NBER WORKING PAPER SERIES

THE ROLE OF ALCOHOL AND DRUG CONSUMPTION IN DETERMINING PHYSICAL FIGHTS AND WEAPON CARRYING BY TEENAGERS

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Working Paper 7500
http://www.nber.org/papers/w7500

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2000

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NBER Working Paper No. 7500
January 2000
JEL No. I0, J13

ABSTRACT

The purpose of this study is to examine the question of whether alcohol or drug use causes teenagers to engage in violent behaviors as measured by physical fighting, carrying a gun, or carrying other types of weapons. Simple OLS estimation of the effects of drug and alcohol consumption on violence may be biased because of the possibility that both behaviors are determined by unmeasured individual traits. Two-stage least squares estimates are employed to establish causality. This method first predicts consumption using the prices of beer, marijuana and cocaine and then enters predicted consumption in the violence equation. This technique allows the consumption measures to be purged of their correlation with unobserved characteristics. Data come from the National School-Based Youth Risk Behavior Surveys, which are nationally representative samples of high school students. Results indicate that beer and marijuana consumption do cause teens to engage in more physical fights, while cocaine use appears to have no relationship. None of the substances lead to increased probabilities of carrying a gun or other weapon.

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INTRODUCTION

The issue of teenage violence has been thrust into the national spotlight by a recent string of shootings in our nation's high schools, although during the past few decades, teenage violence has become an increasingly growing problem. The Bureau of Justice Statistics (1994 and 1999a) reports that violent victimization rates against youths who are between the ages of 16 and 19 have been rising since the 1970s. The rate in 1973 was 61.4 per 1,000 persons. This rate grew to 64.8 in 1983, to 77.9 in 1992, and to 91.1 in 1998. Using data from the 1994 National Crime Victimization Survey, the Bureau of Justice Statistics (1996) also reports that teens of ages 16-19 have the highest rates of victimization as compared to all other age groups for all types of violent crimes, including rape and robbery (121.7 per 1000 people) and assault (104.8 per 1000 people). The homicide victimization rate for teens ages 14-17 increased almost 125 percent from 1985-1995, whereas the same rate increase by only 9 percent from 1976-1985. The rate at which teens commit homicides have also been increasing. These rates fell between 1976 and 1985 from 10.6 to 9.8 offenders per 100,000 population, but then increased to 23.6 in 1995 (Bureau of Justice Statistics, 1999b).

A Recent Gallup poll highlights the prevalence of violence and weapons in the lives of teenagers. A 1999 survey finds that 17 percent of student say that "students bringing weapons to school" is a "very big" or "big" problem in their school. "Gangs and violence" are the third most often cited problem teenagers say faces people their age. Three in ten teenagers fear for their physical safety when they are in school (Newport, 1999).

An important question for designing policies to reduce violence is to know what causes teens to engage in violence and to carry weapons. Certainly a wide variety of factors contribute

to the culture of violence faced by today's teenagers including family structure, environment, and peer behavior. One of the most widely cited correlates of violent behavior is alcohol and drug use, although it is not clear from the current literature that there exists a direct causal relationship from drugs or alcohol to violence. This paper will examine the causal role of alcohol and drug consumption in determining the probabilities of being in a physical fight, carrying a gun, or carrying weapons other than guns. While the later two acts are not necessarily violent acts, carrying a weapon implies the potential for violence. Simple ordinary least squares regression models are compared to two-stage least squares models in which the potential unmeasured correlation between substance use and violence is purged by the use of instrumental variables. Prices of drugs and alcohol serve as instruments. Results indicate that beer and marijuana consumption do play a causal role in instigating physical fights, while cocaine use appears to have no relationship. None of the substances lead to increased probabilities of carrying a gun or other weapon. Given that there is evidence of a causal relationship for physical violence, a secondary aim of this paper is to examine the direct effects that increases in the price of beer, marijuana and cocaine may have in reducing the incidence of fighting.

THE LITERATURE

The link between violent behaviors and substance use

The association between drug or alcohol use and violent behaviors is well documented for both youths and adults. In research on adult violence, alcohol and drug consumption has frequently been shown to be a correlate of criminal violence (see Miczek et al. 1993 for a complete review of this literature). Studies by Kwon et al. (1997), Jarrell and Howsen (1990) and Kellermann et al. (1993) all show that higher alcohol consumption or availability is

associated with higher rates of gun-related fatalities. Kellermann et al. (1993) shows that illicit drug use positively associated with homicides. Studies on domestic violence also show a link between alcohol consumption and violence (Gelles and Cornell, 1990 and Leonard, 1993).

In considering violence by youths, Rossow, et al. (1999) and Bernburg and Thorlindsson (1999) show that when violence is measured as specific acts such as beating or threaten to beat someone or having been in a fight with a weapon, frequent intoxication will lead to increased violence, as will use of marijuana or other drugs. Salts and Lindholm (1995) find that alcohol and marijuana use are highly associated with increased violent behaviors in both black and white adolescent males. Similar findings hold for teens of both genders when examining drug use and violence in school (Furlong et al. 1997).

Weapon carrying by youths is also correlated with drug and alcohol use. Miller et al. (1999) find a strong association between drinking, drugs and gun ownership by college students in the College Alcohol Study. Their results show that among students who binge drink, 4.3 percent own a gun as compared with 2.9 percent who do not binge drink. A more striking number is that 12.4 percent of the students who report they need a drink first thing in the morning own a gun. Seven percent of gun owners used crack or cocaine during the semester as compared to 3 percent of students who did not own a gun. Sheley and Brewer (1995) find that drug activity (either using or selling) positively influences the likelihood of carrying a gun. Hemenway et al. (1996) find the same result for alcohol consumption.

The causality issue

It is important to note that none of these studies establish a direction of causality from alcohol consumption or drug use to violent acts. In fact, there is no general agreement in the

existing literature on the direction of the causality. One prominent theory is that alcohol use does cause violence by acting through a pharmacological mechanism that alters behavior (Pernanen, 1981 and Fagan, 1993). A competing theory proposes reverse causality where violence may cause alcohol consumption in that people who plan on being violent may drink in order to give themselves courage or an excuse for the behavior (Fagan, 1990 and Cordilia, 1985). Finally, a third theory states that alcohol and violence are both outcomes of an unobserved third factor, for example, a risk-taking personality (Fagan, 1990).

Even less is known about why youths carry weapons. One commonly cited reason is that of protection (Hemenway et al. 1996), while other research has shown that weapon carrying is a result of antisocial attitudes and behaviors (Page and Hammermeister, 1997). A third hypothesis is the "replicative externalities" model where adolescents feel less safe when their classmates carry guns causing them in turn to acquire guns (Hemenway et al. 1996). These theories all imply that the link between substance use and weapon carrying are a result of a third factor, be it measureable or unmeasurable. While there is little reason to believe that short-term alcohol use will directly cause teens to carry weapons, participation in the illegal drug market may promote weapon carrying (Goldstein 1985). In addition, long-term use of alcohol, marijuana, opiates, amphetamines or PCP can alter the nervous system in a way that actually promotes tendencies towards violence, while cocaine use can lead to paranoid or psychotic states in which violence may occur (National Research Council, 1993 and Goldstein, 1985).

Evidence from the economics literature

Some evidence of a causal relationship from drugs and alcohol to physical violence has emerged from the economics literature. This literature looks at the direct effects of substance

prices and other related regulations on violence. Any observed direct effects of the price of alcohol on occurrences of violence implies causality from consumption to violence because there is no reason to expect any correlation between prices and violence except through consumption. Grossman and Markowitz (forthcoming) examine the relationship between the price of alcohol and violence on college campuses. The measures of violence used in this paper are indicators for whether the student has gotten in trouble with authorities; has damaged property or pulled a fire alarm; has gotten into an argument or a fight; and has taken advantage of another person sexually or has been taken advantage of sexually. Results of this paper show that increasing the price of alcohol would be a viable mechanism to reduce the incidence of these measures of violent behaviors. In addition to the reduced form estimates of price on violence, this paper also uses a two-stage least squares estimation technique similar to the one used in this paper to examine the direct effects of consumption on violence. Results show that alcohol consumption does in fact cause college students to engage in violent activities.

Other evidence of a causal link comes from studies on domestic violence (Markowitz and Grossman, 1998, forthcoming and Markowitz, 1999) and crime (Cook and Moore, 1993 and Chaloupka and Saffer, 1992). The studies on domestic violence show that higher alcoholic beverage prices lead to lower incidence of both child abuse and wife abuse. In studies on crime, Cook and Moore (1993) and Chaloupka and Saffer (1992) examine the effects of alcohol prices on a time series of aggregate state crime rates in the United States. In particular, both sets of authors look at rates of murder, rape, assault, and robbery. Results of these studies indicate that increasing the tax on beer reduces most types of violent crimes (with the exception of assault). Other evidence on the effects of alcohol consumption and its availability on crime rates comes from Scandinavian studies. Lenke (1975) and Takala (1973) look at changes in alcohol prices,

incidence of strikes by employees of liquor stores, and introduction of new sales points (i.e. selling beer in grocery stores) to explain changes in violent crime rates. Both studies show that violent crimes decrease when alcohol is less available.

ANALYTICAL FRAMEWORK

Two simple equations highlight the possible relationships between violence and drug or alcohol consumption:

1) $V_{it} = \alpha_0 + \alpha_1 A_{it} + \alpha_2 E_{jt} + \alpha_3 X_{it} + \alpha_4 u_i + \varepsilon_{it}$,

2) $A_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 P_{jt} + \beta_3 Y_{it} + \beta_4 u_i + \omega_{it}$,

where V represents a measure of violence or weapon carrying, A is a measure of alcohol or drug use, P is the full price of alcohol or drugs, E represents variables affecting violence levels such as law enforcement or gun control measures, and X and Y and represent observed individual characteristics which may affect violence (X) and drug and alcohol use (Y). The vectors X and Y may have many of the same elements in common. Unobserved individual traits, such as personality or propensity towards violence, which do not vary over time are represented by u_i. The subscripts i, j, and t, refer to individuals, geographic area, and time, respectively.

Many of the studies discussed in the literature review have used ordinary least squares (OLS) regression to estimate equation 1. However, estimating equation 1 by OLS can lead to biased and inconsistent coefficients if there is reverse causality present ($\beta_1 \neq 0$) or the unmeasured individual-level factor is correlated with violence and substance use ($\alpha_4 \neq 0$ and $\beta_4 \neq 0$). If either is the case, drug and alcohol consumption will be correlated with the error term in equation 1, thus estimating the coefficients by OLS will violate the requirement that the right-hand side variables be orthogonal to the error term. In the case of

reverse causality when there is no third factor present, alcohol is correlated with the error term in the violence equation because all the same exogenous variables, including the error term, that determine violence also determine alcohol consumption. This can be seen by substituting equation 1 into equation 2. In the case where the third factor is present but there is no reverse causality, u_i is present in both the violence and alcohol equations, thus, alcohol consumption is correlated with the error term in the violence equation.

In order to avoid the problems presented by OLS estimation, the two-stage least squares (TSLS) technique is used to estimate equation 1. This instrumental variable technique requires at least one exogenous variable (instrument) that will predict drug and alcohol use but which is not correlated with the error term in the violence equation. When estimating equation 1 by TSLS, drug and alcohol consumption are first predicted by the instruments and then the predicted values are used as regressors in equation 1. The predicted values of consumption are purged of their correlation with the error term in the violence equation, leading to unbiased estimates of drugs and alcohol use on violence. A positive coefficient on predicted alcohol or drug consumption will indicate that increased substance use causes increased violence. A zero coefficient rules out causality.

A reduced form violence equation can be derived by substituting equation 2 into equation 1:

3) $V_{it} = \delta_0 + \delta_1 P_{jt} + \delta_2 E_{jt} + \delta_3 Y_{it} + \delta_4 X_{it} + \delta_5 u_I + \eta_{it}$,

where $\delta_0 = (\alpha_0 + \alpha_1\beta_0)/(1-\alpha_1\beta_1)$; $\delta_1=\alpha_1\beta_2/(1-\alpha_1\beta_1)$; $\delta_2=\alpha_2$; $\delta_3=\alpha_1\beta_3/(1-\alpha_1\beta_1)$; $\delta_4=\alpha_3/(1-\alpha_1\beta_1)$; $\delta_5=(\alpha_1\beta_4 + \alpha_4)/(1-\alpha_1\beta_1)$; and $\eta_{it} = (\varepsilon_{it} + \alpha_1\omega_{it})/(1-\alpha_1\beta_1)$. Estimating the reduced form equation shows the direct effect of changes in the prices of drugs and alcohol in reducing violence or weapon carrying. A negative price coefficient implies that violence is caused

by consumption since there is no intuitive reason to believe that the prices of drugs and alcohol are determinants of violence holding consumption constant.[1] An insignificant coefficient would provide evidence against causality. Thus, the reduced form estimation will serve as a check on the validity of the results from the instrumental variable estimation as well as directly providing the magnitude of the effect of changing prices on the incidence of violence or potential violence.

DATA

Data on violent behaviors and drug and alcohol consumption come from the 1991, 1993 and 1995 National School-Based Youth Risk Behavior Surveys.[2] These surveys contain nationally representative samples of high school students in grades 9-12. In each year, a different sample of students is interviewed. Dependent variables are constructed from the questions on physical fighting and the carrying of weapons. The first dependent variable is a dichotomous indicator for whether the respondent had been in a physical fight in the past year. The second is a dichotomous indicator for whether the respondent has carried a gun in the past 30 days, and the third is a dichotomous indicator for whether the respondent carried a weapon other than a gun, such as a knife or club, in the past 30 days. Information on yearly weapon carrying or fighting in the past 30 days is not available from the survey questionnaire. Caution must be exercised in interpreting the meaning of the weapon carrying variable. While the survey question does ask the respondent specifically about carrying a weapon, it may be possible that teens who carry pocket knives (such as Swiss Army knives) and who have no violent intentions will respond positively to this question.

The questions on alcohol include the number of days in the past thirty days on which the respondent had at least one drink of alcohol (termed drink), and the number of days in the past

thirty days on which the respondent had five or more drinks of alcohol in a row within a couple of hours (termed binge). Questions on drug use include the number of times in the past thirty days the respondent used marijuana (termed marijuana) and the number of times in the past thirty days the respondent used any form of cocaine including crack, powder, or freebase (termed cocaine).

The socioeconomic and demographic characteristics of the respondents are very limited in that only age, gender, and race, are consistently reported in all surveys. All of these variables are included in each model. Four additional measures which may help control for the respondent's personality or propensity towards risk are also included. The first is an indicator of how often the respondent wears a seatbelt when he or she is a passenger in a car, the second is if the respondent seriously considered attempting suicide in the past year, the third is the number of sports teams run by either the school or an outside organization on which the respondent plays, and the fourth is the number of days in the past thirty days on which the respondent smoked. These variables may be endogenous in that they may be determined by the same unmeasured factors that predict violence and/or drug and alcohol use. They are included because these variables should not be causal determinants of violence, with the possible exception of suicide. Models were tested which first exclude only the suicide indicator and second, exclude all four measures of risk. For each of the substances, in models which exclude only the suicide variable, the results are virtually unchanged. In models without all four variables, the OLS coefficients on drugs and alcohol become larger in magnitude, although statistical significance is unaffected. The TSLS estimates become smaller in absolute value and statistical significance is unaffected for fighting and gun carrying. The TSLS estimates of the drinking and drug use variables on weapon carrying remains negative but become insignificant in all equations, thus the results for

other weapons will be discussed with this caveat in mind.

Since the set of individual characteristics is very limited in these data, some state-level variables are included to proxy for some of the unmeasured individual-level characteristics. All models include the percentage of the respondent's state that are Mormon, Protestants, Southern Baptist and Catholic, as well as real income per capita and the unemployment rate. Data on religious affiliation in 1990 and come from Bradley et al. (1992). Data for 1991, 1993 and 1995 are interpolated based on a rate of growth from 1980 to 1990. Data on real income come from the Bureau of Economic Analysis and unemployment figures come from the Bureau of Labor Statistics.

Instruments

Variables measuring the price of drugs and alcohol will serve as instruments which are used to predict consumption but not violence. The prices are theoretically valid instruments because there is little reason to believe that the prices of drugs and alcohol are predictors of teen violence or weapon carrying, holding consumption constant. Prices should, however, predict consumption. Previous research has show that consumption of these goods is negatively related to their prices. (Leung and Phelps, 1993; Grossman, et al. 1998; and Grossman and Chaloupka, 1998; Saffer and Chaloupka, 1999).

Three variables will be used as instruments: The real (1982-1984=1) state-level excise tax on beer, the real price of cocaine, and an indicator for whether a state has decriminalized the possession of small amounts of marijuana for personal use. Prices of marijuana are generally not available so the decriminalization indicator is used instead. For this variable, a value of 1 means the state has decriminalized, thus users in these states

face a lower expected penalty and a lower price of possessing marijuana. Beer taxes come from the Beer Association's *Brewer's Almanac*, cocaine prices come from the Drug Enforcement Administration's System to Retrieve Information from Drug Evidence (STRIDE) and information on decriminalization of marijuana comes from the Bureau of Justice Statistics (1995). Cocaine prices are available until 1994, so the 1995 data are assigned cocaine prices for 1994. The methodology for creating the cocaine price series is described in detail in Grossman and Chaloupka (1998). In addition to the three true instruments, all the above mentioned state-level and individual-level characteristics are used to predict consumption, although these variables also appear in the second stage equations as well.

DESCRIPTIVE STATISTICS

Table 1 shows the means and standard deviations of all the variables for the full sample and by response for the three measures of violence. Any observations with missing data are omitted from the analyses. Forty percent of the sample report having been in at least one physical fight in the past year, seven percent report carrying a gun in the last 30 days, and 15 percent report having carried a weapon other than a gun in the last 30 days. In addition, 48 percent of the sample drank, 19 percent binge drank, 17 percent used marijuana and 2 percent used cocaine in the last 30 days. These rates of teenage substance use are similar to that found in the Monitoring the Future Study (Johnston, et al. 1998).

The rates of drug and alcohol use by respondents who report positive instances of fighting or weapon carrying are much higher than that for respondents who do not fight or carry weapons. For respondents who fight, the rates of participation are 61 percent, 30 percent, 26

percent and 5 percent for drinking, bingeing, marijuana and cocaine use, respectively. The same rates for respondents with no fighting history are 39 percent, 13 percent, 11 percent and one percent, respectively. For respondents who carry a gun, participation rates for drinking, bingeing, marijuana and cocaine use are 77 percent, 48 percent, 44 percent, and 13 percent, respectively. Again, the drug and alcohol use is much lower for respondents who do not report carrying a gun; 46 percent drink, 17 percent binge, 15 percent use marijuana and 2 percent use cocaine. Similar trends hold for respondents who carry other types of weapons (64 percent versus 45 for drinking, 30 percent versus 18 for bingeing, 26 percent versus 16 for marijuana, and 4 percent versus 2 percent for cocaine use.) All of these proportions are statistically different from each other.

The Youth Risk Behavior Surveys record the number of occasions on which the respondent used an illegal substance. As with the participation rates, the number of occasions on which the respondent drank, binged, used marijuana or used cocaine is much higher for respondents who report fighting or carrying a weapon (see Table 1).

Along with higher rates of substance use, people who fight are more likely to carry a gun (14 percent) or other weapon (23 percent) than those who do not fight (3 percent and 9 percent, respectively). In addition, of the people who carry guns, 75 percent have been in a physical fight. This is compared to only 37 percent of people who do not carry guns. Finally, of the people who carry other weapons, 63 percent have been in a physical fight versus 36 percent of people who do not carry other weapons. Unfortunately, because of the wording of the survey question, it is impossible to determine the rates of multiple weapon carrying, i.e. the rates of gun carrying given other weapon carrying.

ESTIMATION AND RESULTS

The structural model

Linear probability methods are used to estimate equation 1. Logit models were tested but the conclusions remain unchanged. Models were also tested which correct the standard errors according to White (1980) and the standard errors remain virtually unchanged.

Tables 2 and 3 show the results of bingeing, drinking, marijuana use and cocaine use separately on the probability of being in a physical fight (columns 1 and 2), carrying a gun (columns 3 and 4), and carrying a weapon other than a gun (columns 5 and 6).[3] Table 2 presents the results for binge drinking while Table 3 shows the results for drinking, marijuana use and cocaine use. For brevity, the coefficients on all variables are shown in Table 2 while only the coefficients on the illicit substances are shown in Table 3. The results of the other variables in the regressions do not vary depending on the inclusion or exclusion of a particular substance. Columns 1, 3 and 5 of these tables show the OLS results and columns 2, 4, and 6 show the TSLS results. Three tests of the validity of the TSLS regressions are reported. The first is an F-test on the set of true instruments. Bound et al. (1995) show that as the F-statistic on the instruments gets smaller, the bias in the TSLS estimates approaches that of OLS. Thus, is it important for the instruments to have explanatory power in predicting consumption. Second, the Basmann (1960) overidentification test is presented. An insignificant value of this test indicates that the overidentification restrictions are valid. In other words, an insignificant value indicates that the instruments are not mistakenly left out of the second stage, and they are not correlated with the error term. Finally, the Hausman (1978) test shows if the OLS estimators are consistent. The first stage results for binge drinking, drinking, marijuana use and cocaine use are shown in Appendix Table 2. The first stage models presented are based on the regressions for physical

fighting since the first stage results are very similar to that of the other two dependent variables, and vary only because of missing values on the dependent variables.

The OLS results of Table 2 show that binge drinking is positive and statistically significantly related to physical fighting, carrying a gun and carrying an other type of weapon. These OLS results are consistent with the literature discussed above. The TSLS estimates tell a slightly different story. For physical fighting, the TSLS estimate confirms the OLS estimate. Here, the coefficient on binge drinking is positive and significant, although the magnitude is ten times larger than the OLS estimate. The interpretation of the TSLS coefficient is that one less day on which the average respondent binges will lead to an decrease in the probability of being in a physical fight by 0.108 (or 10.8 percentage points). While this effect seems large, one must recognize that a one day decrease in the average number of days binged represents a 47 percent decrease in the mean number of days binged. In elasticity form, a one percent decrease in number of days on which a respondent binges will decrease the probability of being in a physical fight by 0.293 percent.[4]

The statistics at the bottom of the even numbered columns check the validity of the TSLS estimates. In column 2, the F-test on the instruments shows that the prices of drugs and beer are statistically significant predictors of binge drinking. Second, the overidentification restrictions are valid, and third, consistency of the OLS coefficient is rejected. These tests provide evidence that the TSLS is the appropriate technique for estimation and that the TSLS results for physical fighting are unbiased.

The TSLS results for the probability of carrying a gun do not confirm the OLS results. The coefficient on binge drinking in the TSLS model (column 4) is negative and not statistically significant. Interestingly, the F-test of the instruments in the first stage are statistically

significant, and the overidentification restrictions are valid. However, the difference in the two estimates is not large enough to result in a significant value of the Hausman test, thus consistency of the OLS estimator cannot be rejected.

As with the probability of carrying guns, the OLS estimation of binge drinking on the probability of carrying weapons shows a positive relationship, however this result becomes negative once the unobserved correlation between binge drinking and carrying a weapon has been purged. The coefficient on the TSLS estimate in column 6 of Table 2 is –0.08, indicating that a one percent decrease in the number of binge drinking occasions will actually raise the probability of carrying a weapon by 0.675 percent. The TSLS results for other weapons are trustworthy because the first stage instruments are significant, the overidentification restrictions are valid and consistency of OLS is rejected.

The negative coefficients on binge drinking in the weapon carrying equation and the gun carrying equation (the latter of which is not statistically significant) are at odds with the evidence provided by the simple means presented in Table 1 and with the OLS estimation in Table 2. At this point, some additional checks on the validity of this result are offered. One explanation for this result may be based on the states the teenagers live in. The TSLS estimation relies on variations in the state level prices of drugs and alcohol to predict consumption. In order for the TSLS coefficient to be negative, states which have higher prices of drugs and alcohol also must have higher probabilities of weapon carrying. If higher beer taxes are observed in states that are traditional hunting states (as is the case in the southern states) then a positive relationship would appear between taxes and weapon carrying, leading to a negative relationship between binge drinking and weapon carrying. Estimates in Table 4 attempt to control for unobserved area effects, although as shown below, adding dummies for the region of the country still results in

negative coefficients on the TSLS estimates for guns and other weapons, although the standard errors of these coefficients increase. In order to further test the theory that the some weapons are being carried for recreational purposes, a new dependent variable was created which takes on a value of one only if the respondent carried any type of weapon to school. This question is only available in the 1993 and 1995 cross sections. Results are not shown, but the TSLS coefficient on binge drinking remains negative and significant at the 10 percent level in a two-tailed test when using this dependent variable. In light of this evidence, the most plausible explanation for the contradictory results is that the OLS estimates are biased and there is indeed no positive causal relationship between substance use and weapon carrying, rather the positive simple correlation between the two behaviors is a reflection of some other unmeasured trait.

The results of the other independent variables generally do not depend on the method of estimation (OLS versus TSLS) and are fairly consistent across the dependent variables as well. For example, older teens are less likely to fight or carry guns and other weapons, as are females and teens who report wearing a seatbelt when they are a passenger in a car. Being black, Hispanic or of another non-white race is associated with higher probabilities of being in physical fights and carrying guns. There is no association with other weapons for blacks, while Hispanics and other races are less likely to carry other weapons. Teens who smoke are more likely to engage in all three acts, although with the exception of the regressions that include cocaine use, this result only holds in the OLS estimates. The most likely explanation for the insignificant coefficient in the TSLS models is that smoking is being used to predict consumption in the first stage, and since smoking, drinking and marijuana use are highly correlated, the effects of smoking are being picked up by the predicted values of consumption in the second stage.[5] Teens who have thought about committing suicide are more likely to engage in violent behaviors, as are

teens who play on sports teams. This last result does not hold for other weapons. Finally, the larger the percentage of the state that is reported to be Southern Baptist the lower the probability of physical fighting but the higher the probability of carrying weapons other than guns. More Catholics in a state leads to a lower probability of carrying a gun.

Table 3 shows the coefficients on drinking, marijuana use and cocaine use on the probability of physical fights, carrying a gun and carrying other weapons. The effects of drinking (panel A) and using marijuana (panel B) on these three variables are very similar to that of binge drinking. The OLS and TSLS estimations both show that drinking and marijuana use are positively related to the probability of physical fighting. The TSLS estimates show that a one percent decrease in the mean number of days of drinking will decrease the probability of fighting by 0.42 percent, while a one percent decrease in the mean number of occasions on which marijuana is used will decrease the probability of fighting by 0.25 percent. Whereas the OLS results show that drinking or using marijuana is positively related to carrying a gun or other weapon, the coefficients from the TSLS estimations are negative and insignificant for gun use and negative and significant for other weapon carrying. For all three dependent variables, when drinking is being considered, the instruments in the first stage are statistically significant predictors, the overidentification restrictions are valid and consistency of OLS is rejected. The same holds for marijuana use. The results of cocaine use on physical fighting and weapon carrying are less trustworthy. The OLS results show that cocaine use is positively related to physical fighting and gun use, but has no statistically significant relationship with other weapon carrying. The TSLS coefficients for fighting and other weapon carrying are positive but are not statistically significant, however, consistency of OLS is never rejected.

Table 4 re-estimates the models in Tables 2 and 3, but includes three dummy variables

for the region of the country in which the respondent lives. The areas are the Northeast, Midwest, and South. The West is the omitted category. Regions are included in order to further control for unobserved state-level variation that may be correlated with teenager's substance use and violent behaviors. Recall that the measures such as religion, unemployment and real per capita income also help control for unobservables. State dummies were tested, but are not used for two reasons. First, only 38 states are represented in the three years of the survey and not all states are available in all years. In order to include dummies for every state, a state would have to appear in more than one year so as to not be collinear with the other state level variables. Including only the respondents who live in states that are surveyed in multiple years reduces the number of respondents by about 12 percent and includes only 23 states. Secondly, by including the state dummies, the TSLS estimates become biased because the first stage results are unreliable. This is a result of the state level prices being highly collinear with the state dummies which leads to the problems associated with severe multicollinearity.[6] Nevertheless, including state dummies does not alter the OLS results.

Including dummies for the broader regions of the country rather than the state dummies allows the entire sample to be included, as well as minimizing the problem of multicollinearity in the first stage.[7] Table 4 shows the coefficients on the illicit substances. Across all models, the OLS results remain unchanged from the corresponding estimates in Tables 2 and 3. The TSLS estimates are also similar in sign and magnitude, but generally lose statistical significance. For example, without regional dummies, the TSLS estimate of binge drinking is 0.108 and is significant at the 5 percent level. With the regional dummies the coefficient falls to 0.062 and becomes insignificant at conventional levels. Note that the F-statistic on the instruments in the first stages have fallen. This indicates that with the regional dummies, the instruments are only

weak predictors of substance use, thus the bias in the TSLS estimate approaches that of OLS. Interestingly, the coefficients on binge drinking and drinking in the other weapon equation remain negative and are statistically significant at the 10 percent level in a two-tailed test when regional dummies are included.

In summary, the TSLS results in Tables 2-4 show evidence that higher alcohol and marijuana use leads to an increased probability of physical fighting. These results also show that increased drug and alcohol use do not lead to a higher probability of carrying guns or other types of weapons. What is not clear, however, is why a possible negative relationship appears between drinking or marijuana use and carrying weapons other than guns after the correlation with the error term has been purged. Recall that the coefficients on bingeing and drinking are negative and statistically significant in equations which both include and exclude regional dummies, although in models of other weapon carrying which exclude the four potentially endogenous measures of risk the coefficients on the substances are not statistically different from zero.

The existence of, and possible explanation for the negative coefficient on weapon carrying needs further investigation. One suggestion for why the negative relationship emerges is that weapons and drugs are substitute goods, that is, that teens spend their income on either drugs or weapons. As is discussed further below, the reduced form estimates presented in Table 5 presents some evidence that the alcohol and weapons are net substitute goods. A second possible explanation deals with the costs of engaging in criminal behavior. Becker (1968) describes a model of crime in which the criminal's choice level of crime is determined by weighing the probable costs and benefits of crime. The model can be expanded to include the role of alcohol or drugs in affecting the probability of getting caught and facing penalties. In

other words, if it is the case that alcohol or drug consumption affects an individual's behavior in such a way as to impair judgement, then a careful criminal would be less likely to consume these substances for fear of raising the probability of getting caught (Cordilia, 1985). This argument may be more relevant for property crimes than violent crimes, and in fact, Markowitz and Grossman (1998, forthcoming) argue that alcohol consumption lowers rather than raises the probability of getting caught in the case of domestic violence where alcohol can be used as an excuse for the violence.

The reduced form

Estimating the reduced form model as shown in equation 3 provides indirect evidence for or against the causality link from substance use to violence, as well as providing the magnitude of the direct effect of changes in the prices of the substances on the probability of violence. If drinking alcohol, for example, actually causes teens to engage in physical fights, and beer taxes are negatively related to drinking, then one would expect the beer tax to be negatively related to physical fighting in the reduced form. If there is no causal relationship from substance use to a measure of violence then the prices should have no direct effect on violence. In the case of weapons, since both goods are purchased with income, the reduced form will also show whether the goods are net substitutes, complements, or have no relation to each other.

Table 5 shows the results of the reduced form estimates for physical fighting (column 1), carrying a gun (column 2) and carrying an other type of weapon (column 3). The negative and statistically significant coefficient on the beer tax in the physical fight equation confirms the TSLS estimates from Table 2. This result indicates that a one percent increase in the beer tax will lower the probability of physical fighting by 0.02 percent. The marijuana decriminalization

indicator and the price of cocaine have no direct effects on physical fighting. For cocaine, but not for marijuana, this result is consistent with the TSLS results. The likely explanation for the contradictory marijuana result is that the decriminalization indicator is a poor measure of the price of marijuana and thus has no direct effect on fighting. Nevertheless, marijuana consumption may still be adequately predicted by the models in Table 3 if the price of beer predicts marijuana use due to complementarity or substitutability between the two substances.[8] As shown in Appendix Table 2, the first stage results for marijuana use confirm that this is the case since the coefficient on the decriminalization indicator is positive (although not statistically significant), and the coefficient on the beer tax is negative and statistically significant.

The TSLS results in Tables 2 and 3 for the probability of carrying a gun show no statistically significant relationship between drinking or drug use and carrying a gun, although the coefficients on binge drinking, drinking and marijuana use are all negative. The reduced form is in agreement with these results, for column 2 of Table 5 shows that none of the prices are statistically significant predictors of carrying a gun.

Finally, column 3 of Table 5 shows the reduced form equation for other weapon carrying. Recall that the TSLS estimate predicts that the more days on which a respondent drinks will lead to a lower probability of weapon carrying. This result is confirmed by the reduced form where the tax on beer is positively related to weapon carrying. The marijuana decriminalization indicator and cocaine price have no relationship with other weapon carrying. These results also provide evidence that beer consumption and weapons such as knives are net substitute goods since increasing the price of beer will increase the probability of carrying a weapon, holding real income constant. Note that the income effect estimated here is imprecise since income is measured by a state-level per capita income and is not adjusted for the cost of living faced by

teens.

Including the 3 regional dummies does not alter the sign or the magnitude of the reduced form equations in Table 5 (results not shown). However, the addition of the dummies does raise the standard errors of the three price coefficients. For physical fighting, the beer tax coefficient becomes significant at only the 13 percent level in a two-tailed test. For guns, the beer tax and marijuana decriminalization coefficients remain insignificant, and for other weapons, the beer tax remains positive and significant at the 10 percent level.

CONCLUSION

The purpose of this study is to examine the question of whether alcohol and drug use cause teenagers to engage in violent behaviors as measured by physical fighting, carrying a gun, or carrying other types of weapons. Evidence from simple means and OLS regression estimation show that drinking (as measured by number of days the respondent had a drink and by the number of days the respondent had 5 or more drinks in a one sitting), marijuana use and cocaine use are all positively related to the probability of physical fighting, carrying a gun and carrying an other type of weapon. While drugs, alcohol and violent behaviors may be linked, these simple results do not provide evidence of causality from drugs and alcohol to violence or potential violence. In fact, the OLS estimates may be biased because of the possibility that both substance use and violent behaviors are determined by unmeasured individual traits.

Causality can be established by using two-stage least squares to estimate the drug and alcohol consumption coefficients. The technique predicts consumption using the prices of beer, marijuana and cocaine, and then predicted rather than actual consumption is used in the violence equation. This technique allows the consumption measures to be purged of their correlation with

unobserved individual characteristics. Results from the two-stage estimation show that binge drinking, drinking and marijuana use are all causal determinants of physical violence. Cocaine use has no relationship with physical fighting. None of the substances lead to increased probabilities of carrying a gun or other weapon. The magnitudes of the effect on fighting of a decrease in drinking or marijuana use may be very small. A one percent decrease in the mean number of days on which a respondent binges will decrease the probability of being in a physical fight by 0.29 percent. The percentage reductions in fighting from a one percent decrease in the number of days of drinking or using marijuana are 0.42 percent and 0.25 percent, respectively.

Reduced form estimates provide additional evidence of the causal link from drinking to physical violence, and also show the direct effect of raising substance prices on the probability of physical violence. Policies aimed at reducing alcohol consumption, such as raising the price of beer through increased taxes, would be effective in reducing both consumption the incidence of physical fights, although again, the magnitude may be very small. A one percent increase in the beer tax will lower the probability of physical fighting by 0.02 percent. Re-criminalizing marijuana or raising the price of cocaine through increased enforcement of drug laws would have no direct effects on violence.

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FOOTNOTES

Research for this paper was supported by grant number 1 R01 AA10817 from the National Institute on Alcohol Abuse and Alcoholism to the NBER. I would like to thank Jonathan Gruber for the data, and Michael Grossman, Robert Kaestner, and Linda Edwards for helpful comments and suggestions. This paper has not undergone the review accorded official NBER publications; in particular, it has not been submitted for approval by the Board of Directors. Any opinions expressed are those of the author and not that of NIAAA or the NBER.

[1] One exception may be if the violence is committed by illegal drug sellers trying to maintain monopoly prices or exclusive territories. In this sample, the proportion of teenagers who sell illegal drugs is unknown. However, in the 1997 National Longitudinal Survey of Youth, the proportion is fairly low, about 6.6 percent sell or help to sell illegal drugs. In addition, only 1.4 percent of the sample sold drugs regularly, that is, more than once a month for 12 months, and the majority report earning less than $100.00.

[2] Data are available for 1997 as well. Since cocaine prices are only available until 1994, the 1997 data are not used. However, Appendix Table 1 shows results for models which use all 4 available years of data by excluding the cocaine price and consumption variables from all models. The magnitude and statistical significance of the OLS coefficients are very similar to those in Tables 2 and 3. The TSLS coefficients are similar in magnitude, but the standard errors increase, and the F-tests on the instruments in the first stage are only significant in the binge drinking equation.

[3] Each substance is entered into a violence equation separately since including consumption of all three substances together in one TSLS model leads to severe multicollinearity

between the predicted values. This occurs because all three substances are predicted using the same set of variables.

[4] The elasticity is calculated by multiplying the coefficient on binge drinking by the ratio of the average number of days binged to the proportion of respondents who fight. A similar fromula is used for the other measures of substance use and violence.

[5] The simple correlation coefficients between smoking and binge drinking, drinking and marijuana use are all approximately 0.40.

[6] In fact, a combination of state and time dummies almost perfectly predict the beer taxes. The R-squared from a regression of the beer tax on the state dummies and year dummies is 0.985. The R-squared is 0.886 for a regression of the decriminalization on the state and year dummies and is 0.953 for cocaine price on state and year dummies.

[7] The R-squares of substance price on region and year dummies are much lower: 0.28, 0.33, and 0.28 for the beer tax, marijuana decriminalization and cocaine price, respectively.

[8] Saffer and Chaloupka (1998) and Farrelly et al. (1999) show evidence that beer and marijuana are complement goods.

Table 1
Means and Standard Deviations

	All Respondents (N=33,430)		Fight=1 (N=13,310)	Fight=0 (N=20,120)	Gun=1 (N=2,420)	Gun=0 (N=31,010)	Other Weapon=1 (N=4,990)	Other Weapon=0 (N=28,440)
	Mean	SD	Mean	Mean	Mean	Mean	Mean	Mean
Fight	0.40	(0.49)	--	--	0.75	0.37	0.63	0.36
Knife	0.15	(0.36)	0.23	0.09	--	--	--	--
Gun	0.07	(0.26)	0.14	0.03	--	--	--	--
Number of days drink	2.75	(5.16)	4.20	1.79	7.72	2.36	4.21	2.49
Number of days binge	1.22	(3.08)	1.99	0.71	3.95	1.01	1.94	1.09
Number of times marijuana	3.61	(10.67)	5.74	2.19	11.27	3.01	5.73	3.23
Number of times cocaine	0.46	(4.01)	0.88	0.18	2.70	0.28	0.76	0.40
Percentage drink	0.48	(0.50)	0.61	0.39	0.77	0.46	0.64	0.45
Percentage binge	0.19	(0.40)	0.30	0.13	0.48	0.17	0.30	0.18
Percentage marijuana	0.17	(0.38)	0.26	0.11	0.44	0.15	0.26	0.16
Percentage cocaine	0.02	(0.15)	0.05	0.01	0.13	0.02	0.04	0.02
Real beer tax	0.44	(0.40)	0.43	0.45	0.48	0.44	0.45	0.44
Marijuana decriminalization	0.31	(0.46)	0.32	0.31	0.31	0.31	0.31	0.31
Cocaine price	95.46	(20.69)	95.65	95.34	95.25	95.48	97.10	95.17
Age	16.21	(1.23)	16.10	16.29	16.31	16.20	16.14	16.22
Female	0.53	(0.50)	0.43	0.59	0.15	0.56	0.30	0.57
Black	0.24	(0.43)	0.26	0.23	0.30	0.23	0.24	0.24
Hispanic	0.25	(0.43)	0.24	0.25	0.25	0.25	0.23	0.25
Other race	0.07	(0.25)	0.07	0.07	0.08	0.07	0.06	0.07
Smokes	4.06	(9.10)	6.09	2.71	8.61	3.70	6.11	3.70
Seat belt	3.51	(1.25)	3.27	3.67	2.93	3.56	3.21	3.56
Suicide	0.24	(0.43)	0.30	0.20	0.28	0.24	0.32	0.23
Sports	1.21	(1.50)	1.37	1.11	1.58	1.18	1.28	1.20
Real Income	143.21	(18.74)	143.56	142.99	141.83	143.32	143.95	143.08
Unemployment	6.65	(1.34)	6.71	6.62	6.69	6.65	6.78	6.63
Protestant	22.65	(11.15)	22.59	22.69	23.75	22.56	22.63	22.65
Catholic	17.73	(10.91)	18.19	17.43	16.69	17.81	18.27	17.64
Southern Baptist	9.00	(9.24)	8.65	9.24	10.00	8.93	8.67	9.06
Mormon	0.80	(0.79)	0.79	0.81	0.77	0.80	0.78	0.80
1993	0.42	(0.49)	0.42	0.42	0.49	0.42	0.38	0.43
1993	0.28	(0.45)	0.27	0.29	0.29	0.28	0.23	0.29
Northeast	0.14	(0.35)	0.15	0.14	0.13	0.14	0.17	0.14
Midwest	0.19	(0.39)	0.21	0.18	0.18	0.19	0.18	0.19
South	0.46	(0.50)	0.44	0.48	0.50	0.46	0.45	0.47
West	0.21	(0.40)	0.20	0.21	0.19	0.21	0.20	0.21

Table 2
OLS and TSLS Estimates
Binge Drinking

	Physical Fight		Gun		Other Weapon	
	OLS	TSLS	OLS	TSLS	OLS	TSLS
	(1)	(2)	(3)	(4)	(5)	(6)
Binge	0.019	0.108	0.017	-0.016	0.004	-0.083
	(21.78)**	(2.34)*	(34.18)**	(-0.64)	(6.15)**	(-2.20)*
Age	-0.041	-0.058	-0.003	0.003	-0.013	0.003
	(-20.47)**	(-6.49)**	(-2.51)*	(0.66)	(-8.38)**	(0.41)
Female	-0.138	-0.084	-0.097	-0.116	-0.139	-0.191
	(-26.52)**	(-2.92)**	(-34.26)**	(-7.60)**	(-35.46)**	(-8.26)**
Black	0.107	0.144	0.055	0.042	0.005	-0.030
	(15.37)**	(6.91)**	(14.66)**	(3.83)**	(0.92)	(-1.84)
Hispanic	0.035	0.030	0.024	0.027	-0.014	-0.008
	(5.32)**	(3.76)**	(6.73)**	(6.32)**	(-2.88)**	(-1.25)
Other race	0.020	0.050	0.039	0.029	-0.032	-0.058
	(1.99)*	(2.59)**	(7.06)**	(3.00)**	(-4.13)**	(-3.94)**
Smokes	0.007	-0.004	0.002	0.006	0.002	0.013
	(22.90)**	(-0.65)	(10.97)**	(1.91)	(10.00)**	(2.82)**
Seatbelt	-0.036	-0.009	-0.014	-0.024	-0.017	-0.042
	(-17.10)**	(-0.60)	(-12.33)**	(-3.15)**	(-10.65)**	(-3.77)**
Suicide	0.118	0.078	0.020	0.034	0.067	0.104
	(19.97)**	(3.53)**	(6.11)**	(2.94)**	(15.03)**	(6.09)**
Sports	0.022	0.012	0.007	0.011	-0.004	0.006
	(12.69)**	(2.04)*	(7.45)**	(3.50)**	(-3.35)**	(1.23)
Income	0.0002	0.001	0.0004	-0.0002	0.001	0.0002
	(0.80)	(1.99)*	(0.39)	(-0.90)	(5.97)**	(0.77)
Unemployment	0.009	0.003	0.001	0.003	0.009	0.015
	(4.01)**	(0.63)	(0.85)	(1.52)	(5.63)**	(4.73)**
Protestant	-0.0003	-0.0003	-0.0001	-0.00003	0.0005	0.001
	(-1.17)	(-1.25)	(-0.46)	(-0.24)	(2.43)*	(2.26)*
Catholic	0.0001	-0.0005	-0.001	-0.001	0.0004	0.001
	(0.16)	(-0.94)	(-4.67)**	(-2.88)**	(1.49)	(2.29)*
Southern Baptist	-0.001	-0.002	-0.0003	0.0001	0.001	0.002
	(-2.27)*	(-2.77)**	(-1.11)	(0.24)	(3.97)**	(3.95)**
Mormon	0.0001	-0.008	-0.002	0.001	0.005	0.012
	(0.03)	(-1.31)	(-0.91)	(0.26)	(1.72)	(2.57)*
1993	-0.009	-0.004	0.037	0.035	-0.061	-0.067
	(-1.47)	(-0.52)	(11.19)**	(8.97)**	(-13.25)**	(-10.89)**
1995	-0.026	-0.034	0.021	0.024	-0.073	-0.068
	(-3.58)**	(-3.69)**	(5.48)**	(5.26)**	(-13.54)**	(-9.60)**
Observations	35,276	35,276	35,408	35,408	35,201	35,201
R-squared	0.12	0.08	0.12	0.08	0.07	0.04
F on instruments		5.524**		4.970**		5.499**
Overidentification test		0.064		2.203		0.073
Hausman test		4.744*		1.896		7.890**

T-statistics in parentheses and intercept not shown.
* significant at 5% level; ** significant at 1% level

Table 3
OLS and TSLS Estimates
Drinking, Marijuana Use, and Cocaine Use

	Physical Fight		Gun		Other Weapon	
	OLS	TSLS	OLS	TSLS	OLS	TSLS
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A						
Drink	0.014	0.062	0.011	-0.020	0.004	-0.049
	(26.56)**	(2.35)*	(39.06)**	(-1.19)	(10.36)**	(-2.11)*
R-squared	0.12	0.09	0.12	0.07	0.07	0.04
F on instruments		5.834**		4.585**		5.208**
Overidentification test		0.233		1.559		0.247
Hausman test		4.048*		4.674*		7.930**
Observations	34,302	34,302	34,419	34,419	34,230	34,230
PANEL B						
Marijuana	0.004	0.029	0.004	-0.009	0.001	-0.022
	(15.02)**	(2.15)*	(26.50)**	(-1.31)	(6.12)**	(-2.09)*
R-squared	0.11	0.08	0.10	0.07	0.07	0.045
F on instruments		5.321**		5.463**		5.571**
Overidentification test		0.295		1.458		0.403
Hausman test		4.478*		4.149*		6.838**
Observations	35,498	35,498	35,639	35,639	35,434	35,434
PANEL C						
Cocaine	0.005	0.028	0.008	0.021	0.0003	-0.016
	(8.18)**	(1.14)	(23.08)**	(1.54)	(0.61)	(-0.83)
R-squared	0.11	0.10	0.10	0.08	0.06	0.06
F on instruments		7.711**		7.264**		7.055**
Overidentification test		2.666		1.354		3.189*
Hausman test		0.914		1.012		0.746
Observations	35,730	35,730	35,880	35,880	35,665	35,665

T-statistics in parentheses and intercept not shown.
* significant at 5% level; ** significant at 1% level

Table 4
OLS and TSLS estimates
Binge Drinking, Drinking, Marijuana Use, and Cocaine Use
Regions Included

	Physical Fight		Gun		Other Weapon	
	OLS	TSLS	OLS	TSLS	OLS	TSLS
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A						
Binge	0.019	0.062	0.017	-0.025	0.004	-0.078
	(21.78)**	(1.18)	(34.23)**	(-0.74)	(6.31)**	(-1.65)
R-squared	0.12	0.10	0.12	0.07	0.07	0.05
F on instruments		3.571*		2.944*		3.343*
Overidentification test		2.454		0.207		0.042
Hausman test		0.704		1.828		4.331*
Observations	35,276	35,276	35,408	35,408	35,201	35,201
PANEL B						
Drink	0.014	0.025	0.011	-0.022	0.004	-0.042
	(26.58)**	(0.96)	(39.10)**	(-1.15)	(10.51)**	(-1.66)
R-squared	0.12	0.11	0.12	0.07	0.07	0.05
F on instruments		5.009**		3.743*		4.085**
Overidentification test		3.138*		0.117		0.201
Hausman test		0.166		4.252*		4.631*
Observations	34,302	34,302	34,419	34,419	34,230	34,230
PANEL C						
Marijuana	0.004	-0.003	0.004	-0.003	0.001	-0.008
	(14.95)**	(-0.40)	(26.58)**	(-0.83)	(6.24)**	(-1.40)
R-squared	0.11	0.10	0.10	0.08	0.07	0.06
F on instruments		12.802**		13.746**		13.425**
Overidentification test		3.002*		0.137		0.878
Hausman test		0.81		3.105		2.762
Observations	35,498	35,498	35,639	35,639	35,434	35,434
PANEL D						
Cocaine	0.005	0.063	0.008	0.013	0.0003	-0.023
	(8.22)**	(1.04)	(23.03)**	(0.44)	(0.71)	(-0.55)
R-squared	0.11	0.09	0.10	0.09	0.06	0.06
F on instruments		1.509		1.602		1.550
Overidentification test		2.001		0.364		1.712
Hausman test		1.145		0.032		0.329
Observations	35,730	35,730	35,880	35,880	35,665	35,665

T-statistics in parentheses and intercept not shown.
* significant at 5% level; ** significant at 1% level

Table 5
Reduced Form Estimates

	Physical Fight (1)	Gun (2)	Other Weapon (3)
Beer tax	-0.019	0.007	0.014
	(-2.27)*	(1.57)	(2.29)*
Marijuana decriminalization	0.005	0.005	-0.000001
	(0.87)	(1.63)	(-0.0002)
Cocaine price	-0.0001	-0.00004	0.0002
	(-0.59)	(-0.44)	(1.18)
Age	-0.038	0.0004	-0.012
	(-18.79)**	(0.36)	(-8.24)**
Female	-0.151	-0.109	-0.140
	(-29.17)**	(-37.90)**	(-36.27)**
Black	0.101	0.050	0.003
	(14.49)**	(13.01)**	(0.62)
Hispanic	0.035	0.029	-0.010
	(4.93)**	(-7.41)**	(-1.83)
Other race	0.013	0.034	-0.031
	(1.29)	(5.91)**	(-4.03)**
Smokes	0.009	0.004	0.003
	(32.38)**	(24.16)**	(13.13)**
Seatbelt	-0.042	-0.020	-0.018
	(-20.28)**	(-17.01)**	(-11.27)**
Suicide	0.126	0.026	0.069
	(21.39)**	(8.06)**	(15.67)**
Sports	0.023	0.009	-0.004
	(13.64)**	(9.48)**	(-3.09)**
Income	0.00001	-0.0001	0.001
	(0.06)	(-0.88)	(5.63)**
Unemployment	0.009	0.002	0.010
	(4.14)**	(1.89)	(5.76)**
Protestant	-0.0004	0.0001	0.001
	(-1.40)	(0.32)	(2.49)*
Catholic	-0.0001	-0.001	0.001
	(-0.23)	(3.20)**	(2.31)*
Southern Baptist	-0.001	-0.0001	0.001
	(-1.09)	(-0.34)	(3.34)**
Mormon	-0.0002	0.0003	0.008
	(-0.05)	(0.15)	(2.57)*
1993	-0.010	0.035	-0.060
	(-1.51)	(9.72)**	(-12.52)**
1995	-0.027	0.022	-0.069
	(-3.20)**	(4.73)**	(-10.99)**
Observations	35,820	35,972	35,756
R-squared	0.10	0.09	0.06

T-statistics in parentheses and intercept not shown.
* significant at 5% level; ** significant at 1% level

Appendix Table 1
OLS and TSLS estimates
Binge Drinking, Drinking, Marijuana Use
1991-1997 Data

	Physical Fight		Gun		Other Weapon	
	OLS	TSLS	OLS	TSLS	OLS	TSLS
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A						
Binge	0.019	0.134	0.016	-0.021	0.004	-0.093
	(25.39)**	(1.98)*	(41.40)**	(-0.59)	(7.14)**	(-1.71)†
R-squared	0.121	0.077	0.118	0.078	0.062	0.038
F on instruments		4.412*		3.597*		4.095*
Overidentification test		0.696		1.852		2.989
Hausman test		4.310*		1.300		5.153*
Observations	49,675	49,675			49,531	49,531
PANEL B						
Drink	0.014	0.112	0.011	-0.022	0.004	-0.064
	(31.19)**	(1.79)†	(47.22)**	(-0.65)	(12.85)**	(-1.34)
R-squared	0.127	0.059	0.128	0.066	0.0652	0.034
F on instruments		2.458		1.626		2.161
Overidentification test		0.211		1.886		2.962
Hausman test		4.911*		1.343		3.838*
Observations	48,261	48,261	48,403	48,403	48,121	48,121
PANEL C						
Marijuana	0.004	0.054	0.003	-0.006	0.001	-0.037
	(19.20)**	(1.58)	(29.53)**	(-0.48)	(9.42)**	(-1.49)
R-squared	0.116	0.052	0.103	0.077	0.063	0.027
F on instruments		1.935		1.895		2.091
Overidentification test		0.402		2.375		2.042
Hausman test		4.862*		0.604		5.584*
Observations	49,934	49,934	50,109	50,109	49,803	49,803

T-statistics in parentheses and intercept not shown.
†significant at 10% level; * significant at 5% level; ** significant at 1% level

Appendix Table 2
First Stage Results

	Binge	Drink	Marijuana	Cocaine
Beer tax	-0.169**	-0.333**	-0.685**	0.020
	(-3.42)	(-3.96)	(-3.93)	(0.28)
Decriminalization	0.031	0.015	0.044	0.184**
	(0.88)	(0.25)	(0.35)	(3.65)
Cocaine price	-0.002	-0.001	0.00001	-0.004**
	(-1.47)	(-0.81)	(0.003)	(-2.80)
Age	0.185**	0.296**	0.241**	0.041**
	(15.26)	(14.36)	(5.63)	(2.34)
Female	-0.607**	-0.936**	-1.594**	-0.338**
	(-19.53)	(-17.72)	(-14.52)	(-7.50)
Black	-0.408**	-0.295**	1.728**	0.090
	(-9.74)	(-4.14)	(11.67)	(1.48)
Hispanic	0.024	0.195**	0.175	0.543**
	(0.56)	(2.70)	(1.17)	(8.84)
Other race	-0.349**	-0.514**	0.101	0.450**
	(-5.67)	(-4.91)	(0.47)	(5.04)
Smokes	0.119**	0.215**	0.437**	0.072**
	(68.90)	(73.79)	(72.24)	(28.94)
Seatbelt	-0.308**	-0.578**	-0.885**	-0.162**
	(-24.65)	(-27.10)	(-20.05)	(-8.97)
Suicide	0.450**	0.944**	0.988**	0.458**
	(12.71)	(15.69)	(7.91)	(8.94)
Sports	0.114**	0.227**	-0.015	0.045**
	(11.08)	(12.97)	(-0.42)	(3.04)
Income	-0.007**	-0.008**	0.018**	-0.001
	(-5.94)	(-3.92)	(4.22)	(-0.47)
Unemployment	0.061**	0.106**	0.337**	0.110**
	(4.47)	(4.61)	(7.05)	(5.61)
Protestant	0.0002	-0.007*	-0.055**	-0.004
	(0.11)	(-2.21)	(-8.67)	(-1.61)
Catholic	0.004	0.002	-0.037**	-0.006
	(1.54)	(0.55)	(-4.57)	(-1.69)
Southern Baptist	0.015**	0.031**	-0.030**	-0.00001
	(5.03)	(6.12)	(-2.78)	(-0.001)
Mormon	0.065**	0.067	0.328**	0.110**
	(2.73)	(1.67)	(3.92)	(3.21)
1993	-0.068	-0.081	0.920**	0.035
	(-1.77)	(-1.23)	(6.76)	(0.62)
1995	0.035	0.214*	2.733**	0.247**
	(0.69)	(2.49)	(15.34)	(3.38)
Observations	35,276	34,302	35,498	35,730
R-squared	0.20	0.22	0.19	0.04

T-statistics in parentheses and intercept not shown.
* significant at 5% level; ** significant at 1% level