

Are Illegal Drugs Inferior Goods?

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Abstract

Using data from the National Survey on Drug Use and Health, evidence of income inferiority in illegal drug consumption is presented. This is done by estimation of binary choice probit models with endogenous regressors. The simultaneity issue between drug consumption and income has been addressed by using a two-step estimation procedure. The results indicate that accounting for simultaneity shows income inferiority with regard to drug consumption. An implication of this study is that income distributive policies might be effective in controlling drug consumption. It also points out the regressive nature of the government's substance abuse program.

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I. Introduction

Substance abuse continues to be one of the most serious health problems facing US policymakers. The malaise continues despite government efforts to prevent drug abuse either through enforcement policies or by providing drug rehabilitation treatment to the users. According to the ONDCP, drug consumers in US spent an estimated \$60 to \$90 billion per year between 1988 and 1995 for illicit drugs and for licit drugs used illegally. A natural question therefore arises about the characteristics of the US population that use illegal drugs.

Given that a major share of drug control expenditure by the government has been directed towards the supply side of the drug market, economic research has focused on the price effects of illegal drug abuse. Work in these areas has mainly followed the lines of the rational addiction literature developed by Becker and Murphy (1988). Using the Monitoring the Future (MTF) panel, Grossman and Chaloupka (1998) examined the rational addiction model for cocaine consumption. Their results suggest annual cocaine participation to be negatively related to the price of cocaine. In addition, they find current cocaine participation to be positively related to past and future participation. Saffer and Chaloupka (1999) estimate the effects of alcohol, cocaine, and heroin prices, and marijuana decriminalization on the demand for these substances using data from the National Household Survey on Drug Abuse (NHSDA). Their results provide empirical evidence that illegal drug use is price responsive. Marijuana decriminalization was found to increase the probability of marijuana participation by about 8%.

However, there is not much rigorous study on the effect of income distribution on drug abuse. Intuitively this seems to be surprising, given that substance abuse has been

found to be particularly prevalent in the Black and the Hispanic segment of the overall population who are economically disadvantaged as well. Using income data provided in the NHSDA, Saffer and Chaloupka (1999) found heroin to be an inferior good while for cocaine and marijuana, they found income to be mostly insignificant. The income variable they used was a continuous variable measured in 1983 dollars and was defined as income from all sources including wages, self-employment, social security, public assistance, child support and other pension income. In their study of the National Longitudinal Sample of Youth (NLSY), Sickles and Taubman (1991) found income to have no effect on illegal drug use among youth and young adults. More recently, using NHSDA, Leung and Yu (unpublished), found probability of substance abuse to have a concave relationship with income.

However, there are two major grounds on which the above studies can be criticized in terms of their results on income inferiority towards illegal drug abuse. Firstly, given that these surveys ask people about their total earnings, there exists significant probability of under-reporting of income on the part of the individuals. This would automatically bias any results of the effect of income on illegal drug abuse. Moreover, given that income in turn might be affected by substance abuse, any single equation estimate of drug consumption on income might suffer from simultaneity bias. Kenkel and Wang (1999) suggest strong interrelationships between alcohol abuse and labor market outcomes in that the alcoholics have a higher probability of ending up in bad jobs and to be sorted into blue collar occupations rather than White-collar or service occupations. This basically implies that the assumption of zero correlation between an explanatory variable and the error term in an equation is violated. This would obviously

lead any single equation estimate of income to be biased and inconsistent. The appropriate model must take this endogeneity into account.

Using 1991-93 National Survey on Drug Use and Health (NSDUH) data, I investigate the effect of income distribution on the probability of past month consumption of marijuana and cocaine for the overall US population. The major conclusions are as follows: there is a fair amount of evidence in support of inferiority in illegal drug consumption. The probability of substance abuse, namely consumption of marijuana and cocaine, progressively goes down for higher income categories. Moreover the results are quite robust to inclusions of several important control variables that have been included in previous studies. In models where income is treated as endogenous, I still obtain similar results. In order to take care of the endogeneity issue arising out of the simultaneous effect of income on drug consumption, I use an instrument for income in the final estimation for drug consumption. This instrument is created out of an ordered probit regression of income on the major explanatory variables included in the study. Given that the instrument I use is based on fitted values of income, it is a linear combination of the exogenous variables and hence uncorrelated to the error term in the original equation.

Section II describes the NSDUH data set and the basic variables used in the analysis. Section III presents some descriptive statistics that show the proportion of individuals in different income categories who are into drug consumption. Section IV presents the single-equation probit estimates of the effect of changes in income categories on the probability of substance abuse. Section V lays down the methodology for the instrumental variable estimation in case of a limited dependent variable model with

endogenous regressors. Section VI presents the results for the effect of income on the probability of substance abuse when predicted values of income are used as instrument for original income categories. Section VII discusses the main findings and concludes.

II. Data

Data for this study have been mostly obtained from the NSDUH dataset. The NSDUH is designed to study drug and alcohol use and report on the patterns and consequences of substance abuse for the general US population aged twelve and above. The survey questions include age at first use as well as lifetime, annual, and past-month usage for the following drugs: alcohol, marijuana, cocaine (including crack), heroin, hallucinogens, inhalants, tobacco, pain relievers, tranquilizers, stimulants, and sedatives. Respondents are also asked about personal and family income sources and amounts, illegal activities and arrest records, problems resulting from use of drugs, and perception of risk associated with drug abuse. Demographic data include gender, race, marital status, ethnicity, educational level, job status, income level, household composition, and population density of the place of residence of the surveyed individual. While the NSDUH data set still remains one of the most popular data sources in drug use research, there are certain limitations of the data source as well. First, the data are self-reports of drug use and their value depends on respondents' truthfulness and memory. Secondly, the survey is cross-sectional rather than longitudinal. Thus the individuals have been interviewed only once and not followed up for future periods. Thirdly, the target population of the survey is the non-institutionalized section of the US population. This excludes people in active military duty, prisons, and hospitals, as well as people who are

homeless. Although the excluded sections make up for only around one percent of the US population, these people might have a higher percentage of hard core drug users than the included. Moreover, a lot of geographical information about the place of residence of the individuals, e.g. from which state they are from, has been excluded from the survey in order to protect the anonymity of the individuals. The data used in our study are thus a cross-section of different individuals over time.

Excluding data on variables with missing observations, the pooled data set consists of 87,832¹ observations, which is important given that the large sample size increases the number of drug users surveyed and hence the precision of the estimates. In keeping with previous studies that found drug prices to be an important determinant of drug usage, I append the NSDUH data set with data on drug prices obtained from “The Price of Illicit Drugs: 1981 through the Second Quarter of 2000” from the ONDCP website. In this report, researchers have used the System to Retrieve Information from Drug Evidence (STRIDE) of the Drug Enforcement Administration (DEA) and similar data to develop price series for illegal drugs. Based on STRIDE data from 1981 through the middle of 2000, the report presents trends in price (per pure gram) and purity of cocaine and marijuana for different US regions. This price data have been matched with the geographical information available in the NSDUH data set.

¹Originally, the 1991 study consists of 32,594 observations on 1,283 variables; the 1992 study consists of 28,832 observations on 1360 variables; the 1993 study consists of 26,489 observations on 1,380 variables. Deleting the missing observations on different variables, we arrive at 87,832 observations for the entire data set.

Table I presents definitions and summary statistics for the variables used in the study. Annual drug participation may be interpreted as reflecting more occasional use while participation in past month may be interpreted as more regular use. Given that we are more interested in the effect of income on regular drug users, the study uses past month illegal drug use as the dependent variable. Alcohol use every month past year, race dummies, marital status dummy, education dummies, work status dummies, geographical, time and income dummies have been suitably created from the original variables mentioned in the study. Individuals who never used alcohol either in the past year or at any point of time have been selected as the reference group for the alcohol consumption experience variable. Similarly in the age category, individuals in the 12 to 18 year old category have been chosen as the reference group. For the race variable, individuals belonging to races other than the Whites, Blacks and Hispanics have been chosen as the reference category. Unmarried individuals have been chosen as the reference category for marital status dummy variable. For the education category, individuals not completing the entire twelve years of high-school has been selected as the reference category. For the work status category, individuals not in the labor force have been considered as the reference category. Instead of reporting actual values of income as a continuous variable, current versions of the NSDUH only report income categories in which different individuals belong to. For the income variable, individuals earning less than \$9,999 per year have been considered as the reference group. Eight regional dummies based on nine Census region divisions have been used in the regressions. The New England division of the Northeast region has been chosen as the reference group. These regional dummies account for regional specific disturbances uncontrolled for by

the included regressors. Given that there are three years of data, two time dummies have also been included, of which 1993 has been chosen as the base year.

Table I shows marijuana to be the most commonly used drug followed by cocaine. Around 6.7% of the overall population used marijuana in the past month while only around 1.3% used cocaine in the past year. The most important exogenous variables in this analysis are the different income categories. Around 23% of the population has earnings between \$10,000 and \$19,999; around 16% has earnings between \$20,000 and \$39,999; around 5% earns between \$40,000 and \$75,000, and only around 0.6% of the population earns above \$75,000. The remaining 55% of the population has earnings below \$9,999.

III. Descriptive Statistics

Tables II and III show the proportion of individuals in different income categories who consumed illicit drugs in the past month as well as in the past year. In case of marijuana, past month as well as past year drug use goes down as income goes up. While around six percent of the individuals consuming marijuana last month were in the lowest income group, the fraction of population consuming marijuana had declined to around four percent for the highest income category. Similarly, while around twelve percent of the population in the lowest income group was into marijuana consumption past year, only eight percent of individuals in the highest income group consumed marijuana last year. In case of cocaine, the fraction of individuals who consumed cocaine in the past month or in the past year more or less remains unchanged for different income groups.

Thus the income inferiority relationship seems to be more pronounced for marijuana consumption as compared to cocaine consumption.

IV. Probit Models of illegal drug consumption

This section goes beyond simple cross tabulations to highlight the role of income in explaining the probability of an individual consuming illegal drugs in the past month. Past month participation reflecting frequent use of an illegal drug has been regularly used in previous studies (Saffer and Chaloupka, 1999). However the role of income distribution in illegal drug participation has been relatively ignored. In this section I extend this literature by examining the illegal drug user's decision by estimating a set of probit equations.

A. Single-Equation Probit Models

Let the indicator variable be $Y_i = 1$ if the individual has consumed illegal drugs in the past month and let $Y_i = 0$ otherwise. The choice problem is described by the latent variable model: $Y_i^* = X_i\beta + C_{i1}\delta_1 + C_{i2}\delta_2 + C_{i3}\delta_3 + C_{i4}\delta_4 + \varepsilon_i$ (1)

where Y_i^* is the net benefit the individual derives from drug consumption, X_i is a vector of individual characteristics and domestic drug prices, C_i -s are four separate income dummies representing distinct income categories and ε_i is a normally distributed random error with zero mean and unit variance. Individuals would consume drugs only if the expected net benefits from drug consumption are positive and thus the probability that an individual consumes illegal drugs is:

$$P[Y_i = 1] = P[X_i\beta + C_{i1}\delta_1 + C_{i2}\delta_2 + C_{i3}\delta_3 + C_{i4}\delta_4 + \varepsilon_i > 0]$$

$$= \phi[X_i\beta + C_{i1}\delta_1 + C_{i2}\delta_2 + C_{i3}\delta_3 + C_{i4}\delta_4] \quad (2)$$

where $\phi[\cdot]$ is the evaluation of the standard normal cdf.

In all of the probit models for marijuana and cocaine, I use the set of individual characteristics listed in Table I as well as prices for marijuana and cocaine as explanatory variables. Maximum likelihood estimates of marijuana and cocaine consumption are reported in tables IV and V respectively. To measure the quantitative importance of all our right-hand side dummy variables, the marginal effect $\partial P(Y = 1) / \partial X_i$ for a reference individual is reported as well. The appropriate marginal effect for a binary independent variable, say C_{i1} , would be: $P[Y = 1 / \bar{x}_{(d)}, C_{i1} = 1] - P[Y = 1 / \bar{x}_{(d)}, C_{i1} = 0]$ (3)

where $\bar{x}_{(d)}$ denotes the means of all the other variables in the model.

B. Regression Results

Tables IV and V present the estimation results for past month marijuana and cocaine participation respectively. Single equation probit techniques have been used to estimate the participation models. Each of the tables presents a specification which uses past month participation as the dependent variable. For all of marijuana and cocaine, all specifications include gender, age, race, marital status, recent criminal history, alcohol usage, region, time, and income dummies. Prices of marijuana and cocaine have also been included separately in the individual regressions for marijuana and cocaine consumption to generate direct price effects of illegal drug consumption. In addition to these variables, the second specification includes the educational status of individuals. Given that income is driven to a significant extent by educational attainment, education dummies have been included to account for a potential source of omitted variable bias. In the final specification, the work status dummies have been included to control for the fact

that income is also driven by work status of individuals. These alternatives are presented as tests of robustness with respect to the original specification.

The demographic variables used in this study are gender, marital status, age and race categories. Results from the basic specification show males to be more likely to use both drugs. Married people have lower probability of consumption for both marijuana and cocaine. The results for different age-groups vary for different kinds of drugs- in case of marijuana, individuals in the 18-25 age category have a higher probability of participation compared to the reference group while the probability is lower for the above-25 age group. In case of cocaine, both the age groups turn out to be significant, the probability being highest for the above-25 age group. The White and Black race categories are significant for both marijuana and cocaine consumption. The Hispanic race category is significant and positive for cocaine consumption but insignificant for marijuana consumption. Record of being arrested in the past year turns to be positively significant for both illegal drugs. Frequent alcohol drinkers have higher probability of illegal drug participation compared to the individuals who did not use alcohol very frequently in the past year.

The second specification shows that the probability of drug consumption decreases with the level of education. The final specification shows unemployed individuals to have the highest probability of participation for all forms of illicit drugs. Individuals in workforce have higher probability of marijuana participation while this variable is insignificant in case of cocaine consumption. Young adolescents in school have higher probability of marijuana consumption while they are not significant in case of cocaine consumption. Region and time dummies provide additional controls for

omitted factors affecting drug use. These results, in general, concur with previous studies for both the control variables.

The economic variables in this study are price and income. While marijuana price is significant in the final specification, cocaine price is not significant in any of the specifications for cocaine consumption. Given that the price data used in this study are highly aggregated regional drug prices, I do not expect them to yield precise estimates of the effect of drug prices on consumption. The most important variables from the standpoint of this study are the four dichotomous income categories. There is clear evidence of income inferiority in case of marijuana consumption as the coefficients are not only significant for all income groups, but they progressively decrease as we move into higher income categories. Thus the probability of marijuana consumption significantly decreases for higher income categories. The evidence towards income inferiority is tempered in the case of cocaine consumption -- for the basic specifications, the first three income categories are significant while the highest income category is not significant. For the final specification, however, none of the income categories are significant in case of cocaine consumption. Separate Wald tests were also conducted to test the equality of the different income categories and the null hypothesis was rejected for marijuana. In case of cocaine, the null hypothesis of equality of the income categories, however, was not rejected except in the first specification. Thus, after controlling for a variety of factors including education and job status of the individuals, the single equation probit estimates point towards income inferiority in marijuana consumption. The probability of marijuana consumption monotonically decreases for

higher income categories. The income inferiority result is, however, not so unambiguous in case of cocaine consumption, on the basis of single equation estimates.

V. Two step regression

All of the single-equation models presented in the previous section treat the income categories as exogenous. However as Kenkel and Ping (1999) have argued, alcohol abuse has been found to have adverse effects on worker productivity including long-ranging adverse consequences on future jobs and lifetime earnings. In similar veins, illicit drug abuse can also have serious effects on worker productivity and income outcomes. Using the National Longitudinal Survey on Youth (NLSY) data set, Gill and Michaels (1992) found drug use to significantly reduce the probability of employment. Using the same data set, Kaestner (1994) showed marijuana and cocaine use to have negative impact on labor supply in a cross-sectional analysis, particularly among the male population. Thus in estimating drug consumption with income as an exogenous variable, there is a serious likelihood of overlooking the endogeneity of income and it being correlated with the error term. Under this circumstance, the single equation probit estimates for drug consumption would produce biased and inconsistent estimates for the income categories under consideration. In order to take care of this endogenous nature of the income variables, drug consumption is estimated using a suitable instrument for the income variable.

The structure of the model can be represented by the following system of equations:

$$y_{1it} = \beta_1 X_{1it} + \varepsilon_{1it} \quad (4)$$

$$y_{2it} = \alpha_1 X_{1it} + \alpha_2 X_{2it} + \alpha_3 E(\hat{y}_1) + \varepsilon_{2it} \quad (5)$$

where y_1 = income categories, y_2 = drug consumption, X_1 = socio-demographic variables affecting income, X_2 = drug price, i = nine US geographic divisions, t = time period from the years 1991-93, $E(\hat{y}_1)$ = estimated value of income on the basis of X_1 . ε_1 and ε_2 follow standard assumptions of being distributed $(0, \sigma_i^2)$ $i = 1, 2$ and are distributed independently of each other. $E(\hat{y}_1)$ is obtained from the ordered probit regression as follows: in the first stage, I run an ordered probit regression estimating income as a function of all explanatory variables affecting income. Only those variables found to have significant impact on income in the previous studies have been included in this regression. These include gender, marital status, race, education and work status dummies as well as drinking habit and criminal record of individuals. The time and region dummies are also included to control for other factors that might have been omitted.

In the second stage, I use the estimated value of income along with other variables to estimate drug consumption. Thus I use the ordered probit regression in the first stage to obtain a suitable instrument for income and then use this instrument in the second stage to estimate the original drug consumption equation. This instrumental variable is thus in the same class as the two-stage least squares analog proposed by Heckman (1978).

The results for the ordered probit regressions are not reproduced here and can be obtained from the author on request. In order to estimate drug consumption taking into account the endogenous nature of income, an instrument for income is created by calculating the expected income of each individual. From the ordered probit regression, I calculate an expected value of income for each individual by multiplying the probability

of being in any income category with the mid-point of each income category. Successive middle points for the first four income categories are taken to be \$5,000, \$15,000, \$30,000 and \$57,500 respectively; the median income level for individuals with income above \$ 75,000 is considered to be \$100,000.² Thus for the final drug consumption estimation, the different income categories are converted into a single continuous variable and this expected value of income variable is used as an instrument for income in the final regression.

VI. Instrumental variable estimation for drug consumption

Regression results for illicit drug consumption are summarized in tables VI and VII. The first specification presents (maximum likelihood) bivariate probit estimates for drug consumption regressed on the instrument for income and the same right-hand variables used in the basic single-equation models. The income instrument is found to be highly significant and negatively related to drug consumption for both the drugs. This indicates drug consumption to be negatively related to income, so that illegal drugs might indeed be dubbed as inferior goods. A square of income variable has also been included in order to capture the rate of change in income- it is generally found to be significant and positive in case of both marijuana and cocaine consumption in most of the specifications. Past year arrest record is found to be positively related to past month drug consumption. Frequent drinkers have higher probability of drug participation compared to the reference

² Successive regressions using other values of average income for the \$ 75,000+ group produce similar results. This is due to the fact that there is a very small mass that gets distributed to the highest income group.

group. Individuals who did not use alcohol very frequently in the past year have higher probability of using both marijuana and cocaine, although the likelihood is less than that of frequent drinkers. As in case of single equation probit, male population have higher probability to consume both the drugs, although it turns out to be insignificant in the final specification for cocaine. The young population in the 18-25 age group is found to have higher probability of consuming marijuana and cocaine compared to the reference group. The older 25 years-and-above age group is not significant for marijuana consumption; it is in general significant for cocaine consumption, except in the final specification. Among the race categories, the White and the Black population have higher probability of using both marijuana and cocaine. The Hispanics are significant and positive only in case of cocaine consumption.

In the second specification, I have included education dummies as additional control variables. For marijuana consumption, the education categories are, in general, significant and negative and the probability of illegal drug participation falls with the level of education. For cocaine consumption, individuals with high school education are never significant. The probability of cocaine consumption also goes down for higher education categories. Thus it is likely that education has some sobering effect on illegal drug participation. The income variable still remains significant and negative indicating that probability of drug consumption is negatively related to income.

The third specification includes the work status of individuals along with the rest of the variables in the first two specifications. The probability of illicit drug consumption is highest among the unemployed individuals followed by individuals in the workforce. Young adolescents are found to be insignificant in case of both the drugs. The income

variable is significant and negative for both marijuana and cocaine. The income squared variable is significant and positive indicating drug consumption to decrease at an increasing rate with increase in income. Given that the unobservable regressor (i.e. income) in the second step has been estimated in calculating the second-step coefficients and standard errors, suitable correction procedures based on Murphy and Topel (1985) have been applied to correct for the standard errors and the variance-covariance matrix. However, the results for the standard errors only change marginally after the correction and the resultant t-statistics remain unchanged for all the variables.

VII. Conclusion

The main contribution of this study is that it finds marijuana and cocaine consumption to be significantly dependent on income, with the probability of consumption going down with increase in income. This is in sharp contrast to Niskanen (1992) who argued family and cultural characteristics rather than economic factors to be more important in determining drug consumption. Given that the price variable is significant and takes the correct sign in the final specification, I adopt the final specification to be the correct specification for marijuana consumption. Although the price variable takes the correct sign in case of cocaine consumption, it is never significant in any of the specifications. This research should hold far-reaching policy implications in the war on drugs. A case of income inferiority on illegal drug consumption would establish substance abuse to be more prevalent among the low-income groups of the US population. Low-income groups being more risk-prone and vulnerable, substance abuse policies should be more geared to target this section through drug rehabilitation programs

or through other health schemes. Further implication follows from the status of marijuana and cocaine as banned substances. Supply control programs cause the domestic price of illegal drugs in US to increase manifold compared to their source price. Concentration of substance abuse among the low income groups thus point towards the regressive consequence of treating these substances as illegal, since it is the low income groups who end up paying the higher price due to the illegal status of narcotics in the US.

References:

- Becker, Gary S. and Kevin M. Murphy (1988) "A Theory of Rational Addiction".
Journal of Political Economy 96(4): 675-700.
- Gill, A.M. and R.J. Michaels (1992) "Does drug use lower wages?" *Industrial and Labor Relations Review* 45: 419-34.
- Grossman Michael and Frank J. Chaloupka (1998) "The demand for cocaine by young adults: a rational addiction approach" *Journal of Health Economics*, 17: 427-474
- Heckman, James J. (July 1978) "Dummy Endogenous Variables in a Simultaneous Equation System" *Econometrica* 46(4): 931-59
- Kaestner, Robert (Winter 1994) "The effect of illicit drug use on the labor supply of young adults" *Journal of Human Resources* 29(1): 126-55.
- Kenkel, Donald S. and Ping Wang (1999) "Are alcoholics in bad jobs?" in Frank J. Chaloupka, Michael Grossman, Warren K. Bickel and Henry Saffer (eds.) *The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Research*, NBER, Chicago, IL: University of Chicago Press, pp. 251-78.
- Leung, Siu Fai and Shihti Yu (March 2003, unpublished) "The consumption of legal and illegal addictive substances: Onset, Initiation, Timing and Interdependence".
Hong Kong University of Science and Technology and National Chung Hsing University
- Murphy, Kevin M. and Robert H. Topel (October 1985) "Estimation and Inference in Two-Step Econometric Models" *Journal of Business and Economic Statistics* 3(4): 370-379.

- Niskanen, William A. (July 1992) "Economists and drug policy" *Carnegie-Rochester Conference Series on Public Policy* 36(0): 223-48.
- Saffer, Henry and Frank Chaloupka (1999) "State drug control spending and illicit drug participation". National Bureau of Economic Research Inc., *NBER Working Papers*: 7114
- Saffer, Henry and Frank Chaloupka (July 1999) "The demand for illicit drugs" *Economic Enquiry*, 37(3): 401-411.
- Sickles, Robin and Paul Taubman (May 1991) "Who uses illegal drugs?" *American Economic Review*, 81(2): 248-51.

Table I: Summary Statistics

Variable Name	Definitions	Mean	Standard Deviation
MARIJUANA- PAST MONTH USE	0-1 dummy variable, =1 if used within the past month	.066	.249
COCAINE- PAST MONTH USE	0-1 dummy variable, =1 if used within the past month	.013	.115
ARRESTED FOR DRUG SALE/POSSESSION IN PAST 12 MONTHS	0-1 dummy variable, =1 if arrested for illegal drug sale/possession	.004	.063
FREQUENTLY USED ALCOHOL EVERY MONTH PAST YEAR	0-1 dummy variable, =1 if used frequently every month past year	.253	.434
USED ALCOHOL BUT NOT VERY FREQUENTLY EVERY MONTH PAST YEAR	0-1 dummy variable, =1 if rarely used every month past year	.373	.483
MALE	0-1 dummy variable, =1 if male	.449	.497
YOUNG	0-1 dummy variable, =1 if individual belongs to 18-25 age group	.241	.428
OLD	0-1 dummy variable, =1 if individual belongs to 25+ age group	.506	.499

Variable Name	Definitions	Mean	Standard Deviation
MARRIED	0-1 dummy variable, =1 if individual is married	.324	.468
WHITE	0-1 dummy variable, =1 if individual is white	.48	.499
BLACK	0-1 dummy variable, =1 if individual is black	.236	.424
HISPANIC	0-1 dummy variable, =1 if individual is Hispanic	.249	.433
HIGH SCHOOL EDUCATION	0-1 dummy variable, =1 if individual has completed high school	.258	.438
SOME COLLEGE EDUCATION	0-1 dummy variable, =1 if individual has some years of college education	.175	.38
COLLEGE GRADUATE	0-1 dummy variable, =1 if individual has college degree and completed graduate/professional school	.135	.342
WORKING	0-1 dummy variable, =1 if individual is in workforce	.529	.499
UNEMPLOYED	0-1 dummy variable, =1 if individual is unemployed	.079	.271
IN SCHOOL	0-1 dummy variable, =1 if individual is in school	.259	.438

Variable Name	Definitions	Mean	Standard Deviation
MID ATLANTIC	0-1 dummy variable, =1 if individual is from mid Atlantic states	.142	.349
EAST NORTH CENTRAL	0-1 dummy variable, =1 if individual is from East North Central states	.146	.353
WSET NORTH CENTRAL	0-1 dummy variable, =1 if individual is from West north Central states	.032	.177
SOUTH ATLANTIC	0-1 dummy variable, =1 if individual is from South Atlantic states	.276	.447
EAST SOUTH CENTRAL	0-1 dummy variable, =1 if individual is from East South Central states	.029	.167
WEST SOUTH CENTRAL	0-1 dummy variable, =1 if individual is from West South Central states	.085	.279
MOUNTAIN	0-1 dummy variable, =1 if individual is from Mountain states	.114	.318
PACIFIC	0-1 dummy variable, =1 if individual is from Pacific states	.157	.364
1991	0-1 dummy variable, =1 if year=1991	.371	.483

Variable Name	Definitions	Mean	Standard Deviation
1992	0-1 dummy variable, =1 if year=1992	.328	.469
PERSONAL INCOME	Category 1: < \$ 10,000		
ALL CATEGORIES	Category 2: \$ 10,000- \$ 19,999		
	Category 3: \$ 20,000- \$ 39,999		
	Category 4: \$ 40,000- \$ 74,999		
	Category 5: > \$ 75,000		
PERSONAL INCOME	0-1 dummy variable, =1 if \$ 9,000-\$ 19,999	.23	.421
	individual earns between \$ 9,000 and \$ 19,999		
PERSONAL INCOME	0-1 dummy variable, =1 if \$ 20,000-\$ 39,999	.161	.368
	individual earns between \$ 20,000 and \$ 39,999		
PERSONAL INCOME	0-1 dummy variable, =1 if \$ 40,000-\$ 74,999	.051	.22
	individual earns between \$ 40,000 and \$ 74,999		
PERSONAL INCOME	0-1 dummy variable, =1 if \$ 75,000+	.006	.077
	individual earns above \$ 75,000		
COCAINE PRICE (\$)		1.326	.167
MARIJUANA PRICE (\$)		1.696	.488

Table II: Relationship between income and marijuana consumption

INCOME CATEGORY	< \$ 9,999	\$10,000- \$ 19,999	\$20,000- \$ 39,999	\$ 40,000- \$ 74,999	> \$ 75,000
Proportion of individuals using marijuana past month	.06	.07	.06	.05	.04
Proportion of individuals using marijuana past year	.12	.14	.13	.10	.08

Table III: Relationship between income and cocaine consumption

INCOME CATEGORY	< \$ 9,999	\$10,000- \$ 19,999	\$20,000- \$ 39,999	\$ 40,000- \$ 74,999	> \$ 75,000
Proportion of individuals using cocaine past month	.01	.02	.01	.01	.01
Proportion of individuals using cocaine past year	.03	.04	.04	.03	.04

Table IV: Single Equation Probit Estimates for Past Month Marijuana Consumption

Independent variable	Past Month Marijuana Consumption		
CONSTANT	-2.528*(30.95)(-.174)	-2.498*(30.48)(-.169)	-2.573*(28.85)(-.172)
MALE	.186*(11.99) (.013)	.172* (11.02) (.012)	.155* (9.79) (.011)
YOUNG	.089* (3.79) (.006)	.175* (6.56) (.013)	.089* (2.94) (.006)
OLD	-.129* (5.03) (-.009)	-.045 (1.59) (-.003)	-.127* (3.79) (-.008)
WHITE	.252* (4.88) (.017)	.239* (4.61) (.016)	.234* (4.51) (.016)
BLACK	.375* (7.09) (.031)	.325* (6.09) (.026)	.301* (5.62) (.023)
HISPANIC	.10 (1.89) (.007)	.038 (.72) (.003)	.027 (.50) (.002)
ARRESTED FOR DRUG SALE/POSSESSION IN PAST 12 MONTHS	1.177* (16.69) (.211)	1.147* (16.22) (.20)	1.084* (15.25) (.179)
FREQUENTLY USED ALCOHOL EVERY MONTH PAST YEAR	1.704* (57.11) (.263)	1.717* (57.49) (.264)	1.692* (56.16) (.255)
USED ALCOHOL BUT NOT VERY FREQUENTLY EVERY MONTH PAST YEAR	1.009* (34.29) (.095)	1.017* (34.56) (.095)	1.0006*(33.69)(.091)
MARRIED	-.387* (19.95) (-.024)	-.397* (20.37) (-.024)	-.38* (19.36) (-.023)
HIGH SCHOOL EDUCATION	-	-.055* (2.53) (-.003)	-.055* (2.52) (-.004)
SOME COLLEGE EDUCATION	-	-.188* (7.60) (-.011)	-.17* (6.79) (-.01)
COLLEGE GRADUATE	-	-.337* (11.24) (-.018)	-.327* (10.84) (-.017)
WORKING	-	-	.174* (5.48) (.011)
UNEMPLOYED	-	-	.437* (12.66) (.041)
IN SCHOOL	-	-	.079* (2.09) (.005)
MID ATLANTIC	-.132* (2.47) (-.008)	-.126* (2.35) (-.008)	-.122* (2.28) (-.007)
EAST NORTH CENTRAL	-.117* (2.19) (-.007)	-.117* (2.19) (-.007)	-.121* (2.27) (-.007)

Independent variable	Past Month Marijuana Consumption		
WSET NORTH CENTRAL	-.182* (2.69) (-.011)	-.191* (2.83) (-.011)	-.191* (2.82) (-.011)
SOUTH ATLANTIC	-.219* (4.19) (-.014)	-.213* (4.05) (-.013)	-.213* (4.06) (-.013)
EAST SOUTH CENTRAL	-.128 (1.85) (-.008)	-.146* (2.10) (-.009)	-.145* (2.08) (-.008)
WEST SOUTH CENTRAL	-.208* (3.64) (-.012)	-.207* (3.61) (-.012)	-.206* (3.58) (-.012)
MOUNTAIN	.176* (3.24) (.014)	.178* (3.28) (.014)	.181* (3.32) (.014)
PACIFIC	.029 (.56) (.002)	.033 (.62) (.002)	.029 (.54) (.002)
MARIJUANA PRICE (\$)	-.003 (1.85) (-.0002)	-.003 (1.81) (-.0002)	-.003* (1.97) (-.0002)
1991	-.097* (5.33) (-.006)	-.096* (5.28) (-.006)	-.089* (4.91) (-.006)
1992	-.115* (6.03) (-.008)	-.111* (5.84) (-.007)	-.112* (5.84) (-.006)
PERSONAL INCOME \$ 10,000- \$ 19,999	-.102* (5.21) (-.007)	-.081* (4.11) (-.005)	-.067* (2.99) (-.004)
PERSONAL INCOME \$ 20,000- \$ 39,999	-.208* (8.79) (-.012)	-.133* (5.41) (-.008)	-.116* (4.25) (-.007)
PERSONAL INCOME \$ 40,000- \$ 74,999	-.356* (9.26) (-.018)	-.225* (5.63) (-.013)	-.21* (5.02) (-.012)
PERSONAL INCOME \$ 75,000+	-.506* (4.75) (-.022)	-.331* (3.06) (-.016)	-.315* (2.89) (-.016)
R^2	.20	.21	.21

Note: - Absolute value of asymptotic t-statistics in first parentheses;

- Marginal effects of the independent variable in second parentheses;

*- null hypothesis rejected at 5% level of significance

Table V: Single Equation Probit Estimates for Past Month Cocaine Consumption

Independent variable	Past Month Cocaine Consumption		
CONSTANT	-3.371*(10.83)(-.045)	-3.318*(10.63)(-.043)	-3.24* (10.13) (-.041)
MALE	.093* (3.46) (.001)	.079* (2.93) (.001)	.066* (2.40) (.0008)
YOUNG	.193* (4.28) (.003)	.287* (5.90) (.004)	.143* (2.55) (.002)
OLD	.212* (4.53) (.003)	.30* (6.08) (.004)	.137* (2.29) (.002)
WHITE	.267* (2.32) (.004)	.255* (2.19) (.003)	.241* (2.07) (.003)
BLACK	.488* (4.19) (.009)	.435* (3.69) (.008)	.389* (3.29) (.007)
HISPANIC	.459* (3.96) (.008)	.392* (3.34) (.007)	.377* (3.20) (.006)
ARRESTED FOR DRUG SALE/POSSESSION IN PAST 12 MONTHS	1.184* (15.11) (.072)	1.149* (14.60) (.066)	1.075* (13.53) (.055)
FREQUENTLY USED ALCOHOL EVERY MONTH PAST YEAR	1.403* (23.66) (.058)	1.415* (23.87) (.058)	1.382* (23.11) (.054)
USED ALCOHOL BUT NOT VERY FREQUENTLY EVERY MONTH PAST YEAR	.687* (11.23) (.013)	.698* (11.40) (.013)	.673* (10.89) (.012)
MARRIED	-.349* (10.46) (-.004)	-.355* (10.61) (-.004)	-.342* (10.14) (-.004)
HIGH SCHOOL EDUCATION	-	-.099* (2.87) (-.001)	-.088* (2.50) (-.001)
SOME COLLEGE EDUCATION	-	-.202* (4.96) (-.002)	-.162* (3.89) (-.002)
COLLEGE GRADUATE	-	-.35* (6.74) (-.003)	-.321* (6.11) (-.003)
WORKING	-	-	.026 (.51) (.0003)
UNEMPLOYED	-	-	.392* (7.36) (.008)
IN SCHOOL	-	-	-.078 (1.16) (-.0009)
MID ATLANTIC	-.004 (.04) (-.00006)	-.003 (.03) (-.00004)	-.003 (.03) (-.00004)
EAST NORTH CENTRAL	-.036 (.37) (-.0004)	-.039 (.40) (-.0005)	-.048* (.48) (-.0006)

Independent variable	Past Month Cocaine Consumption		
WSET NORTH CENTRAL	-.193 (1.49) (-.002)	-.207 (1.59) (-.002)	-.216 (1.65) (-.002)
SOUTH ATLANTIC	-.079 (.81) (-.001)	-.075 (.78) (-.0009)	-.075 (.77) (-.0009)
EAST SOUTH CENTRAL	-.154 (1.16) (-.002)	-.173 (1.30) (-.002)	-.169 (1.26) (-.002)
WEST SOUTH CENTRAL	-.064 (.61) (-.0008)	-.071 (.68) (-.0008)	-.066 (.64) (-.0008)
MOUNTAIN	.136 (1.21) (.002)	.132 (1.17) (.002)	.128 (1.13) (.002)
PACIFIC	-.006 (.05) (-.00007)	-.01 (.09) (-.0001)	-.025 (.20) (-.0003)
COCAINE PRICE (\$)	-.146 (.74) (-.002)	-.154 (.78) (-.002)	-.161 (.81) (-.002)
1991	.058 (1.24) (.0008)	.061 (1.30) (.0008)	.07 (1.48) (.0009)
1992	-.043 (-1.18) (-.0005)	-.038 (-1.05) (-.0005)	-.038 (-1.04) (-.0005)
PERSONAL INCOME \$ 10,000- \$ 19,999	-.114* (3.52) (-.001)	-.089* (2.72) (-.001)	-.014 (.38) (-.0002)
PERSONAL INCOME \$ 20,000- \$ 39,999	-.215* (5.36) (-.002)	-.134* (3.19) (-.001)	-.042 (.89) (-.0005)
PERSONAL INCOME \$ 40,000- \$ 74,999	-.274* (4.24) (-.003)	-.142* (2.11) (-.001)	-.05 (.71) (-.0006)
PERSONAL INCOME \$ 75,000+	-.261 (1.56) (-.002)	-.097 (.57) (-.001)	-.004 (.02) (-.00005)
R^2	.18	.19	.195

Note: - Absolute value of asymptotic t-statistics in first parentheses;

- Marginal effects of the independent variable in second parentheses;

*- null hypothesis rejected at 5% level of significance

Table VI: Instrumental Variable Probit Estimate for Past Month Marijuana Consumption

Independent variable	Past Month Marijuana Consumption		
CONSTANT	-2.475* (28.73) (-.17)	-2.367* (27.26) (-.16)	2.291* (22.01)(-.152)
MALE	.215* (13.21) (.051)	.174* (10.35) (.012)	.214* (6.29) (.015)
YOUNG	.179* (5.81) (.013)	.253* (7.87) (.019)	.247* (4.37) (.019)
OLD	.001 (.029) (.00007)	.023 (.654) (.001)	.117 (1.09) (.008)
WHITE	.265* (5.12) (.018)	.24* (4.62) (.016)	.257* (4.78) (.017)
BLACK	.367* (6.91) (.305)	.323* (6.05) (.026)	.296* (5.52) (.023)
HISPANIC	.091 (1.72) (.006)	.038 (.71) (.003)	.013 (.25) (.0009)
ARRESTED FOR DRUG SALE/POSSESSION IN PAST 12 MONTHS	1.152* (16.29) (.203)	1.143* (16.14) (.199)	1.063* (14.83) (.173)
FREQUENTLY USED ALCOHOL EVERY MONTH PAST YEAR	1.724* (57.29) (.268)	1.728* (57.29) (.267)	1.715* (54.80) (.261)
USED ALCOHOL BUT NOT VERY FREQUENTLY EVERY MONTH PAST YEAR	1.025* (34.62) (.097)	1.031* (34.77) (.096)	1.015* (33.99) (.093)
MARRIED	-.387* (19.91) (-.024)	-.406* (20.73) (-.024)	-.382* (18.39) (-.023)
HIGH SCHOOL EDUCATION	-	-.048* (2.12) (-.003)	.0002 (.008) (.00002)
SOME COLLEGE EDUCATION	-	-.185* (7.07) (-.011)	-.099* (2.28) (-.006)
COLLEGE GRADUATE	-	-.372* (10.94) (-.019)	-.258* (3.77) (-.014)
WORKING	-	-	.395* (3.38) (.026)
UNEMPLOYED	-	-	.414* (11.86) (.038)
IN SCHOOL	-	-	.035 (.873) (.002)
MID ATLANTIC	-.143* (2.67) (-.009)	-.134* (2.5) (-.008)	-.129* (2.42) (-.008)
EAST NORTH CENTRAL	-.116* (2.18) (-.007)	-.118* (2.21) (-.007)	-.125* (2.34) (-.008)

Independent variable	Past Month Marijuana Consumption		
WEST NORTH CENTRAL	-.172* (2.55) (-.01)	-.186* (2.76) (-.011)	-.189* (2.8) (-.011)
SOUTH ATLANTIC	-.219* (4.19) (-.014)	-.215* (4.11) (-.013)	-.217* (4.13) (-.013)
EAST SOUTH CENTRAL	-.118 (1.71) (-.007)	-.139* (2.003) (-.008)	-.139* (1.99) (-.008)
WEST SOUTH CENTRAL	-.202* (3.52) (-.012)	-.203* (3.54) (-.012)	-.203* (3.53) (-.011)
MOUNTAIN	.177* (3.26) (.013)	.175* (3.23) (.013)	.176* (3.23) (.013)
PACIFIC	.016 (.30) (.001)	.023 (.44) (.002)	.018 (.35) (.001)
MARIJUANA PRICE (\$)	-.003 (1.94) (-.0002)	-.003 (1.86) (-.0002)	-.003* (2.01) (-.0002)
1991	-.097* (5.34) (-.006)	-.095* (5.21) (-.006)	-.088* (4.79) (-.006)
1992	-.114* (5.99) (-.007)	-.11* (5.79) (-.007)	-.111* (5.79) (-.007)
INCOME	-.037* (2.02) (-.002)	-.082* (4.26) (-.005)	-.191* (3.85) (-.013)
INCOME SQUARED	-.001 (.77) (-.00008)	.005* (3.22) (.0003)	.009* (4.55) (.0006)
R^2	.20	.20	.21

Note: - Absolute value of asymptotic t-statistics in first parentheses;

- Marginal effects of the independent variable in second parentheses;

*- null hypothesis rejected at 5% level of significance

Table VII: Instrumental Variable Probit Estimate for Past Month Cocaine Consumption

Independent variable	Past Month Cocaine Consumption		
CONSTANT	-3.245*(10.29)(-.042)	-3.138* (9.91) (-.04)	-2.968* (8.95) (-.037)
MALE	.152* (5.34) (.002)	.119* (4.05) (.001)	.104 (1.64) (.001)
YOUNG	.371* (6.49) (.006)	.432* (7.38) (.007)	.277* (2.76) (.004)
OLD	.467* (7.50) (.006)	.491* (7.84) (.007)	.325 (1.67) (.004)
WHITE	.297* (2.55) (.004)	.275* (2.35) (.004)	.253* (2.11) (.003)
BLACK	.47* (3.99) (.009)	.431* (3.64) (.008)	.385* (3.25) (.006)
HISPANIC	.445* (3.79) (.008)	.396* (3.36) (.007)	.369* (3.12) (.006)
ARRESTED FOR DRUG SALE/POSSESSION IN PAST 12 MONTHS	1.139* (14.45) (.065)	1.129* (14.29) (.063)	1.059* (13.04) (.053)
FREQUENTLY USED ALCOHOL EVERY MONTH PAST YEAR	1.447* (24.16) (.061)	1.449* (24.17) (.06)	1.404* (22.63) (.055)
USED ALCOHOL BUT NOT VERY FREQUENTLY EVERY MONTH PAST YEAR	.719* (11.67) (.013)	.723* (11.75) (.013)	.688* (11.06) (.012)
MARRIED	-.34* (10.16) (-.004)	-.353* (10.48) (-.004)	-.345* (9.59) (-.004)
HIGH SCHOOL EDUCATION	-	-.057 (1.57) (-.0007)	-.051 (.85) (-.0006)
SOME COLLEGE EDUCATION	-	-.151* (3.50) (-.002)	-.116 (1.49) (-.001)
COLLEGE GRADUATE	-	-.309* (5.29) (-.003)	-.299* (2.42) (-.003)
WORKING	-	-	.169 (.786) (.002)
UNEMPLOYED	-	-	.372* (6.92) (.002)
IN SCHOOL	-	-	-.125 (1.79) (-.001)
MID ATLANTIC	-.014 (.14) (-.0002)	-.103 (.10) (-.0001)	-.009 (.09) (-.0001)
EAST NORTH CENTRAL	-.035 (.36) (-.0004)	-.039 (.39) (-.0005)	-.053 (.53) (-.0006)

Independent variable	Past Month Cocaine Consumption		
WEST NORTH CENTRAL	-.189 (1.46) (-.002)	-.202 (1.56) (-.002)	-.218 (1.67) (-.002)
SOUTH ATLANTIC	-.071 (.74) (-.0009)	-.071 (.73) (-.0009)	-.079 (.81) (-.0009)
EAST SOUTH CENTRAL	-.145 (1.09) (-.001)	-.163 (1.22) (-.002)	-.17 (1.27) (-.002)
WEST SOUTH CENTRAL	-.057 (.55) (-.0007)	-.064 (.62) (-.0008)	-.069 (.66) (-.0008)
MOUNTAIN	.141 (1.25) (.002)	.135 (1.19) (.002)	.123 (1.08) (.002)
PACIFIC	-.015 (.13) (-.0002)	-.017 (.14) (-.0002)	-.03 (.25) (-.0004)
COCAINE PRICE (\$)	-.146 (.74) (-.002)	-.155 (.78) (-.002)	-.159 (.79) (-.002)
1991	-.059 (1.25) (-.0008)	-.061 (1.31) (-.0008)	-.071 (1.49) (-.0009)
1992	-.039 (1.06) (-.0005)	-.036 (.99) (-.0004)	-.038 (1.03) (-.0005)
INCOME	-.107* (3.20) (-.001)	-.14* (4.02) (-.002)	-.176* (1.99) (-.002)
INCOME SQUARED	.003 (1.77) (.00004)	.008* (2.76) (.0001)	.011* (3.21) (.0001)
R^2	.18	.19	.196

Note: - Absolute value of asymptotic t-statistics in first parentheses;

- Marginal effects of the independent variable in second parentheses;

*- null hypothesis rejected at 5% level of significance