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ABSTRACT

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In this study we provide evidence on the effect of alcohol consumption on occupational attainment in England. To do this we use samples of employees from the Health Survey for England between 1992 and 1996. We find that due to the endogenous nature of alcohol consumption, OLS estimates may provide a biased picture of the impact of alcohol consumption on occupational attainment. Using various sets of instrumental variables, we find positive and significant returns to moderate levels of drinking for male and female employees which drop-off rapidly as consumption increases.

JEL Classification: J24

Keywords: Alcohol, occupational attainment, endogeneity

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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 effect 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, 2000a, 2000b; Register and Williams, 1992; Zarkin *et al*., 1998a); 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*., 1998b).

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 2 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 II we review the current literature in this area. In Section II we consider the current data set, provide descriptive statistics and observe its advantages and shortcomings. This is followed in Section IV by our main results, which include OLS and instrumental variable estimates of the impact of drinking on log mean wages. These results are summarised in Section V.

I. 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) and Hutcheson *et al*. (1995) 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 (Hutcheson *et al*., 1995). 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 exogenous determinant. Empirically this would be specified as:

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

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 an 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:

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

where z_i, x_i, and w_i are defined as before, γ is a vector of parameters, 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:

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

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 occupational wages and alcohol consumption (i.e. $\delta > 0$), then if ξ is negative (positive), OLS estimates will tend to understate (overstate) 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 (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 flatter age-earnings profile (i.e. they select jobs with current high wage but tend not to invest in human capital). The use of instrumental variables (IV) provides a way of addressing this issue. 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:

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

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 with occupational attainment or wages. We discuss our instruments, and their validity, in more detail in Section IV.

II. 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 employment; 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 (or month) 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.

Notable contributions to the literature on the drinking-participation relationship include Kenkel and Ribar (1994), Mullahy and Sindelar (1991), and Mullahy and Sindelar (1996).[1] 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 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 II, 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 (Hutcheson *et al*., 1995). 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 heteroskadasticity, 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 are predicted to have the highest wages compared to abstainers and heavy drinkers, with maximum returns occurring at 1.69 drinks per day (full effect estimates) and 2.4 drinks per day (direct effect estimates), corresponding to a wage premium of around 5% over non-drinkers.

Following up the work of French and Zarkin, Zarkin *et al*. (1998b) use data from the 1991 and 1992 sweeps of the US National Household Survey on Drug Abuse (NHSDA) 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. Their results suggest that the highest returns correspond to a monthly consumption of 6 to 16 drinks for males and 3 to 8 drinks for females. 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 (2SLS) alternatives, on the grounds that their instruments are invalid. The instruments used in their 2SLS estimates are based on information about NHSDA respondents' own assessment of the risk associated with using certain substances. These IV estimates suggest wage differentials in the range of 50% to 200%, which are rejected by Zarkin *et al*. as "implausibly

large". The rejection by Zarkin *et al*. of their IV results is perhaps 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. Using religious preference as an instrument, the results for the 1979 sample support an inverted-U shape for the relationship between drinking intensity and earnings, suggesting that moderate drinkers earn more than either abstainers or abusive drinkers. Maximum returns appear to occur at 54 drinks, with a return of 50% on the average household income at this level of consumption.[2] 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, using the prices of beers, spirits and wines as identifying restrictions. Their selection-corrected wage estimates are comparable to Heien (1996) and French and Zarkin (1995), and 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.

III. DATA

Our data source is the Health Survey for England (HSE), collected by the Unit of Social and Community Planning Research beginning in 1992. The HSE is an annual survey and is designed to monitor trends in the nation's health. We use data from the 1992-1996 sweeps of the survey. 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 16,000 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 the data from all our HSE years. The focus of this paper is the 15,819 men aged from 25 to 65 at the time of the survey, and the 18,430 women aged 25 to 60, who reported that they were in employment at the time of the interview. Following previous studies, and in order to focus on workers who have had access to alcohol for a number of years, we limit our observations to employees aged 25 plus (the legal age for drinking in England is 18).[3]

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 that is used to monitor the "Health of the Nation" consumption targets for alcohol. These 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 units[4] of alcohol for men, and 14 units for women, although recently it has been revised in terms of daily consumption (i.e. 3 to 4 units per day for men, equivalent to 21-28 units per week). It is with respect to these targets that we position our argument.

Variable definitions

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, we focus on occupational success. As it is difficult to define and rank occupations objectively, we use an approach due to Nickell (1982) and recently used by Harper and Haq (1997).[5] Here we rank occupations using the average earnings associated with an individual's occupation. In other words, we define occupational success in terms of relative levels of average hourly pay for the occupation in question. Conceivably we could elaborate this ranking further by standardising each mean occupational wage according to differences in factors such as age and educational attainment. However, this adds a considerable layer of complexity (requiring almost 900 separate regression estimates) to what is otherwise a simple indicator of occupational attainment. As such our wage variable is thus to be interpreted as simply a measure of the labour

market status of the individual's occupation, rather than as an indicator of his or her actual wages, or of success within an occupation. We achieve this occupational ranking by using the wage information from a pooled sample of approximately 84,000 employees from the UK's Quarterly Labour Force Survey (details of how the occupational success variable is derived are given in Appendix A). Given that there are nearly 900 occupations defined in the HSE, 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 seven drinking intensity variables based on the health targets mentioned above: one category for abstainers, one for light drinkers, two for moderate drinkers, two for heavy drinkers, and one for very 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); light to moderate drinkers consume 8 to 21 units (5 to 14 for females); moderate drinkers consume 22 to 43 units per week (15 to 29 for females); moderate to heavy drinkers consume 44 to 64 units per week (30 to 44 for females); heavy drinkers consume 65 to 86 units per week (45 to 59 for females); and very heavy drinkers consume in excess of 86 units per week (in excess of 59 for females). Our definition of light to 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 five indicator variables of alcohol use based on frequency of drinking: non-drinkers, infrequent drinkers, occasional drinkers, frequent drinkers, and daily drinkers. For males and females, daily drinkers report that they drink almost every day of the week; frequent drinkers are those who report drinking on 5 to 6 days a week; occasional drinkers are those who report regularly drinking on 3 or 4 days per week over the year prior to the survey. Infrequent drinkers are those who drink more than once or twice a month, but no more than twice a week, and non-drinkers are those who report no drinking over the past year, although we include in this category the respondents who drink very occasionally (e.g. less than once per month). Further details of the alcohol related questions used in the HSE are provided in Appendix A.

Sample characteristics

The salient drinking features of our samples are provided in Table 1, along with information on mean hourly wages. It is widely accepted that surveys tend to understate alcohol consumption (Hoyt and Chaloupka, 1992; MacDonald *et al*., 1999), however, at almost 18 units per week, our average consumption rate for male employees is comparable with the health targets discussed above. The mean consumption for female employees, however, is somewhat lower than the health target at just over 7 units per week. In terms of our drinking intensity measure, abstainers account for only 10% of the male sample but 24% of the female sample. The majority of drinkers fall into the light and moderate categories, although it is of some concern that almost 10% of males fall into the heavier drinking categories, with the average regular alcohol consumption in excess of 50 units per week. Defining alcohol consumption in terms of frequency, the majority of males and females are infrequent or occasional drinkers, with a large proportion of females (over 40%) falling into the non-drinking category. A curious feature of the current sample is the proportion of males and females who report daily drinking, which is larger than the proportion that report frequent drinking (i.e. on 5 to 6 days a week). It is also worth noting that for all measures, the levels of alcohol consumption described here are considerably higher than those reported for US and Canadian employees in the studies highlighted in Section II.

The descriptive statistics presented in Table 1 also highlight the relationship between alcohol consumption and occupational attainment. For both males and females, the figures suggest an inverted-U shape for the relationship between drinking intensity and mean hourly wages. For males, moderate levels of alcohol consumption are associated with the highest mean occupational wages, with those at either end of the drinking spectrum earning about 15% less. For females, mean wages are highest in the moderate to heavy category, whereas the lowest mean occupational wage is associated with the abstainer category. This association between alcohol consumption and wages is also apparent when we consider drinking frequency. Those who drink frequently tend to be employed in occupations with a mean hourly wage around 6% higher than occasional drinkers and daily drinkers, and 20% higher than non-drinkers. Moreover, these differentials are remarkably consistent for men and women.

TABLE 1

ALCOHOL CONSUMPTION AND MEAN OCCUPATIONAL WAGES BY DRINKING STATUS[a]

	Males (n=15819)			Females (n=18430)		
	Mean units of alcohol	Mean hourly wage	Sample prop[n]	Mean units of alcohol	Mean hourly wage	Sample prop[n]
Full sample	17.69 (0.15)	£7.33 (0.02)		7.09 (0.07)	£5.96 (0.02)	
Intensity measures						
Abstainers	0.00	£6.43 (0.05)	10.25%	0.00	£5.45 (0.03)	23.69%
Light drinkers	3.54 (0.03)	£7.17 (0.04)	26.52%	2.12 (0.01)	£5.90 (0.03)	29.62%
Light to moderate drinkers	13.76 (0.06)	£7.59 (0.03)	33.07%	8.48 (0.04)	£6.22 (0.03)	31.92%
Moderate drinkers	30.71 (0.11)	£7.62 (0.04)	20.81%	20.25 (0.09)	£6.35 (0.05)	11.48%
Moderate to heavy drinkers	51.90 (0.19)	£7.40 (0.08)	6.11%	35.36 (0.21)	£6.47 (0.11)	2.25%
Heavy drinkers	73.67 (0.33)	£6.98 (0.11)	2.31%	51.45 (0.37)	£6.00 (0.21)	0.68%
Very heavy drinkers	99.51 (0.78)	£6.63 (0.18)	0.94%	78.23 (1.93)	£5.68 (0.24)	0.37%
Frequency measures						
Non-drinkers[b]	1.57 (0.05)	£6.68 (0.04)	22.97%	0.86 (0.02)	£5.55 (0.02)	41.29%
Infrequent drinkers	11.76 (0.12)	£7.17 (0.03)	34.30%	6.84 (0.06)	£5.60 (0.03)	33.49%
Occasional drinkers	24.87 (0.28)	£7.71 (0.04)	20.27%	13.84 (0.19)	£6.49 (0.04)	13.15%
Frequent drinkers	31.43 (0.56)	£8.15 (0.08)	6.84%	18.24 (0.45)	£6.92 (0.09)	3.66%
Daily drinkers	39.09 (0.46)	£7.79 (0.05)	15.63%	23.27 (0.40)	£6.58 (0.06)	8.42%

[a] Standard errors in parenthesis.

[b] The proportions in the non-drinker frequency category are considerably higher than the proportions in the abstainer intensity category because the former includes a large number of interviewees who report drinking less than once per month.

IV. EMPIRICAL RESULTS

Benchmark models

To allow comparison with the previous literature we begin our analysis by estimating a simple OLS log mean-wage equation, using a standard set of covariates to capture the independent effects of alcohol consumption, personal characteristics and demographic attributes on occupational attainment. These include age, gender, educational attainment and marital status. We also include regional dummies[6] and an indicator of health status (descriptive statistics for all the variables used in our analysis are provided in Table A1 in Appendix B). This simple specification is broadly in line with previous studies, in particular Heien (1996). We estimate separate models for males and females to allow for differences in the determinants of occupational attainment between genders. We also estimate separate models to reflect our different measures of current drinking intensity and frequency. The first intensity model (Model 1) includes a continuous variable measuring the number of units of alcohol consumed per week, plus a square term to capture the inverted-U shape relationship between alcohol and occupational wages that was suggested in our earlier descriptive analysis. Following Zarkin *et al.* (1998b), the second intensity model (Model 2) relaxes the inverted-U shape functional form, and includes six indicator variables to reflect the different categories of drinking intensity above abstainer, previously defined as light through to very heavy drinker. Our frequency model (Model 3) includes the previously defined drinking frequency variables (daily, frequent, occasional and infrequent), with non-drinkers as the base. The final model we estimate (Model 4) is intended to capture the impact of changing patterns of individual alcohol consumption over time. HSE interviewees are asked to compare their current consumption of alcohol with that of five years ago, and state whether it is greater, lower or unchanged. Thus in this final model, we extend the specification of Model 1 by controlling for differences in current consumption compared to five years previous, with no change in consumption levels as the base category.

The results of our analysis, which are consistent across the four estimated models, are presented in Tables 2 and 3. Our first observation is that the main socio-economic regressors behave as one would expect. In all cases, there is a positive and significant association between educational attainment and occupational success. For males, compared to those who are married or cohabiting, there is a significant negative association between being single or widowed, etc. and mean occupational wages. This is not true for females, where being single is positively associated with occupational success (although the estimated coefficients are substantively small). Of interest

is the significant positive impact of drinking on the occupational attainment of males and females. In our first intensity model, the estimated coefficients for drinking intensity and its squared component are significant, with the signs 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 4.5% mean wage premium compared to the same male who does not drink. For females the figure is slightly lower, with an estimated premium of 3.4% 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. The second intensity model supports this result, confirming the inverted-U shape for the relationship between drinking and occupational attainment. For males, all the estimated coefficients, except for the very heavy drinker category, are positive and significant when compared to the base abstainers. The magnitude of the estimated coefficients increases with drinking intensity, reaching a peak for the moderate drinker category, after which it declines. A similar pattern is observed for females, except that the biggest estimated coefficient is for the moderate to heavy drinker category, after which the estimated coefficients decline and become insignificant with respect to the base category. In Model 3, the estimated coefficients for the drinking frequency categories are all positive and significant, suggesting that compared to non-drinkers, any frequency of drinking is associated with a higher mean occupational wage. The magnitude of the estimated coefficients follow a similar pattern to those for the intensity model, with a peak observed for the 'drinks frequently' category.

Our final model is concerned with the impact of changing alcohol consumption over a five-year period. 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. To overcome this we have controlled for these changes in drinking in Model 4. The results suggest that an increase in consumption compared to five years ago is associated with higher mean occupational wages, whereas a decrease in consumption works in the other direction (although the estimated coefficient is not significant for females). It is interesting to note, however, that in controlling for changes in consumption over time this has practically no impact on the magnitude or significance of the estimated coefficients on drinking and its squared component.

TABLE 2

OCCUPATIONAL ATTAINMENT: OLS ESTIMATES FOR MALES[a]

Covariate	Model 1	Model 2	Model 3	Model 4
	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)
Age	0.018 (11.28)	0.018 (11.25)	0.018 (11.00)	0.018 (10.85)
$Age^2/100$	-0.017 (9.47)	-0.017 (9.41)	-0.017 (9.35)	-0.017 (9.15)
Marital status				
Single	-0.080 (12.67)	-0.077 (12.22)	-0.080 (12.81)	-0.081 (12.85)
Widowed/separated/divorced	-0.061 (7.74)	-0.059 (7.32)	-0.060 (7.42)	-0.062 (7.61)
Education				
Degree or higher qualification	0.486 (69.16)	0.482 (68.60)	0.474 (66.98)	0.481 (68.17)
Higher vocational qualification	0.268 (41.30)	0.264 (40.72)	0.262 (40.42)	0.265 (40.84)
'A' level or equivalent	0.314 (37.15)	0.311 (36.88)	0.308 (36.42)	0.311 (36.83)
'O' level or equivalent	0.159 (25.82)	0.157 (25.44)	0.156 (25.38)	0.157 (25.51)
Other qualification	0.112 (10.62)	0.111 (10.53)	0.109 (10.44)	0.111 (10.54)
Alcohol consumption				
Mean weekly units of alcohol	0.0033 (11.83)	-	-	0.0032 (11.37)
$(\text{Mean weekly units of alcohol})^2/100$	-0.0038 (10.17)	-	-	-0.0037 (10.04)
Very heavy drinker	-	0.026 (1.16)	-	-
Heavy drinker	-	0.053 (3.51)	-	-
Moderate to heavy	-	0.082 (7.73)	-	-
Moderate drinker	-	0.092 (11.40)	-	-
Light to moderate drinker	-	0.084 (11.07)	-	-
Light drinker	-	0.043 (5.52)	-	-
Drinks almost every day	-	-	0.083 (12.01)	-
Drinks frequently	-	-	0.099 (10.79)	-
Drinks occasional	-	-	0.079 (12.32)	-
Drinks infrequently	-	-	0.044 (7.81)	-
Drinks more than five years ago	-	-	-	0.022 (3.30)
Drinks less than five years ago	-	-	-	-0.016 (3.37)
Good health	0.047 (8.46)	0.044 (8.01)	0.045 (8.14)	0.045 (8.20)
Intercept	1.260 (34.59)	1.231 (33.52)	1.264 (34.73)	1.285 (34.63)
Observations	15819	15819	15819	15819
Adjusted R^2	0.305	0.307	0.310	0.307
F Test	303.38	261.031	284.669	281.074

[a] Absolute t-statistics are given in parenthesis.
Also included (but not reported) are seven regional dummies and four year dummies.

TABLE 3

OCCUPATIONAL ATTAINMENT: OLS ESTIMATES FOR FEMALES[a]

Covariate	Model 1	Model 2	Model 3	Model 4
	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)
Age	0.022 (12.26)	0.022 (12.18)	0.021 (11.83)	0.021 (12.07)
$Age^2/100$	-0.024 (11.11)	-0.024 (11.17)	-0.023 (10.85)	-0.024 (10.97)
Number of children	-0.044 (9.54)	-0.048 (9.62)	-0.044 (9.53)	-0.044 (9.51)
$(\text{Number of children})^2$	0.006 (4.65)	0.07 (4.74)	0.006 (4.67)	0.006 (4.58)
Marital status				
Single	0.013 (2.06)	0.015 (2.27)	0.015 (2.31)	0.013 (2.05)
Widowed/separated/divorced	-0.004 (0.77)	-0.004 (0.68)	-0.001 (0.26)	-0.005 (0.86)
Education				
Degree or higher qualification	0.612 (88.59)	0.610 (88.05)	0.606 (86.62)	0.612 (88.47)
Higher vocational qualification	0.439 (70.65)	0.438 (70.26)	0.434 (69.72)	0.439 (70.47)
'A' level or equivalent	0.314 (38.51)	0.312 (38.24)	0.309 (37.78)	0.314 (38.42)
'O' level or equivalent	0.178 (36.87)	0.177 (36.56)	0.175 (36.36)	0.177 (36.76)
Other qualification	0.144 (16.57)	0.144 (16.52)	0.142 (16.36)	0.143 (16.51)
Alcohol consumption				
Mean weekly units of alcohol	0.0032 (9.26)	-	-	0.0029 (8.15)
$(\text{Mean weekly units of alcohol})^2/100$	-0.0040 (6.27)	-	-	-0.0038 (5.79)
Very heavy drinker	-	-0.004 (0.14)	-	-
Heavy drinker	-	0.030 (1.33)	-	-
Moderate to heavy	-	0.079 (6.27)	-	-
Moderate drinker	-	0.056 (8.55)	-	-
Light to moderate drinker	-	0.041 (8.16)	-	-
Light drinker	-	0.021 (4.24)	-	-
Drinks almost every day	-	-	0.065 (9.33)	-
Drinks frequently	-	-	0.084 (8.48)	-
Drinks occasional	-	-	0.048 (8.20)	-
Drinks infrequently	-	-	0.024 (5.71)	-
Drinks more than five years ago	-	-	-	0.015 (2.82)
Drinks less than five years ago	-	-	-	-0.001 (0.25)
Good health	0.036 (7.50)	0.034 (7.10)	0.035 (7.21)	0.036 (7.432)
Intercept	1.030 (28.21)	1.024 (27.99)	1.049 (28.74)	1.036 (27.95)
Observations	18430	18430	18430	18430
Adjusted R^2	0.405	0.406	0.408	0.406
F Test	503.402	435.289	470.697	466.675

[a] Absolute t-statistics are given in parenthesis.
Also included (but not reported) are seven regional dummies and four year dummies

In addition to the results presented in Tables 2 and 3, we have also explored the potential effect of cohort effects on our estimated drinking coefficients. To explore this in the current context, we split the sample into a younger cohort (age 25-39) and an older cohort (age 40 plus). We then re-estimated all the models reported in Tables 2 and 3. In Table A2 in Appendix C we present the estimated coefficients for all the drinking variables in the four models for each age group. The results of this experiment are quite revealing. Whereas previous studies of the relationship between drug abuse and occupational attainment have shown that there tends to be some noticeable differences between the labour market experiences of younger and older cohorts (Burgess and Propper, 1998; MacDonald and Pudney, 2000a), the results for the current data show no significant difference between age groups. Apart from some very slight differences in the magnitude of the estimated coefficients and the 't' statistics, the only noticeable difference is with respect to the variables introduced to control for changes in alcohol consumption over time (Model 4). For males, the impact of changing drinking patterns is more apparent for the older group, and is only of marginal significance for the younger group. The results for the full sample of females revealed that only the association with increased drinking was significant. With the sample split by age group, this factor is only important for the younger group. However, taking all the models into account, splitting the sample into younger and older cohorts appears to make very little difference to the results. We have tested this further by making the younger group even younger (age less than 30), but this still has no real impact on the estimated drinking coefficients.

The second issue we explore concerns the possibility that factors such as current health status and family formation will be endogenously determined with drinking (Burgess and Propper, 1998; Kenkel and Ribar, 1994). For example, just as it is expected that an individual's family formation/marital status will have an impact on alcohol consumption, it is quite conceivable that alcohol consumption might have an impact on family stability and hence its current composition. To explore this potential endogeneity problem further, and following French and Zarkin (1995), we re-estimated the models presented in Tables 2 and 3 excluding the health and family formation variables. Thus we are able to compare the estimates from "full" and "direct" effect models. The full effect estimates are presented in Table A3 in Appendix C along side the direct effect estimates to allow comparison. This comparison reveals remarkably little difference between the direct and full effect estimates of the coefficients on drinking in each of our models. There are some very slight differences in the magnitude of the estimated coefficients, but these are statistically insignificant. Where the difference is most noticeable is with respect to the results for Model 2 for females. Here we observe that the full effect estimates suggest that the inverted-U shape of the alcohol-wage relationship peaks further to the left than was suggested by the direct effect

estimates. Apart from these differences, the results do not generally support the exclusion of family structure and health status from the occupational attainment equation.

Instrumental Variables

It is well established that our OLS estimates will be biased if there exists some unobservable individual heterogeneity which determines both alcohol consumption and occupational attainment. One example of this is the unobserved rate of time preference discussed in Section I. Another example might be if employees who are 'sociable but sensible' (an unobserved characteristic in our sample) consume moderate amounts of alcohol but also gain higher occupational attainment than either abstainers or heavy drinkers. If this is the case, alcohol consumption will not be exogenous, and our OLS coefficients of moderate drinking will be biased upwards capturing not only the true effect of moderate drinking but also the positive effect on occupational attainment of having this unobservable characteristic.

Given that each of the OLS models suggests a quadratic or inverted-U shape relationship between alcohol consumption and occupational attainment, for brevity, in the following discussion we only focus on the OLS Model 1 specification. To test for possible endogeneity of alcohol consumption, we estimated separate OLS models with units of alcohol and units of alcohol squared as dependent variables. The generalised residuals from these two models were then included as additional covariates in the occupational attainment model. The two resulting coefficients were found to be significant determinants of occupational attainment at the 95% level of confidence for men and 99% level for females, suggesting that alcohol consumption cannot be treated as exogenous and that our OLS estimates are likely to be biased (Smith and Blundell, 1986).

The use of instrumental variable estimation (IV) provides one method to account for endogeneity and thus allow us to more accurately assess the true impact of alcohol consumption on occupational attainment. The practical difficulty with IV estimation is finding an instrument or set of instruments which are significant determinants of the endogenous variable(s) but also orthogonal to the residuals of the main equation (i.e. not a significant determinant of occupational attainment). Moreover, a number of recent studies have questioned the interpretation which can be given to IV estimates, and their general usefulness for policy evaluation. For example, Heckman (1997) has shown that both OLS and IV techniques require very restrictive assumptions in order to provide estimates of the average effect of 'treatment on the treated'. Angrist *et al*. (1996) argue that the only treatment effect that IV can consistently estimate is the average treatment effect for

those who change treatment status (alcohol consumption level) because they comply with the assignment-to-treatment mechanism implied by the instrument(s). They refer to this parameter as the 'local average treatment effect' (LATE). In our context, IV estimates of the effect of alcohol consumption on occupational attainment using, say, the number of dependent children in the household as an instrument, would then be interpreted as the average 'return' to drinking for an employee who changed his or her alcohol consumption level only because of having more (less) children in the household, but would not have changed otherwise.

One implication of this interpretation is that different instruments should provide very different estimates of the effect of alcohol consumption on occupational attainment. Therefore, in order to investigate the robustness of our results, we estimate separate two-stage-least-squares (2SLS) models for male and female employees using three alternative sets of instruments (descriptive statistics for the instruments used are provided in Table A1 in Appendix B). In the first model (IV-1), in which we are able to use the data for all the available HSE survey years, we use as instruments three binary indicators for long-term non-acute illnesses: diabetes, stomach ulcers and asthma. We find that each of these illnesses is associated with a significantly reduced level of alcohol consumption for both male and female employees. For example, 24.3% of males (47.8% of females) with long-term diabetes in our sample report to be abstainers from alcohol, compared to only 9.6% (23.4%) of non-diabetics (t = 5.91; t = 6.45). Conditional on being a drinker, men who do not have diabetes consume on average 19.78 units (9.31 for females) of alcohol per week, which compares to 15.73 (6.88) units for diabetic men (t = 3.94; t = 2.98). In contrast, we believe that it is reasonable to assume that these types of non-acute illness are not typically severe enough to inhibit occupational attainment.[7] For males we also include the number of dependent children (and it's square) as instruments, and we include living in an urban area for females. The presence of dependant children significantly reduces drinking levels for men, whilst female employees residing in an urban locality consume significantly higher levels of alcohol than their rural counterparts. We make the assumption that male labour supply and occupational attainment are independent of the number of children, and given the national mean wage nature of our dependent variable, and having controlled for region in our models, that female occupational attainment is unaffected by residing in an urban versus rural location.[8] Both of these arguments are validated by the data when the variables are included in the occupational attainment model.

In the second model (IV-2) we use instruments which are only available in the 1995 and 1996 surveys. Here we use binary indicators for whether or not the interviewee's mother or father smoked regularly as exogenous instruments. Given that smoking and drinking are often complements, these measures may provide a proxy for parental drinking habits. We find that both

measures are positive and significant when included in the IV first-stage drinking models. As with our previous model, we also include the number of dependent children (and it's square) for males, and living in an urban area for females. In our final model (IV-3) we use instruments that are available only in the 1992, 1993 and 1994 surveys that are based on individuals' self-assessment of how much they drink. In this case our instruments are binary indicators for 'feeling that you should cut down on one's own drinking', 'feeling guilty about one's own drinking' and 'having been annoyed by criticism from others about one's own drinking in the last three months'. We assume that each of these subjective outcomes is likely to be associated with a change in current alcohol consumption.[9]

The power of these instruments in determining alcohol consumption levels is verified by the tests proposed by Bound *et al*. (1995). Tables 4 and 5 provide the *F*-statistics on the inclusion of the sets of instruments in the drinking models which are all statistically significant at the 5% level.[10] In addition, we have calculated the partial R^2 by regressing alcohol consumption against our potential sets of instruments, having subtracted out the explanatory effect of common exogenous regressors. The resulting partial R^2 values suggest that instrument sets IV1 and IV2 explain around 1% more of the variation in alcohol consumption for both males and females, whilst instrument set IV3 has considerably greater explanatory power, explaining around 20% more of the variation. Although the previous alcohol-wage literature does not provided any information in order for us assess the relative power of our instruments, we note that our results compare favourably with those from the recent returns to education literature, with Harmon and Walker (1995) reporting a partial R^2 of 0.0046, Harmon and Walker (1999) reporting partial R^2 values between 0.0025 and 0.0078 and Ichino and Winter-Ebmer (1999) reporting partial R^2s ranging from 0.003 to 0.114, for their years of schooling instruments in log wage equations. In additional to these tests, since each of our IV models is over-identified, with the number of exogenous instruments being greater than endogenous variables, we are able to compute the Sargan χ^2 statistics to test the general validity of the instrument sets. Only for the IV1 model for females can the null hypothesis that the instruments are valid be rejected at the 5% level of significance.

The IV estimates of the alcohol coefficients are presented in Tables 4 and 5, for our three sets of instruments.[11] The results reveal a lot about the biases in our single-equation models.[12] In all cases, the IV estimates of the coefficients on alcohol consumption and its square are significantly larger than the OLS estimates (with t-tests in the range of 8 to 45). Indeed, if we compare the estimated returns for the IV models they all suggest a higher return than the OLS estimates, but over a much shorter range. For example, using the results for model IV-2, we observe that whereas

the OLS estimates suggest a mean wage premium of 4.5% for a male with base characteristics who drinks an average of 21 units of alcohol per week (compared to a male with same characteristics who does not drink), the IV estimates suggest a gain of 13.7%. Our other IV estimates suggest even higher returns (35.5% for IV-1 and 15.3% for IV-3) and although we must treat these with considerable caution given the general imprecision of IV estimates, we can take some comfort in comparing these estimates to those presented in the US literature (approximately 50% in Heien (1996) and between 50% and 200% in Zarkin *et al*. (1998b)). To illustrate the differences in our estimates, we plot our predicted mean wage-alcohol consumption profiles in Figures 1 and 2, using the IV-2 estimates (our preferred set of instruments) for males and females respectively.

TABLE 4

OCCUPATIONAL ATTAINMENT: IV ESTIMATES FOR MALES[a]

Covariate	Model IV-1	Model IV-2	Model IV-3
	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)
Alcohol consumption			
Mean weekly units of alcohol	0.0278 (2.45)	0.0107 (1.74)	0.0103 (2.81)
(Mean weekly units of alcohol)^2/100	-0.0519 (2.64)	-0.0260 (2.58)	-0.0144 (2.52)
Observations	15819	7261	8557
Adjusted R^2	0.148	0.224	0.296
F Test	119.773	106.06	172.698
Partial R^2 (for instruments in 1st stage)	0.010	0.009	0.179
F Test (for instruments in 1st stage)	22.31	12.38	638.34
Sargan Test χ^2 (d.f.)	0.862 (3)	3.526 (2)	3.263 (1)

[a] Absolute t-statistics are given in parenthesis.

TABLE 5

OCCUPATIONAL ATTAINMENT: IV ESTIMATES FOR FEMALES[a]

Covariate	Model IV-1	Model IV-2	Model IV-3
	Coefficient (|t|)	Coefficient (|t|)	Coefficient (|t|)
Alcohol consumption			
Mean weekly units of alcohol	0.0273 (2.77)	0.0295 (1.82)	0.0136 (3.65)
(Mean weekly units of alcohol)^2/100	-0.0500 (2.02)	-0.1063 (2.38)	-0.0286 (3.11)
Observations	18430	8715	9714
Adjusted R^2	0.343	0.189	0.405
F Test	386.293	93.015	287.981
Partial R^2 (for instruments in 1st stage)	.012	.011	0.220
F Test (for instruments in 1st stage)	37.65	74.14	946.25
Sargan Test χ^2 (d.f.)	6.521 (2)	0.075 (1)	3.177 (1)

[a] Absolute t-statistics are given in parenthesis.

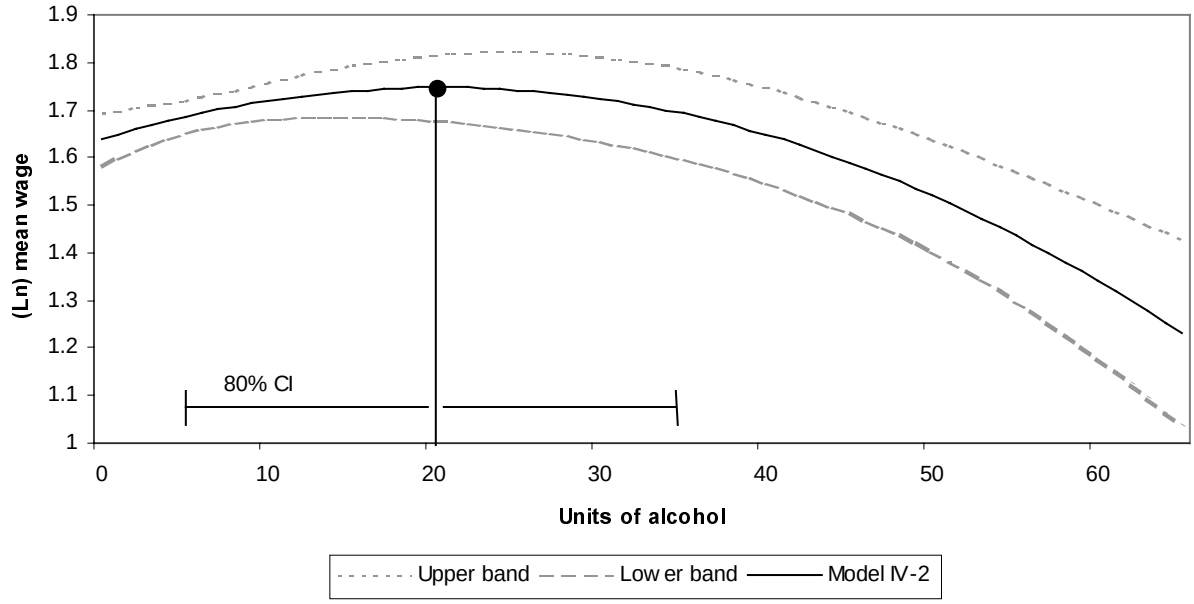

FIGURE 1. Predicted male alcohol-mean wage profiles

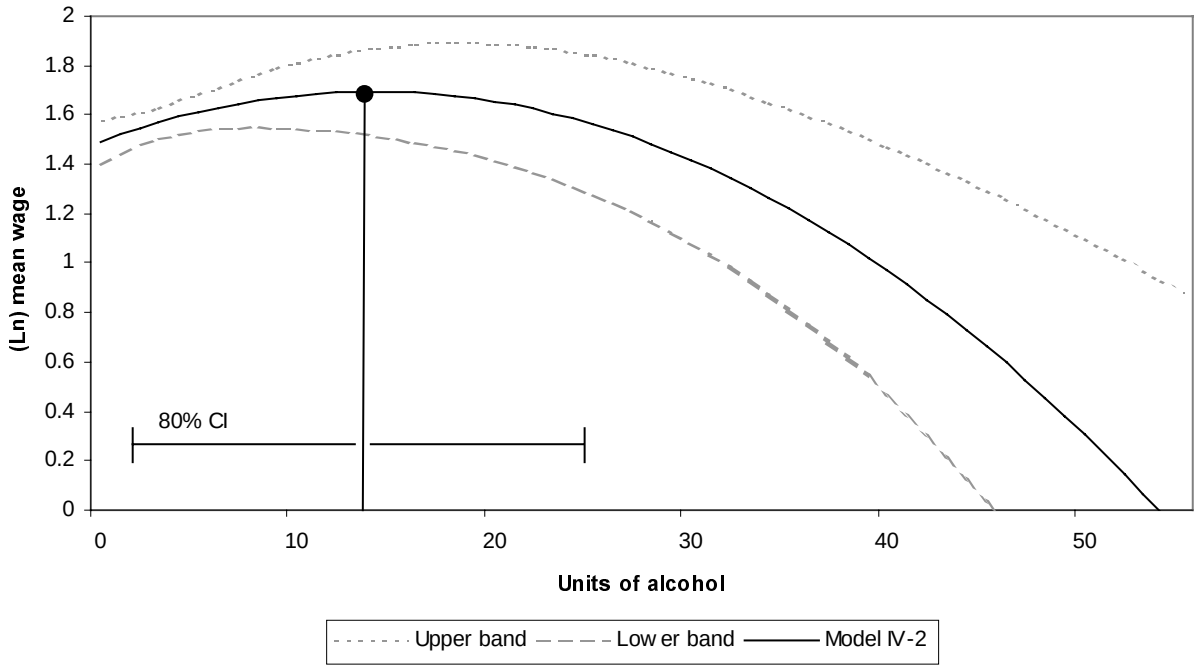

FIGURE 2. Predicted female alcohol-mean wage profiles

The plots in Figures 1 and 2 are produced for a 30 year old male and female with base characteristics. We see that the IV estimates typically indicate a higher mean wage premium for moderate drinkers over non-drinkers and heavy drinkers, but these returns to alcohol consumption are positive over a much shorter range compared to the OLS results. Unfortunately, the confidence bands given in Figures 1 and 2 also reveal a lot about the imprecision of IV estimation. This is particularly apparent with respect to the turning points. In Table 6 we provide the turning points for all our estimated wage-alcohol consumption profiles, along with confidence intervals evaluated at an 80% level of confidence. We observe that for males, whereas the OLS estimates suggest a maximum point at 44 units of alcohol, the turning points for the IV estimates correspond to consumption in the range of 21 to 36 units. The difference is more apparent for females, with the maximum points for the IV estimates corresponding to consumption in the range of 14 to 28 units of alcohol compared to a turning point at 40 units suggested by the OLS estimates. However, taking into account the imprecision in the estimates of the turning points, whilst we are not able to identify with confidence the exact consumption level when 'returns' are maximised, the results are robust in the sense that moderate drinking does imply a positive return which drops-off sharply as consumption increases.[13]

TABLE 6:

TURNING POINTS AND CONFIDENCE INTERVALS (20% LEVEL)[a]

	Turning point - units of alcohol	Lower bound	Upper bound
Males			
OLS	43.87 (3.723)	39.10	48.63
IV 1	26.76 (11.439)	12.12	41.40
IV 2	20.44 (11.940)	5.16	35.73
IV 3	35.67 (12.889)	19.17	52.16
Females			
OLS	39.74 (4.314)	34.22	45.27
IV 1	27.27 (10.385)	13.97	40.56
IV 2	13.86 (8.998)	2.34	25.38
IV 3	23.67 (6.705)	15.09	32.25

[a] Standard errors in parenthesis

Given the cross-sectional nature of our data, it is also difficult to draw strong inference about any causality suggested by these results. Moreover, we believe that it is unlikely that the premium for moderate drinkers is 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 the social mechanisms mentioned earlier in Section I (e.g. "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 earlier, is that it is not possible to account for the effect of all unobservable heterogeneity that might be positively correlated with moderate alcohol consumption and occupational attainment. Nevertheless, our results suggest that the combination of the positive factors associated with moderate alcohol consumption (medical and social), and the unobservable characteristics of such drinkers, are 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 affect on occupational attainment.

V. 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 (defined as the mean hourly wage for each occupation). To our knowledge, this is the first attempt to investigate this relationship using British data. Overall our results are consistent with recent studies for the US and Canada.

We began by presenting single-equation OLS estimates of the impact of drinking on occupational attainment. Regardless of how we defined our drinking variables, the results suggested a positive association between alcohol consumption and mean occupational wages that appeared to have an inverted-U shape form. However, the principle aim of this paper has been to control for the endogeneity of alcohol consumption in the mean wage regressions using 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.

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.

APPENDIX A: VARIABLE DERIVATIONS

Occupational ranking

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 (INECACA=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.

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 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 defined above.

The drinking frequency measures 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 B: SAMPLE CHARACTERISTICS

TABLE A1

VARIABLE MEANS (STANDARD ERRORS IN PARENTHESIS)

	Males	Females
Covariate	Mean (S.E)	Mean (S.E)
Age	43.086 (0.090)	40.749 (0.073)
Number of children	-	0.777 (0.008)
Good health (self assessed)	0.807 (0.003)	0.817 (0.003)
Marital status		
Married or cohabiting	0.784 (0.003)	0.774 (0.003)
Single	0.143 (0.003)	0.101 (0.002)
Widowed/separated/divorced	0.073 (0.002)	0.125 (0.002)
Education		
Degree or higher qualification	0.157 (0.003)	0.101 (0.002)
Higher vocational qualification	0.200 (0.003)	0.128 (0.002)
'A' level or equivalent	0.088 (0.002)	0.063 (0.002)
'O' level or equivalent	0.248 (0.003)	0.355 (0.004)
Other qualification	0.048 (0.002)	0.052 (0.002)
No qualifications	0.259 (0.003)	0.300 (0.003)
Alcohol consumption		
Mean weekly units of alcohol	17.691 (0.149)	7.094 (0.072)
Very heavy drinker	0.009 (0.001)	0.004 (0.001)
Heavy drinker	0.023 (0.001)	0.007 (0.001)
Moderate to heavy drinker	0.061 (0.002)	0.022 (0.001)
Moderate drinker	0.208 (0.003)	0.115 (0.002)
Light to moderate drinker	0.330 (0.004)	0.319 (0.003)
Light drinker	0.265 (0.004)	0.296 (0.003)
Abstainer	0.102 (0.002)	0.236 (0.003)
Drinks almost every day	0.156 (0.003)	0.084 (0.002)
Drinks frequently	0.068 (0.002)	0.037 (0.001)
Drinks occasional	0.203 (0.003)	0.131 (0.002)
Drinks infrequently	0.343 (0.004)	0.335 (0.003)
Non-drinker	0.230 (0.003)	0.413 (0.004)
Drinks more than five years ago	0.133 (0.003)	0.175 (0.003)
Drinks less than five years ago	0.484 (0.004)	0.390 (0.004)
Regional variables		
North & Yorkshire	0.152 (0.003)	0.151 (0.003)
North West	0.143 (0.003)	0.143 (0.003)
East Midlands	0.104 (0.002)	0.100 (0.002)
West Midlands	0.107 (0.002)	0.100 (0.002)
Anglia & Oxford	0.119 (0.003)	0.116 (0.002)
North Thames	0.117 (0.003)	0.121 (0.002)
South Thames	0.125 (0.003)	0.131 (0.002)
South and West	0.133 (0.003)	0.139 (0.003)
Instrumental variables		
Diabetes (1992-6)	0.020 (0.001)	0.010 (0.001)
Stomach Ulcers (1992-6)	0.042 (0.002)	0.034 (0.001)
Asthma (1992-6)	0.044 (0.002)	0.053 (0.002)
Number of children (1992-6)	0.626 (0.008)	-
Urban (1992-6)	-	0.762 (0.003)
Mother smoked (1995-6)	0.441 (0.006)	0.473 (0.005)
Father smoked (1995-6)	0.740 (0.005)	0.728 (0.005)
Should cut down drinking (1992-4)	0.190 (0.004)	0.129 (0.003)
Felt guilty about drinking (1992-4)	0.044 (0.002)	0.034 (0.002)
Been annoyed by criticism (1992-4)	0.056 (0.002)	0.024 (0.002)
Observations	15819	18430

APPENDIX C: SUPPLEMENTARY RESULTS

TABLE A2
ALCOHOL COEFFICIENTS BY AGE GROUP[a]

	Males		Females	
Covariate	Age <40 coefficient (|t|)	Age 40+ coefficient (|t|)	Age <40 coefficient (|t|)	Age 40+ coefficient (|t|)
Model 1				
Mean weekly units of alcohol	0.0032 (7.67)	0.0032 (8.77)	0.0030 (5.80)	0.0033 (7.02)
(Mean weekly units of alcohol)^2/100	-0.0037 (6.85)	-0.0036 (7.27)	-0.0045 (4.78)	-0.0034 (3.85)
Model 2				
Very heavy drinker	0.0029 (0.09)	0.0549 (1.78)	0.0335 (0.77)	0.0378 (0.94)
Heavy drinker	0.0590 (2.43)	0.0479 (2.45)	0.0021 (0.07)	0.0661 (2.16)
Moderate to heavy drinker	0.0854 (4.95)	0.0796 (5.76)	0.0575 (3.13)	0.1010 (5.85)
Moderate drinker	0.0846 (6.20)	0.0954 (9.43)	0.0545 (5.49)	0.0557 (6.30)
Light to moderate drinker	0.0824 (6.33)	0.0825 (8.82)	0.0440 (5.64)	0.0374 (5.74)
Light drinker	0.0349 (2.62)	0.0476 (5.00)	0.0245 (3.16)	0.0182 (2.77)
Model 3				
Drinks almost every day	0.0675 (5.70)	0.0898 (10.57)	0.0639 (5.31)	0.0630 (7.52)
Drinks frequently	0.1040 (7.49)	0.0920 (7.55)	0.0842 (5.61)	0.0779 (5.99)
Drinks occasional	0.0879 (8.96)	0.0690 (8.11)	0.0534 (6.27)	0.0387 (4.90)
Drinks infrequently	0.0431 (5.01)	0.0442 (5.92)	0.0254 (4.12)	0.0224 (3.85)
Model 4				
Mean weekly units of alcohol	0.0031 (7.36)	0.0031 (8.46)	0.0026 (4.89)	0.0031 (6.38)
(Mean weekly units of alcohol)^2	-0.0037 (6.75)	-0.0035 (7.18)	-0.0041 (4.32)	-0.0032 (3.61)
Drinks more than five years ago	0.0127 (1.20)	0.0287 (3.27)	0.0206 (2.54)	0.0108 (1.53)
Drinks less than five years ago	-0.0169 (2.27)	-0.0153 (2.58)	-0.0274 (0.45)	-0.0043 (0.78)
Observations	6715	9104	8854	9576

[a] Absolute t-statistics are given in parenthesis.

TABLE A3

FULL AND DIRECT EFFECTS ESTIMATES OF ALCOHOL CONSUMPTION ON MEAN OCCUPATIONAL WAGES[a]

	Males		Females	
Covariate	Direct Effect Coefficient (|t|)	Full Effect Coefficient (|t|)	Direct Effect coefficient (|t|)	Full Effect coefficient (|t|)
Model 1				
Mean weekly units of alcohol	0.0033 (11.83)	0.0033 (11.91)	0.0032 (9.26)	0.0039 (11.23)
(Mean weekly units of alcohol)^2/100	-0.0037 (10.17)	-0.0039 (10.65)	-0.0040 (6.27)	-0.0048 (7.35)
Model 2				
Very heavy drinker	0.0261 (1.16)	0.0318 (1.41)	0.0042 (0.14)	0.0511 (0.90)
Heavy drinker	0.0532 (3.51)	0.0492 (3.22)	0.0297 (1.33)	-0.0558 (1.30)
Moderate to heavy drinker	0.0828 (7.73)	0.0851 (7.89)	0.0794 (6.27)	0.0603 (3.01)
Moderate drinker	0.0916 (11.40)	0.0996 (12.26)	0.0565 (8.55)	0.0718 (8.69)
Light to moderate drinker	0.0839 (11.07)	0.0944 (12.42)	0.0409 (8.16)	0.0570 (10.81)
Light drinker	0.0427 (5.52)	0.0530 (6.82)	0.0214 (4.24)	0.0301 (6.41)
Model 3				
Drinks almost every day	0.0828 (12.01)	0.0842 (12.11)	0.0647 (9.33)	0.0731 (10.51)
Drinks frequently	0.0988 (10.79)	0.1020 (11.00)	0.0840 (8.48)	0.0923 (9.28)
Drinks occasional	0.0791 (12.32)	0.0801 (12.39)	0.0476 (8.20)	0.0571 (9.82)
Drinks infrequently	0.0440 (7.81)	0.0473 (8.33)	0.0242 (5.71)	0.0301 (7.10)
Model 4				
Mean weekly units of alcohol	0.0032 (11.37)	0.0032 (11.45)	0.0029 (8.15)	0.0036 (10.11)
(Mean weekly units of alcohol)^2	-0.0037 (10.04)	-0.0039 (10.51)	-0.0038 (5.79)	-0.0045 (6.92)
Drinks more than five years ago	0.0223 (3.30)	0.0220 (3.22)	0.0151 (2.82)	0.0136 (2.53)
Drinks less than five years ago	-0.0156 (3.37)	-0.0155 (3.34)	-0.0010 (0.25)	-0.0021 (0.52)

[a] Absolute t-statistics are given in parenthesis.

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NOTES

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

[2] These figures are not presented in Heien (1996), but rather are based on are own calculations using the reported parameter estimates.

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

[4] One unit of alcohol = 8 grams of ethanol, or approximately one half pint of beer, a small glass of wine, or a single measure of spirits.

[5] Interestingly, Harper and Haq (1997) find no difference in their results according to whether they used wages or occupational ranked by mean hourly wages in their study of occupational attainment amongst British men.

[6] The regional variables are restricted to the eight Regional Health Authority regions in the HSE.

[7] However, there is a question of causality with regard to diabetes and ulcers. Whilst heavy consumption of alcohol is not generally a direct medical cause of diabetes, it might increase the probability of detection and thus reporting in the HSE. Similarly, there are many causes for stomach ulcers, which for a small minority of individuals could be the results of high alcohol consumption levels. With regard to diabetes, the HSE can be used to assess the direction of causality. Of those individuals who report having become a diabetic in the five years prior to interview, over 85% report having reduced their level of drinking over the same period.

[8] Of the males who have at least one dependent child, 9.12% are abstainers compared to 10.86% of men with no children (t = 3.52). Conditional on being a drinker, the former group have a mean alcohol consumption of 17.91 units which compares to 20.71 units for childless men (t = 8.82). Only 21.1% of women living in an urban locality are abstainers from alcohol compared to 24.5% of women living in non-urban areas. Of those women who do drink, the mean units of consumption for urban females is 9.4, which compares to 8.9 for non-urban females (t = 2.15).

[9] Of course, the causality between these instruments and alcohol consumption is open to question. Whereas we assume that such feelings lead to a change in drinking behaviour, it is equally as plausible that such feelings are the results of heavy drinking in the past. Caution should therefore be adopted when considering the results of IV3. However, the model does provide an additional comparison for IV1 and IV2, and in fact, provides similar estimates of the shape of the drinking-occupational attainment profile.

[10] The F-test and partial R^2 results at provided in Tables 4 and 5 only for the drinking model and not the drinking squared model. The results for the latter model, however, are very similar to the former.

[11] For brevity we report only the coefficients on the alcohol consumption variables. We note, however, that there is practically no difference in the magnitude, sign or significance between the other estimated OLS coefficients reported earlier and the unreported coefficients for the IV models. The full results are available from the authors on request.

[12] We have also re-estimated models IV2 and IV3 using all the available instruments, including the three non-acute illness variables for both genders, and the number of dependent children for males and urban locality for females. The coefficients for drinking and drinking squared are not statistically different from the original models. For the extended IV2 model the respective coefficients are 0.009 (t = 1.65) and –0.021 (t = 2.38) for males, and 0.023 (t = 2.45) and –0.069 (t = 2.88) for females. The extended results for IV3 are 0.010 (t = 2.61) and –0.023 (t = 2.33) for males, and 0.015 (t = 4.07) and –0.031 (t = 3.49) for females. In addition, we have estimated the IV models using information on the number and type of leisure and sporting activities pursued by individuals in an average week as exogenous instruments. Again, the results confirm the suggested inverted-U shape of the alcohol-attainment relationship. All of these additional results are available from the authors on request.

[13] Unfortunately, we are not able to compare our results directly with previous studies as the standard errors for the turning points or confidence bands for their wage-consumption profiles are not provided.

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