

# Adolescents alcohol-use and economic conditions: a multilevel analysis of data from a period with big economic changes

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**Abstract** This paper examines how the unemployment rate is related to adolescent alcohol use and experience of binge drinking during a time period characterized by big societal changes. The paper uses repeated cross-sectional adolescent survey data from a Swedish region, collected in 1988, 1991, 1995, 1998, 2002 and 2005, and merges this with data on local unemployment rates for the same time periods. Individual level frequency of alcohol use as well as experience of binge drinking is connected to local level unemployment rate to estimate the relationship using multilevel modeling. The model includes municipality effects controlling for time-invariant differences between municipalities as well as year fixed effects controlling for municipality-invariant changes over time in alcohol use. The results show that the unemployment rate is negatively associated with adolescents' alcohol use and the experience of binge drinking. When the unemployment rate increases, more adolescents do not drink at all. Regular drinking (twice per month or more) is, on the other hand, unrelated to the unemployment rate. Examining gender-differences in the relationship, it is shown that the results are driven by behavior in girls, whereas drinking among boys does not show any significant relationship with changes in the unemployment rate.

**Keywords** Alcohol use · Unemployment rate · Multilevel methods · Sweden

**JEL Classification** E32 · I12

## Introduction

At the beginning of the 1990s Sweden experienced a major economic recession. The unemployment rate increased dramatically from 1.3% in 1990 to 8.8% in 1993. The unemployment rate among 16- to 19-year-olds rose from 4.6% among males and 5.4% among females to 21.4% (males) and 17.4% (females). Consistently, the employment rate (among 16–64 year olds) decreased from 83.2% in 1990 to 72.1% in 1993 [1]. The economic crisis has had long lasting effects on the Swedish economy, and Swedish youth unemployment is still among the highest of all OECD countries.

It is reasonable to hypothesize that major social changes affect adolescents' health-related behaviors such as alcohol use. Downturns in the economy may affect adolescent alcohol use in both directions. Decreasing income for adolescents may restrict the possibilities for consumption, but economic downturns may also imply an increase in psycho-social stress, which may affect health-related behaviors.

Alcohol use during adolescence is a particular cause for concern because of the stability in alcohol consumption among individuals over the life course. Adolescents with a high level of consumption tend to retain a high level of consumption as adults [2]. Adolescents are, in general, also more vulnerable to the negative effects of alcohol use. Adolescence is a time when there is substantial neuromaturation involving many parts of

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the brain, thus drinking among adolescents may affect memory, deteriorate sensitivity to motor impairment and damage frontal-anterior cortical regions [3]. The short-term negative effects of alcohol use among adolescents, such as (1) increased risk of physical injury, (2) being exposed to physical violence, and (3) engaging in high-risk sexual behavior [4], also represent a significant problem. These negative consequences of alcohol use are risks at the individual level, but they also imply negative societal effects due to increased demands for health care (e.g., due to injuries and accidents) as well as negative externalities affecting others due to drinking and the behavior that follows from binge drinking. A study on the societal cost of alcohol consumption among the whole population in Sweden (in 2002) estimated a total net cost of 20.3 billion Swedish kronor, and that alcohol consumption causes a net loss of 121,800 quality-adjusted life-years (QALYs) [5]. Hence, understanding what drives changes in the consumption of alcohol among adolescents is important for public health as well as public finance arguments.

In a recent paper, the relationship between economic conditions (upturns and downturns) and adolescent alcohol and drug use in the United States was examined [6]. The results showed that economic downturns are related to greater use of alcohol, marijuana and cocaine. According to the study, the results enable predictions of when and where an increase of drug use will occur, i.e., early indications for implementation of prevention programs. This is important considering that the most efficient preventive programs among adolescents are those that intervene at an early stage before adolescents become more resistant to behavioral changes [7, 8]. The relationship found for adolescents [6] contradicts the literature focusing on adult alcohol use, which in general indicates increasing use of alcohol in good times and decreasing use in bad times [9–12]. A recent paper examining Swedish alcohol sales from 1861 to 2000 found that, throughout this time period, alcohol sales increased in economic upturns and decreased in economic downturns [13].

At face value, the trends in unemployment rates and adolescent alcohol use in Sweden do not seem to parallel each other (see Fig. 1 below). A sharp increase in alcohol use occurred in the late 1980s, i.e., prior to the economic downturn, while the increases during the crises were more moderate. The current paper subjects the relationship between unemployment rate and adolescent alcohol use to a more rigorous analysis, taking both individual level as well as aggregated data into account, and controlling for possible confounders using multilevel regression analysis. The paper capitalizes on the substantial literature exploiting regional variation in economic conditions to analyze

the relationship between unemployment rate and adolescent alcohol use.

The rest of the paper is structured as follows. “**Methods**” describes the statistical analysis of the “**Data**” and the “**Empirical strategy**” used, while “**Regression results**” presents the results of the multilevel regression analyses. “**Discussion and conclusions**” concludes the paper with a discussion.

## Methods

### Data

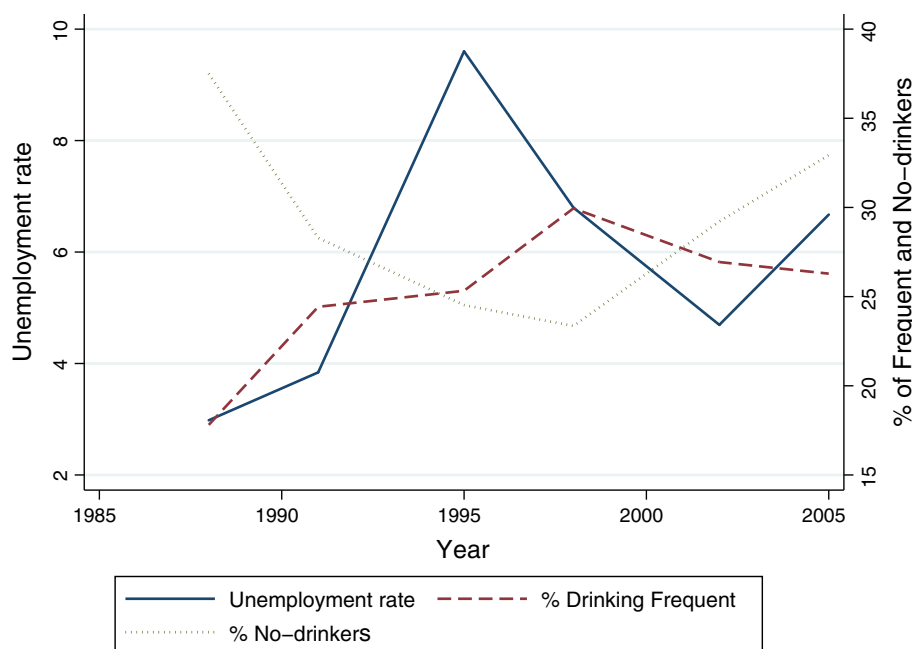
The paper is based on cross-sectional data collected in 1988, 1991, 1995, 1998, 2002 and 2005 among Year 9 adolescent compulsory school pupils (15- to 16-years-old) within the county of Värmland in Sweden. Värmland county has 274,000 inhabitants and is situated 250 km east of the capital Stockholm, bordering Norway to the west.

In all, more than 17,000 students participated in the study. This study makes use of data from 14 out of 16 municipalities that participated in each year of investigation, comprising 15,206 students.<sup>1</sup> The number of respondents each year was: 2,701 (1988); 2,605 (1991); 2,426 (1995); 2,342 (1998); 2,478 (2002) and 2,654 (2005). The corresponding non-responses were: 10.0% (1988), 11.1% (1991), 6.3% (1995), 9.3% (1998), 11.8% (2002) and 14.9% (2005).

The data were collected in schools using a questionnaire, which was completed anonymously in the classroom and returned in a sealed envelope. In each year of investigation, data collection took place in the second semester of Year 9. Data collection was carried out in accordance with the research ethics principles in humanistic-social science research stipulated by the Swedish Research Council.

To measure alcohol use, we analyzed two different outcome variables that were available for all years (1988–2005): alcohol use and binge drinking. First, the outcome variable alcohol use used the following question from the survey: *During this school year, how often have you been drinking beer, wine or hard liquor?* The five response categories were as follows: (1) never, (2) <1/month, (3) 1/month or more, (4) 2/month or more, (5) 1/week or more. The second outcome variable, binge drinking, indicates whether the adolescent drank a large amount of alcohol on the same occasion during the current school year (measuring experience of drunkenness, rather than

<sup>1</sup> Two municipalities were excluded because of non participation in 1 year (1995).



**Fig. 1** Percentage of regular drinkers and unemployment rate in the region of Värmland, 1988–2005

frequency of use). In the survey, this is defined as alcohol equal to or more than 17.5 cl strong liquor (1/4 of a full-sized bottle or 1/2 of a half-sized bottle), or one bottle of wine, or four large bottles (50 cl) of full-strength cider, or four large bottles of full-strength beer, or six large bottles of medium-strength beer, at any one time. In the analysis, we also controlled for whether the adolescent is a boy or a girl.

The two outcome variables are shown more in detail in Table 1. In the case of alcohol use, the proportion of adolescents never drinking (current school year) was highest in 1988 (37%), and lowest 10 years later in 1998 (21%). Drinking less than once a month (<1 month) has not changed much over time. The increase, particularly in 1995–2002, is seen rather in the proportion of adolescents drinking twice a month (2/month) or once a week or more (1/week or more), which more than doubled compared to 1988. In the last survey year, 2005, there is an increase in the proportion of adolescents not drinking at all. However, the proportion of adolescents drinking 1/week or more increased more or less steadily over the entire time period. This gives a rough indication that alcohol habits are polarized over the years. Compared with the 1990s, more adolescents are not drinking at all in 2005, but more adolescents are regular drinkers.

Regarding binge drinking at least once during the school year we see a similar pattern as for alcohol use, with the lowest proportion in 1988 and the highest in 1998. We can also see that most adolescents indicating that they have

used alcohol have had an experience of binge drinking, i.e., alcohol use without high drunkenness seems relatively unusual in this particular age-group.<sup>2</sup>

The research question is to relate the unemployment rate at the municipal level with individual level alcohol-use, to examine if a change in the unemployment rate is related to drinking patterns. Thus, we merged the survey data on alcohol use with data on unemployment rates at the municipal level for each year for which we have survey data (1988, 1991, 1995, 1998, 2002 and 2005). This variable—unemployment rate—is based on register data administrated by the Swedish Public Employment Service.<sup>3</sup> To give a brief overview of the general tendencies of alcohol use and the unemployment rate, Fig. 1 depicts the evolution over time of the unemployment rate as well as of the proportion of adolescents never drinking and the

<sup>2</sup> For example, in 2005, 68% used alcohol at least once (100–31.74%) and 52.5% report binge drinking at least once. This leaves a proportion of ~16% of adolescents reporting to have used alcohol but not reporting a large amount on one specific occasion (binge drinking).

<sup>3</sup> The definitions of unemployment differ slightly between the Swedish Public Employment Service (used here) and the official Labor Force Surveys conducted by Statistics Sweden (which should be used for international comparisons). However, since we are interested in the change in the unemployment rate over time for the included municipalities, the important criteria is that the data are comparable across time for the municipalities.

**Table 1** Adolescent alcohol use and binge drinking (%)

	1988 ( <i>n</i> = 2,682)	1991 ( <i>n</i> = 2,588)	1995 ( <i>n</i> = 2,388)	1998 ( <i>n</i> = 2,261)	2002 ( <i>n</i> = 2,442)	2005 ( <i>n</i> = 2,621)
Outcome variable: alcohol use						
1. Never	37.06	27.82	23.32	20.61	27.68	31.74
2. <1 Month	34.19	34.93	37.31	35.60	32.88	30.87
3. 1/Month	10.92	12.83	14.03	13.84	12.49	11.10
4. 2/Month	13.27	16.96	15.87	19.20	16.26	14.96
5. 1/Week or more	4.54	7.47	9.46	10.75	10.68	11.33
Outcome variable: binge drinking						
Binge drinking	50.15	60.82	61.8	64.4	59.7	52.5

proportion of adolescents drinking 2/month or more in the region of Värmland (regular drinking).<sup>4</sup>

Figure 1 shows that the time-period that is the subject of the analysis in this paper captures the Swedish economic crisis during the 1990s. The unemployment rate took off slowly in 1990/1991, reached a peak in 1993, and started to decrease to lower levels again in 1997. Figure 1 also presents some of the information shown in Table 1 graphically, e.g., that the proportions of regular drinkers and never drinkers reached their highest and lowest levels, respectively, in 1998.

### Empirical strategy

The approach taken in the present study is to relate the unemployment rate at the municipal level with individual level alcohol use and binge drinking to examine if the unemployment rate is associated with individual-level drinking. Because of hierarchical structure of the data, modeling this mixed data set at the individual level violates regression assumptions of independent observations. There will also be unobserved heterogeneity at the municipality level, which implies that the municipality means of alcohol use and binge drinking will vary across the municipalities because of factors that cannot be measured. To take account of these problems, we estimated a multilevel (mixed-effects) model with a random intercept [14, 15], which can be described as:

$$Y_{ijt} = \beta_1 + \beta_2 \times \text{boy}_{ijt} + \beta_3 \times U_{jt} + a_t + \zeta_j + e_{ijt}. \quad (1)$$

In Eq. 1 *i* represents the individual, *j* the municipality and *t* the survey year. Regarding the terms in Eq. 1,  $\zeta_j$  is a random intercept for municipalities, distributed independently from the residual error term  $e_{ijt}$ . The random municipality

intercept captures unobserved heterogeneity across municipalities that are also important determinants of alcohol use, for example local cultures, habits, educational levels [16]. Regarding the fixed part of the model, we include an individual specific variable (boy), which takes the value 1 if the respondent *i* in municipality *j* in year *t* is a boy (0 for a girl). We also include year fixed effects ( $a_t$ ). This is included to avoid spurious correlations by controlling for time trends, which is decisive since the time trends of drinking habits and unemployment rates may have different and uncorrelated origins. As an example, alcohol use may be higher in 1995 compared to 1988 due to the higher unemployment rate, or just due to the fact that the time-trend in unemployment rate and alcohol-use happen to move in the same direction. By including the year fixed effects we control for this (potential) nonsense relationship.

Finally, the variable of most interest in this paper is  $U_{jt}$ , which is the unemployment rate in municipality *j* in year *t*. For example, an individual surveyed in the municipality of Karlstad in year 1988 will be assigned a value of  $U_{jt}$  that is equal to the unemployment rate in Karlstad in 1988. An individual surveyed in Karlstad in the year 2005 will be assigned a value of  $U_{jt}$  that is equal to the unemployment rate in Karlstad in 2005, etc.

The estimations in the paper were performed using ordinal as well as binary logit multilevel models using the Gllamm program for Stata [15] as well as the standard mixed-effects routine in Stata v.10.

### Regression results

Table 2 shows the results from the multilevel model (Eq. 1); the dependent variable is the ordinal drinking variable (alcohol use), as defined in Data. Table 2 includes four models, where model 1 is a baseline model that includes only year effects,  $a_t$  in Eq. 1, in the fixed effects part of the model (hence, not including the unemployment rate or if the adolescent is a boy or a girl). This is to provide

<sup>4</sup> Never drinking is the first category of the dependent variable alcohol use as shown in Table 1. Regular drinking is the proportion of adolescents drinking 2/month and 1/week or more, i.e., categories 4 and 5 of the dependent variable alcohol use as shown in Table 1.

**Table 2** Odds ratios from multilevel ordinal logit estimations (95% CI in brackets), dependent variable: alcohol use scale 1–5 (see Table 1)

	Model 1 All respondents	Model 2	Model 3 Boys	Model 4 Girls
Unemployment rate	–	0.96** (0.93–1.00)	0.99 (0.94–1.04)	0.95** (0.90–0.99)
Boys	–	1.05* (0.99–1.11)	–	–
1988	1	1	1	1
1991	1.49*** (1.36–1.65)	1.75*** (1.45–2.12)	1.49*** (1.14–1.93)	1.94*** (1.48–2.55)
1995	1.70*** (1.54–1.87)	2.07*** (1.64–2.60)	1.67*** (1.22–2.28)	2.38*** (1.72–3.28)
1998	1.90*** (1.72–2.10)	2.11*** (1.82–2.43)	1.87*** (1.53–2.27)	2.29*** (1.87–2.81)
2002	1.61*** (1.45–1.77)	1.65*** (1.49–1.83)	1.51*** (1.31–1.75)	1.79*** (1.54–2.07)
2005	1.44*** (1.31–1.59)	1.51*** (1.35–1.69)	1.37*** (1.17–1.59)	1.64*** (1.40–1.93)
Level 1 units	15,206	15,206	7,628	7,578
Level 2 units	14 (in six different years)	14 (in six different years)	14 (in six different years)	14 (in six different years)
Variance level 2	0.06 (0.02)	0.06 (0.02)	0.07 (0.03)	0.07 (0.02)

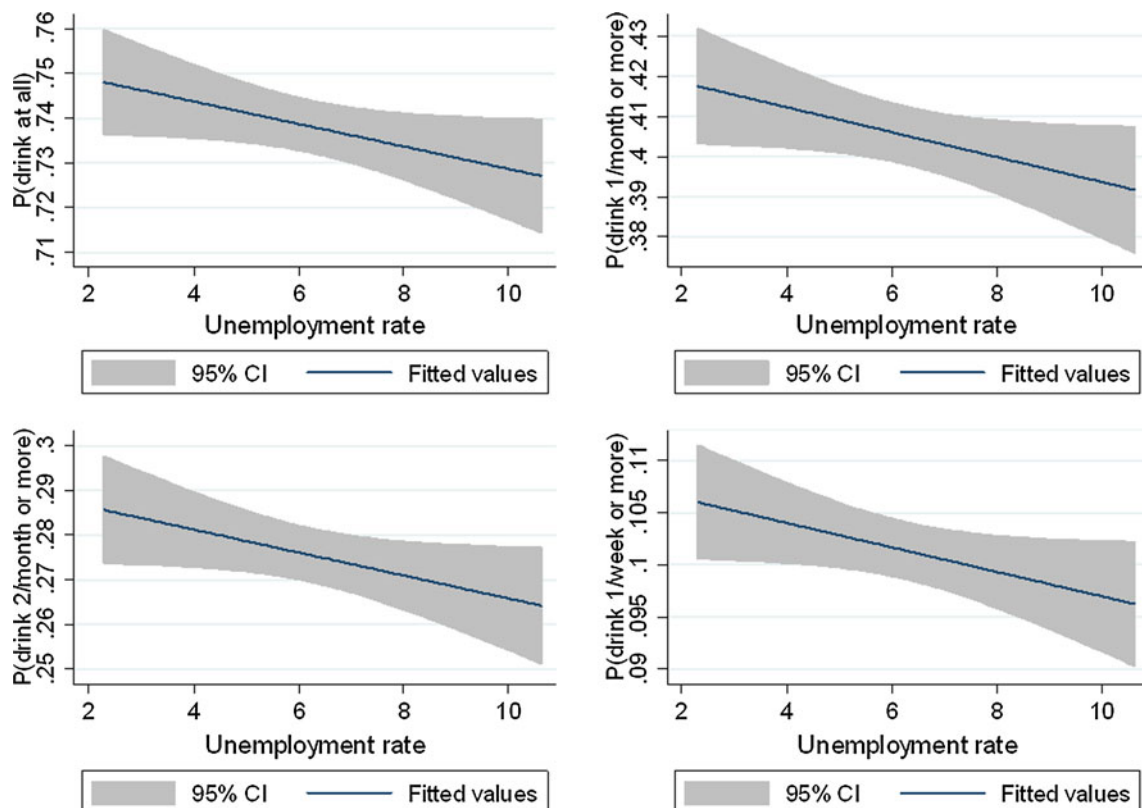
\*\*\*  $P < 0.01$ ; \*\*  $P < 0.05$ ; \*  $P < 0.1$

a descriptive view of the overall trend in drinking. Model 2 is the main model in the paper as specified in Eq. 1. Models 3 and 4 are the same as model 2 but estimated for boys and girls separately.

In model 2, the odds-ratio for the unemployment rate is 0.96 for all respondents and statistically significant at the 5% level. Considering that it is a proportional ordinal logit

model, the actual coefficient may be hard to interpret intuitively. However, since the odds-ratio is smaller than one, the model predicts that when the unemployment rate increases, adolescent alcohol use decreases.

Looking at models 3 and 4, it can also be seen that changes in the unemployment rate seem to be related to girls' alcohol use, but not to boys' alcohol use, i.e., girls



**Fig. 2** Predicted probabilities by unemployment rate, based on ordinal logit estimation. The figures are based on the results in model 2 as shown in Table 3. Grey areas represent 95% confidence bands

drink less in poor economic times and more in good economic times (using the unemployment rate at the level of the municipality as the proxy for economic conditions). Table 2 also reveals strong time trends in alcohol consumption (model 1–model 4). Starting in the baseline year 1988, when consumption was lowest during the time period covered here, there was a strong increase in adolescent drinking peaking in 1998. At the beginning of the twenty-first century, drinking decreased, but was still higher in 2005 compared to 1988. The largest increase is between 1988 and 1991, i.e., before the onset of the economic crisis.

To interpret the magnitude of the effect of the unemployment rate on alcohol use, Fig. 2 plots the predicted probabilities from the ordinal logit estimation in Table 2 (model 2).

Figure 2 indicates a negative slope in all four graphs. In the first graph, the interpretation is that as the unemployment rate increases, the predicted probability to drink at all decreases (at higher unemployment rates, more adolescents do not drink at all). As an example, using average values, an exogenous shock increasing the unemployment rate from ca. 1.5% to 8% (as happened during the economic crisis in Sweden) increases the proportion of adolescents never drinking at all from 23% to 25%. The magnitude of the effect is largest for the probability to drink at all, and the probability to drink 1/month or more (the upper two graphs). The magnitude of the effect is even smaller for the two lower graphs (drinking 2/month or more and drinking once a week or more). The main interpretation is that the results reported in Table 2 are related mainly to changes in lower levels of alcohol use among adolescents, and that the more regular drinking is not related to the local unemployment rate.

The results presented above were based on a proportional-odds ordinal logit model. The model assumes equal

distance between the ordinal drinking categories, which in many applications is not met. In this part a generalized ordinal model is estimated, by creating four dichotomous dependent variables for each cut-point in the ordinal alcohol use variable. These variables are defined as Cut 1 (=1 if drinks <1 month or more), Cut 2 (=1 if drinks 1/month or more), Cut 3 (=1 if drinks 2/month or more) and Cut 4 (=1 if drinks 1/week or more).

Table 3 shows the results of a multilevel binary logit model estimated for the four mentioned dependent variables.

The results from the more generalized model in Table 3 confirm the results from the main results in Table 2. A higher unemployment rate is related to less drinking, and the relationship holds for the low frequency consumption categories (Cut 1 and Cut 2). Hence, a higher unemployment rate implies a lower proportion of adolescents who drink at all, but there is no effect on more regular drinking (Cut 3 and Cut 4).

The results in Tables 2 and 3 refer to the frequency of alcohol use. Table 4 analyses the relationship between the unemployment rate and binge drinking, defined as previously stated as having consumed a large amount of alcohol at any one time (current school year).

The results for binge drinking at least once during the school year reinforce the results for alcohol use. In model 2, we see that increasing unemployment rate is associated with decreasing likelihood of binge drinking (OR = 0.94). Examining the boy–girl pattern we see the same relationship as for alcohol use as well, i.e., the relationship is driven by the behavior of girls (OR = 0.91 in model 4). Looking at the results in model 2, we also see that boys are less likely to binge drink at least once during the school year.

The time trends for binge drinking at least once (model 1) are similar as for alcohol use. A large increase is

**Table 3** Odds ratios (95% CI in brackets) from multilevel binary logit estimations on Cut1 to Cut 4

	Model 1 Cut 1 (<1 month or more)	Model 2 Cut 2 (1/month or more)	Model 3 Cut 3 (2/month or more)	Model 4 Cut 4 (1/week or more)
Unemployment rate	0.94** (0.90–0.99)	0.97* (0.93–1.01)	1.01 (0.96–1.06)	1.02 (0.95–1.09)
Boys	0.95 (0.89–1.02)	1.08** (1.01–1.15)	1.13*** (1.05–1.21)	1.42*** (1.27–1.60)
1988	1	1	1	1
1991	1.92*** (1.51–2.44)	1.71*** (1.36–2.15)	1.43*** (1.11–1.85)	1.59** (1.06–2.38)
1995	2.49*** (1.86–3.33)	1.92*** (1.47–2.51)	1.49*** (1.11–2.00)	2.02*** (1.28–3.19)
1998	2.29*** (1.91–2.74)	2.03*** (1.72–2.40)	1.86*** (1.54–2.25)	2.39*** (1.76–3.23)
2002	1.56*** (1.38–1.77)	1.65*** (1.46–1.87)	1.69*** (1.48–1.95)	2.50*** (1.99–3.15)
2005	1.35*** (1.18–1.54)	1.56*** (1.37–1.77)	1.64*** (1.42–1.90)	2.66*** (2.09–3.38)
Level 1 units	15,206	15,206	15,206	15,206
Level 2 units	14 (in six different years)	14 (in six different years)	14 (in six different years)	14 (in six different years)
Variance level 2	0.24 (0.05)	0.25 (0.05)	0.22 (0.05)	0.23 (0.06)

\*\*\*  $P < 0.01$ ; \*\*  $P < 0.05$ ; \*  $P < 0.1$

**Table 4** Odds ratios (95% CI in brackets) from multilevel binary logit estimations; dependent variable: binge drinking

	Model 1 All respondents	Model 2	Model 3 Boys	Model 4 Girls
Unemployment rate	–	0.94*** (0.90–0.98)	0.99 (0.93–1.05)	0.91** (0.86–0.97)
Boys	–	0.87*** (0.82–0.93)	–	–
1988	1	1	1	1
1991	1.54*** (1.38–1.72)	2.01*** (1.61–2.51)	1.46** (1.07–1.98)	2.59*** (1.88–3.55)
1995	1.61*** (1.44–1.80)	2.25*** (1.72–2.93)	1.49** (1.04–2.15)	3.10*** (2.12–4.54)
1998	1.80*** (1.60–2.02)	2.11*** (1.79–2.50)	1.55*** (1.23–1.95)	2.76*** (2.18–3.50)
2002	1.48*** (1.32–1.65)	1.55*** (1.38–1.74)	1.31*** (1.11–1.54)	1.81 (1.54–2.14)
2005	1.10* (0.99–1.23)	1.20*** (1.06–1.36)	0.97 (0.81–1.15)	1.45*** (1.22–1.73)
Level 1 units	15,168	15,168	7,561	7,607
Level 2 units	14 (in six different years)	14 (in six different years)	14 (in six different years)	14 (in six different years)
Variance level 2	0.19 (0.04)	0.22 (0.05)	0.23 (0.06)	0.20 (0.05)

\*\*\*  $P < 0.01$ ; \*\*  $P < 0.05$ ; \*  $P < 0.1$

seen between 1988 and 1991, and the peak in binge drinking is seen in 1998. In 2005 the likelihood of binge drinking was almost back at the same level as in 1988.

## Discussion and conclusions

The results indicate that a weaker economy, when the unemployment rate increases, is associated with less frequent adolescent alcohol use and binge drinking at least once during the school year. The effect is driven by behavior in girls and is manifested by an increasing proportion of adolescents who never drink or who reduce an already low level of consumption. Regular drinking (2/month or more) shows no significant relationship with economic conditions. In the analysis on binge drinking at least once during the current school year, the results also indicate that increasing unemployment rates at the level of the municipality is associated with a lower proportion of adolescents binge drinking at least once during the school year. The results in this paper indicate a pro-cyclical relationship, with increasing alcohol use in economic upturns, and, conversely, decreasing alcohol use in economic downturns. However, this relationship was not seen for frequent alcohol use, indicating that economic conditions may affect drinking differently depending on the level of drinking. The overall results in this paper are consistent with most papers on economic conditions and alcohol use among adults [9–12]. A pro-cyclical relationship among Swedish adults has been documented to hold for every time-period from 1861 to 2000 [13]. However, the results contradicts a recent paper also focusing on adolescents, which reported that adolescents in the United States drink slightly more in economic downturns [6].

There are several potential reasons why adolescent alcohol use decreases in economic downturns. Income

effects may play a dominant role, i.e., decreasing incomes lead to decreasing consumption of all goods, including alcohol. If parents become unemployed this may affect the financial resources the adolescents have to allocate and spend on different goods. We have no data on the proportion of adolescents actually working themselves during their full-time education, but based on data from the survey in 2005 we know that approximately 50% of adolescents work extra sometimes during the year, and that 15% work extra at least a couple of times a week. Hence, the share is large enough to make it at least possible that the reduced working possibilities in economic downturns also directly affect income earned by adolescents. Another possible reason is that when unemployment increases (and overtime work is reduced), parents will spend more time with their children, thereby restricting the possibilities for the adolescent to consume alcohol.

An important aspect of our results was that the relationship was driven by behavior in girls. It has long been argued that boys and girls react differently to negative life events, which economic stress and downturns may increase the likelihood of.<sup>5</sup> Girls are often said to react to negative life events with depressed mood, while boys react with anger. It has also been shown that girls are more likely to report stresses that involve other people or pose threats to their social relationships [17–19]. However, although it is not clear if such behavioral patterns could explain any of the results in this paper, they indicate that it is no surprise that the relationship is not equal for boys and girls. To be able to answer this in further research it may be necessary to examine the main factors causing the relationship

<sup>5</sup> To give some examples: in economic downturns the risk of parental unemployment increases and schools may cut-back on resources and staff. In economic upturns the opposite may happen, increased likelihood of parental employment and increases in school resources, etc.

between economic conditions and alcohol use more explicitly. In general, we saw that girls were more likely to use alcohol as well as to binge drink at least once during the school year. This is consistent with the results of a previous study on adolescent alcohol use in Sweden, where girls tended to drink more frequently [20]. However, in that study frequent binge drinking was higher for boys than for girls. Unfortunately we do not have data on frequent binge drinking to analyze in this paper.

In a recent paper on adolescent substance use and economic conditions in the United States [6], it is argued that economic conditions can be used to predict where teenage substance use may be on the rise, hence arguing for preventive measures being implemented depending on the economic conditions. However, the reported odds ratios on the relationship between the unemployment rate and alcohol use and binge drinking reported in this paper are relatively small, which indicates that a change in the unemployment rate is not to be considered as a highly significant predictor of changes in adolescent drinking behavior. As an example, an exogenous shock in the unemployment rate from 1.5% to 8% (which is more or less what happened during the Swedish economic crisis in 1990–1993) would increase the proportion of adolescents never drinking at all from 23% to 25% (based on model 2 in Table 2). However, it may be argued that in severe economic downturns where tax income for municipalities decreases, it may prove efficient to re-allocate money from alcohol preventive policies among adolescents into other policy areas, the argument for this being that adolescents do not seem to increase their risky alcohol use in economic downturns. As shown here, if anything, adolescents (at least girls) decrease alcohol use in economic downturns.

Further, the results in this paper do not indicate that the high levels of alcohol use in the 1990s in Sweden were due to the economic crisis. It has been argued that the major social change and economic crisis in Sweden during the 1990s increased adolescents' risk behaviors [21, 22], but the present paper reports the opposite, at least regarding adolescent alcohol use. A major problem with the earlier cited papers indicating that the economic crisis increased adolescent risk behavior is that these papers compare behaviors before the crisis with behavior during/after the crisis without controlling for time trends. Such comparisons are likely to suffer from spurious correlations.

Finally, a cautionary note is in order regarding self-reported survey data. In general population studies it has been shown that respondents tend to understate alcohol consumption [23]. As discussed elsewhere [24, 25], this is not necessarily true for adolescents who might instead overstate alcohol use to boast to their peers. By administering the survey anonymously and not allowing the

adolescents to communicate during the completion of the questionnaire, this bias should be minimized. Furthermore, a study from the United States has indicated consistency both within-survey and over time from self-reported alcohol data by adolescents [26]. A cautionary note should also be made regarding the fact that the results in this paper are based on data from only one region in Sweden, and data collected in other parts of Sweden have yet to be analyzed in order to judge whether the reported results reoccur in adolescent samples from regions with structures and populations that differ from the county of Värmland. However, regarding adolescent behavior, a recent Swedish paper analyzed alcohol- and drug-use in Värmland with a southern and a northern region in Sweden, and even though there are large differences in illicit drug use, the differences in alcohol use in the different Swedish regions were small [20]. Regarding the county of Värmland, GDP/capita in Värmland is 17% lower compared to the Swedish national average, while unemployment rates do not differ much compared to the national average [27]. Hence, we do not see any strong reasons why the relationship should be specific to the region of Värmland, but naturally this would need to be analyzed to go from speculation to evidence.

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