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Alcohol, Drugs and Violent Crime

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Abstract

The purpose of this paper is to examine the relationship between alcohol and illegal drug regulation, and the incidence of criminal violence in a nationally representative sample of individuals in the United States. The data come from the 1992, 1993 and 1994 National Crime Victimization Surveys. Violence is measured by physical assault, rape/sexual assault, robbery, and alcohol- or drug-involved violent crimes. Results from the preferred specifications indicate that higher beer taxes decrease the probability of assault and alcohol- or drug-involved assault, but not rape or robbery. Higher cocaine prices are associated with lower probabilities of assaults and robberies. States which are classified as decriminalized for marijuana tend to have higher probabilities of assault and robbery, although an alternative measure of the penalty for possession of marijuana, longer jail sentences, confirms the penalty effect only for assault.
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1. Introduction

It is commonly believed that alcohol consumption leads to violence. This belief is fostered by research from many disciplines showing a positive, but not necessarily causal, association between alcohol use and violence, as well as showing high rates of alcohol use among violent criminal offenders. For example, the Bureau of Justice Statistics (BJS,

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1998) reports that 41% of violent male inmates in local jails admit to drinking at the time of the offense as compared to 35% of property crime inmates. Similar results are found in other studies comparing violent and non-violent criminals (Myers, 1986; Roslund & Larson 1979). Rapists are highly likely to have used alcohol prior to their crimes, with rates of use by offenders ranging from 50% to 65% (Barnard, Holzer, & Vera, 1979; Rada, 1975). A similar observation is made for people who commit murders and assaults (Tinklenberg & Ochberg, 1981; Wolfgang & Strohm 1956).

Other research has revealed that it is not only the criminals who consume alcohol prior to committing crimes, but the victim's behaviors may inadvertently put him or her at risk (Pernanen, 1991). Drinking may alter a person's judgment and relax his/her guard, which can lead to increased victimization risk for assault and other personal crimes such as rape and robbery. A number of studies have shown that alcohol and drugs are frequently used by crime victims (Johnson, Gibson, & Linden, 1978; Williams & Singh, 1986; Wolfgang & Strohm, 1956).

A second common perception is that there exists a link between illegal drug consumption and violence, however, the empirical support for this notion is rather mixed. Chaiken and Chaiken (1982) find that 83% of violent inmates used drugs during the same period as the crime, while finding no association between juvenile crime and juvenile use of marijuana or experimentation with hard drugs. By contrast, Beachy, Petersen, and Pearson (1979) show that adolescent marijuana users are more aggressive than non-users. The BJS (1988) reports that about 25% of violent offenders claim they were under the influence of drugs at the time of the offense. However, the BJS study also reports that all jail and prison inmates (not just violent criminals) are much more likely to use drugs than the general population.

Aside from consumption related violence, considerable amounts of violence have resulted from the illegal drug distribution network and the enforcement of drug laws. Goldstein, Brownstein, Ryan, and Bellucci (1989) examine drug-related murders in New York City. Three-quarters of these murders were committed by people who killed while stealing to pay for drugs, were involved in territorial disputes, or were collecting drug debts. Interestingly, less than 5% of the drug related murders were a result of drug consumption (some in combination with alcohol), and about 10% were attributed to alcohol consumption alone.

Resignato (2000) synthesizes the drug use/drug enforcement literature and examines violent crime as a function of both use and enforcement. He finds no strong evidence that drug consumption increases murders and other violent crimes, while finding that stricter enforcement of the drug laws is positively associated with higher violent crime rates.

It is important to note that the studies showing a high correlation between alcohol use, drug use, and violence do not establish causality. As discussed below, these behaviors may be observed together for a variety of reasons. If, however, consumption directly causes violent crime, then one way to lower crime would be to lower consumption. Economists have shown that the consumption of alcohol and illegal drugs can be reduced through higher prices (Grossman & Chaloupka, 1998; Leung & Phelps, 1993; Saffer & Chaloupka, 1999a). The purpose of this paper is to examine the relationship between the prices of alcohol and illegal drugs, and the incidence of criminal violence.

The data used in this study come from the 1992, 1993 and 1994 National Crime Victimization Surveys. Results from the preferred specifications show that higher beer taxes

are associated with a lower incidence of assault, but not rapes or robberies, although fewer outlets licensed to sell alcohol may lower rapes. Higher beer taxes are also associated with a lower probability of alcohol- or drug-involved assault. Higher cocaine prices are associated with lower probabilities of assaults and robberies, and states which are classified as decriminalized for marijuana tend to have higher probabilities of assaults and robberies. Lastly, an alternative measure of the penalty for possession of marijuana, longer jail sentences, confirms the penalty effect only for assault.

2. Theories on causality between substance use and crime

A number of hypotheses have been proposed to explain the observed link between substance use and violence. Theories range from simple pharmacological effects to the complex interaction of endocrinological, neurobiologic, environmental, economic, social and cultural determinants (see National Research Council, 1993 and Goldstein, 1985 for detailed discussions). A brief summary of some of the major theories are presented here. As discussed further below, these competing theories are not problematic for the analytical framework or conclusions of this paper. The framework used here may help shed light on which of these theories are consistent with the empirical results.

2.1. Pharmacological theory

The first theory asserts that alcohol consumption does cause violence through biological or pharmacological mechanisms that alter behavior (Fagan, 1993; Pernanen, 1981). For example, in the case of alcohol, a purely biological violence response may occur as a result of changes in physiological responses, such as certain brain functions (Fagan, 1990). While this hypothesis does not suggest a simple dose–response relationship where ingestion automatically leads to violence, this does suggest that alcohol consumption may cause certain individuals to engage in aggressive behavior (Miczek et al., 1994).

Unlike with alcohol, there is some uncertainty surrounding the pharmacological link between drugs and violence. It is known that biological effects differ by drug type and amount of use. For example, short-term use of marijuana may inhibit aggressive behavior, while long-term use can alter the nervous system in a way that promotes tendencies towards violence (National Research Council, 1993). Cocaine smoking can lead to depression, paranoia, irritability and violence, although these states are much slower to develop when cocaine is used in its powered form (Fagan, 1993).

The pharmacological properties of drug and alcohol consumption may also affect potential victims and lead to violence by altering judgment. An individual under the influence of alcohol or drugs may relax his/her guard, which can lead to increased victimization risk for assault and other personal crimes such as rape and robbery (National Research Council, 1993; Pernanen, 1991).

2.2. Economic theories

An observed correlation between violence and consumption may also arise if people who plan on being violent drink in order to give themselves courage or an excuse for

the behavior (Cordilia, 1985; Fagan, 1990). From an economics standpoint, this theory translates into using substances as a way of lowering the cost of violence by lowering the probability of facing penalties. Becker (1968) shows that the criminal's choice level of crime is determined by weighing the probable costs and benefits of crime. Alcohol use may decrease the probability of facing penalties if the victim or the courts are less willing to impose costs on criminals who drink. This may occur if the criminal's behavior is deemed to be out of his or her control as a result of being under the influence of drugs or alcohol.[1,2]

In the case of robbery, the relationship between consumption and crime may stem from an economic compulsion. That is, robberies may occur if an addict commits a robbery to support a drug or alcohol habit (Goldstein, 1985). A related hypothesis is that the link between illegal drugs and violence may arise from systemic violence, that is, violence that results from being involved in the illegal drug distribution network (Goldstein, 1985).[3] In the most simple case, a dealer may be robbed of his or her stash of drugs. Violence may also arise from disputes over territories between rival drug dealers, from disputes within the hierarchy of a seller's organization, or as a user's punishment for failing to pay a debt.

2.3. Environmental and situational factors

Alcohol and violence may actually be unrelated, but are observed together because both behaviors are outcomes of an unobserved third factor, for example, a risk-taking personality or an environment that encourages both behaviors (Fagan, 1990). From the victim's perspective, according to the "lifestyle" theory of victimization, "persons who drink extensively or go "cruising' for social activity, especially at night, are at higher risk for assault because such behavior often occurs at bars, parties, and other places where victimization risk is heightened." (Sampson & Lauritsen, 1994, p. 32).

3. Previous literature

It is clear that there is an association between alcohol, illegal drugs, and crime, but knowledge of this association alone may not be helpful in guiding public policy designed to reduce crime. Studies from economics add a new dimension to the literature on substance use and crime by providing estimates of the effectiveness of policy tools (i.e. tax increases on alcohol) in reducing violent crime. The underlying theory behind all of these studies is that if alcohol and illegal drugs contribute to violence then policies which reduce consumption may also reduce violence. This paper improves on the existing literature in that it is the first to analyze the impact of alcohol and drug regulatory variables on violent crime in a nationally representative, individual-level data set for the United States. The data come from

[1] See Markowitz and Grossman (1998) for a complete derivation of a model in which alcohol affects the probability of facing penalties.

[2] Note that this last argument may only hold for violent criminals. Criminals who commit property crimes may be more likely to be caught and face penalties if drinking causes them to be more careless while committing the crime (Cordilia, 1985).

[3] This argument is less relevant for cases of rape and sexual assault.

the 1992, 1993 and 1994 waves of the National Crime Victimization Survey (NCVS). This survey gathers information on incidents of criminal victimization for a random sample of individuals, and includes a number of characteristics about the victims and perpetrators. As discussed below, such data is crucial to minimize biases due to the underreporting of crime in aggregate-level crime statistics. This is also the first study to use measures of alcohol- or drug-involved crimes, which are desirable dependent variables when examining the effects of substance use policies on an outcome of substance use.

The first studies were written by Chaloupka and Saffer (1992) and Cook and Moore (1993) who examine the effects of alcohol taxes on state crime rates in the United States. Using data from the FBI's Uniform Crime Reports, both sets of authors look at rates of murder, rape, assault, and robbery during the 1970s and 1980s. Each estimates a reduced form model where the crime rate is a function of the state excise tax on beer and state-specific characteristics. Chaloupka and Saffer's model also includes the price of marijuana and expenditures on police. Cook and Moore show that alcohol consumption is positively related to rape, robbery and assault, but not homicide, and that increasing the tax on beer reduces the rates of rape and robbery, but has no effect on assault or homicide. Chaloupka and Saffer find similar results; higher beer taxes lower the rates of rape, robbery, and homicide, but not assault. They also show that decriminalizing marijuana will raise the rates of rape, robbery and assault.

In another study using the Uniform Crime Reports, DeSimone (2001) examines the impact of cocaine prices on both property and violent crime rates. Data come from 29 large cities during the 1981–1995 period. Results show that higher cocaine prices will decrease the rates of murder, rape, robbery, and assault, although the result for assault is sensitive to the inclusion of other variables.

Markowitz (2001) has examined the relationship between alcoholic beverage prices and robbery, assault, and sexual assault in an international framework. Using individual-level data in the 1989 and 1992 International Victimization Surveys, this paper shows that increases in the price of alcoholic beverages decreases the probability of all three types of violence in 16 different countries around the world. The same results hold for the tax on alcohol. However, these results are highly sensitive to the inclusion of country fixed effects which account for the unobserved effects of culture on crime and drinking.

There is some evidence that crime rates may rise with a higher density of outlets licensed to sell alcohol, although all the research to date on this question focuses on small geographic areas and cannot be generalized to the United States. Scribner, MacKinnon, and Dwyer (1995) and Gyimah-Brempong (2001) show that violent crime rates increase with higher alcohol outlet densities in Los Angeles County and Detroit, respectively. Scribner, Kaplan, and Allen (1999) show that a higher outlet density is associated with a higher homicide rate in New Orleans.

This paper is the first to analyze the impact of alcohol and drug regulatory variables on rape, robbery, and assault in a nationally representative, individual-level data set for the United States. Previous crime studies (such as that by Cook & Moore, 1993; Chaloupka & Saffer, 1992, and DeSimone, 2001) have had to rely on aggregate crime rates. Aggregate-level data present a problem in that such data only include crimes that have been reported to the police. In the United States, for example, estimates from the National Crime Victimization Survey reveal that less than half of violent crimes are reported to police. The use of

aggregate data may cause the price coefficients in the reduced form equation to be biased because of measurement error. If this measurement error is random, the only effect would be to raise the standard errors of the coefficients on all the independent variables. However, if crime is systematically underreported and correlated with the prices of drugs or alcohol then the coefficients on the prices would be biased down. Such a situation might occur if, for example, people in areas with low alcoholic beverage prices visit bars more frequently, consume more alcohol, engage in bar-room brawls but do not report such assaults to the police. Goldstein (1985) reports that many intoxicated victims do not report their victimizations because they do not wish to talk to the police while drunk. Also, these victims may be confused about the details of the crime and may believe that reporting the crime would be futile. The use of victimization data avoids any potential bias which may arise as a result of non-reporting to the police.

A second advantage of using individual-level data over aggregate-level data is that the characteristics of the victim can be included in the models. Since models of crime describe individual behavior, the use of aggregate data relies on an unlikely assumption of homogeneity of the population. The individual's characteristics are likely to be much better predictors of victimization than a state population's average characteristics. This will result in more precise estimates.

4. Analytical framework

The analytical framework is derived from the economic models of crime developed by Becker (1968), Chaloupka and Saffer (1992) and Cook and Moore (1993). Criminal violence is determined by both the actions of the perpetrator and the victim. Taking into account the drinking habits and personal characteristics of both the potential criminal and victim gives the following equation for violence:

$$V_i = v(A_i, A_j, E, Y_i, Y_j, U_i, U_j). \tag{1}$$

Eq. (1), termed the structural violence equation, shows that the probability of being a victim of a violent crime (V_i) is a function of the alcohol consumption of the individual (A_i) who is the potential victim, the alcohol or drug consumption of other individuals (A_j) who are potential perpetrators, law enforcement variables such as arrest rates (E), and other observed characteristics of individuals (Y_i, Y_j) which affect the propensity towards crime or victimization such as age, gender, income, and employment status. Unobserved individual-level factors (U_i, U_j) which influence the probability of violent crime are also included.

Alcohol or drug consumption by the potential victim (A_i) and the potential perpetrator (A_j) can be expressed by similar demand functions:

$$A_i = a(P_{\mathrm{A}}, E, Y_i, U_i), \tag{2}$$

$$A_j = a(P_{\mathrm{A}}, E, Y_j, U_j), \tag{2a}$$

where P_{A} is the full price of alcohol or drugs, E are law enforcement variables which may affect consumption through the enforcement of drug- or alcohol-related laws, and Y and U

are individual characteristics that may determine consumption. These sets of characteristics may be the same ones which determine violence. Given that the crimes examined in this study are crimes of personal contact, the victim and the criminal will be located in close proximity and thus face the same full prices and law enforcement variables.[4] The full price of alcohol reflects both the monetary price and other costs of obtaining the substance, such as time and travel costs. The full price of drugs includes the monetary price and potential penalties associated with the sale and possession of illegal substances.

Substituting Eqs. (2) and (2a) into Eq. (1) gives a reduced form violence equation:

$$V_i = v(P_{\mathrm{A}}, E, Y_i, Y_j, U_i, U_j). \tag{3}$$

Eq. (3) can be fully estimated empirically only when the characteristics of both the potential victim and criminal are observed, and this will be possible only when a crime has been committed. In light of this, a modified version of Eq. (3) serves as the basis for estimation when only the characteristics of potential victims are observed:

$$V_i = v(P_A, E, Y_i, e) \tag{4}$$

where e is an error term that contains Y_j, U_j, and U_i. Including individual-level fixed effects will account for the time-invariant, unmeasured victim characteristics in the error term (U_i). Note that omitting characteristics of the perpetrator should not be problematic so long as these are uncorrelated with the prices of drugs and alcohol, the variables of interest in this paper.[5]

This paper presents empirical estimates of the reduced form equation (Eq. (4)). This is particularly relevant to policy because the drug and alcohol price coefficients will show the propensity of increases in the full prices of drugs and alcohol to reduce violent crime. A negative coefficient on the beer price, for example, indicates that raising the price of beer is associated with reductions in violent crime, while a zero or positive coefficient shows that increasing the price will not reduce violent crime.

4.1. The reduced form and causality

The conclusions of this paper hold without regard to the direction of causality between substance use and violence, although the signs on the price and policy coefficients may give clues as to which (if any) causality theories hold. These hypotheses and their expected effects are summarized in Table 1. Causality is not at issue because consumption is substituted out of the equation. So long as the prices and policies are uncorrelated with the error term in the violence equation, the reduced form coefficients are unbiased estimates given that there is no reason to believe that state-level substance use policies will affect violence other than through consumption. Previous research has shown a strong, negative relationship

[4] For example, Goldstein (1985) finds that the most common victims of income generating drug related violence are people residing in the same neighborhood as the offender.

[5] If the omitted perpetrator characteristics are correlated with the included individual characteristics, then the coefficients on these individual characteristics may be biased. However, including some characteristics of the state population will mitigate this potential source of bias.

Table 1
Expected signs of alcohol and drug policy coefficients

Theory	Beer tax	Percent dry	Alcohol outlets	Marijuana penalties/cocaine price
Pharmacological	–	–	+	?
Lower penalties	–	–	+	–
Economic compulsion (assuming inelastic demand, and relevant for robberies)	+	+	–	+
Systemic violence	NA	NA	NA	?
Situational/environmental	No effect	No effect	No effect	No effect

NA—not applicable; ?—indeterminate.

between alcohol prices, drug prices, and consumption. For example, Kenkel (1993), Leung and Phelps (1993), Manning, Blumberg, and Moulton (1995) and Grossman, Bickel, and Saffer (1998) all show negative price elasticities of demand for alcohol. Grossman and Chaloupka (1998) find a negative price elasticity of demand for cocaine, and Pacula et al. (2001) show the same result for marijuana. Chaloupka, Grossman, and Tauras (1999) and Saffer and Chaloupka (1999a) also find negative price elasticities of demand for marijuana and cocaine. For simplicity, the discussion below focuses on the direction of the coefficients on the monetary prices of drugs and alcohol, which will be measured by the price of cocaine and the state excise tax on beer, respectively. As discussed further below, two other measures of the full price of alcohol are considered (liquor outlets and percent of the population living in dry counties), as are measures of the penalties for possession of marijuana. The analysis of these substance use related policies will follow similar reasoning to that of the monetary price. Predictions regarding all of these measures of the full prices of drugs and alcohol are shown in Table 1.

First consider the pharmacological theories. If violence is caused by the pharmacological properties of alcohol, then so long as higher prices decrease consumption, the price coefficient in the reduced form will be negative, indicating that higher alcoholic beverage prices will reduce violence. Note that the pharmacological theory may apply to consumption by either the victim or the perpetrator. Given the uncertainty of the pharmacological properties of illegal drugs, it is difficult to predict the direction of the drug price coefficients in the reduced form violence equation as consumption may either raise or lower violence depending on the drug under consideration and the amount of time elapsed.

Next, consider the first of the economic theories. A negative price coefficient may emerge when consumption is used as a way to lower the probability of facing penalties for violent behaviors. Decreasing the prices of drugs or alcohol will increase consumption and lower the probability of facing penalties, thereby lowering the cost of engaging in violence. Decreased costs of committing violence is expected to raise violence, thus creating a negative relationship between the price of substances and violence.

When considering the economic compulsion theory as it relates to robbery, the predicted effects of changes in the prices of drugs and alcohol on violence depends on the price

elasticity of demand. An increase in price will increase (decrease) expenditures on alcohol and drugs if the price elasticity of demand is inelastic (elastic), leading to more (less) income-generating violence. Previous research has shown the price elasticities of demand for alcohol, marijuana, and cocaine are inelastic (Leung & Phelps, 1993; Pacula et al. 2000; Saffer and Chaloupka, 1999a), implying that an increase in price will increase violence, and the price coefficient will be positive.[6]

The direction of the relationship between drug prices and violence arising from the institutional characteristics of the illegal drug market (the systemic violence theory) depends on assumptions about the market structure and drug dealers reactions to changes in revenues. In a competitive market, consider a movement along a fixed demand curve caused by the entry of dealers into the illegal drug market, perhaps due to decreased penalties or lax law enforcement, which lowers the full price of drugs. Systemic violence is expected to rise as the market size increases because more dealers will be using violence to enforce codes of conduct within their organizations or to punish debtors. In this case, a negative effect of price on violence will be observed. Entry will also lead to declining profits for each seller which may result in violent "drug wars" as dealers battle for territory, again creating a negative relationship between price and violence.[7] However, some researchers argue that the opposite holds. Increased enforcement which reduces supply, increases prices, and increases revenues could lead to intensified violence as dealers have more incentives to fight for increasingly valuable market shares (Burrus, 1999). This would lead to a positive relationship between price and violence. Therefore, the expected effect of drug prices on violence is ambiguous.

Finally, when situational or environmental factors are relevant, the price coefficient in the reduced form may be zero. That is, if violence and consumption are linked only by some measured or unmeasured third factor (for example, a risk-loving personality), then price increases should have no direct effect on violence. Note that even when the third factor is unmeasured, the price coefficients in the reduced form will be zero as long as price is uncorrelated with the omitted factors. As discussed below, any possible correlation is minimized through the inclusion of individual-level fixed effects and a number of individual and state-level characteristics.

It is difficult to tell from the signs of the price coefficients which of the theories on the relationship between drugs, alcohol and violence applies, indeed, these theories are not necessarily mutually exclusive. It is quite likely that different theories apply simultaneously. Consider the joint effects of pharmacological violence and violence stemming from economic compulsion (assuming an inelastic demand). A negative price coefficient will emerge if the negative effects of price on pharmacological violence outweigh the positive effects of price on income producing violence. Conversely, a positive price coefficient will emerge if the opposite holds, while a zero coefficient may emerge if the two effects cancel out each other. Estimating the reduced form equation will give clues to the direction of causality, but will not provide definitive evidence. Rather, the reduced form equation can guide policy

[6] When considering measures of the availability of alcohol, the economic compulsion theory relies on the full price of alcohol increasing due to increased time and travel costs to obtain substances.

[7] A negative relationship would also emerge in a model where drug dealers operate as territorial monopolists (Burrus, 1999).

makers as it shows the propensity of price changes to impact violence, without regard to the causality between consumption and violence.

5. Data

The crime data come from the 1992, 1993 and 1994 National Crime Victimization Surveys (NCVS). The NCVS is a nationally representative survey of households focusing on individuals' experiences with criminal victimization. The survey includes a rotating panel of individuals and is administered every six months for a three-year period. A new rotation group enters the sample every six months, replacing a group which has been in the sample for three years. Because of the panel design, a person can have one to six interviews recorded in this data. There are approximately 200,000 people surveyed over the three-year period providing a sample of nearly 450,000 observations.

5.1. Dependent variables

The first three dependent variables examined are indicators of having been a victim of assault, rape/sexual assault, and robbery. Respondents who report having been victimized at least once in the last six months were assigned a value of one for the appropriate crime, otherwise they were assigned a value of zero. Any incident which occurred outside the United States or in a state other than the respondent's current residence is omitted from the analyses.

The definition of assault includes simple and aggravated assault, and is characterized by completed aggravated assault with injury; attempted or threatened aggravated assault with weapon; or completed simple assault with or without injury. The definition of robbery includes the acts of completed robbery with or without injury from assault; or attempted robbery with or without injury. Rape/sexual assault is defined as completed or attempted rape; sexual attack with serious or minor assault; or sexual assault without injury. In these data, the most serious crime is recorded. For example, robbery with injury from serious assault is recorded as a robbery, not as an assault. In this sense, crime is underreported in these data. Recall error by respondents is a second source of potential underreporting. Random recall error will not bias the coefficients, but will increase the standard errors. To the extent that recall error is correlated with consumption and prices, the policy coefficients may be biased. As discussed above, this type of correlation is more likely to occur among data on crimes reported to the police. Unfortunately, in this survey there is no way to know the extent of such measurement error.

Table 2 shows the means and standard deviations of all variables. The means are weighted to produce population estimates. According to the simple statistics, there is a 1.32% chance of being a victim of assault (both aggravated and simple), a 0.09% chance of being a victim of rape or sexual assault and a 0.28% chance of being a victim of robbery. One of the primary advantages of using the individual level data over aggregate crime data is that the latter tends to be underreported. Although not strictly comparable, the numbers from the NCVS are much higher than similar estimates obtained from the FBI's Uniform Crime Reports (UCR)

Table 2
Definitions, means and standard deviations

Variable	Definition	Mean ($N = 443{,}271$)	Standard deviation
Assault	Dichotomous indicator for aggravated and simple assault	0.0132	(0.11)
Rape/sexual assault	Dichotomous indicator for rape or sexual assault	0.0009	(0.03)
Robbery	Dichotomous indicator for attempted and completed robbery	0.0028	(0.05)
Alcohol/drug involved assault	Dichotomous indicator for alcohol- or drug-involved aggravated and simple assault	0.0046	(0.06)
Alcohol/drug involved rape/sexual assault	Dichotomous indicator for alcohol- or drug-involved rape or sexual assault	0.0004	(0.02)
Alcohol/drug involved robbery	Dichotomous indicator for alcohol- or drug-involved attempted and completed robbery	0.0007	(0.02)
Beer tax	Real state excise tax on beer	0.394	(0.35)
Number of outlets	Number of outlets licensed to sell liquor per 1000	2.353	(0.94)
Percent dry	Percentage of the state in dry counties	4.697	(8.86)
Cocaine price	Real cocaine price	94.925	(18.98)
Marijuana decriminalization	Dichotomous indicator for the decriminalization of marijuana for personal use	0.341	(0.47)
Jail	Midpoint of the minimum and maximum statutory jail terms (in years) for possession of small amounts of marijuana.	0.308	(0.44)
Fine	Midpoint of the minimum and maximum statutory fine (in 1000s of real dollars) for possession of small amounts of marijuana.	1.335	(7.00)
Assault arrest rate	County level arrest rate for assault	0.529	(0.54)
Rape arrest rate	County level arrest rate for rape	0.390	(0.41)
Robbery arrest rate	County level arrest rate for robbery	0.350	(0.41)
State unemployment rate	State unemployment rate	6.891	(1.41)
State per capita real income	State real income per capita in hundreds	143.699	(19.85)
Mormon	Percent of state that is Mormon	1.558	(6.37)
Southern Baptist	Percent of state that is Southern Baptist	7.110	(8.72)
Catholic	Percent of state that is Catholic	20.171	(12.97)
Protestant	Percent of state Protestant	21.548	(9.18)
Age	Respondent's age	40.889	(19.13)
Female	Respondent's gender	0.516	(0.50)
Black	Respondent's race is African American	0.117	(0.31)
Hispanic	Respondent's race is Hispanic	0.081	(0.27)
Other race	Respondent's race is other than white, Hispanic or Black	0.032	(0.18)
Divorced	Respondent is divorced	0.166	(0.37)
Single	Respondent is single	0.303	(0.45)
Household income	Real household income, in 1000s	23.530	(14.31)
Education	Years of completed schooling	12.189	(3.27)

Table 2 (*Continued*)

Variable	Definition	Mean ($N = 443{,}271$)	Standard deviation
Not employed	Respondent is unemployed, not employed or in the military	0.325	(0.44)
Number of shopping trips	The number of days on which the respondent went shopping	53.520	(61.20)
Number of evenings out	The number of days on which the respondent spent the evening out for reasons of work, school or entertainment	51.304	(63.06)
Public transportation	The number of days on which the respondent rode public transportation	8.995	(34.28)

Note: Means are weighted to produce population estimates.

which includes only crimes reported to the police.[8] Over the same three-year period, the probabilities of forcible rape and robberies from the UCR are 0.04 and 0.25, respectively, and is 0.44 for aggravated assault. The comparable aggravated assault rate from the NCVS is 0.53.

Not all violence is alcohol- or drug-related, so an alternative dependent variable for this study would include only those incidents where substances use was a factor. Unfortunately, the NCVS does not question the victims on their substance use, but an approximation of the perpetrators' substance use is available. Each respondent who was victimized was asked, "was the offender drinking or on drugs or don't you know?" Using the response to this question, three additional dependent variables are created which show the probability of being a victim of a drug- or alcohol-involved crime. That is, any violent incident in which the offender was believed to be under the influence of drugs or alcohol was coded as a one. Respondents who report victimizations that were not drug- or alcohol-related are coded as zero. Similarly, respondents who report no victimization are coded as zero. Missing values are placed where drug and alcohol use by the perpetrator is unknown.

In this sample, known incidents of alcohol- or drug-involved crime comprise 33% of assaults, 46% of rapes, and 25% of robberies. Thus, the probability of being a victim of an alcohol- or drug-involved crime is much lower than for all violent crimes (see Table 2). The majority of criminals, 64%, were observed to be under the influence of alcohol, with approximately 16% reported to be on drugs only, 15% on both drugs and alcohol, and the remainder on either drugs or alcohol (which one was unknown).

Estimating the impact of drug and alcohol prices on crimes involving these substances will provide the most appropriate measure of the relationship between the substance use policy variables and violent crime. These variables are not the sole focus of this paper because of the potential for severe underreporting of substance use. Forty-two percent of assault victims, 24% of rape/sexual assault victims and 61% of robbery victims report that the offender's substance use status at the time of the crime is unknown. Underreporting in the dependent variable will increase the standard errors, but will not bias the coefficients as long as the error is uncorrelated with the independent variables. If victims who are under

[8] See Rand and Rennison (2002) for a detailed discussion on the comparison of the two crime data sources.

the influence of these substances systematically cannot tell if the perpetrators are under the influence then the price coefficients will be biased down. Conclusions based on these variables are made with caution.

5.2. Independent variables

The real (1982–1984 = 1) state-level excise tax on beer is used as a measure of the price of alcohol. This tax is used because beer is the most prevalent alcoholic beverage associated with crime. In surveys of local prison inmates and adults on probation, it is reported that beer is consumed alone or in conjunction with other types of liquor in approximately 80% of criminal cases in which any type of alcohol is consumed (BJS, 1998). Beer taxes come from the Beer Instiutes's *Brewers' Almanac*.

In order to capture the full price of obtaining alcohol, the per capita number of outlets licensed to sell alcohol in a state and the percentage of each state's population living in counties where it is illegal to sell beer (dry counties) are included. With larger percentages of populations living in dry counties or fewer liquor outlets, travel time to obtain alcohol increases, adding to the full price of alcohol. Data on the number of outlets come from *Jobson's Liquor Handbook* (various years), and the population living in dry counties come from the *Brewers' Almanac* (1996). Models are presented with and without these two variables since they may be endogenous in the crime equation. As Scribner et al. (1995) and others point out, outlets and violence may be positively related not because of increased alcohol consumption, but because the outlets are located in places where the risk of criminal violence is elevated, for example, in dimly lit areas or areas with a lack of security. More generally, outlets and dry counties will be endogenous in a crime equation if there are some unobserved neighborhood characteristics that determine both the level of crime and the availability of alcohol. Within a city, for example, residential neighborhoods may be successful in keeping out bars and liquor stores and at the same time may lower crime through a neighborhood watch program. The potential endogeneity is purged in the fixed effects models since unobserved time-invariant area characteristics (area fixed effects) drop out when individual fixed effects are included.

All models estimated include measures of the prices of marijuana and cocaine for two reasons. First, based on the evidence of a link between drugs and violence, the inclusion of these prices will show the direct effect of drug price changes on the probability of violence. Second, there is evidence that drugs and alcohol are either complement goods (Farrelly, Bray, Zarkin, Wendling, & Pacula, 1999; Pacula, 1998; Saffer & Chaloupka, 1999b), or substitute goods (Chaloupka & Laixuthai, 1997; DiNardo & Lemieux 2001). Thus higher drug prices may impact the consumption of alcohol and thereby impact violence.

The real state-level price of cocaine is included in all models. Cocaine prices come from the Drug Enforcement Administration's System to Retrieve Information from Drug Evidence (STRIDE). The methodology for creating the cocaine price series is described in detail in Grossman and Chaloupka (1998).

Next, the full price of marijuana is captured in two ways. First, an indicator is included for whether or not a state has decriminalized the possession of small amounts of marijuana for personal use. Information on decriminalization of marijuana comes from the BJS (1995). Users in the states which have decriminalized possession may face a lower expected penalty

and a lower price of using marijuana. It is debatable as to what exactly decriminalization status represents. In a recent study, Pacula, Chriqui, and King (2003) find that decriminalization status does predict marijuana use, although the authors also discover that the decriminalized states cannot be identified solely through statutory fines and penalties. Thus, it is questionable whether individuals in decriminalized states actually face lower sanctions than those living in non-decriminalized states. The authors do conclude, however, that there are differences in marijuana use based on the decriminalization classification, which may indicate state acceptance towards use or greater knowledge of the reduced penalties for possession. It is therefore unclear whether decriminalization status represents reduced penalties or cultural factors surrounding marijuana use, and as such, conclusions based on this variable should be made with caution.

Because of the uncertainty surrounding the interpretation of the marijuana decriminalization indicator, an alternative approach to measuring the penalties for possession of marijuana is presented. Models are shown which omit the decriminalization indicator and include instead the midpoint of the minimum and maximum statutory fine and jail terms (in years) for possession of small amounts of marijuana. These data come from state statutes, collected by the lawyers and policy analysts for the ImpacTeen Illicit Drug Team.

A number of other independent variables are included to help predict the probability of violent victimizations. These include the respondent's age, gender, race (black, Hispanic, other race, with white race as the omitted category) marital status, number of years of completed schooling, employment status, and household income. Next, three variables that might account for behavior which may put the individual at risk for violent attacks are included: (1) the number of days on average during the past six months on which the respondent went shopping; (2) the number of days in the last six months the respondent spent the evening out away from home, for reasons of work, school, or entertainment; (3) the number of days in the last six months on which the respondent rode public transportation. Table 2 shows the means and standard deviations for all variables.

The county-level arrest rate for the type of violent crime in question is included in all models to proxy for law enforcement and the probability of facing arrest. When assault is the dependent variable, the arrest rate for assault is included in the model. When rape is considered, the arrest rate for rape is included, and similarly for robbery. Information on arrests come from the FBI's *Uniform Crime Reports.* The arrest rate is defined as the number of arrests divided by the number of known offenses. If a crime is underreported then the arrest rate is overstated. Including the arrest rate in crime studies is often problematic because of potential reverse causality where more arrests may be indicative of more police protection, which in turn may be attributable to higher crime rates. This problem is alleviated by using a partially lagged arrest rate.[9] The endogeneity of the arrest rate is not problematic for the main conclusions of this paper so long as the arrest rate is uncorrelated with the prices of alcohol and drugs.[10] Models were tested that exclude the arrest rate and results remain unchanged.

[9] A 12-month arrest rate is matched with crimes occurring in a six-month period.

[10] The omission of any other law enforcement variables that are typically used in crime studies does not bias the coefficients on alcohol or drug prices so long as they are uncorrelated.

A series of dummy variables for the half year in which the respondent was interviewed is included in all models to help capture some of the national trends in violent crimes. The state-level unemployment rate and per capita real income are also included in all models. These variables help account for the phase of the business cycle which may have an influence on crime, as well as being a proxy for the opportunities available to perpetrators. Higher unemployment rates may be positively related to crime rates in that if fewer opportunities exist for legal activities, more time may be allocated to illegitimate activities. Similarly, higher per capita income may represent the availability of more legitimate opportunities and less violent crime. If income producing crimes are considered, the effects of income would be ambiguous in that the returns to income producing crimes are greater when the per capita income is greater.

Lastly, the percentage of each state that are Mormon, Protestants, Southern Baptist and Catholic, are include in all models. These variables may help account for the perpetrators' unmeasured personality traits. Data on religious affiliation come from Bradley, Green, Jones, and McNeil (1992). Since these data are reported only in 1980 and 1990, values for 1992, 1993 and 1994 are interpolated based on a rate of growth from 1980 to 1990.

6. Estimation and results

Tables 3 and 4 show the effects of alcohol and drug policies on the probabilities of being a victim of assault, rape/sexual assault, and robbery. Five models are presented in each table, and all are estimated using linear probability models. The first four columns of each table provide baseline results and exclude individual-level fixed effects, with the first and third columns also excluding the potentially endogenous alcohol availability variables. The first and second column include the marijuana decriminalization indicator while the third and fourth columns include instead the marijuana jail and fine variables. Models were also tested that exclude all illegal drug variables, and the results of the alcohol policy variables are similar (result are available upon request).

To account for a possible correlation among individuals living in the same state, the standard errors have been adjusted according to Huber (1967). This adjustment is particularly important for the coefficients on the state-level variables where all individuals living in a state are assigned the same value. The model in the last column of each table includes individual-level fixed effects, and also includes the two alcohol availability variables since there is no endogeneity problem when fixed effects are present. Fixed effect models were tested which exclude the availability variables, and the results remain unchanged.

The primary advantage to the fixed effects models is that they account for any unobserved time-invariant characteristics that may predict victimization and which may be correlated with some of the included independent variables. Additionally, since people in this sample do not move, the individual-level fixed effects subsume state-level fixed effects which are often used to account for unmeasured state sentiment towards alcohol and drug control. The fixed effects models therefore become particularly important if prices are endogenous because legislatures set drug or alcohol policy in response to the level of violence in the state

Table 3
Assault

	(1)	(2)	(3)	(4)	(5)
Beer tax	−0.0017 (−2.07)	−0.0012 (−1.73)	−0.0017 (−1.78)	−0.0012 (−1.22)	−0.0155 (−1.90)
Number of outlets		−0.0004 (−1.32)		−0.0004 (−1.09)	−0.00004 (−0.04)
Percent dry		3.73E−06 (0.08)		0.00002 (0.44)	0.0001 (1.29)
Cocaine price	−0.00004 (−2.29)	−0.00005 (−2.62)	−0.0001 (−2.49)	−0.0001 (−2.82)	5.16E-07 (0.01)
Marijuana decriminalisation	0.0020 (2.82)	0.0021 (3.07)			
Jail			−0.0021 (−1.97)	−0.0022 (−1.98)	
Fine			−8.65E−07 (−0.04)	−6.82E-06 (−0.28)	
Assault arrest rate	−0.0008 (−2.39)	−0.0007 (−2.40)	−0.0006 (−2.03)	−0.0007 (−2.11)	−0.0003 (−0.61)
State unemployment rate	−0.0002 (−0.68)	−0.0002 (−0.81)	−0.0002 (−0.70)	−0.0003 (−0.91)	0.0002 (0.30)
State per capita real income	−0.00002 (−0.82)	−0.00003 (−0.98)	−0.00002 (−0.71)	−0.00003 (−0.82)	−0.00001 (−0.10)
Mormon	−0.00002 (−0.64)	−0.00004 (−0.86)	−0.00005 (−1.12)	−0.0001 (−1.30)	0.00182 (0.55)
Southern Baptist	−0.0003 (−5.42)	−0.0003 (−5.42)	−0.0003 (−5.54)	−0.0003 (−5.47)	0.0018 (1.10)
Catholic	−0.0002 (−4.11)	−0.0002 (−4.24)	−0.0002 (−4.49)	−0.0002 (−4.70)	0.0010 (0.72)
Protestant	−0.0001 (−2.13)	−0.0001 (−2.02)	−0.0001 (−1.91)	−0.0001 (−1.90)	0.0008 (0.96)
Age	−0.0004 (−18.00)	−0.0004 (−17.97)	−0.0004 (−18.09)	−0.0004 (−18.07)	
Female	−0.0052 (−12.27)	−0.0052 (−12.26)	−0.0052 (−12.27)	−0.0052 (−12.26)	
Black	−0.0032 (−4.15)	−0.0031 (−4.11)	−0.0033 (−4.21)	−0.0032 (−4.21)	
Hispanic	−0.0047 (−4.92)	−0.0047 (−4.95)	−0.0047 (−5.07)	−0.0047 (−5.07)	
Other race	−0.0044 (−1.97)	−0.0044 (−2.01)	−0.0043 (−1.93)	−0.0043 (−1.96)	
Divorced	0.0093 (15.19)	0.0093 (15.21)	0.0094 (15.10)	0.0094 (15.16)	0.0069 (4.86)
Single	0.0064 (9.69)	0.0064 (9.69)	0.0065 (9.80)	0.0065 (9.79)	0.0157 (15.98)
Household income	−0.0002 (−7.20)	−0.0002 (−7.21)	−0.0002 (−7.33)	−0.0002 (−7.34)	0.00005 (1.03)
Education	−0.0004 (−4.34)	−0.0004 (−4.36)	−0.0004 (−4.29)	−0.0004 (−4.30)	−0.0005 (−3.34)
Not employed	0.0009 (1.85)	0.0008 (1.83)	0.0009 (1.85)	0.0008 (1.84)	−0.0020 (−2.65)
Number of shopping trips	0.00003 (9.48)	0.00003 (9.48)	0.00003 (9.51)	0.00003 (9.50)	0.00001 (1.72)
Number of evenings out	0.00004 (7.47)	0.00004 (7.47)	0.00004 (7.40)	0.00004 (7.41)	0.00003 (8.80)
Public transportation	0.00005 (6.18)	0.00005 (6.24)	0.00005 (6.39)	0.00005 (6.44)	0.00004 (4.53)
R-squared	0.011	0.011	0.011	0.011	0.002
N	443,385	443,385	443,385	443,385	364,410
Individual fixed effects included	No	No	No	No	Yes

Note: *T*-statistic in parentheses, intercept and time dummies not shown. Standard errors in columns 1–4 are adjusted for clustering by state.

Table 4
Rape/sexual assault and robbery

	(1)	(2)	(3)	(4)	(5)
Panel A: rape/sexual assault					
Beer tax	0.00005 (0.36)	−0.0001 (−0.80)	0.00004 (0.29)	−0.00011 (−0.75)	−0.0005 (−0.24)
Number of outlets		0.0001 (1.14)		0.00004 (0.96)	0.0007 (3.24)
Percent dry		−0.00002 (−2.62)		−0.00001 (−2.52)	0.00002 (0.70)
Cocaine price	−2.18E−06 (−0.57)	−1.09E−06 (−0.28)	−1.90E−06 (−0.51)	−8.22E−07 (−0.21)	0.00001 (1.54)
Marijuana decriminalization	−0.0001 (−1.52)	−0.0001 (−1.62)			
Jail			−0.0001 (−0.87)	−0.0001 (−0.63)	
Fine			−3.27E−06 (−1.19)	−2.77E−06 (−1.06)	
Rape arrest rate	0.0002 (2.04)	0.0002 (2.14)	0.0002 (1.94)	0.0002 (2.03)	−0.00005 (−0.29)
R-squared	0.002	0.002	0.002	0.002	0.0002
N	443,605	443,605	443,605	443,605	364,549
Individual fixed effects included	No	No	No	No	Yes
Panel B: robbery					
Beer tax	−0.0004 (−1.76)	−0.0004 (−1.56)	−0.0004 (−1.78)	−0.0004 (−1.50)	0.0020 (0.52)
Number of outlets		−0.0001 (−0.56)		−0.00004 (−0.38)	0.0002 (0.57)
Percent dry		−0.00001 (−0.95)		−0.00001 (−0.71)	−0.00001 (−0.25)
Cocaine price	−0.00001 (−2.80)	−0.00001 (−2.72)	−0.00002 (−2.82)	−0.00002 (−2.70)	−2.01E−06 (−0.11)
Marijuana decriminalization	0.0004 (1.97)	0.0004 (2.15)			
Jail			−3.04E−06 (−0.02)	3.16E−06 (0.02)	
Fine			−4.76E−06 (−0.72)	−0.00001 (−0.83)	
Robbery arrest rate	−0.0006 (−3.14)	−0.0006 (−3.11)	−0.0006 (−3.20)	−0.0006 (−3.18)	−0.0002 (−0.65)
R-squared	0.003	0.003	0.003	0.003	0.0007
N	443,551	443,551	443,551	443,551	364,509
Individual fixed effects included	No	No	No	No	Yes

Note: *T*-statistic in parentheses, intercept not shown. Standard errors in columns 1–4 are adjusted for clustering by state. All models also include the state unemployment rate and per capita income, religion variables, age, gender, race, marital status, household income, education, employment status, lifestyle variables and time dummies.

or other types of state-level sentiment. Note that the religion variables will also account for some state-level sentiment.

There are some difficulties with the fixed effects estimation as well. All time-invariant variables must be omitted from these models since they are perfectly collinear with the fixed effects. The marijuana decriminalization indicator and the jail and fine variables therefore are omitted from the fixed effects model since no state changed its decriminalization status during the sample period, and only two states changed jail sentences and fines. A second problem is that any bias in the coefficients as a result of measurement error in the independent variables is exacerbated. The more highly correlated a mismeasured variable is across time, the larger the bias will be (Johnston & Dinardo, 1996). It is likely that the price of cocaine suffers from this problem.[11] As a result, when this price is considered, the estimates from the baseline models will be emphasized, and the interpretation of the coefficients will be made with caution.

6.1. Assault

Table 3 shows the results for the probability of being a victim of assault. The most striking result is that the tax on beer is negatively associated with the probability of victimization. This result holds across all models, including the fixed effects model, although in once case (column 4) the coefficient is not statistically significant at conventional levels. However, the magnitudes are very similar in all baseline models. In the models in columns 1 through 4, a 1% increase in the beer tax will decrease the probability of being a victim of assault by a range of 0.03–0.05%. The magnitude of coefficient on the beer tax increases in the fixed effects model, yielding an elasticity of −0.46. This increase implies that there is an omitted, time invariant variable in the baseline models that is positively correlated with both the beer tax and violence.

The coefficients on the number of outlets and the percentage of the state living in dry counties are likely to be biased in the baseline model so the discussion of these coefficients will focus solely on the fixed effects model where unobserved area-level effects are accounted for. Contrary to the findings of previous studies, increasing the number of outlets licensed to sell alcohol does not have any effect on assaults. A zero coefficient likely indicates that increased alcohol availability does not directly cause assaults, but that assaults and outlets occur together in the same locations. In addition, higher proportions of a state living in dry counties will not lead to a higher probability of assault.

Drug prices may also affect the probability of being a victim of assault. The price of cocaine is negative and statistically significant only in the baseline models (columns 1–4). However, once the individual-level fixed effects are included, the coefficient becomes positive and insignificant. The marijuana decriminalization indicator is positive and statistically significant in the baseline models, indicating that assaults are more likely to occur in states which are known as decriminalization states. Here, decriminalizing marijuana will increase

[11] The potential for severe measurement error in cocaine prices (across time and across cities) is described in Horowitz (2001). His conclusions are strongly debated by Caulkins (2001) and others. This debate appears in the December 2001 *Journal of the American Statistical Association*.

the probability of assault by 0.2 percentage points. The effects of longer jail sentences and higher fines are shown in columns 3 and 4. Again, penalties for possession appear to matter, as longer jail sentences are associated with fewer assaults. The coefficients on higher fines are also negative, but are statistically insignificant.

Table 3 also reveals that the state unemployment rate and per capita income have no relationship with the probability of assault. Similarly, after accounting for time-invariant area fixed effects, higher arrest rates have no impact on the probability of assault (see column 5). The results of the individual characteristics show that older people are less likely to be victims of assault, as are women, blacks and Hispanics. Divorced and single people are more likely than married people to be victims of assault. Having more education lowers the probability of assault victimization. Note that the effect of education in the fixed effects model is being driven by those whose education levels change over time (less than half of the sample). Lastly, the lifestyle behaviors of the respondents play a role in determining the probabilities of violent victimizations. More frequent shopping trips, more evenings spent out and frequent rides on public transportation all increase the likelihood of being a victim of assault.

6.2. *Rape/sexual assault*

Panel A of Table 4 shows the determinants of rape/sexual assaults. The results for the individual and state characteristics tend to be similar across the crimes and are excluded from Table 4 for brevity. Even though the majority of rape/sexual assault victims (94%) are women, the results are presented for both genders combined. Limiting the sample to females yields results that are practically identical to those shown in Table 4.

These results show that neither higher drug prices or penalties nor higher alcohol prices will have an effect on the probability of rape/sexual assault in any specification. However, the fixed effects model in column 5 reveals that more outlets licensed to sell alcohol are positively related to the probability of rapes, and this result is statistically significant at the 1% level. A 1% increase in the number of outlets will increase the probability of rape by 1.24%. This result implies that an increase in the full price of beer, as accomplished through restricted availability, may lower the incidence of rapes.

The effect of the rape arrest rate on rapes depends on the specification. Surprisingly, the results show a positive relationship between the rate arrest rate and the probability of being a victim of rape in the models in columns 1–4, however, the effect becomes negative and statistically insignificant once the fixed effects are added. The change in the coefficient highlights the importance of controlling for unobserved time invariant effects when considering the impact of law enforcement variables on crimes.

6.3. *Robbery*

As with rapes, increasing the tax on beer appears to have no effect on the probability of being a victim of robbery (Panel B of Table 4). Even though the tax coefficient is negative and significant at the 10% level in the models in columns 1 and 3, this result is very sensitive to the inclusion of the availability measures and the fixed effects.

The coefficient becomes positive but remains statistically insignificant in the fixed effects model.

More outlets licensed to sell alcohol and higher percentages of the population living in dry counties also have no effects on robberies any model. Recall that for robbery, a zero price coefficient may be indicative of offsetting effects of price on violence from pharmacological reasons and economic compulsion reasons. As for the drug prices, higher cocaine prices are associated with decreases in the probability of robbery victimization, but this result does not hold once the fixed effects are included. Decriminalizing marijuana is associated with an increase in robbery while the other penalties for possession of marijuana have no impact on robberies and thereby refute the decriminalization result. Lastly, a higher robbery arrest rate is associated with a lower probability of robbery, but this result disappears in the fixed effects model.

6.4. Alcohol/drug involved crime

Table 5 shows the impact of drug and alcohol regulatory variables on the probability of crimes that were committed while the perpetrator was observed to be under the influence of drugs or alcohol. Recall that these dependent variables are subject to severe measurement error so these results should be interpreted with caution. The results for the state and individual characteristics are very similar to those show in Table 3 and are therefore not shown.

The determinants of the probability of being a victim of a drug- or alcohol-involved assault are shown in panel A of Table 5. The results in all models show that higher beer taxes will lead to a lower probability of this type of assault, although statistical significance is not achieved in three of the baseline models and is never greater than the 10% level. Nevertheless, the tax elasticity is similar across all baseline models in columns 1–4 and is also similar to that of all assaults. The tax elasticity for the baseline models range from -0.05 to -0.06, and is -0.71 in the fixed effects model.

Decriminalizing marijuana, shorter jail sentence, and lower cocaine prices are all associated with an increase in drug- or alcohol-involved assaults. However, this statement can only be made when the individual-level fixed effects are excluded. Fewer outlets licensed to sell alcohol and higher percentages of counties that are dry will not reduce drug- or alcohol-involved assaults, nor will higher arrest rates.

Panel B of Table 5 shows the results for alcohol- or drug-involved rape and sexual assault. Here, increases in the beer tax will not affect the probability of these crimes, nor will changes in the number of alcohol outlets or percent dry (see column 5). The coefficients on the cocaine price vary in sign and statistical significance depending on the model under consideration, leading to no definitive conclusions about the ability of higher cocaine prices to lower the incident of rape or sexual assault.

Lastly, Panel C of Table 5 examines the probability of alcohol- or drug-involved robbery. These results show that the arrest rate, drug prices, and alcohol availability measures all have no propensity to affect robbery, although higher beer tax may reduce the probability. The coefficients on the beer tax is negative and statistically significant in all baseline models but becomes insignificant when the fixed effects are included. Note that a similar result is found in Table 4 when all robberies are considered.

Table 5
Alcohol/drug involved crimes

	(1)	(2)	(3)	(4)	(5)
Panel A: assault					
Beer tax	−0.0007 (−1.63)	−0.0007 (−1.75)	−0.0007 (−1.56)	−0.0006 (−1.44)	(−0.0083) (−1.82)
Number of outlets		0.00002 (0.13)		0.00003 (0.18)	−0.0002 (−0.36)
Percent dry		8.59E−07 (0.04)		0.00001 (0.35)	0.0001 (2.04)
Cocaine price	−0.00002 (−2.29)	−0.00002 (−2.35)	−0.00002 (−2.56)	−0.00002 (−2.67)	0.00001 (0.41)
Marijuana decriminalization	0.0007 (2.18)	0.0007 (2.21)			
Jail			−0.0012 (−2.79)	−0.0012 (−2.88)	
Fine			0.00002 (1.66)	0.00002 (1.55)	
Assault arrest rate	−0.00003 (−0.18)	−0.00004 (−0.18)	−4.09E−06 (−0.02)	−0.00002 (−0.08)	−0.0002 (−0.67)
R-squared	0.004	0.004	0.004	0.004	0.001
N	441,302	441,302	441,302	441,302	362,862
Individual fixed effects included	No	No	No	No	Yes
Panel B: rape/sexual assault					
Beer tax	−0.00002 (−0.25)	−0.0001 (−0.53)	−0.00002 (−0.27)	−0.00006 (−0.53)	−0.0011 (-0.86)
Number of outlets		−0.00004 (−1.13)		−0.00004 (−1.32)	0.0002 (1.33)
Percent dry		−0.00001 (−2.66)		−0.00001 (−2.70)	0.00001 (0.64)
Cocaine price	−3.38E−06 (−2.04)	−2.89E−06 (−1.66)	−2.73E−06 (−1.68)	−2.34E−06 (−1.36)	0.00001 (2.18)
Marijuana decriminalization	−0.0001 (−1.93)	−0.0001 (−1.82)			
Jail			0.00001 (0.07)	0.00002 (0.21)	
Fine			4.63E−07 (0.25)	−2.98E−07 (−0.19)	
Rape arrest rate	0.0001 (1.16)	0.0001 (1.12)	0.0001 (1.09)	0.0001 (1.06)	−0.0001 (−0.45)
R-squared	0.001	0.001	0.001	0.001	0.0001
N	443,523	443,523	443,523	443,523	364,500
Individual fixed effects included	No	No	No	No	Yes
Panel C: robbery					
Beer tax	−0.0004 (−5.75)	−0.0003 (−5.03)	−0.0004 (−5.47)	−0.0003 (−4.26)	−0.0014 (−0.78)
Number of outlets		−0.00006 (−1.58)		−0.0001 (−1.46)	0.0001 (0.49)
Percent dry		−2.75E−06 (−0.84)		−1.81E−06 (−0.54)	0.00001 (0.56)
Cocaine price	−1.84E−06 (−0.93)	−1.88E−06 (−0.98)	−2.62E−06 (−1.20)	−2.82E−06 (−1.32)	0.00001 (0.63)
Marijuana decriminalization	0.0001 (1.56)	0.0001 (1.80)			
Jail			−0.0001 (−0.82)	−0.0001 (−0.90)	
Fine			−4.80E−08 (−0.02)	−8.60E−07 (−0.37)	
Robbery arrest rate	−0.0001 (−1.45)	−0.0001 (−1.31)	−0.0001 (−1.38)	−0.0001 (−1.25)	−0.0001 (−0.41)
R-squared	0.001	0.001	0.001	0.0011	0.0002
N	442,883	442,883	442,883	442,883	364,029
Individual fixed effects included	No	No	No	No	Yes

Note: *T*-statistic in parentheses, intercept not shown. Standard errors in columns 1–4 are adjusted for clustering by state. All models also include the state unemployment rate and per capita income, religion variables, age, gender, race, marital status, household income, education, employment status, lifestyle variables and time dummies.

7. Discussion

Alcohol and drug consumption have often been linked with incidents of violent crime. Given this positive relationship, the main question this paper addresses is whether altering the prices and availability of drugs and alcohol can be used as policy tools to reduce violent crime. The empirical framework in this paper allows the question to be answered without regard to the possible direction of causality between consumption and violence, and while recognizing that consumption may be by either the perpetrator or the victim. Linear probability models provide baseline estimates, and mitigate potential biases from measurement error which are problematic in the fixed effects estimations, particularity for cocaine prices. However, individual-level fixed effects models are important as these models account for unobserved time-invariant heterogeneity across individuals and the areas in which they live.

Despite the strong correlation frequently observed between alcohol and drug consumption and violence, this study provides little evidence that increases in the full prices of illegal drugs or alcohol will impact the probability of violent victimizations, particularly when rapes and robberies are concerned. Some evidence is provided, however, that assaults may be influenced by substance use policies.

Three measures of the full price of alcohol are considered; beer taxes, alcohol outlets and the percent of the state population living in dry counties. The conclusions of these variables come from the fixed effects models which account for unobserved area effects. Overall, higher beer taxes are associated with a lower probability of assault but have no impact on rapes or robberies. In no model do fewer alcohol outlets or larger percentages of populations living dry counties decrease assault or robbery rates. However, more outlets are associated with a higher probability of rape victimization in the fixed effects specification, suggesting a potential policy tool to reduce rapes.

It is interesting to note that none of the alcohol policies consistently predict robbery rates. It is possible that robberies and alcohol consumption are spuriously related which would result in no direct impact of the policies on robbery. It is just as likely that the results for robbery represent offsetting pharmacological and economic compulsion effects (where robbery is committed to finance an alcohol habit), leading to an indeterminate impact of alcohol policies on robberies. Unfortunately, it is impossible to determine a causal story from these data, however, it is clear that changes in the three alcohol regulatory policies will not reduce robbery rates.

Estimating the impact of illegal drug prices and penalties on violent crime proves to be difficult as data limitations and problems associated with measurement error prevent firm conclusions from being drawn from the fixed effects models. The results are presented with the caveat that unobserved, time invariant state effects are not accounted for. Nevertheless, illegal drug prices and penalties appear to influence the probability of assaults and robberies while having no effects on rapes. Specifically, higher cocaine prices are associated with lower probabilities of assaults and robberies. States which are classified as decriminalized for marijuana tend to have higher probabilities of assault and robbery. This decriminalization indicator may reflect lower penalties of possession, or may represent a more general attitude towards marijuana usage. An alternative measure of the penalty for possession of marijuana, longer jail sentences, confirms the penalty effect only for assault.

Similar results emerge with regard to all the alcohol and drug policies when alcohol and/or drugs are involved in the crime. In cases where the perpetrator was observed to be under the influence of a substance by the victim, higher beer taxes will decrease the probability of assaults and have no effect on rapes or robberies. Measures of alcohol availability have no discernable impact on any alcohol- or drug-related crime examined. The effects of the marijuana penalties and cocaine prices also vary according to the crime under consideration, and are similar to the results described above. In general, all of the results for drug- and alcohol-involved crimes are questionable because of the potentially severe underreporting of the drug and alcohol consumption of the perpetrator.

The results of this paper can be used to inform the public policy debate on ways to reduce violent crime although caution must be taken in doing so. While increases in the beer tax will decrease the probability of assault victimizations, raising the tax will also impose costs on the many people who drink and are not violent. Cocaine and marijuana price increases may be achieved by allocating more resources to the war on drugs, yet by doing so, scarce resources will be diverted from other types of crime prevention programs.

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