

The Impact of Alcohol Use on Occupational Attainment and Wages*

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October 1998

Abstract

In this study we provide evidence on the effect of alcohol consumption on occupational attainment and wages in England. To do this we use a pooled sample of employees from the Health Survey for England of 1994, 1995 and 1996. Using the technique of Instrumental Variables we find positive returns to moderate levels of drinking that drop-off rapidly as consumption increases. This result holds when we use a restricted sample consisting of only those individuals with consumption patterns that have remained constant over a five year period.

JEL classification: C51; I12; J24

Keywords: Alcohol, Occupational Attainment, Mean Wages, Instrumental Variables

*The Health Survey for England is used with permission of the depositor (Social and Community Planning Research) and supplier (the Data Archive at the University of Essex). The authors are grateful to Stephen Wheatley Price for helpful comments and suggestions on an earlier draft of this paper. The usual disclaimer applies.

1 Introduction

The impact of substance abuse (including alcohol and nicotine) on social welfare has always been a significant concern for governments and social policy makers. The use of psychoactive drugs is typically criminalised in most societies and high taxation is used to discourage alcohol and cigarette consumption. From an economic perspective, the consumption of licit and illicit substances has significant implications for human capital formation. Since the work of Becker (1964) and Grossman (1972) there has been a common belief among economists that a strong relationship exists between health and earnings. Apart from genetic and dietary factors that might affect this relationship (Thomas and Strauss, 1997), economists have been concerned about the impact of substance use or abuse (that may result from the indirect affect of this consumption upon health), on labour market outcomes. In this respect, there is a growing literature on the labour market outcomes of smoking (Leigh and Berger, 1989; Levine *et al.*, 1997); illicit drug use (Burgess and Propper, 1998; Gill and Michaels, 1992; Kaestner, 1991, 1994a, 1994b; Kandel *et al.*, 1995; MacDonald and Pudney, 1998; Register and Williams, 1992); and alcohol consumption (Berger and Leigh, 1988; French and Zarkin, 1995; Hamilton and Hamilton, 1997; Heien, 1996; Kenkel and Ribar, 1994; Mullahy and Sindelar, 1991, 1996; Zarkin *et al.*, 1998).

In this paper we consider further the relationship between past and present alcohol consumption and labour market outcomes, by investigating the effect of drinking on occupational attainment for a large random sample of English employees. This unique data set (The Health Survey for England) contains considerable detail on drinking experience and individual, and socio-economic characteristics. We use as our measure of occupational attainment, the mean hourly wage rate associated with an individual's occupation (see Section 3 for details). The focus of the paper is the endogenous nature of alcohol consumption and occupational attainment, an issue that has sometimes been neglected in the literature. The balance of the paper is as follows. In the next section we discuss the mechanisms that drive the relationship between alcohol consumption and occupational attainment. We also discuss the empirical issues that arise when considering this relationship, particularly endogeneity. Following this, in Section 3 we review the current literature in this area. In Section 4 we consider the current data set, provide descriptive statistics and observe its advantages and shortcomings. This is followed in Section 5 by our main results, which include OLS and instrumental variable (IV) estimates of the impact of drinking on log mean wages. These results are summarised in Section 6.

2 Theoretical and empirical considerations

The purpose of this paper is to test the impact of drinking habits on occupational attainment, where attainment is measured by mean hourly wages. In the literature, it is suggested that the principle mechanism that drives the relationship between alcohol consumption and labour market attainment is medical. For example, there is considerable evidence to suggest that moderate alcohol consumption can benefit health, say, by reducing stress and tension levels, and lowering the incidence of other illnesses such as heart disease and strokes (See Heien, 1996, for an extended discussion). Improved health leads to reduced absenteeism from the workplace and increased productivity, which generate greater promotional opportunities and wages. Conversely, excessive alcohol consumption can result in negative consequences for health, and thus be to the detriment of promotion opportunities and wages. In addition to the medical evidence, we can also highlight a number of informal mechanisms that link drinking to attainment. Firstly, the consumption of alcohol can have a networking role if part of that consumption is associated with additional social time spent with work colleagues and associates. Individuals might use this time to informally obtain additional information about the workings of the firm and any new job or promotion opportunities which may exist. Furthermore, social time with work colleagues may enable individuals to signal to more senior members of staff their motivation for the job and commitment to the firm. Both mechanisms tend to reduce the asymmetry of information between employee and employer, but of course, they can work in the opposite direction. For example, excessive levels of drinking would provide a negative signal to employers about an individual's suitability for occupational advancement.

Given the variety of mechanisms that may exist at the workplace, the relationship between varying levels of alcohol consumption and labour market attainment is an important area for policy concern that has hitherto only been partially addressed in the literature, and never in a British context. One stumbling block has been the lack of appropriate data. In order to test the relationship one needs information about an individual's drinking habits, at a reasonable level of detail, and sufficient knowledge about their employment status together with demographic variables. The second problem, one which is inherent in all studies of the relationship between substance use and labour market outcomes, concerns the possible simultaneity of alcohol use and wage (or occupational attainment) determination, and uncertainty about the causal path between them.

In a simple single-equation model of wages, estimated by Ordinary Least Squares (OLS) regression, we would treat alcohol consumption as an exoge-

nous determinant. Empirically this would be specified as:

$$w_i = x_i\beta + z_i\xi + \varepsilon_i \quad (1)$$

where w_i is the logarithm of wages, x_i is a row vector of personal and demographic attributes, β the corresponding vector of parameters, z_i is a measure of drinking intensity (or frequency), and ε_i is a normally distributed error term that represents the unobserved variation in the determinants of w_i . The OLS estimate of ξ indicates the impact of drinking on log wages.

However, there is sufficient theoretical and empirical evidence to suggest that drinking is not exogenous to wages. This issue of endogeneity follows from conventional consumption-labour supply theory in which alcohol consumption is determined in response to market wages and non-labour income. If one also assumes that the negative health consequences of alcohol use (or abuse) ultimately affect the relationship in the other direction, the causality between alcohol consumption and wages is likely to be reciprocal. The reciprocal equation can be specified as:

$$z_i = x_i\beta + w_i\delta + \mu_i \quad (2)$$

where z_i , x_i , β , and w_i are defined as before, and μ_i is a normally distributed error term. Thus if we ignore the possible simultaneity of w_i and z_i , we result in a biased estimate of ξ . Assuming ε_i and μ_i are uncorrelated, the relationship between the OLS estimate of ξ_{OLS} , and the true measure of ξ will be given by:

$$\xi_{OLS} = \xi + \frac{\delta}{1 - \delta\xi} \frac{\sigma_\mu^2}{\sigma_z^2} \quad (3)$$

where σ_μ^2 represents the variance of μ_i , and σ_z^2 represents the variance of z_i . Thus, if there is a positive association between mean wages and alcohol consumption (i.e. $\delta > 0$), then if ξ is negative, OLS estimates will tend to understate the true impact of drinking on occupational attainment.

Related to this issue is the possible existence of unobserved heterogeneity whereby the error term, ε_i in equation (1), is correlated with one of the explanatory variables. This can arise if some of the unobserved attributes that affect occupational attainment and wages (e.g. personality type) also influence an individual's choice to consume alcohol. For example, suppose the unobserved characteristic is an individual's rate of time preference. Individuals with a high rate of time preference tend to base consumption decisions on the pleasure they derive currently, without taking into account potential future adverse health consequences (Becker and Murphy, 1988). On the other hand, individuals with a high rate of time preference also tend to select jobs

with a steeper age-earnings profile (i.e. they select jobs with current high wage but tend not to invest in human capital). The method of instrumental variables (IV) provides a way of overcoming this. To use IV we require a covariate, ν_i , that is correlated with our drinking variable, z_i , but is not correlated with ε_i . Provided our instrument obeys this requirement, the IV estimate of the impact of drinking will be consistent:

$$\xi_{IV} = \xi + \frac{\text{cov}(\nu, \varepsilon)}{\text{cov}(\nu, z)} = \xi \quad (4)$$

because $\text{cov}(\nu, \varepsilon) = 0$ and $\text{cov}(\nu, z) \neq 0$ (Maddala, 1992). One of the practical difficulties with this approach, however, is to find instruments that are powerful predictors of alcohol consumption but are unrelated to occupational attainment and wages. We discuss our instruments in more detail later in Section 5.

3 Literature review

Applied work concerned with alcohol consumption and labour market outcomes has generated considerable controversy in recent years, not least because there appears to be a growing consensus that the relationship between drinking and wages is positive. There are generally three main areas that have received attention: the impact of drinking on labour market participation and employment¹; the nature of the relationship between alcohol consumption and earnings; and issues concerning the endogenous relationship of drinking and labour market outcomes. The majority of the literature is set in a US or Canadian context as suitable datasets are difficult to obtain. Before we review this literature, it is important to highlight an assumption concerning the relationship between past and current alcohol consumption that is implicit in most studies. Survey questionnaires typically present interviewees with questions about their alcohol consumption in the past year (or month) prior to interview. However, it is unlikely that alcohol consumption over the past year will have a significant impact on current labour market outcomes. Therefore, it must be assumed that recent alcohol consumption is a good indicator of past consumption. One aim of this paper is to examine the validity of this assumption by using information on alcohol consumption evaluated over a five-year period.

¹In the interests of clarity, we do not consider the impact of alcohol consumption on employment in this paper. This subject is discussed in MacDonald and Shields (1998). For our purposes here, we note that excessive drinking has a negative impact on employment outcomes, for males and females.

Notable contributions to the literature on the drinking-participation relationship include Kenkel and Ribar (1994), Mullahy and Sindelar (1991), and Mullahy and Sindelar (1996)². Acknowledging that the relationship between alcohol consumption and earnings is sensitive to the alcohol measures used, Kenkel and Ribar (1994) use the 1989 panel of the US National Longitudinal Survey of Youth to construct a number of past and present drinking variables. Looking at earnings and hours of labour supplied, the authors find that once simultaneity and heterogeneity are accounted for (via instrumental variables), alcohol abuse and heavy drinking have a negative effect on the earnings of men and women. Oddly, they also find that for women, alcohol abuse and heavy drinking have a significant positive effect on labour supply. However, they find no significant effects for male labour supply. Of course, looking at labour supply in terms of hours worked is not really a true consideration of the affect of alcohol abuse on participation. What is more, as has been the case with research on drug use and wages, using this data set leads to criticism because of the relative youth of the sample (Kandel et al., 1995). Given that younger respondents tend to drink more (on average) than older individuals, it is difficult to see whether the effects observed are temporary or permanent. Mullahy and Sindelar (1991) use data from the US Epidemiologic Catchment Area (ECA) survey. Focusing on whether an individual has met ECA criteria for alcohol abuse or dependence, the authors find that the participation effects of alcohol abuse vary with age, but are consistent across gender. In particular they find that participation is reduced when individuals are alcoholic, but the results are only significant for the older cohort (30+). However, alcoholism unambiguously reduces personal income in all age groups. Mullahy and Sindelar (1996) find similar results using data from the 1988 US Alcohol Supplement of the National Health Interview Survey. The authors focus on the effects of problem drinking on employment outcomes. Using instrumental variables to overcome the effects of unobserved heterogeneity, they find that problem drinking reduces employment, and increases unemployment, for both men and women. Given the restrictions of the data set, however, Mullahy and Sindelar are not able to look at the relative attainment of those in employment and how this is related to alcohol consumption.

One of the earliest studies to consider the drinking-attainment relationship is Berger and Leigh (1988). The authors use data from the 1972-73 US Quality of Employment Survey to estimate wage equations for drinkers and non-drinkers, and a probability of drinking equation. Taking account

²Mullahy and Sindelar are quite prolific in the whole area, so we limit our discussion to these two contributions.

of self-selection, their results suggest that drinkers receive higher wages, on average, compared to non-drinkers. However, this work has been criticised because the data is now well over 25 years old, and the authors only include a dichotomous variable to capture drinking status (drinkers are defined as those who consume alcohol once or twice a week). An important recent contribution to the literature has been the recognition that the relationship between job performance (and hence earnings) and alcohol consumption need not necessarily be linear (Heien, 1996; Hamilton and Hamilton, 1997; French and Zarkin, 1995). As discussed in Section 2, the motivation for this comes from recent medical literature that typically suggests that moderate drinking may lower the risk of coronary heart disease (among other things), and hence may be associated with better job performance compared to abstainers and heavy drinkers. In this respect, French and Zarkin (1995) focus on the relationship between alcohol consumption and wages at individual worksites. Data were collected between 1991 and 1993 at four US worksites and used to estimate full effect and direct effect models of alcohol use on wages. Using straightforward ordinary least squares (OLS), but controlling for heteroskedasticity, the authors include a squared (and cubic) alcohol use variable in their log-wage equations. Their results support their hypothesised inverse U-shape relationship between drinking and wages. They suggest that moderate drinkers (those who drink around two drinks per day on average) are predicted to have the highest wages compared to abstainers and heavy drinkers.

Following up the work of French and Zarkin, Zarkin *et al.* (1998) use data from the 1991 and 1992 sweeps of the US National Household Survey on Drug Abuse to test their previous findings. Focusing on prime-age male and female workers, the authors use eight indicator variables of drinking intensity rather than a continuous variable with a squared (or cubic) component. Using OLS to estimate this specification, they reject their previously supported inverse U-shaped drinking-wage profile, concluding that there is a positive (and fairly constant) return to drinking across a wide range of consumption levels. A curious result in this work concerns endogeneity. The authors accept that this is a potential problem with their single-equation OLS estimates, but reject their instrumental variable two-stage least squares alternatives (not reported in the paper) on the grounds that their instruments are invalid. This conclusion is drawn because their IV estimates suggest much higher returns to drinking. The rejection by Zarkin *et al.* of their IV results is surprising given the importance that has been attached to endogeneity in the literature, particularly in the work of Heien (1996) and Hamilton and Hamilton (1997). Indeed, Auld (1998) suggests that Zarkin *et al.*'s results, rather than being anomalous, are consistent with other results in the literature.

Heien (1996) uses data from the US National Survey on Alcohol Use for 1979 and 1984. Recognising the potential endogeneity of alcohol consumption, the author applies non-linear three-stage least squares regression to estimate an annual earnings equation for each year. The results support a quadratic relationship between drinking intensity and earnings, suggesting that moderate drinkers earn more than either abstainers or abusive drinkers. Heien postulates that previous researchers have failed to agree on the impact of drinking in wages because they have not allowed for curvilinear effects. This conclusion is supported by the work of Hamilton and Hamilton (1997). In this work, the authors use data from the Canadian 1985 General Social Survey. They focus on male workers between the ages of 25 and 59 years, and define several categories of drinking status based on frequency and intensity measures. To address the possible endogenous relationship between drinking and earnings, the authors use a multinomial logit equation to allow for selection into drinking status. Their selection-corrected wage estimates suggest that there is a positive return to moderate alcohol consumption relative to abstention, but that there is a drop-off in earnings for heavy drinkers compared to moderate drinkers.

4 The Data

Our data source is the Health Survey for England (HSE) of 1994, 1995 and 1996, collected by the Unit of Social and Community Planning Research³. The HSE is an annual survey and is designed to monitor trends in the nation's health. For our purposes, information about individuals' alcohol consumption is collected in order to estimate the prevalence of, and differences in, risk factors associated with ill-health between population subgroups. The survey covers the adult population aged 16 or over living in England, and data is collected by a combination of face-to-face interviews, self-completion questionnaires and medical examinations. Using the Postcode Address File as a sampling frame, the HSE typically generates a sample size of approximately 16000 adults per survey year. The data is generally considered representative of England and additional details of the sampling procedures can be found in Prescott-Clarke and Primatesta (1998). In order to allow reliable econometric estimation of the relationship between drinking and attainment, we pool our three years of the HSE which yields a sample of 38,272 individuals. The focus of this paper is the 8795 men aged 22 to 65, and the 9509 women

³The Health Survey of England was also undertaken between 1991 and 1993. However, a number of variables in these surveys are not consistent with latter surveys so we do not analyse these data in this paper.

aged 22 to 60, who reported that they were in employment at the time of the interview. Following previous studies, we limit our observations to employees over the age 21 in order to focus on workers who have had access to alcohol for a number of years ⁴.

The HSE presents interviewees with a variety of alcohol consumption questions. Not only are individuals asked about their current drinking habits in terms of frequency and intensity, they are also quizzed about their prior drinking and asked to compare their current drinking with that of 5 years ago. The question set used in the HSE is almost identical to that used in the General Household Survey (GHS). The GHS alcohol consumption figures provide additional information which is used to monitor the Health of the Nation consumption targets for alcohol. These targets establish a maximum level of alcohol consumption that will not accrue a significant health risk. Until recently the recommended level was an average weekly consumption of 21 units⁵ of alcohol for men, and 14 units for women, although recently they have been revised in terms of daily consumption (i.e. 3 to 4 units per day for men). It is with respect to these targets that we position our argument.

4.1 Variable definition

In order to explore the relationship between drinking and occupational attainment we begin by defining our dependent and alcohol consumption variables. Individual wages are not observed in the HSE. As an alternative, following Nickell (1982), we rank occupations using the average hourly earnings associated with each occupation. This is achieved by using a pooled sample of approximately 84,000 employees from the UK's Quarterly Labour Force Survey (see Appendix 1 for more details). Given that there are nearly 900 occupations defined in the survey we treat the associated mean hourly wage as a continuous variable in our analysis (Nickell, 1982).

Our alcohol consumption measures are defined by drinking intensity (mean weekly consumption in units) and drinking frequency (number of episodes of drinking per week) evaluated over the last 12 months. We construct a number of drinking measures to capture different types of consumption habits and the possible non-linear relationship between consumption and mean wages. We first define six drinking intensity variables based on the health targets

⁴We also exclude ethnic minority and immigrant employees since preliminary analysis of the data suggests that these groups have a very different drinking profile to the native white population. The implication is that a separate analysis should be conducted on these groups. Unfortunately, the HSE does not yield a sufficient sample to undertake this.

⁵One unit of alcohol = 8 gms of ethanol, or approximately one half pint of beer, a small glass of wine, or a single measure of spirits.

mentioned above: one category for abstainers, one for light drinkers, two for moderate drinkers, and two for heavy drinkers. Our categories are defined using fractions and increments of the target consumption of 21 units per week (14 units for females). Thus, a male light drinker consumes 1 to 7 units per week (1 to 4 units for females); moderate1 drinkers consume 8 to 21 units (5 to 14 for females); moderate2 drinkers consume 22 to 43 units per week (15 to 29 for females); heavy1 drinkers consume 44 to 65 units per week (30 to 44 for females); and heavy2 drinkers consume in excess of 65 units per week (in excess of 45 for females). Our definition of moderate drinking corresponds to that given in Stampfer *et al.* (1993), but reflects the slightly higher limits suggested by UK health authorities. We then define three indicator variables of alcohol use based on frequency of drinking: non-drinkers, occasional drinkers, and frequent drinkers. For males and females, frequent drinkers are those who report regularly drinking on 3 or more days per week over the year prior to the survey. Occasional drinkers are those who drink more than once or twice a month, but no more than twice a week. Our third category, non-drinkers, consists of those who report no drinking over the past year, but also includes the small number of respondents who drink very occasionally (e.g. once or twice a year). Further details of the alcohol related questions used in the HSE are provided in Appendix 1.

4.2 Sample characteristics

The salient drinking features of our samples are provided in Table 1. It is widely accepted that surveys tend to understate alcohol consumption (Hoyt and Chaloupka, 1992). Having said this, at 18.4 units per week, our average consumption rate for male employees over the age of 21 is comparable with the health targets discussed above⁶. The mean consumption for female employees, however, is somewhat lower than the health target at 7.7 units per week. In terms of our drinking intensity measure, 10% of males and 25% of females report to being abstainers, while 25% of males and 28% of females report that they are light drinkers. At the other end of the drinking scale, it is of some concern that 10% of males report drinking in excess of 43 units of alcohol per week (Heavy1 + Heavy2), which is considerably higher than the 3% of female employees who are heavy drinkers. Defining alcohol consumption in terms of frequency, we find that 46% of men and 54% of women report to drinking more than once or twice a month but less than twice a week (Occasional drinkers). Looking at frequent drinking, we find that 45% of males

⁶In our analysis we exclude from the sample the tiny minority of males and females with reported consumption rates in excess of 100 units per week.

and 28% of females report that they drink on 3 or more days each week. Importantly, less than 1-in-10 male and 1-in-5 female employees in England report that they never drink (or drink on only one or two occasions a year). It is also worth noting that the levels of alcohol consumption described here are considerably higher than those reported for US and Canadian employees in the studies highlighted in Section 3.

In Table 1 we present some simple descriptive statistics that highlight the relationship between alcohol consumption and occupational attainment. The figures in table 1 also help illustrate the potential problem of endogeneity that was discussed in Section 2. The mean hourly wage of male employees in our sample is £7.40, which is around 20% higher than for females (£6.15). For both males and females, the figures suggest a quadratic relationship between drinking intensity and mean hourly wages. For males, moderate levels of alcohol consumption are associated with the highest mean wages, with those at either end of the drinking spectrum earning about 15% less. For females, mean wages are highest in the Heavy1 category. The mean hourly wage for those in the Heavy1 category is 17% higher than the mean wage for abstainers, and 7% higher than the wage of Heavy2 drinkers. The relationship between alcohol and wages is somewhat different, however, when we consider drinking frequency. Those who drink frequently obtain the highest occupational attainment, being employed in occupations with a mean-wage around 10% higher than occasional drinker and 20% higher than non-drinkers. Moreover, these differentials are remarkably consistent for men and women.

Table 1 about here

5 Results

5.1 Benchmark models

To allow comparison with previous literature we begin our analysis by estimating a simple OLS log mean-wage equation⁷, using a standard set of

⁷One concern with concentrating on just those in the sample who are employees is that our OLS estimates may be biased due to sample selection (Zarkin *et al.*, 1998). This will occur if our sample of employees is not randomly selected from the population. However, to address this potential problem we used the two-stage selection procedure of Heckman (1979). Two variants of the selection equation were used. Firstly, binary probit models of the decision to work or not were estimated. Secondly, multinomial logistic selection models were estimated, which differentiated between labour market non-participation,

covariates to capture the independent effects of personal and demographic attributes on occupational attainment. These include age, gender, educational attainment and marital status. We also include regional dummies⁸ and an indicator of health status, plus some additional variables to reflect the type of industry the individual is employed in, and the employer's size. For a description of all the variables used in our analysis, and their descriptive statistics, see Table A1 in Appendix 2. We estimate separate models for males and females to allow for differences in the determinants of occupational attainment between genders⁹. We also estimate separate models to reflect our different measures of current drinking intensity and frequency (two intensity models and one drinking frequency model). The first intensity model includes a continuous variable (ALCOHOL) measuring the number of units of alcohol consumed per week (plus a square term, $ALCOHOL^2/100$). The second intensity model, which relaxes the quadratic functional form, includes five indicator variables to reflect the different categories of drinking intensity above abstainer, previously defined as light through to heavy². Our frequency model includes the two previously defined drinking frequency variables (frequent and occasional), with non-drinkers as the base. The base characteristics for all the regressions reported in Tables 2 and 3 are: no qualifications, married, no serious illness, manufacturing industry, large firm and South Thames region.

Table 2 about here

Table 3 about here

The results shown in Tables 2 and 3 are consistent across the three models. Our first observation is that the main socio-economic regressors behave as one would expect. In particular, for males and females we find significant positive returns to education, but a lower return for individuals who are single or divorced/widowed/separated. For males only, serious illness (SERIOUSILL) is significantly associated with lower occupational attainment

unemployment, employment and self-employment. For both these models, for males and females, we found that the inverse Mills ratio was insignificant in the log mean wage regression. However, the results of this procedure should be viewed with some caution (See, for example, Heckman, 1976 and Olsen, 1982).

⁸The regional variables are restricted to eight Regional Health Authority regions in the HSE.

⁹We have also estimated separate models for each of the three years of data used. The estimated coefficients are essentially the same across the years and simple Chow tests support the pooling of the data.

in all three models. Working in a small firm is also associated with lower attainment for males and females. With respect to industrial sectors, there are significant returns to males and females working in finance and transport services compared to the base, but diminished returns for those working in the primary industry and wholesale/retail sectors. We also observe a regional variation, with lower returns for most males and females working outside of the South Thames region.

Of interest is the significant positive impact of drinking on the occupational attainment of males and females. In our first intensity model, drinking intensity (ALCOHOL) and its squared component ($ALCOHOL^2/100$) are significant, with the signs on the coefficients suggesting an inverse U-shaped relationship with occupational attainment. Thus, using the two estimates, a male with base characteristics, who drinks an average of 21 units of alcohol per week, will gain a 4.3% mean wage premium compared to the same male who does not drink. For females the figure is higher, with an estimated premium of 5.2% for those who drink an average of 14 units of alcohol per week compared to a female with base characteristics who does not drink. However, as drinking increases, the premium starts to decrease, although it is positive for most of the relevant drinking range. This result is supported by the second intensity model, in which all the intensity categories are positive, although only the middle intensity categories are significant (MODERATE1 through to HEAVY1). In terms of drinking frequency, however, we find that compared to the base (non-drinkers), frequent and occasional drinking is significantly and positively associated with mean wages.

To explore these findings further we decided to restrict our sample to those individuals who reported that their drinking habits had not changed over the past five years. Restricting the sample in this way allows us to examine the assumption, implicit in much of the literature, that current alcohol consumption is a good indicator of past consumption. We can also use the estimation results to draw inference about the long-term impact of drinking on occupational attainment. Only 34.2% of males and 37.6% of females report to currently drinking the same amount as they did five years ago. Just over 20% of men and 16% of women report drinking more than they did five years ago, with the remainder reporting to drinking less. For employees who have increased their alcohol consumption in the last five years, the alcohol variables evaluated over the last 12 months (or 1 month in some studies), will over-estimate their long-term alcohol consumption and thus under-estimate the impact of drinking on occupational attainment and wages. The opposite would be the case for employees who have reduced their alcohol consumption in the last five years. Having said this, the estimates produced

using our reduced sample are consistent with the results presented above¹⁰. The estimated mean wage premium for a male with base characteristics who has an average weekly alcohol consumption of 21 units is 5.1%, for females the comparable premium is 6.1%. These premiums are slightly higher than those presented for the whole sample, but the differences are not statistically significant. The results of the frequency models are also consistent with the estimates produced using the unrestricted sample. This suggests that the possible impact of changing patterns of alcohol consumption is less apparent than expected, as the positive and negative influences on the estimates cancel each other out.

5.2 Instrumental Variables

Of course, any causal relationship suggested by the results presented above is open to scrutiny. As mentioned previously, we suspect that simultaneity exists between alcohol consumption and mean wages. We are also concerned that our measure of drinking is likely to be correlated with the unobservable determinants of occupational attainment¹¹. If we are able to identify some regressor that is a structural determinant of drinking but not of labour market attainment then instrumental variable (IV) estimation should provide a more consistent estimation of the impact of drinking. For males our instrument for the first intensity model is the number of children under 16 in the household. In our frequency model for males, which requires two instruments, we also use a dummy variable to indicate a long-term non-acute health problem such as diabetes and stomach ulcers. Children is a well accepted instrument for estimates of male earnings as the introduction of children into the household tends to affect female labour outcomes. Diabetics have to be very careful about their sugar intake and, on average, tend to have considerably lower alcohol consumption rates than non-diabetics. However, we are aware of no theoretical or practical reason why diabetes should have any impact on occupational attainment¹². For females, in addition to using

¹⁰For brevity we do not include these results (or those, based on IV, in Section 5.2) in this paper. They are, however, available from the authors on request.

¹¹The endogeneity of alcohol consumption with respect to mean wages is also supported by a Hausman t test which includes the residual from an OLS drinking equation in the log mean wage regression (Smith and Blundell, 1986).

¹²The inclusion of children and diabetes variables in the male mean wage regression, and diabetes in the female regression, yield insignificant coefficients. They are, however, highly significant (1% level) if included in models of drinking intensity and frequency. In addition to using diabetes as an instrument we have also estimated the IV models using other long-term non-acute illnesses such as stomach ulcers and combinations of such illnesses. The results are essentially the same regardless of the instrument chosen.

diabetes as an instrument, in our frequency model we use information on whether the employee lives in a rural or urban location as a second instrument. Living in an urban area, for females, is significantly associated with increased alcohol consumption but not significantly related to occupational attainment. The validity of these instruments for both males and females is reasonably justified in terms instrument selection criteria proposed by Bound *et al.* (1993). Unfortunately, we are only able to provide IV estimates for our first intensity model and our frequency model as we do not have sufficient instruments in order to estimate the second intensity model (which has five drinking indicators). The results of our estimates are presented in Table 4.

Table 4 about here

The results shown in Table 4 reveal a lot about the biases inherent in the single-equation models. Concentrating on the frequency model, we observe that compared to the OLS estimates, our drinking frequency variables are no longer significant for males. For females, only the frequent drinking variable (FREQDRNK) is significant, with the coefficient being larger than the OLS estimate. With respect to our drinking intensity model, we observe that the variables remain significant and precisely determined, but the coefficients are somewhat larger. Thus, our calculation of the return to drinking 21 units per week for males with base characteristics becomes 19.8%, and for females, the return to drinking an average of 14 units per week is 41.7%. However, the IV estimates suggest that the returns to alcohol consumption are positive over a much shorter range compared to the OLS results, particularly for males. To illustrate these differences, in Figures 1 and 2 we plot our predicted mean wage-alcohol consumption profiles using the OLS and IV estimates of the first intensity model.

Figure 1 about here

Figure 2 about here

It is clear from the profiles in Figures 1 and 2 that the IV estimates suggest a maximum return to alcohol consumption at around the current safe drinking limits (the maximum return for males is 21.1% at 24 units and for females it is 41.8% at 13 units). These returns begin to disappear at around twice the safe limits, at which point the effect on wages becomes negative.

This is an important result as the simple OLS estimates, although suggesting much lower returns, point to a positive return to drinking over a far greater range. Indeed, the optimum level of consumption suggested by the OLS estimates appears to roughly coincide with the point at which the IV estimates suggest negative returns begin. Therefore, by using instrumental variables to overcome our endogeneity problem, and using a curvilinear specification for the model, we observe that the benefits of drinking accrue over a much smaller range than is suggested by simple OLS estimates.

As with our OLS models, we have also estimated IV models with the samples restricted to those who reported to consume the same amount of alcohol over the five years prior to interview. The size and signs of the coefficients for the intensity models are very similar to those for the full sample, with moderate drinking associated with the highest occupational attainment. Unfortunately, partly as a result of the reduced sample sizes, these estimates are less precise than for the full sample, and we are thus less confident about the reliability of these results.

It is difficult to draw inference about any causality suggested by these results. It is unlikely that the large premiums for moderate drinkers are driven purely by the health mechanisms mentioned previously, although the results are consistent with those produced using Canadian and US data. Rather, we would suggest that social mechanisms, such as networking and signalling, are likely to be important if a considerable proportion of employees' alcohol consumption takes place in a social setting with work colleagues or associates. Of course, a problem with this analysis, and the previous literature discussed in Section 3, is that it is not possible to account for the effect of all unobservables that might be positively correlated with moderate alcohol consumption and occupational attainment (for example, a sociable but sensible individual characteristic). Nevertheless, our results suggest that the combination of the positive factors associated with moderate alcohol consumption (medical and social), and the unobservable characteristics of social drinkers, are strongly associated with success in the labour market. Although it is difficult to position these results in terms of a policy debate, it is clear that an acceptance by government of the positive aspects of moderate alcohol consumption upon health is also justified in terms of the indirect effect on occupational attainment.

6 Concluding remarks

In this paper we have used data from the Health Survey for England to consider the impact of alcohol consumption on occupational attainment and

wages. To our knowledge, this is the first attempt to consider this relationship using British data. Overall our results are consistent with recent studies for the US and Canada.

The principle aim of this paper has been to control for the endogeneity of alcohol consumption in the mean wage regressions using the method of Instrumental Variables. We have shown that ordinary least squares estimates tend to lead to biased estimates of the impact of drinking on occupational attainment. Whereas OLS estimates suggest a positive return to drinking across a wide range of consumption, the IV estimates, although initially higher, are positive over a much shorter range. Indeed, the IV estimates suggest that the returns to drinking have a negative impact on attainment at around the point where the OLS estimates suggest the highest positive return (for males, the IV estimates suggest that the premium becomes negative beyond 48 units of alcohol per week, whereas the OLS estimates suggest a maximum premium of 5.9% at this level of drinking). These results were supported when we restricted the samples to employees with consumption patterns that had remained constant over a five-year period.

Interestingly, the optimal consumption rates suggested by the IV estimates are approximately consistent with the drinking targets proposed by the British government. In other words, our results suggest that the optimal level of alcohol consumption in terms of occupational attainment, appear to coincide with the suggested drinking limits for maintenance of good health.

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Tables & Figures

Table 1
Sample characteristics

<i>Drinking Measures</i>	Male			Female		
	Alcohol Units	Hourly Wage	Sample Mean	Alcohol Units	Hourly Wage	Sample Mean
<i>Intensity</i>						
All sample	18.41	£7.40	-	7.72	£6.15	-
Abstainer	0	£6.65	.10	0	£5.67	.25
Light	3.71	£7.21	.25	2.36	£6.08	.28
Moderate1	13.26	£7.65	.34	8.14	£6.37	.32
Moderate2	29.94	£7.64	.22	19.60	£6.48	.13
Heavy1	51.63	£7.34	.07	34.58	£6.64	.02
Heavy2	76.77	£6.82	.03	55.43	£6.22	.01
<i>Frequency</i>						
Non-drinker	0.49	£6.54	.09	0.40	£5.52	.19
Occasional	9.83	£7.15	.46	5.39	£6.07	.54
Frequent	30.78	£7.84	.45	17.34	£6.76	.28

Table
Mainly arising: LS estimates

Variable	od 1 1		od 1 2		od 1	
	B	E	B	E	B	E
A E	. 30 **	00	.0 9* *	. 02	02 **	.0 2
A E ² 10	-. 33 **	00	-. 32 **	00	-. 32 **	00
CHILD EN	.0 1	. 03	.0 1	. 03	.0 1	. 03
LC HO	.0 3* *	. 01	-	-	-	-
AL OH L ² 10	-. 03 **	00	-	-	-	-
L GH	-	-	01	.0 8	-	-
MO ER TE	-	-	04 **	.0 8	-	-
MO ER TE	-	-	05 **	.0 9	-	-
HE VY	-	-	04 **	.0 2	-	-
HE VY	-	-	01	.0 7	-	-
OC DR NK	-	-	-	-	.0 4* *	. 10
RE DR NK	-	-	-	-	.0 6* *	. 10
ER OU IL	-. 32 **	01	.0 1* *	. 11	.0 00 **	01
DE RE +	. 41 **	01	.4 1* *	. 10	.43 **	.0 0
H GH OC	21 **	.0 9	. 18 **	00	.2 4* *	. 09
LE EL	30 **	.0 2	. 07 **	01	.3 2* *	. 12
LE EL	14 **	.0 9	. 45 **	00	.1 2* *	. 09
TH RQ AL	09 **	.0 4	. 97 **	01	.0 6* *	. 14
IN LE	.0 6* *	. 09	.0 5* *	. 09	.0 8* *	. 09
IV RC D	-. 04 **	.0 3	-. 04 **	.0 3	-. 04 **	.0 3
P IM RY ND	.0 6* *	. 09	.0 6* *	. 09	.0 6* *	. 09
SA E/ ET IL	.0 4* *	. 08	.0 3* *	. 08	.0 5* *	. 08
UB ER IC	-. 01	01	-. 02	01	-. 03	01
FI AN E	. 56 **	01	.0 4* *	. 10	.05 **	.0 0
T AN PO T	. 64 **	00	.0 4* *	. 09	.06 **	.0 9
O HE IN	-. 56 **	01	-. 54 **	01	-. 58 **	01
SM LL IR	-. 74 **	01	-. 76 **	01	-. 74 **	01
(C ns an)	1 16	.0 4	1 16	.0 4	1 15	.0 4
O s.	79		87 5		8 95	
dj st d R	.3 8		. 09		31	
F	1 7. 0		1 4. 9		1 0. 2	

Note: Regional and individual miswires included nor made

** = significant level

** = significant 5% level,

= significant 1% level

Table 3
Female log mean hourly earnings: OLS estimates

Variable	Intensity model 1		Intensity model 2		Frequency model	
	B	SE	B	SE	B	SE
AGE	.021***	.002	.021***	.002	.020***	.002
AGE ² /100	-.025***	.002	-.025***	.002	-.024***	.002
CHILDREN	-.029****	.003	-.0300***	.003	-.029***	.003
ALCOHOL	.005***	.001	-	-	-	-
ALCOHOL ² /100	-.009***	.001	-	-	-	-
LIGHT	-	-	.012*	.006	-	-
MODERATE1	-	-	.037***	.006	-	-
MODERATE2	-	-	.044***	.008	-	-
HEAVY1	-	-	.073***	.017	-	-
HEAVY2	-	-	.006	.028	-	-
OCCDRINK	-	-	-	-	.042***	.007
FREQDRINK	-	-	-	-	.094***	.008
SERIOUSILL	-.006	.009	.007	.009	-.005	.009
DEGREE+	.516***	.010	.516***	.010	.504***	.010
HIGHVOC	.292***	.009	.292***	.009	.286***	.009
ALEVEL	.246***	.012	.246***	.012	.239***	.012
OLEVEL	.132***	.007	.132***	.007	.128***	.007
OTHERQUAL	.079***	.011	.079***	.011	.076***	.011
SINGLE	.007	.009	.009	.009	.010	.009
DIVORCED	.005	.009	.005	.009	.007	.009
PRIMARYIND	-.082***	.013	-.082***	.013	-.0800***	.013
WSALE/RETAIL	-.127***	.010	-.127***	.010	-.126***	.010
PUBSERVICE	-.018	.011	-.018*	.011	-.017	.011
FINANCE	.0400***	.010	.039***	.010	.040***	.010
TRANSPORT	.034***	.012	.034**	.012	.034***	.012
OTHERIND	-.078***	.015	-.077***	.015	-.077***	.015
SMALLFIRM	-.056***	.008	-.056***	.008	-.056***	.008
Constant	1.236	.041	1.235	.041	1.240	.041
Obs.	9509		9509		9509	
Adjusted R ²	.373		.372		.378	
F	195.89		177.12		199.97	

Note: Regional and year dummies were also included in our model

*** = significant at 1% level,

** = significant at 5% level,

* = significant at 10% level

Table
 Male and Female log multivariate: Variables

Covariate	Males				Females			
	Intensity model		Frequency model		Intensity model		Frequency model	
	B	SE	B	SE	B	SE	B	SE
AGE	.029***	.003	.028***	.002	.024***	.008	.012	.008
AGE ² /100	-.033***	.003	-.032***	.003	-.028**	.012	-.014**	.006
CHILDREN	-	-	-	-	-.040*	.022	-.017***	.005
ALCOHOL	.017**	.008	-	-	.063**	.026	-	-
ALCOHOL ² /100	-.036**	.017	-	-	-.236*	.125	-	-
FREQDRINK	-	-	.004	.158	-	-	.559***	.143
OCCDRINK	-	-	-.132	.215	-	-	.252	.197
SERIOUSILL	-.033**	.015	-.033***	.013	-.012	.042	.020	.015
DEGREE+	.383***	.032	.423***	.024	.485***	.065	.405***	.032
HIGHVOC	.185***	.020	.217***	.014	.243***	.030	.233***	.025
ALEVEL	.265***	.029	.303***	.019	.234***	.039	.187***	.021
OLEVEL	.119***	.018	.145***	.013	.107***	.021	.096***	.022
OTHERQUAL	.078***	.021	.091***	.015	.108**	.049	.050***	.015
SINGLE	-.019	.021	-.066***	.014	.011	.033	.008	.023
DIVORCED	-.042**	.020	-.045***	.013	.045	.037	.018*	.011
NORTH/YORKS	-.046**	.020	-.042***	.013	-.090***	.027	-.040	.033
NWEST	-.040**	.019	-.046***	.012	-.058**	.026	-.025	.030
EMIDLANDS	-.054***	.017	-.042***	.013	-.092**	.047	-.032	.039
WMIDLANDS	-.029*	.017	-.017	.012	-.059	.057	.003	.028
ANGLIA	-.017	.015	-.011	.012	-.057	.069	.021	.026
NTHAMES	-.002	.016	.013	.013	-.034	.049	.027	.018
SOUTH/WEST	-.044***	.017	-.014	.014	-.071	.077	.010	.025
PRIMARYIND	-.048***	.013	-.059***	.010	-.107***	.040	-.070***	.021
WSALE/RETAIL	-.048***	.011	-.060***	.009	-.131***	.037	-.111***	.013
PUBSERVICE	.013	.018	.001	.012	-.023	.062	.023	.017
FINANCE	.062***	.015	.051***	.011	.018	.056	.054***	.013
TRANSPORT	.059***	.012	.059***	.010	-.004	.043	.026	.023
OTHERIND	-.046***	.019	-.060***	.014	-.106**	.043	-.071***	.021
SMALLFIRM	-.055***	.015	-.069***	.010	-.039*	.021	-.047***	.009
(Constant)	1.153	.080	1.287	.167	1.135	.161	1.142	.452
Obs.	8795		8795		9509		9509	
Adjusted R ²	.194		.295		.113		.299	
F	83.82		144.97		46.07		151.40	

Note: *** = significant at 1% level, ** = significant at 5% level,
 * = significant at 10% level

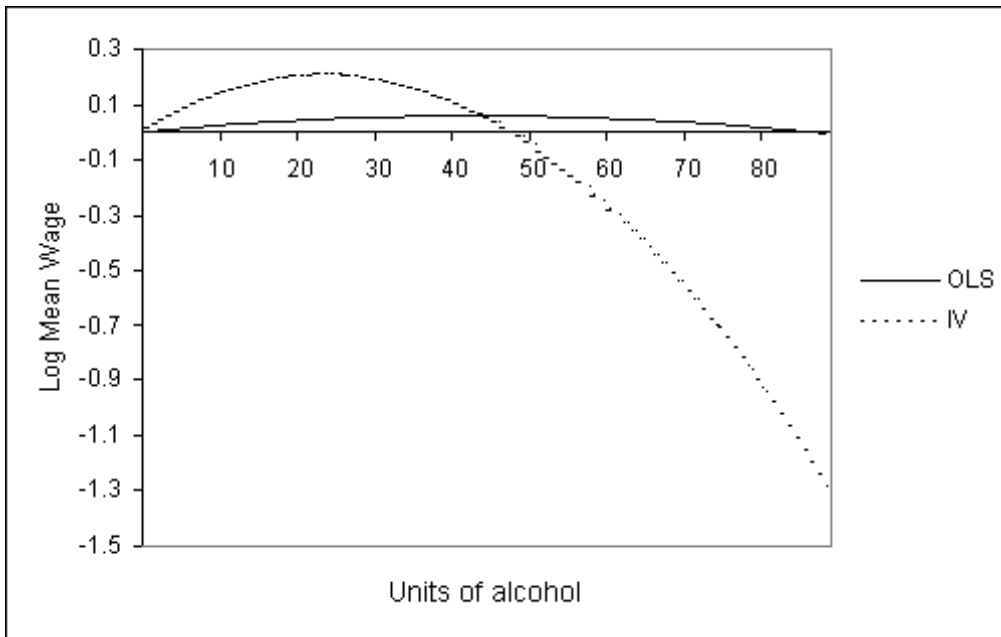


Figure 1: Predicted male alcohol-mean wage profiles

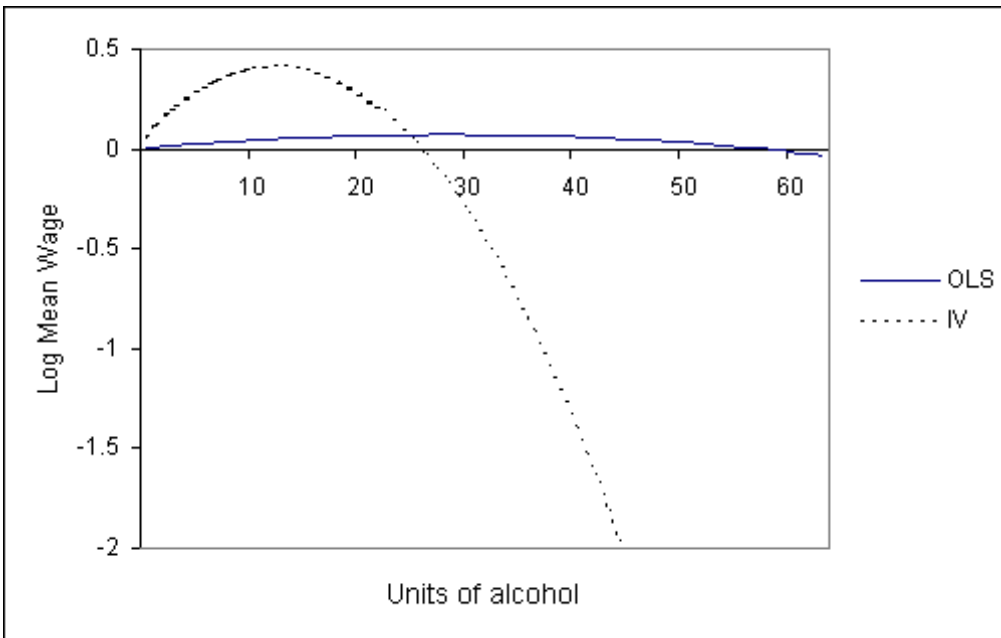


Figure 2: Predicted female alcohol-mean wage profiles

Appendix 1 Variable construction

Method of ranking occupations

In order to calculate the mean hourly wage associated with each occupation we have used pooled data from the Quarterly Labour Force Survey (QLFS) of the United Kingdom for 1993, 1994 and 1995 (12 quarterly surveys in all). The QLFS, introduced in 1992, interviews a nationally representative sample of approximately 160,000 individuals aged over 16, in each quarter. The principal aim of the survey is to produce a set of national (and regional) employment and unemployment statistics for use by government departments, but information is also collected about respondents' income and, if employed, wages. A panel element incorporated into the QLFS means that each individual is interviewed for five consecutive quarters. However, questions about wages are only asked in the fifth interview. The QLFS codes occupation to the 3-digit level of the Standard Occupational Classification introduced in 1990 (variable SOCMAIN) which gives 899 possible occupation categories.

Selecting only those individuals who were in employment, in wave 5 (IN-ECACA=1 and THISWV=5), and aged between 22 and 65, provides a sample of 83,777 employees for which gross weekly wage (GRSSWK) information was available. Using information on usual weekly hours of work (TTUSHR) we are then able to calculate the mean hourly wage from each occupational category, and these values are mapped into the Health Survey for England, which uses the same occupational coding as the QLFS.

Derivation of drinking intensity and frequency measures

The Health Survey for England collects a wide range of information about respondents' past and current alcohol consumption. The continuous drink measure (ALCOHOL) used in this paper, and defined as the usual number of units drunk in a week (over the last 12 months), is a derived variable provided by the Unit of Social and Community Planning Research. The variable is calculated from the following two questions:

1. How often have you had a drink of during the last 12 months?

This question was asked separately for Shandy, Beer, Spirits, Sherry and Wine. Possible answers to each of the questions were:

- a. Almost every day
- b. 5 or 6 times a week
- c. 3 or 4 days a week
- d. Once or twice a week
- e. Once or twice a month
- f. Once every couple of months
- g. Once or twice a years
- h. Not at all in last 12 months

2 In the last 12 months how much have you usually drunk on any one day?

This question was also asked separately for Shandy (answered in half pint units, with one half pint equal to 0.5 units), Beer (half pints = 1 unit, large cans = 2 units, small cans = 1 unit), Spirits (single measure = 1 unit), Sherry (glasses = 1 unit) and Wine (glasses = 1 unit). Each respondent was additionally asked about their consumption of other alcoholic drinks, which were not de ned above.

The drinking frequency measures (FREQDRINK, OCCDRINK, NODRINK) were calculated using the question:

3 (Thinking now about all kinds of drinks) how often have you had an alcoholic drink of any kind during the last 12 months?

- a. Almost every day
- b. Five or six times a week
- c. Three or four days a week
- d. Once or twice a week
- e. Once or twice a month
- f. Once every couple of months
- g. Once or twice a year
- h. Not at all in the last 12 months

We distinguish those respondents whose alcohol consumption had remained constant (DRINKEQU=1) over the last five years using the question:

4 Compared to five years ago, would you say that on the whole you drink more, less or about the same nowadays?

- a. More nowadays
- b. About the same
- c. Less nowadays

Appendix 2 Sample characteristics

Table A1-(continued over)
Variable Descriptions and means
(standard errors in parentheses)

Variable	Description	M	F
<i>Personal and family status</i>			
AGE	chronological age	36.91 (.115)	39.68 (.110)
CHILDREN	number of children in house under 16 years old	.636 (.010)	.606 (.009)
MARRIED	1 = married or cohabiting	.771 (.004)	.758 (.004)
SINGLE	1 = single	.175 (.004)	.136 (.003)
DIVORCED	1 = widowed/separated/divorced	.054 (.002)	.106 (.003)
<i>Health and drinking status</i>			
ALCOHOL	mean weekly units of alcohol consumed over past year	18.41 (.190)	7.72 (.096)
ABSTAINER	consumes no units of alcohol per week	.101 (.003)	.248 (.004)
LIGHT	alcohol consumption rate of 1-7 (1-4) units per week	.252 (.005)	.276 (.005)
MODERATE1	alcohol consumption rate of 8-21 (5-14) units per week	.336 (.005)	.315 (.005)
MODERATE2	alcohol consumption rate of 22-43 (15-29) units per week	.215 (.004)	.128 (.003)
HEAVY1	alcohol consumption rate of 44-65 (30-44) units per week	.066 (.003)	.024 (.002)
HEAVY2	alcohol consumption rate of 66+ (45+) units per week	.030 (.002)	.009 (.001)
NODRINK	1 = non-drinker or once or twice a year	.088 (.003)	.189 (.004)
OCCDRINK	1 = drinks > twice a month, no more than twice weekly	.463 (.005)	.535 (.005)
FREQDRINK	1 = drinks regularly on 3 or more days a week	.449 (.005)	.276 (.005)
NONSERILL	1 = has a non-serious health problem	.923 (.003)	.916 (.003)
SERIOUSILL	1 = has a serious health problem (e.g. heart condition)	.077 (.003)	.084 (.003)
<i>Educational status</i>			
DEGREE+	1 = degree or higher qualification	.175 (.004)	.120 (.003)
HIGHVOC	1 = higher vocational qualification	.242 (.005)	.133 (.003)
ALEVEL	1 = A level or equivalent	.082 (.003)	.063 (.002)
OLEVEL	1 = O level or equivalent	.251 (.005)	.361 (.005)

Table A1 (continued)
Variable Descriptions and means
(standard errors in parentheses)

Variable	Description	M	F
OTHERQUAL	1 = other qualification	.049 (.002)	.066 (.003)
NOQUAL	1 = no formal qualifications	.200 (.004)	.257 (.004)
<i>Industry and firm variables</i>			
PRIMARYIND	1 = works in primary industry	.125 (.003)	.062 (.002)
WSALE/RETAIL	1 = works in wholesale/retail/hotels/catering	.204 (.004)	.257 (.004)
PUBSERVICE	1 = works in public-based services	.071 (.003)	.153 (.004)
MANUFACT	1 = works in manufacturing industry	.322 (.005)	.108 (.003)
FINANCE	1 = works in financial services or real estate	.109 (.003)	.282 (.005)
TRANSPORT	1 = works in transport services	.139 (.004)	.104 (.003)
OTHERIND	1 = works in other sector	.050 (.002)	.047 (.002)
SMALLFIRM	1 = employed by small firm (< 25 employees)	.105 (.003)	.155 (.004)
LARGEFIRM	1 = employed by large firm	.895 (.003)	.845 (.004)
<i>Regional variables</i>			
NORTH/YORKS	1 = North and Yorkshire	.144 (.004)	.151 (.004)
NWEST	1 = North West	.137 (.004)	.133 (.003)
EMIDLANDS	1 = East Midlands	.101 (.003)	.100 (.003)
WMIDLANDS	1 = West Midlands	.111 (.003)	.105 (.003)
ANGLIA	1 = Anglia and Oxford	.125 (.003)	.119 (.003)
NTHAMES	1 = North Thames	.118 (.003)	.120 (.003)
STHAMES	1 = South Thames	.125 (.003)	.128 (.003)
SOUTH/WEST	1 = South and West	.139 (.004)	.143 (.004)
N		8795	9509