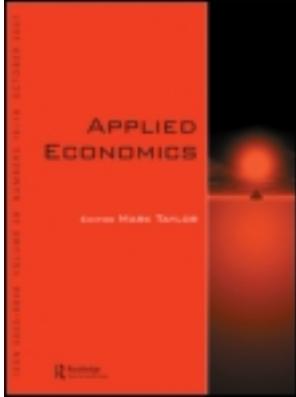


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Human development and alcohol abuse in adolescence

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The aim of this article is to analyse the development of human capital in adolescents, as represented by their state of health and educational attainment, when this capital is affected by the abusive consumption of alcohol measured by grams of ethanol. To that end, we adopt a theoretical framework derived from the Model of Rational Addiction, the Model of Health Demand and the Model of Schooling Demand, which is then estimated by using data drawn from the Spanish National Survey on Drug Use in the School Population (1996, 1998, 2000). Results confirm that higher alcohol consumption leads to worse health states and lower academic efficiency among adolescents, which suggests the need to implement effective policies aimed at reducing alcohol abuse among this population group.

I. Introduction

Nowadays it is increasingly appreciated that the wealth of a country is not measured merely in economic terms, but also includes three more, and different, forms of capital, namely, social, natural and human, with a rich society being considered as one that reaches high levels in all four. From among these, in this article we focus on the development of human capital, specifically among the adolescent population, when this is affected by the abusive consumption of alcohol.

In this line, it is well-known that adolescents represent the most sensitive population group in terms of tendencies, peer pressure or, in general, external effects. Thus, while these young people have yet to develop their own identity, they are more vulnerable to the risks of, among other things, experimenting with drugs. More particularly, although moderate alcohol consumption is not socially rejected in most developed countries, the

consequences of taking this to abusive levels are nevertheless serious and wide ranging, in the form, for example, of illness, traffic fatalities or social conflicts. Some of these consequences, which directly influence the development of the adolescents' human capital, in the form of poor health or inadequate educational achievement, are not perceived immediately by the individual. Rather, their impact only emerges years later, as the consequence of an addictive and abusive pattern of consumption that exhibits the characteristics of tolerance and reinforcement.

Against this background, in this article we study the development of human capital among the adolescent population, with this being represented both by state of health and educational achievement, when such capital is affected by the abusive consumption of alcohol. One of the novel aspects introduced in this study, at least to the best of our knowledge, is that we measure this consumption by the grams of ethanol that the adolescent ingests, with

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the underlying idea being that such an indicator clearly allows for the fact that a glass of a strong liquor will have a greater influence on human capital than the equivalent glass full of, for example, a fruit-based liquor. The second novel feature is that we offer a detailed consideration of both the state of health and educational achievement of the adolescent. Here, our argument is that these two factors jointly characterize the human capital of the adolescent in the individual decision process.¹

In order to carry out this analysis, we adopt a theoretical framework which supposes the simultaneous application of the Model of Rational Addiction of Becker and Murphy (1988), the Model of Health Demand of Grossman (1972) and the Model of Schooling Demand of Cook and Moore (1993). The principal hypothesis infers that adolescents decide about their abusive consumption of alcohol taking into account that this will have a repercussion on their addiction stock, as well as a depreciation rate on both their health state and their educational achievement. The model that emerges from this theoretical framework has four equations that are estimated in three stages. The first of these includes the alcohol consumption, as well as a measure of the academic effort made by the adolescent to increase his/her education level. These estimations are then used in the second stage to estimate the individual's state of health, and, finally, in the third stage, we estimate an indicator of the individual's educational achievement taking into account the previous estimations. We apply this proposed model by using data drawn from the Spanish National Survey on Drug Use in the School Population (1996, 1998, 2000). Our empirical results will hopefully allow us to derive a better understanding of the reality of the effects of alcohol abuse on the human capital development of adolescents, which must represent the appropriate starting point when seeking to achieve the goal of increasing this capital.

The rest of the article is organized as follows. In Section II, we specify the theoretical framework. Section III, is dedicated to describing the data and the econometric model. The empirical results are considered in Section IV and, finally, Section V closes the article with a summary of the most relevant conclusions and policy implications.

II. Theoretical Framework

According to the results obtained by Gruber (2001), we consider that adolescents maximize myopically their utility function. That is to say, they do not foresee the implications of their present consumption for when they become adults, given that they only take into account their time horizon as adolescents. Thus, the individual utility function is characterized by $U = U(C(t), Z(t), S(t), V(t), H(t), E(t), t)$, where C is the addictive substance consumption, Z the consumption of other goods and services, S the addiction stock, V the academic effort made by the adolescent to increase his/her education level, H the state of health and E the maximum education level reached by the individual. The utility is valued at the present moment by the temporal discount rate $e^{-\rho t}$, with this allowing us to discount the utility of subsequent periods at an increasing rate. For the sake of operational simplicity, we consider that each adolescent has the same discount rate.

The addiction and formation of human capital models are introduced in the following way. According to the Model of Rational Addiction of Becker and Murphy (1988), we define the temporal path of the addiction stock, $\dot{S} = \partial S / \partial t$, as $\dot{S} = C(t) - \delta S(t)$, in such a way that this stock is discounted by the depreciation rate δ . Similarly, when considering the Model of Health Demand of Grossman (1972), the health state formation is characterized by $\dot{H} = I(t) - \gamma(C(t), t)H(t)$, where the temporal path of the health state $\dot{H} = \partial H / \partial t$, is equal to the investment carried out I , discounted by its depreciation, whose rate γ depends on the addictive substance consumption. As regards the educational achievement, we follow the Model of Schooling Demand of Cook and Moore (1993), according to which the education level is described by $\dot{E} = V(t)r(H(t), t)$, where the temporal path of that level $\dot{E} = \partial E / \partial t$ is equal to the product of intellectual effort and scholastic efficiency r , which depends on the state of health.

Moreover, we introduce the budget restriction, in such a way that when the adolescent decides about the goods and services that maximize his/her utility, that adolescent is subject to limited economic resources. This restriction adopts the following form: $Y(t) = P_C(t)C(t) + P_Z(t)Z(t)$, where Y represents the

¹ Although we have recently witnessed a significant increase in the number of articles dedicated to studying the negative relationships between the human capital of adolescents and their abusive alcohol consumption, the majority of these are focused on only one form of human capital, e.g. health state (Keng and Wallace, 1999; Dee, 1999; Levy, 2000; Bonomo *et al.*, 2001; Lakdawalla *et al.*, 2001) or educational achievement (Mullahy and Sindelar, 1989, 1994; Cook and Moore, 1993; Yamada *et al.*, 1996; Koch and Ribar, 2001; Dee and Evans, 2003; Williams and Wechsler, 2003).

adolescent's available money per week, and P_C and P_Z the prices of the goods C and Z , respectively.

Joining all these elements, we define the generic theoretical model as maximizing the utility function $U = U(Z(t), C(t), S(t), H(t), V(t), E(t), t)$ at its current value, subject to restrictions: $\dot{S} = C(t) - \delta S(t)$, $\dot{H} = I(t) - \gamma(C(t), t)H(t)$, $\dot{E} = V(t)r(H(t), t)$ and $Y(t) = P_C(t)C(t) + P_Z(t)Z(t)$.

To obtain a system that characterizes our model, we specify an instant utility function which is quadratic in its elements $((C(t) - S(t)), Z(t), V(t), H(t), E(t))$. Furthermore, we assume that this function has positive first derivatives and that it is concave with negative second derivatives. The main advantage of such a form is that we can model the negative impact of the addictive goods consumption through an increase in the addiction stock. Similarly, the academic effort made by the adolescent implies an increase in the utility which is every time lower, in such a way that:

$$U(t) = \alpha_1(C(t) - S(t))^2 + \alpha_2 Z^2(t) + \alpha_3 \left(\frac{1}{V(t)}\right)^2 \alpha_4 H^2(t) + \alpha_5 E^2(t) \tag{1}$$

thereby making the calculations more straightforward.

Apart from the utility function, it is also necessary to specify the depreciation rates of both the academic effort and the health state. Whilst the first increases when the health state improves, $r(H(t), t) = \omega_3 + \omega_4 H(t)$, the second increases when there is higher alcohol consumption, that is to say, $\gamma(C(t), Z(t), t) = \omega_1 + \omega_2 C(t)$. The values of $r(t)$ and $\gamma(t)$ are limited between 0 and 1. The closer r is to 1, the higher will be the individual's academic productivity, while the closer γ is to 1, the more rapid will be the depreciation of the health state.

To solve the maximization problem, we use Optimal Control theory, which requires that the Lagrangian fulfils a number of conditions, in such way that, at each moment in time t , the Lagrangian depends only on the value of the variables corresponding to that moment. In order to built it, we first define the following Hamiltonian:

$$H^s = e^{-\rho t} U + \lambda^s(t)[C(t) - \delta A(t)] + \mu^s(t)[I(t) - \gamma^s(C(t), Z(t), t)H(t)] + \eta^s(t)[V(t)r_i(H(t))]$$

and then multiply it by the inter-temporal discount rate: $H = e^{\rho t} H^s$, that is to say, $\lambda(t) = e^{\rho t} \lambda^s(t)$, $\mu(t) = e^{\rho t} \mu^s(t)$, $\eta(t) = e^{\rho t} \eta^s(t)$. Having reached this point, we obtain the Lagrangian adding the budget restraint and the corrected Lagrange multiplier:

$$L = H + \beta \left[I_0 - \int_0^T e^{-rt} [Y(t) + P_C(t)C(t)] dt \right]$$

from which maximization we obtain the following first order conditions:

$$U_C(t) + \lambda(t) - \mu(t)\gamma_C(t)H(t) - \beta P_C(t) = 0$$

$$U_Z(t) - \beta P_Z(t) = 0$$

$$U_V(t) + \eta(t)r(t) = 0$$

$$\mu(t) = \int_t^T e^{\int_t^\tau (\rho + \gamma(\tau)) d\tau} (U_H(\tau) + \pi(\tau)V(\tau)r_H(\tau)) d\tau$$

$$\lambda(t) = \int_t^T e^{(t-\tau)(\rho + \delta)} U_s(\tau) d\tau$$

$$\eta(t) = \int_t^T e^{(t-\tau)\rho} U_E(\tau) d\tau$$

$$Y(t) = P_C(t)C(t) + P_Z(t)Z(t)$$

which, in turn, allow us to derive the demand equations for both alcohol and for other goods and services, as well as the academic effort equation $(C(t), Z(t), V(t))^2$:

$$C(t) = C(C(0, .., t - 1, t + 1, .., T), Z(t + 1, .., T), V(0, .., t - 1), P_C(t), P_Z(t), I(0, .., t), \rho) \tag{2}$$

$$Z(t) = Z(C(0, .., t - 1, t + 1, .., T), Z(t + 1, .., T), V(0, .., t - 1), P_C(t), P_Z(t), I(0, .., t), \rho) \tag{3}$$

$$V(t) = V(C(0, .., t - 1, t + 1, .., T), Z(t + 1, .., T), V(0, .., t - 1), P_C(t), P_Z(t), I(0, .., t), \rho) \tag{4}$$

At this point, we are also able to calculate the optimal value of the health state and, thereafter, the optimal value of the educational achievement:

$$H(t) = \int_0^t e^{\int_t^\tau (\omega_1 + \omega_2 C(\tau)) d\tau} I(\tau) d\tau \tag{5}$$

$$E(t) = \int_0^t V(\tau)(\omega_3 + \omega_4 H(\tau)) d\tau \tag{6}$$

² We have used Mathematica 4.0 in order to solve this optimization problem. All the detailed expressions derived from this resolution are available from the authors upon request.

III. Data and Econometric Specification

We have drawn samples of 18 830, 16 558 and 18 264 individuals corresponding to the years 1996, 1998 and 2000, respectively, from the Spanish National Survey on Drug Use in the School Population. We have only considered those adolescents whose ages fall between 14 and 18, inclusive, and who have provided coherent answers to all the questions necessary in order to specify the model.

As stated earlier, in this article we measure alcohol consumption by the grams of ethanol that the adolescent ingests. This idea of introducing the ingestion of ethanol, instead of the number of alcoholic drinks, is due to the fact that we can thereby easily control for the influence of alcohol over the individual's organism. For instance, the influence of strong liquor will be greater than that of fruit-based liquor, given that the first has double the number of grams of ethanol than the second (Table 1). Additionally, this indicator allows us to homogenize the different drinks, given that if this was not the case, we would have to pay attention to all kinds of drinks. This would have supposed the carrying out of six independent estimations, one for each main group (wine, beer, vermouth, cocktail, fruit-based liquors and strong liquors), which would undoubtedly have made the understanding of the results much more difficult.

As regards the price of alcoholic drinks, we used the corresponding Harmonized Consumer Price Index (HCPI) calculated by the Spanish National Statistical Institute, given that this is a statistical measure which summarizes the evolution of the acquisition capacity of the resident population in Spain to buy alcoholic drinks.

However, before estimating the model, we will first offer some prior descriptive statistics which provide an indication of the scale of alcohol abuse among adolescents in Spain. Mean and SDs of the variables for the total sample appear in Table 2. As regards the dependent variables, we can first note that the consumption of alcohol, *AlcoholConsumption*, among Spanish adolescents is extremely high, with 83.7, 85.0 and 76.1% of the sample adolescents having consumed alcoholic drinks in 1996, 1998 and 2000, respectively. For its part, academic effort is measured by the *SchoolAbsence* variable, with this informing us about school absences on the part of the adolescent. The third of the dependent variables, *HealthState*, which reflects the percentage of adolescents who themselves recognize that they have suffered from

Table 1. Ethanol grams per habitual alcoholic drink

Alcoholic drink	Ethanol grams per drink
Glass of wine/champaign	15
Glass or bottle of beer	11
Vermouth	21
Glass of fruit-based liquor	24
Glass of strong liquor/cocktail	48

health problems as a result of alcohol consumption, is similarly worrying, in that it shows an increase from 7.4% in 1996 to 11.5% in 2000. Finally, through the *SchoolFailure* variable, we have measured the educational achievement of the adolescent by the percentage of students who have had to repeat the academic year. In this case, the variable improves slightly over the sample period, with the repeat rate falling from 34.1% in 1996 to 31.4% in 2000, although nevertheless remaining disturbingly high.

With respect to the exogenous variables, the individual and family characteristics reveal that 51.8% of the adolescents sampled are females and that the average age of the entire sample is 15.6 years. Continuing with these characteristics, we can note that 88.8% of the students live with both parents and that whereas 87.9% of the fathers work, only 48.7% of the mothers do. If we focus on the mothers' education level, 51.1% of them have a level equal or inferior to High School. Furthermore, we can note that 35.7% of the adolescents interviewed attend private schools and that only 90.2% of them are attending secondary school. Spanish youths do not usually split their time between studies and employment of some form, with it being confirmed that just 8.3% of them work. Most go out with friends on Saturday nights, returning home, on average, after midnight. Only 41.1% of these young people practice some type of sport in their leisure time. Alongside the generalized consumption of alcoholic drinks, the percentage of students who smoke is also a worryingly high, 41%. What it more, these teenagers have been drinking alcoholic beverages for 2.1 years and, a consequence of having drunk without control, some 14% of them have been involved in disputes. A total of 48.2% of adolescents interviewed have attended discussions on the dangers of drug consumption, valuing these sessions, on average, as useful or very useful. As regards monetary variables, the available money that the adolescents have per week is around

Table 2. Descriptive analysis

Variable	Codification	Mean (SD)
Dependent variables		
<i>AlcoholConsumption</i>	Grams of ethanol consumed during the week by the adolescent	175.9590 (441.1282)
<i>SchoolAbsence</i>	This takes the value 1 if the adolescent is absent but with justification and 2 otherwise	1.0410 (0.1992)
<i>HealthState</i>	This takes the value 1 if the adolescent does not have health problems related to alcohol consumption and 2 otherwise	1.0920 (0.2890)
<i>SchoolFailure</i>	This takes the value 1 if the adolescent has not repeated any school year, 2 if has repeated one, and 3 if more than one	1.4032 (0.6291)
Independent variables		
Area	This takes values according to the residential area (1 North; 2 Centre; 3 East; 4 Madrid; 5 South; 6 Islands)	2.9911 (1.6398)
Gender	This takes the value 1 if the adolescent is male and 2 if female	1.5189 (0.4996)
Age	Year of birth of adolescent	15.6218 (1.2271)
Accommodation	This takes the value 1 if the adolescent lives with both parents, 2 if with only one and 3 with neither	1.1285 (0.3812)
FatherWork	This takes values according to the labour situation of the father (1 work; 2 domestic work; 3 unemployed; 4 pensioner; 5 otherwise)	1.3773 (1.0572)
MotherWork	This takes values according to the labour situation of the mother (1 work; 2 domestic work; 3 unemployed; 4 pensioner; 5 otherwise)	1.5974 (0.7152)
MotherEducation	This takes values according to the education level of the mother (1 if she has no studies; 2 Basic School Certificate; 3 Standard School Certificate; 4 Vocational Training/Higher School Certificate; 5 Univ. Degree; 6 Unknown)	3.5984 (1.7302)
School	This takes the value 1 if the school the adolescent attends is state and 2 if it is private	1.3570 (0.4791)
SecondarySchool	This takes the value 1 if the adolescent attends secondary school and 2 otherwise	1.0981 (0.2974)
Work	This takes the value 1 if the adolescent does not work and 2 if the adolescent works	1.0835 (0.2767)
ReturnHome	This takes values according to the return home timetable (1 before 12 p.m.; 2 between 12–1; 3 between 1–2; 4 between 2–3; 5 between 3–4; 6 after 4; 7 next day)	2.7442 (1.9382)
Sport	This takes the value 1 if the adolescent does not practice any sport and 2 otherwise	2.4117 (1.4109)
Smoker	This takes the value 1 if the adolescent is a smoker, 2 if an ex-smoker and 3 if he or she has never smoked	2.1794 (0.9538)
DrinkingYears	Number of years drinking alcohol	2.4635 (2.1387)
Disputes	This takes the value 1 if the adolescent has not taking part in disputes after drinking alcohol and 2 otherwise	1.1404 (0.3474)
DrugDiscussion	This takes the value 1 if the adolescent has not attended a drug discussion group at school and 2 otherwise	1.36981 (0.4827)
InformationValuation	This takes values according to the valuation of drug information (1 very useful; 2 useful; 3 not very useful; 4 useless; 5 adolescent has no opinion)	2.48705 (1.5310)
Money	Amount of money that the adolescent has available per week (in Euros)	12.6576 (14.2811)
AlcoholPrice	HCPI alcoholic drinks	131.5425 (11.3511)
Year 1996	This takes the value 1 if the adolescent has been interviewed in 1996 and 0 otherwise	0.3509 (0.4772)
Year 1998	This takes the value 1 if the adolescent has been interviewed in 1998 and 0 otherwise	0.3086 (0.4619)
Year 2000	This takes the value 1 if the adolescent has been interviewed in 2000 and 0 otherwise	0.3404 (0.4738)

Table 3. Estimation results

Variables	<i>AlcoholConsumption</i>		<i>SchoolAbsence</i>		<i>HealthState</i>		<i>SchoolFailure</i>	
Constant	176.6243***	(3.8496)	0.9425***	(42.6426)	-0.0465	(-0.9971)	-3.4650***	(-39.0164)
Area	-9.1390***	(-7.3259)	0.0046***	(7.7218)				
Gender	-66.8240***	(-18.7908)	-0.0116***	(-6.8055)	-0.0012	(-0.5083)	-0.0668***	(-13.7470)
Age	-6.0681***	(-3.7461)	0.0005	(0.6916)	-0.0050***	(-4.5878)	0.2193***	(101.6768)
Accommodation							0.0697***	(11.3420)
FatherWork	4.2414***	(2.5330)	0.0048***	(5.9583)				
MotherWork					-0.0034**	(-2.0445)	0.0112***	(3.4242)
MotherEducation							-0.0030**	(-2.2310)
School							-0.0973***	(-19.2745)
SecondarySchool							0.2306***	(28.0700)
Work	62.9133***	(9.5861)	0.0206***	(6.5325)				
ReturnHome	38.0916***	(36.2633)	0.0062***	(11.8607)				
Sport					0.0125***	(12.1616)		
Smoker					-0.0254***	(-17.8744)		
DrinkingYears	43.9751***	(48.3485)	0.0076***	(17.5363)				
Disputes					0.1520***	(41.8048)		
DrugDiscussion					0.0062*	(1.8593)		
InformationValuation	8.7016***	(7.1517)	0.0034***	(5.9317)				
Money	0.0001***	(17.6583)	0.0001***	(11.4955)				
AlcoholPrice	-1.1254***	(-4.3632)	0.0001	(1.1427)				
Year 1996	7.5400	(1.1376)	-0.0107***	(-3.3769)	-0.0149***	(-4.3677)	-0.0358***	(-6.0206)
Year 1998	100.504***	(16.2357)	-0.0089***	(-3.0053)	-0.0131***	(-3.1801)	-0.0130**	(-2.2036)
<i>AlcoholConsumption</i>					1.0350***	(22.0557)		
<i>SchoolAbsence</i>							0.7339***	(6.7375)
<i>HealthState</i>							0.5396***	(14.2925)

Notes: Asymptotic *t*-statistics in parenthesis.

***Indicates individual significance at the 1% level.

**Indicates individual significance at the 5% level.

*Indicates individual significance at the 10% level.

12.5€, whereas the HCPI of the alcoholic drinks is, on average, 131.5.

Turning now to the specification of the econometric model, we adopt a three-stage estimation method and start by first estimating both alcohol consumption and academic effort³:

$$C(t) = \alpha_0 + \alpha_1 C(t-1) + \alpha_2 X_1(t) + \alpha_3 Y(t) + \alpha_4 P_C(t) + \alpha_5 I(t) + u_1(t) \quad (7)$$

$$V(t) = \beta_0 + \beta_1 C(t-1) + \beta_2 X_1(t) + \beta_3 Y(t) + \beta_4 P_C(t) + \beta_5 I(t) + u_2(t) \quad (8)$$

where $X_i(t)$, $i=1, 2$ and 3 represents the individual and family characteristics.

In the second stage, we calculate the state of health, introducing the estimation of alcohol consumption in the equation:

$$H(t) = \gamma_0 + \gamma_1 C(t) + \gamma_2 X_2(t) + \gamma_3 I(t) + u_3(t) \quad (9)$$

We conclude with the estimation of the educational achievement, measured in terms of the *SchoolFailure* variable, taking into account the previous estimations of the health state and the academic effort:

$$E(t) = \lambda_0 + \lambda_1 H(t) + \lambda_2 V(t) + \lambda_3 X_3(t) + u_4(t) \quad (10)$$

IV. Empirical Results

For an appropriate presentation of the estimation results (Table 3), we maintain the order established in the theoretical and empirical frameworks. Thus, we first explain the estimations corresponding to the first stage, that is to say, the *AlcoholConsumption* and *SchoolAbsence* variables, then continue with the *HealthState* variable and, finally, conclude with the *SchoolFailure* variable. However, before describing

³ Following Keng and Wallace (1998), in the specification of the econometric model, we have omitted those lagged endogenous variables whose presence may give rise to multicollinearity.

the individual results, we should draw attention to the very acceptable significance levels shown by almost all the exogenous variables.

Beginning then with the *AlcoholConsumption* variable, the table reveals that in the north and centre of Spain, adolescents tend to consume more alcoholic drinks than those resident in the south and the Islands. Furthermore, young males would appear to ingest more grams of ethanol than their female counterparts. As regards age, the older the individual, the lower the quantity consumed, with this being clear in the way that lack of experience powers greater consumption without control. With respect to the family labour situation, it emerges that if the father is working, then the adolescent ingests a lower quantity of ethanol per week, with the contrary being the case if the adolescent works. As regards permissive family attitudes, the later the adolescent is allowed to return home after a night out, the greater the quantity demanded on his/her part. We can also observe that if there is an increase in the number of periods in which alcohol is consumed, then the volume of alcohol ingestion will increase, given this addictive goods' characteristics of tolerance and reinforcement. As regards the way in which the adolescent values available information on drug consumption, we can appreciate that if the adolescent does not find it valuable, then he/she will ingest a larger quantity of ethanol. The monetary variables have an expected impact, in such a way that alcohol consumption is positively correlated to the money available to the adolescent, and negatively to the prices of alcoholic drinks.

With respect to the second variable, *SchoolAbsence*, we should first recall that this is measured by the adolescent's absence from school. In this regard, it emerges that the fact of being resident in the north and centre of Spain appears to reduce the tendency of being absent from school when compared to residents in the south and the Islands. We also appreciate that female adolescents are absent from school on a fewer number of occasions than their male counterparts, and that the older the individual, the fewer the absences. With respect to the family labour situation, if the father is working, then the adolescent has a lower tendency of unjustified absence from school, although the contrary is the case if the adolescent works. In relation to permissive family attitudes, the later the adolescent is allowed to return home after a night out, the greater is the tendency for absence from school. We can also observe that if there is an increase in the number of periods in which alcohol is consumed, then the tendency of being absent increases. As regards the way in which the individual values anti-drug

information, we can observe that if the adolescent does not find it valuable, then he/she will have a greater tendency towards school absence. With respect to the impact of available money that adolescents have per week and the price of alcoholic drinks, we find that these are positively correlated to the tendency of being absent from school. Finally, it is interesting to note that this tendency seems to increase in 2000 as compared to earlier periods.

When estimating the second stage, we measure the *HealthState* variable through a dichotomous variable that indicates whether the adolescent has suffered an accident, such as abrasions, falls or traffic accidents, after consuming alcohol. We can see that adolescent females suffer fewer accidents than their male counterparts, and the older the individual is, the greater will be the tendency of having suffered an accident. Analysing the mother's employment, we can observe that if the mother works, then the health state of her adolescent offspring is worse. As regards leisure, note particularly that practicing sport is positive for the state of health and, in contrast, that smoking or being involved in social conflict increases the tendency of suffering an accident. When considering the effect of having been informed about drugs at school, we can note that these campaigns are not very effective, in that they do not appear to reduce the number of accidents related to alcohol consumption. The state of health seems to worsen with the passage of the time, and finally, our first hypothesis is validated when we observe that if the adolescent consumes more grams of ethanol, the probability of suffering accidents significantly increases.

Concluding with the estimation of the *SchoolFailure* variable, we focus on whether the adolescent has had to repeat an academic year. When considered by gender, we can note that adolescent females achieve better results than their male counterparts, given that they have a lower propensity to fail the academic year. As regards age, the older the individual is, the greater will be the tendency of failing the academic year. The family situation has a clear repercussion on academic productivity, given that if the adolescent lives with both parents, then he/she has a lower tendency to repeat. On the other hand, considering the characteristics of the mother, we find that if she works, this will negatively affect the academic performance of her adolescent offspring and that, in contrast, her own academic level has a positive effect on this performance. Attending a private school or being registered at a state secondary school apparently reduces the tendency to repeat an academic year. The number of adolescents who are required to repeat also seems

to increase with the passage of the time. Finally, our second hypothesis would appear to be validated, as we can observe that the worse the individual's state of health and the greater the number of school absences, the higher the probability of having to repeat an academic year.

V. Conclusion and Policy Implications

In this article, we have focused on the effects of alcohol consumption on the development of human capital among the adolescent population when this capital is measured both by state of health and academic achievement. To that end, we have drawn on data from the Spanish National Survey on Drug Use in the School Population (1996, 1998, 2000). On the basis of our results, our most generalized conclusion is that higher alcohol consumption leads to worse human capital development among this population group.

The reality underlying this conclusion is a worrying one. Alcohol consumption among Spanish adolescents is high. More particularly, we have found that adolescent males abuse alcohol more than their female counterparts, are more frequently absent from school without justification and have a higher tendency to fail the academic year. Perhaps of greatest concern is the fact that when analysing the temporal evolution, we found that, with the passage of time, both male and female adolescents exhibit more health problems and have to repeat the academic year more often.

Turning now to policy implications, and in the light of the aforementioned increase in unjustified school absences and health problems, we have to question whether the current range of health and academic goods and services offered by the public sector are the most suitable for modern-day Spanish adolescents. In this sense, we should also recall that, whilst these goods and services are provided by the State, that does not mean that they are free.

Having said that, and despite the fact that there is no evidence from Spain on the effectiveness of public policies aimed at reducing alcohol abuse, such as higher taxes on alcoholic drinks or an increase in the minimum legal age of access to such substances, the national government would nevertheless appear to have recognized the scale of the problem and is starting to allocate part of its resources to the prevention and rehabilitation of adolescents who have fallen into the trap of alcohol abuse. In this

regard, particular attention should be drawn to the Spanish government's National Anti-drug Campaign, *Plan Nacional sobre Drogas (2001)*, one of whose aims is to provide information not only to young people, but also to their teachers and parents, in the hope that these can exert a positive influence on adolescent habit formation.

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References

- Becker, G. and Murphy, K. (1988) A theory of rational addiction, *Journal of Political Economy*, **96**, 675–700.
- Bonomo, Y., Coffey, C., Wolfe, R., Lynskey, M., Bowes, G. and Patton, G. (2001) Adverse outcomes of alcohol use in adolescents, *Addiction*, **96**, 1485–96.
- Cook, P. and Moore, M. (1993) Drinking and schooling, *Journal of Health Economics*, **12**, 411–29.
- Dee, T. (1999) State alcohol policies, teen drinking and traffic fatalities, *Journal of Public Economics*, **72**, 289–315.
- Dee, T. and Evans, W. (2003) Teen drinking and educational attainment: evidence from two-sample instrumental variables estimates, *The Journal of Labour Economics*, **21**, 178–202.
- Grossman, M. (1972) On the concept of health capital and the demand for health, *Journal of Political Economy*, **80**, 223–55.

- Gruber, J. (2001) Introduction, in *Risky Behaviour Among Youths: An Economic Analysis* (Ed.) J. Gruber, Chicago Press, Chicago.
- Keng, S. and Wallace, E. (1999) Health, binge drinking and labour market success: a longitudinal study on young people. Staff Paper of State University of Iowa 330.
- Koch, S. and Rivar, D. (2001) A siblings analysis of the effects of alcohol consumption onset on educational attainment, *Contemporary Economic Policy*, **19**, 162–74.
- Lakdawalla, D., Bhattacharya, J. and Goldman, D. (2001) Are the young becoming more disabled? Working Paper NBER 8247.
- Levy, A. (2000) Would a rational Lucy take off without assessing the probability of a crash landing?, *Eastern Economic Journal*, **26**, 431–37.
- Mullahy, J. and Sindelar, J. (1989) Life-cycle effects of alcoholism on education, earnings, and occupation, *Inquiry*, **26**, 272–82.
- Mullahy, J. and Sindelar, J. (1994) Alcoholism, work, and income, *Journal of Labour Economics*, **11**, 494–520.
- Plan Nacional Sobre Drogas (2001) Drogas: más información, menos riesgos. Ministerio del Interior.
- Williams, J., Powell, L. M. and Wechsler, H. (2003) Does alcohol consumption reduce human capital accumulation? Evidence from the Alcohol college study, *Applied Economics*, **35**, 1227–39.
- Yamada, T., Kendix, M. and Yamada, T. (1996) The impact of alcohol consumption and marijuana use on high school graduation, *Health Economics*, **5**, 77–92.