MONASH University
Business and Economics

Centre for Health Economics

Research Paper 2008 (30)

Does bingeing affect earnings?

Preety Srivastava
Research Fellow, Centre for Health Economics,
Monash University

August, 2008

Centre for Health Economics
ISSN 1833-1173
ISBN 1 921187 29 8

Does Bingeing Affect Earnings?

Preety Srivastava
CHE, Monash University

June 2008

Abstract

While excessive drinking is associated with lower earnings through adverse health effects, absenteeism and low productivity, moderate alcohol consumption has been argued to generate positive wage effects. These positive wage premiums are usually expected to arise from the social effect of drinking and the beneficial health consequences of drinking in moderation. Using unit-record data from the Australian National Drug Strategy Household Survey, this paper examines the impact of drinking patterns on individuals' earnings, controlling for selectivity bias driven by the endogenous relationship between drinking and earnings. In particular, a Multinomial Logit Selectivity model is estimated for four drinking statuses. This study shows that frequent bingeing is associated with reduced earnings whilst non bingers and occasional bingers earn a positive premium over abstainers. Further, a decomposition of the earnings differentials indicates that, across various occupations, abstainers are at least as, if not more, 'productive' than drinkers and frequent bingers are less 'productive' than non bingers and occasional bingers.

JEL Classification: C3, D1, I1
Keywords: Binge drinking, earnings, selectivity bias, Multinomial Selectivity model

All correspondence to:
Preety Srivastava
Centre for Health Economics,
Monash University,
Melbourne, VIC 3800,
Australia
Fax: + 61 3 9905 8344
Phone: +61 3 9905 8152
Email: preety.srivastava@buseco.monash.edu.au

1 Introduction

Heavy episodic or binge drinking has been a major concern for policymakers worldwide. Whilst moderate drinking is widely considered as a harmless means to relax and socialise and even beneficial to health, excessive drinking is often associated with acute health consequences, crime, violence, road fatalities and various other adverse social and psychological outcomes. Recent debate on problem drinking has also focussed on its adverse impact on labour market outcomes usually through impaired health, absenteeism and poor job performance (see Mangione et al., 1999; Gmel and Rehm, 2003). Where workers receive wages that reflect their productivity, heavy drinking or bingeing is likely to have an adverse effect on their earnings. Collins and Lapsley (2002) estimated drug abuse related loss of productive capacity in the Australian paid workforce to be around AUD$5.5 billion, of which alcohol contributed around 35 percent. Their study identified three principal ways in which drug abuse has an important impact on productivity: deaths and illnesses causing premature retirement; absenteeism from sickness or injury; and reduced on-the-job productivity. In recent years, a small body of literature has examined the drinking-earnings relationship using Australian data (see Barrett, 2002; Lee, 2003; Lye and Hirschberg, 2004). This paper contributes to this literature by investigating the impact of *bingeing* on individuals' earnings.

The relationship between alcohol use and abuse, and labour market outcomes has received growing attention in the international literature, more so in the last decade. It has been argued that while excessive drinking is associated with lower earnings through adverse health effects, absenteeism and low productivity, light, or moderate, alcohol consumption seems to generate positive wage effects (see French and Zarkin, 1995; Heien, 1996; Hamilton and Hamilton, 1997; MacDonald and Shields, 2001; Barrett, 2002; Lye and Hirschberg, 2004). These positive wage premiums are expected to arise from the beneficial health

effects of drinking in moderation. Several studies have found that light and moderate drinking are associated with a lower incidence of stroke (see Baum-Baicker, 1985; Fagrell et al., 1999; Denke, 2000). One Dutch study found that moderate drinkers under stress were less likely to be absent from work than were either abstainers or heavy drinkers under stress (Vasse et al., 1998). In addition, it is argued that individuals derive benefits from the 'networking' effect of alcohol consumption (see Peters and Stringham, 2006). It is believed that drinking can increase social capital which in turn increases earnings.

Researchers have explored the impact of drinking on labour market outcomes using different approaches, modelling techniques, and various measures of alcohol use and abuse. One major empirical issue that has often been raised in the literature on alcohol consumption and labour market outcomes is endogeneity because some labor market outcomes and drinking may have a simultaneous relationship (*i.e.*, structural endogeneity) and because there may exist unobserved heterogeneity (*i.e.*, statistical endogeneity). The heterogeneity problem arises because unobserved attributes that affect earnings may be correlated with unmeasured personal characteristics that influence an individual's propensity to drink. For example, the unobserved characteristic can be a 'willingness to socialise' (Lee, 2003) or a lack of motivation (Dave, 2004) that can potentially influence both drinking and labour outcomes. MacDonald and Pudney (2000) identified a high rate of time preference as a potential unobservable characteristic causing individuals to select high-paying jobs without consideration for investment in human capital, but also, according to Becker and Murphy (1988), making them more likely to take drugs. Gill and Michaels (1992) suggested that the genetic predisposition to idleness could be a potential unobserved characteristic of drug users and that individuals with such characteristic would be relatively unproductive.

Most studies have dealt with the issue of endogeneity of substance abuse and earnings by using an instrumental variable approach (see Kenkel et al., 1994; Mullahy and Sindelar,

1996; MacDonald and Shields, 2001, 2004). Much as the IV technique is easily applied and estimated, the main challenge in empirical studies is finding valid instruments given that poor instruments can do more harm than good (see Bound et al., 1995; Heckman, 1995).

Another approach to model the drinking-earnings relationship found in recent literature is the multinomial selectivity model. This is an extension of the standard sample selection model (Heckman, 1979) generalised to polychotomous choices by Lee (1983). Trost and Lee (1984) used this model to study the returns to education. They estimated separate earnings equations by education status, correcting for selection bias due to self-selection into different educational choices. Using a similar approach to examine the drinking-earnings relationship, researchers have estimated separate earnings equations for each drinking group adjusting for selection bias due to individuals self selecting themselves into drinking categories (see Hamilton and Hamilton, 1997; Barrett, 2002; Lee, 2003). This approach allows labour market returns to individual characteristics to vary by drinking status. Using a standard sample selection model, Berger and Leigh (1988) examined the wage differentials between drinkers and non-drinkers. They found that drinkers earned a substantial wage premium relative to abstainers. Hamilton and Hamilton (1997) extended this analysis to three drinking categories and found that abstainers and heavy drinkers earn less than moderate drinkers. Their study showed that selectivity bias had important implications on predicted wage differentials. Similar findings have been obtained by Barrett (2002) and Lee (2003). Table 1 summarises some of the literature related to alcohol and labour market outcomes, highlighting their findings and indicating the nature of the data.

The general consensus in the empirical literature is that drinkers earn more than abstainers. Those studies have mostly considered three drinking statuses and have found an inverted U-shaped relationship between drinking and earnings in general indicating that moderate drinking leads to a significant earnings premium relative to abstention and heavy

Table 1: Selective Survey of Economic Studies on Drinking-Earnings Relationship

Author/Year	Data	Findings
Berger and Leigh (1988)	US data	Premium for drinkers over non-drinkers
Kenkel et al. (1994)	US NLSY data	Wage penalty for heavy male drinkers
French and Zarkin (1995)	Employees from 4 US worksites	Inverted U-shaped relationship with a peak premium at approx.1.5 to 2.5 drinks per day on average
Heien (1996)	US national survey on alcohol use	Inverted U-shaped relationship with highest premium for moderate drinkers
Mullahy and Sindelar (1996)	US national health survey data	Reduced employment
Hamilton and Hamilton (1997)	Canadian data	Inverted U-shaped relationship with highest premium for moderate drinkers
French et al. (1998)	US national data	Flat premium for drinkers over non-drinkers
Zarkin et al. (1998)	US national survey on drug abuse	Flat premium for male drinkers over non-drinkers No such evidence for females
Zarkin et al. (1998)	US national survey on drug abuse	Little effect on the number of hours worked by young men
MacDonald and Shields (2001)	UK health survey data	Inverted U-shaped relationship with highest premium for moderate drinkers
Barrett (2002)	Australian national health survey data	Inverted U-shaped relationship with highest premium for moderate drinkers
Terza (2002)	US national health survey data	Alcohol consumption decreases the likelihood of being employed
Lee (2003)	Australian Twin Registry data	Inverted U-shaped relationship with highest premium for moderate drinkers
Peters (2004)	US NLSY data	Controlling for unobserved heterogeneity shows no effect of drinking on wages
MacDonald and Shields (2004)	UK health survey data	Problem drinking substantially decreases probability of employment
Lye and Hirschberg (2004)	Australian national health survey data	Inverted U-shaped relationship with highest premiums for low/moderate drinkers
Auld (2005)	Canadian General Social Survey	Progressive premium for moderate and heavy drinkers over abstainers

drinking. In contrast, the focus of this study is on individuals' bingeing behaviour. Grouping individuals into four drinking statuses - abstainers, non bingers, occasional bingers and heavy bingers - we use the multinomial selectivity model to examine the relationship between drinking patterns and earnings. The structure of the paper is as follows. Section 2 outlines the empirical model. Section 3 discusses the results and provides earnings predictions by drinking status. A thorough decomposition of the earnings differentials is carried out in Section 4 to identify their main drivers. Section 5 summarises the findings.

2 A Multinomial Selectivity Model for Earnings

Let the earnings equation for individual i with drinking status j be given by,

$$E_{ij} = \mathbf{x}_i'\beta_j + u_{ij} \qquad (i = 1, \dots N \text{ and } \ j = 1, \dots J). \tag{1}$$

where earnings E_{ij} are assumed to be a linear function of observable individual attributes $\mathbf{x}_i$ such as socioeconomic and demographic characteristics, job and occupation characteristics, and health status, and $u_{ij} \sim N(0, \sigma_j^2)$. Given separate earnings equations, the estimated coefficients β_j's across various drinking levels are then compared to determine whether labour market returns differ by drinker type. However, estimating separate earnings equations by drinking status can result in a sample selectivity bias because the rational individual is likely to self-select himself into that drinking group which yields him the highest present value of net benefits. Lee (1983) proposed a selection model to account for such bias. In particular, he generalised the two-step Probit selection Heckman model (Heckman, 1979) into a polychotomous-choice setup where in the first stage the choices are modelled using a Multinomial Logit (MNL) model and the second stage is an OLS regression.

Assuming that the indirect utility function for individual i with drinking status j is

given by

$$U_{ij} = V_{ij} + \varepsilon_{ij} \qquad (i = 1, \ldots N \text{ and } \; j = 1, \ldots J). \tag{2}$$

V_{ij} is the observable part of the utility that is typically assumed to be a linear function of observable characteristics $\mathbf{x}_i$ plus additional variables that solely reflect the individual's preferences over levels of alcohol consumption, such that

$$U_{ij} = \mathbf{z}_i^{'}\gamma_j + \varepsilon_{ij}. \tag{3}$$

ε_{ij} is the stochastic component accounting for unobserved individual tastes and preferences. Let Y_i $(Y_i = 1, \ldots J)$ indicate the choice made by consumer i. The consumer is assumed to select the choice that gives him/her the maximum utility. That is, $Y_i = j$ if $U_{ij} > U_{ik}, (k = 1, 2, ...J;\ k \neq j)$. Assuming ε_{ij} error terms are distributed according to the Type I Extreme Value distribution, this results into the standard MNL choice model

$$P_{ij} = P(Y_i = j) = \frac{\exp(\mathbf{z}_i^{'}\gamma_j)}{\sum_{j=1}^{J} \exp(\mathbf{z}_i^{'}\gamma_j)}. \tag{4}$$

Now, conditional on alternative j being chosen, the specification of the earnings equation accounting for selection bias is

$$E_{ij}^{*} = \mathbf{x}_i^{\prime}\beta_j + \theta_j\hat{\lambda}_j + w_{ij} \tag{5}$$

where

$$\hat{\lambda}_j = \frac{\phi\left\{\Phi^{-1}\left[F(\mathbf{z}_i^{'}\gamma_j)\right]\right\}}{F(\mathbf{z}_i^{'}\gamma_j)},$$

and $F(.)$ denotes the MNL distribution function. The functions $\phi(.)$ and $\Phi(.)$ are the standard normal pdf and cdf respectively, and the error terms w_{ij} have mean zero. The

selection term on the right-hand side of Equation (5), $\hat{\lambda}_j$, is called the Inverse Mills Ratio (IMR) and is constructed using the first-stage MNL model results. It controls for the truncated mean of the observed residuals in the earnings equations arising from individuals selecting their preferred drinking status. The truncated mean is a generalisation of the standard Heckman correction term to the situation where individuals choose over multiple alternatives.

The parameter θ_j is estimated along with β_j where $\theta_j = \sigma_j \rho_j$, ρ_j being the correlation coefficient between u_{ij} and the error terms in the selection equation and σ_j is the standard deviation of the disturbance u_{ij}. The asymptotic covariance matrix of the two-stage estimation is adjusted using the Murphy and Topel (1985) correction procedure. Once the selectivity bias is accounted for, Equation (5) can be used to predict an individual's earnings given his/her drinking status as if he/she were randomly allocated to a given drinking status.

3 Data

Data from the 2001 and 2004 sweeps of the National Drug Strategy Household Surveys (NDSHS) are pooled together in this analysis (NDSHS, 2004). The NDSHS is a nationally representative survey of the non-institutionalised civilian population of Australia where individuals are personally interviewed about their awareness and attitude to both licit and illicit drugs. More sensitive and confidential questions about personal drug usage are collected by means of self-completed 'drop-and-collect', hence minimising the likelihood of any non-response bias. For the purpose of this study, the sample is restricted to individuals in their prime working age, 25 to 60 years, whose main activity is work and who are full-time employees.[1]

[1]Note that the selectivity bias that arises because of individuals' self-selection into the labour force (see Heckman, 1974), is not controlled for in this analysis. Accounting for this bias would add one more layer

The NDSHS does not contain data on hourly earnings or the number of hours worked. Individuals' personal annual income before tax for the year prior to the survey is therefore used as a measure of earnings. This measure of earnings may not strictly represent individuals' earnings given that it may constitute their income from other sources. However, restricting the sample to prime working age full-time workers ensures that earnings will be the principal source of variation in individuals' income. Another shortcoming related to individuals' income reported in the NDSHS is that it involves categorical responses where respondents choose from many income categories the one that best represents their income level. As is common practice, midpoints of income brackets are used to convert the discrete income series into a continuous variable.

In contrast to previous literature that has examined the drinking-earnings relationship, individuals are grouped into abstainers, non bingers, occasional bingers and frequent bingers. Although binge drinking is a term widely recognised as the act of drinking heavily on an occasion, there appears to be a lack of consensus on its definition. Much of the difference in the definitions has been driven by variations in the units of measurement of alcoholic beverages and in other instances, the number of drinks. A problematic feature of these definitions is that very often neither the duration of an occasion nor the drink sizes and strength is defined. In Australia, the National Health and Medical Research Council (NHMRC) recommends guidelines for the maximum number of standard drinks to be consumed in order to minimise risks in the short and long terms and maximise any potential health benefits. They indicate three risk levels - low, medium and high - based on both the amount (i.e. number of standard drinks consumed on any one day) and frequency of consumption (NHMRC, 2001). Table A.1 in the appendix depicts the drinking guidelines as set by the NHMRC.

The NDSHS records detailed information on individuals' drinking behaviour in terms of

of complexity to the model which is beyond the scope of the paper.

frequency and intensity of alcohol consumption in the twelve months prior to the survey. In the absence of a standard measure of binge drinking, the NHMRC's definition of risk levels for short-term harm associated with drinking is used in this study. Bingers are thus defined as those indulging in medium to high risk drinking, that is to say men drinking at least seven and women drinking at least five drinks on a single occasion. This is also consistent with the definition of binge or heavy drinking, in the literature (for example, Laixuthai and Chaloupka, 1993; Kenkel et al., 1994; Manning et al., 1995; Chaloupka and Wechsler, 1996; Dee, 1999; Barrett, 2002; Williams et al., 2002). The four drinking groups - abstainers, non bingers, occasional binge drinkers and frequent binge drinkers - are defined as follows: abstainers are those who have not consumed any alcohol in the past year; non bingers refer to those who drink but do not binge (i.e., consumption in a day of less than seven drinks by males and less than five drinks by females); occasional bingers are those individuals who binge less than three days a week; and frequent bingers are those who binge at least 3 days a week. Table 2 depicts the pattern of alcohol use among males and females in the unrestricted sample. There appears to be a slight increase in the percentage of frequent binge drinkers between 2001 and 2004 among both males and females. The pooled sample shows that 30.7 per cent of males and 26.7 per cent of females binge occasionally while 9.3 per cent of males and 6.0 per cent of females binge at least 3 days a week.

Table 2: Pattern of Recent[a] Alcohol Consumption (Percent)

	2001		2004		Pooled		
	Male	Female	Male	Female	Male	Female	All
Abstainers	14.94	20.44	12.91	18.57	13.94	19.50	17.07
Non Binger	46.86	47.53	45.22	48.12	46.06	47.83	47.06
Occasional Binger	29.61	26.29	31.79	27.15	30.68	26.73	28.45
Frequent Binger	8.59	5.73	10.09	6.15	9.32	5.95	7.42
Drinking Participation	85.1	79.6	87.1	81.4	86.1	80.5	82.9
Binge participation	38.2	32.0	41.9	33.3	40.0	32.7	35.9

Notes: [a]Used in the last 12 months.

The surveys also provide comprehensive information on repondents' social, economic and demographic characteristics. Also included in the surveys are the industry and occupation of respondents' employment. Alcohol prices by states of residence are used as a determinant of drinking status choice. The series is obtained from the Australian Bureau of Statistics (ABS, 2006b) and deflated using the all-items CPI for individuals' respective state of residence (ABS, 2006a). These are all used as explanatory variables in the model. A detailed description of all variables used in this paper is given in the appendix. In addition, Table A.2 in the appendix presents summary statistics of the sample by drinking groups. From the raw data, it appears that occasional bingers have the highest earnings. In particular, individuals who binge occasionally earn about 26 percent more than abstainers and about 9 percent more than non bingers. On the other hand, frequent bingers earn about 10 percent less than the occasional bingers and 2 percent less than the non bingers.

4 Discussion of Results

4.1 Model I with exogenous drinking status

To start, the earnings equation is estimated using OLS by including dummy variables for three of the drinking levels and using abstainers as the base case. Controlling for individuals' demographic characteristics, the effects of the three dummies are found to be statistically significant. The estimated coefficients and standard errors are reported in the first two columns of results in Table 3 under Model I. From the results it appears that occasional bingers have the highest earnings. In particular, they earn 15.7 percentage points (pp) more than abstainers and 6.9 pp more than non bingers. On the other hand, frequent bingers face a penalty of 2.1 pp over occasional bingers. An analogous exercise was carried out by Hamilton and Hamilton (1997) who found a premium of 7.4 pp for moderate drinkers over non-drinkers and a premium of 6.6 pp (although statistically insignificant)

for heavy drinkers over moderate drinkers.[2] Similar findings were obtained by Zarkin et al. (1998). However, due to the endogeneity of drinking status and earnings it is very likely that these estimates of earnings differentials are biased.

4.2 Model II with endogenous drinking status

Next, the multinomial selectivity model for earnings is estimated. In the first stage, individuals' drinking status choice is modelled using a MNL model. The model is specified as a function of a range of socioeconomic and demographic factors, alcohol price, health status and various other explanatory variables that determine drinking status. Note that variables (such as alcohol price, single parent status, and whether individual started drinking before age 18) that are included in the drinking status choice equation and excluded from the earnings equation, give additional explanatory power to the model and help identify the earnings equation parameters.[3] Table A.3 in the appendix reports the estimated results for the drinking status choice model. Given that the focus of the study is on the earnings function, the results are not discussed here.

The second-stage of the multinomial selectivity model entails estimating the earnings equations separately for each drinking group. This requires an adjustment for the selectivity bias likely to arise given that individuals' unobservable characteristics influencing their drinking decision are correlated with those affecting their earnings. As a consequence, their earnings are not observed randomly and thus for a set of observed characteristics including alcohol use, they would earn higher or lower wages. For instance, here, a negative selectivity bias for the frequent bingeing status would indicate that individuals with unobserved characteristics associated with a higher probability of frequent bingeing are associated with

[2]Hamilton and Hamilton (1997) defined moderate drinkers as those who consumed less than 8 drinks on a single day and heavy drinkers as those consuming at least 8 drinks on a single day.

[3]Note that the parameters in the earnings equation can also be identified through the nonlinearity of the inverse mills ratio, $\hat{\lambda}$, rather than through exclusion restrictions, unless $\mathbf{z}'\hat{\gamma}$ in Equation (5) does not have much variation in the sample (Wooldridge, 2002).

lower earnings as a frequent binger. In such circumstances a random sorting would yield a higher average wage for frequent bingers as compared with the observed sorting.

Demographic effects. Table 3 also presents the estimated results of the second-stage selectivity-corrected earnings regressions (Model II). The impact of age is first examined. The age effects indicate an inverted U-shaped relationship of earnings with age, in general, with a drop-off for individuals in the 55-60 age bracket. For non bingers, earnings are significantly higher in the age group 45-54 and decline slightly for older individuals. For frequent bingers, earnings are markedly higher in the 50-54 age band and decline significantly for older individuals. The age-earnings relationship is less distinct for occasional bingers and abstainers.

Some other important differential effects due to individuals' characteristics are also observed across the four groups. In particular, among non bingers and occasional bingers, males earn about 30-33 percent more than females whereas male frequent bingers earn about 22 percent more than female frequent bingers. There appears to be a positive premium for married individuals as compared to their non-partnered counterparts among frequent bingers. There is no evidence of lower earnings for Aboriginals and Torres Strait Individuals (ATSI) across any drinking category. There are positive returns for those residing in capital cities among all four drinking groups, with a premium as high as 13 percent for frequent bingers. As expected, education seems to generate a significantly higher premium across all four drinking groups suggesting that there is a payoff to being more educated relative to those with less than year-12 qualifications, but this pay-off is relatively smaller for abstainers.

State effects. Geographical differences in earnings are controlled using state indicators. The results indicate that individuals in Victoria (VIC), Queensland (QLD) and South Australia (SA) have, in general, substantially lower earnings than workers in the base

Table 3: Earnings OLS Estimates

	Model I		Model II							
			Abstainer		Non Binger		Occasional Binger		Frequent Binger	
Constant	9.424	(0.049)**	9.591	(0.179)**	9.215	(0.102)**	9.548	(0.086)**	9.962	(0.154)**
Age: 30-34	0.044	(0.014)**	0.021	(0.058)	0.032	(0.025)	0.063	(0.019)**	0.103	(0.042)**
35-39	0.096	(0.014)**	-0.051	(0.057)	0.121	(0.027)**	0.125	(0.020)**	0.150	(0.042)**
40-44	0.106	(0.014)**	0.028	(0.058)	0.169	(0.029)**	0.111	(0.022)**	0.163	(0.044)**
45-49	0.143	(0.014)**	0.091	(0.055)	0.222	(0.032)**	0.145	(0.025)**	0.167	(0.046)**
50-54	0.147	(0.015)**	0.029	(0.057)	0.251	(0.035)**	0.136	(0.029)**	0.213	(0.049)**
55-60	0.097	(0.016)**	-0.003	(0.059)	0.218	(0.039)**	0.103	(0.036)**	0.074	(0.056)
Male	0.309	(0.009)**	0.234	(0.033)**	0.325	(0.014)**	0.301	(0.014)**	0.220	(0.033)**
Married	-0.011	(0.008)	0.024	(0.031)	-0.022	(0.014)*	-0.005	(0.013)	0.102	(0.033)**
ATSI	-0.014	(0.036)	-0.020	(0.113)	-0.073	(0.064)	0.055	(0.058)	-0.098	(0.084)
Capital	0.100	(0.009)**	0.120	(0.034)**	0.104	(0.014)**	0.102	(0.013)**	0.130	(0.029)**
Degree	0.226	(0.013)**	0.118	(0.048)**	0.259	(0.021)**	0.238	(0.022)**	0.221	(0.053)**
Mid-edu	0.055	(0.011)**	-0.023	(0.039)	0.066	(0.016)**	0.077	(0.018)**	0.049	(0.033)
Excelhlth	0.158	(0.043)**	0.171	(0.145)	0.263	(0.071)**	0.145	(0.077)*	0.082	(0.096)
Goodhlth	0.106	(0.043)**	0.155	(0.146)	0.191	(0.071)**	0.117	(0.077)	-0.014	(0.096)
VIC	-0.056	(0.011)**	-0.090	(0.041)**	-0.071	(0.016)**	-0.041	(0.017)**	0.017	(0.037)
QLD	-0.084	(0.012)**	-0.110	(0.042)**	-0.086	(0.018)**	-0.084	(0.019)**	-0.073	(0.037)**
SA	-0.107	(0.015)**	-0.227	(0.056)**	-0.100	(0.023)**	-0.102	(0.023)**	-0.104	(0.050)**
WA	-0.042	(0.013)**	-0.061	(0.054)	-0.070	(0.020)**	-0.013	(0.021)	-0.072	(0.043)*
TAS	-0.110	(0.021)**	-0.149	(0.105)	-0.051	(0.032)	-0.160	(0.031)**	-0.138	(0.060)**
ACT	0.016	(0.017)	-0.046	(0.064)	0.032	(0.025)	0.006	(0.028)	0.060	(0.073)
NT	0.066	(0.016)**	0.015	(0.061)	0.086	(0.026)**	0.053	(0.025)**	0.070	(0.046)

Standard errors are given in parentheses. *significant at 10% level; **significant at 5% level.

Table 3: Earnings Estimates (Cont.)

	Model I		Model II							
Industry			Abstainer		Non Binger		Occasional Binger		Frequent Binger	
Primary	0.223	(0.022)**	0.230	(0.101)**	0.208	(0.035)**	0.228	(0.032)**	0.227	(0.064)**
Manufac	0.180	(0.016)**	0.094	(0.058)	0.186	(0.024)**	0.187	(0.025)**	0.203	(0.045)**
Util & Cons	0.189	(0.017)**	0.055	(0.074)	0.194	(0.027)**	0.183	(0.027)**	0.282	(0.049)**
Transport	0.224	(0.020)**	0.156	(0.078)**	0.223	(0.031)**	0.232	(0.031)**	0.267	(0.059)**
Communic	0.309	(0.028)**	0.193	(0.087)**	0.331	(0.045)**	0.327	(0.045)**	0.297	(0.091)**
Finance	0.189	(0.014)**	0.116	(0.053)**	0.186	(0.022)**	0.210	(0.021)**	0.210	(0.044)**
Govt Admin	0.246	(0.017)**	0.276	(0.067)**	0.240	(0.027)**	0.252	(0.026)**	0.220	(0.057)**
Education	0.034	(0.017)**	-0.044	(0.064)	0.043	(0.025)*	0.027	(0.028)	0.128	(0.067)*
Health	0.002	(0.015)	-0.031	(0.055)	-0.005	(0.023)	0.025	(0.025)	0.015	(0.053)
Recreational	-0.080	(0.026)**	-0.222	(0.113)**	-0.100	(0.042)**	-0.030	(0.038)	-0.125	(0.093)
Personal	0.049	(0.021)**	-0.146	(0.077)*	0.080	(0.033)**	0.070	(0.033)**	0.016	(0.073)
Occupation										
Admin	0.466	(0.016)**	0.455	(0.070)**	0.441	(0.025)**	0.495	(0.024)**	0.381	(0.055)**
Prof	0.354	(0.013)**	0.338	(0.048)**	0.355	(0.020)**	0.366	(0.021)**	0.278	(0.051)**
AsscProf	0.294	(0.013)**	0.322	(0.051)**	0.282	(0.021)**	0.310	(0.021)**	0.224	(0.044)**
Traders	0.056	(0.016)**	0.046	(0.064)	0.020	(0.025)	0.116	(0.025)**	-0.071	(0.048)
Clerical	0.108	(0.023)**	0.180	(0.090)**	0.082	(0.035)**	0.137	(0.037)**	-0.026	(0.078)
Production	0.017	(0.019)	0.012	(0.068)	-0.022	(0.029)	0.091	(0.031)**	-0.081	(0.055)
Service	-0.156	(0.020)**	-0.140	(0.068)**	-0.217	(0.030)**	-0.052	(0.032)	-0.346	(0.067)**
Labourer	-0.235	(0.019)**	-0.216	(0.061)**	-0.249	(0.029)**	-0.174	(0.032)**	-0.408	(0.054)**
$\hat{\lambda}$			0.026	(0.043)	0.168	(0.054)**	-0.033	(0.034)	-0.171	(0.078)**
Selection Bias			0.049	(0.079)	0.144	(0.046)**	-0.034	(0.034)	-0.326	(0.149)**
D_{nb}	0.088	(0.014)**								
D_{ob}	0.157	(0.014)**								
D_{fb}	0.136	(0.018)**								
R^2	0.366		0.275		0.379		0.375		0.386	

D_{nb}, D_{ob} and D_{fb} represent dummies for non binger, occasional binger, and frequent binger respectively.

Standard errors are given in parentheses. *significant at 10% level; **significant at 5% level.

Selection bias is calculated as $\theta_j \bar{\lambda}_j$ where $\lambda_j = \frac{\phi(.)}{\Phi(.)}$.

state, New South Wales (NSW). Among occasional and frequent bingers, Tasmanian (TAS) workers have the lowest earnings followed by South Australians.

Returns to job characteristics. The returns to job characteristics are estimated by including industry and occupation indicators in the model. There appears to be a significant difference in the earnings differentials with respect to industry. Among abstainers, those in government administration and defence (Govt Admin) industry seem to receive the highest earnings; abstainers' earnings are comparatively higher in the primary industry as well. Among non bingers and occasional bingers, those in communications services (Communic) receive markedly higher earnings while among frequent bingers, those in communication services, utilities and construction (Util & Cons), and transport and storage services (Transport) receive the highest earnings.

The pattern of earnings differentials is rather consistent with respect to individuals' occupation. Among all four categories of drinkers, those in administrative and professional occupations (Admin, Prof, AsscProf) receive substantially higher earnings while labourers receive the lowest earnings. In fact, earnings are found to be markedly lower for those who are in service, or labourer, occupations among frequent bingers and substantially higher for those in administrative and professional occupations among non bingers and occasional bingers. It is quite likely that in such physical-intensive occupations heavy drinking would significantly affect individuals' productivity while in white collar professions, drinking would increase earnings via positive socialising and networking effects.

Selection Correction. The selectivity bias which is captured through the Inverse Mills Ratio coefficient shows statistically significant biases for non bingers and frequent bingers. In particular, an upward bias of around 14 percent is observed for non bingers and a downward bias of around 33 percent is observed for frequent bingers, who self-select themselves as non bingers and frequent bingers, respectively. This implies that a worker who self-

selects himself or herself as a frequent binger has on average 33 percent lower earnings than a frequent binger with similar characteristics but who is drawn at random from a population of income-earners. As mentioned above, this bias results from individuals self-selecting themselves into drinking groups because of certain observable and unobservable characteristics which are associated with both drinking and earnings. For example, if the unobserved characteristis is a 'willingness to socialise' (Lee, 2003), this attribute might result in a person having an above average probability of being a frequent binger but because he or she socialises too often rather than works hard, he or she has a below average earnings.

To assess the impact of selectivity bias, earnings equations are estimated separately by drinker type assuming that there is no selection bias. Due to space constraint the detailed estimation results are not reported here. The exclusion of the IMRs from the earnings equations has, in general, little effect on the estimated coefficients and mostly affects the constant term. However, for the non binger and the frequent binger categories where selectivity biases are significant, the effect of excluding the IMRs is slightly more significant across a few observed characteristics.

4.3 Observed and Predicted Earnings Under Various Model Specifications

Table 4 depicts a range of observed and predicted log[4] of earnings using all the various models discussed above. The first row represents earnings based on observed data for the respective drinking categories. The remaining rows depict predicted earnings. It is interesting to see the effects on predicted earnings when the predictions are made using one set of 'average' characteristics for each drinker type (second row of predictions under M3 and M4 respectively). The estimates are quite close to the observed average earnings

[4]Natural logarithmic of real annual earnings before tax measured in Australian dollars.

Table 4: Observed and Predicted Earnings

	Abstainer	Non Binger	Occasional Binger	Frequent Binger
M1. Mean Earnings based on observed data	10.180	10.328	10.410	10.306
M2. Single Earnings equation with dummies for drinking status	10.174	10.262	10.331	10.310
M3. Separate earnings equations by drinking status excluding IMR				
Predicted earnings with 'average' characteristics for all drinking groups	10.222	10.313	10.381	10.389
Predicted earnings with 'average' characteristics for each drinking status	10.172	10.322	10.405	10.311
M4. Separate earnings equations by drinking status including IMR				
Predicted earnings with 'average' characteristics for all drinking groups	10.232	10.312	10.382	10.385
Predicted earnings with 'average' characteristics for each drinking status	10.184	10.329	10.403	10.288

Earnings are in natural logarithmic form.

and lower earnings are predicted for frequent bingers as compared to non bingers and occasional bingers. On the other hand, an 'average' set of characteristics for all drinking groups (first row of predictions under M3 and M4 respectively) smoothes the differential earnings across the four drinking groups. Here, the highest earnings are associated with frequent bingers. This tends to suggest that there are important earnings differential effects that can be attributed to individuals' characteristics and that need to be accounted for.[5] Finally, the set of predictions under M3 estimated by excluding the IMR can be compared to those under M4 where sample selectivity bias is accounted for. As expected, there does appear to be a discrepancy between the two set of predicted earnings, in particular, for abstainers and frequent bingers.

In summary, these results indicate that occasional bingers have the highest earnings among all four drinking groups. The findings therefore substantiate the literature on the inverted U-shaped drinking-earnings relationship. Prior studies have mostly grouped indi-

[5]Note that a simple OLS or single equation model for earnings fails to account for the differences due to individuals' characteristics.

viduals into abstainers, moderate drinkers and heavy drinkers. Those studies have found moderate drinkers to be the highest income earners. In this analysis, where individuals are categorised in terms of their bingeing behaviour, non bingers are found to earn more than abstainers but even higher earnings are associated with occasional bingers. Only the frequent bingers experience a drop-off in their earnings.

5 Earnings Differentials

To get more insight on the composite effect of individuals' characteristics on their earnings across the four drinking groups, earnings differentials across the groups are next estimated. According to Oaxaca (1973), earnings differentials can be decomposed into two components - the difference due to individuals' characteristics and the difference due to productivity. Extending Oaxaca's work, Idson and Feaster (1990) included a third component which represents differences arising from selection bias. The earnings differential between individuals with drinking status j and k is thus estimated as

$$\begin{aligned} E(\ln E_j|\overline{\mathbf{x}}_j) - E(\ln E_k|\overline{\mathbf{x}}_k) &= 0.5(\widehat{\beta}_j + \widehat{\beta}_k)(\overline{\mathbf{x}}_j - \overline{\mathbf{x}}_k) + (\widehat{\beta}_j - \widehat{\beta}_k)0.5(\widehat{\mathbf{x}}_j + \widehat{\mathbf{x}}_k) \\ &\quad + (\widehat{\theta}_j\overline{\lambda}_j - \widehat{\theta}_k\overline{\lambda}_k) \end{aligned} \tag{6}$$

where $\overline{\mathbf{x}}_j$ is the vector of sample means of observable characteristics for drinking group j, and $\overline{\lambda}_j$ is the mean IMR for drinking group j. Thus, the first term represents earnings gap attributed to differences in characteristics across drinking groups. The second term represents differences due to coefficients, or due to returns to the earnings-determining characteristics of workers. It suggests how the attributes, or characteristics, are rewarded and not as much the attributes themselves (in loose terms the 'productivity' of the worker). For instance, it suggests how a non binger's earnings will change if he/she starts bingeing frequently. The third term represents the earnings differentials due to the unobserved

characteristics of workers who self-select themselves into the respective drinking groups.

Standard errors for the earnings differentials and their respective components are estimated using simulation methods. In particular, 500 sets of parameters of the earnings equation for the respective drinking group are simulated from asymptotic normal distributions. Each time, earnings differentials and their components are calculated, thereby obtaining 500 sets of results. Sample standard errors are then calculated as estimates of the standard errors for the earnings differentials and their respective components.

5.1 Earnings differentials of non bingers and frequent bingers *vis-a-vis* abstainers

Table 5 reports a few earnings differentials and their decompositions. The first row of results depicts the average observed earnings differentials. Both non bingers and frequent bingers enjoy a positive premium over abstainers with differences as high as -0.1475 and -0.1254, respectively. Predicted earnings differentials and their decompositions are given in subsequent rows. The predicted earnings differential between non bingers and abstainers (column I) of -0.1447 is very close to the observed value. The predominant part of this differential is accounted by selectivity bias (-0.0949), although statistically insignificant, and differences in characteristics of the two drinking groups (-0.0594). The earnings differential attributable to differences in the regression coefficients is a negligible 0.0096 in favour of abstainers but statistically insignificant. This can further be decomposed into a part that is explained (differences due to returns to earnings-determining characteristics) and another part that is unexplained (differences in intercepts). Here, the explained component is quite substantial and negative (-0.3668) indicating that non bingers receive higher returns to their characteristics than abstainers. However, these returns are swamped by the equally large, but positive, unexplained difference of the intercepts (0.3763). This large intercept term results from the inability to account for other potential determinants

of earnings such as employees' skills, experience and spouse income.

The earnings differential between abstainers and frequent bingers (column II) is primarily driven by the difference in regression coefficients (-0.4998) while the selectivity bias is positive, significant and substantially large (0.3745) increasing the earnings gap in favour of abstainers. The difference of 0.0221 due to characteristics favours abstainers. These add up to an overall earnings differential of 0.1032 in favour of frequent bingers. The difference due to regression coefficients can further be split into an explained component of -0.1287 due to returns to characteristics while the major part of -0.3711 is due to the unexplained intercept differences. It appears that frequent bingers also receive higher returns to their characteristics than abstainers.

5.2 Earnings differentials of non bingers and abstainers *vis-a-vis* frequent bingers

The last two sets of results in Table 5 (Columns III and IV) depict the earnings differentials of frequent bingers *vis-a-vis* non bingers and occasional bingers, respectively. The predicted earnings differentials of -0.0415 and -0.1150 clearly indicate that non bingers and occasional bingers have higher earnings than frequent bingers. The earnings differential between frequent bingers and non bingers is primarily explained by the difference due to regression coefficients (0.5278) in favour of frequent bingers and a selectivity bias of 0.4694 in favour of non bingers. The difference due to coefficients entails a component that explains the difference due to returns to characteristics (-0.2197) which is again dominated by a large unexplained intercept difference of 0.7475. A similar differential structure holds for the earnings differential between frequent bingers and occasional bingers. In both cases, the negative returns to characteristics indicate that non bingers and occasional bingers receive higher returns to their characteristics than frequent bingers.

Table 5: Decomposition of Earnings Differentials

	$E_a - E_{nb}$ (I)		$E_a - E_{fb}$ (II)		$E_{fb} - E_{nb}$ (III)		$E_{fb} - E_{ob}$ (IV)	
Observed Earnings Differential	-0.1475		-0.1254		-0.0221		-0.1044	
Predicted Earnings Differential	-0.1447	(0.019)**	-0.1032	(0.023)**	-0.0415	(0.018)**	-0.1150	(0.017)**
Differences due to:								
1. Characteristics	-0.0594	(0.003)**	0.0221	(0.009)**	-0.0999	(0.008)**	-0.0899	(0.006)**
2. Coefficients (a+b)	0.0096	(0.086)	-0.4998	(0.162)**	0.5278	(0.148)**	0.2669	(0.151)*
(a) Returns to characteristics	-0.3668	(0.193)*	-0.1287	(0.199)	-0.2197	(0.148)	-0.1469	(0.141)
of which: Admin	*0.0011*	*(0.005)*	*0.0053*	*(0.006)*	*-0.0052*	*(0.005)*	*-0.0114*	*(0.006)**
Prof	*-0.0048*	*(0.015)*	*0.0129*	*(0.015)*	*-0.0177*	*(0.012)*	*-0.0190*	*(0.012)*
AsscProf	*0.0053*	*(0.007)*	*0.0138*	*(0.010)*	*-0.0083*	*(0.007)*	*-0.0134*	*(0.007)**
Traders	*0.0025*	*(0.007)*	*0.0159*	*(0.011)*	*-0.0128*	*(0.007)**	*-0.0277*	*(0.007)***
Clerical	*0.0029*	*(0.003)*	*0.0059*	*(0.003)**	*-0.0032*	*(0.002)*	*-0.0048*	*(0.002)***
Production	*0.0024*	*(0.005)*	*0.0083*	*(0.008)*	*-0.0050*	*(0.005)*	*-0.0137*	*(0.005)***
Service	*0.0045*	*(0.004)*	*0.0115*	*(0.005)***	*-0.0063*	*(0.004)**	*-0.0132*	*(0.003)***
Labourer	*0.0022*	*(0.005)*	*0.0166*	*(0.007)***	*-0.0113*	*(0.004)***	*-0.0156*	*(0.004)***
(b) Unexplained	0.3763	(0.212)*	-0.3711	(0.233)	0.7475	(0.187)**	0.4138	(0.177)**
3. Selection Bias	-0.0949	(0.094)	0.3745	(0.170)**	-0.4694	(0.152)**	-0.2920	(0.158)*

a: abstainers; *nb*: non binger; *ob*: occasional binger; *fb*: frequent binger.

Standard errors are given in parentheses. *significant at 10% level; **significant at 5% level.

Next, a further decomposition of the returns to individuals' observed characteristics is carried out in Table 5. It is interesting to note that although the overall earnings differentials favour non bingers and frequent drinkers to abstainers (*i.e.*, negative $E_a - E_{nb}$ and $E_a - E_{fb}$), the differential effects due to returns to observed 'occupational characteristics' are mostly positive, although generally statistically insignificant. This tends to indicate that in most occupations, abstainers would be 'more productive' or at least the same (*i.e.*, statistically insignificant differences) as non bingers and frequent bingers given their characteristics, although their overall earnings are lower. This is because these positive effects are offset by the large, negative differential effects from returns to age characteristics (see Table A.4 in the appendix that depicts the complete set of observable factors that contribute to earnings differentials). On the other hand, while the overall earnings differentials favour non bingers and occasional bingers to frequent bingers (*i.e.*, negative $E_{fb} - E_{nb}$ and $E_{fb} - E_{ob}$), the differential effects due to the 'occupational characteristics' are all negative. In other words, given their characteristics, for all occupations frequent bingers are 'less productive' than non bingers and occasional bingers. Finally, the size and significance of the selectivity terms highlight the importance of accounting for sample selection bias driven by endogeneity. Ignoring selectivity bias can result in over or underestimation of the effect of drinking on earnings.

6 Summary

This paper adds to this literature by investigating the impact of bingeing behaviour on earnings. The analysis is conducted on full-time Australians' workers in their prime working age and their drinking statuses are defined as abstainers, non bingers, occasional bingers and frequent bingers. Due to common unobservable factors that relate to both earnings and the propensity to drink, the relationship between drinking and earnings is potentially

endogenous. To account for endogeneity and allow flexibility, separate earnings equations are estimated by drinking status using a multinomial selectivity model that adjusts for selectivity bias due to workers' self-selection into the various drinking groups.

The results substantiate the empirical findings in the literature that drinking patterns impact on labour market outcomes. In particular, an inverted U-shaped relationship is found between drinking and earnings with a premium for non bingers and occasional bingers over abstainers, and an earnings penalty for frequent bingers. In addition, some important differential effects are observed across all four drinking groups. In particular, abstainers are found to have a flat age-earnings profile while the inverted U-shaped relationship between age and earnings is quite pronounced for frequent bingers. Education appears to generate a higher premium across all four drinking groups but the education-earnings profile is flatter for abstainers. Significant differential effects are observed across all four drinking groups by both industry of employment and occupation. Finally, significant selectivity bias is estimated for non bingers and frequent bingers, which highlights the importance of accounting for self-selection.

The second stage of the analysis entails a decomposition of the earnings differentials across the four groups. In particular, the decomposed earnings differentials have three contributing factors: selectivity, earnings-determining characteristics, and returns to the earnings-determining characteristics (or 'productivity'). The results indicate that abstainers earn less than non bingers and frequent bingers and also appear to be less 'productive'. However, a further decomposition of this 'productivity component' indicates that across all occupations, abstainers are at least as, if not more, 'productive' than drinkers. These results are, however, masked by a large unexplained component most likely resulting from omission of important earnings determinants, such as workers' experience and spouse income that are unavailable for the purpose of this analysis. On the other hand, across all

occupations frequent bingers are found to be less 'productive' than occasional bingers and non bingers. The decomposition also reveals an important contribution of selectivity bias to earnings differentials.

This analysis has made some important contributions to the extant literature. Most prior studies have grouped individuals in terms of abstainers, moderate drinkers and heavy drinkers, and have found moderate drinkers to have the highest earnings. In this analysis, individuals have been categorised in terms of their bingeing behaviour. The findings suggest that non bingers earn more than abstainers but occasional bingers have even higher earnings. Only the frequent bingers experience a drop-off in their earnings.

A Appendix

DEFINITION OF VARIABLES

Dependent Variables	
Levels of Alcohol Consumption	
Abstainer	if not consumed any alcohol in the past year.
$Y = 0$	
Non Binger	for males consuming less than 7 drinks and females consuming
$Y = 1$	less than five drinks on a single day.
Occasional Binger	for males consuming at least 7 drinks and females consuming
$Y = 2$	at least 5 drinks on a single day no more than three days a week.
Frequent Binger	for males consuming at least 7 drinks and females consuming
$Y = 3$	at least 5 drinks on a single day on more than three days a week.
Ln(W)^p: natural logarithm of real personal annual income before tax measured in Australian Dollars.	

Explanatory Variables

$\mathbf{P}^{alc}$: natural logarithm of real price index of alcohol (state specific).

Educational Attainment

Degree: 1 if the highest qualification is a tertiary degree, 0 otherwise.

Mid-edu: 1 if highest qualification is a non-tertiary diploma, trade or non-trade certificate or at least year 12, 0 otherwise.

LessYr12: 1 if the highest qualification is less than year 2, and 0 otherwise (used as the reference category).

Main Occupation

Work: 1 if employed part-time or full-time, and 0 otherwise.

Study: 1 if mainly study, 0 otherwise.

Unemp: 1 if unemployed, 0 otherwise.

Otheract: 1 if retired, on pension or performing home duties, 0 otherwise (used as the reference category).

Health

Excelhlth: 1 if health is perceived as very good or excellent, 0 otherwise.

Goodhlth: 1 if health is perceived as fair to good, 0 otherwise.

Poorhlth: 1 if health is perceived as poor, 0 otherwise (used as the reference category).

State

NSW: 1 if from New South Wales, 0 otherwise (used as the reference category).

VIC: 1 if from Victoria, 0 otherwise.

QLD: 1 if from Queensland, 0 otherwise.

SA: 1 if from South Australia, 0 otherwise.

WA: 1 if from Western Australia, 0 otherwise.

TAS: 1 if from Tasmania, 0 otherwise.

ACT: 1 if from Australian Capital Territory, 0 otherwise.

NT: 1 if from Northern Territory, 0 otherwise.

Industry

Primary: 1 if working in primary industry, 0 otherwise.

Manufac: 1 if working in manufacturing industry, 0 otherwise.

Utils & Cons: if working in utilities and construction industry, 0 otherwise.

Trade: 1 if working in trade industry, 0 otherwise (used as the reference category).

Transport: 1 if working in transport and storage industry, 0 otherwise.

Communic: 1 if working in communications services industry, 0 otherwise.

Finance: 1 if working in finance industry, 0 otherwise.

Govt Admin: 1 if working in govt. administration and defence industry, 0 otherwise.

Education: 1 if working in education industry, 0 otherwise.

Health: 1 if working in health and community services industry, 0 otherwise.

Recreational: 1 if working in cultural and recreational services industry, 0 otherwise.

Personal: 1 if working in personal and other services industry, 0 otherwise.

Occupation

Admin: 1 if occupation falls under 'managers and administrators', 0 otherwise.

Prof: 1 if occupation falls under 'professionals', 0 otherwise.

AsscProf: 1 if occupation falls under 'associate professionals', 0 otherwise.

Traders: 1 if occupation falls under 'tradesperson and related workers', 0 otherwise.

Clerical: 1 if occupation falls under 'advanced clerical and service workers', 0 otherwise.

Sales: 1 if occupation falls under 'intermediate clerical, sales and service workers', 0 otherwise (used as the reference category).

Production: 1 if occupation falls under 'intermediate production and transport workers', 0 otherwise.

Service: 1 if occupation falls under 'elementary clerical, sales and service workers', 0 otherwise.

Labourer: 1 if occupation falls under 'labourers and related workers', 0 otherwise.

Other

Age: natural logarithm of age of respondent.

Agesq: square of Age variable.

Male: 1 for male, 0 otherwise.

Married: 1 if married or *de facto,* and 0 otherwise.

Depchld: 1 if there are preschool children in the household, 0 otherwise.

Singpar: 1 if coming from a single parent household, 0 otherwise.

Capital: 1 if resides in a capital city, 0 otherwise.

ATSI: 1 if respondent is of Aboriginal or Torres Strait Islander origin, 0 otherwise.

Yngdrnk: 1 if started drinking before age 18.

Table A.1: Guidelines for Alcohol Consumption

	Low risk	**Risky** (standard drinks)	**High risk**
For risk of harm in the short-term:			
MALES			
On any one day	up to 6 on any one day, no more than 3 days per week	7 to 10 on any one day	11 or more on any one day
FEMALES			
On any one day	up to 4 on any one day, no more than 3 days per week	5 to 6 on any one day	7 or more on any one day
For risk of harm in the long-term:			
MALES			
On an average day	up to 4 per day	5 to 6 per day	7 or more per day
Overall weekly level	up to 28 per week	29 to 42 per week	43 or more per week
FEMALES			
On an average day	up to 2 per day	3 to 4 per day	5 or more per day
Overall weekly level	up to 14 per week	15 to 28 per week	29 or more per week

Note: It is assumed that the drinks are consumed at a moderate rate to minimise intoxication, *e.g.* for men, no more than 2 drinks in the first hour and 1 per hour thereafter, and for women, no more than 1 drink per hour. Applies to persons of average or larger size, *i.e.* above about 60 kg for men and 50 kg for women. Persons of smaller than average body size should drink within lower levels.

Source: National Health and Medical Research Council (NHMRC, 2001)

Table A.2: Summary Statistics by Drinking Status

	Abstainer	Non Binger	Occasional Binger	Frequent Binger
Mean:				
Earnings[a]	10.180	10.328	10.410	10.306
Age	42.859	43.693	38.500	39.673
%:				
Capital	70.843	69.278	66.422	59.508
Male	46.194	51.350	56.757	63.131
Married	70.035	73.050	68.749	56.781
Depchld	14.573	13.606	17.244	10.478
Singpar	4.884	5.772	7.154	6.746
ATSI	1.827	0.956	1.151	2.471
Yngdrnk	31.014	59.931	83.449	84.955
Degree	32.187	34.005	34.550	20.456
Mid-edu	44.105	46.819	49.441	55.468
LessYr12[b]	23.399	19.039	15.884	23.969
Excelhlth	59.8592	60.1177	57.0139	42.2553
Goodhlth	39.0845	39.2048	42.3889	56.1892
Poorhlth[b]	1.0563	0.6775	0.5972	1.5554
Industry:				
Primary	2.751	3.453	4.851	4.654
Manufac	12.092	10.277	10.319	12.526
Util & Cons	2.815	3.908	4.331	5.441
Trade[b]	16.507	14.179	15.110	19.507
Transport	4.607	4.991	5.182	6.845
Communic	3.135	1.715	1.913	1.985
Finance	15.867	16.474	18.982	16.632
Govt Admin	7.230	7.628	8.587	6.708
Education	10.173	12.382	8.361	5.749
Health	15.995	15.196	11.223	8.624
Recreat	1.663	2.200	2.802	2.122
Personal	4.223	3.560	3.977	3.696
Occupation:				
Admin	5.932	9.176	11.598	8.380
Prof	25.983	28.724	26.317	16.274
AsscProf	12.830	13.650	15.647	15.028
Traders	9.478	10.205	11.781	17.521
Clerical	2.901	3.086	3.075	2.909
Sales[b]	20.245	17.813	16.865	15.235
Production	7.157	6.580	5.540	10.803
Service	6.512	5.084	4.429	4.571
Labourer	8.511	5.395	4.399	9.141

[a]used as the reference category in the estimation.
[b]Natural logarithmic of real annual earnings before tax measured in Australian dollars.

Table A.3: First-stage Drinking Status Choice Model Estimates

	Non Binger		Occasional Binger		Frequent Binger	
Constant	-1.823	(8.068)	-6.219	(8.445)	8.578	(10.676)
Age	2.616	(3.705)	8.002	(3.888)**	-1.969	(4.923)
Agesq	-0.236	(0.503)	-1.263	(0.529)**	0.166	(0.671)
Male	0.051	(0.058)	0.242	(0.061)**	0.541	(0.079)**
Married	0.133	(0.065)**	0.027	(0.069)	-0.547	(0.085)**
Depchld	-0.094	(0.087)	-0.291	(0.090)**	-0.603	(0.124)**
Singpar	0.281	(0.132)**	0.507	(0.136)**	0.143	(0.169)
ATSI	-0.577	(0.231)**	-0.551	(0.242)**	0.119	(0.274)
Yngdrnk	1.259	(0.060)**	2.259	(0.064)**	2.454	(0.094)**
Capital	-0.035	(0.062)	-0.195	(0.065)**	-0.404	(0.081)**
Degree	0.298	(0.078)**	0.349	(0.083)**	-0.544	(0.110)**
Mid-Edu	0.266	(0.073)**	0.324	(0.078)**	0.023	(0.096)
P^{alc}	-0.832	(0.929)	-1.330	(0.978)	-1.020	(1.251)

Standard errors are given in parentheses. *significant at 10% level;

**significant at 5% level.

Table A.4: Decomposition of Earnings Differentials due to Returns to Characteristics

	$E_a - E_{nb}$		$E_a - E_{fb}$		$E_{fb} - E_{nb}$		$E_{fb} - E_{ob}$	
Ret. to Charac.	-0.3668	(0.193)*	-0.1287	(0.199)	-0.2197	(0.148)	-0.1469	(0.141)
of which:								
Age:30-34	-0.0013	(0.009)	-0.0117	(0.010)	0.0097	(0.006)	0.0069	(0.008)
35-39	-0.0245	(0.009)**	-0.0316	(0.011)**	0.0044	(0.007)	0.0044	(0.008)
40-44	-0.0220	(0.010)**	-0.0201	(0.011)	-0.0010	(0.008)	0.0083	(0.007)
45-49	-0.0221	(0.011)**	-0.0120	(0.012)	-0.0085	(0.008)	0.0029	(0.007)
50-54	-0.0365	(0.011)**	-0.0249	(0.010)**	-0.0054	(0.008)	0.0077	(0.006)
55-60	-0.0319	(0.010)**	-0.0082	(0.009)	-0.0161	(0.007)**	-0.0019	(0.004)
Male	-0.0437	(0.017)**	0.0075	(0.025)	-0.0595	(0.021)**	-0.0478	(0.021)**
Married	0.0334	(0.023)	-0.0490	(0.029)*	0.0808	(0.023)**	0.0670	(0.022)**
ATSI	0.0007	(0.002)	0.0016	(0.003)	-0.0004	(0.002)	-0.0026	(0.002)
Capital	0.0111	(0.025)	-0.0069	(0.027)	0.0172	(0.021)	0.0183	(0.020)
Degree	-0.0480	(0.017)**	-0.0279	(0.020)	-0.0105	(0.016)	-0.0049	(0.016)
Mid-Edu	-0.0405	(0.020)**	-0.0359	(0.026)	-0.0089	(0.018)	-0.0146	(0.020)
Excelhlth	-0.0550	(0.098)	0.0461	(0.091)	-0.0930	(0.063)	-0.0317	(0.062)
Goodhlth	-0.0138	(0.064)	0.0800	(0.084)	-0.0972	(0.058)*	-0.0642	(0.060)
VIC	-0.0039	(0.009)	-0.0203	(0.010)*	0.0178	(0.008)**	0.0115	(0.008)
QLD	-0.0041	(0.007)	-0.0068	(0.010)	0.0022	(0.007)	0.0020	(0.007)
SA	-0.0098	(0.005)**	-0.0095	(0.006)	-0.0003	(0.004)	-0.0002	(0.005)
WA	0.0008	(0.006)	0.0010	(0.007)	-0.0002	(0.005)	-0.0068	(0.005)
TAS	-0.0026	(0.003)	-0.0004	(0.004)	-0.0036	(0.003)	0.0010	(0.003)
ACT	-0.0051	(0.004)	-0.0052	(0.005)	0.0014	(0.004)	0.0025	(0.004)
NT	-0.0044	(0.004)	-0.0045	(0.006)	-0.0012	(0.004)	0.0014	(0.004)
Industry								
Primary	0.0007	(0.003)	0.0001	(0.004)	0.0008	(0.003)	0.0000	(0.004)
Manufac	-0.0101	(0.007)	-0.0133	(0.009)	0.0019	(0.006)	0.0018	(0.006)
Utils & Cons	-0.0094	(0.005)*	-0.0190	(0.007)**	0.0082	(0.005)	0.0097	(0.006)*
Transport	-0.0031	(0.004)	-0.0062	(0.005)	0.0025	(0.004)	0.0020	(0.004)
Communic	-0.0034	(0.002)	-0.0026	(0.003)	-0.0006	(0.002)	-0.0006	(0.002)
Finance	-0.0113	(0.009)	-0.0152	(0.011)	0.0039	(0.008)	-0.0001	(0.009)
Govt Admin	0.0026	(0.005)	0.0039	(0.006)	-0.0014	(0.004)	-0.0024	(0.005)
Education	-0.0100	(0.008)	-0.0140	(0.008)*	0.0078	(0.006)	0.0073	(0.005)
Health	-0.0041	(0.010)	-0.0057	(0.009)	0.0023	(0.007)	-0.0011	(0.006)
Recreat	-0.0024	(0.002)	-0.0018	(0.003)	-0.0005	(0.002)	-0.0022	(0.002)
Personal	-0.0089	(0.003)**	-0.0065	(0.004)	-0.0023	(0.003)	-0.0021	(0.003)
Occupation								
Admin	0.0011	(0.005)	0.0053	(0.006)	-0.0052	(0.005)	-0.0114	(0.006)*
Prof	-0.0048	(0.015)	0.0129	(0.015)	-0.0177	(0.012)	-0.0190	(0.012)
AsscProf	0.0053	(0.007)	0.0138	(0.010)	-0.0083	(0.007)	-0.0134	(0.007)*
Traders	0.0025	(0.007)	0.0159	(0.011)	-0.0128	(0.007)*	-0.0277	(0.007)**
Clerical	0.0029	(0.003)	0.0059	(0.003)*	-0.0032	(0.002)	-0.0048	(0.002)**
Production	0.0024	(0.005)	0.0083	(0.008)	-0.0050	(0.005)	-0.0137	(0.005)**
Service	0.0045	(0.004)	0.0115	(0.005)**	-0.0063	(0.004)*	-0.0132	(0.003)**
Labourer	0.0022	(0.005)	0.0166	(0.007)**	-0.0113	(0.004)**	-0.0156	(0.004)**

a: abstainers; *nb*: non binger; *ob*: occasional binger; *fb*: frequent binger.
Standard errors are given in parentheses. *significant at 10% level; **significant at 5% level.

References

ABS (2006a). Consumer price index 14th series: By region, all groups. Cat. No. 640101b. Australian Bureau of Statistics: Canberra.

ABS (2006b). National aboriginal and torres strait islander health survey 2004-05, cat. no. 4715.0. Australian Bureau of Statistics: Canberra.

Auld, M. (2005). Smoking, Drinking, and Income. *Journal of Human Resources 40*(2), 505.

Barrett, G. F. (2002). The effect of alcohol consumption on earnings. *Economic Record 78*(240), 79–96.

Baum-Baicker, C. (1985). The health benefits of moderate alcohol consumption: A review of the literature. *Drug Alcohol Dependence 15*(3), 207–27.

Becker, G. S. and K. M. Murphy (1988). A theory of rational addiction. *Journal of Political Economy 96*(4), 675–700.

Berger, M. C. and J. P. Leigh (1988). The effect of alcohol use on wages. *Applied Economics 20*(10), 1343–51.

Bound, J., D. A. Jaeger, and R. M. Baker (1995). Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association 90*, 430–443.

Chaloupka, F. J. and H. Wechsler (1996). Binge drinking in college: The impact of price, availability, and alcohol control policies. *Contemporary Economic Policy 14*(4), 112–124.

Collins, D. J. and H. M. Lapsley (2002). Counting the cost: estimates of the social costs

of drug abuse in australia in 1998-99. National Drug Strategy Monograph Series No. 49. Commonwealth Department of Health and Ageing: Canberra.

Dave, D. (2004). Illicit drug use among arrestees and drug prices. NBER Working Paper No. 10648, National Bureau of Economic Research, Cambridge, MA.

Dee, T. S. (1999). The complementarity of teen smoking and drinking. *Journal of Health Economics 18*(6), 769–793.

Denke, M. (2000). Nutritional and health benefits of beer. *Americal Journal of Medical Sciences 320*(5), 320–326.

Fagrell, B., U. De Faire, S. Bondy, M. Criqui, M. Gaziano, M. Gronbaek, R. Jackson, A. Klatsky, J. Salonen, and A. Shaper (1999). Frontiers in medicine the effects of light to moderate drinking on cardiovascular diseases. *Journal of Internal Medicine 246*(4), 331–340.

French, M. T. and G. A. Zarkin (1995). Is moderate alcohol use related to wages? evidence from four worksites. *Journal of Health Economics 14*(3), 319–344.

French, M. T., G. A. Zarkin, and L. J. Dunlap (1998). Illicit drug use, absenteeism, and earnings at six u.s. worksites. *Contemporary Economic Policy 16*(3), 334–346.

Gill, A. and R. Michaels (1992). Does drug use lower wages? *Industrial and Labor Relations Review 45*(3), 419–34.

Gmel, G. and J. Rehm (2003). Harmful Alcohol Use. *Alcohol Research & Health 27*(1), 52–63.

Hamilton, V. and B. H. Hamilton (1997). Alcohol and earnings: Does drinking yield a wage premium? *Canadian Journal of Economics 30*(1), 135–151.

Heckman, J. (1974). Shadow Prices, Market Wages, and Labor Supply. *Econometrica 42*(4), 679–694.

Heckman, J. (1979). Sample selection bias as a specification error. *Econometrica 47*(1), 153–161.

Heckman, J. (1995). Instrumental variables: A cautionary tale. NBER Technical Working Paper No.185, National Bureau of Economic Research, Cambridge, MA.

Heien, D. M. (1996). Do drinkers earn less? *Southern Economic Journal 63*(1), 60–68.

Idson, T. L. and D. J. Feaster (1990). A selectivity model of employer-size wage differentials. *Journal of Labor Economics 8*(1), 99–122.

Kenkel, D., D. Ribar, P. Cook, and S. Peltzman (1994). Alcohol Consumption and Young Adults' Socioeconomic Status. *Brookings Papers on Economic Activity. Microeconomics 1994*, 119–175.

Laixuthai, A. and F. J. Chaloupka (1993). Youth alcohol use and public policy. *Contemporary Policy Issues 11*(4), 70–81.

Lee, L. (1983). Notes and comments generalised econometric models with selectivity. *Econometrica 51*(2), 507–512.

Lee, Y. (2003). Wage Effects of Drinking in Australia. *The Australian Economic Review 36*(3), 265–282.

Lye, J. N. and J. Hirschberg (2004, 2004/09/10/). Alcohol consumption, smoking and wages. *Applied Economics 36*(16), 1807–1817.

MacDonald, Z. and S. Pudney (2000). Illicit drug use, unemployment, and occupational attainment. *Journal of Health Economics 19*(6), 1089–1115.

MacDonald, Z. and M. A. Shields (2001). The impact of alcohol consumption on occupational attainment in england. *Economica 68*(271), 427–453.

MacDonald, Z. and M. A. Shields (2004). Does problem drinking affect employment? evidence from england. *Health Economics 13*(2), 139–155.

Mangione, T., J. Howland, B. Amick, J. Cote, M. Lee, N. Bell, and S. Levine (1999). Employee Drinking Practices and Work Performance. *Journal of Studies on Alcohol 60*(2), 261–262.

Manning, W. G., L. Blumberg, and L. H. Moulton (1995). The demand for alcohol: The differential response to price. *Journal of Health Economics 14*(2), 123–148.

Mullahy, J. and J. Sindelar (1996). Employment, unemployment, and problem drinking. *Journal of Health Economics 15*(4), 409–434.

Murphy, K. and R. Topel (1985). Estimation and Inference in Two-Step Econometric Models. *Journal of Business & Economic Statistics 3*(4), 370–379.

NDSHS (2004). Computer files, national drug strategy household surveys, 1988, 1991, 1993, 1995, 1998, 2001 and 2004, social science data archives. Australian National University: Canberra.

NHMRC (2001). Australia alcohol guidelines: Health risks and benefits. National Health and Medical Research Council, Commonwealth of Australia: Canberra.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review 14*(3), 693–709.

Peters, B. L. (2004). Is there a wage bonus from drinking? unobserved heterogeneity examined. *Applied Economics 36*(20), 2299–2315.

Peters, B. L. and E. Stringham (2006). No booze? you may lose: Why drinkers earn more money than nondrinkers. *Journal of Labor Research 27*(3), 411–421.

Terza, J. V. (2002). Alcohol abuse and employment: A second look. *Journal of Applied Econometrics 17*(4), 393–404.

Trost, R. and L. Lee (1984). Technical Training and Earnings: A Polychotomous Choice Model With Selectivity. *The Review of Economics and Statistics 66*(1), 151–156.

Vasse, R., F. Nijhuis, and G. Kok (1998). Associations between work stress, alcohol consumption and sickness absence. *Addiction 93*(2), 231–241.

Williams, J., F. J. Chaloupka, and H. Wechsler (2002). *Are There Differential Effects of Price and Policy on College Students' Drinking Intensity?* Blackwell Synergy.

Wooldridge, J. (2002). *Econometric Analysis of Cross-Section and Panel Data*. MIT Press.

Zarkin, G. A., M. T. French, T. Mroz, and J. W. Bray (1998). Alcohol use and wages: New results from the national household survey on drug abuse. *Journal of Health Economics 17*(1), 53–68.

Zarkin, G. A., T. A. Mroz, J. W. Bray, and M. T. French (1998). The relationship between drug use and labor supply for young men. *Labour Economics 5*(4), 385–409.