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Participation and Consumption of Illegal Drugs among Adolescents

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Abstract

This paper identifies the determinants affecting the adolescent populations' decision regarding whether or not to consume illegal drugs. The authors estimate a simultaneous Type II Tobit model for each sample substance, including marijuana, LSD, amphetamines, cocaine, volatile substances, and heroine. The data are drawn from three Spanish Surveys on Drug Use in the School Population conducted in 1994, 1996, and 1998. The results indicate that illegal drug use among Spanish adolescents is clearly determined by economic variables. It is similarly determined by other sociodemographic variables, such as personal habits, family environment, and the receipt of information regarding the negative consequences of drug use. (JEL D81, I10, K42, D12)

Introduction

The use of illegal drugs, particularly among adolescents, imposes a number of individual and social costs. These include increased crime [Silverman and Spruill, 1977; Simonds and Kashani, 1980; Benson et al., 1992; Resignato, 2000], health problems [Tommasello, 1982; Nahas and Latour, 1992; Polen et al., 1993; Pope et al., 1995], and employment or school difficulties [White et al., 1988; Kaplan and Liu, 1994; Yamada et al., 1996; Mijares, 1997; Mensch and Kandel, 1988; Bray et al., 2000; MacDonald and Pudney, 2000a, b; 2001; French et al., 2001]. Apart from these clearly significant aspects, two additional factors require analysis: (1) the addictive nature of drug use, where individuals who have started to consume find that they cannot quit the habit and must go on consuming [DeFonseca et al., 1997; Grossman and Chaloupka, 1998; Samhsa, 1998] and (2) the testing of the gateway theory, which states that there is a systematic sequencing in the use of addictive substances that begins with alcohol and cigarettes, continues on to marijuana, and leads finally to hard drugs such as cocaine, heroine and LSD [Chaloupka and Laixuthai, 1997; DeSimone, 1998].

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In addition to these studies, which reflect the socioeconomic relevance of illegal drug abuse, papers published by [Gill and Michaels, 1991] and [Saffer and Chaloupka, 1999] provide specific and significant evidence on the determinants of this pattern of behaviour. Gill and Michaels use the National Longitudinal Surveys of Youth corresponding to 1980 and 1984 in order to estimate a Probit equation that explains the individual decision to use illegal drugs. They find that non-economic factors dominate the decision to participate in the illegal drug market. Saffer and Chaloupka employ the National Household Surveys of Drug Abuse corresponding to 1988, 1990, and 1991 in order to estimate various Probit specifications for different illegal drugs. Their main contribution is the use of prices to estimate price elasticities of participation, i.e., -0.28 for cocaine and -0.94 for heroin. Although these two papers undoubtedly offer relevant contributions, they both focus on the significant participation equation, assuming it is an empirical measure of consumption. However, neither one has paid any attention to the specific factors that determine the quantity of illegal drugs that the individual will demand.

The public problem of illegal drug use is a widespread phenomenon in many countries of the developed world and is especially worrying among the adolescent population. Although it is well established that illegal drug use among this age group is significant in the United States, it is also prevalent in other countries, such as Spain. A comparison of the Spanish rates derived from the Spanish Surveys on Drug Use in the School Population conducted in 1994, 1996, and 1998 with those corresponding to the U.S. homogenous participation rates obtained from the Youth Risk Behavior Surveys conducted in 1995, 1997, and 1999 confirms this reality. Indeed, the situation in Spain would appear to be even bleaker. U.S. data now reveal a decreasing trend in the adolescent use of marijuana (rates have fallen from 26% in 1995 to 24% in 1999) and a stable trend in the use of cocaine of about 3.5%. In Spain, however, participation rates in the majority of illegal drugs reflect significantly increasing trends, with marijuana and cocaine use rising from 12.8% and 1.1%, respectively, in 1994, to 17.2% and 2.4% in 1998.

A preliminary descriptive analysis of the illegal use of drugs by Spanish adolescents indicates that marijuana was the most widely used illegal drug during the 1990s (15.2%). This was followed by LSD and amphetamines (around 2.4%–2.5%), cocaine and volatile substances (around 1.5%), and heroine (0.3%). In fact, illegal drug use worsened throughout the 1990s as participation and frequency of consumption increased while the starting age decreased. It is, therefore, crucial to gain a better understanding of the socioeconomic determinants of illegal drug use among the adolescent population in Spain.

In light of the above, this paper offers evidence on the illegal drug participation and consumption decisions of Spain's adolescent population. Specifically, the authors follow Maddala [1983] by estimating a simultaneous Type II Tobit model for each of the illegal substances included in the sample, including marijuana, LSD, amphetamines, cocaine, volatile substances, and heroine. This specification includes two equations. The first models an individual's decision regarding whether or not to consume an illegal drug, while the second determines the quantity demanded if the individual decides to do so. The data source derives from three Spanish Surveys on Drug Use in the School Population conducted in 1994, 1996, and 1998.

The analysis considers a number of habitual socioeconomic factors, such as gender, age, working parents, and individual income, as well as additional relevant variables, such as whether family members smoke cigarettes, risky or healthy social behaviors, and self-evaluation about the dangers and addictive character of drugs. Such empirical results provide a better understanding of the determinants of illegal drug use among young people in Spain and must be the starting point for legislators shaping policies aimed at effective prevention.

The Data

As mentioned earlier, the data used in this work comes from three surveys conducted by the Spanish SDUSP in 1994, 1996, and 1998. The surveys offer 22,578, 19,191, and 18,346 observations, respectively, and were carried out by the Spanish Government's Delegation for the National Plan on Drugs. They contain complete information on both individual and family socioeconomic characteristics. At the same time, they offer data on a number of other factors related, for example, to school performance, harmful and healthy habits, and the effects of information on the consequences of illegal drug consumption. All of this data were obtained directly from the surveyed adolescents, who answered a complete questionnaire on drug use anonymously. Their parents were not present during the interviews and were not informed about the responses of their children. Such precautions limited any underreporting in the adolescents' responses to illegal drug use or other questions [Evans et al., 1977; Warner, 1978].

The information was collected in a variety of public and private centers of secondary education and vocational training. In order to ensure a representative sample, the Spanish Surveys on Drug Use in the School Population adopted the following procedures. In the first step, they implemented a random selection process to determine the number of centers in which the interviews were to be conducted. A minimum number of 600 students per region were guaranteed. In the second step, they used another random selection procedure to determine the two classrooms per center where students would be interviewed. Note that the proportion of adolescents in the classrooms who answered the survey was higher than 98.5% in each of the three sample years.

Mean and standard deviations of the variables for the total sample appear in Table 1. The dependent variables for the two equations of the model are Participation and Consumption. The first indicates whether or not the adolescent has consumed any illegal drugs during the last 30 days, while the second measures the frequency of consumption during that same period. The authors of this paper also consider a number of independent variables, including Gender, Age, Working mother, Working father, Primary studies mother, Primary studies father, University studies mother, University studies father, Employment, Income, Family smoking, Education failure, Membership, Reading, Going clubbing, Sports, Night-time activities, and Information.

According to the results summarized in Table 1, it is clear that marijuana exhibits the highest percentage of users throughout the sample period: 15.2%. This is followed by LSD (2.5%) and amphetamines (2.4%). Cocaine (1.6%) and volatile substances (1.4%) come next. Finally, heroin—at 0.3%—shows the lowest participation rate. However, this ranking varies if one concentrates on the frequency of consumption, which derives from a positive decision to participate. Now the highest frequencies appear for heroine (8.22 times per month) and marijuana (5.97 times per month). These are followed by volatile substances, cocaine and amphetamines (which are consumed between 4.00 and 5.00 times per month) and by LSD (which is consumed 3.54 times per month).

With respect to the exogenous variables, a descriptive analysis reveals that 48.6% of the adolescents sampled were males and that the average age of the entire sample was 15.79. Whereas 86.4% of fathers had a paid job, only 43.4% of mothers worked outside the home. Sixty percent of the mothers and 58% of the fathers had a secondary school certificate or lower. In contrast, only 11.9% of the mothers and 15.9% of the fathers had a university degree. The number of adolescents with a paid part-time job was 9.3%; their average weekly income was 2952.59 monetary units measured in pesetas (in constant 1998 values). Other relevant statistics are that a high percentage of adolescents, 64.9%, lived with family members who smoked at home and that approximately half of the

TABLE 1
Variable Definitions and Sample Characteristics

Variable	Definition	Mean (SD)
Marijuana		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.152 (0.359)
Consumption	Frequency of consumption during the last 30 days	5.977 (6.826)
LSD		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.025 (0.155)
Consumption	Frequency of consumption during the last 30 days	3.545 (4.729)
Amphetamines		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.024 (0.152)
Consumption	Frequency of consumption during the last 30 days	4.061 (5.029)
Cocaine		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.016 (0.127)
Consumption	Frequency of consumption during the last 30 days	4.266 (5.683)
Volatile substances		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.014 (0.115)
Consumption	Frequency of consumption during the last 30 days	4.594 (6.042)
Heroin		
Participation	This takes value 1 if the young person consumes the drug during the last 30 days; otherwise, it takes 0.	0.003 (0.059)
Consumption	Frequency of consumption during the last 30 days	8.224 (9.074)
Gender	This takes value 1 if the young person is male, and 0 if female.	0.486 (0.500)
Age	Age of consumption	15.792 (1.436)
Working mother	This takes value 1 if the mother works; otherwise it takes 0.	0.434 (0.496)
Working father	This takes value 1 if the father works; otherwise it takes 0.	0.864 (0.343)

Primary studies: mother	This takes value 1 if the mother has no schooling, a basic school certificate, or a secondary school certificate.	0.602 (0.489)
Primary studies: father	This takes value 1 if the father has no schooling, a basic school certificate, or a secondary school certificate.	0.585 (0.493)
University studies: mother	This takes value 1 if the mother has a university degree.	0.119 (0.323)
University studies: father	This takes value 1 if the father has a university degree.	0.159 (0.366)
Working	This takes value 1 if the young person has a part-time job outside of school; otherwise, it takes 0.	0.093 (0.291)
Income	Available income per week by the young person in constant 1998 Spanish pesetas.	2952.59 (7647.98)
Family smoking	This takes the value 1 if the young person lives with other individuals who smoke; otherwise, it takes 0.	0.649 (0.477)
Education failure	This takes the value 0 if the young person has not had to repeat a school year, 1 if he/she has had to repeat only one year; and 2 if he/she has had to repeat more than one year.	0.458 (0.671)
Memberships	This takes the value 1 if the young person is a member of an association (e.g., political, religious, sport); otherwise, it takes 0.	0.533 (0.553)
Reading	This takes values according to the frequency of reading books or magazines in the last 30 days (0 = never; 1 = less than once a week; 2 = one to three times a week; 3 = four to six times a week; 4 = daily).	2.456 (1.294)
Going clubbing	This takes values according to the frequency of visiting bars in the last 30 days (0 = never; 1 = less than once a week; 2 = one to three times a week; 3 = four to six times a week; 4 = daily).	1.667 (1.190)
Sports	This takes values according to the frequency of participating in sports activities in the last 30 days (0 = never; 1 = less than once a week; 2 = one to three times a week; 3 = four to six times a week; 4 = daily).	2.302 (1.349)
Night-time activities	This takes values according to the frequency of going out at night in the last 12 months (1 = never; 2 = less than once a month; 3 = one to three nights a month; 4 = once a week; 5 = two nights a week; 6 = three nights a week; 7 = more than three nights a week)	3.715 (1.740)
Information	This takes the value 1 if the young person studies at a school that conducts information campaigns on the risks associated with drug consumption; otherwise, it takes 0.	0.434 (0.496)

sample, 53.3%, were members of a political, religious or sport association. Finally, only 43.4% of these young people had received information on the negative consequences of drug consumption through information campaigns carried out at their schools or vocational training centers.

The Empirical Model

Due to the addictive nature of illegal drugs, the authors have adopted the general recommendations of Maddala [1983, pp. 28] in order to create a model of participation and consumption. Maddala states: "In actual practice, these decisions are simultaneous rather than sequential." Consequently, the authors use a Type II Tobit model where the individual simultaneously decides whether or not to consume illegal drugs and how much to consume. This model, also called a censored regression model with stochastic threshold [Maddala, 1983; Amemiya, 1985], is consistent with the sample selection. This implies that only those adolescents who have decided to consume drugs, that is to say, those who give a positive response to the participation question, provide information about the quantity consumed. The model comprises two equations. The first is given by the Probit model and takes the form of a selection equation that discriminates between drug users and non-users. The second, described as a regression equation, relates the quantity demanded with explanatory factors of this demand. The formulation of this simultaneous equation model, which explicitly examines the correlation between the disturbances of the two equations, can be stated as:

$$Y_{1i} = \begin{cases} 1 & if \quad Y_{1i}^{*} = x_{1i}'\beta_1 + u_{1i} > 0 \\ 0 & otherwise \end{cases} \tag{1a}$$

$$Y_{2i} = \begin{cases} Y_{2i}^{*} = x_{2i}'\beta_2 + u_{2i} & if \quad Y_{1i} = 1 \\ 0 & otherwise \end{cases} \tag{1b}$$

where β_1 and β_2 are vectors of parameters, x_{1i} and x_{2i} are vectors of individual characteristics, and u_{1i} and u_{2i} are non-observable random variables. Y_1^* and Y_2^* are latent variables, with the first indicating whether or not the individual is a consumer, and the second showing the quantity demanded conditional upon whether the individual has decided to be a consumer.

Given the nature of the two decision processes, one can expect that non-observable effects will influence the two equations, and that the errors, therefore, are not independent. In particular, one can assume that the errors (u_{1i} and u_{2i}) follow a bivariate distribution with zero mean and a covariance matrix where ρ is the correlation coefficient:

$$\sum = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix} = \begin{pmatrix} 1 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix} \tag{2}$$

The authors impose $\sigma_1^2 = 1$ as a normalizing assumption given that this parameter is not identified in a manner independent from the β_1. In any event, only the indicator that calculates the probability β_1/σ_1 is interesting, not the individual estimation of β_1 and σ_1. The participation and consumption equations are calculated using the Heckman two-stage method, which estimates the participation equation in the same way as a Probit model and uses the inverse Mills ratio function ($\lambda = \phi_1/\Phi_1$, with ϕ_1 and Φ_1 being the

density and distribution functions of the standard normal evaluated at $x'_{1i}\beta_1$) as an additional variable in the consumption equation in order to correct the sample selection. This consumption equation is, in turn, estimated by ordinary least squares over the selected sample, and computes heterokedastic-consistent standard errors.

In order to control for regional unobservable differences, the authors introduce dummy variables corresponding to the 17 regions into which Spain is divided. Omitting such regions could attribute the effects of the non-observable regional characteristics to the socio-economic variables.

In addition, the authors have tested the exogeneity of the personal habits variables, that is to say, Membership, Reading, Sports, Going clubbing, and Night-time activities, by means of the Hausman [1978] test. This test consists of two steps. The first estimates the habit variables by OLSQ (the other variables used in the model are explanatory). In addition, a number of variables allow one to identify the equations. These identification variables (Educated mother and Educated father) take eight values according to the specific education level of the parents (1 = no education; 2 = basic school certificate; 3 = secondary school certificate; 4 = first level of vocational training; 5 = second level of vocational training; 6 = higher secondary school certificate; 7 = university diploma; and 8 = university degree). Occupation takes the value 1 if both parents are employed; High status takes the value 1 if both parents have a job that requires high qualifications; and Low Age takes the value 1 if the adolescent is less than 16 years old, the minimum legal age for entry into a bar in Spain. In the second step, the fitted variables are added to the model, and each one is individually tested. The results of this test reveal that exogeneity of all the habit variables is not rejected in any of the six sample substances, except for the Going Clubbing variable in the case of amphetamines.

On the basis of the Type II Tobit model (1a)–(1b), one can derive the effect of income changes on the observed consumption beginning with the expected value:

$$E(Y_{2i}) = \Phi_1\left(x'_{2i}\beta_2 + \sigma_{12}\frac{\phi_1}{\Phi_1}\right) \tag{3}$$

The variation of $E(Y_{2i})$ with respect to income can be decomposed in the following way:

$$\frac{\partial E(Y_{2i})}{\partial x_{ki}} = \Pr\left(Y^*_{1i} > 0\right)\frac{\partial \mathrm{E}\left(Y_{2i}\middle|Y^*_{1i} > 0\right)}{\partial x_{ki}} + E\left(Y_{2i}\middle|Y^*_{1i} > 0\right)\frac{\partial \Pr\left(Y^*_{1i} > 0\right)}{\partial x_{ki}} \tag{4}$$

where:

$$\Pr\left(Y^*_{1i} > 0\right)\frac{\partial E\left(Y_{2i}\middle|Y^*_{1i} > 0\right)}{\partial x_{ki}} = \Phi_1\left(\beta_{2k} + \sigma_{12}\frac{\phi_1(-\beta_{1k})x'_{1i}\beta_1\Phi_1 - (\phi_1)^2\beta_{1k}}{(\Phi_1)^2}\right) \tag{5}$$

$$E\left(Y_{2i}\middle|Y^*_{1i} > 0\right)\frac{\partial \Pr\left(Y^*_{1i} > 0\right)}{\partial x_{ki}} = \left(x'_{2i}\beta_2 + \sigma_{12}\frac{\phi_1}{\Phi_1}\right)\phi_1\beta_{1k} \tag{6}$$

and with β_{1k} and β_{2k} being the parameters corresponding to the variable x_k in the first and second equations of the model, respectively. Thus, income affects consumption in two ways. First, expression (5) allows one to define the income elasticity that is conditional

TABLE 2
Type II Tobit Model: Participation Estimations

Variable	Marijuana	LSD	Amphetamines	Cocaine	Volatile Substances	Heroin
Intercept	−7.7186***	−7.0352***	−5.8013***	−6.6353***	0.2481	−5.2531
	(0.6410)	(1.6967)	(1.5947)	(1.6984)	(1.3117)	(5.8464)
Gender	0.3218***	0.2586***	0.2310***	0.2211***	0.1843***	0.3264***
	(0.0205)	(0.0378)	(0.0391)	(0.0465)	(0.0429)	(0.0979)
Age	0.6287***	0.5193***	0.3670*	0.3941*	−0.2551	0.3551
	(0.0760)	(0.2059)	(0.1922)	(0.2013)	(0.1590)	(0.7347)
Age squared	−0.0174***	−0.0170***	−0.0119**	−0.0114*	0.0042	−0.0162
	(0.0023)	(0.0063)	(0.5797)	(0.0060)	(0.0048)	(0.0230)
Working mother	0.1298***	0.0230	0.1170***	0.1172***	0.0057	−0.0357
	(0.0191)	(0.0349)	(0.0360)	(0.0427)	(0.0402)	(0.0849)
Working father	−0.1213***	−0.1410***	−0.1277***	−0.1659***	−0.0811	−0.1894*
	(0.0268)	(0.0469)	(0.0490)	(0.0558)	(0.0564)	(0.1094)
Primary studies mother	−0.0385	−0.0502	−0.0384	−0.0488	0.0513	0.0236
	(0.0234)	(0.0420)	(0.0437)	(0.0524)	(0.0499)	(0.1039)
Primary studies father	−0.0546**	−0.0886**	−0.0353	−0.0577	−0.1236***	−0.1518
	(0.0240)	(0.0436)	(0.0454)	(0.0539)	(0.0499)	(0.1074)
University studies mother	0.0245	−0.0884	−0.0491	−0.0204	0.0605	−0.1316
	(0.0342)	(0.0647)	(0.0660)	(0.0777)	(0.0714)	(0.1600)
University studies father	0.1473***	0.0949*	0.1393***	0.0832	−0.0077	0.1964
	(0.0308)	(0.0553)	(0.0581)	(0.0693)	(0.0644)	(0.1277)
Working	−0.0020	0.0908*	0.0962*	0.1832***	0.1003	0.4149***
	(0.0310)	(0.0505)	(0.0511)	(0.0567)	(0.0636)	(0.1015)
Income	0.0626***	0.0765***	0.0946***	0.0896***	0.0425***	0.0490***
	(0.0058)	(0.0086)	(0.8735)	(0.0096)	(0.0110)	(0.0176)
Income squared	−0.0011***	−0.0013***	−0.0017***	−0.0015***	−0.0007***	−0.0005*
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)

Family smoking	0.1369***	0.1350***	0.1276***	0.1384***	0.0702*	0.1297
	(0.0199)	(0.0378)	(0.0392)	(0.0469)	(0.0423)	(0.0948)
Education failure	0.1481***	0.1676***	0.2169***	0.1997***	0.0482	0.1260*
	(0.0153)	(0.0270)	(0.0278)	(0.0325)	(0.0349)	(0.0690)
Memberships	−0.0452***	0.9342	−0.0372	−0.0542	0.0342	0.0514
	(0.0182)	(0.0286)	(0.0365)	(0.0450)	(0.0328)	(0.0585)
Reading	−0.0371***	−0.0383***	−0.0511***	−0.0826***	−0.0045	−0.1177***
	(0.0074)	(0.0133)	(0.0137)	(0.0162)	(0.0154)	(0.0320)
Going clubbing	0.3907***	0.2820***	0.2754***	0.2636***	0.1504***	0.2544***
	(0.0112)	(0.0197)	(0.0206)	(0.0239)	(0.0208)	(0.0423)
Sports	−0.0836***	−0.0598***	−0.0570***	−0.0558***	−0.0514***	−0.0631*
	(0.0080)	(0.0142)	(0.0151)	(0.0178)	(0.0165)	(0.0341)
Night-time activities	0.1252***	0.1137***	0.1155***	0.1108***	0.0750***	0.1255***
	(0.0066)	(0.0123)	(0.0129)	(0.0151)	(0.0133)	(0.0293)
Information	−0.0743***	−0.1212***	−0.1114***	−0.0828*	−0.0695*	−0.1232
	(0.0186)	(0.0347)	(0.0360)	(0.0424)	(0.0395)	(0.0864)
T94	−0.5981***	−0.2382***	−0.3478***	−0.6916***	−0.3043***	−0.5324***
	(0.0281)	(0.0514)	(0.0532)	(0.0652)	(0.0554)	(0.1260)
T96	−0.1363***	0.0658	−0.0043	−0.3267***	−0.1715***	−0.1855**
	(0.0222)	(0.0411)	(0.0416)	(0.0482)	(0.0463)	(0.0940)
Number observations	35,358	35,358	35,358	35,358	35,358	35,358
Log likelihood	−11,983.0	−3086.1	−2901.2	−2017.4	−2185.9	−472.2

Notes: SD in parentheses.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

on being a consumer; this indicates the percentage change in consumption by consumer weighted by the probability of being a consumer when income varies by 1%. Second, expression (6) permits the characterization of the participation elasticity, which measures the percentage change in the probability of being a consumer weighted by the quantity conditional on being a consumer when income varies by 1%. By adding these together, the total income effect becomes:

$$\frac{\partial E(Y_{2i})}{\partial x_k} = \phi_1 \beta_{1k} x'_{2i} \beta_2 + \Phi_1 \beta_{2k} - \sigma_{12} \phi_1 \beta_{1k} x'_{1i} \beta_1 \tag{7}$$

whose elasticity indicates the percentage change in consumption by the ith respondent, whether a consumer or not, when income varies by 1%.

Results and Policy Implications

This section considers the effects that different socioeconomic factors have on both participation and consumption and offers some policy proposals aimed at reducing the consumption of illegal drugs among the Spanish adolescent population based on the empirical results. This remains a difficult task, however, due to the non-regulated nature of the market.

The estimations of the model appear in Tables 2 and 3. It can be noted that the participation results are, in general, in line with those of Gill and Michaels [1991] and Saffer and Chaloupka [1999]. Given that the independent variables imply similar effects in the equations corresponding to the different drugs, and with the aim of avoiding unnecessary repetitions, the authors will simultaneously refer to the results obtained for all sample substances.

In regards to the participation decision (Table 2), results show that adolescent males have a higher probability of being consumers than their female counterparts. This result is particularly robust and statistically significant for all illegal drugs in the sample. Moreover, this probability becomes higher as the adolescent grows older. However, the effect is not linear given that the estimated parameter of the age-squared variable is negative. This latter result is again significant for marijuana, LSD, amphetamines and cocaine.

In regard to family environment, the employment status of the father and the mother exhibits opposite effects when considering the probability of participation. For example, if the father is unemployed, there is a positive effect on that probability; if the mother is employed outside the home, there is also a positive effect. These results are significant for marijuana, LSD, amphetamines, cocaine, and heroine when considering the father's employment status, and for marijuana, amphetamines, and cocaine when considering the mother's. This result appears to confirm that a relatively weak economic situation in the family could act as an incentive for adolescent participation in the drug market.

In regard to the parents' level of education, explanatory variables have practically no effect on the participation decision, except in the case of university level studies, which is positively correlated to the father. This effect is statistically significant for marijuana, LSD, and amphetamines. Such a paradoxical result has two possible explanations. First, parents who studied at a university in the 1960s and 1970s could have been integrated into the era's "hippy" environment, which actively encouraged the use of illegal drugs. As a result, they may have adopted a more permissive attitude towards their children's drug consumption. Second, parents with lower education levels correlate positively with a rural environment, where adolescents have fewer opportunities to access the drug market.

In regard to the adolescent's economic situation, there are two major findings. First, the labor variable has a positive effect on the participation decision, although it is not significant in the case of marijuana and volatile substances. Second, income also exerts a positive effect, albeit less than proportionally, given the negative sign of the income squared variable.

Adolescents who live with family members who smoke tobacco at home exhibit a higher probability of consuming the sample drugs, with the sole exception of heroine. Similarly, those adolescents who have suffered education failure also present a higher probability of participating in the drug market, except for the case of volatile substances, where the effect is not significant.

In regard to personal habits, the percentage of users decreases among those adolescents who belong to a political, religious, or sports association, although this result is only significant for marijuana. The participation rates also decrease among adolescents who dedicate an important part of their free time to reading or practicing sports. These effects are statistically significant for all the sample drugs, except for the Reading variable in the case of volatile substances. By contrast, those adolescents who go out at night and go clubbing more frequently appear to have a higher probability of using the sample substances. In light of this finding, a useful way to reduce participation might be to offer alternative activities that enable adolescents to spend their free time pursuing healthier pastimes.

In regard to the information adolescents receive at school or vocational training centers about the negative consequences of drug consumption, one can detect a negative sign for all sample drugs. Thus, it appears that offering such information does indeed reduce the percentage of users. This is significant in all cases except for heroine.

The last two variables included in the participation equation consider trends during the 1990s. Both are significant and exhibit negative signs for marijuana, cocaine, volatile substances, and heroine. Furthermore, the absolute values indicate that the percentage of users has increased steadily over the course of the three sample years.

The first significant difference is that many of the variables that were significant in the participation stage cease to be significant in the consumption state. However, the significance of the inverse Mill's ratio confirms that both equations share non-observable elements that affect decisions in the consumption of both marijuana and volatile substances.

Gender appears as a significant variable only in the case of marijuana and volatile substances, with adolescent males consuming at a higher frequency than their female counterparts. With respect to age variables, there are significant parameters in the case of marijuana that illustrate the positive and concave relationship between age and consumption.

In addition, as was the case with the participation equation, having a working father has a negative influence on the consumption of marijuana, while having a working mother has a positive effect. The mother's employment situation is statistically significant in the case of marijuana. In the majority of cases, the parents' education levels are not significant factors except for university level studies on the part of the father. This variable is positive and significant for marijuana, LSD, and amphetamines. In regard to marijuana and volatile substances, consumption increases with the available income of the adolescent.

In regard to personal habits, Table 3 illustrates that the estimated parameter of the reading variable is significant and negative for marijuana, LSD, amphetamines and volatile substances. Similarly, practicing sports is negatively related with the frequency of consumption of marijuana and volatile substances. Furthermore, more frequent clubbing is positively related with the consumption of marijuana and volatile substances. However, information campaigns waged at schools and vocational training center-

TABLE 3
Type II Tobit Model: Consumption Estimations

Variable	Marijuana	LSD	Amphetamines	Cocaine	Volatile Substances	Heroin
Intercept	−72.0183***	−125.2360	−54.5109	13.6481	−78.3692***	70.2162
	(19.1244)	(106.6450)	(56.1191)	(53.9427)	(28.1838)	(250.1640)
Gender	4.4673***	5.7237	2.7871	1.1273	21.0520**	−9.9200
	(0.6651)	(3.5304)	(1.8520)	(1.6116)	(9.7620)	(10.3032)
Age	5.2693***	7.2017	2.4939	−1.3105	−23.4849*	5.1034
	(1.4876)	(7.2210)	(3.6470)	(3.2541)	(13.8966)	(27.8104)
Age squared	−0.1451***	−0.2547	−0.0816	0.0313	0.3212	0.0332
	(0.0416)	(0.2347)	(0.1152)	(0.0938)	(0.2388)	(0.9081)
Working mother	1.2144***	0.6303	1.6476	−0.3229	1.0112	1.5552
	(0.3098)	(0.4333)	(1.0256)	(0.9501)	(0.7180)	(3.1704)
Working father	−1.5204***	−2.5783	−1.4933	−0.3896	−8.8705**	5.9770
	(0.3497)	(1.9285)	(1.0988)	(1.1777)	(4.3177)	(5.8071)
Primary studies mother	−0.3477	−0.9787	−1.1095*	−0.2892	4.7362*	−4.2365
	(0.2309)	(0.7953)	(0.5858)	(0.7378)	(2.7712)	(3.7367)
Primary studies father	−0.2982	−1.1744	−0.0226	−0.2040	−13.8406**	7.0337
	(0.2519)	(1.3217)	(0.5457)	(0.8713)	(6.6493)	(5.6222)
University studies mother	0.3256	−1.0759	−1.8090**	−0.6742	5.5526*	5.8354
	(0.3100)	(1.2953)	(0.8008)	(0.8681)	(3.1731)	(6.1607)
University studies father	1.7368***	2.7465**	2.2757*	−0.2885	−0.7296	−7.0345
	(0.4077)	(1.3425)	(1.1907)	(0.9641)	(1.1539)	(6.7178)
Working	0.3577	1.9933	1.6106*	0.3426	10.2039*	−12.3378
	(0.3092)	(1.2846)	(0.9500)	(1.4164)	(5.4334)	(11.3570)
Income	0.8153***	1.5747	0.8928	0.1054	4.6667**	−1.4779
	(0.1333)	(1.0104)	(0.7414)	(0.6337)	(2.2230)	(1.5898)

Income squared	−0.0146***	−0.0265	−0.0168	−0.0021	−0.0777**	0.0129
	(0.0024)	(0.0169)	(0.0135)	(0.0106)	(0.0371)	(0.0183)
Family smoking	1.6443***	2.4761	1.1668	0.2041	7.3149*	0.6165
	(0.3302)	(1.8990)	(1.0660)	(1.0839)	(3.8234)	(3.8275)
Education failure	2.0096***	3.5885	1.9462	0.2113	4.9341*	−6.6998
	(0.3206)	(2.2764)	(1.7365)	(1.4774)	(2.5381)	(4.2216)
Memberships	−0.6932***	0.0932	−0.3965	−0.3205	3.2801	−1.6385
	(0.1979)	(0.1857)	(0.5282)	(0.7011)	(2.0372)	(2.9512)
Reading	−0.4478***	−1.0598**	−0.8599*	−0.1632	−1.1707***	1.6691
	(0.0998)	(0.5325)	(0.4438)	(0.5629)	(0.3105)	(3.3972)
Going clubbing	3.8204***	5.7892	3.2471	0.4296	16.7129**	−9.5924
	(0.7831)	(3.8716)	(2.2479)	(1.8087)	(8.0291)	(7.6357)
Sports	−0.9877***	−1.1401	−0.6471	−0.0960	−5.3962*	1.0962
	(0.1842)	(0.8260)	(0.4676)	(0.4956)	(2.7832)	(2.0242)
Night-time activities	1.4179***	2.3748	1.4741	0.0471	8.4010**	−4.1764
	(0.2593)	(1.5521)	(0.9567)	(0.8186)	(4.0129)	(3.7170)
Information	−0.9516***	−2.6112	−1.5186	−0.8470	−7.5956**	3.2420
	(0.2296)	(1.7013)	(0.9743)	(0.8328)	(3.7692)	(4.1170)
T94	−7.3622***	−5.4870*	−4.1881	−2.0564	−33.6691**	21.3768
	(1.2030)	(3.2647)	(2.8980)	(4.7818)	(16.2244)	(16.8560)
T96	−1.9208***	1.3694	−0.3316	−0.4079	−19.2595**	11.3026*
	(0.3479)	(1.0001)	(0.4090)	(2.4170)	(9.0982)	(6.6016)
λ	11.2227***	23.1415	11.9867	0.7952	123.3910**	−36.7881
	(2.6057)	(15.7490)	(9.4367)	(8.3400)	(59.6152)	(33.5797)
Log likelihood	−17,098.7	−2140.2	−2114.2	−14,051.2	−1355.3	−291.7

Notes: SD in parentheses.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

sreduce both the probability and the actual consumption of marijuana and volatile substances.

The time dummy variables do not appear to be significant, except in the case of marijuana, volatile substances and LSD. In the first two of these, consumption increased over the length of the three sample years; in the case of LSD, it increased significantly between 1994 and 1996.

Table 4 shows income elasticities broken down into both participation and consumption. The results indicate that the global income elasticity is between 0.6041 for marijuana and 2.5468 for heroine. Three groups of drugs illustrate similar elasticities. The first comprises marijuana and volatile substances, with elasticities of around 0.6; the second comprises LSD and amphetamines, with elasticities close to 1.5; the third comprises cocaine and heroine, with elasticities of between 2.091 and 2.5468. The results confirm that the highest response to an income change appears in participation, with the response in quantity consumed being much lower. Finally, when differentiated by gender, the previous results are maintained, with the effects being somewhat higher for female adolescents than for their male counterparts except for the case of volatile substances.

All of these results can be used to derive a number of policy implications. First it is easier to affect the participation decision than the consumption decision given that the increasingly addictive character of the sample substances reduces the number of socioeconomic variables that affect the consumption decision.

Second, it would appear that the problem of illegal drug consumption is concentrated in the adolescent male population, suggesting that this is the group to which greater efforts should be directed. Another fundamental aspect in the prevention of illegal drug use is communication between parents and children. This is especially relevant in homes where the mother works outside the home and, therefore, where young people receive less attention. Moreover, those adolescents who work and enjoy higher income levels constitute a high risk collectively. In light of this, parents should be encouraged to pay close attention to the way in which their children spend the income.

The fact that lower participation probabilities appear for adolescents who belong to associations, are habitual readers, or who regularly practice sports confirms the wisdom of providing adolescents with healthy free-time activities. This policy approach is particularly important when considering results that confirm that those adolescents who dedicate their free time to clubbing have the highest probability of both consuming drugs and of doing so with greater frequency. The results also confirm that information campaigns mounted at schools and vocational training centers reduce drug consumption except in the case of heroine.

Summary and Conclusions

This paper has attempted to shed light on illegal drug use decisions among the Spanish adolescent population. It has analyzed the factors that determine the decision regarding whether or not to participate. If an adolescent decides to do so, it has analyzed how much will be consumed. It has also estimated a Type II Tobit model for each of six sample drugs by drawing on the three Spanish Surveys on Drug Use in the School Population conducted in 1994, 1996 and 1998.

The results of this paper are consistent with the authors' intuition; furthermore, they are in line with those reported earlier in the literature. The decision to participate in illegal drugs is much more sensitive to socioeconomic factors than the decision of how

TABLE 4
Income Elasticities

	Marijuana	LSD	Amphetamines	Cocaine	Volatile Substances	Heroin
Total						
Total sample	0.6041	1.4101	1.5392	2.0911	0.6169	2.5468
	(0.3860)	(1.7912)	(1.7327)	(1.9668)	(0.9994)	(5.1871)
Male subsample	0.5479*	1.2833	1.4291	1.8628	0.6346	1.8744
	(0.3158)	(1.5123)	(1.5522)	(1.6030)	(0.9075)	(3.5694)
Female subsample	0.6632	1.3666	1.5242	2.1335	0.4628	2.7048
	(0.4507)	(1.7167)	(1.5881)	(1.8919)	(0.7541)	(5.6216)
Participation						
Total sample	0.3266*	1.1100	1.6020	1.9564	0.5001	3.2003
	(0.1775)	(1.1773)	(1.5413)	(1.8076)	(0.6445)	(4.7946)
Male subsample	0.2966**	0.9930	1.4628	1.7445	0.4954	2.3437
	(0.1400)	(0.9690)	(1.3473)	(1.4664)	(0.5649)	(3.2435)
Female subsample	0.3577*	1.1320	1.6509	1.9906	0.4244	3.5431
	(0.2112)	(1.2342)	(1.5398)	(1.7559)	(0.5744)	(5.8297)
Consumption						
Total sample	0.2775	0.3000	−0.0628	0.1347	0.1169	−0.6534
	(0.2268)	(0.6628)	(0.3058)	(0.1832)	(0.3803)	(2.9046)
Male subsample	0.2513	0.2903	−0.0337	0.1184	0.1392	−0.4693
	(0.1932)	(0.5827)	(0.3016)	(0.1564)	(0.3604)	(2.0106)
Female subsample	0.3055	0.2346	−0.1267	0.1430	0.0384	−0.8383
	(0.2558)	(0.5307)	(0.1426)	(0.1626)	(0.2156)	(3.5464)

Notes: SD in parentheses.
*Significant at the 10% level.
**Significant at the 5% level.

much to consume to such a degree that many of the variables that affect the first decision are not significant in the second. This clearly indicates that the best way to limit illegal drug use among adolescents is to concentrate on reducing the access young people have to the drug market. Here, one should bear in mind that it is much more difficult to reduce the quantity consumed once the individual has started the habit.

The authors have also provided empirical evidence that the available personal income of the adolescent increases both the probability of participation and, in the majority of cases, the frequency of consumption. Similarly, the percentage of users is higher among those adolescents whose fathers are unemployed. Providing incentives for adolescents to pursue healthy habits, such as reading and practicing sports, can reduce the probability of starting to consume. Finally, mounting information campaigns at school or vocational training centers regarding the negative consequences of drug use appears to reduce the percentage of adolescents who consume.

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