rate ratios of homicides for young males and for the total population in relation to Gini Index and Impunity Index, controlling for potential confounding variables. The dependent variables were the numbers of homicides of young males and of the total population. The logs of the young male population count and of the total population count were included in the models as offset terms. The negative binomial model was chosen due to evidence of data over-dispersion and better model fit (smaller differences between predicted and observed rates and smaller Akaike information criterion) than other count models. The means from the highest (5.3) and lowest (2.7) tertiles of the Gini Index and the means from the highest (1.4) and lowest (0.1) tertiles of the Impunity Index were calculated and the predicted homicide rates for the cross-tabulation of high and low Gini Index and high and low Impunity Index were estimated based on the multiple negative binomial model, holding the other covariates at their mean. Analyses were performed using Stata 10.

Results

Homicide rates varied from lows of 0.5 (overall) and 0.6 (15–44-year-old men) per 100,000 in Japan to highs of 53.8 (overall) and 175.6 (young men) per 100,000 in Colombia. Gini Index of income inequality and Impunity Index also showed marked differences, especially comparing OECD with non-OECD countries; OECD countries showed much less income inequality and impunity (see electronic appendix, available in the online version of the paper: LINK). The overall mean, standard deviation, minimum and maximum values for the variables entered in the study are shown in Table 1.

Based on the unadjusted coefficients, countries with lower income inequality, lower infant mortality (less poverty), higher average income (GDP per-capita) and higher education had less impunity. In the adjusted regressions, income inequality, per se, did not predict impunity and none of the other predictors had a significant association with impunity (Table 2).

Fig. 1 portrays the strong relationships between Gini Index of income inequality and the two homicide rates (logged), as well as
between Impunity Index (logged) and the two homicide rates (logged).

Income inequality, impunity and education were the primary significant predictors of both homicide rates, in the adjusted models. Young male homicide rates increased 86% for every point increase in the Gini Index (Gini varied from 2.3 to 5.9), and more than doubled for every point increase in the Impunity Index in the log scale (the Impunity Index varied, in the log scale, from −2.59 to 1.58, and in the original scale from 0.1 to 4.9) (Table 3). Similar results were obtained when a dummy variable indicating whether or not the country was from the OECD was included in the models (data not shown).

On average the predicted homicide rates in countries with low Gini and low impunity were 2 per 100,000 for young males and 1 per 100,000 for the total population. Among the high Gini Index and high Impunity Index countries, the predicted rates were 43 and 14 per 100,000 for young males and total population, respectively (Table 4).

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs*</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min.</th>
<th>Max.</th>
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<tr>
<td>Young male homicide count&lt;sup&gt;b&lt;/sup&gt;</td>
<td>41</td>
<td>2077.4</td>
<td>6245.9</td>
<td>2</td>
<td>35,141</td>
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<tr>
<td>Total population homicide count&lt;sup&gt;c&lt;/sup&gt;</td>
<td>41</td>
<td>2964.3</td>
<td>5244.1</td>
<td>6</td>
<td>45,343</td>
</tr>
<tr>
<td>Gini&lt;sup&gt;d&lt;/sup&gt;</td>
<td>41</td>
<td>3.8</td>
<td>1.1</td>
<td>2.3</td>
<td>5.9</td>
</tr>
<tr>
<td>Impunity&lt;sup&gt;e&lt;/sup&gt;</td>
<td>41</td>
<td>0.5</td>
<td>0.9</td>
<td>0.13</td>
<td>4.9</td>
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<tr>
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<td>11.7</td>
<td>10.5</td>
<td>2.7</td>
<td>39</td>
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<tr>
<td>% Urban&lt;sup&gt;g&lt;/sup&gt;</td>
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<td>73.2</td>
<td>13</td>
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<td>97.1</td>
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<td>% Young male&lt;sup&gt;h&lt;/sup&gt;</td>
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<td>18.6</td>
<td>11.7</td>
<td>2.1</td>
<td>55.5</td>
</tr>
<tr>
<td>Education&lt;sup&gt;j&lt;/sup&gt;</td>
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<td>9.2</td>
<td>0.8</td>
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<td>9.0</td>
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<td>5.9</td>
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<td>41</td>
<td>9.2</td>
<td>0.8</td>
<td>65.2</td>
<td>9.0</td>
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### Table 2

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<th>Variable</th>
<th>Obs</th>
<th>Crude coefficient (95% CI)</th>
<th>Adjusted coefficient&lt;sup&gt;a&lt;/sup&gt; (95% CI)</th>
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</thead>
<tbody>
<tr>
<td>Gini&lt;sup&gt;a&lt;/sup&gt;</td>
<td>41</td>
<td>0.54 (&lt;0.21 to 0.86)</td>
<td>0.40 (&lt;0.23 to 1.03)</td>
</tr>
<tr>
<td>Infant mortality&lt;sup&gt;b&lt;/sup&gt;</td>
<td>41</td>
<td>0.06 (&lt;0.03 to 0.09)</td>
<td>0.01 (&lt;0.07 to 0.08)</td>
</tr>
<tr>
<td>% Urban&lt;sup&gt;c&lt;/sup&gt;</td>
<td>41</td>
<td>−0.02 (&lt;−0.04 to 0.00)</td>
<td>−0.00 (&lt;−0.02 to 0.01)</td>
</tr>
<tr>
<td>% Young male&lt;sup&gt;d&lt;/sup&gt;</td>
<td>41</td>
<td>0.13 (&lt;0.04 to 0.31)</td>
<td>−0.08 (&lt;−0.21 to 0.06)</td>
</tr>
<tr>
<td>GDP&lt;sup&gt;e&lt;/sup&gt;</td>
<td>41</td>
<td>−0.04 (&lt;−0.07 to −0.01)</td>
<td>0.00 (&lt;−0.02 to 0.02)</td>
</tr>
<tr>
<td>Education&lt;sup&gt;f&lt;/sup&gt;</td>
<td>41</td>
<td>−0.67 (&lt;−1.12 to −0.22)</td>
<td>−0.30 (&lt;−0.96 to 0.36)</td>
</tr>
</tbody>
</table>

Note: regressions with robust standard errors.

<sup>a</sup> P < 0.05.

<sup>b</sup> Gini − Gini Index of income inequality in year 2000 (can vary from 1 to 10).

<sup>c</sup> Infant mortality – infant mortality rates per 1000 live births in year 2000 (proxy for poverty levels).

<sup>d</sup> % Urban – percentage of population living in urban areas in year 2000.

<sup>e</sup> % Young male – percentage of 15–44-year-old males in the population in year 2000.

<sup>f</sup> People imprisoned reveals that countries that show greater commitment to education and to distribution of income also show greater commitment to punish serious criminal behavior.

<sup>g</sup> GDP – Gross Domestic Product (GDP) per-capita, based on purchasing parity power in year 2000 (in thousands of dollars).

<sup>h</sup> Education – education component of the Human Development Index in year 2000 (can vary from 0 to 10).

<sup>i</sup> R-squared = 0.468.

### Discussion

Our results are compatible with the hypothesis that both low income inequality and imprisonment of criminals, independent of each other and of other social-structural circumstances, may greatly contribute to the reduction in homicide rates in South and Central American countries, and to the maintenance of low levels of homicides in OECD countries. The novel Impunity Index that relates the number of homicides in the preceding decade to the number of people imprisoned reveals that countries that show greater commitment to education and to distribution of income also show greater commitment to punish serious criminal behavior.

### Income inequality and homicide

The theory linking inequality to homicide is convincing: inequality exacerbates competition and reduces social cohesion (Daly, Wilson & Vasdev, 2001; Kawachi et al., 1997; Wilson & Daly, 1997). In the criminological literature, the effect of inequality and of poverty on homicide has been tested in dozens of studies, as illustrated by two reviews (Messner & Rosenfeld, 1999; Pratt & Cullen, 2005). One meta-analysis included 167 effect size estimates of the effect of inequality on crime (with an adjusted mean effect of 0.207) and 153 effect size estimates for the effect of poverty on crime (with an adjusted mean effect of 0.253). These results lead the authors to conclude that “The effects of both poverty and inequality on crime are fairly robust” (Pratt & Cullen, 2005). In the public health literature, there is more support for the effect of inequality on homicide than for the effect of poverty on homicide; societies of greater inequality show higher homicide rates (Kaplan et al., 1996; Kawachi et al., 1999; Kennedy et al., 1996, 1998; Wilkinson et al., 1998; Wilson & Daly, 1997). There is a strong, consistent, statistically significant, non-artificial correlation between national income inequality and population health (and separately for murder rates also), but though there is some evidence that this relationship is causal, the relative stability of income inequality over time in most countries makes causality difficult to test (Babones, 2008).

In the present study, we used confounding factors similar to Pridemore’s study (Pridemore, 2008), but the effect of inequality, measured by the Gini Index, did not disappear after controlling for poverty and other social factors. On the contrary, in our study Gini remained a strong, independent and significant predictor of variation in homicides. May be, the different results obtained by Pridemore and by ourselves were due to the different countries included in the two studies. In our study, income inequality appeared to affect young males more than the general population; a one unit increase in the Gini Index was associated with 86% more homicides in 15–44-year-old men, but with only 44% more homicides in the total population. One possible reason for this finding is that homicide rates among young males are the most responsive to varying economic circumstances and other cues that disadvantaged young men use to predict their prospects and modulate their risk-proneness (Daly & Wilson, 1988). Poverty (measured by infant mortality, as suggested by Pridemore), on the other hand, lost its significant bivariate association with homicide rates once income inequality and the other covariates were considered. In other words, controlling for income inequality and the other socioeconomic and demographic variables, poverty did not explain the variation in homicide rates.

### Imprisonment and homicide

Imprisonment may affect homicides in two ways: removing killers (and “future” killers, i.e., those who committed serious
crimes but have not killed yet) from the streets renders them incapable of committing further homicides (incapacitation), and the threat of being arrested dissuades unincarcerated people from crimes but have not killed yet (deterrence) (Levitt, 2004; Nagin, 1998; Spelman, 2000). In the present cross-national study we found that a one unit increase in the Impunity Index (in the log scale) was associated with 13% fewer homicides, and for every additional prisoner, approximately 0.3 murders were averted in the number of studies have examined the effect of imprisonment on crime in general, fewer have examined the effect of imprisonment on homicide. Possibly, the best estimate of this effect comes from Marvell and Moody’s time-series analysis between 1930 and 1994 (Marvell & Moody, 1997). In this analysis, a 10% increase in prison population was associated with 13% fewer homicides, and for every additional prisoner, approximately 0.3 murders were averted in the

Table 3
Predictor variables’ rate ratios from the negative binomial models for young males and total population homicides, in South American, Central American and OECD countries.

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Young Male Homicide</th>
<th>Total Population Homicide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude Rate Ratio (95% CI)</td>
<td>Adjusted Rate Ratio (95% CI)</td>
</tr>
<tr>
<td>Gini¹</td>
<td>3.36* (2.76–4.09)</td>
<td>1.80* (1.43–2.14)</td>
</tr>
<tr>
<td>Impunity log²</td>
<td>3.01* (2.45–3.71)</td>
<td>2.15* (1.69–2.73)</td>
</tr>
<tr>
<td>Infant Mortality³</td>
<td>1.16* (1.12–1.19)</td>
<td>0.96 (0.92–1.01)</td>
</tr>
<tr>
<td>% Urban⁴</td>
<td>0.98 (0.95–1.01)</td>
<td>1.02* (1.00–1.03)</td>
</tr>
<tr>
<td>% Young Male⁵</td>
<td>2.00* (1.42–2.81)</td>
<td>1.13 (0.97–1.30)</td>
</tr>
<tr>
<td>GDP⁶</td>
<td>0.92* (0.90–0.95)</td>
<td>1.01 (0.99–1.03)</td>
</tr>
<tr>
<td>Education⁷</td>
<td>0.18* (0.10–0.30)</td>
<td>0.55* (0.37–0.84)</td>
</tr>
</tbody>
</table>

Note: log of number of 15–44 males in the population and log of total population entered as offset, respectively.

¹P < 0.05.
²Gini = Gini Index of income inequality in year 2000 (can vary from 1 to 10).
³Impunity log = “Impunity Index” logged: total number of homicides from 1990 through 1999 divided by the number of persons in prison in year 2001, logged.
⁴Infant mortality = infant mortality rates per 1000 live births in year 2000 (proxy for poverty levels).
⁵% Urban = percentage of population living in urban areas in year 2000.
⁶% Young Male = percentage of 15–44-year-old males in the population in year 2000.
⁷GDP = Gross Domestic Product (GDP) per-capita, based on purchasing parity power in year 2000 (in thousands of dollars).
⁸Education = education component of the Human Development Index in year 2000 (can vary from 0 to 10).
⁹Total population homicide = total number of homicides in year 2000.
USA (Marvell & Moody, 1997). Between 1973 and 1991 the incarceration rate in the USA increased from 96 to 313 inmates per 100,000 residents; by one estimate that should have reduced homicide by more than 30 percent (Levitt, 2004). Essentially, the reduction in homicide over this period was attributable to increased incarceration (Levitt, 2004). The period 1991–2001 saw a sharp decline in homicides, but the reduction in availability of crack-cocaine, and legalization of abortion (Levitt, 2004). Our results are compatible with the hypothesis that imprisonment of criminals in itself, independent of other social-structural circumstances, is associated with homicide rates in South and Central American countries and OECD countries.

The traditional incarceration rate may reflect a crude reaction by countries to the overall level of crime. On the other hand, the Impunity Index we are proposing (ratio of the number of serious crimes, indexed by number of homicides in the preceding decade, to the number of prisoners) may reflect a more intense and refined effort by countries to solve the crimes committed by their citizens. Thus, in essence, both indicators are detecting the same thing: arresting and conviction of criminals. The incarceration rate however may reflect a primary, crude, impulsive reaction against crime (efforts limited mostly to making arrests in the easy cases: less effort expended in investigating and seeking convictions in all cases), while the Impunity Index may reflect more refined, sophisticated and thorough efforts to investigate, arrest and convict criminals.

The Impunity Index is an admittedly somewhat arbitrary index that can be interpreted as a proxy for the probability that an offender (of any serious crime, i.e., murder, robbery, rape, and assault) will avoid penalty. We did not have suitable data for assessing this probability country by country and decided to use the number of homicides from 1990 through 1999 divided by the number of persons in prison in 2001. Our rationale is the following: serious offense cases (indexed here by homicide) should, ideally, be solved and adjudicated reasonably promptly and convicted criminals might be expected to serve substantial sentences, hence the 1990–1999 period (in Brazil for example, the minimum sentence for murderers – “homicídio doloso”, article 121 of the Brazilian Penal Code, equivalent to “Homicide with malice aforethought” – without a previous record is six years and pending good behavior they can be freed after serving two years in prison but such short sentences should themselves be considered a reflection of relative impunity). In other words, the offenders in serious crimes (indexed here by homicides) perpetrated between 1990 and 1999 may be expected, where serious crimes are punished severely, to be in the prison population in 2001; those who are not were either not apprehended or have been treated relatively leniently by the justice system, both of which constitute components of impunity. In summary, the countries that caught more serious offenders in the 1990–1999 period and kept them longer in prison, are thus expected to exhibit lower scores on our Impunity Index. For instance, on average, the 28 OECD countries had an Impunity Index of 0.2, while the 13 non-OECD countries had a score of 1.3. This means that, in OECD countries, for 20 homicides in the preceding decade there were 100 persons in prison for any crime. In contrast, in non-OECD countries, for 130 homicides in the preceding decade, there were only 100 persons incarcerated for any crime. Thus, in non-OECD countries impunity is so extreme that homicides in the past decade outnumber (on average) the total numbers of persons incarcerated for any crime, while in OECD countries the number of people incarcerated could account for all murders and many other crimes. The Impunity Index is an admittedly somewhat arbitrary index that is intended to reflect both the probability and the magnitude of punishment, and to capture the incapacitating and the deterrent effect of prison on serious crimes.

### Table 4

<table>
<thead>
<tr>
<th>Gini</th>
<th>Impunity</th>
<th>Predicted rate per 100,000 (95% CI)</th>
<th>Male homicide</th>
<th>Total population homicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>2 (1.1–2.3)</td>
<td>1 (0.8–1.4)</td>
<td>4 (0.8–1.4)</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>9 (4.4–14.0)</td>
<td>6 (3.3–7.7)</td>
<td>14 (3.3–7.7)</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>8 (4.1–12.0)</td>
<td>3 (1.7–3.8)</td>
<td>6 (1.7–3.8)</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>43 (24.0–63.0)</td>
<td>14 (8.9–19.0)</td>
<td>28 (8.9–19.0)</td>
</tr>
</tbody>
</table>

Low Gini – mean of the bottom tertile – 2.7, High Gini – mean of the top tertile – 5.3

Predicted rate per 100,000 (95% CI) a

**Socioeconomic circumstances and imprisonment**

It is interesting to speculate, then, that countries with better socioeconomic conditions, i.e., lower economic inequality, less poverty, higher average income and higher levels of education, are at the same time more likely to arrest criminals and to keep them in prison. This view contrasts with that which argues that where socioeconomic conditions are better there is less need for punishing criminal behavior (see comments on the Norbert Elias’ civilization theory by Eisner and Neapolitan (Eisner, 2001; Neapolitan, 2001)). We are proposing that in such favourable socioeconomic circumstances there may be less criminal behavior but not less need to punish it. On the contrary, it may be the better the socioeconomic circumstances are overall, the lower the tolerance for serious criminal behavior; people might wish to protect their country’s social fabric more, where the social conditions are better. Conversely, people might be more tolerant of serious criminal
behavior where they perceive the social system as being less kind and less fair; criminal behavior in these circumstances might be an option that many would want to keep open for themselves. For this reason, commitment/efforts to punish it should be weaker. Our results were compatible with this interpretation, as countries with better socioeconomic conditions showed lower scores of the “Impunity Index”.

“It is reasonable to assume that even in a well-ordered society the coercive powers of government are to some degree necessary for the stability of social cooperation” – (Rawls, 1971). Human beings evolved a tendency to punish cheating behavior (aversion to free-riders) (Fehr & Gachter, 2002; Price et al., 2002). The most altruistic individuals (those willing to participate in a collective action independently of believing that each would personally benefit from that action) are those most inclined to punish free-riders (Price et al., 2002). Punishment of defectors seems to be a factor key to cooperation (Boyd & Richerson, 1992; Fehr & Gachter, 2002). At the population level, the willingness to punish co-varied with a behavioral measure of altruism; societies with more altruistic behavior also exhibited high degrees of punishment (Henrich et al., 2006). So, more cooperative societies (for example with lower economic inequality – low income inequality being related to high social cohesion – (Kawachi et al., 1997)) should also show more punishment of defectors (criminals), and therefore lower scores of the proposed “Impunity Index”. That is exactly what we found in our cross-national comparison. Thus, it appears that social cohesion goes hand-in-hand with commitment to punish serious criminal behavior.

According to Neapolitan, Norbert Elias’ civilization theory posits that “as nations modernize and civilize and conditions of life become less harsh and more orderly, social control shifts inward and people become more tolerant of minor deviance. As external sanctions become less important in controlling people, nations reduce prison sentences, develop alternatives to incarceration, and decriminalize some offences.” (Neapolitan, 2001). Eisner suggested that the civilizing process, as proposed by Elias, would decrease impulsivity and increase the level of rationality in the manner in which one lives, leading to higher levels of self-control, which in turn would lead to a gradual pacification of everyday interactions, and eventually be reflected in lower levels of violent behavior (Eisner, 2001). This reasoning, to a certain extent, contrasts with that which we argued above and with evidence of a positive association between the Human Development Index (HDI) and incarceration rates in a cross-national analysis (Neapolitan, 2001): according to our suggestion, and to our results, the threat of external sanctions becomes more important (more prevalent), not less, as nations civilize (as far as civilizing has anything to do with modern market democratic economies with less income inequality, less poverty, higher average income and higher levels of formal education, and that external sanctions have anything to do with imprisonment). More fundamentally, it may even be that Norbert Elias’ civilizing process is partly dependent on (or driven by) an increase in the commitment/effort to punish criminal behavior. As we already argued above, we are suggesting that people may tend to become less tolerant of major deviance, such as serious crimes, as nations civilize (note however that this is still compatible with people becoming more tolerant of minor deviance, as suggested by Elias).

Limitations

The limitations of this study include the cross-sectional design, the problem of ratio variables (spurious association because of measurement error), the use of homicide as a proxy for serious crime, and the choice of countries to be included in the study.

The direction of the association between impunity and homicide cannot be established due to the cross-sectional design. The association we found is entirely compatible with too many homicides (or crime in general) causing high impunity rather than high impunity causing too many homicides; increased crime may overwhelm the police and justice system, with impunity increasing as a consequence (Nagin, 1998).

One of our most successful explanatory variables was a ratio, in which crime (in our study, homicide) was included in both the numerator of the outcome and explanatory variables. The use of variables of this type, when trying to assess the effect of prison on crime, could lead to substantial bias when measurement error is present (even if the errors in measuring crime are completely random and unrelated to the prison population) (D’Alessio & Stolzenberg, 1998; Firebaugh & Gibbs, 1985; Gibbs & Firebaugh, 1990; Levitt, 1998). In our study, the homicide data in the Impunity Index and in the homicide rates are different sets of data; in the first they are the sum of all homicides in the previous 10 years while in the second they are the number of homicides in a single year. This fact may not eliminate the possibility of spurious association due to measurement error, but probably reduced it.

Another limitation is the fact that we cannot be sure that homicide is a good proxy for serious crime in general in every country, and if it is not, then the validity of the Impunity Index is jeopardized. It could be argued that it would be preferable to use as our denominator only imprisoned killers rather than the entire prison population, as it is unlikely that homicides contribute greatly to the prison population. But criminal homicides may be a good marker for serious crime in general, and by relating the number of homicides to the total number of prisoners, the index may be even more accurate in detecting the general incapacitating and deterrent effect of prison than if it related number of homicides to only those in prison due to their commission. One reason for this is the fact that most killers commit a number of other serious offences before they kill (Cook, Ludwig, & Braga, 2005). In any case, information regarding prisoners’ crimes was not available to us for most countries. Also, international police crime statistics are not comparable because there is more underreporting of certain types of crimes in some countries than in others, and so it is not possible to check our assumption that other serious crimes vary proportionally with the number of homicides. There is the possibility that certain countries may impose prison sentences only for serious crimes including homicide, while in others jail awaits those convicted of lesser offences, too; the homicides–prisoners ratio would be lower in the latter case even if the probability of being imprisoned for homicide (and other serious crimes) were identical. If this be so, then our indicator might be predictive of homicide because of incapacitation rather than punishment for homicide: a low ratio would reflect a high prison population and the disproportional removal of potential killers from the streets before they could kill.

Finally, the choice of the countries to include in the study may limit the generalizability of the study to other world regions. However, we believe it is appropriate to study the effect of prison on homicide, separately, for groups of countries in the different regions of the world. There is a geographical–historical–cultural component to the use of imprisonment, which statistically differentiates countries in different regions of the world (Neapolitan, 2001). For this reason, we restricted our sample of countries to the Central and South American regions and the most developed economies in the world (OECD countries). The inclusion of countries from other regions of the world (i.e., from the East and from Africa – apart from Japan and Korea, the OECD countries (Western Democracies) could lead to a sample too diverse in terms of culture, justice and punishment practices, risking hiding the associations we were assessing in this study.
Summary of our main results and conclusion

Our results are compatible with the theoretical model that we are proposing: small income inequality may increase social cohesion and consequently reduce crime (we found that low income inequality was a strong predictor of low homicide, independently of impunity), and at the same time increase the commitment/effort to punish crime (we found that small income inequality, low poverty, high average income and high education were associated with low impunity), which in turn further contributes to the reduction in crime and the maintenance of low levels of crime (we found that low impunity was a strong predictor of low homicide, independently of income inequality).

This study supplies new knowledge compatible with harmful effects of impunity at the national scale on homicide. It also supplies new knowledge compatible with the role of social cohesion (low income inequality, low poverty, high education and high average income) in promoting punishment of criminal behavior or vice-versa. And finally, it provides reinforcing knowledge compatible with harmful effects of income inequality at the national scale on homicide, as it was, to the best of our knowledge, the first cross-national study that assessed, in a multivariate fashion, the relative effects of impunity at the national scale on homicide. It also clearly of income inequality (or anything else) in sizable groups.

Appendix. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.socscimed.2009.08.013.

References


