The American Temperance Movement and Market-Based Violence

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The net impact of market legality on crime is ambiguous if consumption of the illegally traded good causes violence. With modern crime data, I show that drug control policy that increases market-based violence while reducing violence associated with intoxication raises homicide rates for individuals in their 20s relative to older and younger people. Using a state-level panel of age-specific homicides from 1900 to 1940, when many states and eventually the federal government criminalized alcohol markets, I demonstrate that the spread of the temperance movement similarly compressed the age distribution of homicide victims, primarily in northern, urban states with large immigrant populations. (*JEL*: K42, N42, I18)

1. Introduction

On January 1, 1920, the manufacture, sale, and transportation of intoxicating liquor within, into, and from the United States and its territories were prohibited by the 18th Amendment to the United States Constitution. The

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ban was in effect until December 1933, when the 21st amendment was ratified. The passage of the 18th Amendment combined with the Volstead Act, which defined exactly what the Federal government considered intoxicating liquor to be, was the culmination of a nearly 70-year social movement aimed at limiting alcohol consumption in the United States. While the goals of the American Temperance Movement were to promote health, safety, and protestant morality, the prevailing view of the American Temperance Movement is one of utter failure; total alcohol consumption may have fallen (Dills and Miron, 2004; Cook, 2007), but conventional wisdom characterizes the temperance movement as, perversely, introducing a period of widespread lawlessness, fueled by illegal alcohol that was supplied by violent bootleggers (e.g., Okrent 2010).

While this story of prohibition and violence is widely known, to date, hard evidence on the extent and nature of violence during the American Temperance Movement is surprisingly scant, and what exists is based as much on urban legend as actual historical record (Gusfield, 1986). Homicide rates were certainly high during Federal Prohibition, but the criminalization of alcohol markets in the early 20th century took place against a backdrop of major social upheaval that also contributed to violence. What data do exist on crime during this period suggest a more nuanced story than the one portrayed in popular media. Asbridge and Weerasinghe (2009) show that police believed that most of the homicides in Prohibition-era Chicago were not related to alcohol markets. Owens (2011) demonstrates that, conditional on measurable demographic variables like urbanization, immigration, and welfare spending, certain types of dry laws actually appear to have reduced homicide rates. These recent papers are consistent with research on modern county-level dry laws, which tend to reduce crime, although they may increase the abuse of other substances (Conlin et al., 2005; Heaton, 2012).

One factor complicating attempts to estimate the impact of temperance on crime is the fact that criminalizing the market for alcohol has a theoretically ambiguous effect on overall violence. On the one hand, the absence of formal contract enforcement should lead to higher rates of violence among the participants in illegal markets (Reuter, 1985). To date, Chimeli and Soares (2011) provide what is arguably the cleanest evidence of a substantively large increase in this type of market-based crime using data from

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Brazil, which criminalized a subset of the timber market in the 1990s. Evans et al. (2013) document an increase in homicide rates of black American males between the ages of 15 and 24 after the introduction of crack cocaine in large cities, which is consistent with more prime-aged males engaging in violence after an increase in rents in illegal drug markets. To the extent that the mechanisms underlying Chimeli and Soares (2011) and Evans et al. (2013) can be generalized to early 20th century America, criminalizing the market for alcohol should have increased overall violence. Counteracting this effect, however, is the fact that alcohol consumption itself has a direct positive impact on individual violence (Miczek et al., 1994). Dills and Miron (2004) present evidence that alcohol consumption fell in the United States between 1920 and 1933, and Cook (2007) documents reports from social workers that domestic violence among low socioeconomic status families may have fallen. In practice, any national, state, or city-level analysis of the impact of temperance on violence confounds any increase in market-based violence with a reduction in violence associated with reduced alcohol consumption.

In this paper, I present new evidence on the impact of the alcohol prohibition on the nature of violence in the United States. Existing research on violence during the temperance movement has, with the exception of Asbridge and Weerasinghe (2009), relied on aggregate homicide rates, which confound the increases in market-based violence and reductions in violence caused by reduced alcohol consumption (Miron, 1999; Jensen, 2000; Owens, 2011). I build on this research by using data on age-specific homicide rates, which are available at the state level from 1900 to 1940. As I show using more detailed modern homicide data, there is a strong connection between the age of a homicide victim and the circumstances of that victim's death; specifically, market-based violence disproportionately affects people in the middle of the age distribution. People killed in circumstances that are plausibly exacerbated by the effects of alcohol consumption (accidents, fights, or disputes between family members) are relatively more likely to be in the tail ends of the age distribution.

Based on patterns of victim age and homicide circumstances in modern data, I predict that criminalizing the market for alcohol, by simultaneously increasing market-based violence and reducing violence associated with alcohol consumption, should have reduced the homicide rates for older

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and younger people and increased homicide rates for those in the middle of the age distribution. Rather than evaluate the impact of prohibition on the rate of homicide, as the existing research has done, I estimate the impact of prohibition on the distribution of homicide rates across victim ages. I use variation in the timing of the passage and repeal of dry laws to identify the impact of market illegality on the change in homicide rates of people in their 20s relative to people under 20 and over 30. After documenting the robustness of this compression of the age distribution of homicide victims to various assumptions about unobserved determinants of crime, I show that the relationship between market illegality and this indicator of market-based violence was strongest in northern states, urbanized areas, and states with large immigrant populations. This particular geographic pattern of effects is noteworthy, as it is consistent with the (primarily qualitative and anecdotal) evidence on the growth of criminal gangs in the United States (Thrasher, 1927; Abadinsky, 1994; Klein, 1998).

The paper proceeds as follows. In Section 2, I use existing research on alcohol and violent crime to connect drinking with murder rates, with an emphasis on the role of market-based violence. I then use modern homicide data to document the existence of a relationship between homicide circumstances and victim age. In Section 3, I provide short and descriptive case studies on homicides and gang violence in Chicago and Philadelphia during Federal Prohibition. Section 4 describes the available data on crime during the American Temperance Movement in detail. I present my analytic framework for estimating the impact of temperance on the homicide rates of people in their 20s, relative to older and younger victims, and my panel estimates of the relative change in homicide rates in Section 5. Section 6 concludes with discussion and policy implications.

2. Alcohol, Violence, and Illegal Markets

Alcohol consumption is highly correlated with criminal behavior. According to the Bureau of Justice Statistics, roughly 40% of surveyed crime victims believe their attacker was drunk, and roughly 40% of offenders reported consuming alcohol prior to committing crime.[1] Consistent

1. Bureau of Justice Statistics report "Alcohol and Crime." http://bjs.ojp.usdoj.gov/content/pub/pdf/ac.pdf.

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with these reports, a large literature in economics and public health has found evidence of a positive relationship between drinking and criminal behavior (Cook and Moore, 1993; Joksch and Jones, 1993; Markowitz and Grossman, 2000; Carpenter, 2008; Dobkin and Carpenter, 2008). Further, laboratory experiments have consistently shown that, at moderate levels, alcohol consumption increases both individual aggression and the perceived aggression of others (Miczek et al., 1994).

The finding that alcohol consumption increases the probability that an individual will engage in violent behavior is evidence of a direct, intoxication-based link between alcohol and crime. To the extent that a substantial portion of violence is "intoxicated," or caused by intoxicated people who would otherwise not engage in such behavior, policies that reduce drinking should lead to crime reductions.

Criminalizing a market is, to some extent, conceptually equivalent to dramatically increasing costs associated with the goods that market provides. The producer must now bear the cost of avoiding law enforcement, shifting supply inward. Consumers also face legal risk of apprehension and, at a given sticker price, will therefore demand less alcohol. Further, the absence of formal contract enforcement in illegal markets increases the amount of uncertainty associated with each transaction, which may affect both consumers and producers. Both the reduction in supply and reduction in demand will unambiguously reduce the equilibrium quantity demanded. It then follows that if alcohol consumption falls when alcohol markets are criminalized, the intoxicated violence associated with alcohol will also fall.[2]

A reduction in intoxicated violence with market illegality does not necessarily translate into a reduction in overall violence. Market illegality itself can lead to a particular type of crime. In legal markets, the civil court system provides third-party contract enforcement that can be relied upon to resolve disputes. By definition, disputes that arise during transactions in an illegal market do not fall under the jurisdiction of the courts. In the broadest sense, market-based violence is violence used to assign property rights in the absence of formal contract enforcement.[3] Because the civil court does

2. Obviously, producers could also respond to the increase in cost by selling a lower quality good, essentially exiting the market for "higher end" alcohol.

3. See Donohue and Levitt (1998) for a theoretical discussion of the social cost associated with this type of violence.

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not recognize any property rights in, for example, black tar heroin, a black tar heroin merchant cannot sue his supplier in court if she fails to deliver an agreed upon amount of product. While it is plausible that the merchant could rely on informal networks to socially punish the supplier, it is also the case that physical force could be used to compel her to fulfill the terms of the contract; violence is the "last resort in contract enforcement" (Schelling, 1967).[4] To the extent that physical force is beneficial in these illegal markets, individuals who are able and willing to use violence are more likely to choose to participate in them (Reuter, 1985; Levitt and Venkatesh, 2001).

Contract enforcement is not the only mechanism linking market illegality to violence. In legal markets, a business owner who used violence against employees, customers, or competitors would be subject to legal sanctions. In contrast, people engaged in illegal transactions are already violating the law. This reduces the marginal impact on the employer's expected probability of legal sanctions (Reuter, 1985). Not only are the (criminal) victims less likely to contact the police, but also the employer plausibly had a nonzero expectation of punishment even without using force.

When either state or federal law prohibited the commercial sale of alcohol during the temperance movement, an ideal dataset would allow a researcher to observe the subsequent simultaneous reductions in violence due to the limited availability of alcohol and increases in violence among participants in the, now underground, alcohol market. To the extent that these changes in the nature of violence were correlated with the state legal environment, rather than other state demographic changes, and could not be explained by time invariant differences across states or year-specific shocks common to all states, these changes could more plausibly be interpreted as causal. Unfortunately, there are no datasets currently available that both span multiple states and contain information on the circumstances of death. However, modern homicide data from the Census, which indicate whether or not a murder victim was under 20, in their 20s, or over 30 at the time

4. At the same time, nonviolent informal contract enforcement mechanisms are also well documented. Venkatesh (2006) highlights the role that social pressure and repeated games play in Chicago underground economies. Leeson (2007) documents the existence of informal "constitutions" that outlined how disputes would be resolved in large pirate organizations.

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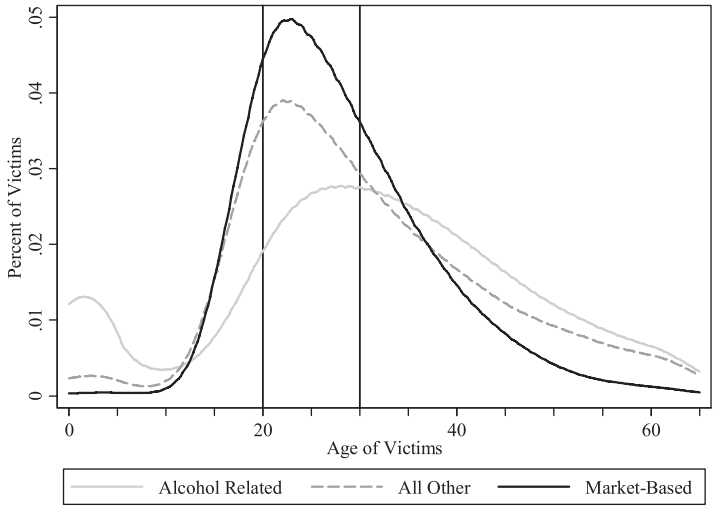

Figure 1. Age Distribution of Homicide Victims, 1976–2004.

of death, do provide important indirect evidence on the probability that the individual was killed in market-based violence (Table A2).

After the market for alcohol is criminalized in a state, the overall percentage change in the homicide rate is equivalent to the weighted sum of the percentage change in the rate of market-based homicides and the percentage change in the rate of alcohol-induced homicides. Importantly, the weights are equal to the fraction of homicides that are market-based and the fraction that are alcohol-induced. Within each of the three age groups identified in the Census, variation in the importance of market-based versus alcohol-induced homicides in each age category will therefore generate variation in the expected homicide rates of people of different ages when a state goes dry.

Figure 1 displays the age distribution of homicide victims recorded in the FBI's Supplementary Homicide Reports (SHR) between 1976 and 2004. I break homicide victims into three different types, based on the reported circumstances of their death: people killed in "alcohol-related" incidents (by family members, in "alcohol-related" arguments, or killed accidentally), people killed in market-based violence (a gangland killing, a dispute over a drug transaction, or directly related to involvement in prostitution

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or gambling), and then, for the sake of comparison, all other homicide victims.[5] This figure clearly shows that homicides that are plausibly triggered by intoxication are more likely to occur at the tail ends of the age distribution than other homicides, and that homicides that are due to gang violence or market activity are disproportionately concentrated in the center of the age distribution.

The two distinct mechanisms linking the legality of alcohol markets to homicide would clearly affect different types of people. Roughly 47% of those killed as a result of market-based violence are in their 20s, 15% are under 20, and 37% are over 30. In contrast, roughly 16% of other types of alcohol-related murder victims are under 20, 33% are in their 20s, and 50% are over 30. Using a common measure of dispersion, the difference in age of victims in the 90th and 10th percentiles, the age distribution of market-based homicides is 104% more compressed than accidental victims, 150% more compressed than people killed by family members, and 54% more compressed than people killed in arguments where alcohol was believed to be a factor.[6]

It is also possible that the variation in the age of homicide victims and homicide circumstances are driven by geographic or temporal variation in population or record keeping. When the probability that a murder victim was killed in a particular circumstance is modeled as a function of their age, the state of death, and the year of death,[7] I fail to reject the null hypothesis that people in their 20s and over 30 are differentially likely to be killed by accident (both age groups are 250%, or 2 percentage-points less likely, than those under 20) or in a drunken fight (62%, or 2 percentage-points, more likely than someone under 20). I cannot reject the null hypothesis that people over 30 are equally likely to be killed by family members as people under 20, but homicide victims in their 20s are 44%, or 9.8 percentage-points, less

5. Gang violence is different from co-offending murders committed by more than one person. Co-offending is actually somewhat unusual among people over 20 (Reiss, 1988; Zimring, 1998).

6. These number are simply the difference in ages of the 90th and 10 percentiles of the age distribution of each type of victim (45, 55, and 34 years, respectively), expressed as a percentage of the 90–10 split of market-based homicide victims (22 years).

7. See Table A1 for these regression results. Modern estimates are highly robust to alternate specifications, focusing on just males or just females, and are stable over time. The precision of the relationship between being over 30 and being killed in mob violence in Chicago and Philadelphia between 1900 and 1940 is sensitive to functional form.

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likely to die in those circumstances. In contrast, someone who was killed in their 20s is approximately 60% (3.6 percentage-points) more likely to be killed in market-based violence than someone under 20 or over 30.

It is clear from the age distribution of homicide victims today that market-based violence is excessively represented among victims between 16 and 35 year olds, as those are the ages at which there are relatively more market-based victims than other types. However, existing historical homicide data simply do not allow us to separately calculate homicide rates for those age categories over time. With this limitation in mind, prevalence rates in modern homicide data imply that, ceteris paribus, reducing the incidence of deaths from family disputes, fighting, and accidents by 10% should reduce the number of homicide victims under 20 by 2.8% (since an estimated 28% of all victims under 20 are killed in one of these situations), the number of homicide victims over 30 by 2.9%, and the number of homicide victims in their 20s by 1.9%. Increasing the incidence of market-based violence by 10% would increase the number of homicides among people under 20 by 0.47%, increase the number of homicides among people over 30 by 0.33%, and increase the number of homicides among people in their 20s by 0.98%. A policy that simultaneously caused both changes would therefore be predicted to result in a net 2.3% reduction in the number of homicides among people under 20, a 0.88% reduction in homicides among people in their 20s, and a 2.6% reduction in homicides among older people. Homicide rates would fall after these two changes, but heterogeneity in the impact of the different mechanisms linking alcohol to violence across the age distribution would lead to, on average, a 1.6% relative increase in the number of victims in their 20s. In subsequent sections, I will investigate whether such age changes occurred in the wake of state temperance laws and Federal Prohibition.

3. Gang Violence and Age in Chicago and Philadelphia

Modern homicide data suggest that increases in market-based violence will be associated with an increase in the probability that a person in his 20s becomes a homicide victim. Of course, this estimate requires that the pattern of involvement in illegal markets in the late 20th century is generalizable to the early 20th century. The plausibility of this assumption depends on the

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mechanisms linking age to participation in illegal markets. To the extent that physical strength is a primary determinant of success in illegal markets (Levitt and Venkatesh, 2001), this would suggest that men in their 20s should have a comparative advantage, since that is the age when men generally have peak muscle strength (Hurley, 1995). This particular mechanism should be relatively time invariant. However, more evidence on the plausibility of this relationship can be found in an examination of individual-level homicide datasets from Chicago and Philadelphia. While there is some variation across cities in the scope of the data collected, both data sets report whether or not the victim was killed in gang violence along with the age of the victim and the year of death. Neither Illinois nor Pennsylvania instituted state-level dry laws, so the legal status of the local market for alcohol is determined by the enactments of the 18th and 21st amendments.

The Chicago Historical Homicide Project (Bienen 2005) reports this information for all homicides in Chicago between 1870 and 1930, explicitly reporting the involvement of organized crime. Data on homicides in Philadelphia in 1902, 1908, 1914, 1915, 1920, 1926, and 1932 were compiled by Lane (2004) and are part of the Ohio State Historical Violence Database. In the observed years, roughly 3% of all homicide victims are killed in gang-related violence, and reported gang-related homicides increased by 1.5 percentage-points during dry years. This is a huge percentage increase in gang-related murders, but it is also probable that newspapers and court reports were more inclined to report deaths as gang-related during Federal Prohibition. However, it is substantially less likely that the news media would disproportionately label victims in the specific age range measurable in the Census Mortality Statistics (CMS) as dying in gang violence.

After 1919, 37% of all gang homicide victims were in their 20s; only 18% were their 20s in wet years. 20 year-olds made up 27% of other murder victims in these two cities during Prohibition, compared with 33% when alcohol could be legally purchased. More than half of gang victims (56%) were over 30 during the 1920s, but this is likely due to population differences; these older victims were 60% of homicide victims killed for other reasons. Of course, not all gang violence is intended to resolve contract disputes, and not all conflicts over economic transactions occur between gang members. However, both historical and modern evidence on gang activity

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and informal economic activity documents a strong link between the two (Abadinsky, 1994; Venkatesh, 2006).

In the top panel of Figure 2, I present the age distribution of victims of gang violence in Chicago and Philadelphia at three points in time: before Federal Prohibition, during Federal Prohibition, and in the modern SHR data. Victims of gang violence in 19th and 20th century Chicago were older than victims of gang violence today—the average age of victims believed to be associated with gang violence is 35. However, consistent with modern data, the age distribution is much more compressed around the late 20s and early 30s than other murder victims.

For the sake of comparison, the bottom panel of Figure 2 displays the evolution of the composition of all other homicide victims. Any general population changes that might affect violence levels overall should also be reflected in these deaths. The sharp change in the age distribution of victims of gang violence is not evident here, suggesting that only a small fraction of the increase in gang-related deaths of 20 year olds was due to other demographic or social changes. What is evident, however, is that the younger average age of gang victims in the modern data is more likely to be driven by something besides illegal market activity, like a change in the age of the overall population. As in the national data, the age distribution of victims of non-gang violence is substantially more spread out than victims of gang violence in Chicago and Philadelphia.

In Table 1, I present point estimates of the change in age distributions of victims of market-based and non-market-based violence in these two cities over time. Between 1900 and 1919, only 18% of people killed in market-based violence were in their 20s, and 65% were over 30. Using the age distribution of other murder victims as a proxy for population and general risk, those in their 20s are actually slightly under-represented among these victims, as one-third of all homicide victims are in their 20s. After Prohibition is in place, dramatically increasing the demand for informal property right protection in the newly illegal market for alcohol, there is a 19 percentage-point increase in the fraction of market-based victims in their 20s, along with a 10 percentage-point reduction in the fraction of all other murder victims in that same age range. Once alcohol markets are criminalized, those in their 30s are less represented among market-based victims than in other murders (56% vs. 60%). Forty years later, when illegal markets for drugs,

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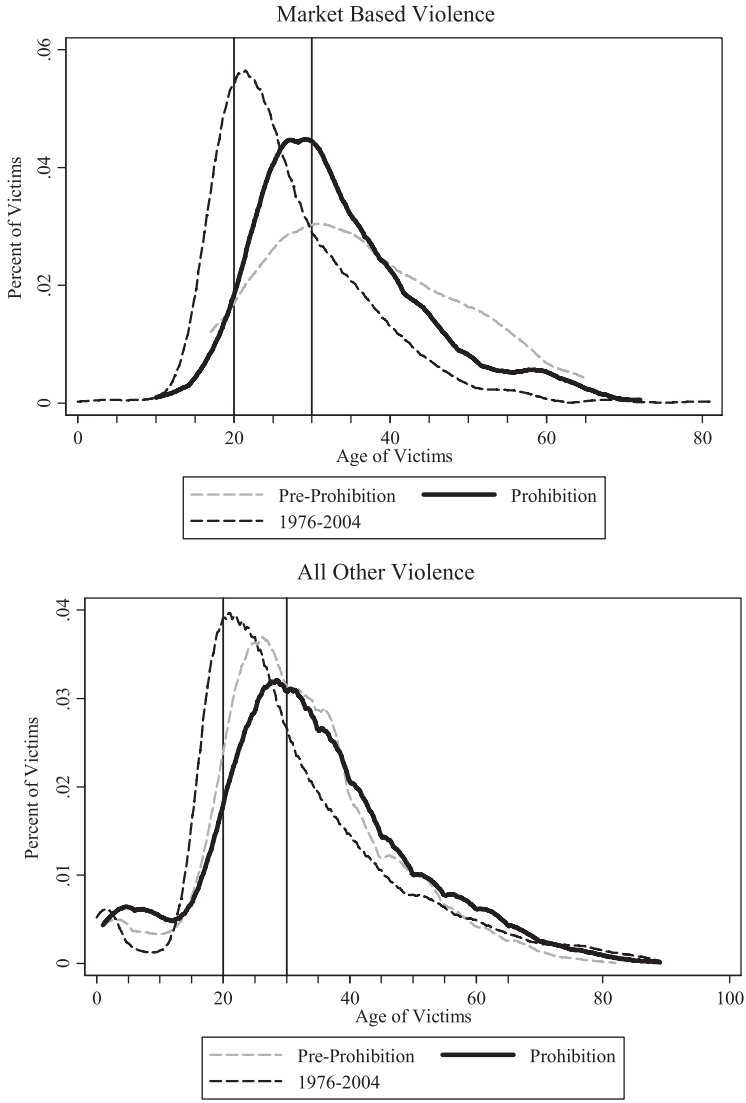

Figure 2. Age Distribution of Homicide Victims in Chicago and Philadelphia after 1900.

sex, and gambling in both cities are large, and also relatively (compared with the early 20th century) stable, 34–36% of all murder victims and 46–56% of all market-based murder victims are in their 20s. Prohibition appears to

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be associated with an inversion of the age distribution of homicide victims, which is still observed in market-based violence today.

Since these major cities were only dry during Federal Prohibition, so it is important to keep in mind that some other national phenomenon could be causing these changes. However, comparing the age of murder victims in these major cities suggests that when alcohol markets operated outside of the legal sector, the fraction of 20 year olds killed in organized crime quadrupled (less than 1% to 4.5%), while market-based violence remained relatively stable (2% to 3% or 0.9% to 0.8%) in older and younger age groups. Analysis of the panel data in the CMS, where we can exploit state-level variation in the legality of alcohol markets, will provide further insight on this issue.

4. Measuring Crime before 1940

Estimating the impact of the Temperance Movement on violence, especially market-based violence, is complicated by the quality of available data, particularly relative to modern crime data. Beginning in 1930, the Federal Bureau of Investigation (FBI) began compiling local law enforcement statistics into the Uniform Crime Reports (UCR), and by 1968 most law enforcement agencies contributed data to this database.[8] Researchers seeking information on crime prior to the late 1960s have two options. Many local police agencies maintain crime records that pre-date the UCR. This type of data, which is used in Asbridge and Weerasinghe (2009) and Fishback et al. (2010), has the advantage of precise measurement of crime incidence, but with limited geographic coverage. Alternately, proxies for crime rates can be found in annual historical vital statistics records collected by the U.S. Census Bureau beginning in 1900.[9]

The CMS contain annual counts of the number of deaths, by cause, in what was called the "death registration area." In 1900, the death registration

8. There were two important innovations of the UCR. First, the definitions of seven "index crimes" were standardized across regions and over time. Second, by 1968, almost all local law enforcement agencies contributed to the UCR, meaning that the FBI could produce a snapshot of national crime rates.

9. The Ohio State University Criminal Justice Research Center also maintains a database of statistics related to violence that covers a wide range of time periods and geographies, with particularly good coverage for New England.

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Table 1. Age of Homicide Victims by Homicide Type, Philadelphia and Chicago, 1900–1932 and 1970–2004

	Market-based Homicide			All Other Homicides		
Age Category	1900–1919	1920–1932	Δp	1900–1919	1920–1932	Δ*p*
p (Victim < 20)	0.077	0.035	−0.042	0.035	0.134	0.099
p (20 ⩽ Victim < 30)	0.185	0.373	0.188	0.373	0.270	−0.103
p (Victim ⩾ 30)	0.646	0.562	−0.084	0.562	0.596	0.034

	Market-based Homicide				All Other Homicides			
	1970	1980	1990	2000	1970	1980	1990	2000
p (Victim < 20)	0.132	0.265	0.202	0.166	0.164	0.161	0.252	0.204
p (20 ⩽ Victim < 30)	0.559	0.455	0.465	0.487	0.365	0.360	0.342	0.394
p (Victim ⩾ 30)	0.309	0.280	0.333	0.347	0.47	0.477	0.405	0.400

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area consisted of 13 states, primarily New England, Michigan, and Indiana. States were subsequently added to the death registry, and in 1931 the addition of Texas made the registry complete. While Census officials initially expressed some concerns about doctors under-reporting homicides, by 1910 the American Public Health Association required that states in the registration area hold undertakers, or "other persons having charge of the body" legally responsible for reporting all deaths "immediately after occurrence" in a standardized way, and enforce criminal penalties for noncompliance (Bureau of the Census, 1912).

One strength of the CMS is that variation in homicide rates appears to track variation in other violent crime rates closely; between 1976 and 2006, the within-state correlation between homicide rates and the rate of all other violent crimes in the UCR is 0.87. However, an important limitation of these data is that they are compiled at state level, and as the states included in the death registry change over time, national homicide rates calculated from the CMS before 1932 are not comparable across years. No gender or racial information is consistently collected by the CMS during this period, but it does contain one demographic measure that can be used to disentangle market-based and intoxicated violence. Specifically, in each year's mortality report, deaths are reported by age of the decedent in a way that allows me to calculate age-specific homicide rates for three groups: people under 20, people between 20 and 29, and people over 30 years old.[10]

10. For those dying before reaching 5 years old, deaths are disaggregated by each year of age. The total number of decedents between the ages of 5 and 9 are also reported, and until 1922 the number people dying at later ages were grouped into 10-year age categories. From 1922 until 1930, the number of deaths occurring between the ages of 10 and 35 were broken into 5-year categories, and from 1934 onward all deaths over the age of 10 are reported in 5-year age categories. In 3 years (1931, 1932, and 1933) deaths are reported between the ages of 20 and 24, 25 and 34, and 35 and 44. While no states are Wet during this period, these years do help identify the relationship between homicide and demographic changes, many of which are highly correlated with temperance. In these years, I will substitute homicide rates for 20–34 year olds, and assume that any difference between this rate and the true 20- to 30-year-old death rate is absorbed in year-fixed effects. Alternately, the true homicide rate for those in their 20s can be bounded by alternately assuming that all deaths of 20–34 year olds are actually people in their 20s, or actually only people in their 30s. Since there is no variation in the legal status of alcohol markets during these years, the impact of this substitution on my coefficients of interest is indirect through the change in the average influence of other covariates. Not surprisingly, this changes the estimated impact of dry laws on the relative change in murder rates only marginally.

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Table 2. Age-Specific Murder Rates, Dry Laws, and Demographics in America, 1900–1940

	Mean	Standard Deviation
Homicides/100k pop, under 20 years old ($n = 1,290$)	2.01	1.37
Homicides/100k pop, 20–29 years old ($n = 1,290$)	13.5	12.0
Homicides/100k pop, over 30 years old ($n = 1,290$)	9.14	7.07
Urbanization ($n = 3,870$)	0.575	0.202
Education rate ($n = 3,870$)	0.924	0.045
% Black ($n = 3,870$)	0.077	0.115
% Foreign born (white only) ($n = 3,870$)	0.134	0.092
% Catholic ($n = 3,870$)	0.175	0.104
% Population 6–20 y.o. ($n = 3,870$)	0.266	0.030
New deal grant/pop ($2005) ($n = 1,008$)	404	213
% of State–years under temperance ($n = 3,870$)	0.505	

Mean and standard deviations weighted by population in each state in each age group. "Urbanization" is defined as the percent of the state population living in a place with more than 2,500 people. The "education rate" is estimated as adult literacy rate between 1900 and 1910, and the percent of 6–14 year olds in school between 1910 and 1940.

Table 2 presents some basic descriptive statistics of crime measures available from 1900 to 1940. Not surprisingly, homicide rates are highest for those in their 20s, at 13 per 100,000 people, compared with 2 per 100,000 for people under 20 and 9 per 100,000 for people over 30. I also present measures of demographic and economic changes, drawn from two sources. State-level measures of the fraction of the population living in an urban area (with more than 2,500 residents), the fraction black, the fraction foreign born, the fraction Catholic, the fraction between the ages of 6 and 20, and a measure of the education rate in the population are all taken from the decennial census data compiled in Haines (2004), with linear interpolations between census years. I also report the average number of dollars granted to the state government as part of the New Deal, scaled by state population.[11] Most of the measured demographic characteristics have a high variance relative to the mean, consistent with rapid social change over this time period. Note that roughly half of my observations are in dry states, and roughly 20% of those occur before or after Federal Prohibition.

By linking the CMS with state-level estimates of population by age from the IPUMS, it is possible to construct age-specific homicide rates at the

11. These data were generously provided to me be Price Fishback.

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state level for three consistently defined age categories: people under 20, people in their 20s, and people over 30, between 1900 and 1940, with the some measurement error during the final years of Federal Prohibition. I will show in the next section that even this coarse disaggregation of homicide rates provides important information about the probable amount of market-based violence in that state and year.

5. The Temperance Movement and Age Distribution of Homicide Rates

5.1. Analytic Framework

The countervailing impacts of lower intoxicated violence and higher market-based violence mean that the net effect of outlawing the commercial sale of alcohol on homicide rates is theoretically ambiguous. However, the predicted effect of temperance on the age distribution of homicide victims is not ambiguous. In states where commercial sale of alcohol was banned, the resulting decrease in the consumption of alcohol should have reduced the number of homicides due to intoxicated causes—young children and older adults killed by intoxicated and aggressive drinkers, or individuals who are killed by accident due to careless and intoxicated behavior. At the same time, to the extent that restricting legal alcohol sales increased the amount of market-based violence, homicides resulting from disputes over illegal sales should also have increased and this type of violence is more likely to involve people in their 20s.[12]

I therefore test whether or not market-based violence rose during the Temperance Movement by comparing the age-specific homicide rates across states between 1900 and 1940. Based on the observed patterns in the SHR, I will interpret a differential increase in the murder rates of people in their 20s as evidence consistent with an increase in market-based violence. I estimate three age-specific homicide rates for each state in each

12. It is also plausible that people in their 20s reduced their alcohol consumption by less than people under 20 or over 30 in response to temperance. If the victims of intoxicated violence were always in the same age group as the assailants, a point which is not necessarily obvious, then this would also cause a compression of the age distribution. To the best of my knowledge, the impact of temperance on the age distribution of drinkers is unknown.

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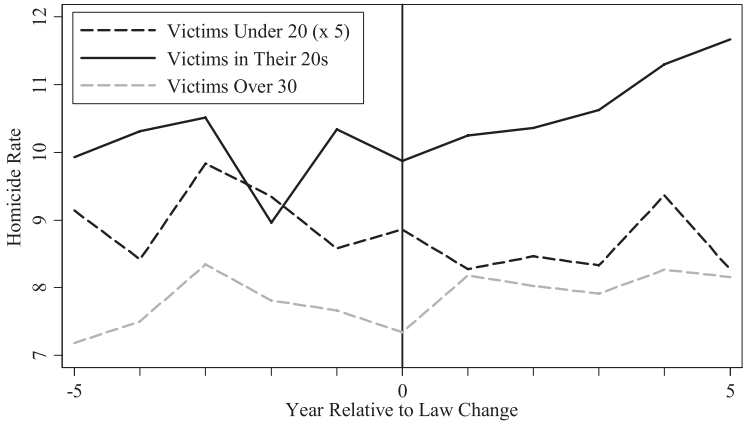

Figure 3. Age-Specific Homicide Rates Around Criminalization of Alcohol Markets. *Note:* Mean Homicide Rates in 25 States, Weighted by Age-Specific State Population.

year: the homicide rate for those under 20, the rate for those in their 20s, and the homicide rate for those over 30. While this is a coarse measure of the age distribution of homicide victims, these three categories are consistently defined throughout my sample period, and a meaningful relationship between these three age categories and homicide circumstances was detectable in modern data.

Figure 3, which plots the mean values of age-specific murder rates in the years leading up to and after alcohol markets were outlawed in a given state, suggests that there was some differential change in these age group-specific murder rates. For ease of comparison, I multiply the murder rates for those under 20 by 5. All rates are generally flat leading up to temperance. After a state goes dry, there is a clear increase in the homicide rate among those in their 20s.[13] There is no such increase for people over 30 or under 20 until about 4 yearsafter temperance, after which it declines again, suggesting that the fraction of all murder victims in their 20s is growing over time, compressing the age distribution of murder victims overall. As shown in Figure 4, when a state goes wet, all homicide rates appear to decline.

13. See Owens (2011) for a more detailed description of the determinants of the timing of state dry laws.

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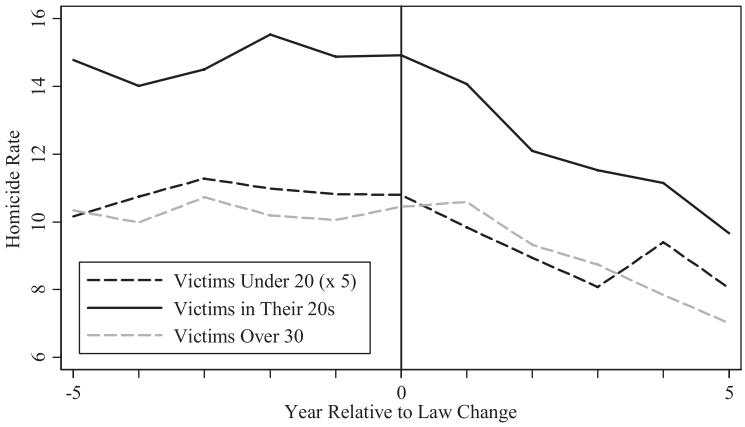

Figure 4. Age-Specific Homicide Rates around Legalization of Alcohol Markets. *Note:* Mean Homicide Rates in 42 States, Weighted by Age-Specific State Population.

While not as dramatic as the divergence when a state goes dry, the distance between the homicide rates of 20 year olds and rates for other age groups narrows, which is consistent with a flattening of the age distribution of victims.

5.1.1. *Average impact of temperance on the age distribution of homicide victims.* I identify the impact of temperance on market-based violence using a quasi-differences-in-differences model, where I compare the change in homicide rates of 20–29 year olds to the changes in homicide rates of the other age groups when state-level dry laws are put in place.[14] My most basic

14. Alternately, I could estimate the fraction of all murder victims that are in their 20s as a function of temperance laws. I prefer Equation (1) because it places more weight on changes in the murder rates of victims under 20, who make up a small fraction of homicide victims. That said, I find that conditional on state-fixed effects, temperance laws increase the fraction of murder victims in their 20s by about 16% with a quadratic time trend, and by about 19% with a control for the fraction of all state residents in their 20s. The theoretical justification for including additional demographic controls is less clear, and as my controls are strong predictors of temperance, this significantly weakens the power of my model. With a full set of controls and state- and year-fixed effects, temperance laws passed in the North and temperance laws passed earlier are associated with statistically precise increases in the fraction of murder victims that are in their 20s.

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model of state–year–age category death rates is

$$\begin{aligned}\ln(&Murder_{ast}/Population_{ast})\\ &=\alpha_a+\delta_s+\lambda_t+X_{st}\theta+Temperance_{st}\beta_1\\ &\quad+\big(\big(20\leqslant VictimAge_a<30\big)\times Temperance_{st}\big)\\ &\quad\times\beta_2+\upsilon_{ast}\end{aligned}\tag{1}$$

where $Murder_{ast}/Population_{ast}$ is the number of homicide victims in age group a in state s in year t, divided by the estimated number of people in that age group in that state and year, and multiplied by 100,000. $20\leqslant VictimAge_a<30$ is a dummy variable equaling 1 if the age group a is people in their 20s, and $Temperance_{st}$ equals 1 if the commercial sale of alcohol was illegal in state s in year t, due to either state or federal law.

In this basic specification, the estimated value of β_1 is the average impact of dry laws on homicide rates, which is the net impact of an increase in market-based violence and a reduction in violence directly caused by lower rates of alcohol consumption. The estimated value of β_2 is the log percentage change in homicide rate of people in their 20s during temperance relative to the log percentage change in homicide rates of people at the tails of the age distribution. To the extent that market-based violence disproportionately affects people in their 20s, a positive value of β_2 will indicate an increase in market-based violence, even though alcohol consumption may be declining in an absolute sense. Importantly, since states are added to the sample at different times, the inclusion of state-fixed effects, δ_s, means that I am analyzing changes in homicide rates within a state.

The first half of the 20th century was a period of major social upheaval. To the extent that urbanization, changes in the demographic makeup of those cities, education levels, and welfare spending are correlated with both the passage of temperance laws and with homicide rates, a failure to control for these factors will bias estimates of β_1 and β_2. Indeed, the literature has shown that these measures are predictors of both the timing of temperance laws (Lewis, 2008; Owens, 2011; Garcia-Jimeno, 2011) and with crime rates (Glaeser and Sacerdote, 1999; Fishback et al., 2007; Fishback et al., 2010). I therefore include in X_{st} contemporaneous measures of the education rate, urbanization, ethnic, religious, racial and age composition

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of the state, as well as the number of dollars granted to the state as part of the New Deal scaled by state population and lagged 1 year.

In my first refinement of Equation (1), I allow for arbitrary variation in homicide rates across states with age category-specific state-fixed effects. Next, I add arbitrary variation over time with year-fixed effects; note that since I am interested in the relative changes in homicide rates within a state, the impact of Federal Prohibition is still contributing to the identification of β_2. I also test the sensitivity of my results to a variety of assumptions about the impact of unobserved shocks to homicide rates. By including state by year-fixed effects, I can allow for arbitrary shocks to the average overall homicide rate each year. Including age category-specific year shocks means I am identifying the compression of the homicide rate only off states that enacted dry laws prior to 1920, or that maintained their own dry laws after 1933. Finally, I allow changes in state demographic characteristics to also affect the relative homicide rates, along with the average homicide rate, by allowing the impact of my variables in X_{st} to vary across age categories. In all regressions, I allow for arbitrary correlation in the remaining unexplained component of murder rates within each state by clustering the standard errors at the state level, and, since all of my variables are aggregate measures that will be more stable in larger states, all equations are weighted by the age-specific state population.

I also test the impact of temperance on the entire three-part age distribution by including an additional dummy for homicide victims that are over 30, $30 \leqslant VictimAge_a$. In this case, the estimated coefficient on $20 \leqslant VictimAge_a < 30$ represents the difference between the log percentage change in homicide rates of people under 20 and in their 20s. While no longer a direct test of the compression of the age distribution, the relative magnitudes and signs of provide more information about the changing nature of violence during the Temperance Movement. In all specifications where I include this additional age dummy, I will also allow all demographic controls in X_{st} to differentially impact the relative homicide rate of people over 30. In light of the relationship between age and homicide circumstances in Philadelphia and Chicago over time, I might expect to see an increase in homicide rates for people over 30; the age of victims of gang violence has shifted downward over time. This simply means that I expect the impact of temperance on the homicide rate of 20 year olds relative to those under 20

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to be larger than the impact of temperance on the homicide rate of those over 30 relative to the homicide rate of the youngest group.

5.1.2. *Heterogeneity in the impact of temperance.* Equation (1) abstracts from the fact that not all temperance laws were the same. It is also not the case that market-based violence was believed to be uniformly distributed across the country. It is therefore reasonable to expect substantial heterogeneity in the impact of temperance, and I will look for patterns in my estimates of β_2 that are consistent with previous research on the impact of temperance laws on violence and conventional wisdom about organized crime.

First, many of the early state-level temperance laws allowed individuals with a high willingness to pay for alcohol to acquire it via legal channels. Of the 32 state level temperance laws passed prior to 1919, 19 allowed manufacture or importation of limited quantities of alcohol for personal use. It was only under "bone-dry" temperance laws, where all importation and all manufacture was banned, that alcohol consumers were forced to engage in illegal transactions. Further, the state-level analysis ignores county-level dry ordinances, which were common in the South.[15] Owens (2011) finds some suggestive evidence that both the popularity of temperance and urbanization affected the relationship between market legality and the homicide rate, and potentially could have affected the nature of violence as well. Finally, sociology has long connected immigration to gang activity, particularly in the early 20th century (Thrasher, 1927), and recent research on social ties within the American Mafia has found that people born outside of the United States were more connected to other Mafia members, and were more likely to hold leadership roles within the organization (Mastrobuoni and Patacchini, 2012). The existence of gangs in an area may have facilitated the spread of illegal markets after a state went dry—research in psychology finds that being around similar peers amplifies risk preferences (e.g., groups

15. County-level data on local dry laws is available from 1900 to 1918. Replacing my binary temperance measure with a continuous measure of the fraction of the state that is dry, incorporating these local ordinances, yields qualitatively identical results. Because these laws were easily subverted, county dry ordinances are perhaps best thought of as modestly raising the price of alcohol, having a smaller impact on both intoxicated and market-based violence than state laws.

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of risk averse people will be even more cautious, and groups of risk loving people even more reckless (Hogg et al., 1990)).

With these factors in mind, I complement Equation (1) with a series of estimates that allow for these types of heterogeneity, as follows:

$$\begin{aligned}
&\ln(Murder_{ast}/Population_{ast}) \\
&\quad = \alpha_{as} + \delta_{st} + \lambda_{at} + X_{st}\theta + Het_{st}\phi + Temperance_{st}\beta_1 \\
&\qquad + ((20 \leqslant VictimAge_a < 30) \times Temperance_{st})\beta_2 \\
&\qquad + ((20 \leqslant VictimAge_a < 30) \times Het_{st})\beta_3 \\
&\qquad + (Temperance_{st} \times Het_{st})\beta_4 \\
&\qquad + ((20 \leqslant VictimAge_a < 30) \times Temperance_{st} \times Het_{st})\beta_5 \\
&\qquad + \upsilon_{ast} \qquad (2)
\end{aligned}$$

where $Het_{st} \in (BoneDry_{st}, WetVotes_{st}/DryVotes_{st}, Urbanization_{st}, North_s, ForeignBorn_{st})$. The values of Het_{st} are defined as follows: $BoneDry_{st}$ equals 1 if the law in question prohibited importation and manufacture of alcohol for personal use. $WetVotes_{st}/DryVote_{st}$ reflects the number of votes for and against the most recent temperance law passed in state s in year t, which is found in Merz (1969). $Urbanization_{st}$ is the fraction of state residents living in places with more than 2,500 people. $North_s$ indicates that state s was in the Union (or was a Union territory), where local dry ordinances were less common, and $ForeignBorn_{st}$ is the fraction of adults living in state s in year t that were born outside the United States. The outcome of interest in all equations is β_5, the relative compression of the age distribution in the geographic area of interest. Note that the first-order effects of demographic changes, temperance, and the source of heterogeneity in murder rates (θ, ϕ, and β_1), along with the second-order interaction between temperance and the source of heterogeneity (β_4), will not be identified.

5.2. Results

5.2.1. *Average impact of temperance on the age distribution of homicide victims.* Table 3 contains my central estimates of the relationship between market legality and age-specific homicide rates. In a model with only state- and year-fixed effects, column 1, going dry is associated with a statistically

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Table 3. Fixed-Effect Estimates of State-Level Homicide Rates by Age Group, 1900–1940

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Temperance × 20 ⩽	0.181***	0.270***	0.184***	0.266***	0.140***	0.180***	0.143***	0.177***
Victim age < 30	[0.0246]	[0.0481]	[0.0244]	[0.0482]	[0.0328]	[0.0458]	[0.0398]	[0.0561]
Temperance × 30 ⩽		0.166***		0.153***		0.0742*		0.063
Victim age		[0.0530]		[0.0533]		[0.0400]		[0.0492]
R^2	0.755	0.756	0.763	0.763	0.886	0.789	0.887	0.887
Demographic controls			x	x	x	x	x	x
Age- × state-fixed effects					x	x	x	x
State- × year-fixed Effects							x	x
Age × demographic controls								
Age × year-fixed effects								
	Identification from State Laws Only							
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Temperance × 20 ⩽	0.0830*	0.122*	0.0757	0.119	0.0599	0.0584	0.0619	0.0357
Victim age < 30	[0.0446]	[0.0699]	[0.0543]	[0.0840]	[0.155]	[0.185]	[0.130]	[0.150]
Temperance × 30 ⩽		0.073		0.081		−0.00313		−0.0509
Victim age		[0.0685]		[0.0821]		[0.0986]		[0.0856]
R^2	0.89	0.891	0.887	0.887	0.89	0.89	0.89	0.891
Demographic controls	x	x	x	x	x	x	x	x
Age- × state-fixed effects	x	x	x	x	x	x	x	x
State- × year-fixed effects			x	x	x	x	x	x
Age × demographic controls	x	x	x	x			x	x
Age- × year-fixed effects					x	x	x	x

The dependent variable in each regression is the natural log of the age-specific murder rate +0.01. The average murder rate for 20 year olds is 13.5. All regressions contain 3,870 observations, have state- and year-fixed effects, and are weighted by age-specific state populations. Standard errors in brackets clustered at the state level. Demographic controls include state-level education rate, percent foreign born, percent between 6 and 20, percent black, percent catholic, lagged New Deal grants per capita (+0.01), and percent foreign born.

$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

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imprecise (unreported) 9% reduction in homicide rates overall, but a 19.8% increase in the homicide rate of 20 year olds relative to other age groups. A reduction in murder rates for young people is driving the ambiguous overall change in homicide rates; column 2 shows that homicide rates for people over 30 also increased by 18% relative to people under 20. The results in columns 3 and 4 suggest that the change in homicide rates for people over 30 may be due in part to demographic changes, as including state-level estimates of urbanization, immigration, education, racial makeup, and federal aid reduces the estimated relative increase in the homicide rate of people at the upper tail of the age distribution.

I observe roughly the same amount of compression in the age distribution of homicide victims when I allow for the age distribution to be unique to each state (columns 5 and 6), and when I allow for state-specific yearly shocks to the overall homicide rate (columns 7 and 8); in each case, we see a roughly 15% increase in the homicide rate of 20 year olds relative to other age groups.[16] Once I allow for annual shocks to the overall homicide rate in each state, I can no longer detect a statistically significant change in the homicide rates of people over 30 relative to those under 20.

Garcia-Jimeno (2011) presents evidence that the relationship between Temperance laws and violence changed over time; while homicide rates in large cities may have dropped when a dry law was initially passed, violence tended to rise as alcohol markets were criminalized for a longer period of time. This is consistent with an intuitive story of the price elasticity of supply increasing in the long run, as it takes time for the alcohol suppliers to "transition" from a legal to an illegal market. Figures 5 and 6 present some evidence on this question. Specifically, in Figure 5, I present t-statistics associated with an extension of my estimates in column 7; $Temperance_{it}$ and $20 \leqslant VictimAge_a < 30 x Temperance_{it}$ are replaced with $DryLawEnacted_{ik}$ and $20 \leqslant VictimAge_a < 30 x DryLawEnacted_{ik}$, where $k \in (-5, 14)$, with $k = 0$ when a dry law is enacted. In anticipation of my later results, I also re-estimate this model for northern states only.[17]

16. Obviously, the state-level demographic changes are no longer identified in this model.

17. Not surprisingly, since roughly the same number of states contribute to their identification, the coefficients themselves yield essentially the same patterns, although the negative relative homicide rate for those in their 20s two years prior to the passage

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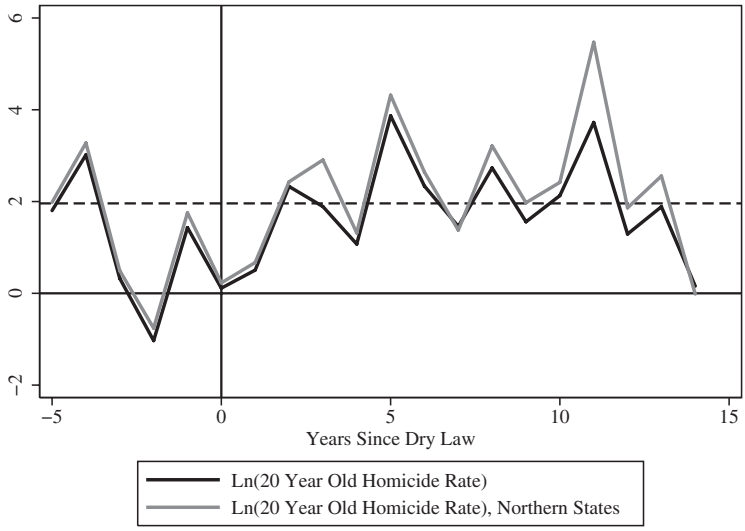

Figure 5. *t*-Statistics of Relative Changes in Homicide Rates of 20 and Over 30 Year Olds Around the Passage of Temperance Laws, Conditional on Demographic Changes, Age by State and State by Year-Fixed Effects, Weighted by Age-Specific State Population, Standard Errors Clustered at the State Level. *Note:* Dashed Horizontal Line Indicates $t = 1.96$.

For both the country on average, and northern states specifically, homicide rates for people in their 20s become statistically larger than homicide rates for older and younger people in the 3rd year that a state goes dry. In years that follow, homicide rates remain higher in the middle of the age distribution, in some years being statistically higher, and in some years dipping below the $p = 0.05$ threshold, which is indicated with a dashed line. Notably, states in the north have very similar (standardized) relative homicide rates relative to the rest of the country until the third dry year. Figure 6 is analogous to the estimates in column 8 of Table 3. Here, standardized relative homicide rates for people over 30 appear to fall after alcohol markets have been criminalized for a decade, and there is never a difference between the homicide rate of those in their 30s relative to those under 20 in northern states and the rest of the country.

of a dry law is particularly noisy, and standardizing the coefficient reduces its magnitude somewhat.

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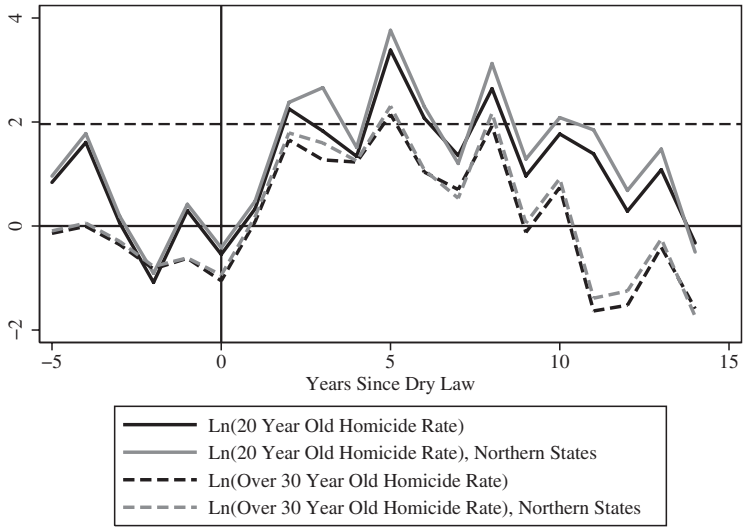

Figure 6. *t*-Statistics of Relative Changes in Homicide Rates of 20 Year Olds Around the Passage of Dry Laws, Conditional on Demographic Changes, Age by State and State by Year-Fixed Effects, Weighted by Age-Specific State Population, Standard Errors Clustered at the State Level. *Note:* Dashed Horizontal Line Indicates $t = 1.96$.

In columns 9 and 10 of Table 3, I allow for state-level demographic changes to affect the age distribution of homicide victims as well as the overall level. These are the same demographic changes that Owens (2011) found eliminated any statistically significant relationship between market legality and overall homicides, but here I am able to detect a marginally statistically precise 8.6% relative increase in the homicide rate of 20 year olds. When I model the full distribution of homicide rates in column 10, it is clear that this is driven by a reduction in the homicide rates of young people, although the impact of going dry on the average homicide rate of people over 30 is too noisy to statistically differentiate it from the change in homicide rates for 20 year-olds. Age-specific urbanization effects are driving the reduction in effect size across columns 7–8 and 9–10; urbanization is highly correlated with both the passage of Dry laws and with homicide rates.[18] It is not surprising that victims of violence in cities were different

18. See Table A3 for estimates of the impact of urbanization on relative homicide rates.

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than victims of violence in more rural areas, but without assuming some structure on the nature of that difference, it is difficult to disentangle the "urbanization" effect on relative homicide rates from the "illegal market" effect. In columns 11 and 12 of Table 3, I include state by year-fixed effects, and while my point estimates are essentially unchanged, they are statistically imprecise ($p = 0.17$ and 0.16, respectively), with the standard errors increasing by more than the estimated difference in average homicide rates.

In the final four columns of Table 3, I add age by year-fixed effects such that I explicitly identify the impact of market legality on the relative homicide rates of those in their 20s from state, rather than federal, dry laws. A priori, it is not obvious that one should expect the results in columns [13–16] to be similar to the other estimates, as the source of identification in these columns is fundamentally different—specifically, the more rural and western states that passed their own dry laws prior to 1920, or kept them on the books after 1933. Indeed, the estimated relative changes in homicides are smaller than those that include Federal Prohibition as a source of identification. In addition, note that the (statistically insignificant) point estimates for homicide rates for those over 30 actually fall in relative to homicide rates for the youngest age groups. However, the absence of a compelling theory as to why the age distribution of homicide victims should be changing in each state and year for reasons besides temperance laws, and the relatively large standard errors on these estimates, make it difficult to draw strong conclusions about the average change in homicide from these results.

5.2.2. *Heterogeneity in the impact of temperance.* The pattern of results in Table 3 imply that criminalizing the market for alcohol at the resulted in a robust shift in the composition of homicide victims toward the middle of the age distribution, consistent with the theoretical impacts of dry laws on violence. However, once I allowed for time-varying factors besides dry laws to affect the distribution, rather than overall level, of homicides, the statistical significance of the change falls below conventional levels. Since historical accounts of organized gang violence tend to focus on specific geographic areas, and there is no strong theoretical motivation for allowing for so much arbitrary unobserved variation in homicide rates, testing for a conditional average impact of temperance on violence is not necessarily a

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high powered test of the impact of market legality on violence in the United States.

In panels A and B of Table 4, I examine how temperance laws affected homicide rates in different contexts, looking for the predicted patterns of heterogeneity based on known historical patterns of gang violence and underground alcohol sales. All results include state by year-fixed effects, state by age category-fixed effects, and age category by year-fixed effects. In panel B, I also allow for demographic changes to also affect the age composition of homicides. While these specifications absorb substantial variation in homicide rates, relaxing assumptions about unobserved changes in the distribution of homicide rates that may be reasonable ones to make, unlike in the final columns of Table 3, the effect heterogeneity here will be identified off all dry laws, including Federal Prohibition.

First, I differentiate between temperance laws that allowed for some legal consumption of alcohol and those that were "bone-dry." I do not find evidence that, conditional on age-specific year-fixed effects, the strictness of the temperance law was related to the age distribution of murder victims. I also do not find strong evidence that temperance laws that barely passed resulted in more market-based violence than those with little opposition. However, the values of the coefficients imply that there was a larger compression of the age distribution in states where Dry laws barely passed. To the extent that the number of Wets is a proxy for the demand for illegal alcohol, one might expect more market-based violence in those states. However, consistent with Owens (2011), the higher levels of illegal alcohol consumption in states where the Dry laws were unpopular at the outset also imply more intoxicated violence, which would tend to flatten the age distribution of homicides. As panel B shows, further allowing other demographic characteristics to directly impact the age distribution of homicide rates does not substantively change this conclusion.

Temperance laws appear to have increased the homicide rate of those in their 20s relative to those under 20, an effect which is statistically significant at the 90% level of confidence. I also estimate that temperance increased the homicide rate of those over 30 in urban areas, but this effect is smaller, less precisely estimated, and mitigated by a first-order, negative impact of prohibition on violence in this age group. To put the magnitude of these effects in perspective, in 1919, the states with the largest urban populations were

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Table 4. State-Level Homicide Rates by Age Category, with Year × Age, Age × State, and State- × Year-Fixed Effects, 1900–1940

	Outright Prohibition		Wets/Drys		Urbanization		North		Immigration	
Heterogeneity:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A					
Temperance × Het× 20 ⩽ Victim age < 30	−0.0675	−0.0511	0.0345	0.043	0.284	0.422*	0.314***	0.354***	0.801**	1.239***
	[0.205]	[0.229]	[0.117]	[0.167]	[0.196]	[0.247]	[0.0819]	[0.103]	[0.348]	[0.408]
Temperance × Het× 30 ⩽ Victim age		0.033		0.0158		0.265		0.0834		0.826**
		[0.136]		[0.153]		[0.194]		[0.0981]		[0.318]
Temperance × 20 ⩽ Victim age < 30	0.0855	0.0779	0.0393	0.0328	−0.0969	−0.172	−0.187*	−0.219	−0.0403	−0.0935
	[0.215]	[0.255]	[0.202]	[0.240]	[0.236]	[0.278]	[0.111]	[0.143]	[0.142]	[0.169]
Temperance × 30 ⩽ Victim age		−0.0158		−0.0125		−0.147		−0.0666		−0.104
		[0.125]		[0.125]		[0.153]		[0.128]		[0.106]
R^2	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
					Panel B: Demographic × Age Category Controls					
Temperance × Het× 20 ⩽ Victim Age < 30	−0.142	−0.0973	0.0521	0.0991	0.237	0.451*	0.243**	0.298**	0.731*	1.311***
	[0.174]	[0.193]	[0.100]	[0.162]	[0.179]	[0.240]	[0.107]	[0.136]	[0.373]	[0.478]

continued.

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Table 4. continued.

	Outright Prohibition		Wets/Drys		Urbanization		North		Immigration	
Heterogeneity:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Temperance × Het×		0.0858		0.0847		0.432*		0.127		1.143***
30 ⩽ Victim age		[0.127]		[0.179]		[0.232]		[0.106]		[0.393]
Temperance × 20 ⩽	0.119	0.0749	0.0293	−0.026	−0.0749	−0.221	−0.146*	−0.217**	−0.0367	−0.137
Victim age < 30	[0.176]	[0.196]	[0.168]	[0.196]	[0.192]	[0.224]	[0.0799]	[0.102]	[0.100]	[0.121]
Temperance × 30 ⩽		−0.0852		−0.104		−0.297*		−0.158*		−0.202**
Victim age		[0.0925]		[0.128]		[0.149]		[0.0929]		[0.0891]
R^2	0.89	0.891	0.89	0.891	0.89	0.891	0.89	0.891	0.89	0.891

The dependent variable in each regression is the natural log of the age-specific murder rate +0.01. Age specific homicide rates in 1931–1933 are actually 20–34 year olds and over 34 year olds. The average murder rate for 20 year olds is 13.5. All regressions contain 3,870 observations and are weighted by age-specific state population. Additional controls in all regressions include second-order interactions between age categories and relevant law heterogeneity. Standard errors in brackets clustered at the state level.
$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$.

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California, Connecticut, Illinois, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Rhode Island.[19] My estimates suggest that in these states, where 75% of people lived in cities on average, going dry increased the relative homicide rate for those over 30 by 5%, and for those in their 20s by 15%. Allowing other demographic changes to affect relative homicide rates increases the first-order reduction in relative homicide rates for 30 year olds, but increases the "urban gradient" of temperance. In other words, a 1 percentage-point increase in urbanization makes the decrease in homicide rates for those over 30 roughly 0.4 log points smaller, meaning that in the most urban states, criminalizing the market for alcohol increases the relative murder rate for this group by 2.7%, compared with 12% for those in their 20s.[20]

Temperance had the strongest impact on my proxy for market-based violence in the north; the statistically significant interaction effect implies that going dry in the north increased the homicide rate among those in their 20s by 13.5% relative to people over 30 or under 20. The impact of dry laws on homicide rates of those over 30 relative to those under 20 is substantively small and statistically indistinguishable from zero, and also statistically different from the increase in the 20-year-old homicide rate. Allowing for the age distribution of homicide victims to evolve with changing demographics does not substantively change these relationships.

The CMS data appear to confirm the link between immigration and gang activity. In states with more immigrants, going dry increased the homicide rate for those in their 20s by more than for those over 30 and under 20, over and above any change we would expect to see based on variation in education, federal aid, urbanization, or racial composition. In 1919, the states with the largest foreign born populations were California, Connecticut, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, and Rhode Island.[21] In these states, where 24% of the population was born

19. These states constitute the 75th percentile of percent living in an urban area in 1919. The reported marginal effects are these points are calculated as $\exp(\beta_{Temperance \times Age\ category} + 0.75 \times \beta_{Temperance \times Age\ category \times Urbanization}) - 1$.

20. The imprecision of the estimated impact of temperance on the homicide rate for 30 year olds makes it difficult to statistically differentiate these two effects, except for the relative compression in Northern states.

21. These states constitute the 75th percentile of percent foreign born in 1919.

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in another country, going dry increased the relative over 30 murder rate by 9.9%, and increased the relative 20–29 murder rate by 23%.[22]

Variation in urbanization and immigration are highly correlated, and states with large immigrant and urban populations are more likely to be in the north. A more precise test of the hypothesis that more compression of the age distribution of homicide victims should have occurred in places with more pre-temperance gang activity involves testing the hypothesis that the interactions of temperance, age, and all three sources of heterogeneity are simultaneously equal to zero. In my most saturated model (panel B of Table 4), the probability that these three proxies are not related to the increase in homicide rates for people in the 20s relative to the tail ends of the age distribution is only 3.4%.

6. Conclusion

There is a widespread belief that the American Temperance Movement created a large and active market for illegal alcohol. Economic theory predicts that illegal market participants should be exposed to higher rates of violence, but there is scant empirical evidence on the magnitude of this increase. Indeed, if the increase in market-based violence is not larger than the reduction in violence caused by reduced alcohol consumption, the total change in violence could be negative. The paucity of data about the impact of the Temperance Movement on alcohol consumption and violence has led to the propagation of conflicting and incomplete "false lessons of Prohibition" (Cook 2007), based primarily on anecdotal accounts or national time series data. In this paper, I provide some of the first empirical evidence in support of one of the popular claims made about the Temperance Movement—the growth of illegal markets increased the scope of market-based violence in the United States.

In modern homicide data that span the years 1976 to 2004, I estimate that murder victims in their 20s are roughly 60% more likely to be killed in market-based violence than murder victims under 20 or over 30. The

22. All results are substantively identical if I use alternate definitions of age-specific homicide rates in 1931, 1932, and 1933. Specifically, in those years I alternately assumed all murder victims between 25 and 34 were in their 20s or were all over 30, or eliminated those 3 years from the analysis entirely. These results are available on request.

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victims of alcohol-related violence are also not evenly distributed across the age distribution, and I show that a policy that simultaneously increased the amount of market-based violence while reducing violence caused by alcohol consumption would unambiguously increase the homicide rate for individuals in their 20s relative to people of other ages. To the extent that the same relationship between age and homicide circumstances holds in the early 20th century, early vital statistics records collected by the census provide empirical support for the notion that temperance laws increased early 20th century market-based violence in the United States. Using the age distribution of homicide rates in the United States between 1900 and 1940, I show that criminalizing the market for alcohol was associated with a 6–17% increase in the homicide rate for 20 year olds relative to those at the tails of the age distribution. While this is a net change, if alcohol consumption fell by half when a state went dry, then a simple back of the envelope calculation suggests that market-based violence certainly increased, by anywhere from 60% to 250%.[23]

While the magnitude of this estimate is sensitive to the specification of aggregate time trends and the relationship between demographic change and the age of homicide victims, patterns of heterogeneity in the relationship between temperance and homicide are not. Further, the impact of temperance on the age distribution of homicide rates was strongest in the North, and in areas with large immigrant and urban populations. This is consistent with the folk wisdom that organized crime was most prevalent in northern cities with large immigrant populations; going dry compressed the age distribution of homicide victims in Illinois, New York, and Pennsylvania, but not in South Carolina and Florida. In the former areas in particular, banning the commercial sale of alcohol appears to have protected children and teens from homicide, but at the cost of exposing young adults to more violence.

23. This is based on a (hypothetical) elasticity of crime with respect to alcohol consumption of 0.5, and then using the estimated parameters in the modern homicide data (Section 2) to estimate the impact of a 25% reduction in homicides due to alcohol consumption across the age distribution, then identifying the increase in market-based violence that would yield a 6% or 17% increase in the homicide rate of 20 year olds relative to the average net change in the homicide rate older and younger people.

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Appendix

Table A1. Age and Circumstances of 414,117 Deaths in the SHR, 1976–2004 and 9,689 Deaths in Chicago and Philadelphia, 1900–1932

	$DV = P$ (Circumstances of Death $= j$)									
	SHR Data, 1976–2004								Chicago and Philadelphia, 1900–1932	
	$j =$ Market-based		$j =$ Accidental		$j =$ Family Members		$j =$ Alcohol-related Fight		$j =$ Gang Violence	
$20 \leqslant$ Victim age $<$ 30	0.0353***	0.0348***	−0.021***	−0.021***	−0.105***	−0.104***	0.181***	0.180***	0.0124*	0.0128**
	[0.00628]	[0.00631]	[0.00292]	[0.00289]	[0.00653]	[0.0065]	[0.00788]	[0.00799]	(0.0049)	(0.0049)
$30 \leqslant$ Victim age	−0.00293	−0.00197	−0.022***	−0.022***	−0.006	−0.0059	0.165***	0.165***	0.0087*	0.0089*
	[0.00724]	[0.00696]	[0.00320]	[0.00319]	[0.00649]	[0.0065]	[0.0141]	[0.0143]	(0.0043)	(0.0042)
P (Circumstances of death $= j$)	0.060		0.008		0.220		0.034		0.027	
R^2	0.0326	0.0565	0.0242	0.0427	0.0329	0.0406	0.0311	0.0449	0.019	0.022
F	174.4	43.22	128.6	39.69	176.3	623	166.1	18.05	8.15	7.3
State- × year-fixed effects		x		x		x		x		x

Each column of each panel reports the results of one equation, where the dependent variable is indicated at the top of each column. All equations include state- and year-fixed effects. Standard errors in brackets clustered at the state level. Robust standard errors in parentheses.
$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

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Table A2. Age-Specific Death Reporting in the CMS

		Age Categories			
Year	States Added to Registry	20–29, 30–39, 40–49	20–24, 25–29, 30–34, 35–44	20–24, 25–34, 35–44	20–24, 25–29, 30–34, 35–39
1900	CT, IN, MA, ME, MI, NH, NJ, NY, RI, VT	x			
1901		x			
1902		x			
1903		x			
1904		x			
1905		x			
1906	CA, CO, MD, PA, SD	x			
1907		x			
1908	WA, WI	x			
1909	OH	x			
1910	MN, MT, UT, *SD removed*	x			
1911	KY, MO	x			
1912		x			
1913	VA	x			
1914	KS	x			
1915		x			
1916	NC, SC	x			
1917	TN	x			
1918	IL, LA, OR	x			
1919	DE, FL, MS	x			
1920	NE	x			
1921		x			
1922	ID		x		
1923	GA, IA, WY		x		
1924	ND		x		
1925	AL, WV, *GA removed*		x		
1926	AZ		x		
1927	AR		x		
1928	GA		x		
1929	MN, NV, OK		x		
1930	SD		x		
1931				x	
1932				x	
1933	TX			x	
1934					x
1935					x
1936					x
1937					x
1938					x
1939					x
1940					x

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Table A3. Estimates of State-Level Homicide Rates by Age Group, State × Year, Year × Age, and Age-×State-Fixed Effects and Heterogeneous Temperance Effects 1900–1940

	Outright Prohibition		Wets/Drys		Urbanization		North		Immigration	
Heterogeneity:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Temperance × Het × 20	−0.142	−0.097	0.0531	0.0628	0.230	0.451*	0.240**	0.298**	0.713*	1.311***
⩽ Victim age < 30	[0.174]	[0.193]	[0.102]	[0.147]	[0.177]	[0.240]	[0.105]	[0.136]	[0.366]	[0.478]
Temperance × Het ×		0.086		0.0202		0.432*		0.127		1.143***
30 ⩽ Victim age										
		[0.127]		[0.160]		[0.232]		[0.106]		[0.393]
Temperance × 20 ⩽	0.119	0.075	0.0271	−0.0411	−0.0716	−0.221	−0.145*	−0.217**	−0.0353	−0.137
Victim age < 30	[0.176]	[0.196]	[0.167]	[0.197]	[0.191]	[0.224]	[0.0801]	[0.102]	[0.100]	[0.121]
Temperance × 30 ⩽		−0.085		−0.134		−0.297*		−0.158*		−0.202**
Victim age		[0.092]		[0.123]		[0.149]		[0.0929]		[0.0891]
Urbanization × 20 ⩽	0.941	1.946	0.976	2.633**	0.818	1.716*	0.61	1.539	0.922	1.916**
Victim age < 30	[0.717]	[1.025]	[0.814]	[1.304]	[0.698]	[0.952]	[0.744]	[1.040]	[0.745]	[0.950]
Urbanization × 30 ⩽		1.874		3.084		1.693		1.73		1.877
Victim age		[1.50]		[1.957]		[1.430]		[1.518]		[1.367]
R^2	0.890	0.891	0.887	0.891	0.887	0.891	0.888	0.891	0.888	0.891

The dependent variable in each regression is the natural log of the age-specific murder rate, +0.01, measured at the state-year level. Age-specific homicide rates in 1931–1933 are actually 20–34 year olds and over 34 year olds. The average murder rate for 20 year olds is 13.5. All regressions contain 3,870 observations, contain state by year, age-group by year, and state by age group-fixed effects, and are weighted by age-specific state population. Additional controls include state-level education rate, percent between 6 and 20, percent black, percent catholic, and percent foreign born, second-order interactions between age categories and relevant law heterogeneity, and interactions between age categories and demographic characteristics. Standard errors in brackets clustered at the state level.

$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

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