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Marijuana consumption and school failure among Spanish students

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Abstract

This paper examines the hypothetically bi-directional relationship which links marijuana consumption and school failure among students. To that end, we propose a simultaneous probability model, which is estimated by using the information provided by the three consecutive waves from the Spanish Surveys on Drug Use in the School Population [(1996, 1998 and 2000). Spanish Government's Delegation for the National Plan On Drugs, Madrid, Spain]. Our results confirm that whilst marijuana consumption is a determinant for school failure among Spanish students, we do not find evidence in the opposite direction. Moreover, explanatory variables, such as the presence of smokers at home, a mono-parental situation or unhealthy habits, among others, are good predictors for both marijuana consumption and school failure.

JEL classification: I21; D12; C35

Keywords: Marijuana consumption; School failure; Students; Spain

1. Introduction

The consumption of marijuana in adolescence has significant socio-economic relevance for a number of reasons. Thus, it is well established that marijuana is an addictive substance and that regular use can result in dependence (Defonseca et al., 1997; SAMHSA (1998a). It is also widely held that marijuana is a so-called *gateway substance*, in the sense that early involvement can increase the likelihood of the subsequent use of harder drugs (Brook, Balka, & Whiteman, 1999; Chaloupka & Laixuthai, 1997; Desimone, 1998; Ellickson, Hays, & Bell, 1992; Kandel, 1975; Kandel, Kessler, & Margulies, 1978; Kandel, Yamaguchi, & Chen, 1992). Furthermore, regular use of marijuana is associated with a number of psychological and physical health effects in the student population, for example, diminished cognitive functioning, diminished psychomotor performance, increased upper respiratory problems and reproductive system problems (Hall, Solowij, & Lemmon, 1994; Jones, 1984; Nahas & Latour, 1992; Polen, Sidney, Tekawa, Sadler, & Friedman 1993; Pope, Gruber, & Yurgelum-Todd, 1995; Tommasello, 1982; Weller & Halikas, 1982). Similarly, early marijuana use has been associated with a wide range of anti-social and dangerous behaviour, including driving under the influence, engaging in crime or dropping out of school (Bray, Zarkin, Ringwalt, & Qi, 2000; Brook et al., 1999; Heishman, Arasteh, & Stitzer, 1997; Osgood, Johnston, O'Malley, & Bachman, 1988; SAMHSA, 1998a, b;

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Spunt, Goldstein, Brownstein, & Fendrich, 1994; Yamada, Kendix, & Yamada, 1996).

In addition to all these aspects, another interesting line of research has tried to determine the factors that lead students to consume marijuana and, in pursuit of this objective, a significant literature on marijuana consumption has emerged. This was first due to the work of epidemiologists and other social scientists, who considered how individual and environmental characteristics, lifestyle factors and perceptions and attitudes about marijuana correlated with its use among the student population. Following this line, and also given the scarce availability of reliable data on the price of this illicit substance, the economic literature on the demand for marijuana has subsequently focused on analysing its socio-economic determinants (Bachman, Johnston, & O'Malley, 1981; Bachman, Johnston, & O'Malley, 1998; Bachman, Johnston, O'Malley, & Humphrey, 1988; Brook, Cohen, & Jeager, 1998; Jessor, Chase, & Donovan, 1980; Kandel, 1985; Pacula et al., 2000).

Against all this background, and concentrating now on both the anti-social behaviour and on the determinants of use aspects, our particular interest lies in analysing the relationship between marijuana consumption and school failure among students. Specifically, we examine the hypothetically bi-directional relationship which links marijuana consumption and failure at school. Although there is ample evidence in both directions, only a limited number of papers have tested this possible endogeneity. As regards the existing literature, papers such as those of Smith and Fogg (1978), Robins (1980) or Hawkins, Catalano, and Miller (1992) have shown that failure at school predicts student drug abuse, whereas those of Yamada et al. (1996), Pope and Yurgelum-Todd (1996), as well as the excellent contribution of Sander (1998), illustrate the effect in the opposite direction.

The application of our analysis is particularly relevant to the case of Spain where, to the best of our knowledge, this is the first paper which focuses on the relationship between marijuana consumption and educational failure among students. Moreover, the statistical information provided by the three consecutive waves from the Spanish Surveys on Drug Use in the School Population-SDUSP (1996, 1998 and 2000) reveals an increase in the number of student consumers of marijuana, as well as high ratios of school failure, although these have slightly decreased from 34% in 1996 to 31% in 2000. Moreover, when considered by gender, we can observe that both marijuana participation and school failure is more prevalent among student males than among their female counterparts. Similarly, the data confirms an increase in marijuana prevalence and school failure as the age of the student increases (Table 1).

For the purpose of determining whether or not there is an endogenous relationship between marijuana consumption and school failure among Spanish students at the end of the 1990s, we propose a simultaneous probability model (Mallar, 1977). This is estimated by way of maximum likelihood using the information provided by the earlier-mentioned three available waves of the Spanish SDUSP. The specification includes two equations, which indicate whether the student consumes marijuana and whether he/she has failed at school, respectively. In addition to considering some covariates for physical, environmental and peer group variables, such as gender, the parents' education level or free-time activities, we also include a number of other relevant

Table 1
Descriptive statistics

Variable	Total	Men	Women	<16 years	16 years	>16 years
1996						
Marijuana consumption	0.161	0.193	0.130	0.095	0.187	0.235
	(0.368)	(0.395)	(0.336)	(0.293)	(0.390)	(0.424)
School failure	0.344	0.381	0.309	0.150	0.404	0.572
	(0.475)	(0.486)	(0.462)	(0.358)	(0.491)	(0.495)
1998						
Marijuana consumption	0.173	0.204	0.145	0.113	0.216	0.254
	(0.378)	(0.403)	(0.352)	(0.317)	(0.411)	(0.435)
School failure	0.322	0.360	0.287	0.151	0.414	0.575
	(0.467)	(0.480)	(0.452)	(0.358)	(0.493)	(0.494)
2000						
Marijuana consumption	0.188	0.217	0.160	0.126	0.232	0.298
	(0.390)	(0.412)	(0.367)	(0.332)	(0.422)	(0.457)
School failure	0.311	0.352	0.273	0.156	0.392	0.624
	(0.463)	(0.478)	(0.446)	(0.363)	(0.488)	(0.484)

variables, such as tobacco use in the peer group or aspects derived from *Gateway Theory*, namely alcohol addiction.

The rest of the paper is organized as follows. In Section 2, we describe the data used to model the relationship between marijuana consumption and school failure. Section 3 is dedicated to specifying and estimating the simultaneous model. The empirical results are included in Section 4. Finally, Section 5 closes the article with a summary of the most relevant conclusions.

2. Data

The data used in this work comes from the three available waves of the Spanish SDUSP corresponding to 1996, 1998 and 2000, which offer 19,191, 18,346 and 20,450 observations, respectively, and which were carried out by the Spanish Government's Delegation for the National Plan On Drugs. These surveys contain complete information on both individual and family socio-economic characteristics, as well as on some other factors related, for example, to school performance, harmful and healthy habits and the effects of available information on the consequences of illegal drug consumption. All this information was obtained directly from the students surveyed, who anonymously answered a complete questionnaire on drug use. Their parents were not present during the interviews and were not informed about the responses of their children, in this way limiting any underreporting in their responses to illegal drug use or other questions. In this line, we assume that students provide their information honestly. The information was collected in different public and private centres of secondary education and vocational training. To ensure a representative sample, a random selection procedure was used in order to determine the two classrooms by centre where the students were to be interviewed. The response rate was higher than 98.5% in each of the three sample years.

Mean and standard deviations of the variables appear in Table 2. The dependent variables for the two equations of the model are *MarijuanaConsumption* and *SchoolFailure*, with the first indicating whether the student has used marijuana during the last 30 days, and the latter indicating if the student has had to repeat a school year. With respect to the independent variables, we first include physical characteristics (*Gender* and *Age*), the education level of the parents (*StudiesMother*, *StudiesFather*), or the labour situation of the parents (*JobMother* and *JobFather*).[1] We also include the *MonoParental* variable which takes the value 1 if the student lives in a household where either the father or the mother are absent and 0 otherwise. For its part, the *Father* variable takes the value 1 if the student lives with this father, but without his mother, and 0 otherwise. Other variables, such as *Environment,* control for the existence of smokers at home. Similarly, variables such as *Working*, *Income*, *Membership* or *NightOut* try to measure significant aspects in the student's environment, namely whether he/she has a part-time job out of school, the weekly disposable income, the attitude toward membership of associations, or the flexibility of the timetable when the student is allowed to go out at night, respectively. Furthermore, the variables *Information* and *Opinion* capture if the student studies at a school which offers information campaigns on the risks associated with drug consumption, and the degree to which the student considers him/herself to be informed through different channels (parents, friends, school, and so on), respectively. Our set of variables also includes *Utility*, which assesses the usefulness of the information campaigns on the risks of drug consumption, *TobaccoFriends*, which measures the proportion of friends who smoke, *AlcoholAddiction*, which indicates the number of years that have passed since the student consumed alcohol for the first time and, finally, *SchoolFailure%*, which takes values according to the proportion of students that have suffered school failure in each Spanish region.

From a reading of Table 2, we can first appreciate that 17.4% of Spanish students have used marijuana during the last month, although this do not imply that these students are regular consumers of this drug, and, secondly, that 32.7% of sample individuals have had to repeat a school year. With respect to the exogenous variables, 48.3% are male students and the average age of the sample is 15.6 years. Turning to the family environment, we can note that while 94.2% of fathers have a paid job, only 50% of mothers work outside the home. Furthermore, 14% of students live in a house where either the father or the mother are absent, whereas 9.9% live with the father but without the

[1] We have also decided to include as independent variable in the subsequent estimation of the model the *AgeSquared* variable, as is usual in the empirical literature on consumer behaviour. Our objective here is to capture possible non-linear variations in the dependent variable in response to changes in the independent variable, in this case, age. With respect to the education level of the parents, Albert (1996) showed that these two variables are highly correlated in Spain for the case of university education during years prior to our sample period. In these circumstances, we have analysed the possible correlation of our two sample variables for the particular period considered in this paper (1996–2000), obtaining a ratio of 0.43, one that is not sufficiently high enough to accept correlation between them.

Table 2
Variable definitions

Variable	Definition	Mean (std. dev.)
MarijuanaConsumption	This takes the value 1 if the student has used marijuana during the last 30 days and 0 otherwise	0.174 (0.379)
SchoolFailure	This takes the value 1 if the student has had to repeat a school year and 0 otherwise	0.327
Gender	This takes the value 1 if the student is male and 0 if female	0.483 (0.469)
Age	Age of student	15.602 (1.229)
StudiesMother	This takes values according to the mother's studies level (1: no studies, 2: basic school certificate, 3: secondary school certificate; 4: first level of vocational training, 5: second level of vocational training; 6: superior secondary school certificate, 7: University diploma, 8: University degree)	3.571 (2.244)
StudiesFather	This takes values according to the father's studies level (1: no studies, 2: basic school certificate, 3: secondary school certificate; 4: first level of vocational training, 5: second level of vocational training; 6: superior secondary school certificate, 7: University diploma, 8: University degree)	3.954 (2.424)
JobMother	This takes the value 1 if the mother works and 0 otherwise	0.500 (0.500)
JobFather	This takes the value 1 if the father works and 0 otherwise	0.942 (0.234)
MonoParental	This takes the value 1 if the student live without his/her father or mother and 0 otherwise	0.014 (0.119)
Father	This takes the value 1 if the student live with his/her father but without his/her mother and 0 otherwise	0.099 (0.299)
Environment	This takes the value 1 if the student lives with other individuals who smoke and 0 otherwise	0.631 (0.483)
Working	This takes the value 1 if the student has a part-time job out of school hours and 0 otherwise	0.087 (0.282)
Income	The student's available weekly income in constant 2000 Spanish pesetas	2.150 (2.381)
Membership	This takes the value 1 if the student is a member of some association of a political, religious or sports type and 0 otherwise	0.571 (0.495)
NightOut	This takes values according to the hour of returning home after a night out (1: before midnight, 2: between 0 and 1 a.m., 3: between 1 and 2 a.m., 4: between 2 and 3 a.m., 5: between 3 and 4 a.m., 6: after 4 a.m., 7: in the morning of the following day)	3.714 (1.956)
Information	This takes the value 1 if the student studies at a school which has information campaigns on the risks associated with drug consumption and 0 otherwise	0.543 (0.498)
Opinion	This takes values according to the degree to which the student considers him/herself to be informed from different channels: parents, friends, school, and so on, about the consequences of drug consumption (1: if the young person does not consider him/herself to be well informed, 2: if he/she is partially informed, 3: if he/she is sufficiently informed, 4:if he/she is fully informed)	3.117 (0.820)
Utility	This takes values according to the assessment the student makes about information acquired by way of parents, friends, teachers, school campaigns, and so on, about the consequences of drug consumption (1: useless, 2: of limited use, 3: quite useful, 4: very useful)	2.329 (0.747)
TobaccoFriends	This takes values according to the proportion of friends that smoke(0: nobody, 1: someone, 2: the greater part of them, 3: everybody)	1.477 (0.926)
AlcoholAddiction	Number of years since the student consumed alcohol for the first time	2.262 (1.864)
SchoolFailure%	This takes values according to the proportion of students that have suffered school failure in each region	0.327 (0.038)

mother. Another relevant statistic is that a high percentage of students, 63.1%, live with family members who smoke at home. Additionally, 8.7% of the sample students have a paid job, with a weekly income of 2150 pesetas (in constant 2000 values). Finally, only 54.3% of students studied at schools or vocational training centres which offered information campaigns on the risks associated with drug use.

3. The model

When we set out to analyse the relationship between marijuana consumption and school failure, it is first

necessary to take into account that there are common factors which will have an influence on both. Thus, if we propose a regression between the variable that computes drug consumption and that which computes school failure, it is not possible to think that students have been randomly assigned among those who repeat courses and those who pass them. More specifically, we can think about some factors, such a deviance, anti-social behaviour, a deviant peer group and others, which determine both whether the student decides to consume marijuana and whether or not he/she decides to make an important effort to pass the course.

Similarly, if we want to analyse whether school failure has some effect on drug consumption and we propose a regression between the variable which computes this school failure and marijuana consumption, we cannot admit, at least a priori, that this consumption is exogenous, given that the factors cited above, and even others not incorporated in the model because it is not possible to measure them, e.g., intellectual ability, have an influence on both variables. In this way, intellectual ability will have an influence on both school failure and marijuana consumption, since this ability will affect the student's ability to understand, for example, information about the future consequences of drug consumption. As a consequence, it will in turn have an influence on the student's decisions with respect to these goods. If this intellectual ability is not explicitly included in the model, it will pass to the error term and thus we cannot estimate the equation by using ordinary least squares.

All this obliges us to suppose, at least a priori, that both variables, namely school failure and marijuana consumption, are jointly determined, with this being the reason why we develop a simultaneous equation model. In this way, we propose the model considered by Mallar (1977) and estimate it by maximum likelihood following the proposal of Amemiya (1978) in a similar context.[2] This model is particularly appropriate when we are interested in analysing two or more related dichotomic decisions.[3]

We implement the model, in line with Blundell and Smith (1993, Chapter 5), by defining two latent variables, MP* (marijuana consumption predisposition) and SF* (school failure predisposition). The latent model can be written as

$$\mathrm{MC}^* = \gamma_1 \mathrm{SF}^* + \beta_1 X_1 + \varepsilon_1, \tag{1.1}$$

$$\mathrm{SF}^* = \gamma_2 \mathrm{MC}^* + \beta_2 X_2 + \varepsilon_2, \tag{1.2}$$

[2]This simultaneous equation model was subsequently explained in Maddala (1983, p. 246, model 6).

[3]Comprehensive reviews of the different estimation methods applied to these types of models, as well as of the relative performance of the estimators, can be found in Rivers and Vuong (1988) and Blundell and Smith (1993).

where MC* and SF* are two non-observable variables which indicate whether the student consumes marijuana and fails at school, respectively. Moreover, (γ_1, β_1, γ_2, β_2) is the vector of coefficients, X_1 and X_2 include the exogenous variables. We only observe two binary variables, MC and SF:

$$\begin{cases} \mathrm{MC} = 1 & \text{if } \mathrm{MC}^* \geqslant 0 \\ \mathrm{MC} = 0 & \text{otherwise} \end{cases} \quad \text{and} \quad \begin{cases} \mathrm{SF} = 1 & \text{if } \mathrm{SF}^* \geqslant 0, \\ \mathrm{SF} = 0 & \text{otherwise.} \end{cases}$$

Solving the above system for MC* and SF*, and modifying slightly the notation in order to distinguish between variables which appear in the drug consumption equation, in the school failure equation, or in both equations, we obtain the following reduced form:

$$\begin{aligned} \mathrm{MC}^* = [&(\gamma_1\beta'_{21} + \beta_{12})X_{12} + \beta'_{11}X_{11} + \gamma_1\beta'_{22}X_{22} \\ &+ \gamma_1\varepsilon_2 + \varepsilon_1]/(1 - \gamma_1\gamma_2) = X\Pi_1 + v_1, \end{aligned} \tag{2.1}$$

$$\begin{aligned} \mathrm{SF}^* = [&(\gamma_2\beta'_{12} + \beta_{21})X_{12} + \gamma_2\beta'_{11}X_{11} + \beta'_{22}X_{22} \\ &+ \gamma_2\varepsilon_1 + \varepsilon_2]/(1 - \gamma_1\gamma_2) = X\Pi_2 + v_2, \end{aligned} \tag{2.2}$$

where X_{12} includes the explanatory variables which affect both equations, X_{11} is the vector of explanatory variables corresponding to the marijuana consumption equation, X_{22} is the vector of explanatory variables solely for the school failure equation, β_{11} is the vector of coefficients associated with X_{11} in the marijuana equation, β_{12} is the vector of coefficients associated with X_{12} in the first equation, β_{21} is the vector of coefficients associated with X_{12} in the for school failure equation and, finally, β_{22} is the vector of coefficients associated with X_{22} in the same school failure equation.

Because of the joint normality of v_1 and v_2, we have $v_2 = \rho v_1 + \xi$, where $\rho = \sigma_{12}/\sigma_1^2\sigma_2^2 = \sigma_{12}$, which enables us to express the reduced form in the following way:

$$\mathrm{MC}^* = X\Pi_1 + v_1, \tag{3.1}$$

$$\begin{aligned} \mathrm{SF}^* &= X\Pi_2 + \rho v_1 = X\Pi_2 + \rho(\mathrm{MC}^* - X\Pi_1) \\ &= X\Pi + \rho\mathrm{MC}^* + \xi, \end{aligned} \tag{3.2}$$

where $\Pi = \Pi_2 - \rho\Pi_1$.

Given that the two error terms are independent, we can express the likelihood function as

$$\begin{aligned} L = &\prod_{i=1}^{n}[P(\mathrm{MC}^* > 0)^{\mathrm{MC}} P(\mathrm{MC}^* < 0)^{1-\mathrm{MC}}] \\ &\times \prod_{i=1}^{n}[P(\mathrm{SF}^* > 0)^{\mathrm{SF}} P(\mathrm{SF}^* < 0)^{1-\mathrm{SF}}] \end{aligned} \tag{4}$$

i.e., to say,

$$\log L = \sum_{i=1}^{n}(1 - \mathrm{MC}_i)\log(1 - F(X_i'\Pi_1) + \sum_{i=1}^{n}\mathrm{MC}_i \log F(X_i'\Pi_1) + \sum_{i=1}^{n}(1 - \mathrm{SF}_i)\log(1 - F(X_i'\Pi + \rho\mathrm{MC}^*)) + \sum_{i=1}^{n}\mathrm{SF}_i \log F(X_i'\Pi + \rho\mathrm{MC}^*). \quad (5)$$

Given that all elements of matrices Π_1, Π_2, and therefore of Π, can be expressed in terms of the structural parameters, as has already been shown in Eqs (2.1) and (2.2), we have directly estimated the parameters of the structural form by maximum likelihood, instead of estimating the reduced form and then recovering these parameters, with this being the reason because we can obtain estimates of γ_1 and γ_2.

In the maximisation of this equation, we substitute the index MC* for its observed counterpart marijuana consumption, given that we are interested in the effect of marijuana use on school results. In this line, it is obvious that if a student uses marijuana, this will affect his/her mental abilities independent of the latent index value. At the same time, if the student does not use this substance, his/her mental abilities will not suffer any alteration whatever the latent index.

Moreover, in order to control for regional unobservable differences, we introduce dummy variables referred to all the 17 autonomous regions into which Spain is divided, given that their omission could attribute regional characteristic effects to the other exogenous variables. Likewise, we test for exogeneity of habits and peer group variables, i.e., to say, *Membership*, *NightOut, TobaccoFriends, Addiction* and *Utility*. To that end, we have used the Haussman (1978) test,[4] which does not allow us to reject the exogeneity assumption of these variables.

4. Empirical results

Before considering the empirical results, let us first describe the identification requirements of the model. In this regard, our identification strategy consists of including two variables in the MarijuanaConsumption equation (*Information* and *TobaccoFriends*) and another two different variables in the SchoolFailure equation (*SchoolFailure%* and *Working*). With respect to the first equation, Table 3 shows that the *Information* variable, which reflects the existence of information campaigns about the harmful consequences of drug use in the school environment, is included after assuming that the information provided about the consequences of drug consumption will not have direct effects on school performance, save those by means of the relationship between drug use and school results. Here, we find evidence supporting the idea that the mounting of information campaigns about the risks of drug use tends to reduce the number of students who actually decide to consume. Additionally, by way the *TobaccoFriends* variable, we have also included information on whether the student has friends who are smokers, bearing in mind that the consumption of tobacco is a widespread habit which does not reduce the mental ability of students, in this way assuming that it has no effect on school performance. Our results indicate that the percentage of marijuana smokers is higher among students who have smoker friends.

With respect to the second equation, the two identification variables are *SchoolFailure%* and *Working*. The first indicates the percentage of students in the region that have repeated the course, reflecting the different levels of scholastic requirements that could be imposed in each region. Here, we can adduce evidence that those students who live in areas with a higher school failure rate themselves have a higher probability of failing in their studies. As regards the second, this indicates whether or not the student has a part-time job. We assume that this variable, once disposable income is introduced in the estimation, has little or no effect on the consumption equation, but has a clear effect on the school failure equation, given that the time available for study differs depending on the work status of the student. Our estimations indicate that if students have a part-time job, then the probability of them failing in their studies is again higher.

With respect to the remaining parameters from the maximum likelihood estimation, we are primarily interested in the coefficients on marijuana consumption status and school failure variables and, in this regard, a first comment should be directed to the causal relationship between school failure and marijuana consumption. As we can see, the results confirm that marijuana consumption is positively related with the probability of school failure, whereas we do not find evidence in the opposite direction, i.e., to say, a situation of school failure does not increase the probability of marijuana consumption.

The positive sign that appears in the correlation coefficient indicates the existence of unobserved factors

[4]The test consists of two steps. In the first, the habits and identification variables are estimated by maximum likelihood probit estimation using as explanatory variables the other variables in the model plus a number of additional variables that allow us to identify the equations. In the second step, the fitted variables are added to the model and a *F*-statistic test was computed. We obtain values 1.52 and 1.61 for the *F*-test in the first and second equation, respectively.

Table 3
Maximum likelihood estimates

	MarijuanaConsumption	SchoolFailure
SchoolFailure	−0.038	—
	(−0.227)	—
MarijuanaConsumption	—	0.512***
	—	(11.378)
Intercept	−13.229***	4.532
	(−6.222)	(1.508)
Gender	0.365***	0.213***
	(5.115)	(7.638)
Age	1.274***	−1.409***
	(4.296)	(−3.877)
AgeSquared	−0.039***	0.062***
	(−3.595)	(5.454)
StudiesMother	0.004	−0.087***
	(0.229)	(−11.470)
StudiesFather	0.026***	−0.067***
	(2.367)	(−9.774)
JobMother	0.094***	0.046*
	(3.112)	(1.765)
JobFather	0.054	−0.044
	(0.819)	(−0.691)
MonoParental	0.099*	0.114**
	(1.699)	(2.076)
Father	−0.006	0.133
	(−0.050)	(1.066)
Environment	0.131***	0.212***
	(2.503)	(8.050)
Income	0.106***	0.000
	(6.940)	(−0.015)
IncomeSquared	−0.005***	0.001
	(−6.895)	(1.049)
Membership	−0.086***	−0.069***
	(−2.794)	(−2.682)
NightOut	0.103***	−0.015*
	(10.720)	(−1.702)
AlcoholAddiction	0.088***	−0.015***
	(9.714)	(−2.483)
Utility	−0.132***	0.201***
	(−4.896)	(11.746)
Opinion	0.094***	0.056***
	(3.976)	(3.405)
T96	−0.202***	0.119***
	(−6.873)	(4.040)
T98	−0.095***	−0.003
	(−2.657)	(−0.083)
Information	−0.076***	
	(−3.059)	
TobaccoFriends	0.516***	
	(31.306)	
SchoolFailure%		5.074**
		(2.068)
Working		0.221***
		(5.652)
ρ	0.207***	
	(7.159)	
Number of observations	16,341	
Wald[a]	12,083.29***	

t-statistics appear in parentheses.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.
[a]79 parameters (47 in the table plus 32 corresponding to the 16 regional dummies in every equation).

correlated with both reduced forms, although this does not necessarily imply that the error terms of the structural form are correlated. Moreover, we have obtained the Wald test in order to check the joint significance of the model, with the result being that this significance cannot be rejected at the 1% level.

Let us now turn to the influence of the remaining variables on the marijuana consumption and school failure relationship, first considering the effect of physical, education and social variables on the probability of both marijuana consumption and school failure.

Starting with physical characteristics, we can note that male students are more likely to consume marijuana than their female counterparts, and that the former group has a higher rate of school failure. Furthermore, we can observe an increase in the probability of drug consumption and of repeating a school year as the age of the student increases. This reflects the fact that as the student grows older, the probability of consuming marijuana increases. Having said that, this increase is non-linear; more particularly, it is less than proportional, as can be derived from the joint consideration of the coefficients which accompany the *Age* and *Age-Squared* variables.

With respect to the educational level of the parents, these have been traditionally used as proxies of social status or economic well-being. In this sense, we can observe that there is a clearly negative relationship between these variables and the probability of repeating the school year. Thus, the results suggest that parents with a higher level of education offer more learning support to their children and exercise greater control over it. However, the positive and significant coefficient associated to the *StudiesFather* variable suggest that marijuana consumption among students is widespread in families with a good economic and cultural situation. On the other hand, the employment status of the father has no significant effect on either of the two equations. However, the fact that the mother has a job increases the probability that her student children will consume marijuana and fail in their school studies.

Another group of variables reflects family composition. Here, we have detected the significant effect of the mono-parental situation with respect to both marijuana consumption and school failure. Thus, students in a one parent family are more likely to use marijuana and to have worse results at school. We have also introduced the *Father* variable in order to control for some possible differences between the mono-parental family being headed by the father or by the mother, although the non-significant coefficient which accompanies this variable indicates that there are no differences between the two situations. In addition, we have found that students who live with smokers at home have a higher probability both of being marijuana consumers and of suffering low levels of education achievement.

With respect to the effect of disposable income, we can appreciate that the percentage of marijuana users increases with income, confirming that this consumption is sensitive to income variations. However, we find that the income variable does not have a significant effect on the *SchoolFailure* variable.

We have similarly included two variables related to the social habits of students. The first, *Membership*, indicates that the percentage of young people who smoke marijuana and have to repeat a school year is lower among those who belong to an association. On the other hand, we have also found that although students who habitually spend their free time in bars and clubs, *NightOut*, show a higher probability of smoking marijuana, the coefficient which accompanies this variable in the second equation has a negative sign and is significant at the 90% confidence level.[5]

Moreover, the results show that the percentage of marijuana smokers is higher among students who have consumed alcohol for a longer period of time and it is lower among those who consider that the information received about the risks associated with drug consumption is useful, with these variables having the opposite sign in the school failure equation. Moreover, our results also reveal that young people who consider themselves to be better informed actually present a higher rate of marijuana users and of students who have to repeat the school year, which would appear to suggest that such individuals might well be underestimating the risks of drug consumption and do not believe that marijuana smoking is addictive. This could be because they have a high rate of time preference which leads them to postpone unpleasant decisions, such as abandoning drug use and starting to study seriously in order to pass their exams.

5. Conclusions

The aim of this paper has been to analyse the interdependencies between marijuana consumption and school failure for a representative sample of Spanish students. To that end, we have used maximum likelihood to estimate a simultaneous equation generalized Probit model employing data drawn from the Spanish Surveys on Drug Use in the School Population (1996, 1998 and 2000).

Our main result suggests that while marijuana use has a positive and significant effect on school failure, there is

[5]This result is not unusual for the student population in Spain, given that the habit of going out at night is very widespread among the student population. In this sense, this habit is common to both good and bad students alike.

no influence in the opposite direction. Thus, apart from the physical consequences of marijuana consumption, this central finding adds weight to the argument that drug consumption influences academic performance, in such a way that school years have to be repeated. This would appear to indicate that policies aimed at reducing marijuana use among the student school population will also have an effect on their educational achievement. However, our results also point to the fact that marijuana consumption is so widespread that it effects both good and bad students alike. As a consequence, such policies should be oriented towards the complete student population and not simply concentrate on the risk group of students with low school achievement.

Furthermore, the estimations support the idea that the higher the studies level of the parents, the lower the probability of exam failure on the part of their student offspring.

We have also found evidence that the mounting of information campaigns at school or vocational training centres on the risks of drug use reduces the proportion of student marijuana smokers. By contrast, young people who consider themselves to be better informed actually tend to consume this substance with a higher probability, suggesting that the opinion the young person has of the information is just as important as the information itself.

Our results also support both *Gateway Theory* and peer group influence, showing that the previous consumption of legal drugs over a significant period of time increases the probability of marijuana consumption. All this suggests that this consumption is a "social activity" for this age-group, given that the probability of using this drug is higher among those students whose friends are also users. As a consequence, policies employed in the war against illegal drug among students should reflect this particular circumstance and should be orientated towards both school and free-time activities, times when students are immersed in their peer group.

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