# From Spirits to Crime: Two Centuries of Alcohol and Homicide in the West *

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**Abstract.** This paper constructs a new annual panel for 14 Western countries, 1800–2016, linking homicide to alcohol consumption (by beverage type), drug offenses, deterrence, and education. The central innovation is the first harmonized long-run cross-country alcohol series that can be aligned with the major historical waves in lethal violence. Across graphical evidence, narratives, and multivariate panel regressions, homicide co-moves strongly with alcohol, while education, deterrence, and demography capture the broader institutional context. We interpret the estimates as suggestive long-run relationships and use them for a multivariate historical accounting of the post-war crime wave and subsequent decline.

*Keywords:* crime, alcohol; drugs; deterrence; education; demography.

*JEL:* D91, K42, I24, J19, N30.

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## 1. Introduction

How and why homicide rates changed over the past two centuries is a central question in the study of crime. Historical research documents a pronounced long-run decline in violence during the nineteenth and early twentieth centuries, followed by a sharp increase after the 1960s and a subsequent fall from the 1990s onward (Eisner, 2014; Pinker, 2011; Lappi-Seppälä and Lehti, 2014). A large micro-level literature links alcohol consumption, education, and deterrence to individual violent behavior, yet it remains largely unknown whether the alcohol–violence nexus documented at the individual level is also visible in the long-run macro-historical trajectory of homicide.

This paper addresses this question by assembling a new annual dataset for 14 Western countries over the period 1800–2016. Its central innovation is the construction of the first harmonized long-run cross-country series on alcohol consumption, including the distribution of drinking across beverage types, that can be directly related to the major historical waves in lethal violence. The historical depth of the data makes it possible to trace the joint evolution of homicide, alcohol use, education, deterrence, demographic structure, and socioeconomic conditions across major institutional and cultural transformations, including industrialization, the expansion of mass education, the rise of modern criminal justice systems, prohibition episodes, and the late-twentieth-century crime wave.

On this basis, the paper provides the first macro-historical quantitative counterpart to the micro-level evidence on the alcohol–violence nexus by documenting its presence in two centuries of aggregate data. The analysis combines graphical evidence, historical narratives, and multivariate panel estimates in a unified framework. The graphical series show that the timing of the long nineteenth-century decline, the post-1960 crime wave, and the subsequent crime drop closely coincide with pronounced changes in per capita alcohol consumption and in the composition of drinking toward lower-alcohol beverages. The multivariate analysis demonstrates that these patterns remain when education, deterrence, and demographic change are controlled for, allowing for a historical accounting of the post-war rise and fall of homicide.

To organize the interpretation of the long-run relationships, we use a simple behavioral mechanism that combines the economic model of crime with the criminological literature on self-control. This mechanism is formally developed in an accompanying theory paper (Madsen and Strulik, 2026). In that framework, alcohol intoxication increases the cost of exerting self-control

and thereby raises the likelihood of impulsive violence (Hull, 1981; Bartholow et al., 2012). Education raises the opportunity cost of crime and is associated with greater self-regulation (Lochner and Moretti, 2004), while deterrence increases the expected cost of offending (Chalfin and McCrary, 2017). The purpose of this behavioral structure is not to provide a structural estimation framework but to guide the historical interpretation of the empirical evidence and the multivariate historical accounting that follows. The empirical analysis can therefore be interpreted as documenting how the main determinants of crime emphasized in this behavioral framework coevolved over the long run.

Establishing causality in macro-historical panels spanning two centuries is inherently difficult because many of the relevant variables are jointly determined and influenced by slow-moving institutional and cultural change. Rather than making strong causal claims, we interpret the estimates as suggestive evidence on the long-run coevolution of homicide and its main correlates. Dynamic specifications and long lags are used to examine the timing of the relationships, but the results are not intended to identify structural parameters. The main contribution of the paper is empirical and historical. We construct the first harmonized long-run cross-country dataset on alcohol consumption and homicide and document their joint evolution over two centuries. The paper therefore complements the qualitative crime-wave literature with systematic long-run evidence.

The rest of the paper proceeds as follows. Section 2 reviews the related literature. Section 3 presents the data. Section 4 documents the long-run patterns and historical narratives. Section 5 introduces the multivariate framework and reports the results. Section 6 concludes.

## 2. Related Literature

A large micro-level literature documents a close association between intoxication and violent behavior. Alcohol and drug use have been shown to lower self-control and foster aggression and impulsivity by removing inhibitions (Uihlein, 1994; Bartholow et al., 2012), weakening self-awareness (Hull, 1981), and impairing performance monitoring (Bartholow et al., 2012). Felson et al. (2008) identify alcohol as a key mediator in violent offending, while Greenfield (1998), Pernanen (1991), and Roizen (1997) report that a substantial fraction of violent crimes are committed under the influence of alcohol. Although these studies do not establish causality, they consistently point to intoxication as an important correlate of violent behavior. Zimmerman

(2004) provides an early economic analysis of this nexus. Our behavioral mechanism is most closely related to Gottfredson and Hirschi's (1990) self-control theory – one of the most widely supported paradigms in criminology (Burt, 2020) – in emphasizing diminished self-regulation rather than changes in risk aversion or time preference.

A related micro-econometric literature examines how alcohol policy, education, and deterrence are linked to crime outcomes. Markowitz (2005) finds that higher beer taxes are associated with fewer assaults, and Carpenter and Dobkin (2011) reviews evidence that lower minimum drinking ages increase violent crime. Dills et al. (2008) show that stricter enforcement of alcohol and drug prohibitions may coincide with higher crime rates, possibly through black-market effects, while Zimmerman and Benson (2007) estimate the joint relationships between beer, wine, and liquor consumption and violent offenses in the United States. Studies on education and deterrence – including Lochner and Moretti (2004), Machin et al. (2011), and Cano-Urbina and Lochner (2019) – document that higher educational attainment is associated with lower crime, and the survey by Chalfin and McCrary (2017) concludes that both the certainty and severity of punishment are negatively related to offending. More recently, Cohen and Gonzalez (2024) show that higher alcohol consumption and outdoor activity on hotter days are linked to increases in violent crime in Mexico. This literature provides detailed evidence on behavioral mechanisms and policy variation but is typically confined to specific countries and relatively short time horizons.

By contrast, the macroeconomic literature on crime has focused primarily on broader structural correlates. Fajnzylber et al. (2002a, 2002b) document a strong positive association between inequality and violent crime across countries, while Glaeser and Sacerdote (1999) and Freeman (1999) relate urbanization, labor-market opportunities, and community structure to crime patterns. Kelly (2000) emphasizes education and demographic change as long-run influences on criminal behavior. The development of penal institutions has also been studied in the context of deterrence and incarceration (Levitt, 2017; Zimmerman, 2010). However, this literature typically relies on shorter panels and has paid little attention to the long-run evolution of alcohol consumption and drinking cultures.

Historical research on violent crime provides a third perspective. It documents the major waves in homicide and relates them to long-term processes of state formation, cultural change, and social modernization (Elias, 1978; Eisner, 2014; Pinker, 2011; Lappi-Seppälä and Lehti,

2014; Garland, 2001). These accounts frequently emphasize the rise of self-control, changes in substance use, and the expansion of the capacity of the state to regulate violence. Yet they are rarely combined with a unified quantitative framework based on harmonized long-run data.

This paper connects these three strands. The micro literature identifies a robust alcohol–violence relationship but cannot assess whether it is visible in the very long run. The macroeconomic literature provides multivariate cross-country frameworks but has largely abstracted from alcohol consumption and its composition. The historical literature documents the major crime waves but relies predominantly on qualitative evidence. By introducing harmonized long-run series on alcohol consumption into a two-century panel and relating them to education, deterrence, and demographic change, the analysis provides a multivariate historical accounting of the major crime waves and complements the existing literature with systematic long-run evidence.

## 3. Data

The data cover the period 1800-2016 for Australia, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, Switzerland, the UK and the US, where the data sample is dictated by data availability. The historical data are collected from various national historical sources, often thematic books, statistical yearbooks and bulletins, and updated from 1960 mostly using international sources. A detailed description of data sources is provided in the online Data Appendix. The Summary Statistics are shown in Table A.1.

The homicide data include only intentional manslaughter and murder. Most countries provide data for reported homicides only, while other countries provide data on convictions only, and a few countries change from convicted to reported cases from around 1900. Dummy variables are included in the regressions to distinguish the two cases as stated above.

We proxy alcohol consumption as the sum of the consumption of registered sales or production of beer, wine and spirits in pure alcohol units per capita. The data are almost entirely based on sales subject to excise taxes or the production of alcoholic beverages plus net imports. We use the following pure alcohol contents to calculate total alcohol consumption: beer, 5%, wine, 12%, and spirits, 40%. The recorded alcohol data only measure alcohol consumption approximately because of unobserved legal and illegal imports of alcohol from other countries and home production, particularly during periods when the sale of alcohol was prohibited or severely restricted.

It is likely that illicit alcohol trade and home production flourished during prohibition; however, it is impossible to say by how much. Based on various indicators of alcoholism during the Finnish alcohol prohibition period 1919-1932, for example, Wuorinen (1932. p. 201) concludes that alcoholism "showed alarming signs of becoming more frequent". If the data for alcohol is unavailable for the whole prohibition period then it is interpolated for the full period, which is the case for the U.S. However, for Finland and Norway, data on alcohol is partly missing for the prohibited period and is therefore only partially interpolated (See the online Data Appendix for details on alcohol prohibition).[1] We include country- and time-specific dummies to ensure that the regression results are not influenced by mismeasurement of alcohol consumption during these periods.

As a proxy for drug consumption we use the number of drug related offenses per 100,000 population due to the unavailability of drug sales/consumption data. Drug related offenses usually refer to crimes of possession, manufacture, or distribution of drugs classified as having a potential for abuse, such as cocaine, heroin, morphine, amphetamines, cannabis and barbiturates; however, since the laws on drug offenses have varied substantially over time and across countries, our drug consumption proxy is tenuous. Despite these reservations, the evidence for Canada, for which long continuous survey data on cannabis consumption is available, suggests that drug related offenses are potentially good proxies for cannabis consumption.[2] Drug offenses capture the diffusion and intensity of drug markets and enforcement, which are historically intertwined with violence via market organization and systemic violence; they are not a direct measure of consumption.

Educational attainment is measured as the sum of attainment at the primary, secondary, and tertiary levels for the working-age population, estimated using data on school enrollments and the age structure of the population following the model developed by Madsen (2014). Enrollment

[1] Alcohol sales were prohibited in some states, territories, and municipalities but not in all in the US from the 1890s; however alcohol was only uniformly prohibited across all US states during the period from 1919 to 1933 (Heron, 2003). Sales of alcohol were never completely prohibited in the Scandinavian countries; however, sales of alcoholic beverages were prohibited in Norway, with large time-variations in the types of alcoholic beverages that were covered by the prohibition over the period 1917-1927 (Johansen, 2013). Alcohol sales were prohibited in Finland over the period 1919-1932 (Johansen, 2013). A national prohibition was also imposed in Canada from 1918 to 1920, see Phillips (2014).

[2] Correlating the log of drug related offenses per 100,000 population and the log of the prevalence of cannabis consumption of the 15+ population over the period 1960-2015 yields a correlation coefficient of 0.97 (the cannabis consumption data are available from Macdonald and Roterman, 2017). Correlating the data (again in logs) in 5-year overlapping differences over the period 1965-2015 yields a correlation coefficient of 0.79; thus, again, suggesting that drug related offenses are likely to be good proxies for drug consumption.

data are readily available from official historical statistical compendia from the late nineteenth century onward for most countries and levels of education. Earlier observations are compiled from a range of national and international sources and historical reconstructions, including counts of Latin schools, student numbers reported in university calendars, and literacy rates used as proxies for primary school enrollment. The age distribution of the population at annual frequency is estimated from census data. For countries where early observations are unavailable, the age structure of neighboring countries is used to retropolate the series.

As measures of deterrence, we use the capital punishment-homicide ratio and the prison population-homicide ratio. The prison population-homicide ratio may deter homicides because it is increasing in the likelihood of being convicted and the expected length of prison terms. The downside of this measure is that not all inmates are homicide convicts and it does not capture the severity of prison penalties (e.g., food quantity and quality, health insults, heating, isolation etc.). Capital punishment is a potentially much stronger and more well-defined homicide deterrent than imprisonment, and it is dominated by homicide convictions and, to a large extent, captures the likelihood of being executed for the homicide (Wood, 2011). However, since would-be murderers are unlikely to know this ratio they may pay more attention to the number of public executions, which tended to be widely publicized during the 19th century.

## 4. Long-Run Historical Evidence and Crime Narratives

This section relates the main historical narratives on the evolution of violent crime to the long-run macro series constructed in this paper. Figures 1 and 2 present sample means with cross-country dispersion bands for our sample of 14 countries. Rather than treating these figures as descriptive background, we use them to assess whether the well-known phases in the history of violent crime are visible in the data and whether they coincide with systematic movements in alcohol consumption, deterrence, education, and demographic structure.

In the following figures we report the annual sample mean for 1800–2016 together with 95% confidence bands based on the cross-country standard deviation in each year. Homicide, deterrence, and alcohol consumption are normalized by their overall sample means in order to make cross-country commonalities visible. Without this normalization the higher level of violent crime in the United States would dominate the figures and obscure the shared temporal patterns. For example, over the period 1950–2000 the average homicide rate was about 7.5 per 100,000 in the

United States compared with roughly 1.5 in the remaining countries, yet the timing of the post-war crime wave and the subsequent crime drop is remarkably similar across the entire sample. The confidence bands therefore provide a visual measure of cross-country dispersion and show that the major turning points in homicide are common macro-historical phenomena rather than the outcome of developments in a single country.

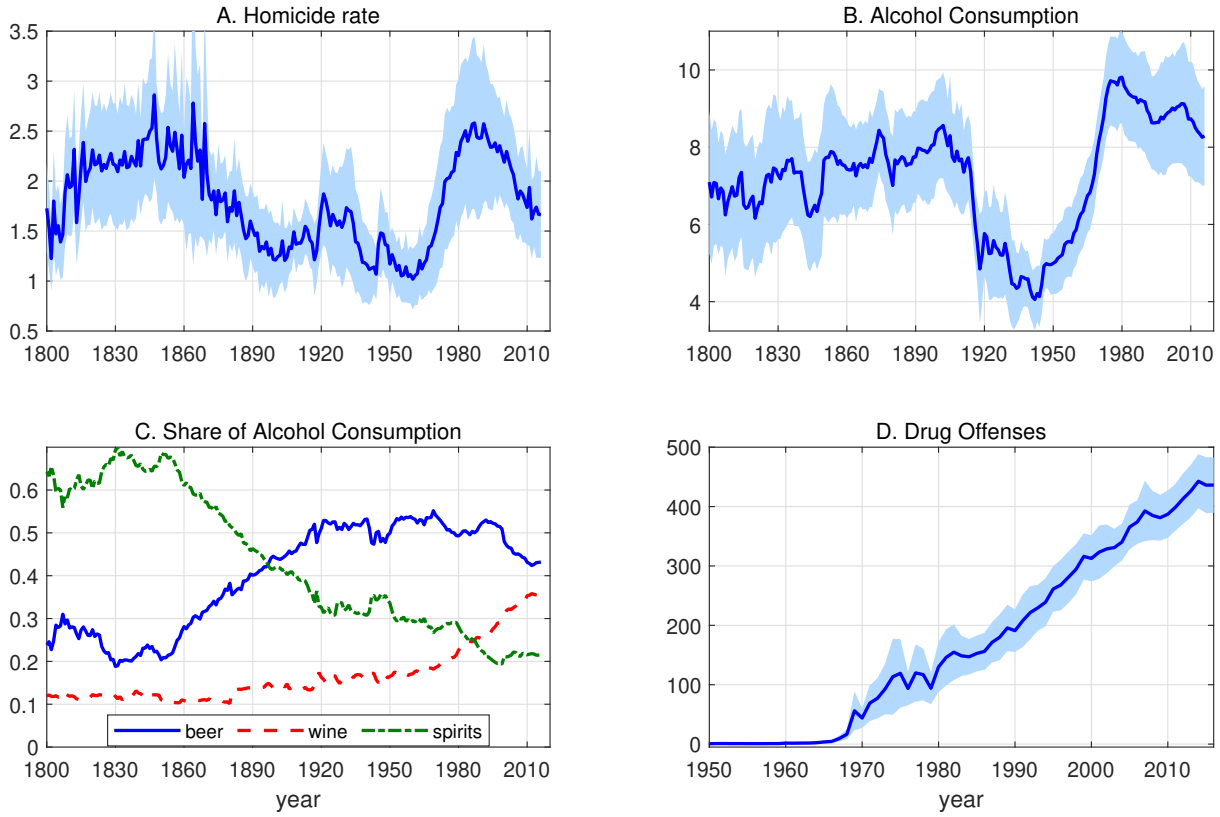
4.1. **The Long-Run Decline in Homicide.** Figure 1.A shows the evolution of homicide rates from the nineteenth century to the present. The figure reproduces the central finding of historical criminology: a pronounced and persistent decline in lethal violence from the nineteenth century until the mid-twentieth century (Eisner, 2014). Homicide falls from comparatively high levels in the early part of the sample to historically low levels by the 1950s.

This decline is commonly interpreted as part of the "civilizing process" (Elias, 1978), during which the use of interpersonal violence became increasingly constrained by both formal institutions and informal norms. The timing of the decline in Figure 1 coincides with the gradual expansion of state capacity, the professionalization of policing and courts, and the spread of mass education across Western countries (Johnson and Monkkonen, 1996; Goldin and Katz, 2008).

The homicide rate increased markedly over the period 1960-1990. Pinker (2011) argues that the increase was caused by a loss of self-control induced by the alcohol and drug abuse of the youth culture. The decline after 1990 was, according to Pinker (2011), driven by a 'recivilizing' process in which self-control became central to crime prevention programs and increasing condemnation of uncontrolled behavior. Similarly, Garland (2001) suggests that the post-1990 decline is an outcome of a more punitive justice system and more intensive control of antisocial behavior. Levitt (2004) argues that the increasing prison population and the larger role for legalized abortions were responsible for a significant fraction of the decline in homicide rates in the US from the 1990s.

4.2. **Alcohol Consumption and Drinking Cultures.** Figure 1.B shows alcohol consumption over time. Consumption increased gradually from about 7 to 8 liters during the nineteenth century before falling sharply between 1905 and 1945. It then rose rapidly after World War II, reaching unprecedented levels in the early 1980s, before declining to almost the level observed in the early twentieth century.

FIGURE 1: LONG-RUN HISTORICAL TRENDS PART I




Data for homicides (per 100,000), alcohol consumption (liter pure alcohol per capita), and drug offenses (per 100,000) are normalized by their overall sample means in order to make cross-country commonalities visible. The lines show the unweighted country average. Shaded areas show 95% confidence bands for the 14 countries in the sample.

The criminology and sociology literature links the post-1900 decline in alcohol consumption to rising self-control, resulting from broader efforts to cultivate self-discipline, responsibility, perseverance, and honesty (Eisner, 2014). Excise taxes probably also played a role. The sharpest fall in alcohol consumption, which occurred at the onset of WWI, 1913-1914, was associated with escalating taxes on alcohol consumption to help finance the war effort since government revenues from import duties, which were a primary source of taxes at that time, shrank along with declining foreign trade (Bentzen and Smith, 2005). Alcohol consumption remained relatively low over the period 1914-1960, partly as a result of high alcohol taxes and increasingly restricted access to alcohol purchases, including war rationing, and excise taxes on alcohol sales were elevated; perhaps induced by emerging cultural change (Bentzen and Smith, 2005). This interpretation is consistent with the alcohol-violence literature that emphasizes the role of availability and policy in shaping violent outcomes (Cook and Moore, 1993).

According to Eisner (2014), the increase in alcohol consumption during the 1960s and 1970s is attributed to a cultural change. Investigating the language used in English-language books, Eisner (2014) finds that sex, drugs and narcissistic self-interest became increasingly popular subjects from the early 1960s to the 1990s. Similarly, Fukuyama (1999) argues that the rise in individualism and the weakening of social controls had an enormous effect on family life, sexual behavior and criminal activity.

A comparison of panels A and B shows that homicide rates fell over the long run through the mid-twentieth century at the same time that alcohol consumption was also declining. In contrast, homicide rose after the 1960s alongside increasing alcohol use, and then fell again from the 1980s onward as alcohol consumption declined once more. This parallel movement between the two trends supports historical narratives that point to shifts in drinking culture as a contributing factor in the long-term reduction of interpersonal violence.

Figure 1.C decomposes alcohol consumption by beverage type. The figure shows a gradual shift away from spirits toward beer and wine over the long run. This compositional change has been linked in the historical literature to reductions in impulsive violence because beverages with lower alcohol content are less strongly associated with acute intoxication. The timing of this shift coincides closely with the decline in homicide shown in Panel A.

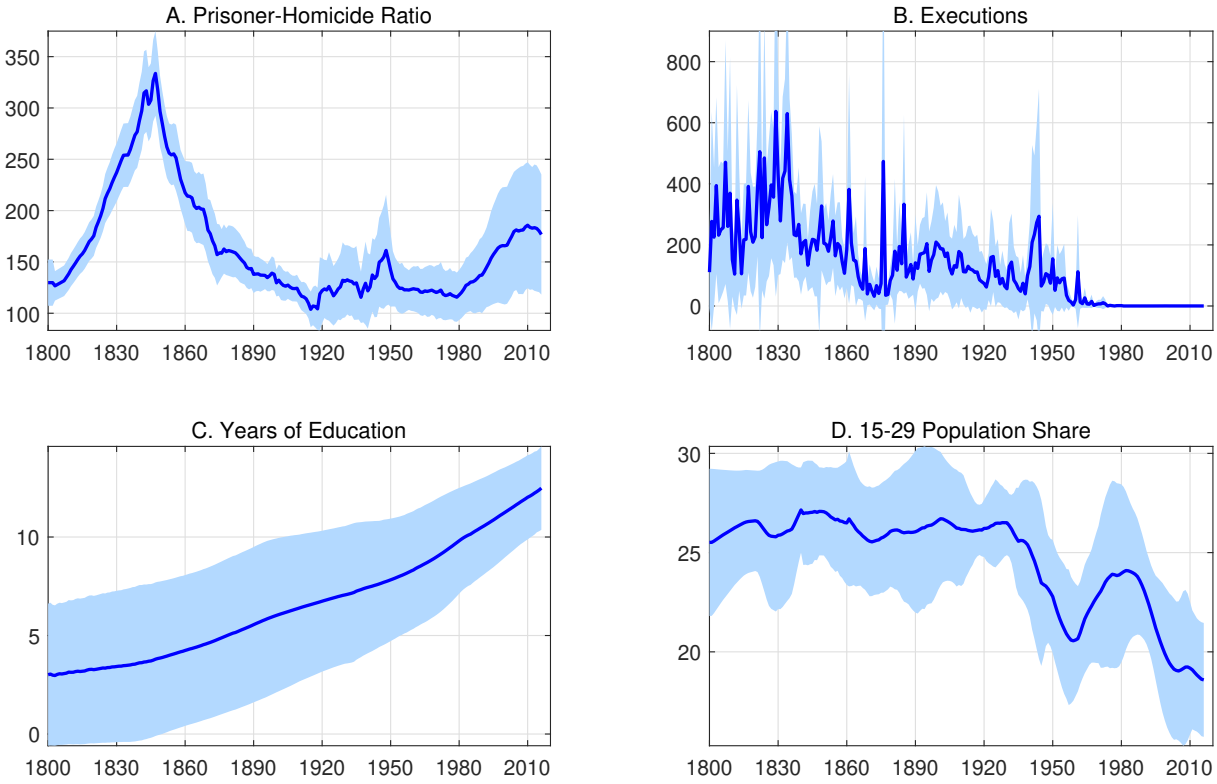
4.3. **Drug Markets and the Late-Twentieth-Century Crime Wave.** Figure 1.D shows the evolution of drug-related offenses. Unlike alcohol consumption, which exhibits substantial variation over the entire sample, drug offenses are essentially a post-war phenomenon. The sharp increase from the 1960s onward coincides closely with the rise in homicide visible in Panel A.

The historical literature on the crime wave emphasizes the diffusion of illegal drug markets as a central feature of this period, particularly in large urban areas (Goldstein, 1985; Blumstein and Rosenfeld, 1998). Drug markets are associated with violence through several channels, including the absence of formal contract enforcement, territorial competition, and the use of violence for debt collection. Including drug offenses in the empirical analysis therefore allows us to capture a central feature of the twentieth-century crime wave that is distinct from alcohol consumption.

4.4. **Deterrence and the Expansion of the Criminal Justice System.** In Figure 2, panel A displays prison deterrence, $Det^{PH}$, computed as the ratio of the prison population to the number of homicides. The ratio, which fluctuates around a relatively constant level at medium-term frequencies, tends to move in the opposite direction of homicide rates. Of particular

significance is the marked parallel decline in $Det^{PH}$ and homicide over the approximate period 1840-1880, where the reduced $Det^{PH}$ may, at least to some extent, have been caused by lower demand for incarceration. In addition, in the 19th and in early 20th centuries, prison sentences were increasingly used as substitutes for executions, whipping and banishment (see Miller, 1974). The sharp rise in incarceration rates from the 1980s onward coincides with the decline in homicide visible in Figure 1.A. This pattern mirrors the timing emphasized in the literature on the crime drop (Levitt, 2004; Zimring, 2007).

FIGURE 2: LONG-RUN HISTORICAL TRENDS PART II




The prisoners-homicide ratio and the execution-homicide ratio are normalized by their overall sample means in order to make cross-country commonalities visible. The lines show the unweighted country average. Shaded areas show 95% confidence bands for the 14 countries in the sample.

Figure 2.B shows the long-run evolution of executions. In most countries, capital punishment was widely used in the nineteenth century, gradually restricted during the late nineteenth and early twentieth centuries, and abolished in the post-war period. This pattern reflects a broader transformation of penal systems from public and highly visible forms of punishment toward incarceration as the dominant sanction (Foucault, 1977; Garland, 2001). In the early part of the sample, when homicide rates were comparatively high (Figure 1.A), executions were also

frequent. Over time, both homicide and the use of capital punishment declined. Historical research has interpreted this joint decline as part of the same long-run process: the consolidation of state authority, the monopolization of legitimate violence, and the increasing regulation of both private and public forms of lethal force (Elias, 1978).

In the post-war period, the near-universal abolition of capital punishment coincides with the emergence of imprisonment as the central instrument of penal policy. The subsequent increase in incarceration rates from the 1980s onward, visible in Figure 2.A, marks a shift from the extensive use of executions to the intensive use of custodial sentences. Including capital punishment in the empirical analysis therefore allows us to capture the long-run severity of punishment in the period before incarceration became the dominant form of deterrence.

4.5. **Education.** Figure 2.C shows the expansion of educational attainment. The rise in education is one of the most pronounced and monotonic trends in the data. The diffusion of primary and later secondary schooling during the nineteenth and early twentieth centuries overlaps with the period in which homicide declines most strongly in Figure 1.A

Historical research has emphasized that the spread of schooling contributed to greater self-discipline, longer time horizons, and higher opportunity costs of criminal behavior (Elias, 1978; Goldin and Katz, 2008). The fact that the most rapid educational expansion coincides with the long-run decline in homicide is consistent with this interpretation. In the post-war period, education continues to increase while homicide first rises and then falls, suggesting that education is one of several forces shaping long-run crime trends rather than a single dominant factor.

The expansion of education can also be interpreted through the lens of the economic model of crime. In Becker's (1968) framework, schooling raises the opportunity cost of criminal activity by increasing expected legal earnings. Micro-econometric evidence shows that this channel is quantitatively important for many forms of crime, in particular property crime (Lochner and Moretti, 2004; Machin et al., 2011). The effects on homicide are typically smaller and less precisely estimated, reflecting the fact that lethal violence is less directly motivated by material gain. Nevertheless, over the long run the opportunity-cost mechanism may still contribute to lower homicide rates by improving labor market attachment, strengthening future orientation, and fostering non-cognitive skills associated with self-control. The historical increase in educational attainment shown in Figure 2.C is therefore consistent with both the civilizing-process interpretation and the economic model of crime.

4.6. **Demographic Structure and the Post-War Crime Wave.** The age structure captures one of the most prominent demographic mechanisms discussed in the historical literature. The 15–29 cohort represents the age group with the highest offending rates (e.g., Cooper et al., 2011), and its share has varied substantially over the past two centuries in connection with the fertility transition and subsequent population aging (Macunovich, 1999).

Figure 2.D shows the share of the population in the high-crime age cohort. The figure displays a pronounced decline in the youth share during in the 1925-1955 period, a pronounced increase during the post-war baby boom, peaking in the early 1980s, followed by a steady decline as populations age. The timing of this demographic cycle closely matches the rise and fall of homicide in Figure 1.A. This correspondence is consistent with the demographic explanation of the post-1960 crime wave, which attributes a substantial part of the increase in violent crime to the unusually large cohorts of young males during this period (Fox, 1997).

4.7. **Three Historical Phases.** Taken together, Figures 1 and 2 reproduce the three major phases in which the turning points in homicide coincide with turning points in alcohol consumption:

(1) A long-run decline in homicide during the nineteenth and early twentieth centuries, visible in Figure 1.A, closely tracking the pronounced fall in spirits consumption and the shift toward beer and wine documented in Figures 1.B and 1.C. This period also coincides with the gradual expansion of education (Figure 2.C) and the strengthening of formal deterrence (Figure 2.A), which together form the broader institutional context of the declining alcohol–homicide co-movement.

(2) A post-1960 crime wave, visible as a sharp increase in homicide in Figure 1.A, emerging during a period of rising per capita alcohol consumption and expanding drug markets (Figures 1.B and 1.D). The increase is reinforced by a temporary demographic shift toward younger populations (Figure 2.D) and comparatively weak formal deterrence (Figure 2.A).

(3) A crime drop since the early 1990s, visible in Figure 1.A, occurring alongside a stabilization and subsequent decline in alcohol consumption (Figure 1.B). This phase is further characterized by demographic aging (Figure 2.D), continued educational expansion (Figure 2.C), and rapidly increasing incarceration (Figure 2.A).

The confidence bands indicate that, despite substantial cross-country differences in levels, the major turning points in the long-run wave pattern occur at broadly similar times across countries, supporting the interpretation of the crime wave and the subsequent decline as common macro-historical phenomena.

## 5. Multivariate Evidence

5.1. **Model Specification and Estimation Method.** The graphical analysis shows that the long-run evolution of homicide closely tracks changes in alcohol consumption, while education, deterrence, drug markets, and demographic structure display slower institutional and social transformations that may shape this relationship. This section examines whether the alcohol–homicide co-movement remains when these concurrent processes are taken into account in a panel framework. The multivariate analysis therefore serves to quantify the historical patterns identified in Figures 1 and 2 and to assess whether the long-run association between alcohol and homicide is robust to the inclusion of other slow-moving correlates, rather than to provide a causal interpretation.

In this sense, the panel estimates are used as a device for historical accounting: they summarize how the joint evolution of alcohol use and the broader institutional and demographic environment aligns with the major crime waves. This approach follows the tradition of long-run macro-crime studies that interpret panel regressions as a way of characterizing broad historical relationships rather than as a source of structural parameters.

To this end, we estimate a panel model using annual data for 14 OECD countries over the period 1815–2016. The long time dimension allows us to relate the three major historical phases identified in the previous section – the nineteenth-century decline, the post-1960 crime wave, and the post-1990 crime drop – to the joint evolution of substance use, education, deterrence, and demographic change. Specifically, we estimate the following model using annual data over the periods 1815-2016 for 14 OECD countries, where the sample period starts in 1815 to cater for the lagged effects of some of the regressors:

$$\log HC_{it} = \lambda_0 + \lambda_1 \log Alc_{it} + \lambda_2 \log Drug_{it} + \lambda_3 \log Det^{PH}_{it} + \lambda_4 \log Det^{CH}_{it} + \lambda_5 Ea_{it} \tag{1}$$
$$+ \lambda_6 Dist_{it} + \lambda_7 Pop^{15-29}_t + Z'\xi + CD_i + TD_t + TT_i + RetroD_{it} + ProD_{it} + WarD_{it} + ConvD_{it} + \epsilon_{1,it},$$

where $HC$ is homicide per 100,000 population; $Alc$ is per capita liters of alcohol consumption; $Drug$ is the number of drug offenses per 100,000 population; $Det^{PH}$ is the ratio of the number

of prisoners to the number of homicides; $Det^{CH}$ is the ratio of the number of executions to the number of homicides; $Ea$ is the educational attainment of the working age population in years; $Dist$ is educational distance, estimated as $Ea^t$ - $Comp_t$, where $Comp$ is years of compulsory education and $Ea^t$ is educational attainment equivalent of pupils enrolled in primary, secondary and tertiary education at year $t$; $Z$ is a vector of controls; $Pop_t^{15-29}$ is the share of the population in the 15-29 year age cohort; $CD$ is country dummies; $TD$ is time-dummies; $TT$ is country-specific time trends; $RetroD$ is year- and country-specific dummies taking the value of one in years in which any of the data are retropolated; $ProD$ is a set of year- and country-specific dummies taking the value of one in years of alcohol sales prohibition, otherwise zero; $WarD$ is year- and country-specific dummies taking the value of one in years in which capital punishment consists of executions of war criminals; and $\epsilon_{1,it}$ is a stochastic error term. $ConvD$ is a shift dummy taking the value of one if homicides are measured as convictions as opposed to reported homicides (10 out of 14 countries in our sample provide data for reported homicides only for the entire period, see online Data Appendix). In addition to the estimates covering the full two-century period, we also analyze the subperiods 1900-2016, 1960-2016, 1980-2016 and 2000-2016.

Since drug offenses are mostly zero before WWII, logs are not defined. To overcome this issue we make the inverse hyperbolic sine transformation, $\log x \approx \text{arcsinh } x \equiv \log\left(x + \sqrt{x^2+1}\right)$. Educational attainment equivalent of pupils enrolled in education at year $t$, $Ea^t$ is measured as the number of years of education of the school age cohorts at year $t$, $Ea^t = (7GER^P + 5GER^S + 5GER^T)/17$. Here, $GER^P$, $GER^S$ and $GER^T$ are gross enrollment rates measured as the number of pupils in primary, secondary and tertiary education divided by the population in the age cohorts 6-12, 13-17, and 18-22, respectively. The weights used to estimate $Ea^t$ reflect the number of years needed to complete each level of education. The gross enrollment rates are converted to educational attainment equivalents because we want to benchmark $Ea^t$ against the compulsory school age. $Dist$ captures the distance in education years between potential victims and potential offenders under the assumption that offenders have a length of education close to that of compulsory education while the length of education of victims in the young age cohorts is assumed to be the average length of education of the young age cohort.

We approximate the education of offenders by years of compulsory education following the evidence that criminals tend to have a low level of educational attainment that tends towards the compulsory level (see, e.g., Lochner and Moretti, 2004). This approach is justified by the

criminological reality that violent criminals are disproportionately concentrated at the absolute floor of the educational distribution, rarely achieving qualifications beyond the legal minimum (Machin et al., 2011). Because mandatory schooling laws act as a binding constraint that directly alters the time allocation and human capital of this specific at-risk subpopulation, tracking compulsory education thresholds provides an accurate, policy-driven baseline for measuring the educational floor of potential offenders over time.

The theoretical relationship between relative educational inequality and lethal violence is rooted in social comparison and predatory economic behavior. When distance in educational attainment widens within an age cohort, it polarizes society into distinct socio-economic groups. This disparity-driven polarization fosters feelings of relative deprivation and envy among lower-educated individuals, eroding local social cohesion and institutional trust while escalating interpersonal strain into violent outcomes (Agnew, 1992). Furthermore, from a rational-choice perspective, a larger educational gap increases the density of affluent, high-earning targets within the same peer group, raising the expected financial returns of predatory acts like robbery or property theft (Becker, 1968). As these economically motivated offenses are carried out against wealthier peers, the structural probability of confrontational encounters escalating into homicide increases significantly.

To reflect the slow-moving nature of education and deterrence and the delay between institutional change and behavioral responses, we take a 15-year weighted moving average of the ratio between the prison population and homicide, compulsory years of education, and the educational attainment equivalent of pupils enrolled in primary, secondary and tertiary education at year $t$ with geometrically declining weights as follows:[3]

$$X_{it}^{A} = \frac{\sum_{j=1}^{15} 0.85^{j-1} X_{i,t-j}}{\sum_{j=1}^{15} 0.85^{j-1}} \tag{2}$$

where $X$ is the actual value and $X^A$ is the moving average of the variable in question. We exclude $X_{it}$ from $X_{it}^{A}$ to avoid contemporaneous feedback effects from the dependent variable. This timing structure aligns the regressions with the life-cycle and generational mechanisms emphasized in the historical discussion. The moving average of compulsory years of schooling

[3]The median months served in state and federal prisons in the US over the period 1923-1982 was, on average, 59.5 months (Cahalan and Parsons, 1987, Table 3.25, 'Selected Years'). This approximately corresponds to the median number created by an annual exit rate of 15%. For education, the 15-year lag period encapsulates the prime crime ages, 15-30 (see text).

is taken because the compulsory education laws were often gradually implemented or enforced (Madsen and Murtin, 2017). The moving average of gross enrollment rates is taken to best capture the education of the general population of the prime criminal activity age. We use the moving average of the prisoners-homicide ratio because it takes time for expected penalty rates to adjust to their actual values and to alleviate a potential bias stemming from the positive correlation between the outcome variable (homicide rate) and the denominator of $Det^{PH}$; thus leading to a negative bias of the coefficients of $Det^{PH}$. We have not measured $Det^{CH}$ as a moving average under the assumption that executions immediately deter homicide. Furthermore, the coefficient of $Det^{CH}$ is close to being unaffected by the link between its denominator and the dependent variable because almost all the identifying variation in $Det^{CH}$ comes from the marked time-variation in the numerator.

5.2. **Baseline Panel Results.** The results of estimating (1) are shown in Table 1. The estimates show that the patterns documented in Figures 1 and 2 remain visible when the variables are considered jointly in panel regressions. The coefficients of alcohol consumption are positive and highly significantly so in five of the six cases. Based on the coefficients in the first column in Table 1, a one standard deviation increase in the log of per capita alcohol consumption is associated with a 14% increase in the homicide rate.

The coefficient of the share of population in the 15–29 age cohort is significantly positive in two of the cases and insignificant in the remaining regressions. The coefficient of drug offenses is significantly positive in half of the specifications. The positive association between drug offenses and homicide reflects the sharp increase in drug offenses from the 1960s onward (Figure 1.D), which closely coincides with the rise in homicide during the crime wave. The subsequent stabilization of drug offenses likewise coincides with the decline in homicide rates.

The results for drug offenses, however, require cautious interpretation because recorded offenses reflect both underlying illicit market activity and enforcement intensity. Changes in policing may affect recorded drug offenses independently of actual drug-market activity and may either reduce violence or, by destabilizing illicit markets, generate violent competition over supply chains (Dills et al., 2008). Accordingly, the coefficient on drug offenses should be interpreted primarily as capturing the long-run expansion of illicit drug markets and their associated systemic violence rather than the causal effect of individual drug consumption on violence. To

Table 1. Homicide FE-OLS Regressions

| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $\log Alc_t$ | 0.25*** | 0.13*** | 0.40*** | 0.33*** | 0.13 | 0.10*** |
| | (6.49) | (2.98) | (4.15) | (2.91) | (0.85) | (7.58) |
| $\log Drug_t$ | 0.03 | 0.13*** | 0.04** | 0.05 | 0.13 | 0.004*** |
| | (1.20) | (3.20) | (2.00) | (1.50) | (0.57) | (7.59) |
| $\log Det_t^{PH}$ | -0.60*** | -0.41** | -0.55*** | -0.33*** | 0.28 | -0.003*** |
| | (25.4) | (12.9) | (12.3) | (5.36) | (1.18) | (16.6) |
| $\log Det_t^{CH}$ | -0.61*** | -24.4** | 379.7* | 3764 | 20358* | 3799*** |
| | (7.69) | (3.22) | (1.78) | (1.14) | (2.10) | (4.57) |
| $Ea_t$ | -0.09*** | -0.02 | 0.11** | -0.03 | 0.38 | 0.00 |
| | (5.75) | (1.24) | (2.18) | (0.28) | (1.27) | (1.67) |
| $Dist_t$ | 0.03*** | 0.02*** | 0.04* | 0.02 | 0.00 | 0.00 |
| | (4.31) | (2.74) | (1.67) | (0.79) | (0.00) | (0.00) |
| $Pop_{15-29}^t$ | 0.08 | 0.23* | -0.11 | 0.04 | -0.56 | 0.23** |
| | (0.61) | (1.77) | (0.79) | (0.21) | (0.63) | (2.37) |
| CD + TT | Y | Y | Y | Y | Y | N |
| Observations | 2728 | 1638 | 798 | 518 | 238 | 238 |
| Est. Period | 1815-2016 | 1900-2016 | 1960-2016 | 1980-2016 | 2000-2016 | 2000-2016 |

**Notes**. The dependent variable is the log of homicides per 100,000 population. The numbers in parentheses are absolute $t$-statistics based on serial correlation and heteroscedasticity consistent standard errors. Fixed time- and country-effects are controlled for in all estimates except in the regression in the last column. Furthermore, country-time specific time-dummies are included for the years the data are retropolated, in years of alcohol prohibition, years at which capital punishment was associated with war crimes (immediately after WWI and around WWII), and dummies taking the value of one for periods/countries for which homicide is measured as convictions (as opposed to reported). $Alc$ = liters of pure alcohol consumption per capita; $Drug$ = number of drug related crimes per 100,000 population; $Det^{CH}$ = number of capital punishments per 100,000 homicides; $Det^{PH}$ = prison population per 100,000 homicides; $Ea$ = years of education of the working age population; $Ea^t$ = years of education of the population of school age; $Dist$ = distance variable, estimated as $Ea^t$ - $Comp_t$, where $Comp$ = years of compulsory education; $Pop_t^{15-29}$ = the share of the population in the 15-29 year age cohort; CD + TT = country dummies plus country-specific time-trends are included in the regression *: Significant at 10%; **: Significant at 5%; and ***: Significant at 1%.

the extent that enforcement shocks reflect broad international waves of the "War on Drugs", their influence is likely to be absorbed by the time fixed effects, reducing the potential bias.

The coefficient of the prisoner-homicide ratio, $Det^{PH}$, is significantly negative in five of the six cases. Referring to the regression in the first column, the approximately 50 percentage point reduction in $Det^{PH}$ over the period from the 1950s to the 1980s was associated with a 30% increase in the homicide rate over the same period, suggesting that the relaxation of the severity of punishment aligns with the upswing in homicides over the same period. For capital punishment, $Det^{CH}$, the coefficients are significantly negative in the estimates covering the periods 1815-2016 and 1900-2016. However, the coefficient is positive and significantly so in three of the four cases in the post-1960 regressions. These counterintuitive results likely reflect the rarity of executions in the post-1960 period and the resulting lack of statistical power.

Outside the United States, executions have been exceptionally uncommon since 1960, averaging only 0.12 executions per year across the sample, compared with 2.15 executions per year when the United States is included.

Our finding that capital punishment significantly reduces homicides in the regressions covering long periods, is consistent with the results of Zimmerman (2004). However, the literature appears divided about the effects of capital punishment on crime rates. A large literature argues that capital punishment is not a deterrent or that any deterrent effect associated with it is too fragile to be deemed robust (see, for example, Donohue and Wolfers, 2005, and the literature surveyed therein). Note, however, that most studies normalize executions by the general population and not by the number of homicides. Strictly speaking, this normalization is not correct, since executions per capita is a biased measure of the actual likelihood of being executed. Finally, the coefficients of the execution rate are unstable across the regressions, suggesting that it is difficult to give an estimate of the trade-off between lives saved from homicide and executions.

The coefficient of educational attainment is significantly negative in the estimate covering the periods 1815-2016 but insignificant or, in one case, positive in estimates covering the periods after 1900. The changing relationship between education and homicide across the pre- and post-1900 eras can be partly explained by shifts in labor-market returns to schooling, educational expansion, demographic change, and the emergence of large illicit markets. Before the turn of the 20th century, formal education distinguished a relatively small share of the population and often provided access to stable institutional employment, reducing exposure to poverty and economic insecurity. As secondary education became widespread during the twentieth century, however, a high school diploma increasingly became a minimum credential rather than a guarantee of a promising start to a career (Goldin and Katz, 2008, pp. 19–25; Murnane and Levy, 1996, pp. 33–41). At the same time, the long-run decline in homicide documented by historical criminologists has been attributed primarily to broader processes of state formation, changing social norms, and increasing self-control, with schooling constituting one element of these wider civilizing processes rather than their sole driver (Eisner, 2003, pp. 83–88).

Another aspect of the fading effects of education is that the increase in homicide rates from the 1960s through the early 1990s was driven largely by demographic pressures, rapid urban change, illicit drug markets – particularly the emergence of crack cocaine – and other structural factors that often overshadowed the direct influence of educational attainment (Ayers, 1993; Grogger,

1998; Levitt, 2004). Consequently, although education continued to improve legal labor-market opportunities, its independent protective effect against homicide became increasingly conditional on broader economic and social circumstances.

Turning to the educational distance between potential murderers and the general population, $Dist = Ea^t$ - $Comp$, we find that homicide increases with the educational gap between potential offenders and their peers in the estimates covering the sample periods, 1815–2016, 1900–2016, 1960-2016 while the coefficient is insignificant in the post-1980 regressions. This result suggests that relative educational disadvantage may be an important determinant of homicide. In societies with already high average levels of education, further increases in educational attainment may have limited effects on homicide if they do not reduce the educational gap between potential offenders and the rest of the population. The estimates therefore point to the importance of relative educational position, indicating that homicide is more closely associated with the educational distance between potential offenders and their peers than with the absolute educational level of potential offenders alone.

Taken together, the regression results in Table 1 reproduce the three major historical phases identified in the graphical analysis. First, the long-run decline in homicide up to the mid-twentieth century coincides with falling alcohol consumption, rising education, and increasing penal severity. Second, the post-1960 crime wave is associated with rising alcohol and drug use while formal deterrence remained comparatively weak. Third, the crime drop since the early 1990s occurs during a period of rapidly increasing incarceration and continued educational expansion. The multivariate framework shows that these associations are not driven by any single factor but reflect the joint movement of several variables over the long run.

5.3. **IV-Regressions.** Because the variables considered here evolve jointly over long periods, reverse causality and measurement error are potential concerns. As a robustness check, we therefore use 15 and 30 year lagged values of the non-deterministic regressors as instruments. Given the historical time scale of the analysis, these lags capture persistence across generations and provide a way of assessing whether the contemporaneous correlations are driven by short-run feedback effects. Long lags reduce mechanical reverse causality and capture the persistence of behavioral and institutional change. However, they do not guarantee that the exclusion restriction holds, because past values of the regressors may still be correlated with unobserved long-run trends. We consider regressions over the periods 1830-2016, 1845-2016, and 1960-2016

and exclude the post-1980 regressions because weak instrument problems raise concerns about their validity in those samples.

The results are shown in Table 2. As a first step, column 1 replaces the contemporaneous regressors in equation (1) with their 15-year lags. This specification can be interpreted as a reduced-form dynamic relationship in which homicide is related to earlier realizations of alcohol consumption, drug markets, education, and deterrence. The coefficients are highly significant and display the same signs as in the baseline estimates, indicating that the long-run co-movements documented above are already visible when the explanatory variables are measured well before the contemporaneous homicide rate.

In columns 2–5 we use 15 and 30 year lags of the non-deterministic variables as instruments for the contemporaneous variables. Anderson-Rubin tests reject the null of no relationship between the endogenous regressors and homicide under weak-instrument-robust inference. The Sargan statistics are insignificant throughout, suggesting that the different lag lengths convey consistent information about the long-run relationships. Turning to the coefficient estimates, the signs, statistical significance and magnitudes closely resemble those obtained in the baseline panel regressions, though with stronger effects as discussed above. Alcohol consumption and the prisoner-homicide ratio remain systematically related to homicide, and the education variables continue to display the same long-run patterns. Overall, the lag-based specifications show that the main findings are not driven by short-run feedback effects or contemporaneous fluctuations. Instead, the relationship between homicide and its correlates reflects slow-moving historical processes that remain visible when earlier realizations of education, alcohol consumption, and deterrence are related to later outcomes.

5.4. **Robustness.** The crime literature emphasizes a range of structural variables that may evolve jointly with homicide over the long run, including demographic structure, inequality, labor-market conditions, economic development, and family structure. To examine whether the historical relationships identified above are sensitive to the inclusion of these additional slow-moving factors, we augment the baseline specification with the following controls: the divorce rate, $Div$; the urbanization rate, $Urb$; income inequality, $Gini$; the unemployment rate, $U$; and real GDP per capita, $Y/Pop$.

Consistent with the literature on social disorganization, we account for structural characteristics of communities through the divorce rate and the urbanization rate. The divorce rate,

Table 2. IV-Regressions

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $Alc_t$ | 0.22*** | 0.63*** | 0.39*** | 0.18*** | 0.45*** |
| | (5.79) | (6.22) | (7.25) | (3.06) | (2.57) |
| $Drug_t$ | 0.06*** | 0.12 | 0.07* | -0.04 | 0.43*** |
| | (2.76) | (1.49) | (1.75) | (1.11) | (4.77) |
| $Det_t^{PH}$ | -0.42*** | -0.20*** | -0.38*** | -0.37*** | -0.10 |
| | (34.3) | (4.08) | (12.8) | (11.0) | (0.82) |
| $Det_t^{CH}$ | -1.20*** | -24.3*** | -97.9*** | -176*** | -3202*** |
| | (13.8) | (9.76) | (7.17) | (3.52) | (3.56) |
| $Ea_t$ | 0.00 | -0.01 | -0.04 | -0.04** | -0.04 |
| | (0.06) | (0.33) | (0.22) | (2.41) | (0.98) |
| $Dist_t$ | 0.03*** | 0.000 | 0.05*** | 0.06*** | 0.05 |
| | (5.30) | (0.01) | (7.44) | (4.15) | (1.51) |
| AR | NA | 213*** | 24.1*** | 9.12*** | 8.18*** |
| Sargan | NA | 0.86 | 4.4 | 5.59 | 0.98 |
| IV Lags | NA | 15 | 15,30 | 15,30 | 15,30 |
| Observations | 2518 | 2518 | 2371 | 1638 | 798 |
| Est. Period | 1830-2016 | 1830-2016 | 1845-2016 | 1900-2016 | 1960-2016 |

**Notes**. The dependent variable is the log of homicides per 100,000 population. The numbers in parentheses are absolute $t$-statistics based on serial correlation and heteroscedasticity consistent standard errors. Time dummies and country dummies are included in all estimates. We include dummies taking the value of one for periods/countries for which homicide is measured as convictions (as opposed to reported). Lags of the non-deterministic variables are used as instruments, where IV Lags = years of lags of the instruments. $Alc$ = liters of pure alcohol consumption per capita; $Drug$ = number of drug related crimes per 100,000 population; $Det^{CH}$ = number of capital punishments per 100,000 homicides; $Det^{PH}$ = prison population per 100,000 homicides; $Ea$ = years of education of the working age population; $Ea^t$ = years of education of the population of school age; $Dist$ = distance variable, estimated as $Ea^t$ - $Comp_t$, where $Comp$ = years of compulsory education; $CD$ = country dummies are included in the regression; AR = Anderson-Rubin (1949) test of weak instruments, distributed as $F(k, n-k-m)$ under the null hypothesis of weak instrument, where $k$ is the number of external instruments, $n$ is the number of observations, and $m$ is the number of exogenous regressors (deterministic variables); Sargan = Sargan's test of overidentifying restrictions, distributed as $\chi^2(14)$ under the null hypothesis that the overidentifying restrictions are not violated. *: Significant at 10%; **: Significant at 5%; and ***: Significant at 1%.

defined as the number of divorces relative to the number of marriages, is used as a proxy for family disruption. Over the long run, this variable also reflects changes in legal institutions and social norms governing marriage and family formation. We include a 10-year lag of the divorce rate to align the timing of family conditions during childhood with the prime ages of offending.

Urbanization is included because migration from rural communities to cities altered social interaction, labor markets, and the organization of daily life. Historical accounts point in different directions: urbanization may weaken local social ties and increase competition for resources, but

it is also closely associated with modernization processes that are linked to declining violence (Eisner, 2014; Elias, 1978). The expected long-run relationship is therefore ambiguous.

Income inequality enters as a summary measure of the distribution of economic resources. Economic and sociological theories associate inequality with crime through different channels, including differential returns to legal and illegal activities (Becker, 1968), the weakening of social control in disadvantaged communities (Shaw and McKay, 1942), and discrepancies between aspirations and opportunities (Cantor and Land, 1985; Li and Liu, 2024). At the same time, the historical trajectories of inequality and homicide do not display a clear common trend, which makes the multivariate evidence particularly informative.

Unemployment and real GDP per capita capture different dimensions of economic activity. The relationship between unemployment and homicide is theoretically ambiguous, reflecting opposing opportunity-cost and victimization channels (Cantor and Land, 1985), and empirical studies have generally found weak or unstable associations (Edmark, 2005). Real GDP per capita is included as a broad indicator of economic development, although it does not necessarily capture the institutional and cultural transformations emphasized in the civilizing-process interpretation.

Columns 1–6 of Table 3 report the results for the sample periods 1815–2016, 1900–2016, 1960–2016, 1980–2016, and 2000–2016. All control variables are included simultaneously. The lagged divorce rate is either insignificant or significantly negative. Using contemporaneous or 20-year lags yields similar results. Over the long run, this variable is strongly influenced by legal reforms that gradually liberalized divorce rather than by short-run changes in family behavior. Moreover, the evolution of divorce and homicide may both reflect broader shifts in social norms that are not fully captured by observable variables. In periods in which divorce was heavily restricted, marital conflict may have been resolved through other channels, including lethal violence, which complicates the interpretation of the simple correlation. Furthermore, when violent crime – defined as offenses against the person involving the use or threat of force, including homicide, rape, robbery, and assault – is used as the outcome variable instead of homicide alone, Errol et al. (2021) find that divorce rates are highly significant determinants of violent crime.

The coefficients of urbanization, real GDP per capita, and unemployment are generally insignificant and do not display a stable pattern across estimation periods. For urbanization, the

sign varies between positive and negative, which is consistent with the coexistence of social-disorganization and modernization mechanisms. The estimates for GDP per capita and unemployment are likewise imprecise and unstable, suggesting that these aggregate indicators do not map directly into the long-run evolution of homicide once education, demographic structure, substance use, and deterrence are taken into account. Taken together, these results indicate that the major historical swings in homicide are not closely aligned with the long-run movements in economic activity or urbanization. This finding is consistent with the meta-analysis of Koeppel et al. (2015), who report substantial heterogeneity in the estimated effects of GDP per capita, urbanization, and unemployment across cross-national studies.

Income inequality is insignificant in all specifications. Using lagged values or lagged instruments for inequality does not alter this result. Although these descriptive patterns do not speak to short-run dynamics, they suggest that inequality is unlikely to have been a central driver of the two-century evolution of homicide in advanced economies. This conclusion is in line with a strand of the empirical literature that finds weaker and less consistent relationships between inequality and homicide than between inequality and other forms of crime (e.g., Box, 1987; Kelly, 2000). Kang (2016) argues that poverty concentration and segregation matters more for violent crime that overall inequality. More generally, cross-national studies face substantial challenges related to measurement differences and unobserved heterogeneity (Atems, 2020), which may account for part of the variation in the reported results.

The inclusion of additional structural controls leaves the main results largely unchanged. The long-run relationships between homicide and alcohol consumption, education, and the severity of punishment remain visible across all specifications, indicating that these associations are not driven by the omission of other slow-moving social and economic factors.

As a further set of robustness exercises, we examine whether the results are sensitive to the composition of alcohol consumption and to an alternative dynamic panel framework. Columns 7 and 8 augment the baseline specification by including the shares of beer, wine, and spirits in total alcohol consumption. These variables capture the long-run shift in drinking patterns documented in Figure 1.C, where the decline in the share of spirits and the corresponding rise in beer consumption coincide with the historical fall in homicide.

The coefficient on the share of spirits, $\log(Alc^S/Alc)_t$ and beer, $\log(Alc^B/Alc)_t$, are both significantly positive. The estimated effect of the spirits share is approximately twice as large as

Table 3. Homicide FE-OLS and ARDL-SUR Regressions, Controls Included

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| $\log Alc_t$ | 0.20*** | 0.14*** | 0.40*** | 0.35*** | 0.26 | 0.35* | 0.31*** | 0.28*** | 0.41*** |
| | (5.96) | (2.91) | (4.21) | (2.65) | (1.39) | (1.95) | (7.39) | (6.41) | (5.62) |
| $\log Drug_t$ | 0.01 | 0.04** | 0.03* | 0.07** | 0.00 | 0.18*** | 0.02 | 0.00 | 0.09** |
| | (0.29) | (2.55) | (1.86) | (2.03) | (1.25) | (4.00) | (1.02) | (0.76) | (2.20) |
| $\log Det_t^{PH}$ | -0.60*** | -0.44*** | -0.53*** | -0.30*** | 0.39 | -0.35*** | -0.60*** | -0.60*** | -0.39*** |
| | (23.2) | (12.0) | (11.3) | (4.43) | (1.25) | (5.43) | (23.6) | (23.5) | (7.43) |
| $\log Det_t^{CH}$ | -0.60*** | -22.4*** | 333* | 4177 | 23175** | -1576 | -0.62*** | -0.63*** | -0.46*** |
| | (7.62) | (2.96) | (1.63) | (1.20) | (2.26) | (0.30) | (7.74) | (7.76) | (4.14) |
| $Ea_t$ | -0.10*** | -0.01 | 0.18*** | 0.01 | 0.74** | 0.09** | -0.08*** | -0.09*** | -0.04 |
| | (5.10) | (0.27) | (3.24) | (0.12) | (2.30) | (1.99) | (3.86) | (4.49) | (1.22) |
| $Dist_t$ | 0.03*** | 0.04*** | 0.04* | 0.02 | 0.03 | 0.05** | 0.08*** | 0.03*** | 0.02* |
| | (4.30) | (3.74) | (1.71) | (0.68) | (0.34) | (2.42) | (3.92) | (3.98) | (1.97) |
| $Pop_{15-29}^t$ | 0.01* | 0.01* | -0.01 | 0.00 | 0.00 | 0.04** | 0.01* | 0.01 | |
| | (1.86) | (1.68) | (1.04) | (0.24) | (0.06) | (2.04) | (1.87) | (1.57) | |
| $Div_{t-10}$ | 0.00 | -0.01*** | -0.02*** | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | |
| | (0.14) | (3.62) | (3.46) | (0.36) | (0.78) | (0.91) | (0.74) | (0.61) | |
| $Urb_t$ | 0.00 | 0.00 | -0.01* | 0.00 | 0.04 | 0.02*** | 0.00 | 0.00 | |
| | (0.38) | (1.00) | (1.64) | (0.55) | (0.72) | (3.38) | (0.96) | (0.76) | |
| $\log(Y/Pop)_t$ | 0.01 | 0.05 | -0.02 | -0.33 | -2.46*** | -0.11** | -0.05 | 0.04 | |
| | (0.16) | (0.53) | (0.09) | (0.70) | (3.61) | (1.98) | (0.58) | (0.40) | |
| $U_t$ | -0.01 | 0.00 | -0.01* | 0.00 | -0.02 | 0.02* | -0.01* | -0.01 | |
| | (1.43) | (1.04) | (1.64) | (0.57) | (1.00) | (1.90) | (1.81) | (1.58) | |
| $Gini_t$ | 0.00 | 0.00 | -0.01 | -0.01 | -0.03 | 0.00 | 0.00 | 0.00 | |
| | (0.40) | (0.82) | (0.80) | (1.30) | (1.19) | (0.40) | (0.11) | (0.09) | |
| $\log(Alc^B/Alc)_t$ | | | | | | | 0.07** | | |
| | | | | | | | (2.02) | | |
| $\log(Alc^W/Alc)_t$ | | | | | | | | 0.00 | |
| | | | | | | | | (0.54) | |
| $\log(Alc^S/Alc)_t$ | | | | | | | 0.15*** | 0.12*** | |
| | | | | | | | (3.71) | (3.19) | |
| CD+TT | Y | Y | Y | Y | Y | N | Y | Y | Y |
| Estimator | FE-OLS | FE-OLS | FE-OLS | FE-OLS | FE-OLS | FE-OLS | FE-OLS | FE-OLS | ARDL-SUR |
| Observations | 2728 | 1638 | 798 | 518 | 238 | 238 | 2728 | 2728 | 2800 |
| Est. Period | 1815-2016 | 1900-2016 | 1960-2016 | 1980-2016 | 2000-2016 | 2000-2016 | 1815-2016 | 1815-2016 | 1815-2016 |

**Notes**. The dependent variable is the log of homicides per 100,000 population. The numbers in parentheses are absolute $t$-statistics based on serial correlation and heteroscedasticity consistent standard errors. Time-dummies, country-specific time-trends, and country-dummies are included in all estimates. Furthermore, year and country-specific dummies are included for the years the data are retropolated, in years of alcohol prohibition, years at which capital punishment was associated with war crimes (immediately after WWI and around WWII), and dummies taking the value of one for periods/countries for which homicide is measured as convictions (as opposed to reported homicides). $Alc$ = liters of pure alcohol consumption per capita; $Drug$ = number of drug related crimes per 100,000 population; $Det^{CH}$ = number of capital punishments per 100,000 homicides; $Det^{PH}$ = prison population per 100,000 homicides; $Ea$ = years of education of the working age population; $Ea^t$ = years of education of the population of school age; $Dist$ = distance variable, estimated as $Ea^t$ - $Comp_t$, where $Comp$ = years of compulsory education; $Pop_t^{15-29}$ = the share of population in the 15-29 year age cohort; $Div$ = number of divorces per marriage; $Urb$ = urbanization rate (fraction of the population living in cities over 50,000 or 100,000 inhabitants); $Y/Pop$ = per capita income; $U$ = unemployment rate; $Gini$ = net income Gini coefficient; $CD + TT$ = country dummies plus country-specific time-trends included in the regression; $Alc^B$ = beer alcohol consumption; $Alc^W$ = wine alcohol consumption; $Alc^S$ = spirit alcohol consumption. The coefficients presented in the ARDL-SUR estimates are the long-run coefficients, i.e., the sum of the lagged coefficients divided by one minus the sum of the lagged coefficients of the dependent variable. All variables are lagged one period in the ARDL-SUR estimates. *: Significant at 10%; **: Significant at 5%; and ***: Significant at 1%.

that of the beer share, whereas the coefficient on the wine share, $\log(Alc^W/Alc)_t$, is statistically insignificant. This indicates that periods in which spirits accounted for a larger fraction of total alcohol consumption were also periods with higher homicide rates, conditional on total alcohol consumption and the other controls. It suggests that the long-run association between alcohol

and homicide is primarily linked to the share of high-alcohol-content beverages rather than to the allocation between beer and wine.

The finding that spirits exhibit the strongest association with homicide, beer a weaker association, and wine no significant relationship is consistent with the alcohol and violence literature. Spirits are more strongly linked to violent crime because their high alcohol concentration facilitates rapid intoxication, increasing impairment of executive functioning, impulse control, and aggressive behavior through acute alcohol myopia (Steele and Josephs, 1990; Babor et al., 2010, Chs. 4–5). Beer is also positively associated with homicide, although the estimated effect is smaller, reflecting both its lower alcohol concentration and its association with heavy drinking in bars and other nightlife settings frequented by young males, who have the highest propensity for violent offending (Norström, 1998, pp. 689–697; Babor et al., 2010, pp. 95–105). By contrast, wine consumption is generally unrelated to homicide, likely because it is more commonly consumed with meals and is associated with more moderate drinking patterns and demographic groups that exhibit lower rates of violent crime (Rossow, 2001).

The historical magnitude of this compositional change is substantial. Between roughly 1860 and 1920 the share of spirits in total alcohol consumption declined by about 50 percent, while the share of beer increased correspondingly. Using the estimated coefficients, this shift is associated with a reduction in homicide of approximately $50 \cdot (0.15 - 0.07) = 4$ percent. This quantitative exercise illustrates how the transition from spirits to lower-alcohol beverages contributed to the long-run co-movement between alcohol consumption and homicide documented in the graphical analysis.

Finally, column 9 reports ARDL-SUR estimates that allow for gradual adjustment and cross-country correlation in the error terms. The resulting long-run coefficients are very similar to those obtained in the fixed-effects specifications. Alcohol consumption and drug offenses remain strongly associated with homicide, while the remaining regressors display the same qualitative patterns as in the baseline estimates. The greater precision of the substance-use variables in this framework reflects the explicit modeling of persistence and delayed adjustment rather than a change in the underlying long-run relationships.

Overall, the results in Table 3 reinforce the interpretation that the evolution of homicide over the past two centuries is closely aligned with the long-run transformation of drinking patterns and the gradual adjustment of the other slow-moving institutional and behavioral variables.

5.5. **Historical Accounting of the Post-war Crime Wave and Crime Drop.** This subsection relates the major post-war swings in homicide to the joint evolution of its main long-run correlates. Using the coefficient estimates from the baseline specification in Table 1, we compute the change in the homicide rate that is associated with the observed changes in each explanatory variable over the periods 1950/1960–1975/1985 and 1975/1985–2016. Capital punishment is excluded because its coefficient is highly sensitive to the estimation period and because executions largely disappeared from the sample in the post-war era.

Results are shown in Table 4. The figures are obtained by multiplying the estimated long-run coefficients by the corresponding changes in the explanatory variables over each period. They therefore summarize how the historical evolution of alcohol consumption, drug markets, education, educational distance, demographic structure, and deterrence aligns with the observed rise and subsequent decline in homicide. The exercise is descriptive and does not attribute the changes in homicide to any single factor in a causal sense.

For the period from 1950/1960 to 1975/1985, the predicted increase in homicide is 61.7 percent, compared with an actual increase of 66.0 percent. The largest positive contribution in this period is associated with the relaxation of deterrence, followed by an increases in alcohol consumption and drug offenses of 27.3 percent. In contrast, the expansion of education is associated with a sizeable offsetting effect of 14.6 percent. Demographic change and educational distance play a comparatively small role over this interval. These patterns mirror the historical narrative in which the post-war crime wave coincided with rising substance use and relatively weak penal severity, while educational attainment continued to expand.

Table 4. Historical Accounting: Change in the Homicide Rate after 1950

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 ) |
|---|---|---|---|---|---|---|---|---|
| | Actual $\Delta \log HC_t$ | $\Delta \log Alc_t$ | $\Delta \log Drug_t$ | $\Delta \log Det_t^{PH}$ | $\Delta Ea_t$ | $\Delta Dist_t$ | $\Delta \log Pop_t^{15-29}$ | Predicted $\Delta \log HC_t$ |
| 1950/1960-1975/1985 | 66.0 | 13.7 | 13.6 | 44.3 | -14.6 | 1.7 | 3.0 | 61.7 |
| 1975/1985-2016 | -27.6 | -1.9 | 3.5 | -10.1 | -20.9 | 2.9 | -6.0 | -32.5 |

**Notes**. 1950/1960 = average over the period 1950-1960; 1980/2000 = average over the period 1975-1985; Predicted $\Delta \log HC_t$ = the predictions of the explanatory variables (columns 2-7); Actual $\Delta \log HC_t$ = actual relative increase in the homicide rate. The simulations are based on the coefficient estimates of the baseline regression in the first column in Table 1 augmented with the share of the population that is in the 15-29 year age cohort. The figures are relative changes over the corresponding periods; not annualized figures.

Over the period 1975/1985–2016, the predicted decline in homicide is 32.5 percent, slightly larger than the observed decline of 27.6 percent. In this phase, the tightening of deterrence, the

continued increase in education, and the reduction in the share of the population aged 15–29 are all associated with lower homicide, while drug consumption contributed to small positive changes. Alcohol consumption contributed only to a 1.9 percent decline in the homicide rate. However, when compositional changes in alcohol consumption are taken into account using the estimates in column 7 of Table 3, the implied alcohol-induced decline in homicide increases to 5.6 percent, reflecting a significant shift in drinking habits from beer and spirits toward wine. This estimate is consistent with the timing of the crime decline, which coincided with demographic aging, rising incarceration rates, and sustained increases in educational attainment.

Taken together, the accounting exercise shows that the large post-war fluctuations in homicide closely track the combined long-run movements in deterrence, education, substance use, and demographic structure. The predicted changes are similar in magnitude to the observed ones in both subperiods, indicating that the multivariate relationships capture the main contours of the historical evolution of homicide. Rather than isolating the effect of individual variables, the results highlight how the joint transformation of these slow-moving institutional and behavioral factors aligns with the rise and fall of violent crime in the second half of the twentieth century.

## 6. Conclusion

This paper has assembled a new annual panel dataset on homicide, alcohol consumption, education, deterrence, and demographic and socioeconomic variables for 14 advanced economies over the period 1800–2016. Its central innovation is the construction of the first harmonized long-run cross-country series on alcohol consumption that can be directly related to the major historical waves in lethal violence. In this sense, the paper provides the first macro-historical quantitative counterpart to the micro-level evidence on the alcohol–violence nexus by tracing its presence in two centuries of aggregate data.

Across the graphical evidence, the historical narratives, and the multivariate analysis, alcohol consistently co-moves with homicide over long-run and in subperiod regressions. The timing of the nineteenth-century decline, the post-1960 crime wave, and the subsequent crime drop coincides with pronounced changes in per capita alcohol consumption and in the composition of drinking toward lower-alcohol beverages. These patterns are visible in the raw data and remain present when education, deterrence, demographic structure, and other structural changes are taken into account in the regressions. Furthermore, the regression results display stable long-run

associations between homicide and alcohol consumption across a wide range of specifications, subperiods, and dynamic formulations.

The accounting exercise for the post-war period further illustrates this point. The large rise in homicide after the 1960s and the subsequent decline closely track the joint evolution of alcohol and drug use, penal severity, educational attainment, and the age structure of the population, with alcohol representing a quantitatively important component of these movements. In this way, the paper connects the quantitative evidence to the crime-wave literature by showing that the factor most frequently highlighted in micro-level studies of violent behavior is also visible in the long-run macro-historical trajectory of homicide. Changes in drinking cultures appear particularly relevant. The long-run shift away from spirits toward beer and wine is consistently associated with lower homicide rates, in line with historical accounts of the transformation of alcohol consumption during the civilizing process.

By contrast, several variables that are often emphasized in cross-sectional studies – including income inequality, unemployment, and urbanization – display no systematic long-run relationship with homicide in this setting. This does not imply that they are unimportant in specific contexts, but it suggests that they were not the primary drivers of the large secular movements in lethal violence across advanced economies.

Overall, the results point to a long-run process in which the transformation of drinking patterns, the expansion of human capital, demographic change, and the development of modern penal institutions evolved jointly with the rise and fall of violent crime. The new dataset and the historical accounting approach open the door for future research on the macro-historical dynamics of violence.

## References


Agnew, R. (1992). Foundation for a general strain theory of crime and delinquency. *Criminology*, 30(1), 47–88.

Atems, B. (2020). Identifying the dynamic effects of income inequality on crime. *Oxford Bulletin of Economics and Statistics* 82, 757-782

Ayers, E. L. (1993). *Vengeance and Justice: Crime and Punishment in the 19th-Century American South.* New York: Oxford University Press.

Babor, T. F., Room, R., Graham, K., Rehm, J., Monteiro, M., and Gmel, G. (2010). *Alcohol: No Ordinary Commodity: Research and Public Policy* (2nd ed.). Oxford: Oxford University Press.

Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S. and Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology*, 121(1), 173-86.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy* 76(2), 169-217.

Bentzen, J. and Smith, V (2005). Short-run and long-run relationships in the consumption of alcohol in the Scandinavian countries. *Nationaloekonomisk Tidsskrift*, 143, 65-80.

Blumstein, A., and Rosenfeld, R. (1998). Explaining recent trends in U.S. homicide rates. *Journal of Criminal Law and Criminology* 88(4), 1175–1216.

Box, S. (1987). *Recession, Crime and Punishment.* London: Macmillan International Higher Education

Burt, C. H. (2020). Self-control and crime: beyond Gottfredson & Hirschi's theory. *Annual Review of Criminology* 3(1), 43-73.

Cahalan, M. W., and Parsons, L. A. (1987). Historical corrections statistics in the United States, 1850-1984. US Department of Justice, Bureau of Justice Statistics.

Cano-Urbina, J., and Lochner, L. (2019). The effect of education and school quality on female crime. *Journal of Human Capital* 13(2), 188-235.

Cantor, D., and Land, K. C. (1985). Unemployment and crime rates in the post-World War II United States: A theoretical and empirical analysis. *American Sociological Review* 50(3), 317-332.

Carpenter, C., and Dobkin, C. (2011). The minimum legal drinking age and public health. *Journal of Economic Perspectives* 25(2), 133-156.

Chalfin, A., and McCrary, J. (2017). Criminal deterrence: A review of the literature. *Journal of Economic Literature*, 55(1), 5-48

Cohen, F., and Gonzalez, F. (2024). Understanding the link between temperature and crime. *American Economic Journal: Economic Policy*, 16(2), 480-514.

Cook, P. J., and Moore, M. J. (1993). Violence reduction through restrictions on alcohol availability. In Blumstein, A. and Wallman, J. (eds), *Violence and Public Policy*, pp. 245–271. Washington, DC: National Academy Press.

Cooper, A., Smith, E.L. and BJS Statisticians. (2011). Homicide Trends in the United States, 1980-2008. Bureau of Justice Statistics November NCJ 236018, Washington DC: U.S. Department of Justice. `https://www.bjs.gov/content/pub/pdf/htus8008.pdf`

Dills, A. K., Miron, J.A., and Summers, G. (2008). What do economists know about crime? (No. w13759). National Bureau of Economic Research.

Donohue, J.J. and J. Wolfers (2005). Uses and abuses of statistical evidence on the death penalty. *Stanford Law Review* 58, 791-845.

Edmark, K. (2005). Unemployment and crime: Is there a connection? *Scandinavian Journal of Economics* 107(2), 353-373.

Eisner, M. (2003). Long-term historical trends in violent crime. *Crime and Justice*, 30, 83–142.

Eisner, M. (2014). From swords to words: Does macro-level change in self-control predict long-term variation in levels of homicide? *Crime and Justice*, 43(1), 65-134.

Elias, N. (1978). *The Civilizing Process, Vol. 1, The History of Manners.* New York, NY: Urizen Books.

Errol, Z., Madsen, J.B., and Moslehi, S. (2021). Social disorganization theory and crime in the advanced countries, 1870-2016. *Journal of Economic Behavior and Organization* 191, 519-537.

Fajnzylber, P., Lederman, D., and Loayza, N. (2002a). What causes violent crime? *European Economic Review* 46(7), 1323-1357.

Fajnzylber, P., Lederman, D. and Loayza, N. (2002b). Inequality and violent crime. *The Journal of Law and Economics*, 45(1), 1-39.

Foucault, M. (1977). *Discipline and Punish: The Birth of the Prison.* New York: Pantheon Books.

Felson, R., Savolainen, J., Aaltonen, M. and Moustgaard, H. (2008). Is the association between alcohol use and delinquency causal or spurious? *Criminology*, 46(3), 785-808.

Fox, J. A. (1997). Trends in Juvenile Homicide, 1976-1996. Report to the U.S. Attorney General, U.S. Department of Justice, Washington, D.C.

Freeman, R. B., (1999). The economics of crime. In Ashenfelder, O. and Card, D. (eds.), *Handbook of Labor Economics*, Vol. 3 Part C, (pp. 3529-3571). Amsterdam: Elsevier Science B.V.

Fukuyama, F. (1999). *The Great Disruption: Human Nature and the Reconstruction of Social Order*. New York: Free Press.

Garland, D. (2001). *The culture of control: crime and social order in contemporary society*. Oxford: Oxford University Press

Glaeser, E. L. and Sacerdote, B. (1999). Why is there more crime in cities? *Journal of Political Economy*, 107(S6), S225-S258.

Goldin, C., and Katz, L. F. (2008). *The Race between Education and Technology*. Cambridge, M.A.: Harvard University Press.

Goldstein, P. J. (1985). The drugs/violence nexus: A tripartite conceptual framework. *Journal of Drug Issues*, 15(4), 493-506.

Gottfredson, M. R. and Hirschi, T. (1990). A general theory of crime. California: Stanford University Press.

Greenfield, L. A. (1998). Alcohol and crime: An analysis of national data on the prevalence of alcohol involvement in crime. Bureau of Justice Statistics, April, NCJ-168632, Washington DC: US Department of Justice.

Grogger, J. (1998). Market wages and youth crime. *Journal of Labor Economics*, 16(4), 756–791.

Heron, C. (2003). *Booze: A Distilled History*. Between the Lines, Toronto, Canada.

Hull, J. G. (1981). A self-awareness model of the causes and effects of alcohol consumption. *Journal of Abnormal Psychology* 90(6), 586-600.

Johansen, P. O. (2013). The Norwegian alcohol prohibition; a failure. *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 14(sup1), 46-63.

Johnson, E. A., Monkkonen, E. H. (Eds.). (1996). The civilization of crime: Violence in town and country since the Middle Ages. University of Illinois Press.

Kang, S. (2016). Inequality and crime revisited: effects of local inequality and economic segregation on crime. *Journal of Population Economics* 29(2), 593-626.

Kelly, M. (2000). Inequality and crime. *Review of Economics and Statistics*, 82(4), 530-539.

Koeppel, M. D., Rhineberger-Dunn, G. M., and Mack, K. Y. (2015). Cross-national homicide: A review of the current literature. *International Journal of Comparative and Applied Criminal Justice* 39(1), 47-85.

Lappi-Seppälä, T., and Lehti, M. (2014). Cross-comparative perspectives on global homicide trends. *Crime and Justice* 43(1), 135-230.

Levitt, S. D. (2004). Understanding why crime fell in the 1990s: Four factors that explain the decline and six that do not. *Journal of Economic Perspectives*, 18(1), 163-190.

Levitt, S. D. (2017). The economics of crime. *Journal of Political Economy*, 125(6), 1920-1925.

Li, L., and Liu, H. (2024). The minimum wage and cross-community crime disparities. *Journal of Population Economics*, 37(2).

Lochner, L., and Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American Economic Review* 94(1), 155-189.

Macdonald, R. and Rotermann, M. (2017). Experimental estimates of cannabis consumption in Canada, 1960 to 2015. Economic Insights No. 77, Statistics Canada. `https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2017077-eng.htm`

Machin, S., Marie, O., and Vujic, S. (2011). The crime reducing effect of education. *Economic Journal*, 121(552), 463-484.

Madsen, J. B. (2014). Human capital and the world technology frontier. *Review of Economics and Statistics*, 96(4), 676-692.

Madsen, J. B. and Murtin, F. (2017). British growth since 1270: The role of education. *Journal of Economic Growth* 22(3), 229-272.

Madsen, J. B. and Strulik, H. (2026). Self-Control, Alcohol, and Crime: A Dual-Self Theory. Working Paper, University of Goettingen.

Macunovich, D. J. (1999). The fortunes of one's birth: Relative cohort size and the youth labor market in the United States. *Journal of Population Economics* 12(2), 215-272.

Markowitz, S. (2005). Alcohol, drugs and violent crime. *International Review of Law and Economics*, 25(1), 20-44.

Miller, M. B. (1974). At hard labor: Rediscovering the 19th century prison. *Issues Criminology*, 9, 91.

Murnane, R. J., and Levy, F. (1996). *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy*. New York: Free Press.

Norström, T. (1998). Effects on criminal violence of different beverage types and private and public drinking. *Addiction* 93(5), 689–699.

Pernanen, K. (1991). *Alcohol in Human Violence*. New York: Guilford Press.

Phillips, R. (2014). *Alcohol: A History*. Chapel Hill, NC: University of North Carolina Press.

Pinker, S. (2011). *The Better Angels of Our Nature: The Decline of Violence in History and Its Causes*. London: Penguin UK.

Roizen, J. (1997). Epidemiological issues in alcohol-related violence. In Galanter, M. (ed.), *Recent Developments in Alcoholism*, Vol. 13, (pp. 37-41). New York, NY: Plenum Press.

Rossow, I. (2001). Alcohol and homicide: A cross-cultural comparison of the relationship in 14 European countries. *Addiction* 96(Suppl. 1), S77–S92.

Shaw, C. R., and McKay, H. D. (1942). *Juvenile Delinquency and Urban Areas*. Chicago, IL: University of Chicago Press.

Steele, C. M., and Josephs, R. A. (1990). Alcohol myopia: Its prized and dangerous Effects. *American Psychologist* 45(8), 921–933.

Uihlein, C. (1994). Drugs and alcohol. In Hirschi, T. and Cottgredson, M. R. (eds), *The Generality of Deviance*, (pp. 149-157). New Brunswick, NJ: Transaction Publishers

Wood, W. R (2011). Capital Punishment/Death Penalty. In, Chambliss, W. J. (ed.), Corrections (Key Issues in Crime and Punishment), (pp. 1-11). Thousand Oaks, CA: Sage Publications.

Wuorinen, J. H. (1932). Finland's prohibition experiment. *The Annals of the American Academy of Political and Social Science* 163(1), 216-226.

Zimmerman, P. R. (2004). A theoretical analysis of alcohol regulation and drinking-related economic crime. *European Journal of Law and Economics* 18(2), 169-190.

Zimmerman, P. R. (2010). The economics of capital punishment and deterrence. In B. L. Benson, and P. R. Zimmerman (Eds.),*Handbook on the Economics of Crime*. Portland, OR: Edward Elgar Publishing.

Zimmerman, P. R., and Benson, B. L. (2007). Alcohol and rape: An "economics-of-crime" perspective. *International Review of Law and Economics* 27(4), 442-473.

Zimring, F. E. (2007). *The Great American Crime Decline*. New York: Oxford University Press.

Table A.1: Summary Statistics

| Variable | N | Mean | St. Dev. | Description |
|---|---|---|---|---|
| $HC$ | 2728 | 1.7 | 1.7 | Homicide rate per 100,000 population |
| $Alc$ | 2728 | 7.3 | 3.4 | Per capita pure alcohol consumption (liters) |
| $Drug$ | 2728 | 120.7 | 305.1 | Number of drug-related crimes per 100,000 |
| $Det^{PH}$ | 2728 | 0.1 | 0.3 | Ratio of prison population to homicides |
| $Det^{CH}$ | 2728 | 1.0 | 0.1 | Ratio of capital punishments to homicides |
| $Ea$ | 2728 | 7.4 | 3.0 | Education of working-age population |
| $Ea^t$ | 2728 | 8.1 | 3.5 | Education of school-age population |
| $Dist$ | 2728 | 2.2 | 2.9 | Distance variable ($Ea^t - Comp_t$) |
| $Pop^{15-29}$ | 2728 | 23.0 | 2.8 | Share of population in 15–29 age cohort |
| $Div$ | 2728 | 3.4 | 5.2 | Number of divorces per 1,000 population |
| $Urb$ | 2728 | 46.2 | 29.0 | Urbanization rate (%) |
| $Y/Pop$ | 2728 | 35.0 | 74.5 | Per capita real GDP |
| $U$ | 2728 | 5.2 | 3.4 | Unemployment rate (%) |
| $Gini$ | 2728 | 32.1 | 8.7 | Net income Gini coefficient |
| $Alc^B$ | 2728 | 3.1 | 2.6 | Beer alcohol consumption per capita |
| $Alc^{BW}$ | 2728 | 1.5 | 2.8 | Wine alcohol consumption per capita |
| $Alc^S$ | 2728 | 2.7 | 1.8 | Spirit alcohol consumption per capita |