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ABSTRACT

In recent years, economists have paid much attention to the demand for alcohol and the negative externalities associated with excessive drinking. Largely ignored in the literature is the link between alcohol use and domestic violence. Given the established positive relationship between alcohol consumption and acts of violence, the purpose of this paper is to examine the role changes in the determinants of the demand for alcohol may play in reducing the incidence of violence aimed at children. Data on violence come from the 1976 Physical Violence in American Families survey. We estimate a reduced form demand model in which violent outcomes are affected by the state excise tax rate on beer, illegal drug prices and other regulatory variables such as availability measures and laws restricting advertising of alcohol. Results show that increasing the tax on beer can be an effective policy tool in reducing violence. Laws designed to make obtaining beer more difficult may also be effective in reducing violence, while restrictions on advertising and increases in illegal drug prices have no effects.

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I. INTRODUCTION

Alcohol use and abuse is an important topic to study because of the significant costs alcohol abuse imposes on individual users, their families, and society as a whole. Costs may include those related to employment, such as reduced productivity, absenteeism or unemployment. Health related costs arise due to diseases such as liver cirrhosis or chronic conditions resulting from poor birth outcomes. Motor vehicle accidents and fatalities are also results of drunk driving. Finally, there is the emotional and physical harm often done to the children and spouses of heavy alcohol users.

The existing economic research on alcohol focuses on many of the harmful outcomes of alcohol abuse, with one notable exception. Currently, there is little work on the role of alcohol and domestic violence. Many studies from other disciplines have shown that alcohol plays a significant role in incidents of domestic violence. For example, it is estimated that about half of all cases of spousal abuse involve alcohol (Gelles, 1974). Due to the prevalence of alcohol in such violence, it may be possible to reduce domestic violence through changes in certain economic policies which affect the demand for alcohol. The purpose of this paper, therefore, is to identify some economic policy tools through which the incidence of physical violence toward children may be reduced.

II. THE LINKS BETWEEN ALCOHOL, DRUGS, AND VIOLENCE

The link between alcohol and violence has been the focus of many biological, psychological, sociological, and epidemiological studies. While each discipline seeks to answer its own questions about the association, for the purpose of this paper one can draw a few main conclusions from the existing literature. First, there is a general agreement that a strong link exists between alcohol consumption and violence. In a variety of settings, alcohol is found to have been used prior to assault. There is an overwhelming amount of evidence showing that the

use of alcohol is prevalent in many cases of criminal assaults and rapes (see Collins, 1981 for an overview). For example, the Bureau of Justice Statistics (1988) reports that about half of convicted offenders incarcerated for a violent crime had been drinking just prior to the crime. In the context of child abuse, Gil (1973) found that 13 percent of child abuse cases involved a perpetrator who was intoxicated at the time of the attack.[1] Many other studies link alcoholism to child abuse. Behling (1979) found that in 69 percent of cases of child abuse at least one parent was an alcoholic. Famularo et al. (1986) found that of parents who had lost custody of their children because of abuse and neglect, 38 percent were alcoholics.

Given the general association between alcohol use and violence, the question of importance is how alcohol use promotes violent behavior. While this paper makes no attempt to explain the causes of the link, a few theories which are relevant to this paper are discussed. To begin, there is no general agreement in the existing literature on the nature of this causality. Theories range from simple pharmacological effects to the complex interaction of endocrinological, neurobiologic, environmental, social and cultural determinants. (See National Research Council, 1993 chapter 4, and Goldstein, 1985 for further information.) For example, there may exist a psychopharmacological relationship in which alcohol can alter behavior by increasing excitability and/or boosting courage. (See Pernanen, 1981 and Fagan, 1993 for a complete discussion.) Under this theory, people may be more likely to commit a violent act when under the influence of alcohol than they would otherwise. A second theory proposes that alcohol affects the brain in such a way that people misinterpret social cues with the result of violent reactions (see Collins and Schlenger, 1988). A third theory asserts that people's reactions to alcohol follow what society has taught them to believe it does. For example, in the United States, people are taught that alcohol and drug use may cause people to lose their inhibitions and/or release violent tendencies, and thus users cannot be blamed fully for their actions. In

other words, drunkenness may give people an excuse for aberrant behavior, despite whether or not actual pharmacological effects exist (see Gelles and Cornell, 1990).

It is commonly believed that there may also be a link between illegal drugs and violence, although the literature supporting this notion is mixed. For example, when the perceived drug use of offenders is reported by the victims of violent crimes, the offender was reported to be under the influence of drugs in 8 to 10 percent of the time (Bureau of Justice Statistics, 1993). The Bureau of Justice Statistics (1988) also reports that about 25 percent of violent offenders claim they were under the influence of drugs at the time of the offense. However, the study also reports that jail and prison inmates are much more likely to use drugs than the general population. Another source of uncertainty regarding the link between drugs and violence concerns the possible biological effects of drugs. It is known that any biological effects differ by drug type and amount of use. For example, short-term use of marijuana, morphine and opium may inhibit aggressive behavior in humans, while long-term use can alter the nervous system in a way that actually promotes tendencies towards violence (National Research Council, 1993). Amphetamines, LSD, PCP and cocaine in small doses tend to increase aggressive behaviors, but this link may be an indirect result of the distortions in the interpretation of social signals by the users. (See Fagan, 1993 and Goldstein, 1985). In general, not much is yet known about the relationship between drugs and violence. Including drugs in this study may help to shed some light on the nature of this connection.

III. RELATED STUDIES

In general, domestic violence has been the focus of many studies in many disciplines, but there is very little work on any aspect of domestic violence from an economic standpoint. However, there has been a number of economic studies which relate negative outcomes of alcohol use to the demand for alcohol and to policies designed to curtail and control alcohol

consumption. For example, many studies have focused on the adverse effects of alcohol on outcomes such as crime rates (Cook and Moore, 1993 and Chaloupka and Saffer, 1995), motor vehicle fatalities (Saffer and Grossman, 1987, Chaloupka, Saffer and Grossman, 1993, Kenkel, 1993, and Ruhm, 1995), and liver cirrhosis mortality (Cook and Tauchen, 1982 and Chaloupka, Grossman, Becker, and Murphy, 1993). As will be done in this paper, these studies focus on the role that determinants of the demand for alcohol, such as the price and availability, have in reducing the specific outcome. The innovation is this paper is that it is the first to consider domestic violence as a negative outcome of alcohol use.

The most notable economic studies on domestic violence are by Long, Witte and Karr (1983) and Tauchen, Witte and Long (1991). Both papers focus only on spousal abuse and model violence as a good which the dominant partner can purchase with income. The paper by Long, Witte and Karr is a theoretical discussion which models a dominant partner's utility as a function of family income, time spent engaged in violence, and tastes for violence. The dominant partner's choice problem is to maximize expected utility subject to income constraints, time constraints, the threat of dissolution of marriage, and the threat of interference by authorities.

Tauchen, Witte and Long (1991) propose a variation of this model where the utility functions for both partners depend on the behavior of the female, the violence the male inflicts on the female, and on the income of both the male and the female. Each partner also faces a reservation level of utility that can be achieved outside the relationship. The key assumption in this model is that the male can transfer income to the female and buy more violence, while the female can reduce the amount of violence inflicted on herself by raising her own income and thus raising her reservation utility. When the female's income is increased, the male must reduce violence inflicted on her in order for the marriage to stay intact. Using a sample of 125 women

who had been physically abused by their partners, the authors empirically test their theory and find that in low income families the predictions of the model hold. For high income families, however, when the perpetrator holds most of the income, increases in income by either partner serves to decrease the violence. When the victim holds the bulk of the income, increases in income result in increased violence, possibly because the victim refuses to transfer income to lower the level of violence.

One drawback to these domestic violence studies is that the models are not general enough to allow for a child or other dependents such as the elderly to be victims. The models reviewed assume that the victim has a choice to be in the relationship or not. In reality, this choice is not always available, especially for very young or very old dependents. Another drawback is the heavy focus on income as a means of buying or avoiding violence. While it is true that many studies have shown that the risk of abuse decreases with income levels, domestic violence is still prevalent among the middle and upper classes. In fact, some studies have shown that the risk of marital violence is higher in families where the wife enjoys more education and a better job than her husband. (See Gelles and Cornell, 1990.) In addition, modeling income as a means to avoid violence seems inappropriate when the husband is the victim because males tend to have a physical advantage over females. Finally, there are many other factors involved in the propensity to commit violence. Alcohol in particular plays a major role and should not be left out of any model dealing with domestic violence. To address these faults, we present a more general framework for a perpetrator's choice level of violence.

IV. ANALYTICAL FRAMEWORK

The model of domestic violence utilized here is derived from Long, Witte and Karr (1983) and Becker (1968). The model is as follows: A perpetrator's choice problem is to maximize a utility function which depends on Z, a good representing the gains to violence such

as control over the victim or stress relief, consumption of alcohol (A), and consumption of all other goods (C).

1) $U=u(Z, A, C)$.

Gains to violence are accomplished directly through violence,

2) $Z=z(V)$.

Violence is produced by time spent engaged in violence (Tv), alcohol consumption (A), and is also affected by α which represents efficiency in producing violence.[2, 3]

3) $V=v(Tv, A, \alpha)$.

It is assumed that $\partial V/\partial Tv > 0$. Alcohol can alter the production of violence in that there may be a physical reaction that makes the user more prone to violence or that makes it easier to commit a violent act, therefore, $\partial V/\partial A > 0$.

As previously discussed, alcohol and violence may be linked not only through the chemical effects of alcohol, but also by the notion that alcohol serves to reduce the probability of the offender having to face consequences by creating a viable excuse for the behavior. That is, the perpetrator may face costs of his actions only if caught. These costs can be monetary costs such as legal fees, fines, or lost wages due to prison sentences and can be accounted for in the budget constraint of the perpetrator. Non-monetary costs may include the dissolution of the relationship, or loss of respect by the victim, family members or friends. For simplicity, the probability of facing non-monetary costs are included in the α term and are assumed to affect the supply of violence. The term P represents the probability of facing monetary costs and is represented by

4) $P=p(\Pi, A)$,

where Π represents the part of the probability that is unaffected by alcohol use, A is alcohol consumption and $\partial P/\partial A < 0$.

Considering the possibility of monetary losses gives two possible budget constraints faced by the perpetrator:

5a) $I=C^{NL} + P_A A + wTv$ when no monetary costs of violence are faced and

5b) $I=C^{L} + P_A A + wTv + L(Tv)$ when costs are imposed.

The term I represents income, P_A represents the monetary price plus travel and time costs of obtaining alcohol, and w is the wage rate which is meant to represent the opportunity cost of spending time engaged in violence. The monetary costs of violence are represented by the loss function L(Tv). The losses are a function of the time spent in violence and it is assumed that losses increase as the time spent in violence increases. C^{NL} and C^{L} denote other consumption when there is no loss and when there is loss resulting from violence, respectively. By design, $C^{NL} > C^{L}$ since L(Tv) is positive. The price of other consumption is normalized to 1 for simplicity.

Substituting equations 2, 3, 4, 5a and 5b into 1 yields an expected utility function:

6) $EU= 1-p(\Pi, A) * U[v(Tv, A, \alpha), A, I- P_A A - wTv] + p(\Pi, A) * U[v(Tv, A, \alpha), A, I- P_A A - wTv - L(Tv)].$

Equation 6 is the expected utility function that a perpetrator maximizes. The choice variables are alcohol consumption and time spent in violence. Maximization yields:

7) $Tv=tv(A, I, w, \Pi, \alpha)$ and

8) $A=a(Tv, I, Pa, \Pi, \alpha)$.

Equation 7 arises because the full price of allocating time to violence depends on the probability of facing monetary costs which depends on alcohol consumption. Equation 8 arises because the full price of alcohol consumption equals the monetary costs of buying alcohol less the expected penalty for apprehension and conviction of violence. The reduction in the expected penalty increases with more violence. As alcohol consumption increases, the expected penalty decreases

and violence increases. Equations 7 and 8 are termed the quasi-structural model of domestic violence and can be estimated when a measure of alcohol consumption is available. Equations 7 and 8 can also be solved simultaneously to get the following:

9) $Tv=tv(Pa, I, w, \Pi, \alpha)$

10) $A=a(Pa, I, w, \Pi, \alpha)$

Equation 9 is the reduced form model of the amount of violence supplied by the perpetrator and is the equation that will be estimated by linear regression techniques in this paper. The coefficient of interest is that of the price of alcohol. A negative coefficient indicates that an increase in the price of alcohol serves to reduce violence through decreased consumption.

The supply of violence given by equation 9 can be divided into two components, the first measuring the probability of participation and the second measuring the quantity of violence supplied conditional on participation. The total effect of a change in the price of alcohol on violence (the unconditional elasticity) can thus be considered as the sum of the elasticities of participation with respect to price and frequency with respect to price. In this paper we will estimate separate equations for participation and frequency. This is an application of Cragg's (1971) two-part model for an outcome with many nonparticipants. An advantage of Cragg's model over the tobit model is that it does not constrain the coefficients on price and other variables to be the same for the two outcomes.

V. DATA

Data on violence aimed at children as well as individual characteristics of the perpetrator come from the 1976 Physical Violence in American Families survey. This survey was designed to collect information about violence in the home and has detailed information on how conflicts are resolved. The data consist of a nationally representative sample of 2,143 married or

cohabiting individuals. Of these individuals, 1,147 have children ages 3-17 living at home and thus comprise the sample examining violence towards children.

A. Dependent Variables

Measures of domestic violence in the Physical Violence in American Families survey are collected by use of the Conflict Tactic Scale (CTS). The CTS gathers information on the number of times in the past year a respondent has committed or has been the victim of a violent act by first asking questions about verbal solutions to disagreements and building up to questions on the occurrence of violent acts. The question aimed at measuring violence toward children is asked as follows:

> Parents and children use many different ways of trying to settle differences between them. I'm going to read you a list of some things that you and (child) might have done when you had a dispute. For each one, I would like you to tell me how often you did it with (child) in the past year.

The list of items include the following: a) Discussed the issue calmly; b) got information to back up your side of things; c) brought in or tried to bring in someone to help settle things; d) insulted or swore at the other one, e) sulked and/or refused to talk about it; f) stomped out of the room or house or yard; g) cried, h) did something to spite the other one; i) threatened to hit or throw something at the other one; j) threw, smashed, hit or kicked something; k) threw something at the other one; l) pushed, grabbed, or shoved the other one; m) slapped or spanked the other one; n) kicked, bit or hit with fist; o) hit or tried to hit with something, p) beat up the other one; q) threatened with a gun or knife; r) used a knife or gun.

The designers of the survey classified the above answers into different scales. Items a-c comprise the "reasoning" scale, items d-j make up the "verbal aggression" scale and items k-r are

termed the "violence" scale. Within the violence scale, items k-m are considered as "minor" acts, and items n-r are considered "severe" acts.

The first set of dependent variables are dichotomous variables that equal one if a parent has committed an act of violence towards the child in the past year. Two different dichotomous variables are constructed: The first is termed the "severe violence" indicator, and equals one if a respondent had committed an act which in general has potential to seriously injure a child. These acts are classified by items n-r in the CTS. That is, in the past year, had the respondent kicked, bit or hit with fist, hit or tried to hit with something, beat up the child, threatened with a gun or knife, or used a gun or knife on the child. Fourteen percent of the 1976 sample responded that they had committed at least one of these acts in the past year. (See Table 1 for means and standard deviation of all variables.)

The second dichotomous variable measures whether a parent has hurt the child in any manner as described by all items in the violence scale with the exception of item "m", slapping or spanking. This measure is termed the "overall violence" indicator. Item "m" is omitted since slapping or spanking is usually considered a way of punishing a child rather than representing an abusive or violent act (Straus and Gelles, 1990). If this is the case, then there should be no relationship between alcohol consumption and measures of physical punishment. Models which include the act of slapping or spanking in the dependent variable demonstrate the expected results, for the coefficient on the beer tax becomes positive and insignificant. In addition, it can be argued that the act of hitting or trying to hit with something (item "o"), can be considered punishment rather than abuse. For example, hitting the child with a belt or a hair brush is a common way to punish a child but hitting with a frying pan might be considered violence. Unfortunately, there is no way to distinguish between responses that were meant as punishments or as violence. Models of the overall violence indicator were tested with and without item "o",

but results were very similar. Henceforth, only the overall violence indicator inclusive of item "o" are reported. Thirty-six percent of the sample said they have committed at least one of the acts in the overall child violence scale in the past year (see Table 1).

Variations on the measures of violence were constructed from the initial question. For example, one can argue that items i (threatened to hit or throw something at the other) and j (threw, smashed, hit or kicked something) should be included in the measures of overall violence. Models were tested that added item j first and then added items i and j together. Results were very similar to those given by the overall violence scales so these additional measures are not reported.

In order to measure the frequency of violence given positive participation, a third dependent variable is created which represents the log of the number of times in the past year a respondent has committed an act in the overall violence scale given that the respondent has committed any violence. A log transformation is used in order to mitigate the effects of outliers. A similar variable for the severe violence scale is not reported even though the coefficients on the beer tax are negative in all models of frequency of severe violence. Due to the small sample size (n=165), however, these effects are never significant.

We use caution in the interpretation of this frequency variable due to the ambiguity regarding the initial survey question. The question asks the respondent how many times in the past year he or she has committed each act. This wording does not allow for a distinction between specific acts of violence that occurred on different occasions or occurred along with other types of violence on the same occasion. For example, a value of "2" for the number of acts could mean that the respondent hit the child twice in the past year, implying separate occasions. Alternatively, the same value could mean that the respondent hit the child once and threw something at the child once, perhaps during the same incident. While unable to measure the

frequency of broad categories of violence, this third dependent variable really represents a combination of intensity and frequency of violence. That is, higher values will represent people who either commit the same act of violence often or commit different acts frequently.

One criticism of the Physical Violence in American Families survey focuses on the reliability of the respondents' answers to the incidence of violence. The survey seeks to gain information about sensitive and possibly deviant types of behavior that often arouses antagonism, high refusal rates and distorted answers from the respondents, thereby bringing into question the reliability of the results. The principle investigators of the survey discuss this criticism at length. (See Straus and Gelles, 1990 for complete discussion of these issues.) First, they claim that the antagonistic aspects are minimized by presenting the questions in the context of *resolving* family conflicts. The questions begin with resolution tactics such as "discuss the issue calmly" which are generally viewed as positive methods of dealing with problems. The scale gradually increases to questions about more socially unacceptable behavior. Through this backdoor method of getting to the violence questions, the respondent has first been given a chance to give the "socially correct" answers and is less apprehensive about discussing incidence of violence. Currently, the CTS seems to be the best available technique for collecting truthful information on domestic violence and has been used in over 200 studies to date (see Straus and Gelles, 1990). Nevertheless, due to the potential for underreporting violence, we consider the dependent variables as conservative estimates of violence. This poses no problem for our conclusions since measurement error in the dependent variable only serves to raise the standard errors leaving the coefficients as unbiased estimators.

A related criticism is how well the Physical Violence in American Families survey reflects the reported national incidence of violence aimed at children. It is difficult to compare the estimates of violence aimed at children from this survey with those collected from other

sources. The most commonly cited source is the *National Study on Child Neglect and Abuse Reporting* as conducted by the American Association for Protecting Children (AAPC). Their data represent cases of physical and sexual abuse or neglect and come mainly from Child Protection Services agencies around the country. This implies that cases of abuse must be reported before they can get into the national statistics, but unfortunately a large proportion of cases go unreported. In 1976 (the earliest year of data available) the AAPC estimates that 669,000 children or about one and a half percent of the child population were abused or neglected (American Association for Protecting Children, Inc., 1986). The Physical Violence in American Families survey estimates that 14.4 percent of children or about 6.6 million children were the victims of severe violence in 1975.

B. Independent Variables

Alcohol Control Variables

The price of alcohol is measured by the state excise tax rate on a case of beer (24 12-ounce cans) as reported by the U.S. Brewers Association, *Brewers' Almanac*. This measure was chosen because beer is the most commonly consumed alcoholic beverage and because most of the variation in beer prices across states is due to differences in excise tax rates. The 1976 survey is conducted in the first quarter of 1976, therefore, the beer tax is taken as a simple average of the state excise tax rates that existed in the four quarters of 1975.

A variety of measures are constructed to represent the availability and prevalence of alcohol in each state. First, variables representing restrictions on beer advertising are included in the models. These variables come from *Modern Brewery Age Blue Book* (1976). Specifically, dichotomous indicators are included for whether a state prohibits the following: price advertising of beer in newspapers and magazines; billboards advertising beer; window displays of signs, packages and products in liquor stores; and consumer novelty giveaways. Restrictions

on the first three will serve to make the full price of beer higher due to increased search costs. Bans on consumer novelties also serve to raise the full price of beer because novelties act as discounts in kind.

Retail availability factors in to the full price of alcohol faced by individuals. To capture the availability effects, three measures are employed. The first is a dichotomous indicator for whether or not grocery stores can sell beer.[4] Data for grocery store sales come from *Jobson's Liquor Handbook* (1976). Secondly, the percentage of each state's population living in counties dry for beer as given by the *Brewers' Almanac* are included. With larger percentages of state populations living in dry counties, travel time to obtain alcohol increases, adding to the full price of alcohol. In addition, this measure serves to capture some of the unobserved sentiment towards drinking which may be reflected in the drinking habits of the state's residents. Finally, the number of retail outlets per 1,000 population that are licensed to sell alcoholic beverages for on-premise or off-premise consumption is included. These data come from *Jobson's Liquor Handbook* (1976).

Illegal Drugs

The price of one gram of pure cocaine is included in some models. Prices are derived from the System to Retrieve Information from Drug Evidence (STRIDE) maintained by the Drug Enforcement Administration (DEA) of the U.S. Department of Justice. The price of one gram of pure cocaine is obtained from a regression of the natural logarithm of purchase price on the natural logarithms of weight and purity, dichotomous variables for each city and year except one, and interactions between the year and variables representing eight of the nine Census of Population divisions. (See Grossman and Chaloupka (1997) for further details.) Since 1977 is the earliest year the cocaine data are available, the violence data are matched with cocaine prices from 1977.

Prices of marijuana are generally unavailable. However, by 1976, some states had decriminalized the possession of small amounts of marijuana for personal use, thus effectively lowering the full price of its use. Therefore, a dichotomous indicator for whether a state decriminalized marijuana is included in some models. Information on decriminalization comes from the U.S. Department of Justice's *Sourcebook of Criminal Justice Statistics*.

Individual Characteristics

Literature on domestic violence from other disciplines provides insight into the personal characteristics that lead to a predisposition towards violence. (See Gelles and Cornell, 1990 for a profile of domestic abusers and their victims.) People who were abused by their parents or saw their parents fight a lot, for example, are more likely to be violent towards their own children. Dichotomous indicators are included to represent whether or not the respondent's parents used physical punishment and if the respondent's parents hit or threw things at each other during the respondent's teenage years. Three measures of stressful life styles are also included. The first measure is the number of children at home. The second is a dichotomous variable indicating whether the respondent talks to other people about personal family problems in order to help relieve stress. The third is the number of specific stressful events encountered in the past year. These events include trouble at work, health problems, money problems, and problems with family members.

Socio-economic and demographic characteristics also play a role in determining an individual's propensity towards violence. Three indicators of race are included; black, not Hispanic; Hispanic; and other race. The missing category is white, not Hispanic. The respondent's age, gender, education, income, occupation, employment status, religion and frequency of religious service attendance are included in all models. In addition, the child's

gender and age are included in the models. Any missing values are coded at the mean of the known observations.

VI. ESTIMATION AND RESULTS

Tables 2 through 4 display limited results from estimating the reduced form model as given by equation 9. Five different models are presented in each table. The first model contains the state excise tax rate on beer and the individual characteristics. The second adds to the first the marijuana decriminalization indicator and the price of cocaine. The third model is the most inclusive for it includes all price, advertising, and availability measures. A fourth specification omits all advertising restrictions, but includes the restrictions on availability, namely the number of retail outlets for alcohol per 1,000 population, the percent of the population living in counties dry for beer and an indicator of whether grocery stores are prohibited from selling beer. Finally, the fifth specification includes only the advertising measures along with the beer tax and the individual characteristics.

Where the dependent variable is a dichotomous indicator, the equations are estimated by probit techniques. The relevant tables show the probit coefficients, the t-statistic on the coefficients in parentheses, and the marginal effects of the coefficients in bold italics. The marginal effects shown for the dummy variables are calculated by $\Phi(X_1b) - \Phi(X_0b)$, where Φ is the cumulative normal density, and X_0 and X_1 are vectors of the means of the independent variables except that the value of the dummy variable of interest equals 0 and 1, respectively. Marginal effects for continuous variables are calculated at the mean of the independent variables.

There are two potential problems with the five models presented. Specifically, the limited specifications are prone to omitted variable bias if the advertising or availability measures are predictors of violence. Omitted variable bias is a more serious problem in probit models than in ordinary least squares because even if the omitted variables are uncorrelated with

the included variable, the coefficient on the included variable can still be inconsistent. (See Greene, 1993, p. 648 and Yatchew and Griliches, 1985 for a discussion of this issue.) However, including all the relevant control variables may lead to the problems of multicollinearity. This problem may arise because states which heavily restrict advertising are more likely to restrict availability. Also, states tend to simultaneously enact laws regulating different forms of advertising.

A. Overall Violence

Beginning with the overall violence indicators, the most striking finding in Table 2 is the negative and statistically significant effect of the excise tax on beer.[5] That is, as the state excise tax on beer increases, the probability of overall violence towards children decreases. The statistical significance of this result is robust across all specifications, and only the magnitude is slightly affected. The tax elasticity is -0.12 when drug, advertising and availability measures are excluded, -0.11 with all the drug price measures included, -0.12 when all drug, advertising and availability measures are included, -0.09 with the availability measures only, and -0.14 with advertising measures only. The average elasticity is about -0.12.

The number of outlets is positive indicating that as the number of retail outlets licensed to sell alcohol increases, the probability of violence towards children increases. This result is significant at the 10 percent level in a one-tailed test in model 4. The signs of the coefficients on the percentage of a state's population living in dry counties and the indicator for whether grocery stores can sell beer are negative as expected. Grocery sales are not significant and the percentage dry is significant only in model 3.

With the exception of the prohibition of window displays, the advertising variables in Table 2, columns 3 and 5, are insignificant individually and do not have the expected signs. The prohibition of displays in liquor store windows lowers the probability of violence towards

children by a range of 9 to 16 percentage points. Multicollinearity among the advertising variables may make the individual effects of the variables indistinguishable from each other. Therefore, the last row in Table 2 reports a chi-squared test of the advertising variables as a set. However, results indicate that the advertising measures are not significant as a set.

B. Severe Violence

Turning to more severe acts of violence, the results in Table 3 show negative and significant effects of the tax on beer. The ability of the state excise tax on beer to lower the probability of severe violence is greater than the effect on overall violence. The tax elasticities in Table 3 are -0.29, -0.27, -0.16, -0.18, and -0.26 for models 1 through 5, respectively. An average of these estimates yields a tax elasticity of -0.23 for severe violence as compared to an average of -0.12 for overall violence.

The effect of the number of outlets on the probability of severe violence are robust to the other included variables. The marginal effects of the number of outlets equal about 0.04 in models 3 and 4 in Table 3, and are statistically significant in both specifications. This means that for every one less outlet per 1,000 people, the probability of severe violence will be reduced by 4 percentage points.

The two other availability measures, the percentage of a state's population living in dry counties and the indicator for whether beer is permitted to be sold in grocery stores, are not statistically significant, although the sign on the percent dry is as anticipated. Finally, the advertising variables in Table 3 are never statistically significant individually or as a set in either model 3 or model 5.

C. Illegal Drugs

Coefficients on the illegal drug prices are insignificant in the models in both Tables 2 and 3. This is not surprising for the marijuana decriminalization indicator given that by 1976, only

four states had decriminalized the possession of small amounts of marijuana for personal use. There simply may not be enough variation in this variable to create any effects. Lack of variation is not a problem for cocaine prices, however. The effect of a change in the price of cocaine on violence may work through two mechanisms. The first is the direct effect of cocaine consumption on violence. The second is the relationship between drug consumption, and alcohol consumption. Depending on whether cocaine and alcohol are substitutes or complements, a decrease in the price of one substance may decrease or increase consumption of the other substance, respectively. One can obtain a zero coefficient if the direct effect of cocaine on violence is zero and cocaine is neither a substitute or a complement with alcohol. This seems to be the likely scenario given the propensity of drugs to induce violence is still in question in the current literature (see discussion above on the link between alcohol, drugs and violence). The relationships between drug and alcohol consumption for adults are still for the most part unknown, thus suggesting an area for further research.

D. Individual Characteristics

Appendix Table A1 shows the results of the socio-economic and demographic characteristics of the respondent on the three different measures of violence towards children. The impact of these variables are not sensitive to the inclusion or exclusion of the alcohol advertising and availability measures, and therefore, results from the models which include only the tax on beer and the individual characteristics are shown. Factors that serve to increase both the probability of severe and overall violence include whether the respondent was hit by his/her parents as a teenager and having more children at home. The age and gender of the child also contribute significantly, with males and young children more likely to be the victim of violence. Being a female respondent serves to increase the probability of child abuse only. The results in Table A1 also show that older people are less likely to be violent toward their children as are

those of certain religious faiths, and in the case of overall violence, those with higher incomes. These results are consistent with other studies on child abuse.

E. Number of Acts of Violence Given Positive Violence

Table 4 shows the results of the log of the number of acts of overall violence towards children for respondents who had reported at least one violent incident in the past year. As stated previously, we are cautious of the meaning of these results due to the problems of the interpretation of the survey question. Nevertheless, the results indicate that the state excise tax on beer is negatively related to the number of acts of violence. This result is significant at the 5 percent level in all models. Specifically, a 1 percent increase in the tax on beer will reduce the number of acts of overall violence by a range of 0.13 percent to 0.19 percent, with an average of 0.16. The availability measures are not statistically significant individually, but two of the advertising variables--the prohibition of billboards and of window displays--are statistically significant. However, only the coefficients on the prohibition of billboards display the anticipated sign.

The socio-economic and demographic variables that are significant in explaining the frequency of violence are different from those that explain the probability of violence (see Appendix Table A1). Being female, having been hit as a teenager, and having a male child all increase the probability of violence. However, these factors are not significant in predicting the frequency of violence. The variables that are significant in reducing the frequency of violence are increases in the education of the respondent and the age of the child. Respondents who are unemployed commit less violence, and respondents who are catholic or are of no religious affiliation commit less violence than those of other religious faiths. Finally, facing more stressful events tends to increase the frequency of violence.

VII. DISCUSSION

This paper focuses on the link between alcohol consumption and domestic violence. We have shown that violence aimed at children can be reduced by increasing the tax on beer. Specifically, a 10 percent increase in the excise tax on beer will reduce the probability of severe violence by 2.3 percent, the probability of overall violence by 1.2 percent, and unconditional overall violence by 2.8 percent. According to the Bureau of the Census (1975) there were 46 million children between the ages of 3 and 17 living with both parents in 1975. If 14.4 percent were the victims of severe violence (6.6 million) then a 10 percent increase in the beer tax would have lowered the number of abused children by about 151,800. While increasing the tax on beer would lower violence, any policy decisions must weight the cost of raising the tax on beer versus the benefits of the reduction in child abuse. Raising the beer tax would serve to penalize people who consume alcohol but who are not violent.

In addition, this study shows some evidence that laws designed to make obtaining beer more difficult may also be effective in reducing violence, with decreases in the number of outlets licensed to sell alcoholic beverages playing a large role in reducing the probability of severe violence. Finally, laws restricting advertising of beer are shown to be ineffective in reducing violence.

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FOOTNOTES

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[1] The term "child abuse" in Gil's study refers to physical violence only. In other works this term is commonly used to describe sexual abuse and neglect as well. We use the term "violence towards children" to represent physical violence only. Other types of abuse are not considered here.

[2] Drug use can also be considered here. Drugs will enter into the discussion in the same manner as alcohol and are therefore omitted.

[3] While technically an efficiency parameter, in the reduced form, α is indistinguishable from taste variables.

[4] Drug stores can also sell beer and liquor in some states, but this variable is not used because it is highly collinear with the indicator for grocery store sales.

[5] Unless otherwise mentioned, statistical significance refers to a one-tailed test at the 5 percent level. A one-tailed test is used because theory predicts the sign of the alcohol regulatory variables.

TABLE 1
Definitions, Means and Standard Deviations

Variable Name	Definition	Mean, Standard Deviation
Indicator of severe violence	Dichotomous variable that equals 1 if the respondent had in the past year done any of the following acts of violence to the child: kicked, bit or hit with fist; hit or tried to hit with something; beat up; threaten to or used a knife or gun.	0.144, 0.351
Indicator of overall violence toward children	Dichotomous variable that equals 1 if the respondent had in the past year done any of the following acts of violence to the child: threw something at the child; pushed, grabbed or shoved; kicked, bit or hit with fist; hit or tried to hit with something; beat up; threaten to or used a knife or gun.	0.357, 0.479
Number of acts of overall violence toward children given positive violence	Number of times in the past year the respondent had done any of the following acts of violence to the child: threw something at the child; pushed, grabbed or shoved; kicked, bit or hit with fist; hit or tried to hit with something; beat up; threaten to or used a knife or gun.	10.748, 14.600
Log number of acts of overall violence toward children given positive violence	Log of number of times in the past year the respondent had done any of the following acts of violence to the child: threw something at the child; pushed, grabbed or shoved; kicked, bit or hit with fist; hit or tried to hit with something; beat up; threaten to or used a knife or gun.	1.740, 1.100
State excise tax on beer	State excise tax rate on a case of beer (24 12-ounce cans.)	0.799, 0.836
Marijuana decriminalization	Dichotomous variable that equals 1 if a state had decriminalized possession of marijuana for personal use.	0.021, 0.103
Cocaine price	Price of one pure gram of cocaine	679.676,107.459
Number of outlets	Number of licensed retail outlets per 1,000 population for on or off premise consumption of alcoholic beverages.	1.049,0.571
Percent dry	Percent of the state population living in counties dry for alcohol consumption.	6.225, 9.095
Grocery sales of beer prohibited	Dichotomous variable that equals 1 if a state does not permit grocery stores to sell beer.	0.028, 0.165
Billboards prohibited	Dichotomous variable that equals 1 if a state does not permit billboards advertising beer.	0.090,0.257
Window displays prohibited	Dichotomous variable that equals 1 if a state does not permit liquor stores to display products or signs in windows.	0.262,0.440
Consumer novelties prohibited	Dichotomous variable that equals 1 if a state does not permit consumer novelties.	0.158, 0.365
Price advertising prohibited	Dichotomous variable that equals 1 if a state does not permit price advertising of beer in magazines or newspapers.	0.321, 0.467

Table 1 (continued)

Parents hit respondent	Dichotomous variable that equals 1 if the respondent's parents hit him/her as a teenager.	0.660,0.435
Parents hit each other	Dichotomous variable that equals 1 if the respondent's parents hit each other	0.172,0.344
Black	Dichotomous variables for race: The omitted category pertains to white.	
	Black: equals 1 if the respondent is black, not Hispanic	0.068, 0.247
Hispanic	Hispanic: equals 1 if the respondent is Hispanic.	0.039, 0.190
Other race	Other race: equals 1 if the respondent indicated American Indian, Oriental or another race.	0.012, 0.106
Education	Respondent's education.	12.312, 2.937
Age	Respondent's age.	37.706, 9.188
Female	Dichotomous variable that equals 1 if the respondent is female.	0.543, 0.498
Income	Family income in thousands of dollars.	32.531,16.444
Female child	Dichotomous variable that equals 1 if the child is female.	0.486, 0.495
Age of child	Age of child.	9.914, 4.455
Number children at home	Number of children living at home.	2.529, 1.250
Part-time	Dichotomous variable that equals 1 if the respondent works part-time.	0.091, 0.287
Unemployed	Dichotomous variable that equals 1 if the respondent is unemployed.	0.030, 0.170
Not employed	Dichotomous variable that equals 1 if the respondent is a student, retired, a homemaker, disabled or otherwise not employed.	0.341, 0.474
Blue collar	Dichotomous variable that equals 1 if the respondent holds a blue collar job.	0.445, 0.482
Catholic	Dichotomous indicators for respondent's religious preference. The omitted category pertains to other minority religions.	
	Catholic: equals 1 if the respondent is Roman Catholic.	0.254, 0.435
Jewish	Jewish: equals 1 if the respondent is Jewish.	0.048, 0.214
Protestant	Protestant: equals 1 if the respondent is Protestant.	0.557, 0.496
No religion	No religion: equals 1 if the respondent reports no religious affiliation.	0.059, 0.235
Frequency of religious services	How often the respondent attends religious services.	4.661, 2.517
Talks with others	Dichotomous variable that equals 1 if a respondent talks to relatives or friends when a family problem arises.	0.460, 0.483
Number of stressful events	Number of major stressful events in the past year.	2.325, 2.001

TABLE 2
Probit Estimates
Dependent Variable=Indicator of Overall Violence[a]
(N=1,147)

	(1)	(2)	(3)	(4)	(5)
State excise tax on beer	-0.151	-0.138	-0.147	-0.108	-0.172
	(-2.67)	(-2.38)	(-2.16)	(-1.71)	(-2.78)
	-0.055	***-0.050***	***-0.054***	***-0.039***	***-0.063***
Marijuana decriminalization		0.074	-0.076		
		(0.19)	(-0.19)		
		0.028	***-0.027***		
Cocaine price		-0.0004	0.0003		
		(-1.05)	(0.54)		
		-0.0002	***0.0001***		
Number of outlets			0.107	0.108	
			(1.20)	(1.27)	
			0.039	***0.039***	
Percent dry			-0.013	-0.003	
			(-1.96)	(-0.58)	
			-0.005	***-0.001***	
Grocery sales of beer prohibited			-0.227	-0.142	
			(-0.84)	(-0.55)	
			-0.078	***-0.050***	
Billboards prohibited			0.239		0.104
			(1.13)		(0.53)
			0.090		***0.038***
Window displays prohibited			-0.465		-0.243
			(-2.74)		(-1.89)
			-0.159		***-0.086***
Consumer novelties prohibited			0.285		0.028
			(1.52)		(0.19)
			0.107		***0.010***
Price advertising prohibited			0.096		0.062
			(0.99)		(0.68)
			0.035		***0.023***
Chi-squared on illegal drug prices		1.16			
		[0.560]			
Chi-squared on availability variables			6.84	2.68	
			[0.077]	[0.443]	
Chi-squared on advertising variables			8.31		5.45
			[0.081]		[0.247]

[a]T-statistics in parentheses, marginal effects in bold italics, p-values in brackets for chi-squared tests, and intercept not shown. Other regressors include family history of violence, respondent's age, sex, income, race, employment status, religion and measures of stress, and the child's age and sex.

TABLE 3
Probit Estimates
Dependent Variable=Indicator of Severe Violence[a]
(N=1,147)

	(1)	(2)	(3)	(4)	(5)
State excise tax on beer	-0.274	-0.252	-0.157	-0.176	-0.250
	(-3.44)	(-3.11)	(-1.71)	(-2.04)	(-2.93)
	-0.052	***-0.048***	***-0.029***	***-0.033***	***-0.047***
Marijuana decriminalization		0.195	0.226		
		(0.46)	(0.52)		
		0.041	***0.048***		
Cocaine price		-0.001	-0.0004		
		(-1.05)	(-0.54)		
		-0.0001	***-0.0001***		
Number of outlets			0.228	0.238	
			(2.11)	(2.30)	
			0.043	***0.044***	
Percent dry			-0.007	-0.004	
			(-0.84)	(-0.61)	
			-0.001	***-0.001***	
Grocery sales of beer prohibited			0.069	0.055	
			(0.22)	(0.18)	
			0.013	***0.011***	
Billboards prohibited			0.101		-0.107
			(0.39)		(-0.44)
			0.020		***-0.019***
Window displays prohibited			-0.119		-0.055
			(-0.59)		(-0.36)
			-0.021		***-0.010***
Consumer novelties prohibited			0.021		-0.144
			(0.09)		(-0.75)
			0.004		***-0.026***
Price advertising prohibited			-0.039		0.004
			(-0.33)		(0.03)
			-0.007		***0.001***
Chi-squared on illegal drug prices		1.35			
		[0.510]			
Chi-squared on availability variables			6.15	7.01	
			[0.104]	[0.072]	
Chi-squared on advertising variables			0.76		1.82
			[0.944]		[0.768]

[a]T-statistics in parentheses, marginal effects in bold italics, p-values in brackets for chi-squared tests, and intercept not shown. Other regressors include family history of violence, respondent's age, sex, income, race, employment status, religion and measures of stress, and the child's age and sex.

TABLE 4
OLS Estimates
Dependent Variable=Log of Number of Acts of Overall Violence Given Positive Violence[a]
(N=409)

	(1)	(2)	(3)	(4)	(5)
State excise tax on beer	-0.218 (-2.61)	-0.231 (-2.69)	-0.186 (-1.84)	-0.192 (-2.04)	-0.167 (-1.87)
Marijuana decriminalization		-0.678 (-1.38)	-0.597 (-1.19)		
Cocaine price		0.0001 (0.21)	0.0002 (0.22)		
Number of outlets			0.017 (0.15)	0.034 (0.31)	
Percent dry			0.004 (0.39)	-0.003 (-0.39)	
Grocery sales of beer prohibited			0.029 (0.08)	0.053 (0.15)	
Billboards prohibited			-0.686 (-2.29)		-0.646 (-2.33)
Window displays prohibited			0.448 (1.83)		0.446 (2.35)
Consumer novelties prohibited			-0.251 (-0.98)		-0.222 (-1.04)
Price advertising prohibited			0.041 (0.32)		0.045 (0.38)
R-squared	0.13	0.13	0.15	0.13	0.14
F-statistic on regression	2.35	2.25	1.98	2.09	2.29
F-statistic on illegal drug prices		0.97 [0.379]			
F-statistic on availability variables			0.06 [0.982]	0.11 [0.952]	
F-statistic on advertising variables			1.67 [0.157]		1.81 [0.127]

[a]T-statistics in parentheses, p-value on F-statistic in brackets and intercept not shown. The F-statistics on the regression are always significant at the 1 percent level. Other regressors include family history of violence, respondent's age, sex, income, race, employment status, religion and measures of stress, and the child's age and sex.

APPENDIX TABLE A1[a]

	Probability of Severe Violence	Probability of Overall Violence	Number of acts of Overall Violence Given Positive Violence
State excise tax on beer	-0.274	-0.151	-0.218
	(-3.44)	(-2.67)	(-2.61)
	-0.052	***-0.055***	
Parents hit respondent	0.205	0.362	0.005
	(1.66)	(3.64)	(0.03)
	0.037	***0.128***	
Parents hit each other	0.025	0.047	-0.025
	(0.18)	(0.39)	(-0.17)
	0.005	***0.017***	
Black	0.237	-0.085	-0.025
	(1.14)	(-0.47)	(-0.09)
	0.051	***-0.030***	
Hispanic	0.292	0.230	0.213
	(1.21)	(1.06)	(0.83)
	0.065	***0.087***	
Other race	-0.313	-0.054	-0.424
	(-0.55)	(-0.15)	(-0.88)
	-0.049	***-0.020***	
Education	0.019	0.032	-0.053
	(0.79)	(1.74)	(-1.95)
	0.004	***0.012***	
Age	-0.025	-0.019	-0.003
	(-3.09)	(-3.15)	(-0.33)
	-0.005	***-0.007***	
Female	0.322	0.132	0.177
	(2.12)	(1.07)	(1.08)
	0.060	***0.048***	
Income	-0.004	-0.005	0.001
	(-1.00)	(-1.73)	(0.13)
	-0.001	***-0.002***	
Female child	-0.260	-0.466	-0.124
	(-2.57)	(-5.61)	(-1.10)
	-0.049	***-0.168***	
Age of child	-0.039	-0.033	-0.067
	(-2.66)	(-2.82)	(-4.16)
	-0.007	***-0.012***	
Number children at home	0.101	0.044	0.043
	(2.48)	(1.30)	(0.91)
	0.019	***0.016***	
Part-time	-0.057	-0.034	0.144
	(-0.29)	(-0.20)	(0.67)
	-0.011	***-0.012***	
Unemployed	-0.148	-0.115	-0.420
	(-0.50)	(-0.49)	(-1.32)
	-0.026	***-0.041***	
Not employed	-0.064	-0.103	-0.039
	(-0.43)	(-0.82)	(-0.24)
	-0.012	***-0.037***	

Table A1 (continued)

Blue collar	0.121	-0.138	-0.037
	(0.99)	(-1.39)	(-0.27)
	0.023	***-0.050***	
Catholic	-0.272	-0.591	-0.254
	(-1.44)	(-3.60)	(-1.36)
	-0.047	***-0.198***	
Jewish	-0.676	-0.383	-0.062
	(-1.99)	(-1.63)	(-0.22)
	-0.086	***-0.127***	
Protestant	-0.139	-0.614	-0.209
	(-0.79)	(-3.98)	(-1.23)
	-0.027	***-0.224***	
No religion	-0.561	-0.765	-0.710
	(-1.93)	(-3.36)	(-2.50)
	-0.077	***-0.226***	
Frequency of religious services	-0.019	-0.034	-0.008
	(-0.85)	(-1.87)	(-0.33)
	-0.004	***-0.012***	
Talks with others	0.158	0.340	-0.035
	(1.45)	(3.81)	(-0.29)
	0.030	***0.124***	
Number of stressful events	0.010	0.026	0.033
	(0.41)	(1.27)	(1.27)
	0.002	***0.009***	

[a]T-statistics in parentheses, marginal effects in bold italics for probit estimates, and intercept not shown.