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ADOLESCENTS ALCOHOL-USE AND ECONOMIC CONDITIONS

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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 during a time period characterized by big societal changes using repeated cross-sectional adolescent survey data from a Swedish region, collected in 1988, 1991, 1995, 1998, 2002 and 2005. Individual level alcohol use is connected to local level unemployment rate to estimate the relationship using multilevel modeling. The results show that the unemployment rate is negatively associated with adolescents alcohol use. When the unemployment rate increases, more adolescents, mainly girls, do not drink at all. Regular drinking (2/month or more) is, on the other hand, unrelated to the unemployment rate. This implies that we may se decreases in adolescent alcohol use in the now expected real economic crisis with increasing unemployment.

Keywords: alcohol use; unemployment rate; multilevel methods; Sweden.

JEL-codes: E32, I12

1. Introduction

In the beginning of the 1990s Sweden experienced a major economic recession. The unemployment rate increased dramatically, from 1.3 percent in 1990 to 8.8 percent in 1993. The unemployment rate among 16-19 year olds rose from 4.6 percent among males and 5.4 percent among females to 21.4 percent (males) and 17.4 percent (females). Consistently, the employment rate (among 16-64 year olds) decreased from 83.2 percent in 1990 to 72.1 percent in 1993 [1]. The economic crisis has had long lasting effects on the Swedish economy. Although the unemployment rate has decreased since 1993 down to 5.9 percent in May 2008, this is clearly a higher number compared to the pre-crisis unemployment rate [2].

Swedish youth unemployment is still among the highest in the OECD countries. Hence, Sweden has lost its position as country without any significant unemployment.

It is reasonable to hypothesize that major social changes may affect adolescents' health-related behaviors such as alcohol use. Downturns in the economy may affect adolescent alcohol use in both directions. Decreasing incomes 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 [3]. 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 the brain implying that binge drinking among adolescents may affect memory, deteriorate sensitivity to motor impairment and damage frontal-anterior cortical regions [4]. Also short-term negative effects from alcohol use among adolescents is a significant problem, such as: (i) increased risk of physical injury, (ii) being exposed to physical violence and (iii) engaging in high-risk sexual behavior [5].

In a recent paper the relationship between economic conditions (upturns and downturns) and adolescent alcohol and drug use in the US was examined [6]. The results show 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 which intervene at an early stage before adolescents become more resistant to behavioral changes [7, 8]. The relationship found for adolescents [6] contradict the literature focusing on adult

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alcohol use, which in general indicate increasing use of alcohol in good times and decreasing use in bad times [9-12].

At face value the trends in unemployment rates and adolescent alcohol use in Sweden do not seem to parallel each others (see Figure 1 in next section). A sharp increase of alcohol use occurred in the late 1980s, i.e. prior to the economic downturn, while the increases during the crises were more moderate. In the current paper the relationship between unemployment rate and adolescent alcohol use is subjected to a more rigorous analysis, taking account of individual level as well as aggregated data 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. Section two describes the data and statistical analysis used in the empirical analysis. Section three shows descriptive statistics as well as the results from the multilevel regression analyses and section four finalizes the paper with a discussion.

2. Methods

2.1 Data

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

In all more than 17,000 students have participated in the study. This study makes use of data from 14 out of 16 municipalities which have been participating all years of

investigations, comprising 15,206 students.[1] 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. At every year of investigation the data collection took place in the second semester of Year 9. The data collection was carried out in accordance with research ethics principles in humanistic-social science research stipulated by the Swedish Research Council.

2.2 Statistical analysis

The approach taken in the present study is to relate the unemployment rate at the municipal level with individual level alcohol-use and to examine if the unemployment rate is associated to individual-level alcohol use. Because of hierarchical structure of the data, modeling this mixed data set at the individual level violates regression assumptions of independent observations, implying deflating the standard errors. There will also be unobserved heterogeneity at the municipality level, which implies that the municipality means of alcohol-use will vary across the municipalities because of factors that cannot be measured. To handle these problems, we estimate a mixed-effects (multilevel) model with a random intercept [13, 14], which can be described as:

$$Y_{ijt} = \beta_1 + \beta_2 \times boy_{ijt} + \beta_3 \times U_{jt} + a_t + \varsigma_j + e_{ijt}. \qquad (1)$$

In equation (1) i represent the individual and j represent the municipality and t represents the survey year. Regarding the terms in equation (1), ς_j is a random intercept for municipalities, independently distributed from the residual error term e_{ijt}. The random municipality intercept

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[1] Two municipalities were excluded because of non participation in one year (1995).

captures unmeasured factors across municipalities that are also important determinants of alcohol use, for example local cultures, habits, educational levels [15]. 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 that were surveyed in the municipality of Karlstad in year 1988 will get 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 get 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 [14] as well as the standard mixed-effects routine in Stata v.10.

3. Results

3.1 Descriptive Statistics

In this paper the main focus is on the relationship between the unemployment rate and alcohol-use. To measure alcohol use the following question from the survey is used: *"How often have you during this school year been drinking beer, wine or hard liquor?"*. The five response categories of the dependent variable *Drinking* are as follows: (1) never, (2)

<1/month, (3) 1/month or more, (4) 2/month or more, (5) 1/week or more. Table 1 shows responses to the ordinal dependent variable (*Drinking*) tabulated by years of investigation.

[Insert Table 1 here]

Table 1 shows that the proportion of adolescents never drinking (current school year) was at high in 1988 (37%), and at a low ten years later in 1998 (21%). The proportion of adolescents drinking less than once a month (<1 month) have not changed much over time. The increase, particularly in 1995-2002, is rather seen in the proportion of adolescents drinking twice a month (2/month) or once a week or more (1/week or more). The proportion more than doubled compared to 1988 for adolescents drinking once a week or more. 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 is more or less increasing over the entire time period. This gives a rough indication that alcohol habits are polarized over the years. Compared with the 1990s, in 2005 more adolescents are not drinking at all, but a larger proportion is regular drinkers.

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. To give a brief overview of the general tendencies Figure 1 depicts the evolution over time of the unemployment rate as well as of the proportion of adolescents never drinking and the proportion of adolescents drinking 2/month or more in the region of Värmland (regular drinking).[2]

[Insert Figure 1 here]

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[2] Never drinking is the first category of the dependent variable *Drinking* as shown in Table 1. Regular drinking is the proportion of adolescents drinking 2/month and 1/week or more, i.e. category 4 and 5 of the dependent variable *Drinking* as shown in Table 1.

Figure 1 shows that the time-period subjected to the analysis in this paper captures the Swedish economic crisis during the 1990s. The unemployment rate slowly took off in 1990/91 and reached its peak in 1993, and starts to decrease to lower levels in 1997 again. Figure 1 also graphically shows some of the information shown in Table 1, e.g. that the proportions of regular drinkers and never drinkers reached their highest and lowest levels respectively in 1998. Finally Table 2 below shows figures for *Regular Drinkers*, *Never Drinkers* and the unemployment rate in the 14 municipalities included in the study.

[Insert Table 2 here]

There is a crude correlation between the drinking patterns and the unemployment rate in the municipalities. Municipalities with a high proportion of regular drinkers also have unemployment rates above average. As an illustration, standard OLS regressions on these 14 observations indicates that there is a statistically significant correlation, such that higher unemployment rates are associated with a lower proportion of no-drinkers and a higher proportion of regular drinkers. However, this crude correlation does not tell much about the relationship between unemployment rates and alcohol use. It is obvious that the unemployment rate is correlated with other socio-economic determinants that may have an effect on adolescents drinking patterns. To address this problem of omitted variable bias, multilevel modeling is used to control for the heterogeneity between the municipalities as well as the general time trends, as described in the section statistical analysis.

3.2 Regression Results

Table 3 below shows the results from the multilevel model (equation 1). In Table 3 the dependent variable is the ordinal drinking variable (*Drinking*), as defined in section two.

Table 3 includes four models, where model 1 is a baseline model that only includes year effects, a_t in equation (1), in the fixed effects part of the model (hence, not including the unemployment rate or the sex of the adolescent). This is to provide a descriptive view of the overall trend in drinking. Model 2 is the main model in the paper as specified in equation (1). Model 3 and 4 is equal to model 2 but estimated for boys and girls separately.

[Insert Table 3 here]

In model 2 odds-ratio for the unemployment rate is 0.96 for all respondents and statistically significant at the 5-percent level. Considering that it is a proportional ordinal logit model, the actual coefficient may be hard to give an intuitive interpretation. Since the odds-ratio is smaller than one, the model predicts that when the unemployment rate increases, adolescent alcohol use decreases.

Looking at model 3 and model 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 drink less in poor economic times and more in good economic times. Table 3 also reveals strong time trends in alcohol consumption (model 1 to model 4). Starting in the baseline year 1988, when the consumption was the lowest during the time period covered here, there was a strong increase in adolescent drinking peaking in 1998. In the beginning of 21st century, drinking decreased, but was in 2005 still higher compared to 1988. The largest increase is between 1988 and 1991, i.e. before the onset of the economic crisis. Yet another large increase is between 1995 and 1998, when the unemployment rate had started to slowly decrease again. On an aggregate descriptive level, this also tends to support the results shown in model 2 regarding the association between high unemployment rate and less drinking.

To provide an interpretation of the magnitude of the effect of unemployment rate on alcohol use Figure 2 below plots the predicted probabilities from the ordinal logit estimation in Table 3 (model 2).

[Insert Figure 2 here]

Figure 2 indicates a negative slope in all four graphs. In the first graph, the interpretation is that as the unemployment rate increase, 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 circa 1.5 percent to 8 percent (as happened during the economic crisis in Sweden) increases the proportion of adolescents never drinking at all from 23 percent to 25 percent. 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 3 are mainly related to changes in lower levels of alcohol use among adolescents, and that the more regular drinking is not related to the local unemployment rate.

3.3 Sensitivity Analysis

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 *Drinking* 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 4 below shows the results from a multilevel binary logit model estimated for the four mentioned dependent variables.

[Insert Table 4 here]

The results from the more generalized model in Table 4 confirm the results from the main results in Table 3. 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 that drinks at all, but there is no effect on the more regular drinking (Cut 3 and Cut 4).

4. Discussion and Conclusions

The results indicate that a weaker economy, when the unemployment rate increases, is associated with less adolescent alcohol use. The effect is driven by the behavior by girls and is manifested by an increasing proportion of adolescents who never drinks or who reduces an already low level of consumption. The regular drinking, 2/month or more, shows no significant relationship with economic conditions. This contradicts the a recent paper focusing on adolescents [6], which reported that US adolescents drink slightly more in economic downturns. Most papers on economic conditions and alcohol use among adults [9-12], shows a pro-cyclical relationship with economic conditions, i.e. drinking increases in economic upturns. In this paper it is shown that economic conditions may affect drinking differently, depending on the level of drinking, i.e. less drinking in downturns was not seen for regular drinking.

The reported odds ratios are relatively small, which indicates that a change in the unemployment rate is not to be considered as a highly significant predictor for changes in adolescents drinking behavior. As an example, an exogenous shock in the unemployment rate

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from 1.5 percent to 8 percent (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 percent to 25 percent (based on model 2 in Table 3).

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 [16, 17], but the present paper reports the opposite, at least regarding adolescent alcohol use. In fact, the paper indicates that the alcohol consumption among adolescents would have been even higher during 1990s if the economic conditions had been better. A major problem with the earlier referenced papers indicating that the economic crisis increases 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.

There are several potential reasons as to why adolescent alcohol use decreases in economic downturns. Income effects may play a dominant role, i.e. decreasing incomes leads to decreasing consumption of all goods, including alcohol. 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.

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 [18]. As discussed elsewhere [19, 20] this is not necessarily true for adolescents who might instead overstate alcohol use to boost to their peers. By administrating 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 US has indicated

consistency both within a survey and over time from self-reported alcohol data by adolescents

[21].

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Tables

Table 1 Adolescent Alcohol consumption, % in different categories

	1988	1991	1995	1998	2002	2005
Never	37.06	27.82	23.32	20.61	27.68	31.74
< 1 month	34.19	34.93	37.31	35.60	32.88	30.87
1 / month	10.92	12.83	14.03	13.84	12.49	11.10
2 / month	13.27	16.96	15.87	19.20	16.26	14.96
1 / week or more	4.54	7.47	9.46	10.75	10.68	11.33
# observations	2,682	2,588	2,388	2,261	2,442	2,621

Table 2 Unemployment rate & alcohol-consumption in the different municipalities, mean values 1988-2005

Municipality	% of no-drinkers	% of regular drinkers	Unemployment rate (%)
Karlstad	33.51	21.76	4.78
Kil	29.86	28.02	4.48
Forshaga	30.01	21.38	4.73
Storfors	34.77	19.54	5.41
Hagfors	28.00	26.99	5.84
Eda	23.23	29.21	4.97
Hammarö	35.27	17.58	3.37
Sunne	26.47	28.30	5.46
Årjäng	25.55	29.92	5.41
Munkfors	19.79	30.00	6.12
Grums	32.10	27.47	4.18
Torsby	22.46	31.76	5.53
Filipstad	23.19	31.55	5.26
Arvika	26.31	26.00	4.52

Notes: Regular is drinking 2/month or more. Numbers refers to average summary statistics over the full time period (1988-2005).

Table 3 Odds ratios from multilevel ordinal logit estimations (std. err. in brackets)

	Model 1	Model 2	Model 3	Model 4
		All respondents	Boys	Girls
Dependent Variable: Drinking scale 1-5				
Unemployment rate	-	0.96**	0.99	0.95**
		(0.02)	(0.03)	(0.05)
Boys	-	1.05*	-	-
		(0.03)		
1988	1	1	1	1
1991	1.49***	1.75***	1.49***	1.94***
	(0.07)	(0.17)	(0.20)	(0.27)
1995	1.70***	2.07***	1.67***	2.38***
	(0.09)	(0.24)	(0.27)	(0.39)
1998	1.90***	2.11***	1.87***	2.29***
	(0.10)	(0.15)	(0.19)	(0.24)
2002	1.61***	1.65***	1.51***	1.79***
	(0.08)	(0.08)	(0.11)	(0.13)
2005	1.44***	1.51***	1.37***	1.64***
	(0.07)	(0.08)	(0.11)	(0.13)
Level 1 units	15,206	15,206	7,628	7,578,
Level 2 units	14	14	14	14
Variance level 2	0.06	0.06	0.07	0.07
	(0.02)	(0.02)	(0.03)	(0.02)

Notes: *** p<.01, ** p<.05, * p<.1

Table 4 Odds ratios from multilevel binary logit estimations on Cut1 to Cut 4

	Model 1	Model 2	Model 3	Model 4
	Cut 1	Cut 2	Cut 3	Cut 4
	(<1 month or more)	(1/month or more)	(2/month or more)	(1/week or more)
Unemployment rate	0.94**	0.96*	1.01	1.02
Boys	0.95	1.08	1.13	1.42
1988	1	1	1	1
1991	1.92***	1.71	1.43	1.59
1995	2.49***	1.92	1.49	2.02
1998	2.29***	2.03	1.86	2.39
2002	1.56***	1.65	1.69	2.50
2005	1.35***	1.56	1.64	2.66
Level 1 units	15,206	15,206	15,206	15,206
Level 2 units	14	14	14	14
Variance level 2	0.24	0.22	0.22	0.23
	(0.05)	(0.05)	(0.05)	(0.06)

Notes: *** p<.01, ** p<.05, * p<.1

Figures

Figure 1 % RegularDrinkers & Unemployment rate in the region of Värmland, 1988-2005
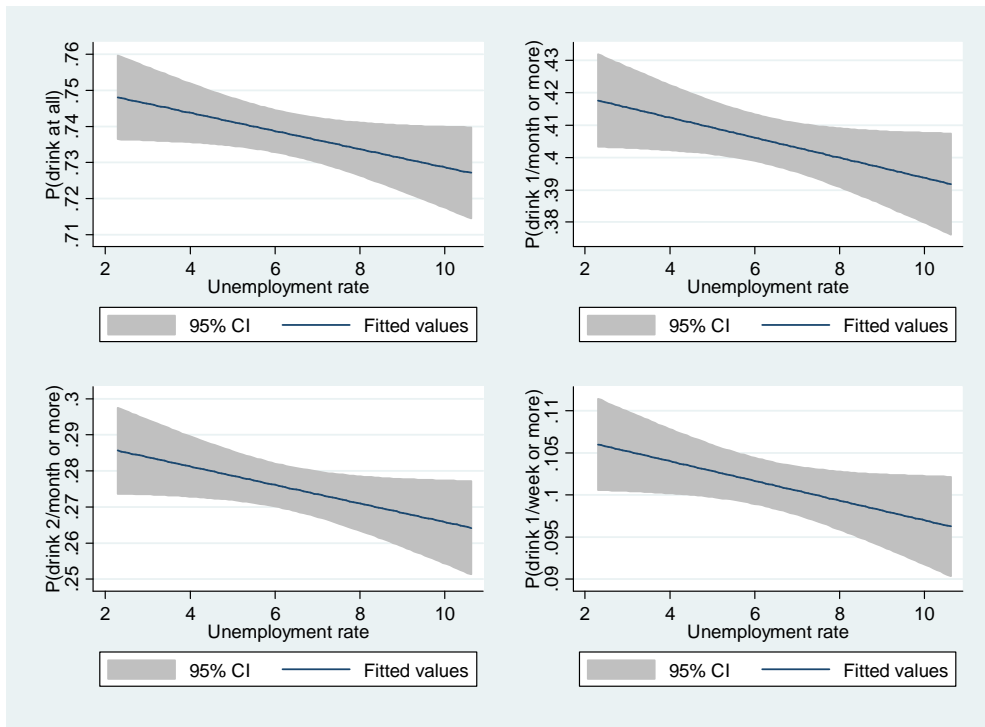

Figure 2 Predicted probabilities by unemployment rate, based on ordinal logit estimation

Notes: The figures are based on the results in model 2 as shown in Table 3. Grey are represents 95 percent confidence bands.