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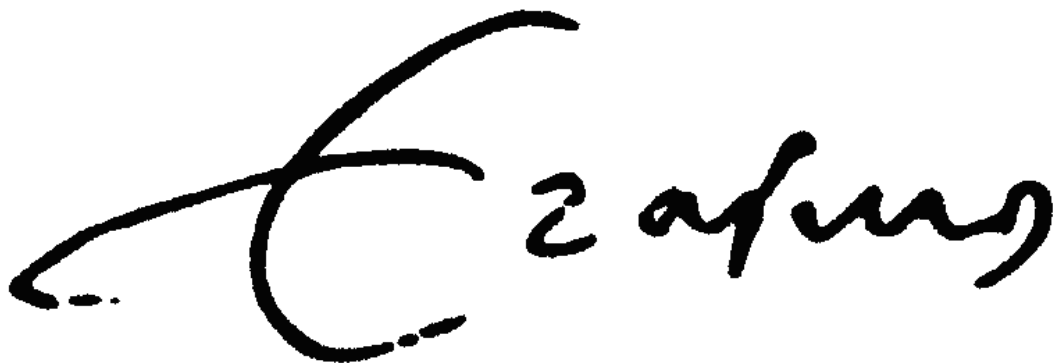## Erasmus School of Economics
Program in Health Economics

MASTER THESIS

2011   Martina Mandelíková

Erasmus University Rotterdam
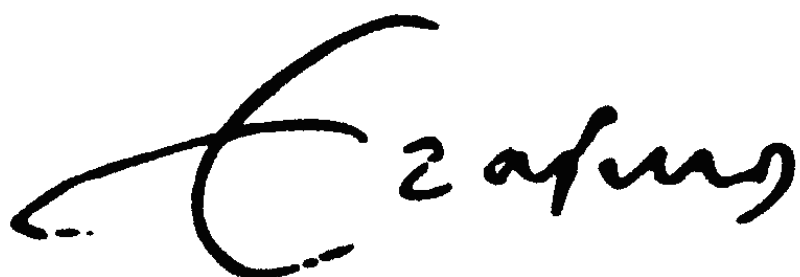**Erasmus School of Economics**
Program in Health Economics

MASTER THESIS

Adolescents Alcohol Consumption:
Identification of determinants of probability to drink with special focus on social interaction

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Abstract

Objective: Underage drinking with increasing pattern towards binge drinking is one of the common problems in European countries. This thesis tries to explain what leads young people to participate in drinking, what is the connection between certain risk behaviours (smoking and drinking) and what role play individuals' peers in the drinking habits of adolescent.

Method: Econometric analysis is used to identify the determinants of drinking and estimate peer influence on the adolescent. Estimated models are based on the available literature on this topic and on economic theory related to addiction and social interaction. Sample used for the empirical part comes from European School Survey Project on Alcohol and Other Drugs done among high school students in Czech Republic.

Conclusions: Results from the analyses suggest that most common drivers of engagement in drinking are sensitivity on alcohol, friends influence, current smoking status, experience with other drugs and judgment of regular intoxication. Further analysis of causality between drinking and smoking brings evidence that first year students' smoking and drinking arises from common causes, while for third year students smoking is more attributable to drinking behaviour. Findings from analyses on peer effect show that influence of classmates on the individual varies across genders and its magnitude and significance depends on the estimated sample. In general, peer effect has always positive sign and regardless of gender and estimated sample it significantly increases participation in drinking of adolescents who have not been drinking before high school.

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List of Abbreviations

ESPAD – European School Survey Project on Alcohol and Other Drugs

GPA – Grade Point Average

LPM – Linear Probability Model

NIAAA - National Institute on Alcohol Abuse and Alcoholism

pp – percentage point

TORA – Theory of Rational Addiction

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1 Introduction

Alcohol is legal and socially acceptable in most countries in the world and is also the most used drug worldwide (Keller & Vaillant, 2011). It is consumed mainly for relaxation, fun and social reasons. Even though majority of people drink alcohol in moderate amounts which can actually lead to positive health outcomes (Keller & Vaillant, 2011), global burden of disease related to alcohol consumption is higher than that of cigarette smoking (Jernigan, 2001). It is mainly because unwise alcohol consumption is not associated only with long-term health effects but rather with acute consequences such as car crashes, drowning or freezing. Such negative outcomes lead to premature deaths and disability especially among young people (Jernigan, 2001). Excess drinking is also associated with reduced productivity, crime, violence or personality deterioration (Cook & Moore, 2000). In general, benefits from production and sale of alcoholic beverages cannot outweigh the costs associated with negative health-related outcomes and socioeconomic consequences (Cook & Moore, 2000).

More importantly, there is increasing evidence that early initiation with drinking leads to higher likelihood of alcohol misuse and alcohol-related injury during lifetime (Jernigan, 2001). Grant & Dawson (1997) estimated that lifetime prevalence of alcohol dependence is more than 40% among those who initiated drinking at the age of 14years or earlier, but decreases rapidly with increasing age of initiation. Individuals who started drinking after the age of twenty, have only 10% probability to become alcoholics or abuse alcohol later in their life. At the same time, there is observable pattern of early start with drinking as well as increase in frequency of binge drinking among adolescents (Hibell et al., 2007). This problem is especially pronounced in European countries, but also in the United States and Australia and recently becomes more common in developing countries (Cawley & Rhum 2011; Jernigan 2001).

Besides the relatively high rates of binge drinking often associated with car accidents, unsafe sex and crime commitment, drinking patterns in adolescents are often predictors for drinking behaviour in adulthood and can also impact personality development and family formation (Cook & Moore, 2000). Postponement of the initiation of drinking could have positive effects on individuals' health but also positive implications for the whole society. Hence, it is

important to focus on the reasons why youngsters start with alcohol consumption in the first place. Despite the relevance of the topic, related evidence is sparse.

Majority of economic studies related to alcohol consumption focus mainly on consequences of drinking or on quantifying the impact of alcohol-control policy on the actual consumption (Cook & Moore, 2000). Impact of price change on the drinking is also one of the important concerns (Cook & Moore, 2000). Main contribution of economists related to explanation of individuals' desire to consume alcohol lies in improvements of standard model of consumer choice and recently in examination of the effect of social interaction[1] (Cawley & Ruhm, 2011; Manski, 2000). While empirical research related to influence of peers, neighbours and others on individual is among economists quite popular, there is a lack of quality research focusing on other determinants of drinking than social interaction. Most of the studies exploring factors influencing adolescents' drinking habits come from social or psychological science studies. Yet, majority of the evidence coming from social studies suffer from reciprocal causality between dependent and independent variables and only minority of the studies tries to properly clarify the causal link (Newbury-birch et al., 2009). In addition, most of the studies focus on explaining occurrence of binge or heavy drinking, rather than determining factors which lead to participation in alcohol consumption.

This thesis tries to fill the gap in existing literature and strive to understand what leads adolescents to participate in drinking with special focus on the social interaction with peers and its effects. The research questions addressed are: *What leads young people to engage in drinking in relatively low age? Is there a connection between alcohol consumption and other substance usage? How can adolescents' peers influence his/her decision to drink?*

Answering those questions can not only supplement available studies, but is also relevant from policy making perspective. Finding correct answers is a necessary prerequisite for creation of successful policy interventions which prevent negative consequences associated with drinking. If for example probability to drink is significantly higher for adolescents from small cities, then prevention program can focus mainly on smaller towns. If there is interdependency between addictive behaviours, then reducing consumption of one could also reduce consumption of the other one which is in the interest of policy makers. On the other hand if

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[1] Discussed in Sections 2.1 and 5.1

participation in drinking is for example side effect of cigarette smoking, trying to reduce alcohol consumption can be very costly and ineffective. Existence of social interaction is associated with existence of "social multiplier". This means that restrictions imposed on individual and his/her peers not only influence individuals' consumption directly, but the effect of the restriction is multiplied through shift in peers' consumption. Proving existence of social interaction and quantifying magnitude of the arising spill-over effect can be essential for precise calculation of the cost-effectiveness of certain intervention.

To find the answers for the research questions, the thesis implements findings from existing literature on this topic and relevant economic theory to build corresponding models and analyse them. The analyses are performed on the sample of high school students from Czech Republic, which is a country with high relevance for the study.

At large, Czech society is very tolerable to regular alcohol use and also to extensive drinking (Sovinová & Csémy, 2003). This attitude towards drinking is reflected in the drinking prevalence which is the third largest in the world - annual per capita consumption is 16.45 litres of pure ethanol when counting both recorded and unrecorded consumption of inhabitants in the age 15+ (WHO, 2011). There are 34.4% of males among drinkers who could be labelled as heavy drinkers and 6% of females. Also drinking prevalence of adolescents is among the highest at least in Europe. The lifetime alcohol prevalence as well as monthly consumption of high school students remains quite stable since 90's. Nonetheless, there is an observable pattern towards binge drinking of the youngsters[2] (Hibell et al., 2007). Moreover, in comparison to other European countries, Czech students are about average not only in drinking, but also in cigarette and marihuana smoking and other drug use[3]. Commonly high prevalence of substance use (and abuse) among youth makes from Czech Republic highly relevant and interesting case to study, especially in regard to drinking. Overall, the dataset from this country can serve very well for the purposes of this thesis[4].

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[2] This pattern is illustrated in Figure 2: Youth alcohol consumption 1995-2007; monthly consumption is quite stable since 1999

[3] Figure 3shows ESPAD score on drinking, smoking and other drugs use of Czech students in comparison to European students' average

[4] Note: The fact that Czech youth score above average in majority of the statistics shall be considered when viewing results from the following analysis and especially in case of its application on other data.

This thesis starts with summary of related theoretical and empirical literature (Section 2). In the next section (3) is discussed the methodology with model specification, detailed description of the data sample and variables used in the study. Section 4 focuses on estimation of Participation in drinking and tries to clarify the causality between drinking and smoking. Next section (5) concentrates on Peer effect. In this part is discussed accessible literature on this topic and detailed identification strategy for estimation of the peer effect in used sample together with results and sub-conclusions is provided. Closing part consists of overall conclusion (Section 6) and final discussion (Section 7) about findings and possible implications of the analyses.

2 Related literature: Factors associated with drinking

2.1 Theoretical literature

2.1.1 Addictiveness of alcohol and its implications for the analysis

From economic perspective, alcohol has been proved to be a normal good - with increasing price, the consumption decreases. Yet, alcohol still differs from normal good, because its consumption is addictive (Cook & Moore, 2000). It means that individuals' alcohol consumption is influenced by three characteristics of addiction as identified by experimental studies (Cawley & Ruhm, 2011): reinforcement, tolerance and withdrawal.

Reinforcement suggests that current consumptions' marginal utility is dependent on the stock of past consumption of addictive good. This means that in two adjacent periods are the consumptions complementary (Becker & Murphy, 1988; Cawley & Ruhm, 2011). Then, individual who has consumed alcohol in past, is very likely to engage in drinking also in current period.

Tolerance implies that utility of current consumption decreases with high levels of past consumption – if current consumption is lower than the past one, also utility from current consumption is lower (Becker & Murphy, 1988). In regards to drinking, the resistance to alcohol increases with sufficient past stock of alcohol consumed. With higher resistance the effects of alcohol decreases and the individual needs to consume more than before to get desired outcomes (feeling relaxed, get drunk).

Withdrawal reflects the situation when individual is exposed to negative physical reactions and reduction in utility when he/she does not consume the addictive good in current period (Chaloupka, Centers, & Tauras, 2010). From medical perspective, withdrawal appears almost any time after sufficient alcohol consumption – in the form of hangover. However, here it refers to withdrawal syndromes related to severe alcohol addiction.

Existence of reinforcement, tolerance and withdrawal has important implication for the economic theory, because it violates the assumption of the basic model of consumer behaviour. This model assumes that the utility of current consumption depends only on the current consumption. Nevertheless, utility of current

consumption of addictive good seems to be highly influenced by past consumption of the good. Economists have created two approaches which take the characteristics of addictive good into account - myopic approach and rational addiction model (Chaloupka et al., 2010).

Myopic addictive models allow individuals' current consumption of the addictive good to be dependent on the past consumption. However, myopic approach assumes that consumer is naive and does not take the addictiveness and side effects of the product into account. In contrary, theory of rational addiction (TORA) (Becker & Murphy, 1988) supposes that individual is aware of the future consequences of his/her present actions (including reinforcement and tolerance) and incorporates them rationally into current utility calculations. Respectively, TORA assumes that immediate utility of addictive good consumption depends on stock of past consumption of addictive good, its current consumption and also on future consumption of addictive substance.

Characteristics of addictive good and the theory of addictive good has following implication for prediction of individual' participation in drinking. First of all, 'reinforcement' indicates that past drinking behaviour shall be good predictor of current consumption. Second, due to the existence of "tolerance effect", individuals' sensitivity shall reflect consumers' past experience with alcohol and also his/her attitude towards drinking. It could be assumed that individuals with low sensitivity to alcohol tend to engage in drinking more often and also drink in higher quantities. Third, individual is assumed to implement all available information and future consequences into consideration. Thus, well known facts about long-term health related problems associated with alcohol abuse should also have (protective) influence on consumers' drinking.

In regards to adolescents' alcohol consumption, Cook & Moore (2000) has concluded that drinking is habit forming behaviour also for youths. Thus, the characteristics of addiction should have affect adolescents' drinking decisions. However, the literature brings evidence that adolescents do not behave exactly in accord with rational addiction model (Gruber, 2000).

The two main violations of the model is existence of excessive myopia and time inconsistent preferences (Gruber, 2000). Adolescents simply do not take into account all consequences of their current behaviour and even if they do they tend to discount the future more heavily than adults. It could be assumed that myopia

leads youth to underestimate addictiveness of alcohol and also its long-term side effects. Time inconsistency suggests that even if adolescents would have the proper information about health related and other risks associated with drinking, they most likely do not take them into account when making actual decisions about participation in drinking. Then most likely positive associations with immediate alcohol consumption should have higher impact on the drinking patterns of youth than negative associations.

2.1.2 Social interaction

Drinking is not only an addictive habit, it is also a social activity and it seems that individuals' decision to drink (such as many other decisions) can be to high extend influenced by behaviour of others (Cook & Moore, 2000). In the previous models the individual is assumed to make his/her decisions in isolations, however Manski (2000) suggests that in reality individuals interact with each other which leads to correlated behaviour within a group of interacting individuals. Existence of social interaction among youth would imply that adolescents' decision to drink is partly attributable to drinking behaviour of his/her friends and peers in general.

Theory behind social interaction will be discussed and tested in details in Section 5.

2.2 Empirical evidence

There are number of empirical researches oriented on explanation of youth drinking and identifying its drivers. In this subsection is provided overview of the most common findings.

Family

Family plays an important role in life of every individual even thought parental influence starts to decrease in puberty and falls steadily with age. Recently, increased probability of alcohol abuse of some individuals has been explained through genetics. It has been shown that adopted boy of alcohol-dependent biological parents are 18%-26% more likely to develop alcohol addiction compare to 6% of adopted boys whose biological parents were not alcoholics (Newbury-birch et al., 2009). Heritable risk relevant behaviour seems to have much higher influence than familial environmental effect. Studies based on observation of adopted twins behaviour concluded that the adoptive parents attitude towards drinking does not

have any effect on the drinking of adolescent (Rutter, 2007). In general, having record of alcohol problems in family history greaten the risk that young person will also suffer from addiction (Newbury-birch et al., 2009).

According to Newbury-birch et al. (2009), relationships in family also play a role. Whilst good family relations work as protective factor, poor relations often lead to increased probability of early initiation with drinking and higher levels of alcohol abuse. Appropriate level of monitoring and support of the adolescent are also connected with reduced consumption. Kokkevi et al. (2007) concluded that fifteen year old students with lower levels of parental control were more likely to consume alcohol ten or more times within 30days. Adolescents with parents who strongly disapprove drinking are less likely to have regularly drinking friends and tend to be less influenced by peers to consume alcohol (Nash, McQueen, & Bray, 2005).

Apart from parents, siblings can affect development of drinking habits of the adolescent. The magnitude of siblings' influence depends mainly on the age difference between siblings. While older siblings' drinking patterns (frequency and intensity) affect alcohol consumption of the younger sibling one year later, younger siblings' drinking does not impact the older one. (Van Der Vorst, 2007) Not surprisingly, the highest influence was found between identical twins – even though the causality in that case is hard to clarify. In general, having older sibling who drinks is an important risk factor for regular drinking whose influence increases steadily if the sibling is same sex co-twin (Scholte, 2008).

Friends and peers

While parental influence decreases with age of the adolescents, the influence of his/her friends increases. The body of related literature is substantial and indicates strong connection between alcohol consumption and peers (Kokkevi et al., 2007; Lundborg, 2006; Newbury-birch et al., 2009; Reed & Rountree, 1997). Unlike family, friends are chosen by the individual himself or herself. The choice of friends reflects personality of the adolescent or the personality he/she wishes to have. Therefore their influence can be very high, because they can serve as an idol for the person or as a support and advisor in decision-making process. Friends are supposed to have highest impact on adolescents drinking behaviour from his/her significant ones – except for identical twin (Scholte et al., 2008). In addition, it is not only participation in drinking but the whole attitude which is influenced by

peers. Lundborg (2006) found evidence that peer binge drinking increases probability that the adolescent also participate in binge drinking - 10percentage point (pp) increase in share of peers binge drinking was associated with 2.3pp higher likelihood of the adolescent to binge drink. Fletcher & Ross (2011) estimates that 10pp increase in friends' drinking increases individuals' probability to drink by 2.8pp. Therefore, the information about drinking habits of friends or peers is essential when analyzing the alcohol usage of individual[5].

Personality

Personal characteristics are good predictors of use as well as possible misuse of alcohol (Newbury-birch et al., 2009). Thrill-seeking individuals are known to be more likely to start experimenting with substances early in the age and tend to abuse alcohol more often than more conservative adolescents. Same patterns are observed among youth who are disruptive, hyperactive and aggressive. Also individuals who tend to break rules are more likely to participate in drinking. (NIAAA, 2006) Likewise, sociable, self-confident and optimistic individuals are more likely to drink than adolescents with low self-esteem and inclination to depression (Engels 2003). However, as Engels (2003) suggests the low self-confidence and depressiveness can be caused by lack of participation in drinking and thus poor social contact with peers.

Previous experience with alcohol

Age when the adolescent starts drinking appears to be a very good predictor of future use of alcohol as well as alcohol abuse. Studies based on US data show that the younger the kid is when first experiencing drunkenness, the higher the chance of alcohol use and abuse in the future. Hawkins et al. (1997) concluded that kids who have tried alcohol at the age of 11 or earlier are more likely to misuse alcohol at the age of 17-18years than respondents who started experimenting with alcohol later. Similar patterns were found among US college students – the later the student started with drinking, the lower was his/her alcohol consumption at college (Newbury-birch et al., 2009).

However, NIAAA (2006) suggests that the early experience with alcohol is attributable to certain personal characteristic of the individual - such as thrill-seeking or adventurousness.

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[5] Peer influence will be discussed in details in Section 5: Peer effect

Smoking and other drugs

The most associated drug with alcohol is tobacco. It has been proved that smoking cigarettes is highly correlated to drinking alcohol (Ritchey et al. 2001; Room 2004; Ida & Goto 2009). Dee & Evans (2003) estimated that teen smokers compared to non-smokers are by 39-50percentage points more likely to participate in drinking. At the same time, participation in drinking increases likelihood of teen smoking by 27- 45percentage points. Hanna et al. (2001) found a relationship between early onset of smoking and probability to develop drinking disorders. Besides the association between being a drinker and being a smoker, there is also evidence of high correlation between drinking events and smoking events. Smokers report higher amount of cigarettes smoked while drinking and also past smokers are more likely to lighten a cigarette during drinking event.(Room, 2004) Still, the causal relationship is hard to clarify.

There are two theories explaining the relationship between smoking and drinking. One suggests that one drug is a gateway to another (Dawson, 2000), the other one assumes that both behaviours are complementary and are explained by other common factors (Ritchey et al., 2001). The reciprocal causality of nicotine and alcohol is discussed in details later (Section 4.2.1).

Likewise, testing softer and harder drugs is associated with higher alcohol abuse and increased probability of problematic drinking. Yet, Newbury-birch et al. (2009) suggests that experimenting with substances and misuse of alcohol consumption is a result of certain personal characteristic rather than the causal effect between risk behaviours.

Beliefs and expectancies about alcohol

Awareness of long-term effects of alcohol consumptions and expectations about alcohol are different across genders and ages. While girls are more aware of the negative effects of heavy drinking, males seem to be less caring about the consequences of long term heavy drinking. However, independent of the gender of the adolescent, the greater is the perceived risk the lower is the chance that the individual engage in problematic drinking. Moreover, the greater the perceived harmfulness of alcohol consumption, the later the individual starts with drinking.

(Brown et al. 2001) The connection between beliefs about risk behaviour and participation in such behaviour was indicated also by Cutler & Glaeser (2005).

Individual expectancies about outcomes from certain risk activity can be even better predictor of possible participation in that activity. In case that adolescent associates drinking with positive outcomes such as feeling more happy or being more sociable it increases likelihood that he/she participates in drinking (Kuntsche et al., 2005). Positive expectations such as having fun, social facilitation and tension reduction are also risk factors for alcohol abuse. In general individuals with such expectations tend to have higher levels of alcohol consumption (Burke & Stephens, 1999). In comparison, teenagers who have negative expectancies about drinking have much lower probability to use and misuse alcohol (Burke & Stephens, 1999).

Sensitivity to alcohol

NIAAA (2006) identifies sensitivity and tolerance to alcohol as another factor influencing adolescents' participation in drinking. It explains that difference between adults and teenagers brain enables adolescents to consume huge amounts of alcohol before experiencing adverse effects of heavy intoxication such as a loss of coordination and severe hangover. Teenagers are often also more sensitive on alcohol in terms of ability to "enjoy" positive effects of drunkenness (NIAAA, 2006).

Academic performance

Many studies suggest a connection between academic performance and drinking habits. Usually, good academic performance is associated with lower rates of alcohol consumption while often absence and poor grades are linked to higher levels of drinking (Perkings, 2002). Frequent binge drinking seems to negatively affect academic performance of college students of both genders (Gill, 2002). Yet, most of the evidence comes from cross-section studies and the causal effect between drinking and grades is hard to determine (Newbury-birch et al., 2009). Moreover, Gill (2002) assumes that engagement in drinking is only a "scapegoat" of other factors leading to the poor performance.

Religious

Religiousness is indisputably one of the protective factors (Newbury-birch et al., 2009). Depth of religiosity, religious affiliation and attendance of services seem to be good predictors of drinking behaviour. Respectively, higher devotion of the

person to the church and religion is related to lower probability to engage in problematic drinking. However, many differences between races and genders exist. For example, white religious adolescents are more likely to consume alcohol than black believers. Boys who are very religious report significantly lower consumption of alcohol than other boys, while the difference for girls is insignificant (Brown et al., 2001). It holds true no regardless of kind of religion. The main reason for substandard alcohol consumption of religious youth is most likely higher respect to rules and stronger boundaries in family compare to non-believers or less religious adolescents (Brown et al., 2001).

Legal drinking age

In the USA, being under or above the legal drinking age appears to be a good predictor of participation in drinking. Carpenter & Dobkin (2009) found evidence that turning the age of twenty-one is associated with immediate increase in alcohol consumption. The study estimates that young adults raise number of drinking days by 21% after turning twenty-one. By contrast, minimum drinking-age law does not seem to play an important role in Europe. First of all, minimum drinking age is usually eighteen or even sixteen years and more importantly, the laws are apparently not enforced that strictly, because the rates of alcohol consumption at the age of fifteen are rather high (Hibell et al., 2007) There might be a slight difference amongst countries, but in general underage drinking is a very common practice.

2.2.1 Limitations of empirical evidence

Based on the evaluation of literature related to adolescents' substance use (Newbury-birch et al., 2009), evidence from majority of articles cited in this chapter is related to the case control or cohort studies which have high risk of bias or confounding. Also, in most of the cases the results do not prove causal relationship between the factor and alcohol consumption. In addition, most of the studies are related to binge or heavy drinking, which might lead to lower influence of those factors when explaining probability of participation to drink.

3 Methodology

In this section, firstly the model and method used for determination of possibly influential factors in regard to adolescents' participation in drinking is described. Then more detailed information about the dataset used is provided together with its pros and cons. Finally, variables used in the regression are introduced and possible drawbacks of the model are discussed.

3.1   Model description

The model estimating the likelihood of student to consume alcohol in past month can be written as follows:

$$\Pr(drank_i = 1) = \alpha + \beta CV_i + \gamma F_i + \delta PE_i + \vartheta PC_i + \mu Ex_i + \varepsilon_i \qquad (3.1)$$

Since the variable of interest is a binary variable the linear probability model (LPM) was used for the analyses. On the left side of the equation is dependant variable $\Pr(drank_i = 1)$ - probability that respondent i participated in drinking during the period of past 30days. On the right side are vectors of certain groups of factors. Those groups are based on the findings from the literature provided in Section 2. CV_i is a vector of control variables consisting of school specification, demographic factors and socioeconomic status of the family of the respondent. F_i is a vector of more specific family variables, such as relationships with parents or older siblings' attitude to alcohol. Vector PE_i examines the effect of peers and contains information about share of friends engaged in drinking. Personal characteristics are covered in vector PC_i and expectations about effects and harmfulness of alcohol in vector Ex_i. Parameter α represents a constant in the model, while parameters $\beta, \gamma, \delta, \vartheta$ and μ are vectors of the constituent influence of related dummy variables. ε_i is an error term.

3.1.1 Advantages and limitations of the method

Linear probability model is easy and very intuitive on interpretation. Moreover, it yields very similar results to more sophisticated logit model[6] and can serve well

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[6] This hypothesis has been tested by using logit model to estimate (3.1). The output is not provided, but the marginal effects at means showed very similar results to those obtained by LPM with just a minor change in magnitude and level of significance for some variables.

when testing relationships with binary criterion (Pohlmann, Leitner, & Psychology, 2003).

Still, results obtained by LPM model must be considered with caution, because having binary dependent variable brings several violations of the OLS assumptions (Aldrich & Nelson, 1984). Firstly, heteroskedasticity of the residuals is present, because the values of dependent variables are only 0 and 1. This problem can be partly controlled by using cluster-robust standard errors estimator (Nichols & Schaffer, 2007). Every model estimated in this thesis is corrected for heteroskedasticity by using cluster-robust standard errors estimator, where the cluster unit used is respondents' class. The number of clusters within each model is between 153 and 170, which is considered to be a sufficient number for accurate inference (Nichols & Schaffer, 2007). Secondly, the errors are not normally distributed (Jones, 2005), however the sample size (9293 observations) is large enough to assume normal distribution. Thirdly, there is a violation of linearity. The main disadvantage of LPM is the possibility to get the values outside the probability range <0,1>. It is possible to correct for this mistake by setting the values outside the range as the lowest respectively highest possible value (zero or one). Nonetheless, the correction is not essential in this study since the focus is on the effect of sole variables and not on the prediction of the overall effect.

3.2   Data source

Data used for this thesis come from European School Survey Project on Alcohol and Other Drugs (ESPAD). This survey is conducted every four years starting in 1995 in several European countries and its aim is to monitor and compare trends in adolescents substance use within and across countries. The data are collected in the form of anonymous questionnaires, which are standardized in all participating countries. ESPAD questionnaire is very complex and covers many important areas regarding substance use of 15 and 16years old students. Besides the current substance use (alcohol, tobacco, marihuana and other drugs) it also includes questions about previous experiences with drugs, opinion on the dangerousness of use, personal characteristic of the respondent and basic information about his/her family. (Csémy et al., 2006; Hibell et al., 2004). Majority of the questions in the ESPAD survey is interval, mainly likert scale type of questions.

3.2.1 Used sample

Empirical analyses in the Sections 4 and 5 are based on data collected in Czech Republic during ESPAD 2003. The advantage of this dataset is a large sample of respondents from all types of high school and different regions. Representativeness of the sample was ensured by the usage of multiple-stage stratification selection[7]. The collected data contains only a very low percentage of missing or inconsistent answers (Hibell et al., 2004). Moreover, compared to data from other countries, the response rate of participating students in participating classes is very high - 95% while the number of eliminated questionnaires is rather low – 0,7%. Thus, data used in this study can be considered as valid, reliable and representative (Csémy et al., 2006; Hibell et al., 2004).

The dataset from Czech Republic has a few other interesting particularities. The survey was run between 3rd and 16th April. It means that all special events which could have influenced frequency or intensity of the substance use (such as New Years Eve, spring holidays, Easter) were avoided. Thus, the answers about substances' use in last 30days should reflect the common consumption of the respondent. In addition to the core questions, the Czech questionnaire contains also questions from the optional psychosocial module. Czech Republic have also used the opportunity to add extra questions and included section about structure and relationships in family. More importantly, as one of a few countries in ESPAD 2003, Czech Republic surveyed not only 15-16 years old students but also 17-18years old students within the same school (Csémy et al., 2006; Hibell et al., 2004). Inclusion of older students as well as additional information about family makes the Czech data very complete and can serve very well for the purposes of this thesis.

3.2.2 Potential of the data

Another specific of Czech data is the fact that the younger group of surveyed students is in the freshmen year at the high school. While in vast majority of observed countries the students age 15-16 are part of the same class for at least a couple of years, the respondents from Czech Republic were exposed to completely new school environment and new collective of classmates during the past few months. Although it is a cross-sectional dataset, the nature of the data enables to

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[7] High **schools were randomly picked based on its type and on distribution of adolescents born in 1987 across different regions**

create a model for peer effect which can be corrected for many problems related to this kind of models.

3.2.3 Limitations of the data

Collected data are based on students' self-reports, not on the real observations of substance use or behaviour. Therefore the data are subject to bias and may not reflect the true behaviour of surveyed individual. Harrell (1985) discusses the influence of social acceptability of illicit substance usage on the reports. It has been shown that standard social norms usually lead to underrating of the usage. However, the underreporting or refusing to admit the usage is usually related to heavy drug use. For alcohol consumption among Czech youth could actually be expected upward bias. In Czech Republic it is perceived as "desirable" to be able to drink huge amounts of beer (based on author's experience), which could lead to over-reported consumption. At the same time, resistance to alcohol might be overstated, because being able to drink more without getting very drunk is also preferred in Czech Republic. This hypothesis is supported by Müller et al. (2011) who suggests that the self-reported level of drunkenness can be biased by the individuals' and country specific perception of drunkenness[8].

Nonetheless, Harrell (1985) considers self-reports as an efficient and flexible method how to get valuable information. Moreover, Barnea et al. (1987) brings the evidence about high reliability and stability of self-reports on drug use. In conclusion, despite the proved validity of ESPAD data and empirical evidence about sufficient reliability and stability of self-reports, estimates based on such data should still be seen with caution.

3.3 Variables description

Variables included in the model are based on potentially important factors identified in the accessible literature. In respect to the data, not all factors can be estimated. Yet, the dataset is very complex and brings the opportunity to test diverse hypothesis. Assumptions about the importance and signs of certain factors are briefly expressed in the following text and are summarized in Table 1:

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[8] While some countries (mainly Northern countries) have positive associations with being drunk, in other cultures (Mediterranean) getting too drunk is undesired outcome of alcohol consumption. Therefore, inhabitants from the former most likely report higher levels of drunkenness while consuming less alcohol, whereas for Southern countries the opposite can be true (Müller et al., 2011).

Summary of risk and protective factors. Those expectations are based on the literature review in Section 2.

All the variables used in the following analyses are derived from certain questions asked in the ESPAD survey[9].

Dependent variable

$\Pr(drank_i = 1)$, where $drank$ is a binary variable. It takes the value of one if the student consumed alcohol more than three times during last month or drank once or twice, but in higher quantities (more than five drinks within one event). The variable has value of zero when the respondent had consumed alcohol less than three times and in low quantity or did not drink at all. The kind of alcohol beverage consumed is not important.

Independent variables
Control variables

To be able to examine the effect of certain factors, it is important to reduce the effect of other exogenous factors which could have influence on the estimates. Therefore the variables: class year, sex, type of school, size of city, age of respondent, wealth of family and education of parents are included.

Class year: *freshmen (*first grade*), juniors (*third grade*)*

Gender: *boys, girls*

School type: *academic, vocational, apprenticeship[10]*

Size of the city: *big city, city, small town.* Cities which are labelled as *big city* are Prague, Brno and Ostrava – cities with more than 300 thousands inhabitants. *City* is for municipalities with number of inhabitants over 50thousands and *small town* is for places with less than 50 thousand residents.

Age: *underage, major.* Where *underage* is one for respondents who has been younger than eighteen years at the day of the survey and *major* for those who already turned eighteen.

Education of biological parents: *father uni father hs, father le, father unknown, mother uni, mother hs, mother le, mother unknown.* Where *uni* means completed university/college education, *hs* stands for obtained high school diploma

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[9] All questions asked in the survey in the exact wording can be find in the ESPAD Report 2003 (Hibell et al., 2004) available on www.espad.org/espad-reports
[10] For further explanation see Section 5.2.1

and/or started but not completed university, *le* is low educated parent – i.e. parent who has lower than secondary education and *unknown* in case that respondent does not know educational level of the biological parent.

Family wealth: *really wealthy, wealthy, average wealth, poorer, very poor.* The wealth of the family is based on the subjective comparison of the wellbeing of the family and other families. The dummy variables *wealthy* and *really wealthy* equal one if the respondent considers his family to be above or well above the average. *Poorer and very poor* have value of one if the family is assumed to be below or much below the average.

Family influence

Structure of upbringing: *parents separated.* This dummy is one in case that the respondent has not been raised by both his biological parents together till the age of fifteen.

Relationships in family: *very good family background, good family background, unstable family background, poor family background.* Those dummy variables summarize self assessed feeling from the situation in family. *Very good family background* means that the respondent thinks that everything in his/her family is in perfect order; *good* has value of one for those who feel that the situation is "more-less" stable. *Unstable family background* is the case when situation in respondent's family is sometimes good and sometimes bad. *Poor family background* marks that according to the adolescent, most of or all the time the situation in the family is very bad.

Monitoring by parents: *strong monitoring, moderate monitoring, low monitoring.* Respondents who reported that their parents always know what he/she does on Saturday nights belong to the group for *strong monitoring. Moderate monitoring* has value of one when respondents' parents know most of the time where their kid is on Saturday nights. *Low monitoring* is the case when parents sometimes or rarely know what the respondent does on Saturday night.

Siblings influence: *often drinking older sibling.*

Based on the literature, good relationships in family and living in complete family are protective factors, while being from broken family or poor bounds and unstable family situation function as the risk factors for adolescents' drinking. Parental monitoring is assumed to have restrictive effect on adolescent (Kokkevi et al. 2007; Newbury-birch et al. 2009). Thus the higher the level of monitoring the

lower shall be the probability to drink. Since older sibling is usually role model for the younger child, his/her frequent experimentation with alcohol probably rises the chance of the younger one to experiment as well (Van Der Vorst et al., 2007).

Peer influence

Friends alcohol consumption: *friends drinking – none/few/some; most, all.* Those dummy variables are based on the share of respondents' friends consuming alcohol.

Peers behaviour appears to be one of the greatest predictors of adolescents behaviour (Fletcher & Ross, 2011; Lundborg, 2006; Scholte et al., 2008). Therefore, high share of drinking friends is assumed to be an important risk factor and to increase substantially the likelihood of an individual to participate in drinking.

Personality

Thrill seeking, risky behaviour: *current smoker, first drunk<14years old, experiences with drugs.* The dummy variables here reflect previous and current experiences with substances and are used as proxies for the personal characteristic – adventurousness. The dummy variable *current smoker* equals one in case that the respondent smoked daily during the past month. *First drunk<14years old* has value of one when the respondent admits first intoxication at the age of 14 or younger. *Experiences with drugs* is one in case that respondent have reported at least one experience with amphetamines/opiates/sniffed a substance or have smoked marijuana at least three times during his/her life.

Self-confidence: *very self-confident, self-confident, not self-confident.* These dummy variables are based on the strong disagreement/disagreement/agreement of respondent with statement that he/she does not have much to be proud of. Presumably, pride and self-confidence are correlated - person who has a lot to be proud of is unlikely to have low self-confidence. Therefore, pride is in the model used as a proxy for self-confidence.

Aggressiveness: *aggressive.* Adolescents with dummy variable for aggressiveness of one admitted that during their life they took part in a fight which was not related to alcohol.

Rules/laws abidance: *rules violation possible, respect to rules, don't know.* Dummy variable *rules violation possible* is positive if the respondent agreed with

the statement – "you can break most rules if they don't seem to apply". Reporting disagreement implies positive value for dummy *respect to rules.* The last dummy – *don't know* has value of one for respondents who could not simply agree or disagree with given statement.

Personal characteristics of individuals can be a very good predictor of engagement in risky behaviour and thus are suggested to have significant effect on the alcohol consumption (Newbury-birch et al., 2009). Especially the effect of thrill-seeking behaviour and violation of rules are assumed to be important risk factors (Hawkins et al., 1997; NIAAA, 2006). Presumably, thrill seeking person is likely to experiment with alcohol in younger age than is the average and also tends to try other drugs. Smoking and drinking are usually complementary behaviours (Ida & Goto, 2009), therefore influence of the variable *current smoker* is assumed to be very high. The problem of reverse causality between them and its possible solution is discussed later (Section 4.2.1)

Expectations about alcohol

Risk perception: *low risk, moderate risk, great risk, unknown.* Those dummy variables reflect respondents' opinion about health effects of regular weekend heavy drinking (more than 5 drinks per event). The risk perception about this type of drinking was used for the model, because weekend binge drinking seems to be the common way of drinking by youth.

Sensitivity on alcohol: *drunk after 1-2glasses, drunk after 3-4glasses, drunk after 5-6 glasses, drunk after 7-8glasses, drunk after 9+ glasses, have never been drunk.* Listed dummy variables measure respondents' self-assessed resistance to alcohol.

Judgment of drinking: *very condemn, condemn, accept, doesn't know intoxication once/week.* Set of those variables reflect students' agreement or disagreement with certain behaviour - in this case intoxication once a week. *Very condemn* has value of one in case that the individual strictly denounce regular binge drinking, *condemn* if respondent somehow disagrees with such behaviour. Dummy variable *accept* means that the student does not condemn regular weekly intoxication and *doesn't know* is one if he/she does not have clear opinion about such behaviour.

Association with alcohol: *positive, negative.* Dummy variable *positive* gets value of one if the student associates alcohol consumption with positive output.

More specifically, if respondent assumes that at least one of the following things is very likely or likely to happen after drinking: feeling relaxed, feeling happy, forgetting problems, feeling friendlier and more outgoing, or having a lot of fun. *Negative* is one for respondents who think that it is very likely or likely that after alcohol consumption they get into trouble with police or/and do something they will regret later on.

As discussed previously, it is expected that the lower the sensitivity the higher the probability to drink (Cawley & Ruhm, 2011; NIAAA, 2006). The condemnation of certain behaviour is supposed to decrease the probability of engaging in such behaviour. Thus the more one disagrees with binge drinking the less likely he/she is to participate in it and vice versa (Ritchey et al., 2001). Positive association are usually indicators of increased probability of drinking while negative associations are restrictive factor (Kuntsche et al., 2005). Perceived health risks associated with regular alcohol abuse are also assumed to be important determinants of drinking (Brown et al. 2001). Presumably, magnitude and significance of the effect depends on the "rationality" of the adolescent (Gruber, 2000). While for myopic individuals the long-term effects of drinking on health do not play an important role, rational individuals shall be more influenced by the perceived risks.

3.4   Limitations of the model

Firstly, the dataset does not allow to estimate influence of all factors discussed in accessible literature. For example information about family such as parental drinking habits and their attitude towards alcohol and other substance use; or more detailed information about sibling could improve the explanatory power of the model. Also religious of the respondent would be interesting information even though Czech Republic is highly atheistic country and just a very few people regularly attend the church service. More detailed data about friends would presumably improve the estimations as well. Especially information about best friends drinking habits or girlfriend/boyfriend alcohol consumption would be desired because those people are supposed to have the highest impact on adolescents' actual consumption. Besides, data about budget constraints of the respondent or his/her popularity among classmates could enrich the model.

Secondly, the data are cross-sectional which makes it hard to determine the causality effects between dependent variable and certain independent variables[11].

Thirdly, the results are based on the Czech sample. As described in Introduction, in Czech Republic, the alcohol consumption is above average and there is a very high level of social tolerance to drinking. Therefore, the determinants of participation in drinking and especially their magnitude can be country specific.

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[11] This is also one of the reasons why the GPA of the students is not included in the model. It has already been suggested in the literature review that the relationship between those two is ambivalent and since only the information about most recent academic performance is available, it is impossible to clarify the causality. Moreover, for first year students it is their first report at high school and is most likely influenced by the different style of teaching and evaluating at the school.

4 Participation in drinking

4.1   Descriptive Statistics

In total, 180 schools participated in the survey. Within each school the questionnaires were distributed in one class of first year and one class of third year students (total 360classes). Distribution among types of class is following: 25.8% goes to academic school, 39.4% attend vocational school and remaining 34.8% are apprenticeship students. Majority of the schools in the sample are situated in small towns – 46.5%, 35.6% is in cities and around 17.9% in big cities.

Altogether, the sample consist of 9293 observations from which 4262 (46%) are boys and 5031 (54%) are girls. Average age of the respondents is 17.1 (1.02) years and approximately half of them attends first year (51.3%) while the other half are third year students (48.7%). Only 1.25% from the whole sample has never tried alcohol. During the past year 96.22% students participated in drinking at least once or twice and 81.8% of respondents claimed to drink alcohol during the past month. Mean of the dependant variable *drank=1* is 0.64 (0.48) and differs with grade and gender. While 58.6% of freshmen admitted to drink more than three times or once/twice but in higher quantities in the past month, 69% third year students did. The difference between males and females who *drank* is 23.5% (57.5% of females and 71% of males).

There is an observable discrepancy in drinking patterns of girls and boys and different school years. Also based on the empirical evidence, the magnitude and significance of different factors can vary across gender and age (Newbury-birch et al., 2009). Therefore, the sample is divided into four subgroups according to the sex and grade. Detailed summary statistic of all variables used in the model for different subgroups is provided in Table 3 - Table 6.

4.2 Results

As mentioned previously the sample is divided into subgroups according to sex and grade and all analyses are done separately those subgroups: first year boys, first year girls, third year boys and third year girls. Data were analyzed using Statistical package STATA 10.0 and STATA 11.2.

Table 7 shows overview of results for all subgroups after estimating model (3.1)[12,13]. The most influential factors (p<0.01 for all subgroups) appear to be drinking habits of friends, engagement in other risky behaviour –namely having experience with drugs and being current smoker. Sensitivity to alcohol as well as disagreement with regular binge drinking also play important role in individuals' participation in drinking. Most restrictive factor seems to be having a low share of drinking friends – having none/few or some friends who drink is associated with significant (p<0.01) reduction in probability to drink by 10 (2.7) to 13.4 (2.2) % compare to adolescents with majority of drinking friends. Even higher protective effect has strict judgment of regular intoxication. Respondents who very condemn such behaviour are from 13.1 (2.9) to 20.3 (4.2) % less likely to consume alcohol compare to individuals who accept weekly intoxication (p<0.01).

Important risk factor is having only friends who are drinkers - the probability to drink is by 6.4 (2.0) – 11.2 (2.2) % higher than for respondents with majority of drinking friends (p<0.01). Also experimenting with other drugs increases the likelihood to participate in drinking alcohol (p<0.01) – being a smoker rises the probability by 7.3 (2.2) – 17.0 (2.7) % and having experience with other drugs lead to increase from 7.4 (1.9) to 10.4 (2.3) %. Not surprisingly, the best predictor of participation in drinking is sensitivity to alcohol. There is a clear positive relationship between probability to drink and higher resistance. Nonetheless, this estimate must be interpreted with caution, because the resistance to alcohol is directly influenced by the current drinking habits of the individual. Interestingly, being able to report even very high sensitivity to alcohol increases the likelihood to drink by 8.7(3.5) – 19.8 (7.1) % when compared to those who have never tried alcohol or have never experienced drunkenness.

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[12] In order to get more complex picture about drinking behavior of the respondents, also frequency of drinking and binge drinking events were estimated. Results from ordered logit regressions are not discussed here, but are summarized in Appendix III: Frequency of drinking and binge drinking events in Table 11 and Table 12

[13] For the interpretation of the coefficients is assumed ceteris paribus condition.

The variable *underage* is insignificant (p>0.1) for both genders.

4.2.1 Reverse causality between smoking and drinking?

As mentioned previously, results of the estimation suggest that being a current smoker is an important risk factor for participation in drinking. However, the relationship between smoking and drinking is not very well specified and the model presumably suffers from reciprocal causality. It is very likely that person who smokes daily tends to engage in risky behaviour more often than non-smoker (Chen et al., 2002). On the other hand, engagement in drinking can result in increased probability to start smoking and continue with the habit (Room, 2004). Determination of the relationship between drinking and smoking is important for two reasons. Besides correcting for possible biased estimates of the coefficients due to endogeneity - correlation of independent variable (*current smoker*) and error term, it can have interesting policy implications. In case that engagement in one of those behaviours significantly influences participation in the other one would mean that preventive program aiming on the "right" drug can lead to spill-over effect and increase efficiency of the intervention. On the other hand, attempt to reduce the resulting behaviour might not be very successful.[14]

Smoking and drinking- data description in the sample

In this sample 83% of smokers were engaged in drinking, while only 50% of non-smokers did. With increasing age the difference between participation in drinking of smokers and non-smokers decreases. While in first grade 82.5% smokers and 43% non-smokers reported alcohol consumption in the last month, in third year it is 84% smokers and 58% non-smokers. Reversely, only 18.6% of abstainers smoke daily, while 52.8% of those who drunk smoke. This means that smokers in this sample are 1,5 times more likely to drink than non-smokers and drinkers are almost three times more likely to engage in smoking than abstainers. Again the difference between abstainers and drinkers and their participation in daily smoking changes with age. Freshmen abstainers smoke in 16.5% of cases while drinkers in 54%; juniors smoke in 21.7% and drink in 51% cases. Observed shares

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[14] It could be argued that there is reciprocal causality also between current drinking and the variable *experience with drugs*. However, since this variable covers lifetime experience with drugs, the probability that respondent experimented with drugs for the first time as a result of past month alcohol consumption is quite low. It is reasonable to assume that the causality here is not reciprocal, but experience with drugs is more a result of personal characteristic, which also influences participation in drinking.

go along with the studies on this topic (Dee & Evans, 2003; Ritchey et al., 2001) and support the hypothesis that there is a connection between drinking and smoking.

4.2.2 Proposed solution

The instrument variable approach is used in order to examine the causal effect between smoking and drinking. The main idea of this method is to find a variable "*z*" which is a good predictor of current smoking status of the adolescent, but cannot be influenced by his/her participation in drinking in past 30days. Thus *z* must fulfil two criteria: It needs to be sufficiently correlated with the independent variable *current smoker* and exogenous at the same time - uncorrelated with the error termε_i.

Variable which should fulfil those criteria is the share of smoking friends[15]. Respectively, dummy variable *friends smoking* which has value of one in case when the respondent reported that majority or all of his/her friends smoke. The choice of this instrument is based on the studies about peer effect on smoking, which bring evidence that share of friends smoking can influence smoking of adolescent (Lundborg, 2006; Pertold, 2009; Taylor, Conard, Koetting O'Byrne, Haddock, & Poston, 2004). Taylor et al. (2004) concludes that adolescents with one significant other (parent, sibling, best friend) who is a smoker, have four times higher chance to smoke cigarettes than adolescents without smoking significant other. By using this instrument the problem with reciprocal causality is overcome, because share of smoking friends can hardly be influenced by current participation in drinking. Moreover, correlation between variable *current smoker* and *friends smoking* is 0.39, so it is plausible to assume that having majority or all friends who smoke is a good predictor of individuals' smoking status.

4.2.3 Results of IV regression

Effect of the instrumental variable was estimated using two-stage least squares estimation method. The instrumental variable was significant in the first stage regression for all subgroups and appears to be an appropriate instrument (F>10,

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[15] Another and maybe more intuitive variable to use as an instrument is lagged smoking experience. It is reasonable to assume that students who used to smoke daily one or two years ago have not stopped with this habit till now. Past positive smoking status should be highly related to the current status and at the same time lagged smoking experience cannot be caused by current drinking of the individual. On the other hand, it is hard to say for what reason the individual started smoking. It can be the case that past daily smoking was a result of past drinking experience. Thus by using lagged smoking experience as an instrument, the causality would still not be solved properly.

see Table 9). Table 8 provides results from second stage regressions for different subgroups. After using the instrument variable, the influence of smoking on probability to drink become insignificant (p<0.1) in all models, but stays positive and high for first year students. For first year boys there is almost no change in the estimated coefficient, while second stage regressions for third year students show negative sign of the coefficient for instrumented current smoking status. Test on endogeneity (Table 9) does not reject the hypothesis about exogeneity of the variables in models for first year girls and boys (p>0.05), but it is rejected for third grade students (p<0.05).

Findings for third year students go along with the gateway theory, which propose that one drug use leads to use of another drug. Results from the second stage regressions for juniors indicate that the causality goes more in the direction from drinking to smoking than vice versa. Such causal effect is suggested by majority of studies on gateway theory (Ritchey et al., 2001). To the contrary, the exogeneity of the variable *current smoker* indicate that the factors normally responsible for reverse causality of drinking and smoking are captured in the model. In addition, the result supports the cumulative risk behaviour approach. This approach suggests that smoking and drinking does not cause one another, but they are a result of shared causes. Similar findings reports Ritchey et al. (2001), who concludes that the strong correlation between smoking and drinking stems from similar causes such as approval of drinking or peer pressure to drink.

4.2.4 Sources of exogeneity

In order to identify the common factors in this case, a set of instrumental variable regressions for first year students is estimated again. In each step one group of possibly responsible variables is excluded from the regression and the endogeneity check is done again. Firstly, the regressions are run while excluding only set of family variables/ peer variables/ personality variables/ variables related to expectations about alcohol. Results provided in Table 10 suggest that the common cause in case of freshmen boys is friends' influence – exogeneity is rejected when variables about share of friends drinking are excluded from the model (p<0.05). In the case of girls this factor plays also important role, however is not the only driver of exogeneity of current smoking status. Looking at the significance of variables in first and second stage regressions shows that the judgment of regular intoxication is important in both. After exclusion of judgmental variables

from the regression, the exogeneity of variables is rejected also for first year girls (p<0.05).

Thus, this analysis finds friends' influence and dis/approval of binge drinking to be common causes of fifteen and sixteen years old adolescents' drinking and smoking, which goes along with the study by Ritchey et al. (2001). In addition, results of this analysis suggest that the influence of friends seems stronger for boys than for girls, while the personal approval or disapproval of certain behaviour has higher impact on decision making process of female than male students.

4.3   Sub-conclusion

Overall, the results of the analysis correspond with the expectations stated earlier and go in accord with empirical evidence and economic theory about addictive good. Main conclusions regarding the analyses in this section are following.

Firstly, as the most important factors for all subgroups (p<0.01) has been identified sensitivity on alcohol, friends influence, currents smoking status, experience with other drugs and judgment of regular intoxication. High impact of sensitivity of alcohol goes along with the characteristics of addictive good and shows impact of reinforcement and tolerance on the current consumption. Significant effect of share of drinking friends on adolescents' participation in drinking suggests existence of social interaction. And importance of current smoking status and experience with other drugs indicates interdependency between alcohol and other addictive substances.

Secondly, significance and magnitude of the coefficients vary substantially across gender and grades. For instance, while for girls the level of monitoring or high risk perception of regular drinking are significant protective factors (p<0.05), they do not play an important role for boys' participation in drinking (p>0.1). Also, juniors with good relationships in family are significantly more likely to participate in drinking (in comparison to juniors with bad family situation), whereas family structure does not seem to affect likelihood of alcohol consumption of first year students.

Thirdly, other personal characteristics than thrill seeking do not seem to have universally high impact on adolescents' participation in drinking. Overall, likelihood to drink for self-confident students is not significantly different from

likelihood of low self-confident adolescents. Agreement with violation of rules significantly increases probability to participate in drinking only for first year girls (p<0.01) and third year boys (p<0.05). Being aggressive has impact only on third year boys and despite expectations aggressiveness appears to be a protective factor.

Fourthly, variables about perceived health risk related to drinking has only a minor importance for boys (p>0.1), but has significant impact on girls (p<0.05). Female students appear to make their decisions about participation in drinking after consideration of their beliefs about risks of alcohol consumption, but male students' behaviour seems more myopic.

Fifthly, having positive association with drinking significantly increases probability to drink in all groups (p<0.01) except for freshmen boys (p>0.1). In contrary, negative association with alcohol consumption is important restrictive factor only for first year boys (p<0.05) and is insignificant in all other subgroups. The results in general would suggest that positive association with drinking has higher value in decision making process than negative associations.

Sixthly, minimum drinking-age law has slightly protective effect on girls – being underage is associated with 2.2 (1.5) % reduced probability to participate in drinking. However the coefficient is insignificant for both genders, which indicates that the legal age restriction has only a minor effect on alcohol consumption of youth in Czech Republic.

Finally, obtained results from the analysis of reciprocal causality of smoking and drinking lead to conclusion that both –gateway and cumulative risk behaviour hypotheses- are correct, depending on the age of youth in the sample and variables included in the estimated model. While becoming daily smoker at younger age seems to be more a result of common factors, cigarette consumption later in the life can be partly explained by adolescents' participation in drinking. As common causes responsible for the interdependency between drinking and smoking among younger students were identified share of drinking friends and judgment of binge drinking. Moreover, for boys the influence of drinking friends was the sole cause of interdependency of those risky behaviours.

5 Peer effect

Share of drinking friends has turned to be one of the main determinants of participation in drinking which goes along with the hypothesis about existence of social interaction. Moreover, it has been identified as one of the common causes of the interdependency between drinking and smoking behaviour among freshmen students. However, the estimate is influenced by many effects which need to be controlled in order to see whether there is a clear causal effect between share of persons surrounding the individual who drink and individuals' engagement in drinking.

Due to the lack of information about respondents' friends, in the following estimation is tested influence of his/her new classmates. This is actually even more interesting object to study. If there is a significant peer effect, it would mean that change of school (going from primary to secondary school) leads to increased prevalence of drinking. Thus, organization of educational system could partly explain why the alcohol consumption at the age of fifteen among Czech youth is so high.

5.1 Economic theory and implications

5.1.1 Social interactions in economic theory

During the past decade social interaction is more in the focus of economists. Economic theories about social interaction also lead to creating alternative approaches about health behaviour of individuals. As other basic economic models, basic health capital model builds on assumption that individuals maximize their utilities in isolation and their decisions are not influenced by actions of other people. In reality, individuals are highly affected by behaviour of others, especially when considering risky behaviour (Lundborg, 2006). That means that individuals demand is driven not only by functional demand (e.g. price), but also by non-functional demand (e.g. preferences of others). Leibenstein (1950) discusses two effects which influence the demand via preferences of other individuals – "bandwagon" and "snob" effect. The bandwagon effect is related to increase in consumption of certain commodity due to consumption of this commodity by others. The snob effect appears when individual wants to behave differently than the crowd. Thus his/her desire to consume certain good decreases when others demand

for the good increases. The connection of those effects to drinking behaviour of adolescents is easy to picture. Drinking is a social activity so adolescent can derive utility from participation in drinking when his/her peers are also drinking (Niankara, 2009). At the same time, during puberty adolescents might want to show independence and rebel against majority. Cawley & Ruhm (2011) suggest that the deviating adolescent is usually not completely separated from the group but rather belongs to smaller group which tries to behave differently than the majority. Thus, bandwagon effect still appears but is limited on a minor peer group.

Preference interactions are only one of three sources of social interaction as named by Manski (2000). Besides preferences, individuals can influence each other through constraint and experience interactions. Constraint interactions can occur if individuals share resources – being on party where is only limited amount of alcohol can reduce ones' alcohol consumption simply because there is not enough alcohol for everyone. Experience interactions means that the decision making process is partly based on observation of actions chosen by others or on experiences shared by others. Adolescent who sees his/her peers having fun while drinking, or hears his/her friend talking about feeling happier while consuming alcohol, will most likely adjust his/her view on drinking and link it with positive outcomes. Positive association about alcohol can then lead to increased consumption.

5.1.2 Explanations for correlated behaviors

(Manski, 2000) identifies three kinds of interactions which could be responsible for similar behaviour of the individuals within one group[16] – endogenous (1) and contextual (2) interactions and correlated (3) effects. Endogenous interaction arises when behaviour of the group influences behaviour of the individual. For instance, when individuals' alcohol consumption increases as a result of high average alcohol consumption of his/her classmates (all else holding equal). Contextual interaction appears if consumption tends to vary with exogenous characteristics of the group members such as socioeconomic or age composition of the group. For example assuming that adolescents with low educated parents are more likely to engage in binge drinking, then individual who is surrounded by such adolescents is more likely to binge drink as well. Finally, correlated effects might be present if the

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[16] The theory on social interaction is summarized in Figure 1, numbers in the brackets correspond with the number of certain effect in the Figure. This should help reader to follow the identification strategy proposed later.

individuals share the same characteristics or environment. For example, if individuals with low educated parents tend to hang out together or if a group of underage individuals lives in a place where access to alcohol is limited.

The reason why it should be distinguished between these hypothesis is difference in implication they have for public policy (Manski, 2000). Consider prevention program only for heavy drinkers in the school. Reduction in their alcohol consumption would then decrease average drinking in the class and through this decrease consumption of other students. Lundborg (2006) gives another example – introduction of minimum legal drinking-age law. Such law directly imposes restrictions on the underage adolescent, because it reduces availability of the alcohol and might cause decline in his/her consumption. Adolescents' peers are exposed to the same restriction and thus their consumption also decreases. As a result, share of drinking peers of the adolescent decline. Presence of endogenous interaction would indirectly influence adolescents' drinking behaviour and lead to higher reduction in his or her alcohol consumption. Existence of "social multipliers" has very positive implication for policy makers. If the social multiplier is large, effectiveness of small intervention can increase substantially and have a great impact on individual behaviour (Lundborg, 2006).

Figure 1: Illustration of Social Interaction
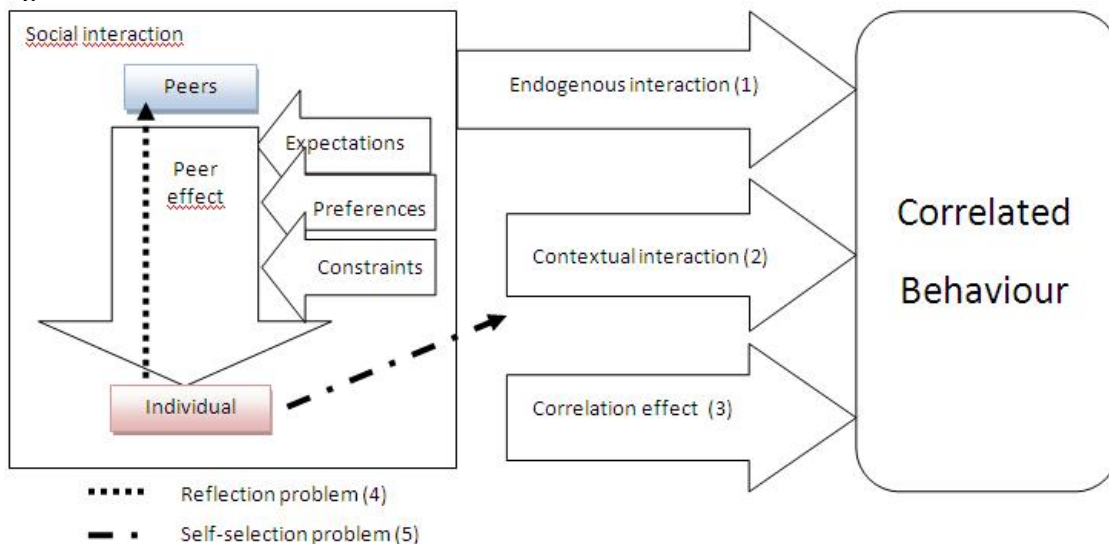
In theory the difference between these effects is clear; however it is not easy to distinguish between them in practice. The main difficulties related to estimation of causal effects of peers on health outcomes on precise analysis of peer effect are capturing "reflection problem"(4) and self-selection of individuals into group(5).

Firstly, the observed similarity in peers and individual behaviour is most likely a result of reciprocal influence – peers' behaviour affects behaviour of the individual but also individual itself has an impact on the behaviour of his/her peers (Manski 2000; Cawley & Rhum 2011). Secondly, individuals are usually not randomly assigned to a peer group. Hence, they tend to self-select into groups based on characteristics they share with the others. As Norton et al. (1998) points out the existence of peer selection indicates that adolescent and his/her characteristic itself causes similarity in peer groups' behaviour. The problem arises when characteristics which are responsible for adolescents' identification with certain group are unobservable (Fletcher & Ross, 2011; Pertold, 2009).

Not taking self-selection and reflection problem into consideration would lead to upward bias of the estimates (Manski, 2000; Norton et al., 1998).

Next, an identification strategy which deals with mentioned difficulties and suggest possible solutions relative to the data available (ESPAD 2003) is proposed.

5.2 Identification strategy

In the first step of the identification strategy the naive model is estimated:

$$\Pr\left(drank_{i(c)} = 1\right) = \alpha + \beta S_i + \gamma X_{i(c)} + \delta \overline{Peer}_{-i(c)} + \varepsilon_{i(c)} \qquad (5.1)$$

This model is identical to model (3.1) with only one change. Dummies about share of friends drinking are replaced by the variable $\overline{Peer}_{-i(c)}$. It is the share of classmates of individuals *i* from class *c* who participated in drinking during the last month (those with positive value for dummy *drank*). The variable was calculated as the mean prevalence of participation in drinking among individuals' classmates after extracting his/her contribution to the mean (Lundborg, 2006):

$$\overline{Peer}_{-i(c)} = \frac{1}{1-N} \sum_{j=1, j \neq i}^{N} (drank_j = 1) \qquad (5.2)$$

The reason for this replacement is the lack of information about individuals' friends – especially about the length of friendship and details about friends' drinking patterns as well as exact share of friends participating in drinking and other friends' characteristics. Moreover, it is reasonable to assume that many current friends arose from respondent's classmates. Also, one of the aims of the thesis is to estimate the impact of school change and for this purposes information

about classmates drinking serves very well. For simplification, the notation of the model was changed. Vector S_i contains information about type of school and size of the city where the school is. Vector $X_{i(c)}$ includes family and personal characteristics as well as expectancies about alcohol consumption of individual i.

The naive model can show whether there is any social interaction between peers and respondent. However, this model does not tackle any of the problems discussed earlier. It only controls for correlated effect (3) by inclusion of variables about individuals' characteristics (Manski, 2000). Thus, at this stage the resulting effect can be assigned to both - endogenous or contextual interaction.

In the second step the reflection problem (4) is restrained. In order to control for mutual influence of peers and the respondent, the lagged drinking experience of peers is used as the instrument for the current consumption. To use lagged group mean behaviour rather than current one in order to tackle reflection problem is also suggested by Manski (2000). However, the appropriate lag length needs to be known to ensure that individuals also have not influenced their past behaviour (Manski, 2000). Therefore, the assumption about nonexistent past interaction (before applying to the secondary school) between classmates must be made. It might seem as a very strong assumption, but when having a closer look at the way of sorting into secondary education in Czech Republic such assumption is not that unrealistic.

5.2.1 Sorting into secondary education in Czech Republic (in year 2002)[17]

The educational system in Czech Republic consists of nine years of mandatory school attendance. Kids usually attend the elementary school in the neighbourhood, but the choice of high school is based on their wishes and results of the admission process to the chosen school. It could be distinguished between three types of secondary schools: academic, vocational and apprenticeship. Those types differ in admission process as well as structure of study. Academic schools are four years programs[18] with analogy of A levels called "Maturita" at the end of the studies and its graduated are usually assumed to continue in tertiary education. Compare to academic schools, vocational schools are more practice oriented (technical schools,

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[17] Description of the sorting procedure is based on personal experience of the authoress, who went through the process at the same year as the participants of ESPAD 2003.
[18] Some academic schools also offer eight and six years programs, so some gifted kids leave the elementary school at the end of 5th or 7th grade already. However, the sample only contains students from four year programs(Hibell et al., 2004).

business schools, etc). Vocational schools are also ended by school-leaving exam and their graduated can continue on university but often go directly into working process. Apprenticeship usually does not lead to Maturita and its graduated cannot apply for university. The distribution of adolescents across types of school is mainly based on their social background and study abilities (Münich, 2004).

Application process to high schools has overcome many changes recently, but in year 2002 pupils in 9th grade could send application forms to two high schools they were interested in, with stated preferences. If the pupil was not successful in the admission process of the more preferred school he/she overcame the process again in the second school. Admission process differs by types and quality of school. While academic schools require entrance exam and consider past GPAs of the applicant, vocational schools and apprenticeship often accept pupils with good GPA directly and only those with lower GPA have to take the entrance test. Majority of the secondary schools in Czech Republic is public and does not charge any tuition fees. In the year of the survey almost 90% of high school students attended public secondary school.

The institutional setting of education in Czech Republic allows to do previously suggested assumption (Pertold, 2009). The choice of primary school is usually not influenced by performance, personality or decision of the kid. Therefore pupils within the class have wide range of characteristics and level of ability and most likely apply for different high schools. This conclusion might be less valid in small cities, where is ordinarily lower number of high schools and moving to another city due to high school is not common. Still, in general it can be assumed that students from the same class at high school have not interacted with each other before the enrolment to that school.

This assumption is very important for the analysis, because it enables the use of lagged past experience with alcohol as instrument for current peers' consumption. The model capturing reflection problem has following form:

$$\Pr(drank_{i(c),t} = 1) = \alpha + \beta S_i + \gamma X_{i(c)} + \delta \overline{Peer}_{-i(c),t-1} + \mu Exp_{i(g),t-1} + \varepsilon_{i(c),t} \qquad (5.3)$$

Where $\overline{Peer}_{-i(c),t-1}$ is share of classmates who reported *past experience with alcohol.* Individuals with this dummy variable of one are those who both reported experiencing drunkenness before high school and drank alcohol more than 40times

during lifetime or 20 to 39times during lifetime and twenty or less times during the last year.

Vector $Exp_{i(g),t-1}$ contains variables about individuals past experience with substances. Those variables were used in the regression before but were hidden in the vector of personal characteristic as proxy for "thrill-seeking" and contained also more recent substance use. In this model the lagged experience with drugs is used, in order to overcome experiencing with drugs that happened on the high school- thus already after interacting with new peers, Dummy variable *Past drug experience* equals to one for individuals who have tried marihuana or/and harder drugs before secondary school, i.e. at the age of fourteen or earlier. Current smoking status is replaced by the past smoking status. Dummy *Past daily smoker* has value of one in case that the respondents used to be/become daily smoker as fourteen years old or earlier. In addition, dummy variables for sensitivity to alcohol are excluded from the model, because resistance to alcohol is influenced by more recent alcohol consumption rather than pre-secondary school experience.

Third variation of the model tries to control for the contextual interaction (2), (5). This can be done by letting the individuals behaviour vary with mean values of exogenous characteristics of the peers (Manski, 2000; Pertold, 2009):

$$\Pr(drank_{i(c),t} = 1) \qquad\qquad (5.4)$$
$$= \alpha + \beta S_i + \gamma X_{i(c)} + \delta \overline{Peer}_{-i(c),t-1} + \vartheta Exp_{i(g),t-1} + \mu \overline{X}_{-i(c)} + \varepsilon_{i(c),t}$$

Here $\overline{X}_{-i(c)}$ represents vector of the control variables for average exogenous peers characteristic. It includes share of classmates with older sibling who drinks, average parental education (resp. share of peers with at least one parent with university degree, secondary degree or both low educated parents), average wealth of the family (resp. share of classmates coming from wealthier family/average wealthy family/poor family), share of classmates not living with both biological parents, share of classmates with poor family background and average level of monitoring (resp. share of classmates with high level of monitoring). The model still contains dummy variables about exogenous characteristics of the individual and his/her past experience with substance use and smoking. It is assumed that parental variable does not change over time. This might not be true for variables about siblings' drinking and level of monitoring, because current situation can vary from situation before individuals' enrolment into secondary school. On the other

hand, one year is not such a long period to change the patterns substantially. Therefore it is possible to assume that the parental effect is constant over time.

Even though self-selection problem (5) is partly limited in previous model by controlling for individuals' observable personal and peer characteristics, the unobservable characteristics of individual towards drinking may still bias the estimates. Students cannot influence in which particular class in the high school they will be inscribed – grouping into classes is usually random process made by the school itself. However, the choice of secondary school is based on adolescents' own preferences and thus the issue of sorting is relevant for this analysis. As Pertold (2009) points out, choice of the school can be based on many factors such as distance from the school, quality of school or difficulty of entrance exam. Besides others, individuals' unobserved preferences towards drinking can influence his/her choice of school which would lead to biased estimates.

Majority of the studies leave this problem unattached and those which deal with it usually apply fixed effect approach for school and grade (Lundborg, 2006), for clusters containing individuals with similar characteristics (Fletcher & Ross, 2011) or use data where peers are randomly assigned (Sacerdote, 2000). The latter is the best possibility, but such data are usually not available. Similar strategy to fixed effect used by (Pertold, 2009) is adopted in this model to reduce the self-selection problem.

It assumes that adolescent base his/her choice of school on the expectations about future peers' attitudes towards drinking. The adolescent intuitively (or maybe consciously) wants to minimize difference between his/her propensity to drink and foreseen drinking behaviour of future classmates in school *s*. It could be expressed as:

$$min\{drink_i - E_i(\overline{peers}_{-i(c),s})\} \qquad (5.5)$$

Where $E_i(\overline{peers}_{-i(c),s})$ denotes adolescents' expectations about peers attitude towards drinking and $drink_i$ is a probability measure representing individuals' propensity to drink. Expectations about peers' attitude are unknown, but as a proxy for expectations can be used drinking behaviour of older students of certain

school[19]. The actual composition of the class might differ from the expected one for example due to the entrance exams. Thus, final composition looks like follows:

$$\overline{peers}_{-i(c),s} = \overline{E_\iota\big(peers_{-\iota(c),s}\big)} + \mu_{(c),s} \tag{5.6}$$

Where $\mu_{(c),s}$ indicates the unexpected shock resulting in difference between actual and expected composition of peers, which is represented by average of all students' expectations $\overline{E_\iota\big(peers_{-\iota(c),s}\big)}$ based on older students' attitude towards alcohol. By including the information about older schoolmates drinking behaviour into the model, self-selection into school stemming from unobservable individuals' propensity to consume alcohol should be reduced.

$$\Pr\big(drank_{i(c),s,t} = 1\big) \tag{5.7}$$
$$= \alpha + \beta S_i + \gamma X_{i(c)} + \delta \overline{Peer}_{-i(c),s,t-1} + \vartheta Exp_{i(c),s,t-1} + \mu \overline{X}_{-i(c),s}$$
$$+ \varphi Old_{s,t-2} + \varepsilon_{i(c),t}$$

Variable $Old_{s,t-2}$ is a mean of lagged participation in drinking of third year students. Lag of the alcohol consumption is used to control for possible interaction between first and third year students. The reason why the lag is two periods instead of one is the lack of available information about last year consumption of older students.

5.2.2 Constraint, expectations and preferences interaction

In the analysis before, the pure peer effect has been estimated. However, the reason why such effect might occur is unclear. As Manski (2000) points out, without specification of the reason the analysis cannot be properly used for policy purposes.

Presumably, *constraint interaction* is not much of an issue in Czech Republic. It has been concluded that minimum drinking age-law is not an important restrictive factor for participation in drinking, which means that there is a low influence of constraint interaction stemming from unavailability of alcohol for underage adolescents. It is not difficult to buy alcohol even underage and its price is so low that budget constraint is a minor problem. Thus, it is reasonable to assume that when peers are drinking together, they always collect enough money

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[19] High schools normally organize "opening day" when prospective students come and see the school and also meet with current students. It is also possible that the individual knows someone from his/her neighbourhood who attends this school and drives the expectations about future peers based on this person.

to buy sufficient amount of alcohol. On the other hand, some individuals might find it difficult to get alcohol by itself. In such case, searching costs are significantly reduced when this adolescent participate in collective drinking, where he/she only pays the costs of alcohol, but does not need to buy it. For this reason, constraint interaction cannot be fully ruled out even in countries with low-control of minimum legal drinking age.

Concerning the *expectation interaction* the clarification of this hypothesis is also limited. Till now, it has been assumed that expectation about alcohol consumption of the individual remain unchanged over time. However, being surrounded by drinking peers most likely changes the view of the individual on drinking. The same effect can have own drinking experience. Therefore, the dummy variables about expectations – *positive/negative association* with drinking shall be left out. In case that this change influence estimates of peer effect, expectation interaction is most likely present.

In available dataset it is also not possible to properly check whether p*references interaction* is the exclusive driver of peer effect. Again, in the previous analysis it has been assumed that the view on health consequences remain unchanged as well as the judgment of regular intoxication. The opinion about health consequences might be more stable over time, because it is a result of general knowledge about alcohol and its long-term effects. The same can hardly be assumed for judgment of regular intoxication. If the adolescent is exposed to peers who engage in such activity and becomes friend with them, the probability that he/she will still strongly disapprove friends' behaviour most likely decreases – the stigma from the usage diminish when the consumption increases (Cawley & Ruhm, 2011). Therefore, judgmental dummy variables in the model are presumably affected by interaction with new peers and shall be left out.

5.3 Limitations

In the identification strategy there are a few issues which might influence the results and thus shall be taken into account.

Firstly, as mentioned previously, available information does not allow examine the reason of existence of endogenous interactions. It is impossible to properly test for the experience and preferences interaction due to the lack of information about associations with alcohol, health related problems and judgment of certain behaviour from period before entering the high school. Moreover, to see

separately the influence of bandwagon and snob effect is completely out of the limits of the dataset (see Niankara (2009)).

Secondly, according to Fletcher & Ross (2011) the specification of the peer group might be too broad. The peer group is defined as the whole class, which might not reflect the real reference group of the adolescent. Moreover, the bonds within classmates are not known. It is possible that individuals do not interact with their classmates outside the school, but spend majority of free time with friends from childhood or their girlfriend/boyfriend from different environment. Since it is impossible to control for influence of friends outside the class and boyfriends/girlfriends of the individual, the estimates might be biased and shall be perceived with caution. This holds true especially for freshmen girls who are more likely to have romantic relationship earlier than boys. In addition, the partner is most likely to be older and thus engage more in drinking which could lead to increased probability of alcohol consumption of the girl.

Thirdly, the variable *Past experience with alcohol* might not be the best proxy for sufficient experience with alcohol before the enrolment into high school. It gets value of one for individuals who both have experienced drunkenness at the age of 14 or earlier and reported drinking 40times or more during lifetime. Such specification not only captures those who engaged in drinking widely even before enrolment, but also individuals who started to drink heavily only at high school. Inclusion of such adolescents might influence the estimates. However, it is believed (hoped) that occurrence of such individuals in the sample is rather low.

5.4 Data Description

Table 13 overviews the age when first year students reported start with certain risky behaviour. There is an observable pattern in sudden increase of risky behaviour at the age of fifteen which goes along with the hypothesis about existence of social interaction and influence of peers on individuals' consumption. Majority of students reports their first drunkenness at the age of fifteen. The share of students who become daily smokes and try marihuana for the first time at that age is also the highest. Against the hypothesis about influence of individuals' peers does not go either the descriptive statistic of dummy variable *drink last month.* The share of students who reported drinking of more than three drinks or binge drinking once or twice during last 30days is more-less constant within grades irrespective to age of the individual. Yet, there is an observable difference in

participation in drinking between students of the same age but in different grades (Table 14). On average, for seventeen years old male students the participation in drinking is 12% higher for those who are in third grade compare to those who are in the first grade.

Summary statistics of the new variables about peers characteristics and mean alcohol consumption of older students can be found in Table 15.

5.5 Results

Table 16 summarizes results from all proposed models. The last two lines are estimates with exclusion of associations related to drinking (model 5) and judgmental variables (model 6). From the results is clear that the share of peers who currently engaged in drinking in past month has higher influence than the share of drinking friends from the previous estimations. While having only drinking friends increases probability to drink by 11.2 (2.2)% for boys and 9.6(2.2)% for girls, in case that the student is in class where all his/her peers drink the likelihood to participate in drinking rises by 30.5(7.9) percentage points for boys and 17.1 (6.8) percentage points for girls. After applying the instrument variable of pre-secondary school drinking of peers[20], the magnitude of the peer effect decreases for boys and becomes less significant ($p<0.05$), but increases for girls and becomes significant on 1%level. Addressing the self-selection problem - control for peers characteristics and older students lagged drinking patterns - leaves the effect of classmates on boy almost unchanged, but becomes less significant ($p<0.1$). The contrary holds true for girls. The magnitude of the effect rises even more – 10% share of drinking classmates is associated with 5.6 percentage point increase in likelihood to participate in alcohol consumption and the coefficient remains highly significant.

In the second column of Table 16 there are estimates for respondents who did not have sufficient experience with drinking before coming to high school. The results for boys and girls follow the same patterns as before, however the discrepancy in magnitude and significance of peer effect for different genders becomes even more pronounced. Estimates from model 4 suggest that classmates influence on boys is insignificant whereas peer effect remains highly significant

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[20] Results from First stage statistics for all estimated models: F>10 and p<0.01, thus the instrument variable seems to have a good predictive power

(p<0.01) for girls and increases by 0.6 percentage points compare to estimate from the full sample.

Relaxing the assumption about unchanging associations with alcohol and judgment of regular intoxication (model 5 and 6) leads to significant shift in peer effect – especially for boys. For pre-secondary school male non-drinkers 10% share of drinking classmates is associated with 4.03 (2.23) percentage point increase in likelihood to drink (p<0.1), for girls it is 6.04 (1.9) percentage points (p<0.01).

However, the most observable twist in estimated results brings relaxation of assumption about non-existent interaction among current high school classmates before the enrolment to secondary school. As discussed previously, this assumption might not be valid for respondents who attend school in a small town. When those students are excluded from the sample, peer effect markedly rises and becomes significant at 5%level for boys, but drops and becomes insignificant for girls in all estimated models. In this sample, resulting effect (model 6) shows that 10% share of drinking classmates is associated with 5.53(1.91) percentage point increase in probability do consume alcohol for boys and with 1.89(2.04) percentage point for girls.

After estimating the last model again for pre-school non-drinkers studying in big cities and cities, the effect decreases slightly for boys on 4.58 (1.26) percentage point (p<0.01) and rises and becomes significant (p<0.05) for girls – 10 percentage points increase in share of drinking classmates is associated with 2.89 (1.41) percentage point increased probability that the girl engage in drinking.

5.6   Sub-conclusion

Results of the analyses bring several interesting findings. Regarding the limited range of this thesis, only the main conclusions from the analyses are presented.

Firstly (and most importantly) the obtained results indicate existence of peer effect. For all estimated models and groups this effect is positive, which would mean that higher share of drinking classmates always increases individuals' likelihood to participate in drinking. However, the magnitude and significance differs substantially between genders and sample used for estimation.

Secondly, girls seem to be much more susceptive by drinking of their peers than boys when the effect is estimated for the full sample and the influence increases

when only pre-secondary school non-drinkers are taken into account. However, there is a twist in significance and magnitude after exclusion of students who attend school in small towns. This would suggest that the assumption about non-existent interaction between classmates before going to high school was incorrect at least for students from small towns and the previous results were biased. Then, the resulting peer effect for girls is insignificant ($p>0.1$) while influence of drinking classmates increases for boys in comparison to previous estimates and becomes highly significant ($p<0.01$). [21]

Thirdly, the peer effect of drinking classmates increases significantly for girls who have not been drinking before enrolment to high school (in comparison to the full sample), while the peer effect for boys without sufficient pre-secondary school drinking experience slightly drops.

Fourthly, after controlling for the reflection problem, the magnitude of peer effect decreases for males, but increases for females (in all samples except for non-drinkers from bigger cities). This finding could meant that while boys have an impact on the resulting behaviour of the peer group, girls are much more susceptive and their influence on the drinking behaviour in the group is not very high.

 Finally, relaxing the assumption about constant expectations about alcohol consumption (model 5) and approval/disapproval of regular intoxication (model 6), the coefficients of peer effect has changed for both genders. This change would suggest that there is an expectation as well as preferences interaction through which the social interaction operates.

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[21] In comparison to other studies, the estimates of the peer effect for boys from big cities and cities in our sample are twice as high and the effect for girls is insignificant. While the final model estimates suggest that 10percentage points rise in share of drinking classmates is associated with 5.53 percentage points increase in probability to drink for boys ($p<0.01$) and 1.89percentage points for girls ($p>0.1$), Fletcher & Ross (2011) estimates the rise is 2.39 percentage points for boys and 2.13 percentage points for girls(both $p<0.01$). Lundborg (2006) associates 10percentage points increase in share of binge drinking friends with 2.3 percentage points' increase in likelihood of binge drinking of the individual ($p<0.01$). This difference can be ascribed to different sample and methodology. The samples vary in ages of respondents, country of origin (US and Sweden), length of interaction with the peers and type of educational institution.

6 Main Conclusions of the Analyses

This section summarizes the findings of performed analyses by answering the research questions asked at the introduction of the thesis.

What leads young people to engage in drinking at a relatively low age?

The importance and the impact of different factors vary with sex and class. However, there can be identified a number of factors which are common for all subgroups. The most important factors for predicting participation in drinking across genders and grades appear to be sensitivity on alcohol, friends influence, current smoking status, experience with other drugs and judgment of regular intoxication ($p<0.01$). Those factors go along with the economic theory on addiction as well as with the approach of social interaction

Is there a connection between alcohol consumption and other substance usage?

Current alcohol consumption of adolescents seems to be linked with their current smoking status- being a current smoker increases the probability to drink by 7.2 (2.1)% - 17(2.7)% depending on gender and grade. Further analyses suggests that the connection between smoking and drinking of first year students can be explained by cumulative risk behaviour approach, while third year students behave more in accord with gateway theory, where drinking is the gateway to daily smoking. The share of drinking friends and judgment of regular intoxication has been identified as the common causes of observed cumulating of drinking and smoking.

How can adolescents' peers influence his/her decision to drink?

Analyses made in Section 5 indicate existence of social interaction between new classmates. Higher share of drinking classmates is associated with increased likelihood of the student to participate in drinking. The resulting peer effect differs in magnitude and significance across genders and sample used for estimation. In the group of students attending school in bigger cities[22], 10percentage point increase in share of drinking classmates is associated with 5.53(1.91) percentage point rise in probability to engage in drinking for boys ($p<0.01$), but it is only 1.89

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[22] Results from sample of students from bigger cities are presented here (model 6), because it is very likely that the estimates from the full sample are affected by reflection problem.

(2.04) percentage point rise for girls (p>0.1). Thus, boys seem to be more vulnerable to the influence of new peers than girls. Girls without pre-secondary school drinking experience are more susceptible to peer effect - 2.89 (1.41) percentage point increase in probability to drink with 10percentage points rise in share of drinking classmates (p<0.05), while male pre-school non-drinkers are slightly less influential - 4.58 (1.26) percentage point (p<0.01).

The results also indentify preference and expectations interaction as two possible sources of the social interaction between peers.

Overall, the drinking behaviour of Czech youth can be partly explained by the economic theory of addiction, however as the main driver of participation in drinking and also in smoking seems to be social interaction with peers. Significance of the peer effect for boys and previously non-drinking girls would also support the hypothesis that change of the school in certain age can lead to increased alcohol consumption of youth.

In any case, as mentioned in different sections the study has several limitations and the obtained results must be viewed with caution. The weakest point of the study is the nature of the data (cross-section), which does not allow to completely clarify the causal effects between certain factors and adolescents' participation in drinking. Also, all the results are country-specific, thus it is hard if not impossible to make universal conclusions from the findings. Further research and dataset containing observations of the individuals over time and from different countries would be needed to approve conclusions of this study.

7 Discussion

Final section of the thesis discusses interesting results from the analyses and proposes possible explanation for them. Given the limitation on the length of the thesis, only a few of them can be discussed here. The rest is left for readers and potential open discussion.

Participation in drinking

Relative to addiction theories, the most interesting results are differences in significance of coefficients for risk perception of health-related effects of regular binge drinking and associations with alcohol consumption between genders. Overall, the results suggest that youth behave rather according to myopic addiction model than the rational one. However, the naivety varies across sex and class. In general, males seem to be more myopic than girls. Based on the results, the group which demonstrates the highest naivety are third grade males. It appears that they do not take into account the health risks associated with drinking at all. On the contrary, as the most "sophisticated" group could be labelled third year girls, for whom the subjective risk perception about regular intoxication is a significant predictor of their actual participation in drinking.

The results also indicate that by majority of the subgroups (except for first year boys) positive associations with drinking are weighted more than the negative associations; respectively negative outcomes do not seem to influence participation in drinking at all. However, it can also be the case that only a minority of students experience negative outcomes (as specified in the model) in reality while vast majority of them enjoy the positive effects while drinking. Then they simply make decisions based on experienced outcomes than on hypothetical pessimistic consequences.

In general, these patterns could have interesting policy implication. For example intervention program aiming on increasing awareness about negative health outcomes from alcohol consumption could have restrictive effect on girls' participation in drinking; such intervention for boys would probably not be beneficial. In any case, it might be wrong to conclude that male students are apathetic to information about negative consequences of drinking. The fact that their drinking behaviour is not influenced by this information can be for example result of higher social pressure to drink. In Czech Republic, where in pubs and

restaurants beer is cheaper than water, it is an unspoken social norm to drink beer in any possible occasion. While deviation from this behaviour is acceptable for girls, for a boy it is usually a source of mocking, especially after turning eighteen (legal drinking age).

Peer effect

The two most interesting results from the analyses of peer effect are the spin of the results after excluding adolescents from small towns and increase of peer effect for girls after controlling for reflection problem.

It has been assumed there was no interaction between the students before enrolment into high school. However, the change in the results after exclusion of students attending school in small towns from the sample suggests that this assumption was wrong. In case that the previous results were biased by existing previous interaction of peers, it could be suggested that girls are much more affected by social interaction with peers they already know for some time, whereas new peers have much lower and insignificant impact on their drinking decisions. For boys is the conclusion reverse. Part of the difference in the coefficients could be also explained by the existence of unobservable differences in characteristics of students from small and bigger cities. Yet, reliability of this hypothesis is questionable, because coefficients of the city size have low magnitude and are insignificant in all the analyses performed.

As suggested previously, increase in magnitude of peer effect for girls after controlling for reflection problem could imply that girls are susceptive and their influence on the drinking behaviour in the group is not very high. The main reason is that girls have usually less experiences with drinking than boys – and as such have lower influence on the drinking behaviour of the group. And while at the elementary school they tend to have mainly girlfriends, at the high school girls might start to interact more with boys and make friends of opposite sex. This suggestion is supported by Curtin (2004), who found an evidence that girls in mixed schools have higher prevalence of drinking and smoking compare to girls attending single-sex school.

Besides, the magnitude of the peer effect of first years' students might be influenced by cultural specifics of Czech Republic. In this country, the age of fifteen

is not associated only with start of secondary education, but also with official ID card issue and until the year 2003 it also used to be age of legal sexual intercourse. It is considered as one of the steps to adulthood and therefore might naturally accelerate youth experimenting with alcohol. Becoming high school student also changes the view of society on the teenager. Those two important life events happening in a relatively short time period can also lead to increased probability that individual starts with drinking, mainly because he/she does not feel like a kid anymore and wants to show his/her maturity. This can be one of the reasons why minimum drinking-age law does not have a restrictive role - teenager is considered to be "adult" before he/she reaches the age of eighteen.

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Appendix

Appendix I: Figures and assumptions

Figure 2: Youth alcohol consumption 1995-2007

source: http://www.espad.org/keyresult-generator
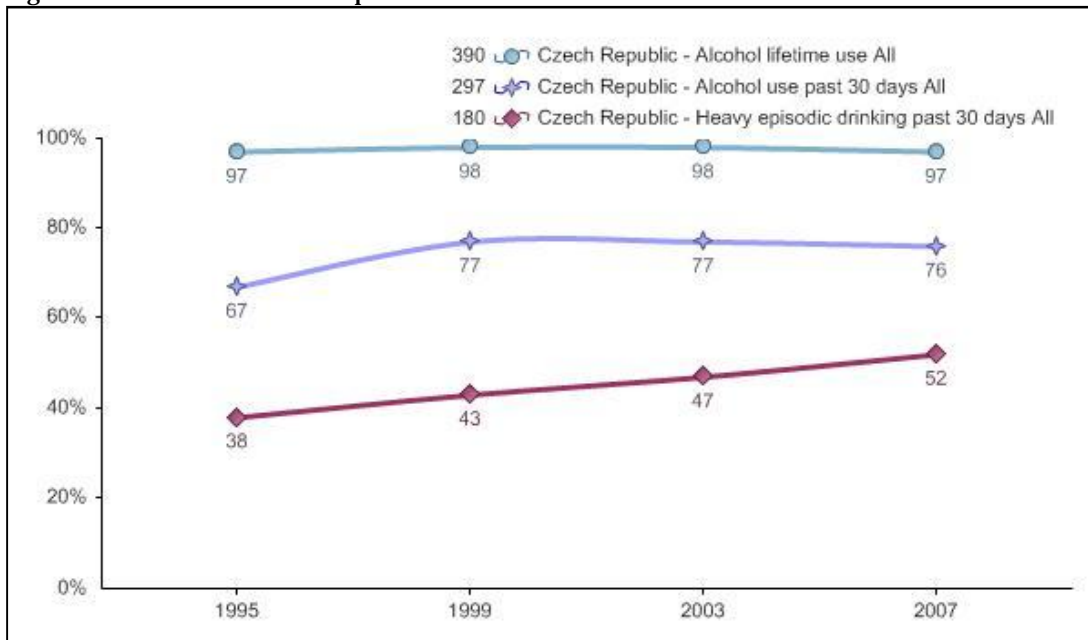
Figure 3: Czech republic comparing to ESPAD average
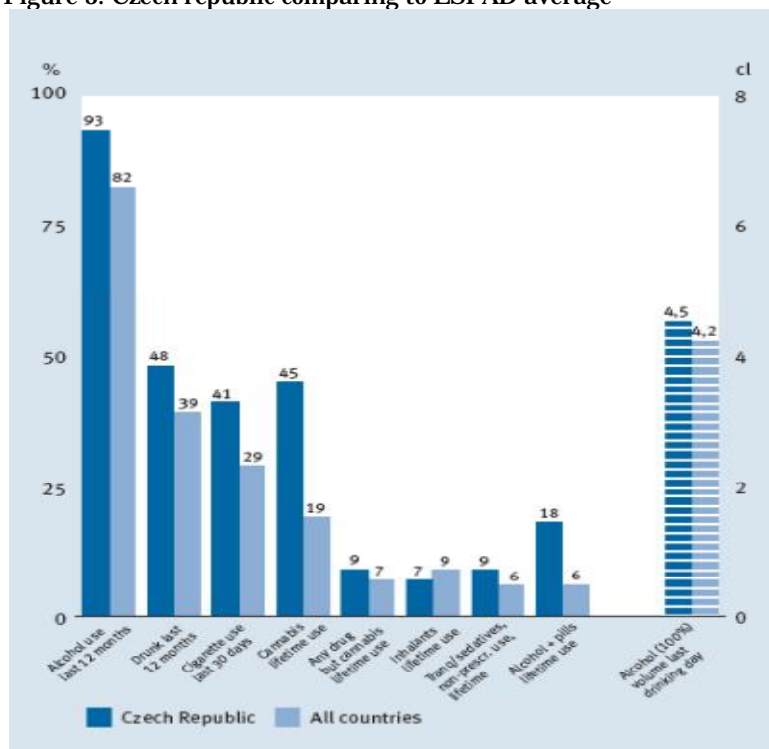
Source: ESPAD report 2007

Table 1: Summary of risk and protective factors

	factors		risk	protective
family influence	relationships in family	situation in family-good		x
		situation in family-bad	x	
		monitoring		x
	sibling	often drinking older sibling	x	
peer influence	peers	none/few/some friends drinking		x
		all friends drinking	x	
personality	thrill seeking, risky behaviour	current smoker	x	
		first drunk <14years old	x	
		experience with drugs	x	
	self-confidence	low	x	x
		high	x	
	aggresive	agressivity	x	
	rules/laws abidance	rules violation possible	x	
		don't know	-	-
association with alcohol	risk perception - weekend drinking more than 5glasses	low risk	x	
		great risk		x
		don't know	-	-
	sensitivity on alcohol	high		x
		low	x	
	judgment of drinking more once a week	codemn intoxicatin once/week		x
		not condemn	x	
	association with alcohol	possitive	x	
		negative		x

Appendix II: Participation in drinking: Descriptive statistics and Estimations

Table 2: Descriptive statistic – general

Variable	Obs	Mean Std, Dev,	Min	Max
boys	9293	0,4586 (0,498)	0	1
girls	9293	0,5414 (0,498)	0	1
vek	9293	17,106 (1,024)	15,34247	20,26027
freshmen	9293	0,5129 (0,500)	0	1
juniors	9293	0,4871 (0,500)	0	1
academic school	9293	0,2576 (0,437)	0	1
vocational school	9293	0,3941 (0,489)	0	1
apprenticeship	9293	0,3483 (0,476)	0	1
big city	9293	0,1792 (0,384)	0	1
city	9293	0,3559 (0,479)	0	1
small town	9293	0,465 (0,499)	0	1

Table 3: Descriptive statistic - control variables

		freshmen				juniors					
		boys		girls		boys		girls			
	variables	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Min	Max
	no of observations	2261		2505		2001		2526			
dependent var	drank in past 30days	0,646	(0,478)	0,533	(0,499)	0,782	(0,413)	0,618	(0,486)	0	1
type of school	gymnasium	0,212	(0,409)	0,300	(0,458)	0,206	(0,404)	0,297	(0,457)	0	1
	vocational	0,345	(0,475)	0,445	(0,497)	0,344	(0,475)	0,427	(0,495)	0	1
	apprentice	0,443	(0,497)	0,255	(0,436)	0,450	(0,498)	0,276	(0,447)	0	1
size of city	big city	0,177	(0,382)	0,180	(0,384)	0,178	(0,383)	0,181	(0,385)	0	1
	city	0,353	(0,478)	0,360	(0,480)	0,349	(0,477)	0,359	(0,480)	0	1
	small town	0,470	(0,499)	0,459	(0,498)	0,473	(0,499)	0,460	(0,498)	0	1
parent's education	father uni	0,214	(0,410)	0,191	(0,393)	0,201	(0,401)	0,181	(0,385)	0	1
	father hs	0,314	(0,464)	0,290	(0,454)	0,311	(0,463)	0,290	(0,454)	0	1
	father le	0,411	(0,492)	0,462	(0,499)	0,432	(0,495)	0,492	(0,500)	0	1
	father unknown	0,039	(0,195)	0,038	(0,190)	0,026	(0,161)	0,019	(0,138)	0	1
	mother uni	0,181	(0,385)	0,145	(0,352)	0,162	(0,369)	0,137	(0,344)	0	1
	mother hs	0,446	(0,497)	0,448	(0,497)	0,445	(0,497)	0,447	(0,497)	0	1
	mother le	0,332	(0,471)	0,376	(0,485)	0,352	(0,478)	0,396	(0,489)	0	1
	mother unknown	0,025	(0,155)	0,015	(0,121)	0,013	(0,115)	0,006	(0,079)	0	1
wealth of the family	really wealthy	0,048	(0,213)	0,028	(0,165)	0,053	(0,224)	0,025	(0,155)	0	1
	wealthy	0,187	(0,390)	0,131	(0,337)	0,158	(0,365)	0,128	(0,334)	0	1
	average wealth	0,656	(0,475)	0,701	(0,458)	0,651	(0,477)	0,693	(0,461)	0	1
	poorer	0,071	(0,257)	0,107	(0,309)	0,093	(0,290)	0,125	(0,331)	0	1
	very poor	0,038	(0,191)	0,034	(0,181)	0,044	(0,206)	0,029	(0,168)	0	1

Table 4: Descriptive statistic - family and friends variables

		freshmen				juniors					
		boys		girls		boys		girls			
	variables	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Min	Max
relationships in family	parents separated	0,207	(0,405)	0,253	(0,435)	0,204	(0,403)	0,220	(0,414)	0	1
	everything totaly fine in family	0,309	(0,462)	0,267	(0,443)	0,298	(0,457)	0,247	(0,432)	0	1
	moreless fine in family	0,458	(0,498)	0,420	(0,494)	0,437	(0,496)	0,427	(0,495)	0	1
	it's changing in the family	0,150	(0,357)	0,193	(0,395)	0,171	(0,377)	0,207	(0,406)	0	1
	bad feelings from family	0,051	(0,221)	0,105	(0,307)	0,064	(0,245)	0,106	(0,308)	0	1
	strong monitoring	0,500	(0,500)	0,575	(0,494)	0,430	(0,495)	0,563	(0,496)	0	1
	moderate monitoring	0,341	(0,474)	0,310	(0,463)	0,400	(0,490)	0,341	(0,474)	0	1
sibling	older sibling often drinks	0,352	(0,478)	0,377	(0,485)	0,373	(0,484)	0,422	(0,494)	0	1
peers	none/few/some friends drinking	0,266	(0,442)	0,269	(0,444)	0,150	(0,357)	0,170	(0,376)	0	1
	all friends drinking	0,149	(0,357)	0,160	(0,366)	0,193	(0,395)	0,203	(0,402)	0	1

Table 5: Descriptive statistic - personal characteristics

| | | freshmen | | | | juniors | | | | | |
| | | boys | | girls | | boys | | girls | | | |
	variables	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Min	Max
thrill seeking, risky behaviour	current smoker	0,391	(0,488)	0,388	(0,487)	0,433	(0,496)	0,409	(0,492)	0	1
	first drunk <14years old	0,404	(0,491)	0,340	(0,474)	0,328	(0,470)	0,217	(0,412)	0	1
self-confidence	experience with drugs	0,383	(0,486)	0,335	(0,472)	0,484	(0,500)	0,399	(0,490)	0	1
	self-confident	0,504	(0,500)	0,545	(0,498)	0,521	(0,500)	0,604	(0,489)	0	1
aggressiveness	very self-confident	0,129	(0,335)	0,085	(0,278)	0,144	(0,351)	0,098	(0,298)	0	1
	agressive	0,498	(0,500)	0,247	(0,431)	0,434	(0,496)	0,171	(0,377)	0	1
rules/laws abidance	rules violation possible	0,348	(0,476)	0,249	(0,433)	0,319	(0,466)	0,208	(0,406)	0	1
	don't know	0,266	(0,442)	0,270	(0,444)	0,243	(0,429)	0,255	(0,436)	0	1

Table 6: Descriptive statistic - expectations about alcohol

| | | freshmen | | | | juniors | | | | | |
| | | boys | | girls | | boys | | girls | | | |
	variables	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Mean	Std, Dev,	Min	Max
risk perception - regular weekly intoxication	low risk	0,326	(0,469)	0,236	(0,424)	0,380	(0,485)	0,241	(0,428)	0	1
	great risk	0,236	(0,425)	0,253	(0,435)	0,197	(0,398)	0,266	(0,442)	0	1
	don't know	0,037	(0,188)	0,043	(0,203)	0,032	(0,176)	0,027	(0,162)	0	1
sensitivity on alcohol	drunk after 1-2glasses	0,043	(0,204)	0,103	(0,303)	0,033	(0,180)	0,151	(0,358)	0	1
	drunk after 3-4glasses	0,276	(0,447)	0,372	(0,483)	0,311	(0,463)	0,464	(0,499)	0	1
	drunk after 7-8glasses	0,307	(0,462)	0,209	(0,407)	0,337	(0,473)	0,183	(0,387)	0	1
	drunk after 9+ glasses	0,117	(0,322)	0,057	(0,232)	0,152	(0,360)	0,048	(0,214)	0	1
	have never been drunk	0,098	(0,298)	0,037	(0,188)	0,098	(0,298)	0,027	(0,163)	0	1
judgment of drinking more once a week	codemn intoxicatin once/week	0,258	(0,438)	0,326	(0,469)	0,233	(0,423)	0,315	(0,465)	0	1
	very codemn intoxicatin once/week	0,117	(0,322)	0,146	(0,353)	0,076	(0,266)	0,121	(0,326)	0	1
	doesn't know intoxicatin once/week	0,079	(0,269)	0,099	(0,299)	0,070	(0,255)	0,097	(0,296)	0	1
association with alcohol	possitive	0,862	(0,345)	0,891	(0,312)	0,905	(0,293)	0,917	(0,276)	0	1
	negative	0,246	(0,431)	0,301	(0,459)	0,205	(0,404)	0,228	(0,419)	0	1

Table 7: Estimation of probability to participate in drinking

Probability to participate in drinking			first year				third year			
			boys		girls		boys		girls	
group	type of variables		coef	se	coef	se	coef	se	coef	se
control variables	type of school	gymnasium	0,023	(0,031)	0,026	(0,024)	0,004	(0,023)	0,034	(0,024)
		apprentice	0,030	(0,024)	0,018	(0,024)	-0,028	(0,021)	-0,027	(0,022)
	size of city	big city	0,025	(0,031)	-0,016	(0,020)	0,006	(0,031)	-0,002	(0,026)
		small town	0,005	(0,025)	0,016	(0,019)	0,025	(0,019)	-0,005	(0,020)
	legal drinking age	underage					-0,002	(0,018)	-0,022	(0,015)
	parent's education	father uni	-0,032	(0,025)	-0,076 ***	(0,027)	0,007	(0,026)	-0,045	(0,029)
		father le	-0,013	(0,021)	-0,023	(0,019)	-0,019	(0,019)	-0,006	(0,020)
		father unknown	-0,087 *	(0,050)	-0,078	(0,050)	-0,049	(0,062)	0,044	(0,060)
		mother uni	0,029	(0,026)	0,058 **	(0,025)	0,068 ***	(0,021)	-0,006	(0,023)
		mother le	-0,020	(0,018)	-0,002	(0,019)	0,007	(0,019)	-0,026	(0,019)
		mother unknown	0,006	(0,056)	0,027	(0,072)	-0,073	(0,081)	-0,066	(0,110)
	wealth of the family	really wealthy	0,061	(0,045)	0,042	(0,051)	0,025	(0,030)	-0,030	(0,048)
		wealthy	0,035	(0,024)	0,023	(0,026)	0,031	(0,021)	-0,023	(0,025)
		poorer	0,001	(0,033)	-0,043 *	(0,024)	-0,039	(0,028)	-0,013	(0,026)
		very poor	-0,044	(0,054)	0,008	(0,042)	0,082 **	(0,040)	0,008	(0,047)
family influence	relationships in family	parents separated	-0,017	(0,021)	-0,026	(0,019)	-0,009	(0,020)	-0,034	(0,022)
		everything totaly fine in family	0,000	(0,038)	0,017	(0,028)	0,017	(0,040)	0,059 *	(0,032)
		everything moreless fine in family	-0,022	(0,038)	0,033	(0,030)	0,061	(0,038)	0,051 *	(0,029)
		bad feelings from family	-0,015	(0,039)	0,007	(0,032)	-0,002	(0,036)	0,004	(0,032)
		strong monitoring	-0,043	(0,029)	-0,066 **	(0,029)	-0,030	(0,023)	-0,099 ***	(0,031)
		moderate monitoring	0,017	(0,025)	-0,022	(0,028)	-0,020	(0,019)	-0,021	(0,029)
	sibling	older sibling often drinks	0,037 **	(0,018)	0,043 **	(0,017)	0,029	(0,018)	0,044 ***	(0,017)
peer influence	peers	none/few/some friends drinking	-0,112 ***	(0,023)	-0,134 ***	(0,022)	-0,100 ***	(0,027)	-0,129 ***	(0,026)
		all friends drinking	0,112 ***	(0,022)	0,096 ***	(0,022)	0,089 ***	(0,018)	0,064 ***	(0,020)
personality	thrill seeking, risky behaviour	current smoker	0,127 ***	(0,021)	0,170 ***	(0,027)	0,087 ***	(0,019)	0,073 ***	(0,022)
		first drunk <14years old	0,048 **	(0,020)	0,023	(0,021)	0,026	(0,016)	0,040 *	(0,023)
		experience with drugs	0,076 ***	(0,021)	0,093 ***	(0,024)	0,074 ***	(0,019)	0,104 ***	(0,023)
	self-confidence	self-confident	-0,006	(0,020)	0,049 ***	(0,019)	0,017	(0,016)	-0,003	(0,018)
		very self-confident	-0,041	(0,028)	0,044	(0,031)	0,001	(0,027)	-0,022	(0,036)
	aggressiveness	agressive	-0,003	(0,017)	0,003	(0,016)	-0,058 ***	(0,016)	0,013	(0,023)
	rules/laws abidance	rules violation possible	-0,006	(0,019)	0,079 ***	(0,021)	0,045 **	(0,018)	0,025	(0,022)
		don't know	-0,042 *	(0,022)	0,029	(0,022)	0,052 **	(0,022)	0,035	(0,021)
association with alcohol	risk perception - regular weekly intoxication	low risk	0,035 *	(0,021)	0,033	(0,022)	-0,002	(0,019)	0,063 ***	(0,022)
		great risk	-0,019	(0,023)	-0,050 **	(0,020)	-0,037	(0,026)	-0,047 **	(0,022)
		don't know	0,047	(0,048)	-0,001	(0,045)	-0,058	(0,061)	0,107 **	(0,048)
	sensitivity on alcohol	drunk after 1-2glasses	0,142 ***	(0,053)	0,087 **	(0,035)	0,198 ***	(0,071)	0,105 ***	(0,036)
		drunk after 3-4glasses	0,274 ***	(0,034)	0,201 ***	(0,025)	0,295 ***	(0,046)	0,239 ***	(0,036)
		drunk after 7-8glasses	0,347 ***	(0,035)	0,274 ***	(0,028)	0,329 ***	(0,049)	0,315 ***	(0,038)
		drunk after 9+ glasses	0,398 ***	(0,037)	0,312 ***	(0,037)	0,394 ***	(0,047)	0,350 ***	(0,046)
		have never been drunk	0,362 ***	(0,039)	0,297 ***	(0,051)	0,402 ***	(0,052)	0,286 ***	(0,063)
	judgment of drinking more once a week	codemn intoxicatin once/week	-0,125 ***	(0,024)	-0,075 ***	(0,022)	-0,120 ***	(0,026)	-0,146 ***	(0,022)
		very codemn intoxicatin once/week	-0,158 ***	(0,031)	-0,131 ***	(0,029)	-0,203 ***	(0,042)	-0,166 ***	(0,034)
		doesn't know intoxicatin once/week	-0,036	(0,033)	-0,010	(0,035)	-0,087 **	(0,037)	-0,031	(0,030)
	association with alcohol	possitive	0,046	(0,029)	0,070 ***	(0,018)	0,066 ***	(0,031)	0,130 ***	(0,033)
		negative	-0,037 **	(0,017)	0,017	(0,018)	-0,013	(0,019)	0,020	(0,020)
		_cons	0,329 ***	(0,056)	0,222 ***	(0,048)	0,350 ***	(0,063)	0,315 ***	(0,068)
		no of obs	2258		2504		2001		2525	
		F	55,510		72,010		25,840		50,300	
		prob>F	0,000		0,000		0,000		0,000	
		Rsq	0,356		0,353		0,284		0,294	
		Root MSE	0,388		0,405		0,354		0,412	
		cluster classes	169		153		169		153	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 8: Estimation of probability to participate in drinking (IV: current smoker=friends smoking)

Probability to participate in drinking with IV for smoking (current smoker=pastdailysmoker)

group	type of variables		first year boys coef	se	first year girls coef	se	third year boys coef	se	third year girls coef	se
control variables	type of school	gymnasium	0,024	(0,038)	0,020	(0,025)	0,000	(0,024)	0,016	(0,026)
		apprentice	0,030	(0,028)	0,031	(0,027)	-0,005	(0,022)	-0,007	(0,022)
	size of city	big city	0,025	(0,031)	-0,017	(0,020)	0,007	(0,030)	0,006	(0,026)
		small town	0,006	(0,025)	0,015	(0,019)	0,021	(0,019)	0,004	(0,021)
	legal drinking age	underage					0,005	(0,019)	-0,020	(0,015)
		father uni	-0,032	(0,025)	-0,078 ***	(0,027)	0,007	(0,027)	-0,048 *	(0,028)
	parent's education	father le	-0,013	(0,021)	-0,022	(0,019)	-0,015	(0,020)	-0,006	(0,020)
		father unknown	-0,087 *	(0,050)	-0,076	(0,050)	-0,020	(0,064)	0,041	(0,062)
		mother uni	0,029	(0,026)	0,055 **	(0,024)	0,068 ***	(0,022)	-0,003	(0,024)
		mother le	-0,020	(0,018)	-0,001	(0,019)	0,007	(0,020)	-0,023	(0,019)
		mother unknown	0,006	(0,057)	0,036	(0,071)	-0,092	(0,074)	-0,078	(0,111)
	wealth of the family	really wealthy	0,061	(0,045)	0,045	(0,051)	0,029	(0,030)	-0,018	(0,047)
		wealthy	0,035	(0,023)	0,023	(0,026)	0,037	(0,021)	-0,012	(0,026)
		poorer	0,001	(0,033)	-0,044 *	(0,024)	-0,044	(0,027)	-0,019	(0,027)
		very poor	-0,044	(0,053)	0,004	(0,042)	0,079 **	(0,040)	0,013	(0,046)
family influence	relationships in family	parents separated	-0,017	(0,020)	-0,023	(0,019)	-0,001	(0,020)	-0,032	(0,022)
		everything totaly fine in family	0,000	(0,038)	0,015	(0,028)	0,017	(0,040)	0,055 *	(0,031)
		everything moreless fine in family	-0,022	(0,039)	0,031	(0,030)	0,062 *	(0,037)	0,047 *	(0,028)
		bad feelings from family	-0,016	(0,039)	0,011	(0,033)	-0,001	(0,036)	0,010	(0,032)
		strong monitoring	-0,042	(0,030)	-0,073 **	(0,031)	-0,041 *	(0,024)	-0,104 ***	(0,032)
		moderate monitoring	0,018	(0,027)	-0,025	(0,029)	-0,032 *	(0,019)	-0,023	(0,029)
	sibling	older sibling often drinks	0,037 **	(0,018)	0,043 **	(0,017)	0,023	(0,019)	0,041 **	(0,017)
peer influence	peers	none/few/some friends drinking	-0,112 ***	(0,023)	-0,136 ***	(0,022)	-0,103 ***	(0,027)	-0,126 ***	(0,026)
		all friends drinking	0,112 ***	(0,023)	0,093 ***	(0,022)	0,077 ***	(0,019)	0,056 ***	(0,020)
personality	thrill seeking, risky behaviour	current smoker (IV)	0,134	(0,164)	0,075	(0,113)	-0,098	(0,084)	-0,142	(0,089)
		first drunk <14years old	0,048 **	(0,020)	0,030	(0,021)	0,044 *	(0,018)	0,058 **	(0,023)
		experience with drugs	0,074	(0,055)	0,125 ***	(0,042)	0,129 ***	(0,030)	0,182 ***	(0,041)
		self-confident	-0,006	(0,021)	0,050 ***	(0,019)	0,006	(0,018)	-0,003	(0,019)
	low self-confidence	very self-confident	-0,041	(0,028)	0,046	(0,031)	-0,013	(0,028)	-0,037	(0,037)
	aggressiveness	agressive	-0,002	(0,018)	0,003	(0,016)	-0,068 ***	(0,017)	0,020	(0,023)
	rules/laws abidance	rules violation possible	-0,006	(0,021)	0,083 ***	(0,021)	0,046 **	(0,018)	0,032	(0,022)
		don't know	-0,042 *	(0,021)	0,033	(0,023)	0,057 ***	(0,022)	0,042 *	(0,023)
association with alcohol	risk perception - regular weekly intoxication	low risk	0,035 *	(0,021)	0,037 *	(0,022)	0,007	(0,020)	0,073 ***	(0,021)
		great risk	-0,019	(0,023)	-0,052 ***	(0,020)	-0,037	(0,025)	-0,046 *	(0,023)
		don't know	0,046	(0,052)	-0,004	(0,044)	-0,057	(0,064)	0,118 **	(0,050)
	sensitivity on alcohol	drunk after 1-2glasses	0,141 ***	(0,052)	0,097 **	(0,039)	0,215 ***	(0,070)	0,127 ***	(0,037)
		drunk after 3-4glasses	0,274 ***	(0,034)	0,211 ***	(0,029)	0,318 ***	(0,047)	0,271 ***	(0,037)
		drunk after 4-5glasses	0,346 ***	(0,043)	0,286 ***	(0,032)	0,358 ***	(0,050)	0,349 ***	(0,039)
		drunk after 7-8glasses	0,397 ***	(0,048)	0,323 ***	(0,038)	0,426 ***	(0,049)	0,396 ***	(0,048)
		drunk after 9+ glasses	0,360 ***	(0,048)	0,301 ***	(0,052)	0,450 ***	(0,058)	0,324 ***	(0,064)
	judgment of drinking more once a week	codemn intoxicatin once/week	-0,124 ***	(0,030)	-0,089 ***	(0,027)	-0,133 ***	(0,027)	-0,170 ***	(0,025)
		very codemn intoxicatin once/week	-0,156 ***	(0,042)	-0,150 ***	(0,037)	-0,227 ***	(0,042)	-0,207 ***	(0,038)
		doesn't know intoxicatin once/week	-0,035	(0,039)	-0,019	(0,034)	-0,103 ***	(0,038)	-0,042	(0,032)
	association with alcohol	possitive	0,046	(0,029)	0,070 ***	(0,025)	0,060 *	(0,031)	0,127 ***	(0,033)
		negative	-0,037 **	(0,018)	0,020	(0,019)	0,000	(0,022)	0,017	(0,019)
		_cons	0,327 ***	(0,074)	0,247 ***	(0,056)	0,386 ***	(0,066)	0,349 ***	(0,070)
		no of obs	2258		2504		2001		2525	
		Wald chi2 (44)	2365,55		3260,74		1114,50		2029,46	
		prob>chi2	0,00		0,00		0,00		0,00	
		Rsq	0,36		0,35		0,25		0,26	
		Root MSE	0,38		0,40		0,36		0,42	
		cluster classes	169		153		169		153	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 9: First-stage regression summary statistics

		Variable	R-sq	Adj R-sq	Partial R-sq	Robust F	Prob>F	test on endogeneity	
first year	boys	current smoker (friends smoking)	0,358	0,345	0,020	40,849	0,000	F(1,168) = 0,001	(p = 0,9715)
	girls		0,454	0,444	0,054	95,700	0,000	F(1,152) = 0,758	(p = 0,3854)
third year	boys		0,311	0,295	0,053	110,808	0,000	F(1,168) = 5,154	(p = 0,0245)
	girls		0,373	0,362	0,060	137,570	0,000	F(1,152) = 6,428	(p = 0,0122)

Table 10: Identification of common causes

excluded set of variables	boys				girls			
	first stage statistic		test on endogeneity		first stage statistic		test on endogeneity	
	Robust F	Prob>F	F stat	p-value	Robust F	Prob>F	F stat	p-value
family	43,843	0,000	0,031	0,860	98,474	0,000	0,693	0,406
friends	29,380	0,000	4,717	0,031	95,841	0,000	2,504	0,116
personality	67,209	0,000	0,223	0,637	145,205	0,000	0,342	0,560
expectations	40,637	0,000	0,002	0,964	96,445	0,000	0,755	0,386
friends and judgment	34,942	0,000	6,241	0,013	115,705	0,000	4,325	0,039
simple regression smoking on drinking	213,633	0,000	30,430	0,000	589,546	0,000	27,889	0,000

Appendix III: Frequency of drinking and binge drinking events

Models predicting frequency of drinking and binge drinking events are estimated by ordered logit model. The dependant variable for frequency is categorical. Model specification remains the same as in (3.1). In the model for frequency of binge drinking, variables about peers and siblings' drinking are replaced by friends' and older siblings' binge drinking behavior.

Table 11: Estimation of frequency of drinking events

freqency of drinking:
(participation in drinking in past 30days)

abstinent
less than once a week
once a week
more than once a week

			first year				third year			
			boys		girls		boys		girls	
group	type of variables		coef	se	coef	se	coef	se	coef	se
control variables	type of school	gymnasium	0,380 ***	(0,145)	0,111	(0,111)	0,260 **	(0,130)	0,321 **	(0,128)
		apprentice	0,029	(0,142)	0,008	(0,125)	-0,046	(0,132)	-0,122	(0,105)
	size of city	big city	0,164	(0,154)	-0,008	(0,121)	0,294 *	(0,154)	0,161	(0,153)
		small town	0,176	(0,133)	0,050	(0,098)	0,178	(0,128)	0,050	(0,097)
	legal age	underage	-0,169	(0,402)	0,187	(0,407)	0,017	(0,090)	-0,079	(0,075)
	parent's education	father uni	-0,056	(0,118)	-0,227 *	(0,133)	-0,136	(0,133)	-0,146	(0,125)
		father le	-0,075	(0,105)	0,009	(0,090)	-0,169	(0,108)	-0,038	(0,100)
		father unknown	-0,382	(0,271)	-0,119	(0,205)	-1,149 ***	(0,322)	-0,220	(0,298)
		mother uni	0,054	(0,125)	0,273 **	(0,125)	0,279 **	(0,121)	-0,041	(0,117)
		mother le	-0,110	(0,104)	-0,118	(0,100)	-0,033	(0,105)	-0,112	(0,094)
		mother unknown	-0,193	(0,288)	-0,282	(0,342)	0,133	(0,631)	-0,250	(0,547)
	wealth of the family	really wealthy	0,524 **	(0,216)	-0,014	(0,226)	0,093	(0,166)	-0,132	(0,213)
		wealthy	0,090	(0,113)	0,157	(0,119)	0,045	(0,125)	-0,036	(0,111)
		poorer	-0,194	(0,144)	-0,155	(0,130)	-0,129	(0,171)	0,025	(0,111)
		very poor	-0,348 *	(0,204)	-0,164	(0,224)	0,451 *	(0,249)	-0,188	(0,214)
family influence	relationships in family	parents separated	0,003	(0,110)	-0,200 **	(0,099)	-0,148	(0,113)	-0,144	(0,116)
		everything totaly fine in family	-0,138	(0,176)	-0,101	(0,148)	0,087	(0,218)	0,349 ***	(0,172)
		everything moreless fine in family	-0,056	(0,174)	0,014	(0,148)	0,187	(0,204)	0,206 ***	(0,158)
		bad feelings from family	-0,084	(0,185)	0,025	(0,156)	-0,032	(0,205)	-0,062	(0,160)
		strong monitoring	-0,363 **	(0,162)	-0,376 **	(0,152)	-0,335 **	(0,141)	-0,684 ***	(0,159)
		moderate monitoring	-0,053	(0,136)	-0,106	(0,141)	-0,252 **	(0,125)	-0,244	(0,163)
	sibling	older sibling often drinks	0,269 ***	(0,087)	0,214 ***	(0,072)	0,237 **	(0,095)	0,236 ***	(0,077)
peer influence	peers	none/few/some friends drinking	-0,576 ***	(0,100)	-0,714 ***	(0,104)	-0,566 ***	(0,148)	-0,547 ***	(0,113)
		all friends drinking	0,580 ***	(0,126)	0,533 ***	(0,104)	0,691 ***	(0,131)	0,486 ***	(0,100)
personality	thrill seeking, risky behaviour	current smoker	0,606 ***	(0,107)	0,689 ***	(0,111)	0,541 ***	(0,114)	0,500 ***	(0,101)
		first drunk <14years old	0,398 ***	(0,100)	0,113	(0,095)	0,357 ***	(0,107)	0,268 **	(0,105)
		experience with drugs	0,398 ***	(0,102)	0,459 ***	(0,104)	0,504 ***	(0,106)	0,580 ***	(0,109)
	self-confidence	self-confident	0,066	(0,093)	0,298 ***	(0,083)	0,278 ***	(0,103)	0,182 **	(0,087)
		very self-confident	-0,030	(0,139)	0,414 **	(0,160)	0,317 **	(0,151)	0,015	(0,145)
	aggressiveness	agressive	0,007	(0,083)	-0,048	(0,088)	-0,190 *	(0,097)	0,055	(0,105)
	rules/laws abidance	rules violation possible	-0,060	(0,087)	0,391 ***	(0,105)	0,095	(0,108)	0,168	(0,109)
		don't know	-0,240 **	(0,099)	0,157	(0,103)	0,040	(0,125)	0,217 **	(0,098)
association with alcohol	risk perception - regular weekly intoxication	low risk	0,281 ***	(0,106)	0,136	(0,101)	0,097	(0,108)	0,288 ***	(0,108)
		great risk	-0,083	(0,105)	-0,218 **	(0,096)	-0,277 **	(0,118)	-0,330 ***	(0,100)
		don't know	0,107	(0,206)	0,103	(0,207)	-0,398	(0,310)	0,317	(0,232)
	sensitivity on alcohol	drunk after 1-2glasses	0,727 ***	(0,227)	0,423 **	(0,177)	0,595 *	(0,312)	0,530 ***	(0,197)
		drunk after 3-4glasses	0,990 ***	(0,172)	1,003 ***	(0,149)	1,231 ***	(0,212)	1,077 ***	(0,191)
		drunk after 4-5glasses	1,421 ***	(0,173)	1,166 ***	(0,162)	1,475 ***	(0,251)	1,482 ***	(0,198)
		drunk after 7-8glasses	1,653 ***	(0,196)	1,513 ***	(0,227)	2,230 ***	(0,250)	1,479 ***	(0,257)
		drunk after 9+ glasses	1,799 ***	(0,234)	1,546 ***	(0,286)	2,339 ***	(0,299)	1,406 ***	(0,337)
	judgment of drinking more once a week	codemn intoxicatin once/week	-0,618 ***	(0,109)	-0,459 ***	(0,099)	-0,597 ***	(0,124)	-0,685 ***	(0,095)
		very codemn intoxicatin once/week	-0,870 ***	(0,149)	-0,796 ***	(0,136)	-1,004 ***	(0,169)	-0,798 ***	(0,137)
		doesn't know intoxicatin once/week	-0,304 **	(0,150)	-0,162	(0,164)	-0,502 **	(0,203)	-0,155	(0,147)
	association with alcohol	possitive	0,490 ***	(0,149)	0,509 ***	(0,157)	0,370 **	(0,179)	0,845 ***	(0,161)
		negative	-0,318 ***	(0,086)	-0,169 *	(0,095)	0,093	(0,107)	0,082	(0,095)
		/cut1	-0,238 ***	(0,519)	-0,164	(0,491)	-0,357	(0,353)	-0,501	(0,320)
		/cut2	1,373 ***	(0,514)	2,033 ***	(0,489)	1,298 ***	(0,352)	1,791 ***	(0,328)
		/cut3	3,575 ***	(0,513)	4,481 ***	(0,505)	3,738 ***	(0,370)	4,480 ***	(0,337)
		no of obs	2154		2384		1950		2452	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 12: Estimates of Frequency of binge drinking events

freqency of binge drinking: (more than 5 drinks/event in past 30days)	no drunkennes less than once a week once a week more than once a week

| | | | first year | | | | third year | | | |
| | | | boys | | girls | | boys | | girls | |
group	type of variables		coef	se	coef	se	coef	se	coef	se
control	type of school	gymnasium	0,024	(0,142)	-0,132	(0,128)	-0,242 *	(0,133)	0,021	(0,114)
		apprentice	0,261 **	(0,109)	0,344 ***	(0,112)	0,025	(0,126)	0,240 **	(0,119)
	size of city	big city	-0,004	(0,135)	0,008	(0,119)	-0,064	(0,145)	-0,067	(0,130)
		small town	0,071	(0,115)	0,157	(0,109)	0,223 **	(0,109)	-0,043	(0,108)
	legal age	underage	0,034	(0,305)	-0,182	(0,618)	-0,036	(0,090)	-0,038	(0,075)
	parent's education	father uni	-0,127	(0,140)	-0,413 ***	(0,153)	0,009	(0,148)	-0,152	(0,174)
		father le	0,020	(0,116)	-0,079	(0,108)	-0,037	(0,132)	-0,057	(0,101)
		father unknown	-0,718 ***	(0,264)	-0,349	(0,267)	-0,548	(0,331)	0,512	(0,374)
		mother uni	-0,016	(0,138)	0,157	(0,168)	0,230	(0,149)	-0,206	(0,141)
		mother le	0,063	(0,091)	0,125	(0,119)	-0,021	(0,119)	-0,028	(0,094)
		mother unknown	0,086	(0,328)	0,257	(0,364)	0,346	(0,448)	-0,435	(0,633)
	wealth of the family	really wealthy	0,686 ***	(0,244)	0,359	(0,240)	0,245	(0,169)	0,214	(0,292)
		wealthy	0,286 **	(0,125)	0,214	(0,154)	0,154	(0,134)	0,025	(0,122)
		poorer	0,044	(0,182)	-0,216	(0,147)	-0,101	(0,145)	-0,132	(0,136)
		very poor	0,384	(0,265)	-0,072	(0,251)	0,196	(0,217)	0,198	(0,231)
family	relationships in	parents separated	-0,063	(0,112)	-0,096	(0,111)	-0,007	(0,116)	-0,224 **	(0,106)
		everything totaly fine in family	-0,010	(0,124)	-0,161	(0,149)	-0,024	(0,131)	0,205 *	(0,123)
		everything moreless fine in family	-0,103	(0,125)	-0,227 *	(0,119)	0,116	(0,128)	0,124	(0,104)
		bad feelings from family	-0,318	(0,216)	-0,240	(0,182)	-0,047	(0,220)	0,026	(0,152)
		strong monitoring	-0,177	(0,151)	-0,277 *	(0,161)	-0,107	(0,128)	-0,313 *	(0,172)
		moderate monitoring	-0,001	(0,138)	-0,170	(0,165)	-0,129	(0,129)	-0,077	(0,149)
	sibling	older sibling often drinks	0,312 ***	(0,108)	0,319 ***	(0,122)	0,308 ***	(0,116)	0,204 *	(0,110)
peer	peers	no friends drunk/week	-0,641 **	(0,264)	-0,887 ***	(0,265)	-0,855 ***	(0,305)	0,019	(0,205)
		few friends drunk/week	-0,284 ***	(0,106)	-0,357 ***	(0,112)	-0,352 ***	(0,113)	-0,366 ***	(0,106)
		majoritiy of friends drunk/week	0,651 ***	(0,114)	0,269 *	(0,133)	0,509 ***	(0,124)	0,543 ***	(0,134)
		all friends drunk/week	0,920 ***	(0,268)	0,529 **	(0,236)	0,457 *	(0,265)	0,870 ***	(0,225)
personality	behaviour	current smoker	0,764 ***	(0,107)	0,675 ***	(0,118)	0,576 ***	(0,120)	0,431 ***	(0,103)
		first drunk <14years old	0,325 ***	(0,105)	0,264 **	(0,108)	0,540 ***	(0,105)	0,347 ***	(0,116)
		experience with drugs	0,412 ***	(0,101)	0,534 ***	(0,107)	0,509 ***	(0,106)	0,395 ***	(0,103)
	low self-confidence	self-confident	0,024	(0,101)	0,059	(0,101)	0,087	(0,104)	-0,119	(0,099)
		very self-confident	0,066	(0,141)	0,071	(0,195)	0,125	(0,144)	-0,148	(0,185)
	aggressiveness	agressive	-0,124	(0,100)	-0,055	(0,098)	-0,371 ***	(0,098)	-0,013	(0,121)
	rules/laws abidance	rules violation possible	0,092	(0,100)	0,334 ***	(0,110)	0,167	(0,116)	0,120	(0,108)
		don't know	0,021	(0,121)	0,079	(0,120)	-0,001	(0,104)	0,237 **	(0,099)
association	risk perception -	low risk	0,285 ***	(0,110)	0,241 **	(0,113)	0,312 ***	(0,097)	0,422 ***	(0,110)
		great risk	-0,378 ***	(0,126)	-0,132	(0,125)	-0,233 *	(0,128)	-0,147	(0,110)
		don't know	0,009	(0,257)	0,104	(0,244)	-0,049	(0,308)	0,462 *	(0,268)
	sensitivity on	drunk after 1-2glasses	0,512 *	(0,298)	0,534 ***	(0,241)	0,791 ***	(0,384)	0,550 **	(0,279)
		drunk after 3-4glasses	1,158 ***	(0,231)	1,270 ***	(0,208)	0,901 ***	(0,299)	1,289 ***	(0,264)
		drunk after 4-5glasses	1,739 ***	(0,223)	1,809 ***	(0,221)	1,534 ***	(0,306)	1,763 ***	(0,281)
		drunk after 7-8glasses	2,215 ***	(0,236)	2,071 ***	(0,220)	2,350 ***	(0,313)	2,242 ***	(0,298)
		drunk after 9+ glasses	2,502 ***	(0,249)	2,080 ***	(0,307)	2,638 ***	(0,346)	2,337 ***	(0,360)
	judgment of drinking more once a week	codemn intoxicatin once/week	-0,500 ***	(0,128)	-0,374 ***	(0,119)	-0,679 ***	(0,113)	-0,677 ***	(0,124)
		very codemn intoxicatin once/week	-0,786 ***	(0,209)	-0,654 ***	(0,200)	-1,146 ***	(0,237)	-1,130 ***	(0,193)
		doesn't know intoxicatin once/week	-0,065	(0,156)	0,073	(0,165)	-0,310	(0,193)	-0,121	(0,135)
	association with	possitive	0,445 **	(0,175)	0,438 **	(0,202)	0,540 ***	(0,190)	0,964 ***	(0,245)
		negative	-0,142	(0,109)	0,084	(0,105)	-0,016	(0,110)	0,088	(0,110)
		/cut1	1,932 ***	(0,471)	1,975 ***	(0,683)	1,405 ***	(0,379)	2,349 ***	(0,422)
		/cut2	4,012 ***	(0,466)	4,198 ***	(0,704)	3,451 ***	(0,390)	4,588 ***	(0,434)
		/cut3	5,481 ***	(0,474)	5,767 ***	(0,717)	4,854 ***	(0,394)	6,228 ***	(0,452)
		no of obs	2175		2407		1965		2471	

note: *** p<0.01, ** p<0.05, * p<0.1

Appendix IV: Peer effect

Table 13: Start with risky behavior (in %)

	first drink	first drunk			daily smoking	first marihuana
	all	all	boys	girls	all	all
never	2,9%	22,1%	18,79%	25,09%	60,9%	56,6%
11years and earlier	31,2%	2,5%	3,06%	1,91%	1,9%	0,6%
12years	18,8%	4,4%	5,17%	3,70%	4,1%	1,3%
13years	18,3%	11,9%	12,63%	9,88%	6,5%	4,4%
14years	17,2%	19,7%	20,19%	19,15%	10,1%	10,5%
15years	9,8%	32,5%	31,65%	33,27%	12,3%	19,5%
16years and older	1,8%	7,7%	8,50%	6,99%	4,2%	7,1%

Table 14: Participated in drinking during last month (share,st.d.)

first year	all		boys		girls	
drink last month	Obs	Mean Std. D.	Obs	Mean Std. D.	Obs	Mean Std. D.
15years	1520	0,58 (0,49)	697	0,63 (0,48)	823	0,53 (0,50)
16years	3090	0,59 (0,49)	1481	0,65 (0,48)	1609	0,53 (0,50)
17years	120	0,63 (0,49)	66	0,67 (0,48)	54	0,57 (0,50)
18years	32	0,69 (0,47)	17	0,82 (0,39)	15	0,53 (0,52)
19years and older	4	0,50 (0,58)	0		4	0,50 (0,58)

third year	all		boys		girls	
drink last month	Obs	Mean Std. D.	Obs	Mean Std. D.	Obs	Mean Std. D.
16years	34	0,85 (0,36)	21	0,86 (0,36)	13	0,85 (0,38)
17years	1753	0,68 (0,47)	746	0,79 (0,41)	1007	0,60 (0,49)
18years	2666	0,69 (0,46)	1183	0,78 (0,42)	1483	0,63 (0,48)
19years and older	74	0,74 (0,44)	51	0,82 (0,39)	23	0,57 (0,51)

Table 15: Descriptive statistics of new variables

Variable	Obs	Mean Std. Dev.	Min	Max
share of peers				
drunk past month	4766	0,586 (0,162)	0,000	1,000
past drinking experience	4766	0,291 (0,132)	0,000	0,800
parents separated	4766	0,231 (0,109)	0,000	0,600
older drinking sibling	4766	0,365 (0,112)	0,000	0,833
parents uni	4766	0,262 (0,206)	0,000	0,962
parents high school	4766	0,444 (0,134)	0,000	0,833
parents low educ	4766	0,261 (0,170)	0,000	0,704
parents unknown	4766	0,012 (0,028)	0,000	0,250
wealthy family	4766	0,195 (0,105)	0,000	0,615
average wealth	4766	0,679 (0,119)	0,000	1,000
poor family	4766	0,126 (0,066)	0,000	0,333
high monitoring	4766	0,539 (0,125)	0,000	0,960
poor situation in family	4766	0,252 (0,112)	0,000	0,583
lagged older students' drinking	4766	0,270 (0,073)	0,102	0,500

Table 16: Peer effect estimation

		freshmen all				nondrinkers				only big city and city			
		boys		girls		boys		girls		boys		girls	
model 1	share of peers drinking	0,305 ***	(0,079)	0,171 **	(0,068)	0,340 ***	(0,099)	0,196 **	(0,081)	0,442 ***	(0,109)	0,062	(0,090)
model2	lagged peers' drinking	0,266 **	(0,119)	0,474 ***	(0,112)	0,189	(0,177)	0,464 ***	(0,166)	0,399 ***	(0,130)	0,203	(0,170)
model3	peers characteristics	0,233	(0,159)	0,606 ***	(0,134)	0,185	(0,218)	0,637 ***	(0,188)	0,397 **	(0,169)	0,234	(0,183)
model4	older students' drinking	0,267 *	(0,160)	0,565 ***	(0,133)	0,236	(0,223)	0,623 ***	(0,192)	0,421 **	(0,175)	0,192	(0,185)
model5	excl expectations	0,275 *	(0,161)	0,532 ***	(0,132)	0,284	(0,219)	0,588 ***	(0,189)	0,432 **	(0,179)	0,1575	(0,193)
model6	excl judgmental dummies	0,364 **	(0,168)	0,527 ***	(0,135)	0,403 *	(0,223)	0,604 ***	(0,190)	0,553 ***	(0,191)	0,1885	(0,204)

Table 17: Peer effect - non-drinkers from bigger cities

		only big city and city, nondrinkers			
		boys		girls	
model 1	share of peers drinking	0,275 ***	(0,099)	0,142	(0,110)
model2	lagged peers' drinking	0,269 **	(0,114)	0,132	(0,127)
model3	peers characteristics	0,319 **	(0,150)	0,087	(0,176)
model4	older students' drinking	0,384 ***	(0,131)	0,177	(0,147)
model5	excl expectations	0,340 **	(0,135)	0,138	(0,154)
model6	excl judgmental dummies	0,458 ***	(0,126)	0,289 **	(0,141)