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Alcohol and Homicide in the United States 1934-1995--Or One Reason Why U.S. Rates of Violence May Be Going Down

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ALCOHOL AND HOMICIDE IN THE UNITED STATES 1934-1995—OR ONE REASON WHY U.S. RATES OF VIOLENCE MAY BE GOING DOWN

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I. INTRODUCTION

In the last few years, a great deal of attention has been devoted to the apparent decline in rates of homicide and other kinds of violence in the United States. Commentators debate whether rates of violence are actually declining, and what are the reasons for this apparent decline. The purpose of this paper is to explore the possibility that one reason for the apparent recent decline in homicide may be its relationship to the rate of alcohol consumption during this same time period. As there is a growing body of research that shows a significant relationship between alcohol and violence at different levels of aggregation, in different countries and sub-units of countries, among different types of people, and across time periods, we will also explore the homicide and alcohol relationship by race and by type of alcoholic beverage. There are also the beginnings of a theoretical body of knowledge that would explain why variations in alcohol consumption and availability should be considered part of the explanation for variations in the rate of homicide and other types of violence. These issues will be discussed in detail in this

paper, and the results of a new multivariate time series analysis of homicide, alcohol consumption and other indicators for the U.S. between 1934 and 1995 will be presented. The importance of this evidence for violence prevention policy will be discussed as well. Part II proposes that historically, declining homicide rates follow decreases in alcohol consumption. Part III reviews some of the theoretical arguments that have been advanced to explain why alcohol would be a causal factor in homicide and other forms of violence, with references to a number of empirical studies that have found support for this idea. The paper then presents the results of a multivariate time series analysis of the data displayed in Figure 1, with controls for some factors represented in the major theoretical models of homicide in the literature. Finally, the implications of this analysis are discussed in terms of their importance for research on violence and for public policy designed to reduce rates of homicide and other violence in the United States.

II. WHY ARE RATES OF HOMICIDE IN DECLINING IN THE U.S.?

According to the U.S. Vital Statistics,[1] the overall rate of homicide in the U.S. has declined steadily in the 1990s. In 1991, the rate of homicides per 100,000 people was 10.5; by 1995, the last year of data available for this report, the overall rate was 8.0.[2] Indeed, media reports indicate that rates for 1996 and 1997 show further declines, with one major media outlet reporting recently that homicide rates are almost as low now as they were in 1970.[3] The data given here in Figure 1 confirm this, as the rate of homicide in the U.S. in 1970 was 8.3 per 100,000.

However, a long term perspective on the issue of whether homicide rates are declining, as shown in Figure 1, might lead to a very different conclusion. Overall homicide rates decreased rather rapidly and more extensively than the decline evidenced

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[1] U.S. CENTER FOR HEALTH STATISTICS, VITAL STATISTICS OF THE UNITED STATES: MORALITY (1997) [hereinafter VITAL STATISTICS].

[2] *Id.*

[3] Matt Lait, *Homicides in L.A. Drop to Lowest Total in 20 Years*, L.A. TIMES, Dec. 29, 1997, at 1.

FIGURE 1: ALCOHOL AND HOMICIDE, 1934-1995
TOTAL CONSUMPTION (4X) PER ADULT
HOMICIDES PER 100,000
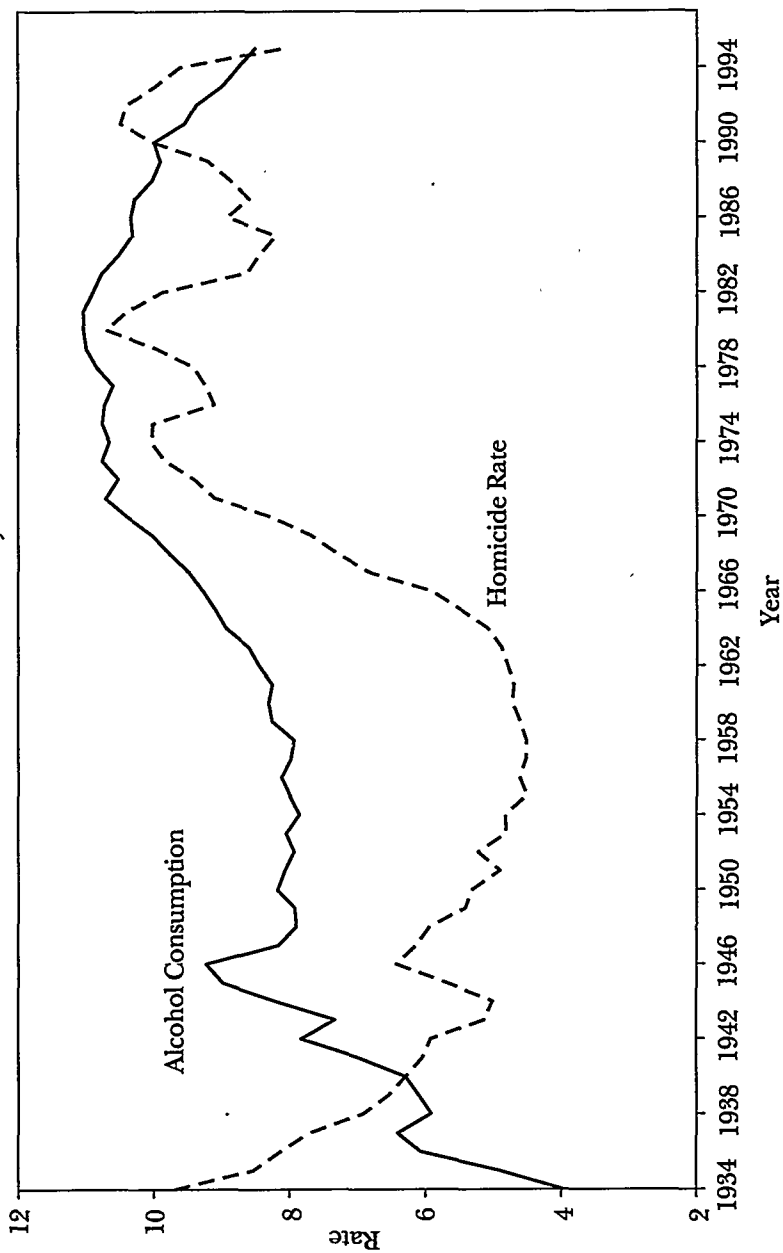
in the 1990s during the 1930s and early 1940s, reaching a low of 5.0 in 1944, from a high of 9.7 in 1934.[4] After a brief rise at the end of World War II,[5] the homicide rate declined steadily during the 1950s, reaching a twentieth century low of 4.5 per 100,000 in 1957 and 1958.[6] It is important for understanding recent trends to place those trends in a longer term context as in Figure 1. Is the current downward trend the beginning of a long term decline in homicide rates, as was evidenced between 1945 and 1958? Or is this current trend a short term decline, to be followed by a sharp increase, as was the case between the late 1970s and the early 1990s? A more far-sighted view of homicide rates in the U.S. recommends against the over-interpretation of shorter term trends, and argues against complacency from a prevention policy point of view.

Another important aspect of the trends in homicide that is not displayed in Figure 1, however, is the fact that hidden by this overall trend in homicide rates is a great deal of variation in those trends themselves, especially when disaggregated by age of the victim. As Blumstein[7] and others have argued, the recent decline in homicide rates, significant as it is, really only applies to the homicides of adults twenty-five years of age and older. The data for youth show the opposite trend, an almost steady *increase* in homicide rates, especially beginning in the mid 1980s.[8] In addition, as Roncek and Maier have shown, homicide rates vary enormously by city block.[9] Furthermore, Alaniz et al. have shown that rates of assault and other kinds of youth violence vary enormously over short distances within moderate and even

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[4] PAUL C. HOLLINGER, VIOLENT DEATH IN THE UNITED STATES 209-11 (1987)

[5] *Id.*

[6] *Id.*

[7] Alfred Blumstein, *Youth Violence, Guns, and the Illicit-Drug Industry*, 86 J. CRIM. L. & CRIMINOLOGY 10, 17-18 (1995).

[8] Robert Nash Parker et al., Alcohol Policy and Youth Homicide: An Examination of Gender- and Race-Specific Models of Victimization (1997) (unpublished manuscript, on file with Presley Center for Crime and Justice Studies, Riverside, CA).

[9] Dennis W. Roncek & Pamela A. Maier, *Bars, Blocks, and Crime Revisited: Linking the Theory of Routine Activities to the Empiricism of "Hot Spots"*, 29 CRIMINOLOGY 725, 736 (1991).

small-sized cities.[10] Sherman has also argued that thirty major urban areas in the U.S. account for a substantial majority of all the homicides in the country.[11] Thus, some caution should be exercised in interpreting the declining homicide rate.

Figure 1 also reveals that for the vast majority of the time covered by these data there is a remarkable correspondence between the rate of alcohol consumption per adult[12] and the homicide rate. Beginning with a decrease in alcohol consumption at the end of World War II, which was followed by a decline in homicide about a year later, a pattern emerged in which changes in alcohol consumption typically foreshadow changes in the homicide rates. The pattern continued for most of the period. For example, alcohol consumption climbed steadily in the middle 1950s while homicide rates began their climb in 1958, peaking in the early 1970s. Between 1958 and 1970, consumption was flat with a slight decline; homicide rates began to decline in the mid-1970s. Again alcohol consumption peaked in the late 1970s, with homicide following by peaking at the end of the decade. By the early 1980s alcohol consumption began a steady decline still continuing in the late 1990s, with homicide again dropping to a low in the middle 1980s. In the late 1980s, fueled by an increase in youth homicide, the two trend lines diverged for the first time in fifty years. By the end of the time displayed here, the decrease in alcohol consumption again foreshadowed a decrease in homicide which began in the early 1990s and continues into the latter part of the decade.

As was the case with trends in homicide alone, it would be inappropriate to over-interpret the relationship displayed between alcohol and homicide in Figure 1, as will be described later in this article. Alcohol consumption trends differ by beverage type as well; like homicide, alcohol consumption also var-

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[10] Maria Luisa Alaniz et al., *Immigrants and Violence: The Importance of Neighborhood Context*, 20 HISPANIC J. OF BEHAV. SCI. 155, 166 (1998).

[11] *See generally* Lawrence W. Sherman et al., *Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place*, 27 CRIMINOLOGY 39 (1989).

[12] G.D. WILLIAMS ET AL., NATIONAL INST. OF ALCOHOL ABUSE AND ALCOHOLISM, ALCOHOL AND HEALTH: A REPORT TO CONGRESS 4 (1997); NATIONAL INST. OF ALCOHOL ABUSE AND ALCOHOLISM, SURVEILLANCE REPORT #31, APPARENT ALCOHOL CONSUMPTION: NATIONAL STATE, AND REGIONAL TRENDS 2 (1995).

ies by age. The apparent relationship shown has not received the proper attention from researchers and others asking the question that has motivated this collection of papers, i.e., what explains why the rate of violence seems to be falling in the U.S.? The use of the plural is deliberate, as it would also be inappropriate to claim that a decline in alcohol consumption is the most important or the only reason why homicide rates are falling. A complete explanation of the variation in the rate of homicide certainly involves a number of competing and complimentary explanations. However, Figure 1 clearly raises the notion that alcohol consumption has an influence on homicide to the status of a testable and reasonable hypothesis for consideration. In fact, there is a growing body of scientific research that suggests a theoretically derived and empirically verified causal link between alcohol and violence net of other important relationships, theories, and hypotheses.[13]

III. LINKING ALCOHOL AND VIOLENCE

A number of studies have reported an association between the homicide rate and alcohol consumption rate. For example, a study of homicide rates in the United States in the early 1980s by Parker found that states with higher rates of alcohol consumption had higher rates of several types of homicide examined.[14] In addition, alcohol consumption interacted with poverty so that places with above-average consumption and above average poverty had even higher rates of homicide.[15]

A second study estimated the impact of consumption on youth homicide rates.[16] This study examined all U.S. states during the period 1976 through 1983, and found that beer consumption rates were significant predictors of youth homicide rates in five of six age groups by victim/offender relationship homicide rates examined. In both of these studies, additional

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[13] For a review, see Robert Nash Parker & Kathleen Auerhahn, *Alcohol, Drugs, and Violence*, 24 ANN. REV. SOC. 291, 307 (John Hagan ed., 1998).

[14] Robert Nash Parker, *Bringing "Booze" Back In: The Relationship Between Alcohol and Homicide*, 32 J. RES. CRIME & DELINQ. 3, 23 (1995).

[15] *Id.*

[16] ROBERT NASH PARKER & LINDA-ANNE REBHUN, ALCOHOL AND HOMICIDE: A DEADLY COMBINATION OF TWO AMERICAN TRADITIONS 102-17 (1995).

factors such as poverty and inequality were included as well, and alcohol consumption was found to be a significant predictor of homicide net of these other factors.[17]

A more comprehensive pooled cross-section time series analysis of youth homicide for states over the period 1973 through 1992 also found a significant net effect for beer consumption on youth homicide rates overall, and specifically for male youth homicide.[18] In this case, controls were included for poverty, inequality, urbanization, beer taxation and other indicators of alcohol policy, and a measure of the impact of the increasing concentration of poor and disenfranchised groups in inner cities.[19]

Studies outside the U.S. have also reported significant effects of alcohol consumption on rates of homicide. For example, Lenke examined the relationship between alcohol consumption and homicide rates in several European states and found evidence of a significant relationship.[20] Parker examined the impact of alcohol consumption on seventeen European and North American countries in a comprehensive pooled cross-section and time series model for the period 1950 to 1985.[21] Although Parker reports that alcohol consumption did not have any direct effects on either male or female homicide rates, consumption interacted with divorce to increase homicide rates for male victims.[22]

A second approach to the nature of the relationship between alcohol and homicide includes studies that examine this relationship in a more indirect manner. In the U.S. general alcohol consumption rate measurements, based on sales of alcohol[23] are available only at the state level. Studies examining the alcohol and homicide link at levels less aggregated than this

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[17] *Id.*

[18] *See* Parker et al., *supra* note 8.

[19] *See* WILLIAM JULIUS WILSON, THE TRULY DISADVANTAGED (1987).

[20] LEIF LENKE, ALCOHOL AND CRIMINAL VIOLENCE: TIME SERIES ANALYSES IN A COMPARATIVE PERSPECTIVE 139 (1990).

[21] Robert Nash Parker, *Alcohol, Homicide, and Cultural Context: A Cross-National Analysis of Gender-Specific Homicide Victimization,* 2 HOMICIDE STUD. 6, 10-11 (1998).

[22] *Id.* at 21.

[23] *See* WILLIAMS, *supra* note 12, at 4.

have utilized measures of the availability of alcohol as a proxy for consumption. This is based in part on results from research on the link between consumption and availability that show a strong positive relationship between these two indicators.[24] For example, a longitudinal study of 256 American cities over the period 1960, 1970, and 1980, reported by Parker and Rebhun found that the density of liquor stores in a city was a significant predictor of the change in homicide rates, in a time frame in which homicide increased 300%.[25] The significant impact of outlet density was net of a number of indicators of processes well known to be predictors and causes of violent crime, including poverty, social bonds, family structure, and racial composition.[26]

On the more micro level of analysis, in contrast to the macro level studies cited previously, two studies of violent crime locations at the address, block, and census track level have found an association between outlet locations and violent locations. Sherman et al., in an investigation of the places that police were repeatedly called to in a large U.S. city, found that on-site outlets such as bars and restaurants were among the "hottest" spots.[27] For example, the top hot spot between December 1985 and December 1986 in the city examined was an intersection where there were several bars, a liquor store, and a park. Police received thirty-three calls reporting rapes, robberies, and auto thefts during the year observed in these data. The third ranking hot spot, with twenty-seven such calls, was another intersection with several bars; the fifth and sixth hottest locations, twenty-seven and twenty-five calls, respectively, also involved multiple or—in the case of the sixth hot spot—a single on site alcohol outlet. In fact, Sherman et al. found that on-site alcohol outlets were part of the locations that accounted for one third of the robberies, rapes, and auto thefts reported in the course of

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[24] Paul J. Gruenewald et al., *The Relationship of Outlet Densities to Alcohol Consumption: A Time Series Cross-Sectional Analysis,* 17 ALCOHOLISM: CLINICAL & EXPERIMENTAL RES. 38, 42 (1993).

[25] *See* PARKER & REBHUN, *supra* note 16, at 64.

[26] *Id.* at 81.

[27] Sherman et al., *supra* note 11, at 45.

a year.[28] Sherman et al. reported that the sixth hottest spot in the city, an individual bar, had a robbery rate that was seven times the robbery rate of the entire city. In addition, one out of every four persons who visited the bar was victimized during the year, assuming maximum occupancy during open hours.[29]

An analysis of data at the city block level for a different American city also found an association between blocks that had bars located on them and the occurrence of assaults, robberies, and rapes.[30] In this analysis, the impact of having one or more bars on the block was significant even after controls for unemployment, poverty, and racial composition had been entered into the regression model.

IV. TWO PATHS LINKING ALCOHOL AVAILABILITY AND HOMICIDE

Taken as a group, these studies suggest two different paths by which we can explain the link between alcohol and homicide. Selective disinhibition[31] is primarily an individual link between alcohol and violence, and the "great attractor" notion[32] is primarily an environmental link. Evidence of a relationship between alcohol and homicide has been well established at the state, city, county, and block level in previous research.[33] However, these two paths describe how this relationship comes about, and help to explain why the data in Figure 1 show such a strong correspondence. As we will evaluate this relationship at the aggregate level, it is important to establish the underlying causal reasoning as to why this relationship makes sense as a candidate for explaining declining rates of violence in the U.S.

A. PATH 1: SELECTIVE DISINHIBITION

In this linkage, the higher the concentration of outlets, the more likely it is that people in and around those outlets will

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[28] *Id.* at 45.

[29] *Id.* at 44.

[30] *See* Roncek & Maier, *supra* note 9, at 744.

[31] PARKER & REBHUN, *supra* note 16, at 33-41; Robert Nash Parker, *The Effects of Context on Alcohol and Violence,* 17 ALCOHOL HEALTH & RES.117, 120 (1993); Parker, *supra* note 14, at 5-6.

[32] Alaniz et al., *supra* note 10, at 161-62.

[33] Parker & Auerhahn, *supra* note 13, at 301-04.

have been drinking prior to the homicide. If we could be certain that one or more of the participants had been drinking prior to the event, this would make the inference that outlet concentration leads to violence much more straightforward, as we could invoke the selective disinhibition approach described by Parker and Rebhun.[34] Aggregate studies of the impact of availability on consumption show that greater concentration of outlets leads to more consumption.[35] Thus, the probabilistic statement describing this first step in the chain that links alcohol with homicide would be that the greater the concentration of alcohol outlets, the higher the likelihood that people near those outlets will have consumed alcohol. If potential victims and offenders have consumed alcohol, the well known effects of alcohol on judgment and information processing come into play.[36] Individuals are more likely to misinterpret the actions of others, to mistake the response of others to their own behavior, to focus more closely on immediate goals rather than more distant goals, and to lead to the operation of active and passive constraint.[37] Active constraint is the social interactional situation in which doing something contrary to the social and behavioral norms is clearly in the personal interests—material, physical, social, psychological, etc.—of an actor. Internalized beliefs and/or external social control must be actively present and functioning to prevent the actor from seeking his/her own interests in an active constraint situation. If alcohol has the effects on judgment, information processing, and focus on near-versus long-term goals and interests that many studies show it does,[38] the person under the influence of alcohol is more likely to overcome active constraint and use violence to achieve a

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[34] PARKER & REBHUN, *supra* note 16, at 33-41. *See also* Parker, *supra* note 31, at 120; Parker, *supra* note 14, at 5-6.

[35] Gruenewald et al., *supra* note 24, at 42.

[36] R. O. Pihl et al., *A Biosocial Model of the Alcohol-Aggression Relationship*, J. STUD. ALCOHOL 128, 136-37 (1993).

[37] PARKER & REBHUN, *supra* note 16, at 33-41; Philip J. Cook & Michael J. Moore, *Economic Perspectives on Reducing Alcohol Related Violence, in* ALCOHOL & INTERPERSONAL VIOLENCE: FOSTERING MULTIDISCIPLINARY PERSPECTIVES 193, 194 (Susan E. Martin ed., 1993).

[38] Pihl, *supra* note 36, at 130.

near-term personal interest goal than those who have not con-
sumed alcohol in the same situation. It is also likely that the
amount of alcohol consumed, relative to body weight and gen-
der, may increase the probability of overcoming active con-
straint and lead to violence. Thus this pathway connects outlet
concentration with consumption, consumption with selective
disinhibition, and selective disinhibition with an increased like-
lihood of violent behavior.

Passive constraint operates in situations where violence pro-
vides no enhancement of personal interests and goals, thus
making it easy to conform to norms against violence. No active
intervention of externally or internally focused agents of control
is necessary to prevent violence. This is why alcohol's effect on
violence is "selective;" alcohol does not always disinhibit because
even intoxicated persons have some sense of goals and the
means to secure them.[39]

So, in this pathway, greater alcohol outlet density leads to
increased violence because greater density increases alcohol
consumption. Since both potential victims and potential of-
fenders have higher average rates of alcohol consumption, and
given that the distinction between victims and offenders is most
often decided by the outcome of the violent incident,[40] higher
rates of both violent offending and victimization would result
from greater concentrations of outlets. Alcohol consumption
plays a direct role in this pathway, linking aggregate consump-
tion to homicide rates; a decrease in consumption should lead
to a decrease in homicide rates.

B. PATH 2: OUTLET CONCENTRATIONS AS "GREAT ATTRACTORS"

In astronomy, the concept of a "great attractor" is that of an
immense region in the universe of known space so full of matter
that all other galaxy clusters and individual galaxies are drawn
towards the attractor by the physical force of gravity. In this ap-
proach to understanding the outlet density-violence relation-
ship, places with outlet concentrations are social "great

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[39] KAI PERNANEN, ALCOHOL IN HUMAN VIOLENCE at 219 (1991).

[40] Janet L. Lauritsen et al., *The Link Between Offending and Victimization Among Ado-
lescents*, 29 CRIMINOLOGY 265, 287 (1991).

attractors," providing a magnet that draws people to these loca-
tions. Once concentrations of people are drawn to a particular
corner or block, a number of possibilities exist. What kinds of
places are these with high concentrations of bars, restaurants
serving alcohol, liquor and convenience stores selling alcohol?
In one sense it could be argued that these are places that are so-
cially disinhibited—people come to these places, to these estab-
lishments, for entertainment, for relaxation, to get away from
the normal constraints of work, school, and home, to seek the
company of others, and so on. So these are places where the
usual social norms and external controls are weakened, and
they are full of people seeking "time-out" opportunities.[41] In
such a context, it would not be surprising to find more violence,
independent of alcohol consumption and the impact of selec-
tive disinhibition. Other non-normative activities are likely to
be attracted to these locations as well—prostitution, drug use
and drug sales, gang related conflicts—all of which would lead
to greater rates of violence around these social attractor loca-
tions.

Does this argument then imply that alcohol availability is
spuriously related to this violence? It does not imply spurious-
ness if in fact alcohol outlets dominate the commercial and re-
tail activity in the location. Therefore, the concentration of the
outlets creates the conditions that make all kinds of time-out
behaviors possible by creating an atmosphere that attracts and
further reinforces such activity. Advertising in such locations
may also contribute to the sense of "anything goes here," in that
the images and lifestyles portrayed in alcohol ads in and around
outlets—such as ads which commodify and demean women—
may help to reinforce the idea that women who come to this
location are available, especially in connection with alcohol.[42]
In addition, the notion that some places attract potential victims

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[41] CRAIG MACANDREW & ROBERT B. EDGERTON, DRUNKEN COMPORTMENT 73(1969).

[42] Maria Luisa Alaniz et al., *Ethnic Targeting and the Objectification of Women: Alcohol Advertising and Violence Among Young Latinas*, in CURRENTS IN CRIMINOLOGY (Robert Nash Parker ed., forthcoming 1999); Maria L. Alaniz & Chris Wilkes, *Reinterpreting Latino Culture in the Commodity Form: the Case of Alcohol Advertising in the Mexican American Community*, 17 HISPANIC J. BEHAV. SCI. 430, 433 (1995).

and motivated offenders is not a new idea.[43] It could be said that in this pathway between alcohol outlets and homicide, the alcohol sold at these outlets is incidental, although actual consumption should lead to selective disinhibition here as well as elsewhere. However, it is the attractor nature of these places, a nature that is established and maintained by the concentration of alcohol outlets, that drives this process, so that from a public policy point of view, the fact that it is alcohol outlets that are concentrated and not dry cleaning outlets or gas stations is important. Thus, the implication is that reducing outlets would reduce violence, but it would do so because of the decline in the attractor nature of the location, not because of any decline in alcohol sales or consumption that might result.

We are not arguing that these two pathways are mutually exclusive—probably some of each are operating to explain the strong empirical relationship found in this study as well as those cited here. However, the relative strength of each path may vary in locations or in historical periods, and the dominance of one path over the other would condition the nature of any public policy debate about why the concentration of outlets should be reduced if we wish to prevent violence. Given the data available here, we cannot distinguish between the two. However, if we can convince the reader that one or both of these pathways is plausible, then we have a theoretical justification for examining this relationship in the context of a study designed to investigate the relationship between homicide and alcohol, and to contribute to the development of policy alternatives that have potential to prevent homicide.

V. DATA AND METHODS

A number of studies have demonstrated the importance of race in research on homicide causation in general. As Messner and Sampson[44] and Huff-Corzine et al.[45] have demonstrated,

[43] *See, e.g.,* Lawrence E. Cohen & Marcus Felson, *Social Change and Crime Rate Trends: A Routine Activity Approach,* 44 AM. SOC. REV. 588 (1979).

[44] Steven F. Messner & Robert J. Sampson, *The Sex Ratio, Family Disruption, and Rates of Violent Crime: The Paradox of Demographic Structure,* 69 SOC. FORCES 693 (1991).

many of the predictors of homicide operate differentially on race-specific homicide rates. For example, Sampson finds that economic deprivation, among other predictors, has a greater impact on African-American violent victimization rates than it does on non-African-American rates.[46] An examination of race specific rates of victimization in the present context might reveal that among African-Americans, poverty has such a strong impact that any additional impact of alcohol is nonsignificant, while the opposite may be true for non-African-Americans. Figure 2 shows the homicide rate disaggregated by race between 1934 and 1995; the categories used here are "nonwhite" and "white", for reasons of data availability over the entire period of time under examination here.[47]

Although the two curves parallel each other over the long term, the nonwhite rate tends to change faster, and over a wider range than the white rate, which is multiplied by 4 in Figure 2 to allow for comparison on the same scale. There are also some differences in the timing of upward and downward movement, peaks and floors; for example, while rates for both groups begin to climb in the late 1950s and early 1960s, the rate for non-whites rises much faster and peaks first, in 1971, while the white rate does not reach its peak until the mid-1970s. Also note that this early 1970s peak is the peak for non-white homicide rates for the post-WW II era, while for whites the overall peak for the entire series does not occur until the early 1980s. Previous research and these data suggest the possibility that alcohol may have a different relationship with homicide disaggregated by race.[48]

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[45] Lin Huff-Corzine et al., *Deadly Connections: Culture, Poverty, and the Direction of Lethal Violence*, 69 SOC. FORCES 715 (1991).

[46] Robert J. Sampson, *Urban Black Violence: The Effect of Male Joblessness and Family Disruption*, 93 AM. J. SOC. 348 (1987).

[47] HOLLINGER, *supra* note 4, at 206-11; VITAL STATISTICS, *supra* note 1.

[48] Darnel Hawkins, *African American Homicide, in* ISSUES IN THE STUDY AND PREVENTION OF HOMICIDE 42, 47 (M.D. Smith & M. Zahn eds., 1998).

FIGURE 2: HOMICIDE RATES BY RACE, 1934-1995
NONWHITE HOMICIDE; 4X WHITE HOMICIDE
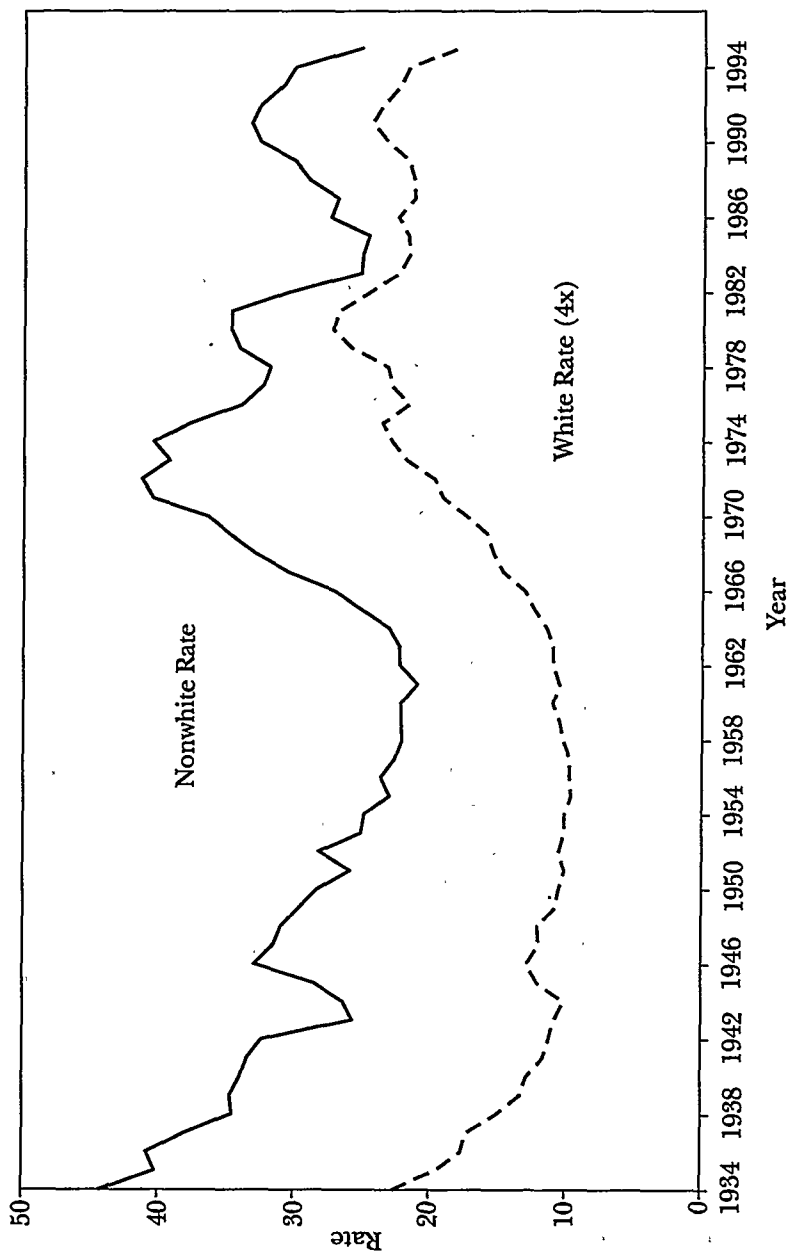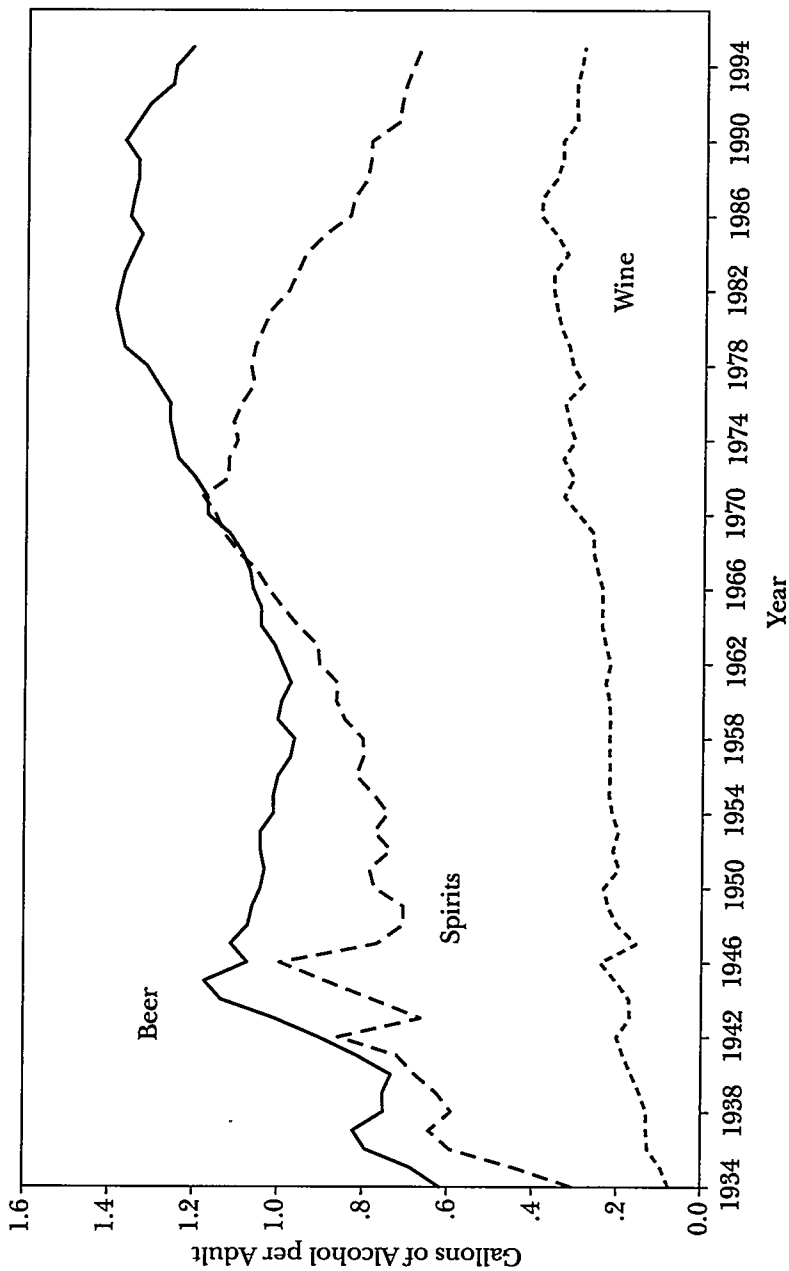
Nonwhite Rate

White Rate (4x)

FIGURE 3: ALCOHOL CONSUMPTION

BY BEVERAGE TYPE

Alcohol consumption can also be disaggregated among the three major beverage types that account for most of the total amount of alcohol consumed between 1935 and the present: beer, spirits, and wine. The three series are displayed in Figure 3, and it is immediately clear that wine consumption is of a different nature from that of beer and spirits during this period.[49] Although all three beverages rise into the Post WWII period, wine changes very little after that, rising from a 1945 peak of about .25 gallons of pure ethanol equivalent per capita to about .3 at the overall peak of the series, 1986.

Spirits and beer, accounting for nearly 90% of total consumption across this entire period, rise more sharply after WWII to a peak in the early 1970s for spirits. Beer consumption continues to rise into the early 1980s, as does overall consumption, and begins to decline towards the end of the period considered here. This different pattern suggests that the relationship between alcohol consumption and homicide rate overall and disaggregated by race, may vary by type of beverage. Research on alcohol consumption indicates that beverages vary in their average cost to consumers, such that spirits are more expensive and show greater variation, followed by wine and then beer on both the cost and variation dimensions.[50] In addition, alcohol consumption overall is well known to vary directly with income.[51] Thus, it might be the case that the homicide and alcohol relationship might differ by race and beverage type. Figure 3 reveals that there is sufficient variation in the three types that it should be possible to include at least two types, wine plus either spirits or beer, in each multivariate model to be estimated here. As there is no evidence from prior research about beverage preference by race, we will empirically examine all possible combinations in the models for African-Americans and whites in order to determine the optimal set of beverage types to include

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[49] WILLIAMS ET AL, *supra* note 12, at 4; NATIONAL INSTITUTE OF ALCOHOL ABUSE AND ALCOHOLISM, *supra* note 12, at 2.

[50] Andrew J. Treno et al., *Alcohol Beverage Price Spectra: Opportunities for Substitution*, 17 ALCOHOLISM: CLINICAL & EXPERIMENTAL 675 (1993).

[51] W. PONICKI, THE PRICE AND INCOME ELASTICITIES OF THE DEMAND FOR ALCOHOL: A REVIEW OF THE LITERATURE (1991).

if indeed the hypothesis about variation by race and beverage type proves to be relevant.

A. ADDITIONAL FACTORS

In any time series analysis covering the span of time such as that in Figures 1, 2, and 3, the investigators will be limited in the number and variety of indicators representing factors other than alcohol that are known to play a role in homicide causation. However, it is incumbent upon the investigator to measure as many concepts from competing theories and perspectives as possible to reduce the possibility that chance alone will masquerade as an important effect in a statistical model. Criminology has been particularly plagued with the problem of what could be called "the one factor wonder theory" a point that has been discussed elsewhere.[52] Here, we have assembled indicators that represent the two major perspectives that have been most successful in understanding and predicting homicide: economic deprivation[53] and routine activity.[54]

Poverty is measured here by the infant mortality rate, one of the components of Loftin and Hill's[55] structural poverty index, and one of the more reliably measured indicators of poverty available.[56] Another advantage of this measure is that it is available for white and nonwhite infants throughout the entire period under study.[57]

We have included two measures from those often used as indicators of the routine activities perspective at the aggregate level. First, we measured the proportion of the population that is between the ages of fifteen and twenty-four inclusive.[58] In ad-

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[52] *See* Parker, *supra* note 14, at 14.

[53] Robert Nash Parker, *Poverty, Subculture of Violence, and Type of Homicide*, 67 SOC. FORCES 983 (1989); Colin Loftin & Robert H. Hill, *Regional Subculture and Homicide: An Examination of the Gastil-Hackney Thesis*, 39 AM. SOC. REV. 714 (1974).

[54] Parker, *supra* note 14; Sampson, *supra* note 46; Cohen & Felson, *supra* note 43.

[55] Loftin & Hill, *supra* note 53, at 720.

[56] Colin Loftin & Robert Nash Parker, *An Errors-in-variable Model of the Effect of Poverty on Urban Homicide Rates*, 23 CRIMINOLOGY 269, 273-74 (1985).

[57] VITAL STATISTICS, *supra* note 1; ROBERT D. GROVE & ALICE M. HETZEL, VITAL STATISTICS RATES IN THE U.S., 1940-1960 (1968).

[58] PARKER & REBHUN, *supra* note 16; U.S. BUREAU OF THE CENSUS, CURRENT POPULATION REPORTS (Series P-25, 1997).

dition, we included in each model a measure of earned income, based on the arguments of Cohen and Felson.[59] In "Routine Activity" theory, as this approach is referred to, the flow of goods and services, for which earnings are a proxy, is an indicator of the availability of attractive and available targets for crime. In the case of the white homicide model, the measure is adult per capita income. In the non-white homicide model, the measure is total earnings from transfer payments of all levels of government per capita. The use of two different measures was designed to reflect the fact that whites dominate the total earnings of the U.S. because of their majority status, and that transfer payments are a much larger proportion of total earnings for non-whites than for whites historically.[60]

In short, two models will be analyzed, one for white homicide and one for nonwhite homicide. Each model will include disaggregated beverage types, infant mortality and earnings disaggregated by race, and the proportion of the population that is young and male.

B. STATISTICAL METHODS

A multivariate time series analysis was utilized to enable a simultaneous estimation of relationship between homicide and each variable, and among the independent variables. Estimating the impact of alcohol consumption on homicide requires a statistical methodology designed to model the complexity of the time dependent processes that are often found in time series data. In order to appropriately test the hypothesis that alcohol is a cause of homicide, the statistical method used must be multivariate in nature. That is, we must be able to estimate the longitudinal impact (if any) of alcohol on homicide while holding other factors, that might have an effect on the latter, statistically constant.

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[59] Cohen & Felson, *supra* note 43.

[60] BUREAU OF ECONOMIC ANALYSIS, U.S. DEP'T OF COMMERCE, STATE PERSONAL INCOME, 1928-1982, at 25-32 (1984); BUREAU OF ECONOMIC ANALYSIS, U.S. DEP'T OF COMMERCE, STATE PERSONAL INCOME 5 (1989); BUREAU OF ECONOMIC ANALYSIS, U.S. DEP'T OF COMMERCE, STATE PERSONAL INCOME 5 (1990); BUREAU OF ECONOMIC ANALYSIS, U.S. DEP'T OF COMMERCE, STATE PERSONAL INCOME 5 (1993); BUREAU OF ECONOMIC ANALYSIS, U.S. DEP'T OF COMMERCE, STATE PERSONAL INCOME 5 (1996).

Given the complexities introduced by the time series data utilized here, ordinary least squares (OLS) or multiple regression are not the most appropriate means to estimate the net effects of alcohol, routine activities, and poverty on homicide. One of the major assumptions of OLS, that the data points or cases are independently sampled from the population, is clearly violated (i.e. observations from 1970 are not independent of observations from 1969). This violation results in residuals or error terms that are correlated with one another, successively, across observations and, therefore, across time. Although it is possible to introduce a correction to an OLS model to deal with this problem, the success of such an approach given the nature of our data is tenuous at best. The reason for this is that there is likely to be a complex set of over time relationships among the independent variables and between the independent variables and the dependent variables. A regression corrected model or generalized least squares model (GLS), rests on the assumption that simple corrections (e.g. first-order serial dependence or perhaps second-order dependence) are required to adjust for the problem. However, the more complex time driven error structures which are presented by these data are difficult to model, and the GLS approach has a number of shortcomings. Similar problems and limitations are also found with regard to Box-Jenkins[61] style transfer function time series modeling.[62]

Neither of these alternatives provides a fully analogous multivariate regression style model which can at the same time deal effectively with the complex error structures engendered by time series data. However, the multivariate time series model or Vector ARMA (Auto Regressive Moving Average) models,[63] of which transfer function models are a special case, has provided analysts with the full OLS analog for time series data. We will utilize the Vector ARMA model because of its ability to model

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[61] GEORGE E.P. BOX & GWYILON M. JENKINS, TIME SERIES ANALYSIS: FORECASTING AND CONTROL (1976).

[62] For a detailed discussion, see Harold D. Holder & Robert Nash Parker, *Effect of Alcoholism Treatment on Cirrohis Mortality: A 20-Year Multivariate Time Series Analysis,* 87 BRIT. J. ADDICTION 1263 (1992).

[63] G. C. Tiao & G. E.P. Box, *Modeling Multiple Time Series with Applications,* 76 J. AM. STAT. ASS'N, 802 (1981).

complex error structures and to provide fully OLS regression analogous results.

C. MODEL SPECIFICATION

Like the procedures used in univariate Box-Jenkins analyses[64] the identification and evaluation of Vector ARMA models involve first of all an exploratory set of analyses designed to provide information about the nature of the model and lag structure required by the data. In this stage, two techniques are used: the cross-correlation matrix (CCM), analogous to the cross-correlation function used in bivariate modeling, and the auto-regression matrices (ARM). An attempt is made to identify a common error structure model for the vector of series; although as described previously, Vector ARMA models can be more complicated, a common noise model is often useful and parsimonious. We utilized the modeling procedures as outlined by Tiao and Box[65] and Liu and Hudak.[66] Significant cross-correlations occur when the noise component of the vector time series is driven by a moving average process, MA(q), where q is equal to any time lag, in this case, q months. If the noise model is of the form MA(q), the CCM for lags less than or equal to q will contain large numbers of significant entries, while those for lags greater than q will show relatively few such entries. Likewise, significant entries within the ARM will occur up to and including lag p, also expressed in months, if a noise model is driven by an auto-regressive process, AR(p). A summary statistic distributed as a Chi-square can be used to determine the degree to which the auto-regression coefficients as a set depart from a null hypothesis of zero auto-correlation for each lag. It is often the case that one type of process is found to be an acceptable description of the underlying time-oriented processes which drive the data, and this will be reflected in the comparison of the CCM and ARM. If one shows no pattern of decay at longer lags while the other demonstrates such a pattern, it is likely that

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[64] BOX & JENKINS, *supra* note 61, at 203-24.

[65] Tiao & Box, *supra* note 63.

[66] LAWRENCE M. LIU & GREGORY B. HUDAK, THE SCA SYSTEM FOR UNIVARIATE-MULTIVARIATE TIME SERIES AND GENERAL STATISTICAL ANALYSIS (1983).

the data can be adequately described by the process associated with the decaying diagnostic matrix. Once the likely lags for the MA(q) and AR(p) models have been identified, multivariate models can be estimated in which our hypotheses are specified and directly tested. The residuals from these models can be examined with the cross-correlation and auto regression matrices, thus helping to identify any additional error structure components which should be included in the models and to uncover any important omitted relationships to be examined in the context of the larger model. This procedure allows us to empirically identify the lag structure over which alcohol may cause changes in homicide. Although prior research and theoretical analyses often suggest which relationships should be lagged, usually there is little or no insight about the specific lag structure available in the previous research.

D. RESULTS

Tables 1 and 2 report results from the identification stage for the models of white and nonwhite homicide.

These tables report the results of the CCM and ARM analyses of the six observed time series. In the case of Table 1, these series are white homicide, per capita earnings, white infant mortality, wine consumption, spirits consumption, and young males. Thus there are severnty-two parameters in each CCM, resulting from the six by six variables in the model. The number of lags is somewhat arbitrary, but we examined twenty-four lags, more than one-third of the series, and found that after eight lags almost no significant correlations were found. On the ARM side of Table 1, the auto regression models use many degrees of freedom, and so only models up to the fourth lag were identified. In the case of Table 1, the identification phase indicates that most of the action is in the AR side of the model, as indicated by the significant CCM correlations, and the sharp drop off in chi squares for the ARM models. The bottom panel indicates that the final model accounts for most of the significant CCM entries observed in the identification phase, and the Lag 1 Chi square has dropped dramatically on the ARM side, suggest-

ing the appropriate model has been identified. Over-fitting[67] was also used to further investigate this model, and no additional parameters were found that further reduced the Chi square on the ARM side of the model. In addition no further significant CCM correlations were accounted for by any of the additional parameters added during over-fitting.

Table 1
Vector ARMA Analysis, White Homicide: Identification and Estimation Phase

Cross Correlation Summary	Auto Regression Summary
IDENTIFICATION	
Lags 1-2: 15 of 72 significant	Lag 1: Chi Square = 156.69
Lags 3-4: 12 of 72 significant	Lag 2: Chi Square = 61.65
Lags 5-6: 16 of 72 significant	Lag 3: Chi Square = 58.22
Lags 7-8: 13 of 72 significant	Lag 4: Chi Square = 57.56
Lags are years; Chi Square significance levels: .05 ≐ 52.6; .01 = 57.9	
AR (1, 2) Model	
Lags 1-2: 7 of 72 significant	Lag 1: Chi Square = 40.87
Lags 3-4: 12 of 72 significant	Lag 2: Chi Square = 60.44
Lags 5-6: 4 of 72 significant	Lag 3: Chi Square = 37.75
Lags 7-8: 2 of 72 significant	Lag 4: Chi Square = 58.87

Lags are years; Chi Square significance levels: .05 = 52.6; .01 = 57.9

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[67] *See* RICHARD HAY MCCLEARY ET AL., APPLIED TIME SERIES ANALYSIS 97 (1980).

Table 2 reports the identification results for nonwhite homicide. Although the final model does result in some reduction in CCM significant entries, the fact that this model includes a properly identified MA component is indicated by the much greater impact on the ARM Chi square values than was the case for white homicide. Over-fitting did not reveal any additional AR or MA parameters which would significantly improve on the fit of this model.

Table 2

Vector ARMA Analysis, Non White Homicide: Identification and Estimation Phase

Cross Correlation Summary	Auto Regression Summary
IDENTIFICATION	
Lags 1-2: 8 of 72 significant	Lag 1: Chi Square = 145.86
Lags 3-4: 9 of 72 significant	Lag 2: Chi Square = 78.72
Lags 5-6: 10 of 72 significant	Lag 3: Chi Square = 62.58
Lags 7-8: 7 of 72 significant	Lag 4: Chi Square = 60.62
Lags are years; Chi Square significance levels: .05 = 52.6; .01 = 57.9	
AR (1,2), MA (2) Model	
Lags 1-2: 7 of 72 significant	Lag 1: Chi Square = 61.49
Lags 3-4: 9 of 72 significant	Lag 2: Chi Square = 55.00
Lags 5-6: 4 of 72 significant	Lag 3: Chi Square =59.99
Lags 7-8: 1 of 72 significant	Lag 4: Chi Square = 53.64

Lags are years; Chi Square significance levels: .05 = 52.6; .01 = 57.9

Table 3 presents the substantive results for white homicide rates.

Table 3: Vector ARMA Model of White Homicide: AR (1,2)

AR (1)

Variable	Effect	Standard Error	T Value
Per Capita Earnings	.330	.115	2.87 *
White Infant Mortality	—	—	—
Wine Consumption	-.436	.074	5.89 *
Spirits Consumption	.487	.100	4.87 *
Percent Young Males	.492	.393	1.25

AR (2)

Variable	Effect	Standard Error	T Value
Per Capita Earnings	—	—	—
White Infant Mortality	.360	.223	1.61
Wine Consumption	-.180	.082	2.20 *
Spirits Consumption	-.070	.085	0.82
Percent Young Males	—	—	—

As multiple versions of the same indicator at different lags can be included in the same model, very high correlations among estimates can cause difficulties analogous to collinearity in a regression model, so that in some cases a parameter which was not significant in the first version of the model was dropped if it displayed a very high correlation with one or more of the other estimates. The AR (1) results for white homicide show significant effects for per capita earnings, and spirits consumption, both positive and in the expected direction. Wine consumption has a negative effect on homicide lagged one year, a finding that probably reflects the fact that while wine consump-

tion was rising in the post prohibition period, white homicide was declining. Further, as shown in Figures 2 and 3, wine consumption has been relatively flat since the mid 1960s, during which white homicide rose and then declined. Beer consumption was included in the model, but did not have a significant impact, either in the absence of the other types of consumption or net of them. Beer consumption also showed very high correlations with the spirits estimates and was therefore dropped from the model. The AR (2) results add little to the overall substantive interpretation of the model, but significantly improve the fit of the overall model.

Table 4 reports the results for nonwhite homicide. The AR (1) and AR (2) results indicate that this model does not do a very good job explaining nonwhite homicide, except that the internal dynamics of each of the six series-with transfer payments substituting for per capita earnings, nonwhite infant mortality for white infant mortality, and beer consumption for spirits-are highly significant at these lags (not reported in the tables). The MA (2) component shows that beer consumption has a significant and positive effect on nonwhite homicide between 1935 and 1995, but no additional effects are found. Spirits consumption was included in earlier versions of this model, and had to be dropped for the same reasons that beer was dropped from the white homicide model.

Table 4

Vector ARMA Model of Non White Homicide: AR (1,2) MA (2)

AR (1)			
Variable	Effect	Standard Error	T Value
Transfer Payments	-.084	0.46	1.83
Non White	-.021	.170	0.12
Infant Mortality			
Wine Consumption	—	—	—
Beer Consumption	—	—	—
Percent Young Males	-.568	.641	0.89
AR (2)			
Variable	Effect	Standard Error	T Value
Transfer Payments	—	—	—
Non White	—	—	—
Infant Mortality			
Wine Consumption	—	—	—
Beer Consumption	—	—	—
Percent Young Males	—	—	—
MA (2)			
Variable	Effect	Standard Error	T Value
Transfer Payments	—	—	—
Non White	-.235	.150	1.57
Infant Mortality			
Wine Consumption	.116	.077	1.51
Beer Consumption	.525	.178	2.95*
Percent Young Males	—	—	—

VI. DISCUSSION AND CONCLUSION

The results in Table 3 and 4 provide corroboration for the notion so well demonstrated in Figure 1 that declining alcohol consumption has something to do with the falling rate of homicide in the U.S. Effects linking alcohol consumption to homicide were found for time lags of one and two years, a reasonable expectation given the way the changes in consumption have occurred over the last sixty years. Further, evidence was found for effects of alcohol on both white and nonwhite homicide, albeit more so for the former rather than the latter. This is consistent with other evidence suggesting that African-Americans drink less than Whites, and may have fewer problems that are directly related to their alcohol consumption.[68] However, the fact that effects occur for both types of homicide and with beverage specific constellations makes sense given the general consumption patterns of whites and nonwhites in the U.S. This suggests that the importance of alcohol policy in violence prevention has been overlooked. Since alcohol is a regulated drug, a system for regulating the distribution of alcohol, and its availability, is already in place. This system typically involves both state and local governments in the process by which an alcohol outlet is permitted to sell alcoholic beverages at retail prices. In approximately one-third of U.S. states, alcohol availability is more tightly controlled via state owned and regulated retail sales monopolies. Research on the impact of availability on consumption has shown that availability in general has a significant positive relationship to consumption[69] and that increased availability leads to increased consumption.[70] Lenke has also shown that decreases in availability of alcohol lead to reduced rates of violence in his research on several cases of strikes, embargoes and other catastrophic decreases in alcohol supplies in several

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[68] Kellie M. Barr et al., *Race, Class, and Gender Differences in Substance Abuse: Evidence of Middle-Class/Underclass Polarization Among Black Males*, 40 SOC. PROBS. 314, 323 (1993).

[69] Gruenewald et al., *supra* note 24.

[70] Harold D. Holder & Alexander C. Wagenaar, *Effects of the Elimination of a State Monopoly on Distilled Spirits' Retail Sales: A Time Series Analysis of Iowa*, 85 BRIT. J. ADDICTION 1615 (1990).

European states.[71] Alaniz et al. show that alcohol availability is a significant predictor of the geographic concentration of youth violence at the neighborhood levels.[72] All of this evidence points to the control of alcohol availability as one possible mechanism to prevent some violence.

Is there direct evidence that changes in alcohol policy lead to reduced levels of violence? Other evidence is beginning to accumulate which shows that alcohol policy can have direct effects on rates of violence. For example, Chiu et al. studied the effect of a complete ban on alcohol imposed by referendum on the City of Barrow, Alaska.[73] This particular case is telling because the citizens of Barrow voted for a ban, lifted that ban, and voted to impose a second ban in a thirty-three month period. Chiu et al report significant decreases in emergency room visits and assaults when the first ban was imposed, dramatic increase in both when the ban was lifted, and significant declines once again when the ban was reinstated.[74] Parker and Rebhun found that increases in the minimum age of purchase for alcohol in several U.S. states had significant and negative effects on youth homicides in which the victim and the offender were acquainted prior to the homicide.[75] In a replication and extension of those results, Parker et al. found that, at least during the period between 1972 and 1984, upward changes in the age of purchase led to fewer youth homicides both overall, and among males, net of a comprehensive set of alternative explanations.[76] Both of these studies show significant impacts of beer consumption on youth homicide, further underscoring the potential of alcohol policy as a tool in violence prevention strategies. Parker et al. also replicate and extend findings from economic research that the rate of taxation for beer has a negative net effect on

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[71] LENKE, *supra* note 20.

[72] Alaniz et al., *supra* note 10.

[73] Arva Y. Chiu et al., *Impact of Banning Alcohol on Outpatient Visits in Barrow, Alaska* 278 JAMA, 1775 (1997).

[74] *Id.* at 1776.

[75] PARKER & REBHUN, *supra* note 16, at 110.

[76] Parker, *supra* note 8, at 12.

youth homicide.[77] The results reported here, combined with those about the relationship between availability, consumption, and violence discussed above, and the direct evidence about the impact of alcohol policy on violence, demonstrate the potential for violence prevention through tighter regulation of alcohol availability, taxation, and restrictions on the age of purchase. In each case these policies require no new legislative agenda, as the authority to regulate and tax alcohol is clearly established at the federal, state, and local levels in the U.S. In some cases stepped up enforcement of existing laws can be a cost-effective way to reduce violence; in Union City, CA, where enhanced enforcement of zoning laws resulted in the closure of several alcohol outlets, youth violence significantly decreased in the block groups where outlets had been closed.[78]

Although the current study shows that alcohol consumption is leading rates of homicide downward, and that there may be many other reasons in addition to declining alcohol consumption that explain this trend, an examination of the history of homicide over the last sixty years that is displayed in Figure 1 demonstrates the fallacy of complacency. Alcohol consumption may begin to rise in the next decade, and if it does we may expect a concomitant increase in homicide rates. However, with effective regulation we may be able to stabilize or further reduce consumption, resulting in fewer homicide deaths in the future. Thus, we can increase our preventative leverage by taking these findings into account and designing policies that allow communities and states to more effectively regulate alcohol with an additional payoff of some additional prevention and control of violence.

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[77] *Id.* *See also* Philip J. Cook & George Tauchen, *The Effect of Liquor Taxes on Heavy Drinking*, 13 BELL J. ECON. 379 (1982).

[78] Robert Nash Parker & Deborah Plechner, The Impact of Alcohol Policy on Youth Violence: the Case of Union City, CA (1998) (unpublished manuscript, on file with author).