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Wage Penalty of Abstinence and Wage Premium of Drinking - A misclassification bias due to pooling of drinking groups?

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Wage Penalty of Abstinence and Wage Premium of Drinking -

A misclassification bias due to pooling of drinking groups?

Short running title:

Misclassification bias in alcohol consumption groups

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Abstract

Several studies have found protective effects of low/moderate (hereafter “light”) alcohol consumption compared with “abstinence” on mortality, health and wage. Some of these studies have been criticised because former drinkers have been included among the abstainers, which may overstate the protective effect of light alcohol consumption. It has also been proposed, but not shown, that the commonly pooled group of light drinkers and former heavy drinkers would understate the protective effect of light drinking. We also suggest that former abstainers might cause the same effect when pooled with light drinkers. The aim of this paper is to study whether pooled groups risk create bias in the form of misclassification and confounding. The analysis focuses on: ‘former drinker error’ (pooling of lifelong abstainers and former drinkers); ‘former abstainer error’ (pooling of former abstainers and lifelong light drinkers); and ‘former heavy drinker error’ (pooling of light drinkers with and without a history of heavy drinking). Swedish panel data were used in a multinomial logit model, presenting odds ratios when comparing the subgroups. The results demonstrate that commonly pooled groups are heterogeneous with respect to a number of variables, which may implicate confounding. Given appropriate controls, misclassification bias is likely in the pooled group of light drinkers. The direction of the misclassification bias, however, is to underestimate the beneficial effect of light alcohol consumption on wage and can therefore not explain the wage penalty of abstinence compared to light drinking.

Key words

JEL: I12; J31; C1

Alcohol consumption; Drinking history; Consumption groups; Misclassification bias

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1. INTRODUCTION

Alcohol consumption has often been shown to have a positive effect on health and wage/income, at least for low and moderate (hereafter referred to as “light”) consumption. The subject however remains open as, although the medical literature has shown a consistent relationship between alcohol consumption and a number of diseases (both protective and detrimental e.g. Carrao et al 2004), the positive effect on general health (i.e. the net effect on health) and the positive effect on wage/income are yet to be conclusively explained.¹

One issue that has received much attention over the years is why abstainers suffer from lower pay and worse health compared with light drinkers. The protective effect of alcohol consumption on mainly cardiovascular diseases has, on many occasions, served as a default explanation. However, this argument has been criticised, especially with regard to labour market outcomes, as it fails to account for the net effect on health, i.e. fails to also include those diseases where alcohol have been shown to have a detrimental effect (Dave & Kaestner 2002; Jarl et al.). Several articles have discussed possible problems in studies showing a negative effect of abstinence. Shaper et al. (1988) discusses the possibility that sick quitters in this group are the reason for low health among the whole group of current abstainers i.e. former drinkers either have lower health due to alcohol consumption or they have stopped drinking due to a health shock. The question was re-opened by Fillmore et al. (Fillmore et al. 1998a; 1998b, Leino et al. 1998), who found that differences exist between long-term abstainers and former drinkers other than their alcohol use, which might confound the relationship between alcohol consumption and mortality; e.g. differences in smoking, health, socio-economic status (SES), unemployment and civil status. They conclude that current

¹This paper focuses on the alcohol-wage literature. The study question is however just as relevant in other areas, e.g. alcohol-health and alcohol-absenteeism literature.

abstainers are not a homogeneous group with respect to determinants in the mortality function. In a recent meta-analysis of 54 published studies, Fillmore and colleagues concluded that failure to separate former drinkers from long term abstainers may have lead to a greatly overestimated protective effect on mortality risk of light alcohol consumption (Fillmore et al. 2006). However, as this study has been heavily criticised, mainly on methodological grounds, caution should be exercised (e.g. Mukamal 2007, Rehm 2007).

The general idea that the drinking history is important and the specific problem of combining former drinkers and long term abstainers into one pooled group of abstainers, called ‘former drinker error’, has been considered in research for a number of years, at least dating back to the sick-quitter hypothesis (Shaper et al. 1988). For example when studying the relationship between alcohol consumption and mortality have numerous studies been conducted controlling for the former drinker error. A recent example is Friesema et al. (2007) who found that lifelong abstainers and former drinkers have worse self-rated health and more health problems compared with moderate drinkers. This difference in health could only partially explain the commonly found “J/U”-shaped relationship between alcohol consumption and all-cause mortality, while the difference in health could not at all explain the similar relationship between alcohol consumption and cardiovascular events. Another example is Green & Polen (2001) who also found that lifelong abstainers and former drinkers had worse health compared with light and moderate drinkers, while lifelong abstainers have slightly better health than former drinkers.

There are very few studies that consider the former drinker error or other inappropriate pooled consumption groups in the alcohol-wage literature. A number of studies have found a positive effect of alcohol on wages, e.g. Peters (2004), van Ours (2004) (a wage premium from

drinking), Lee (2003), Barrett (2002) (a wage premium for moderate drinking). To the authors' knowledge, only four studies in this field have dealt with the former drinker error to some extent. Johansson et al. (2006) studied this issue in greatest depth and found that the pooled group of abstainers had a 9.5 percentage point lower employment probability than drinkers. However, lifelong abstainers showed no difference in employment probability compared with drinkers, leaving almost all the "abstinence penalty" as an effect of former drinkers diagnosed as alcohol-dependent. Heien (1996) found a "U"-shaped relationship between alcohol consumption and wages and also a negative effect of being a former drinker as opposed to a lifelong abstainer. French & Zarkin (1995) report similar results for the effect of alcohol on wages. Both lifelong abstainers and former drinkers suffered from a wage penalty although lifelong abstainers had a smaller coefficient and a weaker statistical significance. In a later attempt to replicate these results using a larger sample, Zarkin et al. (1998) found that alcohol consumption compared with non-use was associated with 7% higher wages for men, an effect which was not affected by distinguishing between lifelong abstainers and former drinkers. There is thus much left to do in the alcohol-wage literature regarding inappropriate pooling of consumption groups, e.g. the former drinker error.

In addition to the former drinker error, it has also been suggested that most people do not stop consuming alcohol completely when faced with, for example, bad health, but rather reduce their consumption to low levels (Rodgers et al. 2007). This would mean that the same arguments that have been made regarding the influence of former drinkers in the abstainer group might also be valid regarding light alcohol consumption. That is, there may be former heavy drinkers in the light consumption group that can be expected to differ from lifelong light drinkers in health and other characteristics which might bias estimations. This would thus constitute a 'former heavy drinker error'.

There is yet an additional error to consider in order to be consistent with the former drinker error; former abstainers who have become current drinkers. This is based on the rather consistent, although debated, finding that abstention has an effect on income and health. It is therefore reasonable to theorise that past abstention is important for the effects of current consumption, much in the same manner as former drinking is considered to be an important issue for the effect of current abstention. This would then be a ‘former abstainer error’. These two suggested error have not been studied in prior research.

The errors discussed above, i.e. inappropriate pooling of consumption groups based on drinking history, can result in two types of biases: confounding (omitted variable bias) and, what we in this paper call, ‘misclassification bias’². Confounding might for example occur if a pooled group is constituted of two or more subgroups that are significantly different from each other in terms of determinants in the equation to be estimated (e.g. the wage function) and those determinants are excluded from the estimation. Inclusion of the variables causing the heterogeneity in the pooled group in the estimation will abolish the bias. Unfortunately this could be a challenge, especially in the presence of unobservable variables. However, knowing how the subgroups differ increases the possibility to avoid the bias. Misclassification bias might occur if the pooled group is heterogeneous with respect to the dependent variable and there is a direct effect between the variable that determines the selection into subgroups (alcohol) and the dependent variable (wage). If this is the case, the estimated coefficient for the pooled group will be the weighted average of the subgroups’ coefficients. The misclassification bias can only be avoided if the subgroups are used un-pooled.

²Another issue often termed as misclassification bias is the fact that alcohol consumption is often considered being under-reported in surveys. This is especially a problem if consumption is correlated to the bias in reporting. However, this is a separate issue from what is studied in this paper. Here we only deal with misclassification bias as defined in the text.

Aim

The aim of this study was therefore to study if the suggested three errors above cause heterogeneity within the pooled groups of alcohol consumption, which might cause confounding and/or misclassification bias. The three specific aims analysed are:

- 1) Are the following pooled groups heterogeneous with respect to the determinants in the wage function?
 - a) lifelong abstainers (LA) and former drinkers (FD) pooled as abstainers (former drinker error)
 - b) former abstainers (FA) and lifelong light drinkers (LLD) pooled as light drinkers (former abstainer error)
 - c) LLD and current light but former heavy drinkers (CLFHD) pooled as light drinkers (former heavy drinker error)
- 2) What characteristics differentiate the subgroups?
- 3) Are the pooled groups specified under (1) heterogeneous with respect to wage/income?

The paper continues as follows: sections two and three present the methods and data used.

The results are presented in section four and discussed in section five.

2. METHODS

In order to study the heterogeneity within pooled consumption groups that is a result of the determinants of the wage function including wage, we need to study how these factors are affecting the selection into different subgroup of alcohol consumption. For example, if gender affects the probability of belonging to different subgroups of alcohol consumption. We will

therefore apply a model where alcohol consumption is the dependent variable and the independent variables are taken from the wage function, including wage. We apply a non-linear multinomial logit model which is a discrete response model appropriate when the dependent variable has more than two unordered outcomes. To facilitate interpretation, the results are presented as marginal effects, calculated at the mean of the independent variables, and odds ratios. The marginal effects measure the change in probability of being in a certain consumption group given a unit change in the independent variable (a discrete change from 0 to 1 when the variable is a dummy). That is, a switch from women to men shows the difference in probability resulting from gender. The calculation of odds ratios allows for comparison between two subgroups at a time, as specified in the aim. White robust standard errors are used, which are robust when the assumptions of the model are violated (White 1982), although the use or non-use of White robust standard errors in this study has a small effect on the coefficients and interpretation.

One important assumption in the model is the property of independence of irrelevant alternatives (IIA) that implies that the odds among the alternative outcomes of the dependent variable are not affected by additional “irrelevant” alternatives (Long & Freese 2006). Existing tests of the IIA property have been shown to be unsatisfactory for applied work (Cheng & Long 2007), which makes it important to give full consideration to the theoretical arguments. That is, the dependent variable must have distinct alternatives that are not substitutes, criteria that are met in the current study.³ Another issue, especially when studying the alcohol-wage relationship, is endogeneity, particularly when studying *why* possible differences exist between consumption groups. However, the underlying question in the

³The model passes the traditional Hausman test of IIA.

current paper is of a more general nature and the causality of the relationships is not of interest.

To get an idea of the quantitative effect of potential bias we also work through an illustrative example. Here we apply an OLS-model that is often the first model tested in the alcohol-wage literature prior to the estimation of more complex models:

$$\ln(y) = \beta x + \varepsilon$$

where y is wage, x is a vector of observable variables, β is a vector of coefficients and ε is the error term.

3. DATA

We applied the model to data from the Swedish Survey of Living Conditions (the ULF survey) from Statistics Sweden, linked to income data from National Income Tax Statistics. Statistics Sweden has conducted an annual systematic survey of living conditions in the form of 1-hour personal interviews with randomly selected adults aged 16–84 years since 1975. In this study we used data from 1996/97 and 1988/89, two bi-annual waves focusing on health-related issues. Several questions in the survey are related to alcohol consumption. A question whether the respondent had consumed any kind of beverage with alcohol content within the previous 12 months was used to construct the dependent variable. In addition, questions on level of consumption were used to differentiate between low and heavy drinking. We used the cut-off points suggested in Rehm et al. (2004) and collapsed hazardous and harmful consumption into heavy consumption in order to avoid too few observations in each category. The panel information allowed us to construct a categorical dependent variable with six outcomes (Table 1). Lifelong abstainers were defined as abstainers during both the wave of 1996/97 and 1988/89. Former drinkers consumed alcohol during 1988/89 but not in 1996/97. There are no observations where former abstainers (drinkers) had current (past) heavy

consumption. The current drinkers were thus divided into four subgroups while current abstainers were divided into two subgroups. A clear majority of the observations were defined as lifelong light drinkers while the second largest group were lifelong abstainers. Around 11% of the sample had changed their consumption between the two waves, leaving 89% with a constant consumption. This is an effect of the eight year time period between waves, a longer period is expected to decrease the number of individual with a constant consumption.

<<Table 1>>

A total sample of 4,335 observations were used after exclusion of individuals <18 years of age in the first wave and those with missing values (426 observations excluded). There were no major differences in socio-demographic variables between the full and used datasets (Table 2). The largest differences were that a slightly smaller percentage of individuals in the used dataset lived alone and a slightly larger percentage was employed.

<<Table 2>>

The independent variables in Table 2 were included in the model based on their theoretical or empirical effect on an individual's income, either directly or indirectly. For example, following the Grossman model are variables of health-related behaviour (weight and exercise) expected to have a direct effect on health and an indirect effect on income through health (Grossman 1972). Although most of the variables are straightforward, some need a more detailed description.

The health variable is based on the EuroQoL-five dimension (EQ-5D) questionnaire. Burström et al. (2001) obtained mean quality of life (QoL) weights for Sweden by mapping the ULF survey data to the EQ-5D measure, giving *modified* EQ-5D dimensions due to the fact that the questions in the ULF data are similar but not identical to those of the EQ-5D. Applying the UK social tariff (Dolan 1997), the authors were able to arrive at QoL scores that were both feasible and valid for Sweden (Burström et al. 2001). We have set negative scores, i.e. health states considered worse than death, equal to zero. As the health variable ranges between 0-1, a unit change in health was rescaled to 0.1 in order to facilitate interpretation. The full income variable consists of two components, annual disposable income and the annuity of net wealth. The dataset contains information regarding disposable income net of taxes (income from capital, employment and business, and all income transfers) and taxable net wealth which was converted to net wealth at market value, following Gerdtham & Johannesson (2002). The annuity of net wealth is based on life expectancy in Sweden differentiated for gender and age, and a 3% interest rate (Statistics Sweden 1998). Both income measures were converted into 1997 prices using the consumer price index and added together to obtain full income. In order to transform the household income into individual (adult) income, we applied the Organisation for Economic Co-operation and Development (OECD) equivalence scale, which takes an intermediate position between full and no economies of scale. In the alcohol-wage literature discussed above and studies regarding different grouping errors, varying income variables are used such as wage, income and earnings. In the current study, we apply the full income measure (except in the illustrative example) which we considered appropriate in order to capture the individual's capacity to purchase alcohol. Possible implications on the results for this study and the alcohol-wage literature in general are left for future research.

Interaction terms for the gender and age variables were employed in the model whereby the age variable was categorised into four different age groups (26–39, 40–54, 55–69 and 70+ years). Being female and in the youngest age group was considered the baseline. Variables are deemed significant at the 5% level although significance at the 10% level is also noted in the Tables.

We studied attrition using a method previously employed for the ULF dataset (Statistics Sweden 2004) which takes advantage of the fact that the ULF survey is a mix between panel and cross-section samples. This makes it possible to assess attrition by comparing the mean values between the two samples, matched for year and 10-year age groups. The *t*-tests comparing of the means of the independent variables show two different tendencies. Attrition for younger age groups (aged 26–55 years) led to a somewhat higher income in the panel sample, as well as a greater chance for employment, having close friends, and having normal weight compared with the cross-sectional sample ($p < 0.05$). For older age groups (aged 56–85) attrition led to the panel sample more representative of the population by decreasing significant differences between it and the cross-sectional sample.

4. RESULTS

This section presents the results of the multinomial logit estimation, both as marginal effects and odds ratios. The section ends with an illustration of the consequences of pooling alcohol consumption groups in a wage estimation.

Table 3 shows marginal effects of the main model, calculated at the mean of the independent variables. A number of variables show significant and different associations between consumption subgroups, for example the probability of being lifelong light drinker was 5.9 percent higher for smokers compared with non-smokers, and smoking was also connected to a

reduction in the chance of being lifelong abstainer. The interaction effects of gender and age show that being a younger man was associated with a higher chance of being lifelong light drinker and being an older woman was associated with a lower chance of being lifelong heavy drinker as well as a higher chance of being lifelong abstainer compared to the youngest women. The variable full income had significant associations for all but one outcome. An increase in income was associated with a higher chance of being lifelong light drinker and a lower chance of abstinence outcomes. See Table 3 for other significant effects.

<<Table 3>>

Table 4 presents the results of the investigation of heterogeneity within pooled consumption groups (odds ratios). The comparisons are between lifelong abstainers (LA) and former drinkers (FD), former abstainers (FA) and lifelong light drinkers (LLD), and LLD and current light-former heavy drinkers (CLFHD). That is, the former drinker error, the former abstainer error and the former heavy drinker error. The results show that the associations of independent variables differed within pooled groups. For example, the odds were 1.781 times greater for being LA as opposed to FD for obese compared with normal weight individuals. The comparison between LA and FD showed a number of other significant differences, e.g. some gender-age interactions were associated with an increase in the odds of being LA, and being a smoker and economically inactive were associated with a reduction in the odds of being LA as opposed to FD.

The second comparison, between FA and LLD, actually showed more significant differences than the first comparison. The gender-age interaction terms were more significant, showing a gender association of higher odds of being LLD as opposed to FA if male. A unit increase in,

for example, full income and health were associated with an increase in the odds of being LLD, while the association of living alone and being economically inactive increased the odds of being FA compared with being LLD. The comparison between LLD and CLFHD suffered from low power due to few observations in the latter group. However, having a close friend was associated with an increase in the odds of being LLD compared with being CLFHD, while the opposite was true for an increase in health.

<<Table 4>>

Table 4 also report significant differences between the investigated subgroups using a Wald test for combining alternatives. According to the test, we rejected the null hypothesis that the subgroups are indistinguishable with respect to the included variables ($p < 0.001$), i.e. the test rejects pooling of compared subgroups due to differences in characteristics which indicates heterogeneity within pooled consumption groups.⁴

Table 5 provides an empirical illustration of the effects on the estimated coefficients following pooling of subgroups. The model replicates the initial OLS estimation of van Ours (2004) but with a differently defined alcohol variable in order to include past consumption. The example shows as expected a penalty effect of abstention compared to the baseline of light alcohol consumption when pooling consumption groups. This effect is reduced from 16.8 to 11.6% for LA when controlling for the former drinker error. Former drinkers show a much stronger negative effect on wage compared to LA. The negative wage-effect of abstention is increasing when separating out subgroups in current light drinkers, keeping LLD

⁴A sensitivity analysis where performed where the Danish social tariff were employed in constructing the health variable instead of the UK social tariff. It gave generally larger associations although no effect on significance. A gender-specific model was also estimated which showed that most of the significant associations found in the main model is connected to women and few connected to men. This indicates a stronger association between women's consumption and life situation compared to men.

as baseline. When both FA and CLFHD are included in the model (i.e. when controlling for the former abstainer- and former heavy drinker error), the negative effect of being LA compared to LLD is 12.5%, which is a smaller effect than the estimate in model 1.

<< Table 5 >>

5. DISCUSSION

The aim of this paper was to study the heterogeneity within pooled groups of alcohol consumption with focus on if this can be expected to cause bias in the form of misclassification and confounding. The results showed that there is empirical evidence for caution regarding both confounding and misclassification. The abstainer group is indicated by the result to be heterogeneous and compiled of lifelong abstainers and former drinkers, where former drinkers are more likely to be smokers and economically inactive, while lifelong abstainers are more likely to be female, between 40 and 69 years of age, obese, and have a parent in the socio-economic group of entrepreneurs. These variables might therefore be implicated as confounders and the results are in line with the general findings of Fillmore et al. (1998a). After controlling for the included variables, no significant differences exist between the subgroups with respect to income. This would suggest that if relevant determinants are controlled for, former drinkers and lifelong abstainers can be pooled without misclassification bias. This is indeed contrary to expectations and supports for example the result of Zarkin et al (1998) where the estimates were not affected by distinguishing former drinkers and lifelong abstainers. We therefore consider the former drinker error mainly to be a confounding problem.

This study also indicates that current light drinkers are a heterogeneous group, compiled of former abstainers, lifelong light drinkers and current light-former heavy drinkers. Lifelong

light drinkers, compared with former abstainers, are more likely to be male and young, have a higher income, better social network and better health, and smoke to a larger extent. Former abstainers, in the same comparison, are more likely to live alone, to be immigrants, economically inactive, and have a parent who is an entrepreneur. These variables might thus be confounders and are mostly expected to work in the direction of lower income for former abstainers compared with lifelong light drinkers. We can only speculate about the reasons for the negative outcomes associated with former abstinence. One possibility is that the abstinence period may have been caused by bad health, which would explain some of the differences that leave former abstainers worse off. The income variable is also significantly different between subgroups which indicates the possibility of misclassification bias in estimations using pooled groups. That is, even after controlling for the determinants in the wage equation, the coefficient of the pooled group will be a weighted average of the coefficients of the subgroups. As can be seen from Table 3, former abstainers are associated with lower income while lifelong light drinkers are associated with higher. The pooled coefficient will therefore underestimate the negative effect of being a former abstainer as well as underestimate the positive effect of being a lifelong light drinker.⁵ Depending on the frequency of the subgroups, it might even be expected in certain situations that the average coefficient will be indistinguishable from zero. The former abstainer error is therefore considered to be a problem both with regard to misclassification bias and confounding.⁶

The last comparison, between lifelong light drinkers and current light-former heavy drinkers, is an issue that has hardly been explored at all in previous research. The analysis of this issue

⁵The magnitude of the misclassification bias in this study could be quite small with respect to lifelong light drinkers due to the relatively small group of former abstainers compared to lifelong light drinkers. As mentioned are the relative proportions of the consumer groups dependent on the time period between waves and a longer period are expected to reduce the number of lifelong light drinkers.

⁶A sensitivity analysis showed that there is a risk that “very low/occasional drinkers” are mistakenly defined a former abstainers or former drinkers due to the characteristics of the data set. The analysis showed that former drinkers and former abstainers are not distinguishable in the model when excluding the top 20% high consumers (current and lagged) in these groups.

in the current study suffers from low power due to few observations in the current light-former heavy drinker group. Although only two variables show significant differences between subgroup, several other variables are significant at the 10% level. In addition, the test for combining alternatives showed a strong rejection for pooling the two subgroups. It would therefore seem that people who have reduced their consumption have different characteristics compared to people with a constant light consumption. It is interesting to note that being current light-former heavy drinker is associated with better health compared with being lifelong light drinker, which is in opposition to the argument that people reduce their consumption due to bad health. The differences between these two subgroups need therefore to be further studied with better data although it seems likely, given several variables significant on a 10% level, that these variables might implicate confounding. Also, with regard to income, pooling lifelong light drinkers and current light-former heavy drinkers might cause misclassification bias due to the suggested former heavy drinker error, reducing the positive effect of lifelong light drinking. Based on this, we suspect that the former heavy drinker error can cause both misclassification bias and confounding, although no definitive conclusions can be drawn.

The illustrative example of an estimated wage model also indicates that pooling of alcohol consumption groups without considering past consumption causes bias. Reducing the amount of pooling in an OLS wage estimation changes the effect of alcohol consumption, with possible exception of model 4 (probably due to few observations in the current light-former heavy drinker group). It should be noted that this simple illustration has not controlled for all factors as identified in the multinomial logit model as it is a replication. The control for drinking history is done with an eight year lag. Controlling for a longer time period would lead to a larger proportion of observations showing a consumption change. That is, due to the

characteristics of the data we do not expect all misclassification bias to be abolished in the illustrative example.

Conclusions

The conclusion of the study is that commonly pooled consumption groups are not homogeneous and that this might implicate confounding and misclassification bias.

Interesting to note is that, according to the current study, the former abstainer error and former heavy drinker error are more probable to cause misclassification bias than the rather commonly known former drinker error. That is, given appropriate controls for the determinants of the wage equation, lifelong light drinkers, former abstainers and current light-former heavy drinkers should not be pooled. Former drinkers and lifelong abstainers can be pooled, given appropriate controls. However, given the information in prior research, we far from recommend pooling until more studies are performed. The conclusions of the illustrative example are along the same lines; all effects following pooling show theoretical validity.

Many research areas have a tradition of taking into account the extended drinking history of individuals, although this has not often been done in (health) economic research, especially with respect to labour market outcomes. Including the lag of consumption to control for drinking history is not enough as the change between lagged and current consumption appear to be the key issue. That is, people who have changed their consumption behaviour are different from people with the same current consumption without a behaviour change, more or less independent of level of consumption. Finally, to answer the question in the title; following the results of the current study, misclassification is expected to bias the estimation of the alcohol effect on wage, reducing the positive effect of lifelong light drinking. However, as the former drinker error is insignificant, the results point in the direction of an even larger

penalty of abstention compared to lifelong light drinking than what is commonly shown. This result is indeed contrary to expectations and should be further studied as well as the original question - why do abstainers suffer from lower wages than light drinkers?

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Table 1 Consumption categories of the dependent variable

| Current \ Lag | Abstain | Low | Heavy |
|----------------------|--------------------------|-------------------------------|--|
| Abstain | Lifelong abstainer 9% | Former drinker 5% | N/A |
| Low | Former abstainer 5% | Lifelong light drinker 77% | Current light-former heavy drinker 1% |
| Heavy | N/A | Lifelong heavy drinker 3% | |

Table 2 Descriptive statistics of variables

| Variable | Description | Full dataset | | Dataset used | |
|-------------------|--|--------------|--------|--------------|--------|
| Consumption group | Cat. dep. variable of alcohol consumption | 4,621 | 3.612 | 4,335 | 3.614 |
| Gender | =1 if male | 5,086 | 0.480 | 4,335 | 0.485 |
| Age | Age in years | 5,086 | 50.459 | 4,335 | 50.654 |
| Alone | =1 if living alone | 5,086 | 0.300 | 4,335 | 0.275 |
| Immigrant | =1 if first-generation immigrant | 5,081 | 0.069 | 4,335 | 0.068 |
| PBC | Parent (father) SES, blue-collar | 4,905 | 0.450 | 4,335 | 0.455 |
| PWC | Parent (father) SES, white-collar | 4,894 | 0.244 | 4,335 | 0.235 |
| PE | Parent (father) SES, entrepreneur | 4,905 | 0.306 | 4,335 | 0.311 |
| Education 1 | =1 if mandatory school only | 5,065 | 0.287 | 4,335 | 0.282 |
| Education 2 | =1 if 1–2 years of upper secondary school | 5,065 | 0.339 | 4,335 | 0.349 |
| Education 3 | =1 if >2 years of upper secondary school | 5,065 | 0.111 | 4,335 | 0.109 |
| Education 4 | =1 if higher education | 5,065 | 0.263 | 4,335 | 0.261 |
| Lnfinc | The log of full income | 5,033 | 11.345 | 4,335 | 11.356 |
| Children | Number of dependent children | 5,086 | 0.548 | 4,335 | 0.579 |
| Friend | =1 if meeting one friend once each month min. | 5,086 | 0.745 | 4,335 | 0.752 |
| Relative | =1 if meeting relative once each month min. | 5,086 | 0.790 | 4,335 | 0.794 |
| Health | Health (mod. EQ-5D) | 5,086 | 0.820 | 4,335 | 0.828 |
| Smoker | =1 if smoker | 5,021 | 0.203 | 4,335 | 0.201 |
| Normal weight | =1 if BMI<25 | 5,086 | 0.545 | 4,335 | 0.544 |
| Overweight | =1 if 24.99<BMI<30 | 5,086 | 0.355 | 4,335 | 0.370 |
| Obese | =1 if BMI>29.99 | 5,086 | 0.101 | 4,335 | 0.086 |
| Exercise | =1 if getting exercise at work or during free time | 5,009 | 0.874 | 4,335 | 0.884 |
| Employed | Main activity employed, studying or armed forces | 5,052 | 0.606 | 4,335 | 0.619 |
| Self-employed | Main activity self-employed | 5,052 | 0.066 | 4,335 | 0.069 |
| Econ. Inactive | Main activity economically inactive | 5,052 | 0.097 | 4,335 | 0.091 |
| Retired | Main activity retired | 5,052 | 0.232 | 4,335 | 0.221 |

BMI = body mass index; EQ-5D = EuroQoL-five dimension questionnaire; SES = socio-economic status.

Table 3 Marginal effects after robust multinomial logit regression

| | LA | FD | FA | LLD | CLFHD | LHD | \bar{X} |
|------------------|------------|------------|------------|------------|-----------|------------|-----------|
| Male 26–39 yrs | -0.018 | -0.028 *** | -0.031 *** | 0.052 ** | 0.013 | 0.012 | 0.145 |
| Male 40–54 yrs | -0.003 | -0.017 *** | -0.039 *** | 0.062 *** | 0.003 | -0.006 | 0.166 |
| Male 55–69 yrs | 0.022 | -0.008 | -0.035 *** | 0.027 | 0.003 | -0.009 | 0.103 |
| Male 70+ yrs | 0.068 * | -0.002 | -0.030 *** | -0.019 | 0.005 | -0.022 *** | 0.071 |
| Female 40–54 yrs | 0.037 * | -0.014 ** | -0.026 *** | 0.008 | 0.003 | -0.008 | 0.165 |
| Female 55–69 yrs | 0.102 *** | -0.004 | -0.020 ** | -0.072 * | 0.014 | -0.020 *** | 0.119 |
| Female 70+ yrs | 0.119 ** | 0.022 | -0.020 * | -0.107 ** | 0.008 | -0.022 *** | 0.087 |
| Alone | 0.018 ** | 0.018 *** | 0.018 ** | -0.068 *** | 0.000 | 0.014 ** | 0.275 |
| Immigrant | -0.014 | 0.015 | 0.032 ** | -0.005 | -0.001 | -0.026 *** | 0.068 |
| PWC | -0.016 | -0.017 *** | 0.001 | 0.033 ** | 0.003 | -0.004 | 0.235 |
| PE | 0.018 ** | -0.008 * | 0.017 ** | -0.027 ** | -0.003 | 0.003 | 0.311 |
| Education 2 | -0.023 *** | -0.011 ** | 0.001 | 0.032 ** | 0.002 | -0.002 | 0.349 |
| Education 3 | -0.007 | -0.006 | -0.004 | 0.019 | 0.002 | -0.004 | 0.109 |
| Education 4 | -0.023 ** | -0.018 *** | -0.014 | 0.049 *** | 0.002 | 0.004 | 0.261 |
| Lnfinc | -0.017 *** | -0.008 *** | -0.012 *** | 0.027 ** | -0.002 | 0.012 ** | 11.356 |
| Children | 0.006 | 0.001 | 0.002 | -0.005 | -0.002 | -0.002 | 0.579 |
| Friend | -0.008 | -0.005 | -0.015 * | 0.029 ** | -0.005 * | 0.005 | 0.752 |
| Relative | -0.021 ** | -0.001 | -0.007 | 0.036 ** | 0.000 | -0.007 | 0.794 |
| Health | -0.003 *** | -0.002 *** | -0.002 * | 0.007 *** | 0.001 *** | -0.001 | 0.828 |
| Smoker | -0.048 *** | -0.007 | -0.023 *** | 0.059 *** | 0.005 * | 0.014 ** | 0.201 |
| Overweight | 0.000 | -0.008 * | 0.007 | -0.008 | 0.001 | 0.008 | 0.370 |
| Obese | 0.028 ** | -0.006 | 0.009 | -0.043 ** | 0.004 | 0.008 | 0.086 |
| Exercise | -0.043 *** | -0.011 | 0.012 | 0.045 ** | 0.003 | -0.006 | 0.884 |
| Self-employed | -0.030 ** | -0.013 | -0.005 | 0.025 | 0.004 | 0.019 | 0.069 |
| Econ. Inactive | 0.026 | 0.061 *** | 0.024 | -0.117 *** | 0.007 | -0.001 | 0.091 |
| Retired | 0.033 * | 0.014 | 0.027 | -0.074 ** | -0.005 | 0.005 | 0.221 |

Being female and 26–39 years old, parent blue-collar, education 1, normal weight and employed are baseline in the model. For a description of categories and abbreviations, see Table 2. LA = lifelong abstainer; FD = former drinker; FA = former abstainer; LLD = lifelong light drinker; CLFHD = current light-former heavy drinker; LHD = lifelong heavy drinker. Significance noted on 1 (***) , 5 (**) and 10 (*) percent levels.

Table 4 Odds ratios of robust multinomial logit estimation

| | LA-FD | FA-LLD | LLD-CLFHD |
|---------------------------------|-----------|-----------|-----------|
| Male 26–39 yrs | 2.820 ** | 0.367 *** | 0.319 * |
| Male 40–54 yrs | 1.863 | 0.269 *** | 0.743 |
| Male 55–69 yrs | 1.748 | 0.287 *** | 0.700 |
| Male 70+ yrs | 2.245 | 0.377 ** | 0.541 |
| Female 40–54 yrs | 2.786 *** | 0.472 *** | 0.698 |
| Female 55–69 yrs | 3.078 *** | 0.626 | 0.258 * |
| Female 70+ yrs | 1.713 | 0.651 | 0.366 |
| Alone | 0.779 | 1.571 *** | 0.877 |
| Immigrant | 0.529 ** | 1.765 ** | 1.141 |
| PWC | 1.458 | 0.987 | 0.724 |
| PE | 1.699 *** | 1.482 ** | 1.633 |
| Education 2 | 0.997 | 0.979 | 0.735 |
| Education 3 | 1.110 | 0.901 | 0.804 |
| Education 4 | 1.343 | 0.673 * | 0.790 |
| Lnfinc | 1.025 | 0.746 *** | 1.357 * |
| Children | 1.070 | 1.062 | 1.349 * |
| Friend | 1.043 | 0.704 ** | 1.971 ** |
| Relative | 0.770 | 0.816 | 1.075 |
| Health | 1.253 | 0.568 ** | 0.197 *** |
| Smoker | 0.511 *** | 0.498 *** | 0.552 * |
| Overweight | 1.326 | 1.166 | 0.820 |
| Obese | 1.781 ** | 1.279 | 0.577 |
| Exercise | 0.801 | 1.278 | 0.619 |
| Self-employed | 0.950 | 0.852 | 0.643 |
| Econ. Inactive | 0.440 *** | 1.817 ** | 0.389 * |
| Retired | 1.028 | 1.845 | 2.590 |
| Test for combining alternatives | | | |
| χ^2 | 62.57 | 124.09 | 73.26 |
| $P > \chi^2$ | 0.00 | 0.00 | 0.00 |

For a description of categories and abbreviations, see Table 2. LA = lifelong abstainer; FD = former drinker; FA = former abstainer; LLD = lifelong drinker; CLFHD = current light-former heavy drinker. Significance noted on 1 (***), 5 (**) and 10 (*) percent levels.

Table 5 OLS illustration of coefficient effects following pooling of alcohol consumption groups in a log wage equation

| | Model 1 | Model 2 | Model 3 | Model 4 |
|--------------------|------------|------------|------------|------------|
| Abstainers | -0.168 *** | | | |
| LA | | -0.116 ** | -0.123 ** | -0.125 ** |
| FD | | -0.288 *** | -0.295 *** | -0.297 *** |
| FA | | | -0.179 *** | -0.180 *** |
| CLFHD | | | | -0.117 |
| LHD | 0.050 | 0.050 | 0.042 | 0.041 |
| Constant | 4.242 *** | 4.248 *** | 4.264 *** | 4.264 *** |
| R ² Adj | 0.043 | 0.043 | 0.046 | 0.046 |
| N | 2788 | 2788 | 2788 | 2788 |

*Age, education and smoking are controlled for in the model and LLD is baseline.