"IT WASN'T ME, IT WAS THEM!" A STUDY OF SOCIAL INFLUENCE IN RISKY BEHAVIOUR BY ADOLESCENTS *

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Abstract

Institutional information does not seem sufficient to prevent drug experimentation by adolescents. A key question is therefore how adolescents decide to experiment with drugs, or, in general, adopt risky behaviours. We use the Add Health panel dataset (1994-1996) to show that risky behaviour by adolescents (the consumption of tobacco, alcohol and marijuana) is correlated with (lagged) behaviour in four different peer groups: others in the same school; others in the same school year; others in the same school who are two years older than the individual; and the individual's friends. Peer group effects are strongest within sexes. However boys do also follow girls, while girls are only little affected by what their male peers do.

preliminary version, comments welcome.

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1 Introduction

Recent survey results on adolescent drug consumption are impressive (Beck *and al.*, 2000). At the age of 17, half of all adolescents have tried cannabis, 40% smoke cigarettes every day, and more than 50% have been drunk at least once in their life.[1] In this context, one can call into question the efficacy of public policies such as safety campaigns and police intervention in schools in the prevention or reduction of psychotrope consumption. Institutional information (laws and prevention) do not seem to prevent (legal or illegal) drug experimentation and continuing use by adolescents.

We therefore ask which variables predict the experimentation and use of psychotropes by adolescents. In particular, we ask to what extent such risky behaviour result from the observation of and interaction with others who consume. Our starting hypothesis is that adolescents' preferences are sensitive to the behaviour of their peers (in this case, other adolescents in the same school). It is likely that the strength of this influence depends on the individual's sex, the sex composition of his or her peer group, and on the position of the individual within his or her environment. We use American data from the Add Health survey (1994-1996) to evaluate the strength of this link in the consumption of cannabis, alcohol and tobacco.

2 Social Interactions

This paper draws on the literature on social influence and non-market interactions. One of the first authors to use the concept of interdependent preference rigorously was Duesenberry (1967). Becker (1974) article appeals to social interactions in the context of the family. Pollak (1976) explicitly introduces a general form of interdependent preferences, whereby individual demand functions include the consumption of other societal members, weighted by the strength of the attachment that the individual feels for them.

In general, research on "peer pressure" or interactions includes the behaviour of the peer group as an argument of the individual's utility function, and hence of his or her behaviour (Akerlof, 1980; Case and Katz, 1991; Clark and Oswald, 1998; Evans *and al.*, 1992; Glaeser *and al.*, 1996; Kandel and Lazear, 1992). Clark (2002) shows that reported levels of subjective well-being amongst the unemployed are higher in regions and households with higher unemployment rates. Lalive and Stutzer (2000) measure the social norm of work in Swiss cantons by the percentage voting for a cut in unemployment benefits in a 1997 referendum; this percentage is shown to be positively correlated with the transition rate out of unemployment. Other work has appealed to social norms in the analysis of economic growth (Futagami and Shibata, 1998), saving (Kosicki, 1987), wages (Bewley, 1998), labour supply (Lindbeck *and al.*, 1999; Woittiez and Kapteyn, 1998), quits (Galizzi and Lang, 1998), academic performance (Sacerdote, 2000), trade union membership (Corneo, 1995) and migration (Stark and Taylor, 1991). Social norms are also commonly appealed to in experimental economics (see Fehr *and al.*, 1998, for example).

Another way of modelling interactions between individuals in an uncertain world is through imperfect information, as analysed by Banerjee (1992), Bikhchandani *and al.* (1992, 1998) and Samuelson (2001). Behavioural models with learning from others' behaviour have recently been applied to strike behaviour (Kuhn and Gu, 1999) and cigarette consumption (Clark and Étilé,

[1] Figures for other Western countries are similar

2002).

Empirical implementation of models of social interaction are problematic for at least three reasons. First, there is no general agreement on who constitutes the peer or reference group. Second, only few datasets contain information which allow the behaviour of any defined peer group to be measured. Third, there is a major problem of the identification of social interaction effects, as discussed by Manski (1993, 1995, 2000). In this paper, we are able to avoid some of these criticisms by using a reference group (the school) that is at least partly exogenous, and by using lagged values of others' consumption behaviour.

A standard equation for estimating social interactions is as follows:

$$Y_{is}^t = \alpha + \beta X_{is}^t + \gamma W_s^t + \theta \overline{Y}_{-is}^{t-1} + \epsilon_{is}^t, \tag{1}$$

where Y_{is}^t is the consumption of individual i who is in reference group s at period t; X_{is}^t are the other individual characteristics of i, W_s^t describe the reference group or environment (in our case, the school), $\overline{Y}_{-is}^{t-1}$ is reference group consumption at time $t-1$ (NOT including individual i), and ϵ_{is}^t is an error term.[2] This paper will use the above equation to model the consumption of cannabis, alcohol and tobacco by adolescents. The initial reference group will be other adolescents at the same school.

Our approach has some similarities with that of Gaviria and Raphael (2001), who use a sample of tenth-graders from the National Education Longitudinal Study (NELS). They show that the consumption of other students in the same school is strongly correlated with the individual's consumption. This conclusion is robust to the instrumentation of reference group consumption, controls for school characteristics, and estimation on sub-samples designed to split adolescents up by their susceptibility to be influenced by others (whether they moved school recently or not).

Gaviria and Raphael model initiation into various behaviours (has the individual already consumed or not?), instrumenting reference group participation rate on parents' and school characteristics aggregated to the reference group level. In our work, we will instrument at the individual, rather than the aggregate, level. We will also split reference groups up by sex. Our panel data also allow us to use one-period lagged values of consumption to describe reference group behaviour, avoiding reverse causality interpretations. Last, instead of looking at initiation or simple participation, we will model the level of consumption (or frequency of the event in question). The problem of non-participation, and therefore censoring of the data, will be dealt with by using a standard Tobit model (Tobin, 1958), described in Appendix A (p.17).[3]

3 Data

We use the Add Health panel dataset (1994-1996) to model possible links between risky behaviour by adolescents (the consumption of tobacco, alcohol and marijuana) and the same behaviours in peer groups. Four peer groups are examined: others in the same school; others in the

[2] In what follows, reference group consumption will always be understood to be lagged, even if no explicit subscripts are written.

[3] The Tobit model is not without its drawbacks. In particular, it assumes that the determinants of participation and of the level of consumption (if participating) are the same, which will not necessarily hold true in the case of rationing or infrequent purchase.

same school year; others in the same school who are two years older than the individual; and the individual's friends.

The Add Health survey (National Longitudinal Study of Adolescent Health) comprises a stratified sample of 80 high schools and 52 middle schools from the U.S.. The sample is representative of American schools with respect to region, urbanisation, school type, ethnicity, and school size. The survey deals health and related behaviours of adolescents who are in school. It was designed to explore the causes of risky behaviour in the light of the social context. The survey was carried out in three parts.

The first, short, survey, called the In-School survey (September 1994 - April 1995) covered 90118 adolescents in 164 schools. The second, called In-Home I (April 1995 - December 1995), comprised long interviews with 20745 adolescents who are representative of those sampled in the In-School survey. These adolescents' parents were also interviewed. Last, the In-Home II survey (April 1996 - August 1996) repeated these long interviews with 14738 of the adolescents from In-Home I.[4]

In this paper, we use the In-Home I and In-Home II surveys. Two waves of survey data are not enough to estimate rational addiction models, but they do enable us to use lagged values of reference group consumption (In-Home I) in the estimating equation for individual consumption behaviour (from In-Home II). This is one of the strong points of the dataset used.

We consider the consumption of tobacco, alcohol and marijuana (we also look at episodes of drunkenness). Table 1 presents the percentage of adolescents consuming the product in question, and the average level of consumption. Results are presented separately by gender for the surveys In-Home I and In-Home II. The second panel of Table 1 reveals that the percentage of non-users exceeds 50 per cent for all four of the behaviours studied (running from 53 per cent for alcohol consumption over the past year to 85 per cent for marijuana use over the past year). This preponderance of "zeros" is behind the use of Tobit estimation techniques.

There are a number of different ways of looking for social interaction effects in this data. One involves measuring the influence of peers on the probability of currently using the substance in question (i.e. participation). The second approach looks at social interactions with respect to the current level of consumption. Last, with panel data, it is also possible to analyse experimentation (indicated by individuals who reported never having tried the substance in question at the In-Home I wave, but then report having tried it at least once in their life at the In-Home II wave).[5] Most of our results refer to peer group effects on the level of consumption: interactions with respect to the participation probability produce qualitatively very similar results.

4 Results

Tables 2 through 5 present our main results for interactions with respect to four types of behaviour: smoking, drinking, drunkenness and smoking marijuana. In these tables, the reference group is taken to be the whole school, split by sex.

[4]Full details of the Add Health data are available at http://www.cpc.unc.edu/projects/addhealth.

[5]This is not without its problems, as the sample of non-experimenters at time $t-1$ is non-random. Good instruments are required to model the subsequent selection bias.

Two sets of regression results are presented in each Table. In the first, the lagged level of consumption in the peer group (i.e. that from In-Home I) is used as an explanatory variable. The use of lagged values partly alleviates the identification problem. In the second, this lagged value of consumption is instrumented using information on both the adolescent and his/her parents (see the regression equation in Appendix B, p.18).[6]

There are three main results from these tables. The first is that lagged consumption behaviour of others in the same school is often significantly correlated with adolescents' current drinking and smoking. The second is that, in general, adolescent girls are a more potent peer group than are adolescent boys, although we shall see that such "following" behaviour is different for adolescent boys and adolescent girls. Third, instrumented lagged consumption attracts mostly larger coefficients, but also mostly less significant. Peer-group average behaviour for smoking and drunkenness (the average level by girls at the same school) remain significant at the five per cent level. This difference between instrumented and non-instrumented values might reflect measurement error.

The other results show that consumption of cigarettes, alcohol and marijuana are higher for adolescent boys, whites, recent movers, and older schoolchildren. They are equally higher for children from one-parent families and for those who have greater disposable income. Many of the control variables for parents' and school characteristics are significant.

Tables 6 to 9 expand upon these initial results in two important ways. First, they consider that the peer group for adolescents may well be more tightly defined than simply all of the other students at the same school. Tables 7 to 9 respectively therefore examine individual consumption behaviour as a function of the consumption of other students in the same year, of students two years older than the respondent, and of the individual's friends respectively. It is worth noting also that this third type of peer group (those two years older than the individual and in the same school) potentially bypasses the endogeneity problem, as the consumption of older adolescents may be argued to be little affected by the behaviour of their younger colleagues.

The second extension refers to the way in which adolescent boys and girls interact. We are interested in differences between young boys and young girls in the role of social influence on risky behaviour. This is also partly a specification issue, as Tables 2 to 5 have already shown that the consumption of other girls generally has a larger effect than the consumption of other boys. It is natural to ask whether this effect depends on the sex of the respondent. In other words, do boys follow boys and girls follow girls?

Tables 6 to 9 therefore present separate results for adolescent boys and girls. For ease of representation, only the coefficients referring to peer group behaviour are presented, although all regressions naturally include all of Table 2-5's other control variables. Tables 7 through 9 also include, in the first panel, pooled results across sex for the three new types of peer group (the analogous pooled results with school as reference group can be gleaned from Tables 2 to 5). Only the estimates on lagged peer group consumption (and not its estimated level) are presented. Again, all of the regressions presented are Tobits.

[6]The information on parents' characteristics is obtained from interviews with the parents themselves, rather than from the adolescents' reports of their parents' behaviour.

The majority of own-sex peer group effects are significant. For example, consider alcohol consumption by adolescent males. This is significantly positively correlated with lagged average alcohol consumption by other adolescent males at the same school (Table 6), in the same year at the same school (Table 7), two years older in the same school (Table 8), and by the respondent's friends (Table 9). Across all four peer groups and all four behaviours, eleven of the sixteen peer group effects are positive and significant at the five per cent level or better, for both young boys and young girls.

A question of interest in Tables 6 to 9 is whether there is any evidence of cross-sex influence, i.e. do boys follow or girls or girls follow boys? There are significant sex differences in this respect. Adolescent males' behaviour is significantly correlated with that of adolescent females for seven of the sixteen peer group effects. This is particularly true with respect to marijuana consumption, but can also be seen for alcohol consumption. However, there is less evidence that girls follow boys in this way: only three of the sixteen peer group effects are significant here.

The last question that can be asked of these results concerns the relative size of the interaction effect. If adolescents are only influenced by older students, then we may well expect the coefficients in Table 8 (average consumption by those in the same school two years older than the respondent) to be larger than those in Tables 2 to 6 (average consumption by all those in the same school). This turns out to be largely the case (although one exception is for adolescent girls' marijuana use). In addition, the estimated coefficients for friends' consumption are not hugely higher than those for other more exogenous peer groups (except, to an extent, for cigarette consumption), whereas an endogeneity argument would have these former to be seriously biased upwards.

5 Conclusion

This paper has contributed to the empirical literature on social interactions. We have used the Add Health survey to show that four different types of "risky behaviours" (smoking, drinking, drunkenness, and marijuana use) are to an extent determined by what others in the peer group do. Our use of panel data has allowed us to circumvent part of the omnipresent endogeneity problem by using lagged values of peer group consumption. In addition, the particularly rich dataset has allowed us to control for not only parents' characteristics but also some school characteristics, avoiding some of the omitted variable problems that have dogged previous estimates.

We have information on the behaviour of different adolescents within the same school. This has allowed us to measure four plausible peer groups: the whole school, the year within the school, those two years older than the respondent within the same school, and the respondent's friends.

We find significant peer group effects for all four behaviours, and for all four peer groups. Peer group effects are stronger within sexes than between sexes: boys mainly follow boys and girls mainly follow girls. There is some evidence of cross-sex interactions, however, which are not symmetric between the sexes. Whereas boys follow girls (notably for alcohol and marijuana), outside of the circle of friends girls are (statistically) indifferent to boys.

Comparing estimated coefficients across regressions allows us to identify for which products peer group effects are the largest, and which peer group exerts the most influence. We find that

cigarette smoking is the most influenced by what others do, and that those two years older within the same school are the most salient peer group.

This paper's results therefore suggest that peer group influence does exist, although somewhat differently across different behaviours. Secondary school children seem to be more influenced by children who are somewhat older than they are, and by children of the same sex. In addition, while boys do follow girls for some behaviours, the inverse is only rarely true.

The pervasiveness of such interactions has at least one important policy implication. Any policy impact on consumption, whether positive or negative, will be amplified through peer group effects. As such it is not enough to evaluate the a targeted policy by its impact on the target group: there will likely be significant spillovers. As such, the dynamics of consumption behaviour, especially by the young, would seem to be an important topic for further research.

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Table 1: Consumption and participation in the Add Health "In-Home" waves

	"In-Home I"			"In-Home II"		
	Mean	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**N**
CONSUMPTION						
Tobacco during the last 30 days						
All	40.21	128.892	20347	50.862	146.34	14507
Young Males	45.081	141.466	10026	55.297	157.618	7045
Young Females	35.477	115.182	10321	46.676	134.706	7462
Alcohol during the last 365 days						
All	112.29	466.318	20225	121.962	480.326	14366
Young Males	149.213	562.052	9941	157.658	538.241	6960
Young Females	76.598	345.998	10284	88.416	415.913	7406
Drunkenness during the last 365 days						
All	9.809	38.847	20456	10.853	37.53	14566
Young Males	12.951	45.869	10086	14.236	43.312	7072
Young Females	6.753	30.195	10370	7.661	30.766	7494
Marijuana during the last 30 days						
All	1.963	17.666	20315	1.947	12.702	14375
Young Males	2.935	24.521	9990	2.778	17.27	6956
Young Females	1.023	5.523	10325	1.169	5.632	7419
PARTICIPATION (in percentage)						
Tobacco during the last 30 days						
All	0.249	0.432	20347	0.305	0.46	14507
Young Males	0.253	0.435	10026	0.311	0.463	7045
Young Females	0.246	0.43	10321	0.299	0.458	7462
Alcohol during the last 365 days						
All	0.464	0.499	20225	0.431	0.495	14366
Young Males	0.466	0.499	9941	0.429	0.495	6960
Young Females	0.461	0.498	10284	0.433	0.496	7406
Drunkenness during the last 365 days						
All	0.285	0.451	20456	0.291	0.454	14566
Young Males	0.303	0.46	10086	0.308	0.462	7072
Young Females	0.267	0.443	10370	0.274	0.446	7494
Marijuana during the last 30 days						
All	0.144	0.351	20315	0.16	0.367	14375
Young Males	0.164	0.37	9990	0.178	0.383	6956
Young Females	0.125	0.331	10325	0.144	0.351	7419

Table 2: Tobacco cons. (during the last 30 days): Tobit estimations with school as reference group

	With cons. of others		**With estimated cons. of others**	
Variable	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
Peer-group average (male)	0.215	(0.193)	-0.571	(0.480)
Peer-group average (female)	0.571*	(0.232)	1.376*	(0.569)
Female	-12.087	(8.346)	-12.054	(8.352)
Age	195.492**	(47.927)	214.289**	(48.249)
Age^2	-5.378**	(1.462)	-5.891**	(1.469)
Recent mover	44.457**	(10.279)	44.307**	(10.285)
White	*(reference)*			
Black	-221.664**	(14.162)	-226.489**	(14.709)
Hispanic	-36.536*	(15.906)	-42.712**	(15.955)
Asian	-53.056*	(26.601)	-56.984*	(26.778)
Other origin	-2.043	(20.690)	-4.965	(20.701)
One parent	31.629**	(9.561)	32.315**	(9.573)
Weekly earnings (100$)	39.192**	(4.899)	39.491**	(4.906)
Parent: Female	8.442	(16.800)	8.931	(16.821)
Parent: Age	0.920	(0.696)	0.905	(0.697)
Parent: Born in USA	81.827**	(16.765)	83.761**	(16.815)
Parent: Public assitance	31.163*	(15.593)	33.021*	(15.609)
Parent: Education	*(8 dummies, plus one reference, not significant)*			
Parent: Work outside home	5.708	(14.451)	4.918	(14.462)
Parent: Full-time work	32.163**	(12.127)	33.429**	(12.139)
Parent: Unemployed	29.901	(19.717)	30.529	(19.723)
Parent: PTA member	-14.492	(9.553)	-15.306	(9.561)
Parent: Income (100$)	-0.105	(0.090)	-0.100	(0.090)
Parent: No money problems	-29.036**	(10.913)	-28.459**	(10.925)
Parent: Alcohol consumption	0.115	(0.076)	0.110	(0.076)
Parent: Tobacco at home	117.111**	(8.668)	118.277**	(8.678)
School: Private	-8.981	(19.162)	-3.884	(19.863)
School: Urban area	-28.853*	(11.547)	-34.979**	(12.048)
School: Suburban area	*(reference)*			
School: Rural area	14.142	(11.458)	21.050†	(11.710)
School: Small-sized	0.958	(14.771)	0.469	(15.535)
School: Medium-sized	1.647	(10.943)	0.328	(11.394)
School: Big-sized	*(reference)*			
Region: West	-38.134**	(13.157)	-50.864**	(13.789)
Region: Mid-West	17.251	(11.559)	5.547	(14.868)
Region: South	*(reference)*			
Region: North-East	19.978	(13.559)	4.298	(17.762)
Intercept	-2113.497**	(393.999)	-2269.677**	(395.115)
Estimated Std Error	295.983**	(4.459)	296.308**	(4.465)
N	8541		8541	
Log-likelihood	-21290.749		-21296.464	
$F_{(.)}$	(40, 8501) 1313.996		(40, 8501) 1302.567	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 3: Alcohol cons. (during the last 365 days): Tobit estimations with school as reference group

	With cons. of others		With estimated cons. of others	
Variable	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
Peer-group average (male)	0.169	(0.145)	-0.303	(0.446)
Peer-group average (female)	0.465*	(0.200)	1.060	(0.925)
Female	-43.080*	(19.921)	-44.460*	(19.906)
Age	448.552**	(114.737)	458.167**	(118.045)
Age^2	-11.383**	(3.493)	-11.620**	(3.575)
Recent mover	18.318	(25.013)	17.915	(25.020)
White	*(reference)*			
Black	-303.860**	(30.064)	-308.137**	(30.952)
Hispanic	12.461	(37.177)	6.106	(37.151)
Asian	-197.988**	(59.592)	-204.012**	(59.854)
Other origin	-89.548†	(53.622)	-87.982	(53.644)
One parent	76.701**	(23.017)	77.543**	(23.017)
Weekly earnings (100$)	83.707**	(12.130)	82.756**	(12.152)
Parent: Female	44.196	(40.640)	44.837	(40.626)
Parent: Age	0.313	(1.648)	0.283	(1.648)
Parent: Born in USA	82.981*	(38.430)	84.658*	(38.543)
Parent: Public assitance	-31.429	(39.255)	-27.640	(39.238)
Parent: Education	*(8 dummies, plus one reference, not significant)*			
Parent: Work outside home	97.507**	(34.340)	97.082**	(34.337)
Parent: Full-time work	-13.915	(28.618)	-14.134	(28.617)
Parent: Unemployed	72.162	(48.590)	72.232	(48.596)
Parent: PTA member	-2.093	(22.614)	-2.887	(22.614)
Parent: Income (100$)	0.520**	(0.196)	0.517**	(0.196)
Parent: No money problems	21.906	(26.558)	22.859	(26.563)
Parent: Alcohol consumption	0.932**	(0.178)	0.933**	(0.178)
Parent: Tobacco at home	113.048**	(20.662)	114.567**	(20.653)
School: Private	-17.376	(43.535)	0.893	(48.055)
School: Urban area	-22.476	(27.302)	-33.681	(28.838)
School: Suburban area	*(reference)*			
School: Rural area	7.222	(27.531)	12.180	(27.620)
School: Small-sized	-10.422	(35.971)	-23.370	(38.770)
School: Medium-sized	21.177	(25.139)	21.577	(26.969)
School: Big-sized	*(reference)*			
Region: West	18.821	(30.052)	-6.226	(36.223)
Region: Mid-West	41.093	(26.671)	23.517	(29.694)
Region: South	*(reference)*			
Region: North-East	80.387*	(31.299)	57.990	(36.779)
Intercept	-4946.610**	(942.934)	-5020.129**	(962.150)
Estimated Std Error	761.625**	(9.284)	761.713**	(9.285)
N	8449		8449	
Log-likelihood	-32065.332		-32068.728	
$F_{(.)}$	(40, 8409) 689.548		(40, 8409) 682.751	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 4: Drunkenness (during the last 365 days): Tobit estimations with school as reference group

Variable	With behavior of others Coefficient	(Std. Err.)	With estimated behavior of others Coefficient	(Std. Err.)
Peer-group average (male)	0.262	(0.177)	-0.912†	(0.522)
Peer-group average (female)	0.736**	(0.237)	2.828**	(0.956)
Female	-11.478**	(2.255)	-11.733**	(2.252)
Age	68.789**	(13.246)	66.568**	(13.743)
Age^2	-1.808**	(0.402)	-1.740**	(0.414)
Recent mover	3.023	(2.818)	2.970	(2.820)
White	*(reference)*			
Black	-37.191**	(3.528)	-35.262**	(3.664)
Hispanic	0.134	(4.158)	0.810	(4.195)
Asian	-26.990**	(7.058)	-25.341**	(7.097)
Other origin	-8.888	(5.892)	-7.474	(5.893)
One parent	9.883**	(2.590)	10.273**	(2.590)
Weekly earnings (100$)	8.715**	(1.313)	8.454**	(1.317)
Parent: Female	6.201	(4.543)	6.682	(4.547)
Parent: Age	-0.161	(0.189)	-0.151	(0.190)
Parent: Born in USA	15.702**	(4.424)	15.424**	(4.424)
Parent: Public assitance	-1.248	(4.405)	-0.618	(4.402)
Parent: Education	*(8 dummies, plus one reference, not significant)*			
Parent: Work outside home	12.255**	(3.898)	12.274**	(3.898)
Parent: Full-time work	-0.889	(3.221)	-0.897	(3.222)
Parent: Unemployed	12.334*	(5.441)	12.479*	(5.443)
Parent: PTA member	0.424	(2.565)	0.677	(2.566)
Parent: Income (100$)	0.050*	(0.022)	0.048*	(0.022)
Parent: No money problems	2.963	(3.004)	2.968	(3.006)
Parent: Alcohol consumption	0.092**	(0.020)	0.092**	(0.020)
Parent: Tobacco at home	14.989**	(2.339)	15.181**	(2.340)
School: Private	-2.950	(5.051)	0.411	(5.103)
School: Urban area	-5.799†	(3.086)	-6.425†	(3.396)
School: Suburban area	*(reference)*			
School: Rural area	0.420	(3.071)	0.582	(3.123)
School: Small-sized	-2.658	(4.157)	0.229	(4.613)
School: Medium-sized	2.002	(2.907)	4.043	(3.228)
School: Big-sized	*(reference)*			
Region: West	10.250**	(3.388)	4.114	(3.844)
Region: Mid-West	9.644**	(2.944)	3.755	(3.495)
Region: South	*(reference)*			
Region: North-East	10.612**	(3.558)	2.453	(4.470)
Intercept	-734.008**	(109.487)	-717.581**	(112.976)
Estimated Std Error	79.569**	(1.205)	79.607**	(1.206)
N	8654		8654	
Log-likelihood	-17465.481		-17467.515	
$F_{(.)}$	(40, 8614) 855.764		(40, 8614) 851.695	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 5: Marijuana cons. (during the last 30 days): Tobit estimations with school as reference group

	With cons. of others		With estimated cons. of others	
Variable	**Coefficient**	**(Std. Err.)**	**Coefficient**	**(Std. Err.)**
Peer-group average (male)	0.098	(0.167)	1.152	(0.838)
Peer-group average (female)	2.493**	(0.784)	-2.792	(3.081)
Female	-7.374**	(1.395)	-7.339**	(1.395)
Age	28.776**	(8.150)	29.829**	(8.383)
Age^2	-0.853**	(0.249)	-0.882**	(0.255)
Recent mover	3.505*	(1.708)	3.601*	(1.708)
White	*(reference)*			
Black	-3.282	(2.032)	-4.328*	(2.129)
Hispanic	7.894**	(2.505)	6.888**	(2.530)
Asian	-0.964	(4.170)	-1.859	(4.198)
Other origin	2.402	(3.512)	2.180	(3.525)
One parent	4.515**	(1.579)	4.517**	(1.579)
Weekly earnings (100$)	4.822**	(0.791)	4.863**	(0.792)
Parent: Female	3.558	(2.805)	3.672	(2.807)
Parent: Age	0.065	(0.113)	0.054	(0.113)
Parent: Born in USA	14.473**	(2.789)	14.904**	(2.801)
Parent: Public assitance	4.014	(2.585)	3.991	(2.587)
Parent: Education	*(8 dummies, plus one reference, not significant)*			
Parent: Work outside home	3.861	(2.427)	3.800	(2.427)
Parent: Full-time work	0.203	(2.013)	0.101	(2.013)
Parent: Unemployed	4.185	(3.272)	4.154	(3.274)
Parent: PTA member	-2.473	(1.597)	-2.630†	(1.596)
Parent: Income (100$)	0.003	(0.015)	0.006	(0.015)
Parent: No money problems	2.382	(1.845)	2.439	(1.843)
Parent: Alcohol consumption	0.026*	(0.012)	0.027*	(0.012)
Parent: Tobacco at home	9.495**	(1.454)	9.556**	(1.455)
School: Private	0.903	(3.047)	-1.262	(3.448)
School: Urban area	-4.514*	(1.849)	-3.334	(2.277)
School: Suburban area	*(reference)*			
School: Rural area	-2.170	(1.921)	-2.389	(1.942)
School: Small-sized	-3.872	(2.528)	-4.480	(3.199)
School: Medium-sized	-3.242†	(1.741)	-2.943	(2.023)
School: Big-sized	*(reference)*			
Region: West	10.063**	(2.182)	11.736**	(2.786)
Region: Mid-West	6.173**	(2.035)	8.915**	(2.723)
Region: South	*(reference)*			
Region: North-East	12.097**	(2.283)	15.024**	(3.161)
Intercept	-322.024**	(67.217)	-332.175**	(68.808)
Estimated Std Error	40.867**	(0.854)	40.889**	(0.855)
N	8483		8483	
Log-likelihood	-8779.998		-8784.273	
$F_{(.)}$	(40, 8443) 397.629		(40, 8443) 389.076	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 6: Tobit consumption equations with school as reference group

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variables	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**
Young Males								
Male peer group	0.435	(0.298)	0.452*	(0.230)	0.592*	(0.277)	0.282	(0.306)
Female peer group	0.023	(0.362)	0.751*	(0.302)	0.764*	(0.345)	1.732	(1.445)
N	4214		4156		4277		4165	
Young Females								
Male peer group	0.026	(0.247)	-0.031	(0.178)	-0.126	(0.217)	-0.043	(0.111)
Female peer group	0.983**	(0.293)	0.100	(0.268)	0.894**	(0.337)	1.742**	(0.500)
N	4327		4293		4377		4318	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 7: Tobit consumption equations with school year as reference group

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variables	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**
All sample								
Male peer group	0.419**	(0.119)	0.210**	(0.080)	0.255*	(0.103)	0.074	(0.093)
Female peer group	0.547**	(0.140)	0.091	(0.129)	0.253	(0.167)	1.533**	(0.483)
N	8203		8113		8310		8155	
Young Males								
Male peer group	0.490**	(0.179)	0.404**	(0.126)	0.370*	(0.161)	0.156	(0.156)
Female peer group	0.354	(0.219)	0.132	(0.212)	0.126	(0.266)	2.245**	(0.853)
N	4041		3987		4102		4001	
Young Females								
Male peer group	0.318*	(0.158)	0.041	(0.099)	0.129	(0.126)	-0.003	(0.065)
Female peer group	0.681**	(0.177)	0.073	(0.155)	0.350†	(0.200)	0.556	(0.343)
N	4162		4126		4208		4154	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 8: Tobit consumption equations with students two years older as reference group

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variables	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**
All sample								
Male peer group	0.171	(0.113)	0.079	(0.058)	0.051	(0.080)	0.189	(0.254)
Female peer group	0.295†	(0.163)	0.317*	(0.152)	0.498*	(0.207)	1.031†	(0.577)
N	5630		5571		5652		5545	
Young Males								
Male peer group	1.598**	(0.224)	0.778**	(0.152)	0.648**	(0.188)	0.128	(0.306)
Female peer group	-0.135	(0.279)	0.186	(0.264)	0.416	(0.303)	2.479**	(0.758)
N	2479		2445		2490		2444	
Young Females								
Male peer group	-0.275	(0.205)	-0.092	(0.127)	0.079	(0.154)	-0.021	(0.154)
Female peer group	2.143**	(0.252)	0.461*	(0.222)	0.930**	(0.255)	1.145**	(0.431)
N	2469		2447		2474		2454	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

Table 9: Tobit consumption equations with friends as reference group

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variables	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**	**Coef.**	**(Sd. Er.)**
All sample								
Male peer group	0.575**	(0.053)	0.227**	(0.052)	0.242**	(0.051)	0.051	(0.040)
Female peer group	0.654**	(0.073)	0.171*	(0.083)	0.331**	(0.078)	1.112**	(0.262)
N	3106		3065		3110		3074	
Young Males								
Male peer group	0.702**	(0.079)	0.307**	(0.073)	0.354**	(0.077)	0.077	(0.061)
Female peer group	0.549**	(0.123)	0.202	(0.158)	0.435*	(0.192)	1.346**	(0.432)
N	1532		1510		1536		1515	
Young Females								
Male peer group	0.438**	(0.071)	0.152*	(0.074)	0.079	(0.064)	0.005	(0.028)
Female peer group	0.708**	(0.084)	0.155	(0.094)	0.248**	(0.069)	0.641**	(0.154)
N	1574		1555		1574		1559	

Significance levels : †=10%; ∗=5%; ∗∗=1%.

We include the number of male friends and the number of female friends as control variables:

The number of male friends is negative and significant (1%) for females' tobacco consumption;

The number of female friends is positive and significant (5%) for female drunkenness.

ANNEXES

Annexe A : Le modèle Tobit

Soit une variable latente y_i^* telle que :

$$y_i^* = X_i\beta + \tilde{e}_i \tag{2}$$

Nous supposons alors que :

$$\begin{array}{rl} y_i = y_i^* & si \quad y_i^* > 0 \\ = 0 & si \quad y_i^* \leq 0 \end{array} \tag{3}$$

Ou écrit d'une autre manière : $y_i = max(0, y_i^*)$. Notons d la variable muette indiquant si l'individu consomme ($d = 1$) ou non ($d = 0$), nous avons :

$$\left\{ \begin{array}{l} y = dy^* \\ d = 1 \Leftrightarrow y^* > 0 \\ d = 0 \Leftrightarrow y^* \leq 0 \end{array} \right. \tag{4}$$

La vraisemblance de l'échantillon peut donc s'écrire :

$$\begin{array}{rl} L = & \prod\limits_{i/y_i=0} Pr(d=0) \prod\limits_{i/y_i>0} Pr(y_i|d=1)Pr(d=1) \\ = & \prod\limits_{i/y_i=0} Pr(y^* \leq 0) \prod\limits_{i/y_i>0} Pr(y_i^* = y_i|y_i^* > 0)Pr(y_i^* > 0) \end{array} \tag{5}$$

Si nous supposons que le résidus suit une loi normale centrée de variance σ, alors :

$$\begin{array}{l} Pr(y^* \leq 0) = 1 - \Phi\left(\dfrac{X_i\beta}{\sigma}\right) \\ Pr(y_i^* = y_i|y_i^* > 0)Pr(y_i^* > 0) = Pr(y_i^* = y_i, y_i^* > 0) = \dfrac{1}{\sigma}\phi\left(\dfrac{y_i - X_i\beta}{\sigma}\right) \end{array} \tag{6}$$

où $\phi(.)$ est la densité de la loi normale centrée réduite. Finalement :

$$Log(L) = \sum_{i/y_i=0} ln\left(1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right) + \sum_{i/y_i>0} ln\left(\frac{1}{\sigma}\phi\left(\frac{y_i - X_i\beta}{\sigma}\right)\right) \tag{7}$$

Nous calculons ensuite l'espérance de la consommation conditionnellement aux paramètres estimés. Elle s'écrit de la manière suivante :

$$E(y_i|X_i) = Pr(y_i = 0) \times 0 + \int_0^{+\infty} y_i f(y_i) dy_i \tag{8}$$

où $f(.)$ est la fonction de densité associée aux observations. Si nous prenons en compte la variable latente comme observation :

$$
\begin{aligned}
E(y_i|X_i) &= Pr(y_i = 0) \times 0 + \int_0^{+\infty} y_i^* f(y_i^*) dy_i^* \\
&= \int_{-X_i\beta}^{+\infty} (X_i\beta + \tilde{e}_i) \frac{1}{\sigma} \phi\left(\frac{\tilde{e}_i}{\sigma}\right) d\tilde{e}_i \\
&= X_i\beta \int_{-X_i\beta}^{+\infty} \frac{1}{\sigma} \phi\left(\frac{\tilde{e}_i}{\sigma}\right) d\tilde{e}_i + \int_{-X_i\beta}^{+\infty} \tilde{e}_i \frac{1}{\sigma} \phi\left(\frac{\tilde{e}_i}{\sigma}\right) d\tilde{e}_i \\
&= X_i\beta\Phi\left(\frac{X_i\beta}{\sigma}\right) + \sigma\phi\left(\frac{X_i\beta}{\sigma}\right)
\end{aligned} \tag{9}
$$

Annexe B : La première étape de l'estimation

Table 10: Tobit on consumption with Parents and individual characters

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variable	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**
PARENTS CHARACTERS								
Female	4.437	(13.398)	2.772	(28.349)	-2.014	(3.632)	0.592	(2.772)
Age	1.607**	(0.558)	2.252†	(1.158)	0.341*	(0.152)	0.283*	(0.115)
Born in USA	97.109**	(13.195)	109.466**	(25.972)	19.814**	(3.468)	15.887**	(2.755)
Alone	-6.318	(11.665)	10.641	(24.560)	-1.684	(3.208)	4.482†	(2.415)
Public Ass.	22.265†	(13.179)	12.507	(28.410)	8.682*	(3.670)	4.351	(2.741)
Education 1	28.090	(19.740)	-39.965	(40.237)	-5.408	(5.378)	-0.463	(4.165)
Education 2	14.835	(14.964)	-9.308	(31.146)	0.274	(4.095)	-0.225	(3.121)
Education 3	35.640	(37.816)	15.188	(82.609)	17.492†	(10.168)	-0.824	(8.474)
Education 4	3.638	(11.670)	-20.056	(23.955)	-1.809	(3.168)	-2.486	(2.448)
Education 5	56.987**	(18.726)	32.585	(41.231)	6.788	(5.300)	2.932	(4.054)
Education 6	-0.651	(13.932)	-25.300	(28.755)	0.003	(3.776)	-3.636	(2.939)
Education 7	37.592**	(11.753)	12.268	(24.209)	4.616	(3.186)	2.562	(2.431)
Education 8	*Reference*							
Education 9	-8.138	(14.797)	-15.498	(29.519)	1.607	(3.901)	-2.466	(3.085)
W. outside home	-9.680	(11.782)	53.009*	(24.654)	5.402†	(3.239)	0.924	(2.528)
Full-time work	28.670**	(9.984)	32.091	(20.657)	3.268	(2.708)	1.675	(2.120)
Unemployed	35.291*	(15.754)	58.639†	(34.019)	12.528**	(4.366)	2.482	(3.352)
Engaged	-12.432	(7.800)	-16.107	(16.141)	-3.898†	(2.126)	-4.338**	(1.660)
Income (1000 $)	-0.030	(0.070)	0.312*	(0.139)	0.054**	(0.018)	0.023	(0.014)
Bills	-11.080	(8.987)	12.390	(18.794)	2.364	(2.464)	1.164	(1.877)
Alcohol	0.115*	(0.059)	0.566**	(0.123)	0.065**	(0.016)	0.043**	(0.012)
Tobacco	146.448**	(7.137)	144.646**	(14.680)	21.575**	(1.929)	15.132**	(1.507)
ADOLESCENT CHARACTERS								
Female	-12.653†	(6.776)	-68.452**	(14.131)	-11.116**	(1.854)	-10.236**	(1.443)
Age	259.884**	(36.542)	726.685**	(75.356)	107.177**	(10.600)	47.215**	(8.007)
Age^2	-7.374**	(1.162)	-20.508**	(2.398)	-3.035**	(0.335)	-1.383**	(0.253)
White	*Reference*							
Black	-223.783**	(11.127)	-206.768**	(20.756)	-29.194**	(2.818)	-0.818	(2.067)
Hispanic	-64.307**	(12.478)	47.363†	(25.708)	2.641	(3.336)	7.852**	(2.539)

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... table 10 continued

	Tobacco		Alcohol		Drunkenness		Marijuana	
Variable	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**	**Coeff.**	**(Std. E.)**
Asian	-29.390	(19.183)	-101.639**	(38.565)	-14.975**	(5.160)	-5.827	(4.000)
Other	-3.614	(16.669)	37.069	(36.498)	-2.317	(4.804)	7.884*	(3.482)
Recent mover	42.384**	(8.317)	35.092*	(17.700)	6.732**	(2.301)	1.080	(1.776)
One parent	58.256**	(11.188)	68.564**	(23.676)	15.111**	(3.086)	8.557**	(2.325)
Weekly (100$)	49.944**	(4.827)	111.453**	(10.481)	12.481**	(1.306)	5.554**	(0.992)
Private school	21.022	(15.054)	-12.824	(30.920)	5.239	(4.054)	12.698**	(3.043)
Urban area	-23.952**	(8.702)	-72.633**	(17.927)	-11.880**	(2.381)	-9.131**	(1.834)
Suburban area	*Reference*							
Rural area	18.710*	(9.393)	17.714	(20.272)	3.595	(2.627)	0.847	(2.056)
Small-sized sch.	-37.800**	(12.045)	-23.865	(25.207)	-5.630†	(3.327)	-12.929**	(2.654)
Med.-sized sch.	-16.340*	(8.298)	-1.847	(17.557)	-3.398	(2.287)	-4.031*	(1.767)
Big-sized sch.	*Reference*							
West	-33.286**	(10.321)	3.452	(20.799)	5.279†	(2.731)	16.869**	(2.125)
Middle-West	30.804**	(8.793)	-12.715	(18.729)	-0.096	(2.461)	13.242**	(1.940)
South	*Reference*							
North-East	33.197**	(10.299)	26.399	(21.846)	6.685*	(2.861)	12.071**	(2.275)
Intercept	-2685.580**	(289.979)	-6889.514**	(596.149)	-1035.006**	(84.591)	-502.676**	(63.870)
Estim. Std. Err.	284.706**	(3.823)	690.192**	(6.394)	80.600**	(0.984)	51.007**	(0.881)
N	13451		13379		13540		13445	
Log-L.	-27530.361		-53464.966		-26409.769		-13115.487	
$F_{(.)}$	2084.211		1329.63		1519.136		818.817	
	(39, 13412)		(39, 13340)		(39, 13501)		(39, 13406)	

Significance levels : $\dagger$: 10% $*$: 5% $**$: 1%

Légende du tableau (10)

Sex: most of time it is the mother who answer to questions.
Age: no comment.
Born in USA: no comment.
Alone: single (never married), widowed, divorced or separated.
Public Ass.: receiving public assistance, such as welfare.
Education 0: never went to school.
Education 1: 8^{th} grade or less.
Education 2: more than 8^{th} grade but did not graduate from high school.
Education 3: went to business, trade, or vocational school instead of high school.
Education 4: high school graduate.
Education 5: completed GED.
Education 6: went to business, trade, or vocational school after high school.
Education 7: went to college, but did not graduate.
Education 8: graduate from a college or university.
Education 9: professional training beyond a 4-year college or university.
White, Black, Hispanic, Asian and Other: racial background.

W. no home: work outside the home.

Full-time W.: employed full-time at last job.

Unemployed: unemployed right now, but looking for a job

Engaged: member of parent/teacher organization.

Income: total income, before taxes did your family receive in 1994, Include the own income, the income of everyone else in the household, and income from welfare benefits, dividends, and all other sources (in thousand dollars).

Bills: to have enough money to pay bills.

Alcohol: consumption by year.

Tobacco: are there any cigarette smokers in household?

Est. Std. E. : estimated standard error.

Table 11: Consumption in Wave I : observed and estimated

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Tobacco					
Observed	40.244	128.943	0	1200	20329
Observed (on Est. sample)	39.4	126.44	0	1200	13315
Estimated	45.552	40.193	0.26	355.299	13315
Alcohol					
Observed	112.389	466.513	0	13520	20207
Observed (on Est. sample)	106.906	446.655	0	10140	13259
Estimated	178.566	93.651	6.402	1012.719	13259
Drunkenness					
Observed	9.817	38.863	0	338	20438
Observed (on Est. sample)	9.250	37.265	0	338	13401
Estimated	12.892	9.162	0.061	93.293	13401
Marijuana					
Observed	1.965	17.674	0	900	20297
Observed (on Est. sample)	1.884	16.832	0	899	13445
Estimated	3.312	2.678	0.039	27.228	13445