THE EFFECTS OF ALCOHOL CONSUMPTION ON EARNINGS IN AUSTRALIA

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Honours Thesis

Bachelor of Arts/Bachelor of Economics (Honours)

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9th June 2009

DECLARATION

I hereby declare that this submission is my own work and any contributions or materials by other authors used in this thesis have been appropriately acknowledged. This thesis has not been previously submitted to any other university or institution as part of the requirements for another degree or award.

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9th June 2009

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Associate Professor Garry Barrett, for his support and assistance throughout my Honours year, for his always timely advice and for writing a paper that inspired my topic. I'd like to thank Associate Professor Peter Kriesler for helping me to get started in Honours. Thanks also to Professor Denzil Fiebig for helping to make econometrics seem intuitive and to Dr Shiko Maruyama for helping to develop my interest in this area.

A big thankyou to both cohorts of Honours students with whom I've shared my Honours year for making the experience that much easier. Finally, thanks to my family and friends, who have seen a lot less of me since thesis writing began, but who have offered all the support I could have hoped for.

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ABSTRACT

The effects of alcohol consumption on health have been of interest to researchers in the medical literature for some time now. This has spilled over into an interest in the economic literature of the effects of alcohol consumption of earnings. The exact nature of this research varies from the effect of alcohol on productivity for those in full-time work, to its effect on labour market participation. This thesis contributes to the literature about the effect of alcohol consumption on earnings through productivity and looks specifically at the issue using recent Australian data.

This is the first research that has been done in this area using the Household Income and Labour Dynamics Australia (HILDA) dataset. It also bases definitions of what is termed heavy alcohol consumption on recently revised guidelines about safe drinking behaviour. Using wave 7 of the HILDA dataset, an extension of the Heckman selection model is used to estimate separate log earnings regressions for abstainers, moderate drinkers and heavy drinkers. Earnings decompositions are then used to analyse whether differences in earnings between drinker groups are attributable to differences in the average level of characteristics or to differences in the productivity returns to those characteristics.

The results show that moderate drinkers receive an earnings premium relative to abstainers that is largely attributable to productivity returns. Heavy drinkers receive a small earnings penalty relative to moderate drinkers, although this is largely due to differences in characteristics rather than differences in productivity returns. These results are found to be sensitive to the definition of the different drinking status groups.

1. INTRODUCTION

In today's society there is an increasing focus on wanting to maintain a healthy lifestyle. Maintaining good health allows us to make the most of other areas in our lives, including work, spending time with family or other leisure time. Smoking and obesity are frowned upon, their negative health implications are widely known and government campaigns are in place to promote awareness of their health impacts. Over recent years in Australia excessive drinking has also been brought under the umbrella of bad health behaviour in public discussion.

The current Federal government is making an effort to tackle our apparent culture of excessive drinking. These efforts have included discussion of health warnings on alcohol packaging (like those currently in place for tobacco products) and banning alcohol sponsorship and advertising in professional sports (Sinclair, 2008b). In early 2008, new policy initiatives in this area have included a commitment of $53 million to tackle this apparent problem of binge drinking and, most recently, a tax on "alcopops" (Sinclair 2008a). This attention coincides with recent downward revisions, by both American and Australian national health bodies, to what is considered a safe level of drinking.

An important economic issue in relation to risky health behaviour is whether an investment in our health, or human capital, through pursuing good health behaviour, corresponds to positive effects in other areas of our lives. This thesis looks at one particular aspect of this problem, whether drinking alcohol affects our human capital in a way that is reflected in work productivity. As such, if alcohol consumption affects work productivity, this should be reflected in the earnings of workers.

The debate about the health effects of alcohol makes this a somewhat complicated and, as such, interesting analysis. There is unqualified acceptance that heavy drinking is damaging to an individual's health and personal relationships. A flipside to these known effects of heavy drinking, there has also been active debate in the medical literature about whether low levels of drinking are actually beneficial for health, in reducing stress, preventing cardiovascular disease and potentially protecting against other diseases (Ashley et al, 2000; Castelnuovo et al, 2002; Bryson et al, 2006).

Even more controversial is the debate about where the line can be drawn between safe and unsafe drinking levels. However, it would seem that there does exist a U-shaped relationship between alcohol consumption and health. The implication is that low levels of alcohol consumption can afford health benefits, but as consumption increases its effects become damaging, with a wide variety of potential health and psychological impacts, including memory loss (Verster et al, 2003; Baglietto et al, 2006). These negative health effects act as a disinvestment in human capital, hence it is expected that they will lead to lower levels of earnings.

Alcohol's status as a social drug also throws up other issues for consideration. A certain level of alcohol consumption may act as an indication of social networking. People who drink socially may be forming networks, particularly if that social drinking is done with work colleagues. Therefore, a certain level of drinking may also have social networking benefits that are reflected in earnings.

For my research, I have classified individuals as belonging to one of three different groups in relation to their alcohol consumption: abstainers, moderate drinkers and heavy drinkers. The

reason for this is to try and separate the potentially positive productivity effects of a safe or moderate level of drinking from the potentially negative effects of a heavy level of drinking. This classification will also reflect the U-shaped effects of alcohol consumption discussed in the medical literature.

In an economic sense, there are three main ways in which alcohol consumption may affect earnings. First of all, it can affect the probability of actually being employed. Once employed, it may affect productivity through on the job performance. It may also affect the level of earnings attained as social networking may improve the likelihood of promotion. My research focuses on the effect of alcohol consumption on the earnings of those already in full-time employment. As such, my research does not deal with the issue of how alcohol consumption affects the probability of being employed. Nor does it deal directly with its effect on the probability of being promoted. Rather, it focuses on whether alcohol consumption affects the earnings of workers, which may reflect either the effects of on the job performance or more rapid promotion through the ranks as a result of social networking.

The model used in my research attempts to determine whether an individual's drinking status, as an abstainer, moderate drinker or heavy drinker, has an effect on their earnings. A significant obstacle to the econometric modelling of this effect is that drinking status is potentially endogenous to earnings. This endogeneity problem arises largely because workers may self-select into drinking status. Another problem is that it is preferable to perform the estimations with a form that is flexible enough to allow the returns to observable characteristics to vary by drinking status, in order to compare the productivity returns between drinker groups.

As such, I use a Heckman selection model to estimate three separate log earnings equations, one for abstainers, one for moderate drinkers and one for heavy drinkers. By estimating these three log earnings equations, it is possible to compare the returns to observable characteristics for each drinker type. The Heckman selection model corrects for the non-random, truncated samples that are created by dividing the original sample into three sub-groups. The variables included in the exclusion restriction of the selection equation act as instrumental variables, which control for the potential endogeneity problem. Following these log earnings estimations, earnings decompositions are used to gain a sense of whether differences in earnings between drinker types are atrributable to differences in the average level of observable characteristics of each drinker group or whether they are due to the difference in returns to those characteristics.

While similar studies have been done in Australia and abroad, they have used much older data than that used for this research and they were published before the recent downwards revisions of safe drinking levels. This study makes use of the Household Income and Labour Dynamic in Australia (HILDA) dataset, which has not previously been used for this research area. HILDA provides a rich source of variables relevant to the empirical modelling of this issue, including potential instrumental variables. The data used by several Australian papers in this area is now two decades old (Barrett, 2002 and Lye & Hirschberg, 2004). The data source used for these papers was the National Health Survey (NHS) 1989-1990 performed by the Australian Bureau of Statistics (ABS).

HILDA is arguably a richer source of data for this topic than the NHS and has the advantage of providing data collected very recently. I am using wave 7 of the HILDA panel dataset.

This wave was collected in 2007 and had only been available for four months at the time of submission.

This thesis also looks at the effects of drinking status on earnings in light of recently revised safe drinking guidelines. Revised guidelines have been published by both the American National Institutes of Health (NIH) and the Australian National Health and Medical Research Council (NHMRC). Previous research by Hamilton & Hamilton (1997) and Barrett (2002) had defined their demarcation between moderate and heavy drinking based on previous safe drinking guidelines that were significantly more generous than the current ones.

The findings of this research reflect those of previous research in this area, showing that there is an earnings premium to moderate drinking (Hamilton & Hamilton, 1997 & Barrett, 2002) . This premium is largely the result of higher productivity returns to observable characteristics for moderate drinkers over abstainers. There is also found to be a small earnings penalty for heavy drinking relative to moderate drinking. However, this penalty is not large enough to cancel out the positive earnings effects of alcohol consumption over abstention. This finding reflects those of previous research that looks at the effects of general alcohol consumption on earnings (Hamilton & Hamilton, 1997 & Barrett, 2002), but does not reflect the findings of research focusing only on binge drinking (Keng & Huffman, 2002) . However, these results are found to be sensitive to the definition of drinker types. For definitions of heavy drinking that give a very low safe drinking threshold, these productivity returns disappear almost entirely. For definitions of heavy drinking that give a very high threshold, these effects are accentuated.

2. BACKGROUND TO "SAFE" DRINKING LEVELS

In Australia, safe drinking guidelines have been published by the National Health and Medical Research Council (NHMRC). The NHMRC is a Federal Government peak body responsible for, amongst other goals, "supporting health and medical research [and] developing health advice for the Australian community" (NHMRC, 2009a). The most recent NHMRC "Australian Guidelines: to reduce health risks from drinking" (2009b), published in February 2009 are an update of previous guidelines published in 2001.

The NHMRC guidelines are based upon a literature review of epidemiological studies and modelling based on a range of Australian data sources (NHMRC, 2009b, p.9). The current guidelines specify that an acceptable level of alcohol consumption for healthy men and women is no more than two standard drinks per day in order to prevent the lifetime risk of harm from alcohol-related disease or injury. It also specifies that no more than four standard drinks should be consumed on any single occasion in order to reduce the risk of alcohol-related injury arising from that occasion, though this will still contribute to the lifetime risk of harm (NHMRC, 2009b, p.2-3). In Australia, and under these guidelines, a standard drink is defined as containing 10 grams of pure alcohol.

The 2009 guidelines are an update of "The Australian alcohol guidelines: health risks and benefits" (NHMRC, 2001). In these 2001 guidelines, healthy drinking levels were defined separately for men and women. For men, safe drinking was defined as an average of no more than four standard drinks per day and no more 28 standard drinks per week, with strictly no more than six standard drinks on any day and one to two alcohol free days per week.

For women the recommended levels were slightly lower with an average of no more than two standard drinks per day and no more than 14 standard drinks per week, as well as a strict limit of four standard drinks on any day and one to two alcohol free days per week (NHMRC, 2001, p. 6). The 2009 guidelines argue that safe drinking levels were revised downwards based on research made available after publication of the 2001 guidelines and a new approach to developing population health guidance (NHMRC, 2009, p. 1).

An alternative set of guidelines are those published by the US National Institutes of Health (NIH), titled "Rethinking Drinking: Alcohol and your health" (NIH, 2009a). The NIH has similar goals to those of the NHMRC in Australia, to act as "the steward of medical and behavioural research for the Nation [and to apply] knowledge to extend healthy life and reduce the burdens of illness and disability" (NIH, 2009b).

These guidelines also specify different levels of safe drinking for men and women. For men it is recommended to have no more than four drinks on any one day and no more than 14 drinks per week. Women are recommended to have no more than three drinks per day and no more than seven drinks per week.

In these American guidelines a standard drink is classified as containing 14 grams of pure alcohol. So, when converted to the Australian definition of a standard drink, the NIH recommendations for men imply no more than 56 grams of pure alcohol on any one day, or five to six Australian standard drinks, and no more than 196 grams of pure alcohol per week, or between 19 and 20 Australian standard drinks per week. From here on, the term "standard drink" will always refer to the Australian definition as this is the definition used by the HILDA data.

I chose the current NIH classification of safe drinking levels as the basis for my preferred demarcations between abstainers, moderate drinkers and heavy drinkers. In terms of this analysis, the NIH guidelines offered two main advantages over other definitions. First of all, it provided a limit to acceptable drinking levels across both the frequency and intensity dimensions of alcohol consumption, unlike the current NHMRC guidelines or the definitions used by Hamilton & Hamilton (1997) and Barrett (2002) which cap intensity only. Secondly, it provided a middle ground for the intensity aspect of drinking between the very low levels recommended by the current NHMRC guidelines and the quite high levels defined by Hamilton & Hamilton (1997) and Barrett (2002). Nevertheless, the construction of this variable is subject to sensitivity analysis as part of this research.

3. LITERATURE REVIEW

There is a small literature that looks specifically at the effects of alcohol consumption on earnings. This literature is situated within two broader themes. The first of these looks at the impact of alcohol consumption on earnings through its effect on labour market participation. The second looks at the effects of alcoholism, smoking and other drug consumption on earnings or labour market participation.

The idea of modelling the impact of alcohol consumption on earnings was first implemented by Berger & Leigh (1988). Their empirical work uses the 1972-1973 Quality of Employment Survey of US civilians aged 16 or over and working 20 or more hours a week. In order to model this effect, the authors divided their sample between drinkers and non-drinkers, which are then divided again between males and females. As a result, four separate log earnings regressions are estimated using the two-stage Heckman selection model as developed by Heckman (1979).

In order to compare the earnings between drinkers and non-drinkers, a type of earnings decomposition is performed, comparing actual and predicted wages for both men and women. The authors find that even after controlling for observable explanatory variables and selection bias, drinkers earn higher wages than non-drinkers. The authors attribute this finding largely to the possibility of moderate alcohol consumption having beneficial effects or to heavy drinkers having to drop out of the labour force once they develop health problems.

Mullahy & Sindelar (1993) find a negative effect of alcoholism, as distinct from general alcohol consumption, on earnings. This finding highlights that the model used by Berger & Leigh (1988) may not be flexible enough to pick up the potentially negative effect of heavy

levels of drinking on earnings. Mullahy & Sindelar (1993) consider two impacts of alcoholism on income. These are both the impact on the likelihood of working and the impact on actual earnings, for those who are already working. The authors use a Heckman selection model where the first step is a probit model estimation of whether an individual is in full-time work and the second is a log earnings equation estimated using OLS.

The authors find that the first effect, that of alcoholism on the likelihood of working, is the most economically significant one but that there is also a negative effect of alcoholism on earnings after controlling for variables correlated with alcoholism. The seemingly contradictory findings presented by Berger & Leigh (1988) and Mullahy & Sindelar (1993) are the result of an analysis of different behaviours, the former looking at general alcohol consumption and the latter at alcohol dependency. The implication is that there needs to be a careful demarcation between the definition of drinking in what is deemed to be a healthy quantity and drinking heavily, or to the point of dependency, when analysing the effects of alcohol consumption on earnings.

The discrepancy between the findings of Berger & Leigh (1988) and Mullahy & Sindelar (1993) clearly left room for further work to be done in modelling the expected negative effects of heavy drinking and in the interpretation of the mechanisms through which alcohol consumption affects earnings. Hamilton & Hamilton (1997) adapt the model used by Berger & Leigh (1988) and extend it so that individuals are not classified simply as non-drinkers or drinkers but as non-drinkers, moderate drinkers or heavy drinkers.

The idea for this extension is to allow for a U-shaped effect of alcohol consumption on earnings, whereby the a priori expectation is that moderate drinkers experience the positive

earnings returns found by Berger & Leigh (1988) but heavy drinkers experience the negative returns found by Mullahy & Sindelar (1993). The use of the Heckman selection model has two-fold benefits in this work. First of all, it is possible to control for the potential endogeneity of alcohol consumption and earnings through the use of instrumental variables in the exclusion restriction of the first stage regression.

Secondly, by estimating a log earnings equation for each of the three sub-groups, it is then possible to use the results, coupled with an earnings decomposition, to make pairwise comparisons between the productivity returns to observable characteristics of each drinking status group. Using this method, and focusing on the population of working males aged 25 to 59, Hamilton & Hamilton (1997) find that moderate drinkers earn a premium relative to abstainers and heavy drinkers receive a wage penalty relative to moderate drinkers.

The approach of using a Heckman selection model to estimate separate log earnings equations for worker sub-samples of interest in conjunction with wage decompositions has been used for further studies in this area as well as in other areas of labour economics. One such example is a paper by Idson & Feaster (1990) that estimates earnings differentials, where the sub-samples of worker are made according to firm size.

Staying within the context of the effect of alcohol consumption on earnings, Barrett (2002) applies the same approach as Hamilton & Hamilton (1997), using the Australian Bureau of Statistics (ABS) National Health Survey (NHS) 1989-1990 and also restricts his analysis to working males aged 25 to 59. Barrett's (2002) are similar to those of Hamilton & Hamilton (1997). He finds that workers earn a premium for moderate drinking and a receive a penalty for heavy drinking.

A trend that is apparent in the literature in this area is that research focused on the effects of drinking on earnings for those already employed tends to consider the effects of general alcohol consumption. On the other hand, the literature that focuses on the effects of drinking on the probability of being employed almost exclusively deals only with alcohol consumption in terms of problem drinking or alcohol dependence (Mullahy & Sindelar, 1996; Feng et al, 2001; Terza, 2002; MacDonald & Shields, 2004; Johansson et al, 2006). As I was interested in the effects of alcohol consumption generally, my research builds on this first area.

Lye & Hirschberg (2004) and van Ours (2004) have looked at the effect of both alcohol consumption and smoking on earnings, arguing that is important to model the simultaneous effects of drinking and smoking on earnings given the potentially strong interaction effect between the two health behaviours. However, both of these papers use a continuous variable for alcohol consumption, which is either the number of alcoholic drinks the individual normally has in a month (van Ours, 2004) or the number of standard drinks consumed per day, adjusted for the day of the week (Lye & Hirschberg, 2004). While easier to model, I do not consider the use of a continuous alcohol consumption variable sufficient for my research, as it does not adequately capture the different dimensions of alcohol consumption, as described by most of the medical literature. As such, I will use a categorical variable similar to that used by Barrett (2002) and Hamilton & Hamilton (1997).

Both Hamilton & Hamilton (1997) and Barrett (2002) use the same definitions for abstainers, moderate drinkers and heavy drinkers. The variables used by both papers are based on data obtained in surveys that ask about the average frequency of alcohol consumption and the quantity of alcohol consumption during a particular reference week. An abstainer is classified as someone who does not drink or drinks less than once a month. A moderate drinker drinks

at least once a month but never consumes more than seven drinks on a single day. A heavy drinker is someone who has consumed eight or more drinks on a single day during the reference period.

While these demarcations were based on current safe alcohol guidelines and medical literature at the time, the cut-off between moderate and heavy drinking seems somewhat high. Under this definition, someone who consumes seven drinks every day is classified as a moderate drinker. In the time since these papers were published, alcohol consumption has come under the spotlight, from both a social acceptance standpoint and from a medical perspective. As a result, the accepted demarcation between moderate and heavy drinking has been revised downwards. Hence, a major goal of this research is to see how the results change, using a demarcation that more closely reflects this updated view on what constitutes healthy drinking levels.

This research will also build on the work of Hamilton & Hamilton (1997) and Barrett (2002) by applying the problem to a much more recent dataset that has not yet been used to address this issue. I will use wave 7 of the HILDA dataset to perform my estimations. Wave 7 was collected between 22 August 2007 and 18 February 2008 (Watson, 2009, p. 95) and as such is significantly more recent than the data used by Barrett (2002), which was collected in 1989-1990 and that data used by Hamilton & Hamilton (1997) which was collected in 1985. It is also more recent than the latest ABS NHS, which is from 2004-2005. As such, the empirical work carried out in this thesis will reflect recent behaviour. HILDA also provides a combination of variables roughly comparable to those used as independent and instrumental variables by Barrett (2002) and Hamilton & Hamilton (1997).

4. THEORETICAL MODEL

In modelling the effect of alcohol consumption on earnings, it is important to choose a model that is able to address the endogeneity problem and that captures the distinction between different drinker types, which results from the different dimensions of drinking behaviour. As such, a model with a flexible functional form is required in order to compare the returns to observable characteristics across drinker types, as a measure of the effects of alcohol consumption on productivity and hence on earnings.

As outlined in the introduction, a major problem with estimating the effects of alcohol consumption on earnings is that there may be an endogeneity problem. The endogeneity problem may arise from the self-selection workers into drinker types. For example, because the population under analysis is restricted to working age males employed full-time, it may be that the individuals we observe as heavy drinkers are those that have self-selected into that category. This could be due to an ability to consume relatively large quantities of alcohol without experiencing a negative impact on their work productivity. Alternatively, it could be that some individuals in high earning and stressful jobs select their drinking status as a coping mechanism for that stress. Furthermore, those individuals who suffer negative health effects as a result of drinking may have already dropped out of the labour force. This type of behaviour would result in a correlation between drinking status as an explanatory variable and the unobservables contained in the error term. It is logical that this type of self-selection problem would be present in the population of interest, and as such, it is important to control for endogeneity.

In order to control for this endogeneity problem, while being able to compare the returns to observable characteristics of each sub-sample, a polychotomous choice model is used. In the

data, alcohol consumption is measured in multiple dimensions, the frequency of drinking, the average intensity of drinking and the frequency of excessive consumption. As such, a categorical drinking status variable is constructed that is able to capture these three dimensions. Each individual in the sample is classified as either an abstainer, a moderate drinker or a heavy drinker. The polychotomous choice model used is an extension of the two-step Heckman selection model to multiple choices. As the measure of alcohol consumption is categorical, rather than a continuous variable, it is not possible to use the normal 2SLS method. Furthermore, the extended Heckman model offers a more flexible functional form than one which constrains the coefficients on observable characteristics to be equal across groups (Idson & Feaster, 1990, p. 113).

Following Hamilton & Hamilton (1997) and Barrett (2002), this model is adapted from that proposed by Lee (1982).

As mentioned previously, three separate earnings equations will be estimated using this approach. The earnings of individual *i* with drinking status *j* are determined by the following log earnings equation:

$$\ln(earnings)_{ij} = x_{ij}^{'}\beta_j + u_{ij}, \quad i = 1, 2, \dots, N \quad j = 1, 2, 3 \quad (1)$$

where $x_{ij}^{'}$ is a vector of human capital, socioeconomic and job-specific characteristics and $u_{ij} \sim N(0, \sigma_j^2)$. By specifying log earnings equations separately for the three different sub-samples, it will be possible to compare the β_j across the different groups to determine the differences in returns to observable characteristics. The observable characteristics in this case are those included in the vector, $x_{ij}^{'}$. According to a priori expectations about the health and

social networking effects of alcohol on productivity, the β_js should be highest for moderate drinkers, followed by abstainers and heavy drinkers.

It is assumed that individuals also have an unobserved utility function, whereby each individual will choose an earnings and drinking combination that maximises their utility, subject to budget and time constraints. This utility function will take the form shown below:

$$V_{ij} = z_{ij}^{'}\gamma_j + v_{ij}, \quad i = 1, 2, \ldots N \quad j = 1, 2, 3 \quad (2)$$

The vector of the individual's characteristics in this equation, $z_{ij}^{'}$, includes all those variables in $x_{ij}^{'}$ and additional variables that determine the individual's preferences over alcohol consumption but do not determine earnings (Barrett, 2002, p. 81).

The preferences determined by this utility function are inherently unobservable, however we do observe the drinking status that is the outcome of these preferences, denoted by I_i:

$$I_i = j \; iff \; V_{ij} > Max \; V_{is} \quad (s = 1, 2, 3 \quad s \neq j) \quad (3)$$

In words, this means that drinking status *j* is observed for individual *i*, if and only if the utility gained from that drinking status and earnings combination is strictly greater than the maximum utility that can be achieved by combination of the same earnings and a different drinking status. Assuming the v_{ij} error terms are distributed according to the type I extreme value distribution, the standard multinomial logit choice model is obtained:

$$\Pr(I_i = j) = \frac{\exp(z_{ij}^{'}\gamma_j)}{\sum_{s=1}^{3}\exp(z_{is}^{'}\gamma_s)} \quad (4)$$

Estimation of the log earnings equations given by equation 1 becomes difficult when the factors present in the choice of drinking status are also correlated with earnings. If the error terms of equations 1 and 2 are correlated, the division of the random sample of workers into three groups based on their drinking status, will create non-random, truncated samples. This endogenous sampling may result in the estimates of the log earnings regressions being biased if the regression is performed as a simple OLS. As a result, a generalised form of the Heckman two-step correction technique is necessary in order to estimate these three earnings regressions. (Hamilton & Hamilton, 1997, p. 137; Barrett, 2002, p.81; Idson & Feaster, 1990, p. 103).

The first step of this modelling approach is the estimation of 4, the selection equation. The variables included in $z_{ij}^{'}$, but not in $x_{ij}^{'}$ of equation 1, constitute the exclusion restriction, an essential component of the Heckman selection model which serves to identify sample selection.

The specification of Heckman-corrected log earnings equations, conditional on drinking status *j* being chosen is given by:

$$\ln(earnings)_{ij} = x_{ij}^{'}\beta_j - \sigma_j \rho_j \frac{\emptyset\{\Phi^{-1}[\mathrm{F}\left(\mathrm{z}_{\mathrm{ij}}^{'}\gamma_{\mathrm{j}}\right)]\}}{F(z_{ij}^{'}\gamma_j)} + \eta_{ij} \qquad (5)$$

The second term on the right-hand size of equation 5 controls for the truncated mean of the observed residuals that result from the previously discussed self-selection of workers into drinking status. This term is a generalised version of the Inverse Mills Ratio (IMR), where individuals choose over multiple alternatives. In this term, F denotes the multinomial logit distribution function, ϕ denotes the standard normal density function, Φ denotes the standard

normal distribution function, ρ_j is the correlation coefficient between η_{ij} and v_{ij} and η_{ij} has mean zero. (Barrett, 2002, p. 82; Hamilton & Hamilton, 1997, p.138-139).

5. ECONOMETRIC APPROACH

5.1 Estimation technique

All estimations and summary statistics presented in this thesis were produced using Stata IC 10.1. My approach was to first estimate a standard OLS model including dummy variables for drinking status in order to compare these results with previous research that did not control for the endogeneity problem.

Following from this, estimations were performed using the preferred Heckman selection model specification. In order to estimate equation 5 for all three drinker types, a two-step procedure is necessary and will provide consistent estimates of the β_js for each drinker type. The first step is to estimate equation 4 to derive estimates of the $\hat{\gamma}_j$ for each drinker type. For this estimation, drinking status is the dependent variable, with moderate drinkers as the base category. The second step is to substitute these $\hat{\gamma}_j$ for the γ_j in the estimation of 5, which is then estimated by OLS for each drinker type. These estimations use robust standard errors based, due to their inclusion of the IMR.

After these estimations are complete, it is possible to formally test for self-selection bias by looking at the estimated value of the correlation coefficient, ρ_j. If $\rho_j = 0$, the implication is that there is no correlation between the unobservables in the selection and earnings equations, hence there is no apparent self-selection bias for the drinker type in question. If $\rho_j > 0$, individuals with drinking status *j* earn more than a randomly selected person would if they were assigned that drinking status, hence it is an indication of positive self-selection. As such, following from equation 5, if the estimated coefficient for the IMR is negative, this implies positive self-selection. Logically then, if $\rho_j < 0$, individuals with drinking status *j* earn less

than a randomly selected person if they were assigned that drinking status, hence it is an indication of negative self-selection. Again, following from equation 5, a positive estimated coefficient for the IMR implies negative self-selection.

5.2 Earnings decompositions

Part of the motivation for using a Heckman selection model in this research is to compare the β_js estimated for each drinker type. While it is easy to compare the specific β_j estimated for each variable across drinker types, it is not so easy to get an idea of the overall difference in the estimated coefficients by simply looking at the results. By calculating earnings decompositions, it is possible to make pairwise comparisons of the differences in earnings between the three drinker groups. These earnings decompositions help to gain some sense of whether an overall difference in earnings between two drinker groups is due to differences in the levels of observable characteristics, represented by the mean levels of the variables included in the log earnings estimations, or to the returns to those characteristics, represented by the β_js.

There are several methods of earnings decomposition mentioned in the literature. However, the preferred specification used for this research follows that used by Barrett (2002) and is adapted from Oaxaca (1973). The earnings decompositions presented in this thesis are calculated according to equation 6 and represent what is called the unconditional earnings decomposition.

$$E\left[ln\left(earnings_j\right)|\bar{x}_j^{'}\right] - E\left[ln(earnings_k)\middle|\bar{x}_k^{'}\right] = \left(\bar{x}_j^{'} - \bar{x}_k^{'}\right)\left(\frac{\beta_j + \beta_k}{2}\right) + \left(\beta_j - \beta_k\right)\left(\frac{\bar{x}_j^{'} + \bar{x}_k^{'}}{2}\right) \quad (6)$$

The earnings decompositions calculation makes up the right-hand side of this equation. The unconditional earnings decomposition does not include the IMR among the variables used in equation 6. The first term on the right-hand side represents the difference in the mean level of characteristics between the two drinker groups. Intuitively, it is the difference in the mean levels of all variables for each sub-sample, weighted by the average of the returns to those variables for each sub-sample.

The second term on the right-hand side represents the difference in returns to observable characteristics between the two drinker groups. Intuitively, it is the difference in the estimated coefficients of all variables for each sub-sample, weighted by the mean level of those variables for each sub-sample.

6. DATA

6.1 Data background

The data used for this empirical analysis is the HILDA Survey, a longitudinal survey conducted by the Melbourne Institute of Applied Economics and Social Research. HILDA has a focus on household and work related issues and so is very rich in terms of questions asked about demographics, labour market activities and health issues. The variables include detailed information about the frequency and intensity of alcohol consumption as well as the frequency of excessive alcohol consumption. It also provides several candidates for instrumental variables, which is essential to this research.

The HILDA survey is based on a large sample of Australian households. For my research, I was interested in using data representative of the entire Australia population for two reasons. First of all, there is a small body of literature about this topic already in Australian research, using data about the Australian population. As such, I was interested in adding to the evidence about the impacts of alcohol consumption on earnings in Australia.

The second reason is that a good deal of the international literature on this topic uses data drawn from a particular subset of the population, rather than the general population. For instance, there are numerous papers (Keng & Huffman, 2005; Levine et al 1997; Kenkel et al., 1994; Renna, 2008; Kenkel & Wang, 1998) that base their models on data from the US National Longitudinal Survey of Youth, and hence can only make inferences about young adults. I am more interested in expanding the research in this area about the effects of alcohol consumption on earnings across a broader range of age groups.

The first wave of HILDA was based on a large probability sample of Australian households living in private dwellings and is intended to be representative of the Australian population (Watson, 2009). Subsequent waves aim to maintain this cross-sectional representativeness through both this initial wave structure and a set of rules for adding new members to the sample households. All household members provided at least one interview in this first wave and formed the panel for subsequent waves. The data in each wave are collected through three main types of survey - a household questionnaire, a person questionnaire and a self-completion questionnaire. These questionnaires are conducted only with those household members aged 15 and above. Further information about the HILDA survey can be found in Watson, N. (ed), 2009, *HILDA User Manual*.

Due to the nature of data collection for HILDA – through probability sampling – each responding person's record has an associated probability weight. These probability weights ensure that estimates match certain known, person-level benchmarks and also account for sample attrition between waves (Watson, 2009, p. 64). All estimations and summary statistics presented in this thesis are obtained using this probability weight.

6.2 The sample

In wave 7, there were a total of 7,063 totally and partially responding households and 12,789 responding individuals, including children and new entrants (Watson, 2009, p. 101-102).

For the purposes of this research, the sample (and thus the population of interest) was restricted to males working full-time, with non-zero current weekly earnings, between the ages of 25 and 64 and no longer in full-time education. The reasons for this restriction are twofold. The restriction to full-time workers is made to define the population of interest for

this research, that is, those individuals who are already employed. The other restrictions were made to avoid having to model labour market participation decisions in an already complicated econometric model. These participation decisions would need to be included in the model if the sample included women, students or people close to retirement age and they are beyond the scope of this research project.

This restriction of the population of interest is standard in the literature (Barrett, 2002; Hamilton & Hamilton, 1997; MacDonald & Shields, 2004; Terza, 2002; Renna, 2008; Lye & Hirschberg, 2004; Auld, 2005). This sample definition will affect interpretation of results. As such, any discussion of the results for the log earnings regressions will be made in the context of the population as defined by this sample.

After these exclusions, the available observations were reduced to 2,531 individuals. Of these, 379 observations had missing information for at least one of the variables used. A large proportion of these observations had missing information because they had not completed the Self-Completion Questionnaire. Interestingly, thirteen individuals were assigned a probability weight of zero and so it was not possible to include them in the estimations. As a result, the final number of observations available for estimation was 2,152. The missing information that led to exclusion of these observations was present in the dependent variable of the selection equation, the independent variables and the instrumental variables. In the case of missing information in the independent variables, I have assumed that this missing information is random and is therefore a case of exogenous sample selection and thus will not bias the results.

A reasonable proportion of the sample with missing information had no information available about their alcohol consumption or for the instrumental variables. For those missing information for alcohol consumption it would have been impossible to construct a drinking status variable for these observations. As such, they had missing information for the dependent variable in the selection equation. Almost all of these had no information on alcohol consumption or the instrumental variables because they had not completed the Self-Completion Questionnaire, where the questions about drinking behaviour were located. 365 observations, or 14.5 percent of the otherwise potential sample, were dropped because they were missing information for alcohol consumption or for the instrumental variables.

As this exclusion was performed on the basis of missing data for the dependent variable of the selection regression and for the instrumental variables, it has the potential to cause bias in the results due to endogenous sampling. In an effort to gauge the extent of this problem, the means for all variables used in the log earnings regressions in the full and restricted sample were compared and were shown to be very similar. As such, I have treated the exclusion as random. The results of this comparison can be found in Appendix 1.

6.3 Dependent Variables

6.3.1 Log earnings equation

For the earnings model, the dependent variable, ln *earnings*, is the log of current weekly gross salary and wages from all jobs. HILDA also has an alternative variable for gross salary and wages. This was gross wages and salaries from last financial year. However, as I am interested in the effects of current alcohol consumption, a retrospective measure of income would not have been an appropriate choice.

This ln *earnings* variable has been subject to some data cleaning by HILDA, whereby missing information has been imputed for some observations and for others a weighted top-code value is used due to privacy reasons. The imputation method varies with the type of respondent with missing information, however the primary method is that used by Little and Su (1989). For those observations with a weighted top-code value, HILDA does this by substituting the weighted average for all observations that exceed the top-coding threshold. As a result of this method, as opposed to when the cut-off value is simply substituted, it is possible to include these observations in my estimations without the potential bias problems associated with censored information. In my sample 57 observations have imputed earnings data and five observations have current weekly gross salary and wages that have been weighted top-coded.

Summary statistics for ln *earnings* are presented in Table 1. These include statistics for the sample overall as well as statistics for each drinking group sub-sample.

Table 1: Summary statistics for ln *earnings*

Sample	Mean	Standard Deviation	Minimum	Maximum
Full sample	7.0391	0.5021	4.3694	8.8462
Abstainers	6.9124	0.5302	4.3694	8.8462
Moderate drinkers	7.1074	0.4937	4.8675	8.8462
Heavy drinkers	7.0125	0.4527	5.4806	8.8462

The first thing to notice about the statistics presented in Table 1 is that for this sample, on average, moderate drinkers earn the most, followed by heavy drinkers while abstainers earn the least. This pattern was also apparent in the summary statistics presented in Barrett (2002, p. 86), using the NHS data. However, this result should not be taken to mean that heavy drinking causes higher earnings, as we still need to control for other factors in earnings determination and for the self-selection of drinking status. While all groups have the same

maximum ln *earnings*, heavy drinkers have the highest minimum value, followed by moderate drinkers then abstainers. A similar pattern is present for the standard deviations across drinker types, with heavy drinkers having the lowest standard deviation, followed by moderate drinkers then abstainers.

6.3.2 Selection (drinking status) equation

The drinking status choice regression uses a categorical variable as the dependent variable. The three categories are abstainer, moderate drinker and heavy drinker. The definition of these three categories is made according to the US NIH (2009) "Rethinking Drinking" guidelines. The three categories are constructed using information gained from three questions about alcohol consumption in the HILDA survey. These are questions B4, B5 and B6 of the Self Completion Questionnaire and their exact wording can be found in Appendix 2.

The first two questions are about the frequency of alcohol consumption and the usual intensity of alcohol consumption. These two dimensions are the most important for the definition of the three drinking categories. Their effect on the demarcations between drinking status categories is summarised in Table 2.

In addition to the demarcations outlined in Table 2, the third dimension of alcohol consumption, the frequency of excessive drinking, is also used in the construction of the drinking status variables. HILDA defines excessive drinking for males as more than six standard drinks in one session. Some individuals who drink on a regular basis may define their "usual" drinking intensity in a particular way, but might also have reasonably frequent episodes of more excessive drinking. For example, someone who has a glass of wine most

nights of the week, but goes out on the weekend and drinks much more than this, might classify their "usual" drinking intensity as 1 to 2 standard drinks even though they may consume much more than this at least once a week. Fortunately though, the question in HILDA wave 7 about the frequency of excessive drinking is able to pick up this extra dimension of drinking status.

Table 2: Drinking Status Definition (percentage of sample)

Frequency									Total
	Never drink	5.25							5.25
	No longer drink	4.41							4.41
		Intensity (standard drinks)							
		1-2	**3-4**	**5-6**	**7-8**	**9-10**	**11-12**	**13+**	
	Drink rarely	10.87	4.11	0.61	**0.29**	**0.22**	**0.03**	**0.00**	16.13
	2-3 days/ month	5.45	3.27	1.41	**0.36**	**0.43**	**0.37**	**0.04**	11.32
	1-2 days/ week	9.21	7.38	3.31	**1.90**	**1.09**	**0.37**	**0.37**	23.63
	3-4 days/week	7.14	7.67	3.20	**0.94**	**0.30**	**0.27**	**0.20**	19.72
	5-6 days/week	3.71	5.14	**2.26**	**0.74**	**0.07**	**0.04**	**0.04**	12.00
	Drink everyday	1.40	3.12	**1.55**	**0.77**	**0.35**	**0.16**	**0.18**	7.54
	Total	37.78	30.71	12.34	4.99	2.46	1.24	0.83	100.00
			=Abstainer		=Moderate Drinker		=Heavy Drinker		

As such, in addition to the demarcations outlined in Table 2, if an individual indicates that they drink in excess of six standard drinks at least once a week they will be classified as a heavy drinker, if they had not already been so classified based on their usual drinking intensity and frequency. Using this third dimension, 646 observations, or 26.86 percent of the weighted sample are classified as heavy drinkers, when before they would have been classified as either abstainers or moderate drinkers.

This is not an insubstantial proportion of the sample, and points to the importance of considering the multiple aspects of drinking behaviour when defining drinking status categories. This particular question about the frequency of alcohol consumption above the

threshold of six standard drinks per sitting is a new addition to wave 7 of the HILDA surveys. As such, it is not available in the data from previous waves. This played a role in selecting wave 7 of HILDA for this research. The fact that this particular variable is only present in wave 7, would have made it difficult to take advantage of the panel aspect of HILDA. It would not have been possible to create the drinking status categories according to the preferred definition using data from other waves.

According to this preferred definitions, 25.21 percent of the sample are abstainers, 54.62 percent are moderate drinkers and the remaining 20.17 percent are heavy drinkers. One feature of these statistics is that there is enormous diversity in the drinking frequency/intensity combinations that people choose. The most frequent combination is that of drinking rarely and drinking one to two standard drinks per usual sitting, with just over one in ten observations falling into that category. At either extreme of the spectrum, 5.25 percent of the sample never drink and 2.07 percent usually drink more than 11 standard drinks per sitting.

A potential problem with survey questions about alcohol consumption is that people may have a tendency to under-report their actual drinking levels or may have problems with recall, as was pointed out by the ABS in their *Users' Guide* for the National Health Survey (ABS, 2006, p. 78). This potential under-reporting problem may lead to biased estimates. Unfortunately, there is not anything that can be done specifically about this type of problem, as there is no way of knowing who may have under-reported and by how much. Therefore, assuming that under-reporting may be present in the data, it is safest to interpret the results as reflecting the lower bound of the impact of alcohol consumption on earnings.

6.4 Instrumental variables

As stressed throughout this thesis, it is important to control for the endogeneity of earnings and drinking status in the empirical modelling of the question at hand. Using the Heckman selection model, the endogeneity problem is corrected by using instrumental variables in the selection equation. These instrumental variables need to be correlated with drinking status but uncorrelated with earnings. Two different types of instrumental variable were used for this research. The first was a dummy variable indicating whether the individual smoked at age 18, *smoke18*, and the second was a group of variables relating to religion. The former will act more strongly for the identification of heavy drinkers and the latter will act more strongly for the identification of abstainers.

The *smoke18* dummy indicates whether the individual had smoked a full cigarette by the age of 18. As part of the New and Continuing Person questionnaires, individuals are asked at what age they first smoked a full cigarette. The *smoke18* dummy was created using this information. However, the question was only asked of those individuals classified as "smokers", which applied to those who had smoked at least 100 cigarettes in their entire life. The idea behind the *smoke18* variable is that it will capture a person's attitude to risky health behaviour. As such, the fact that the question was only asked of smokers should not be problematic. The result will be that the dummy is only switched on for those who had smoked a full cigarette by age 18 and who have smoked at least 100 cigarettes over their lives, which will still act as a measure of risk attitude.

HILDA also had another similar variable, asking at what age an individual first started smoking regularly. An equivalent variable to the *smoke18* dummy was created using this information and the selection equation was estimated using this variable instead of *smoke18*.

However, this variable proved much less relevant to drinking status choice. While it was strongly identified in the heavy drinker outcome of the selection equation and had a p-value of 0.000, it was not well identified in the abstainer outcome, with a p-value of 0.924. As such, *smoke18* was chosen as the preferred variable to be used in the selection equation.

The rationale that the *smoke18* variable will be correlated with drinking status but not with earnings can be easily supported. A dummy variable capturing whether an individual had smoked by age 18 was also used by Barrett (2002) as an instrumental variable in his research on the same issue. In a similar vein, Hamilton & Hamilton (1997) used a dummy variable indicating whether an individual had started drinking by age 18 as an instrumental variable and van Ours (2004) used both a variable indicating whether the individual had started drinking and whether they had started smoking by the age of 16.

As mentioned previously, this variable will reflect an individual's attitude towards risk in the context of health behaviour, which is likely to be correlated with an individual's current drinking status. A concern might be that this variable would be correlated with earnings, as studies have shown a link between smoking and decreased earnings (Ours, 2004; Heineck & Schwarze, 2003). However, as this variable is a measure of historical behaviour, there is a good argument that it will not be correlated with current earnings. The churning of smoking status in the data reflects that the link between past smoking behaviour, to current smoking behaviour and finally to current earnings is tenuous and thus the argument for *smoke18* as exogenous to the log earnings equation holds. The statistics for the churning of smoking status are presented in Table 3.

Table 3: Churning of Smoking Status (percentage of sample)

		Current smoker		Total
		0	**1**	
Smoke18	**0**	49.73	3.20	52.93
	1	26.53	20.54	47.07
	Total	76.26	23.74	100.00

As can be seen in Table 3, 47.07 percent of the sample say they smoked at age 18, however only 23.74 percent of the sample are current smokers. Interestingly, nearly a third of the sample had smoked a cigarette by age 18 but are not currently smokers and 3.20 percent had not smoked by age 18 but are current smokers. Looking at this issue from a slightly different angle, 56.37 percent of individuals who reported having smoked at 18 had quit by the time of the survey and 13.50 percent of current smokers hadn't smoked at age 18.

The information presented in Table 3 demonstrates considerable churning in smoking status and supports my proposal that as a retrospective measure of risk attitude towards health, *smoke18* is not likely to be correlated with current earnings.

The other type of instrumental variable was a group of variables relating to religion. Again, these variables need to be correlated with drinking status but not with earnings in order to be considered useful instruments. The argument that religion should not be correlated with earnings seems a straightforward one. There is no obvious reason why someone's religion would have either a positive or negative correlation with earnings. The correlation between religion and drinking status, however, should be clear. Many religions discourage alcohol consumption, and certainly consumption of alcohol to excess. Therefore, we would expect a person's religious status to be correlated with their drinking status.

Hamilton & Hamilton (1997) used religion variables as instrumental variables in their research on the same issue. They used a dummy variable indicating whether someone has no religion, another indicating whether someone attends religious services at least once a month and also an interaction between this religion attendance variable and a dummy variable indicating whether an individual's religion is Catholicism. The rationale behind this interaction variable is that the Catholic Church has potentially less stringent attitudes towards drinking than other Christian denominations (Hamilton & Hamilton, 1997, p. 143).

Clearly though, in addition to this potential Catholic interaction effect, the impact of religion on drinking status may be a complex one and these few variables may not be able to adequately model the different aspects through which religion could be correlated with drinking status. Fortunately, HILDA contains very rich information about religion and so it is possible to model the different transmission mechanisms through which religion may affect drinking status. The variables that allow this complexity of influence in my model are Religion-broad (which allows individuals to tick a box representing their religion), frequency of attendance at religious services and importance of religion. These are questions B26, B27 and B28 of the Self-Completion Questionnaire, and their exact wording can be found in Appendix 3.

The Religion-broad variable as aggregated in the original HILDA data included 26 different religion categories, many of which were different denominations of the Protestant Church. Furthermore, many of categories had very few observations in the sample and when the drinking status regression was estimated with all 26 variables, a large number of parameters could not be identified. In order to save degrees of freedom and to avoid this problem, the

categories were aggregated to five different groups. The precise definition of each variable can be found in Appendix 4.

The final group of religion variables used as instrumental variables included dummies for the different religion categories, a dummy indicating whether the individual attends a religious service at least once a week, a variable indicating the importance of religion on a scale of 1 to 10 and an interaction variable between each religion category and the importance of religion. For the group of religion category dummies, the variables used are mutually exclusive and exhaustive. This is the case for all groups of dummy variables used in this thesis.

Table 4 provides the summary statistics for all instrumental variables, by drinking status.

Table 4: Mean Values for Instrumental Variables by Drinking Status[1]

Variable	Abstainers	Moderate Drinkers	Heavy Drinkers
Religious attendance	0.1736	0.0755	0.0210
Religious importance	4.2145	2.7969	1.9655
*Protestant **	0.3176	0.3326	0.3045
Catholic	0.2644	0.2502	0.2418
Other Christian	0.0606	0.0366	0.0222
Other religion	0.1114	0.0548	0.0166
No religion	0.2460	0.3259	0.4150
*Protestant*importance **	1.4407	1.0711	0.7560
*Catholic*importance*	1.2927	1.0607	0.8214
*Other Christian*importance*	0.3718	0.1932	0.1285
*Other religion*importance*	0.8587	0.2835	0.0766
*No religion*importance*	0.2506	0.1884	0.1830
Smoke18	0.3945	0.4385	0.6535
Number of observations	438	1,241	473

Looking at the summary statistics for the instrumental variables, there are some striking patterns across the different drinker types. For example, heavy drinkers are by far the most likely to have smoked by age 18, followed by moderate drinkers and abstainers. A similar trend is evident for having no religion. In contrast, abstainers are most likely to attend weekly

[1] The variables marked with * are those dummies excluded in estimation. This notation is maintained throughout this thesis.

religious services and to give a higher importance to religion in their lives, followed moderate drinkers and heavy drinkers. These statistics reflect the expected patterns and also support the argument that *smoke18* will more strongly identify heavy drinkers, while the religion variables will more strongly identify abstainers.

Alternative instrumental variables have been used by other studies in this area that would not have been appropriate to this research. For example Hamilton & Hamilton (1997) use alcohol price variables as instruments. These are province-specific variables (the study was based on Canadian data) and three separate variables are included for the price of spirits, wine and beer (given by sales/volume). The ABS does provide a price index for the composite group of goods, "alcohol and tobacco", by capital city in Australia. However, a further breakdown of prices for just alcohol, or for the sub-groups of alcohol such as spirits, wine and beer, was not easily obtainable. Given that including these price variables as instrumental variables would have meant excluding the State variables from the selection and log earnings regression and that variation in this variable would have been limited by Australia's eight States and Territories, it was decided not to pursue these as instrumental variables for my research.

Barrett (2002, p. 84) also used two instrumental variables indicating the proportion of sample members in an individual's local area (excluding the individual) who were abstainers and who were heavy drinkers. These variables were used to identify the 'wetness' of the local social environment and hence its influence on the individual's drinking behaviour. As HILDA did not include data about the sample members' specific geographic location, it was not possible to use such an instrumental variable in my research.

6.5 Independent variables

The independent variables in the earnings regressions are those that make up the vector of human capital, socioeconomic and job-specific characteristics. They include variables for age, marital status, country of birth, State of residence, section of State, education, occupation and sector of employment. A list of the complete definitions of all independent and instrumental variables can be found in Appendix 4. Summary statistics of the independent variables included in the log earnings regressions are presented in Table 5.

There are a few notable demographic patterns evident from these summary statistics. The first of these is the life-cycle pattern of drinking status. Younger workers make up a higher proportion of heavy drinkers than they do for abstainers or moderate drinkers. Abstainers seem to be concentrated around those who are middle-aged and moderate drinkers are fairly smoothly spread across age groups, with a slight skew towards younger individuals.

Compared to the other drinker types, heavy drinkers are more likely to live regionally or remotely. The moderate drinker group has the highest proportion of individuals with an undergraduate degree and heavy drinkers have the highest proportion of individuals who did not complete High School. In terms of work characteristics, moderate drinkers have slightly higher proportions of professionals, managers and individuals employed in the public sector while heavy drinkers have slightly higher proportions of individuals working as technicians or in trades and as labourers.

Table 5: Mean Values for Independent Variables by Drinking Status

Variable	Abstainers	Moderate Drinkers	Heavy Drinkers
Age 25-29	0.1259	0.1234	0.1726
Age 30-34	0.1338	0.1638	0.1867
Age 35-39	0.1698	0.1551	0.1351
*Age 40-44**	0.1852	0.1432	0.1728
Age 45-49	0.1660	0.1594	0.1368
Age 50-59	0.1139	0.1549	0.1138
Age 60-64	0.1053	0.1001	0.0822
*Married**	0.6928	0.7889	0.7120
Single	0.3072	0.2111	0.2880
*Australian-born**	0.6663	0.7763	0.8481
Immigrant English-speaking	0.0749	0.1101	0.1011
Immigrant other	0.2588	0.1136	0.0507
*NSW**	0.3804	0.2888	0.2991
VIC	0.2381	0.2675	0.2604
QLD	0.1740	0.2066	0.2093
SA	0.0518	0.0793	0.0737
WA	0.1195	0.1008	0.1020
TAS	0.0144	0.0255	0.0275
NT	0.0029	0.0060	0.0242
ACT	0.0189	0.0254	0.0038
*City**	0.7697	0.7186	0.5835
Regional	0.2204	0.2650	0.3856
Remote	0.0099	0.0164	0.0309
Postgraduate degree	0.0306	0.0754	0.0251
Undergraduate	0.1940	0.2625	0.1577
*Diploma**	0.4524	0.4197	0.4364
Year 12	0.1280	0.1174	0.1271
Did not complete High School	0.1950	0.1250	0.2537
Managers	0.1174	0.1881	0.1258
*Professionals**	0.1959	0.2701	0.1760
Technicians & Trades	0.2032	0.2122	0.2579
Community & Personal Services	0.0923	0.0517	0.0546
Clerical & Administrative	0.1180	0.0929	0.0871
Sales	0.0482	0.0401	0.0368
Machinery operators	0.1301	0.0871	0.1554
Labourers	0.0949	0.0578	0.1065
Public sector	0.1898	0.2217	0.1808
Number of observations	438	1,241	473

7. STATISTICAL ANALYSIS

7.1 Results using OLS and drinking status dummies

A log earnings regression was estimated by OLS, which included the dummy variables a*bstainers* and *heavy drinkers*, with *moderate drinkers* as the excluded variable. This regression also controlled for human capital, socioeconomic and job characteristics and the results are presented in Table 6. These results imply that after controlling for the above characteristics, abstainers receive a wage penalty relative to moderate drinkers and that the effect on earnings of being a heavy drinker, relative to being a moderate drinker, is unclear. The estimated coefficient for the *abstainer* variable is statistically significant at the 1 percent level and is also economically significant, indicating that abstainers earn 12.16 percent less, on average, than do moderate drinkers. The estimated coefficient for the *heavy drinker* dummy variable is neither statistically nor economically significant.

The results for the *abstainer* coefficient reflect the pattern of differences in mean ln *earnings* of the different drinker types found in Table 1. They also reflect a priori expectations that moderate drinkers may earn more than abstainers as a result of health and social networking effects. These results imply that after controlling for other characteristics, the average difference in log earnings between moderate drinkers and abstainers is actually higher than that observed in the raw data, which shows that abstainers earn 2.74 percent less than moderate drinkers, on average.

Furthermore, the expected negative earnings penalty for heavy drinkers, is not observed in these results. These results may reflect biases arising from the suspected endogeneity problem and, as such, support the proposed use of a Heckman selection model.

Table 6: OLS Regression Results using Drinking Status Dummies[2]

Variable	Coefficient (Standard Error)
Constant	7.2756*** (0.0558)
Abstainers	-0.1216*** (0.0338)
Heavy Drinkers	0.0034 (0.0274)
Age 25-29	-0.1756*** (0.0532)
Age 30-34	-0.0597 (0.0432)
Age 35-39	-0.0590 (0.0499)
Age 45-49	-0.0275 (0.0447)
Age 50-59	-0.1102** (0.0523)
Age 60-64	-0.0181 (0.0555)
Single	-0.1423*** (0.0344)
Immigrant English-speaking	0.0174 (0.0366)
Immigrant other	-0.0733 (0.0457)
VIC	-0.0151 (0.0337)
QLD	0.0126 (0.0369)
SA	-0.0938** (0.0420)
WA	0.0933**(0.0459)
TAS	-0.0865 (0.0544)
NT	-0.0014 (0.1207)
ACT	0.0326 (0.0621)
Regional	-0.0533** (0.0268)
Remote	-0.0816 (0.1031)
Postgraduate degree	0.2794*** (0.0511)
Undergraduate	0.1277*** (0.0363)
Year 12	-0.0346 (0.0369)
Did not complete High School	-0.1712*** (0.0399)
Managers	0.0359 (0.0398)
Technicians & Trades	-0.1680*** (0.0416)
Community & Personal Services	-0.1188** (0.0470)
Clerical & Administrative	-0.1391*** (0.0412)
Sales	-0.2623*** (0.0635)
Machinery operators	-0.1057** (0.0482)
Labourers	-0.2963*** (0.0781)
Public sector	0.0187 (0.0252)
Number of observations	2152
R-squared	0.2042

[2] Where *** indicates statistical significance at the 1 percent level, ** indicates statistical significance at the 5 percent level and * indicates statistical significance at the 10 percent level. This system of notation is maintained throughout the rest of this thesis.

7.2 Estimation using the Heckman selection model

7.2.1 Results of the selection regression

The first step in this model was to estimate the selection equation, where drinking status is the dependent variable. The results for this regression and the marginal effects calculated from these estimates are presented in Table 7. These results offer some interesting insights about the relevance of the chosen instrumental variables and the effects of socioeconomic and demographic characteristics on drinking status.

The *smoke18* instrumental variable is clearly relevant to the choice of drinking status. It is statistically significant at the 1 percent level for the heavy drinker outcome and is statistically significant at the 10 percent level for the abstainer outcome. A likelihood ratio test was also performed, where the null hypothesis is that the *smoke18* variable has no effect on the choice of drinking status. The value of the likelihood ratio test statistic is 47.53 and is chi-squared distributed with two degrees of freedom. This test statistic has a p-value of 0.0000 and, as such, the null hypothesis is decisively rejected.

As well as being statistically significant, the *smoke18* variable is economically significant. While its effect on the probability of being a moderate drinker is small, it has a large effect on the probability of being either an abstainer or heavy drinker. The results indicate that someone who had smoked a full cigarette by age 18 is 10.62 percent less likely to be an abstainer now and is 13.55 percent more likely to be a heavy drinker now. This is the expected effect and reflects the nature of *smoke18* being an indicator for attitudes towards risky health behaviour.

Table 7: Results of Multinomial Logit Selection Equation[3]

Variable	Abstainers Coefficient (Standard Error)	Heavy Drinkers Coefficient (Standard Error)	Marginal effects on probabilities[4]		
			Abstainer	Moderate Drinker	Heavy Drinker
			Predicted Probability		
Constant	-0.8363** (0.3256)	-1.4144*** (0.3390)	0.2363	0.5913	0.1725
			Marginal Effect		
Age 25-29	-0.4570* (0.2744)	0.2470 (0.2361)	-0.0839	0.0276	0.0563
Age 30-34	-0.5214** (0.2510)	0.1403 (0.2288)	-0.0900	0.0490	0.0410
Age 35-39	-0.1340 (0.2402)	-0.1947 (0.2288)	-0.0164	0.0381	-0.0217
Age 45-49	-0.4002 (0.2570)	-0.3123 (0.2233)	-0.0568	0.0851	-0.0284
Age 50-59	-0.6134*** (0.2377)	-0.3422 (0.2495)	-0.0877	0.1139	-0.0262
Age 60-64	-0.2367 (0.3111)	-0.3565 (0.2686)	-0.0286	0.0673	-0.0387
Single	0.4600** (0.1887)	0.3694** (0.1562)	0.0699	-0.1034	0.0335
Immigrant English-speaking	-0.2765 (0.2283)	-0.0680 (0.2205)	-0.0446	0.0439	0.0007
Immigrant other	0.6978*** (0.2410)	-0.6191** (0.3150)	0.1678	-0.0688	-0.0990
VIC	-0.2453 (0.1966)	0.0039 (0.1808)	-0.0430	0.0328	0.0102
QLD	-0.2874 (0.2234)	-0.2835 (0.1829)	-0.0395	0.0678	-0.0282
SA	-0.5564** (0.2759)	-0.2868 (0.2668)	-0.0796	0.1005	-0.0209
WA	0.1619 (0.2548)	-0.1074 (0.2485)	0.0347	-0.0134	-0.0213
TAS	-0.5295 (0.4288)	-0.4483 (0.3721)	-0.0711	0.1125	-0.0415
NT	-0.8401 (0.8183)	1.0211* (0.5414)	-0.1501	-0.0851	0.2352
ACT	0.0166 (0.4457)	-1.4108** (0.6132)	0.0395	0.0875	-0.1270
Regional	-0.1489 (0.1730)	0.4100*** (0.1434)	-0.0435	-0.0253	0.0687
Remote	-0.2991 (0.5361)	0.6446 (0.4209)	-0.0764	-0.0503	0.1268
Postgraduate degree	-1.2352*** (0.3757)	-0.5199 (0.3636)	-0.1520	0.1887	-0.0368
Undergraduate	-0.5081** (0.2189)	-0.2721 (0.2091)	-0.0758	0.0953	-0.0195
Year 12	0.0401 (0.2464)	-0.0170 (0.2259)	0.0080	-0.0039	-0.0041
Did not complete High School	0.2882 (0.2169)	0.5066*** (0.1816)	0.0292	-0.0944	0.0652
Managers	-0.1804 (0.2645)	-0.2297 (0.2278)	-0.0232	0.0479	-0.0247
Technicians & Trades	0.0695 (0.2432)	0.1264 (0.2266)	0.0073	-0.0228	0.0155
Community & Personal Services	0.7990** (0.3666)	-0.0143 (0.3584)	0.1689	-0.1292	-0.0397
Clerical & Administrative	0.3798 (0.3007)	0.0517 (0.2838)	0.0714	-0.0617	-0.0097
Sales	0.3537 (0.3388)	-0.1380 (0.4224)	0.0754	-0.0422	-0.0332
Machinery operators	0.6034** (0.2795)	0.2363 (0.2751)	0.1090	-0.1137	0.0048
Labourers	0.4413 (0.3076)	0.2514 (0.3045)	0.0741	-0.0899	0.0158
Public sector	-0.0520 (0.1999)	-0.0638 (0.1867)	-0.0068	0.0137	-0.0069
Religious attendance	0.6581** (0.2717)	-0.8472* (0.5078)	0.1679	-0.0543	-0.1136
Religious importance	0.0946** (0.0394)	-0.0209 (0.0423)	0.0179	-0.0111	-0.0068
Catholic	0.1889 (0.3401)	0.1334 (0.2666)	0.0291	-0.0403	0.0112
Other Christian	0.4631 (0.7027)	-1.1739 (0.7422)	0.1318	-0.0068	-0.1250
Other religion	-0.4705 (0.7135)	-1.1927* (0.6848)	-0.0484	0.1599	-0.1115
No religion	0.0418 (0.2444)	0.2517 (0.1880)	-0.0031	-0.0321	0.0352
*Catholic*importance*	-0.0698 (0.0606)	-0.0056 (0.0639)	-0.0124	0.0103	0.0020
*Other Christian*importance*	-0.0603 (0.0974)	0.1687 (0.1157)	-0.0178	-0.0088	0.0265
*Other religion*importance*	0.0917 (0.1032)	0.1238 (0.1227)	0.0115	-0.0254	0.0139
*No religion*importance*	0.0905 (0.0848)	-0.0438 (0.0922)	0.0181	-0.0082	-0.0099
Smoke18	-0.2761* (0.1626)	0.7041*** (0.1405)	-0.0782	-0.0354	0.1136
Number of observations	2152				
Log-likelihood	-1919.3337				

[3] Moderate drinkers are the base group for this estimation and for all subsequent multinomial logit estimations

[4] Marginal effects are calculated at the mean levels of the independent variables. For dummy variables they represents the discrete change in log earnings as the dummy is switched on from 0 to 1. This is the same for all subsequent marginal effects calculations.

Several of the religion variables are individually statistically significant and the group of religion variables are jointly highly significant. They also have the expected effects. *Religious attendance* and *religious importance* are statistically significant at the 1 percent level for the abstainer outcome. *Religious attendance* is also statistically significant at the 10 percent level for the heavy drinker outcome. Again, a likelihood ratio test was performed, where the null hypothesis is that the entire group of "religion" variables has no effect on the choice of drinking status. The likelihood ratio test statistic has a value of 100.50 and is chi-squared distributed with 20 degrees of freedom. Again, the null hypothesis is decisively rejected and the results show that the group of religion variables are highly relevant to the selection of drinking status.

The independent variables present a range of interesting results. The group of age dummies compares the effect of age on the selection of drinking status relative to the excluded group, those aged 40 to 44. While the coefficients are imprecisely estimated, the results suggest that younger individuals are more likely to be heavy drinkers and that the older the individual, the more likely they are to be a moderate drinker. This life-cycle trend in drinking status reflects the expected trend and also the summary statistics presented in Section 6.5.

The education dummies also reveal some clear socioeconomic trends in the choice of drinking status. The excluded variable in this group is *diploma*, representing those with a post-secondary diploma or certificate. The estimated coefficient for the *postgraduate* and *undergraduate* variables are statistically significant at the 1 percent and 5 percent levels, respectively, for the abstainer outcome. The estimated coefficient for the variable *did not complete High School*, is statistically significant at the 1 percent level for heavy drinkers. The accompanying marginal effects suggest that those with a postgraduate degree are 15.20

percent less likely to be abstainers and 18.87 percent more likely to be moderate drinkers than those with a post-secondary diploma. The effect on being a heavy drinker is not large. The effect of holding an undergraduate degree is similar but of a lesser magnitude, with this group 7.58 percent less likely to be abstainers and 9.53 percent more likely to be moderate drinkers. At the other end of the education scale, those who did not complete high school are 9.44 percent less likely to be moderate drinkers and 6.52 percent more likely to be heavy drinkers than those with a post-secondary diploma. These results demonstrate a clear relationship between the level of education of male workers and their resulting drinking behaviour.

It seems that marriage also moderates drinking behaviour. The *single* variable is statistically significant at the 5 percent level for both the abstainer and heavy drinker outcome and the marginal effect suggests that single male workers are 10.34 percent less likely to be moderate drinkers than those who are married. Other demographic patterns are suggested by the results of the selection regression. Immigrants from non-English speaking countries are 16.78 percent more likely to be abstainers and 9.90 percent less likely to be heavy drinkers than individuals born in Australia, where the estimated coefficients for the *immigrant other* dummy is statistically significant at 1 percent and 5 percent levels for the abstainer and heavy drinker outcomes respectively. Geography also seems to play an important role in choice of drinking status. The marginal effect for the *regional* dummy suggests that, relative to those individuals living in cities, male workers living regionally are 6.87 percent more likely to be heavy drinkers and the *remote* dummy suggests those who live remotely are 12.68 percent more likely to be heavy drinkers.

Finally, several dummy variables indicating occupational status demonstrate economically significant marginal effects of their occupation on the choice of drinking status. Relative to

the base group, professionals, individuals in almost all occupations (excluding managers) are more likely to be abstainers and less likely to be moderate drinkers. This trend suggests that the type of occupation you are employed in is important in determining drinking status choice and that those individuals in high-powered jobs, professionals and managers, are more likely to drink alcohol than individuals in other occupations.

Given that both the independent and instrumental variables appear to affect drinking status in the expected way and that the instrumental variables are statistically relevant to the selection regression, these estimates can be used for the construction of the IMR used in the log earnings regressions.

7.2.2 Results for log earnings equations

The second step of the Heckman selection model was to estimate the log earnings regressions for each drinker type, the results of which are presented in Table 8. Most of the coefficients are statistically significant for the moderate drinker regression, while this is the case for fewer variables as part of the abstainer and heavy drinker regressions. This result is most likely due to the fact that the sample size for the moderate drinker regression is nearly three times larger for this group than for the other groups. However, most estimated coefficients in all three regressions have economic significance.

For example, the *postgraduate degree* dummy variable indicates an earnings premium of roughly 25 percent, relative to having a post-secondary diploma or certificate, for all three drinker types. However, this result is imprecisely estimated for both abstainers and heavy drinkers, where the standard errors are at least half the size of the estimated coefficient. Interestingly though, the returns to this education characteristic demonstrate the expected

pattern, where moderate drinkers have the highest returns to postgraduate qualifications, followed by abstainers, followed by heavy drinkers.

The education earnings premium demonstrated by the estimates for the *postgraduate degree* variable is also evident for the *undergraduate* variable across all drinker types. This premium is smaller than that for a postgraduate degree, but demonstrates the same pattern in returns to drinking status. For those who did not complete high school, the earnings penalty is statistically significant for both abstainers and heavy drinkers and suggests the penalty is highest for abstainers, followed by heavy drinkers, followed by moderate drinkers.

As with the with the education dummies, by comparing the estimated coefficients of other variables it is possible to gain a sense of how the returns to human capital, socioeconomic and job characteristics vary amongst the three different groups. For instance, by looking at the constant it appears as though, for the base group[5] at least, a moderate drinker earns, on average, more than a heavy drinker, who will earn more, on average, than an abstainer.

While imprecisely estimated for abstainers and heavy drinkers, the age-earnings profile of each drinker group roughly reflects the expected trend, and that found by both Barrett (2002) and Hamilton & Hamilton (1997). The expected result is that the age-earnings profile will have a roughly concave shape. This profile is precisely estimated for moderate drinkers and the expected concave shape is clear in the results, with the base group, those aged 40 to 44, gaining the highest predicted average earnings. This profile is less apparent for abstainers, where the concave profile disappears for the predictions for those aged 35 to 39 and 45 to 49, for whom the estimations are imprecise, and for those aged 60 to 64 for whom there appears to be an earnings premium. The concave age-earnings profile disappears almost entirely for

[5] A male worker aged 40-44, with a post-secondary diploma or certificate, who is married, lives in a city in NSW, is Australian born and works in the private sector as a professional.

heavy drinkers, for whom the estimated coefficients on all the age dummy variables are both statistically and economically insignificant.

Table 8: Results of Log Earnings Regression by Drinking Status

Variable	Abstainers Coefficient (Standard Error)	Moderate Drinkers Coefficient (Standard Error)	Heavy Drinkers Coefficient (Standard Error)
Constant	6.8401*** (0.2091)	7.4597*** (0.1327)	7.4213*** (0.1685)
IMR	0.1651* (0.0922)	-0.1557 (0.1651)	-0.0818 (0.1048)
Age 25-29	-0.0627 (0.1327)	-0.3598*** (0.0531)	-0.0235 (0.0795)
Age 30-34	-0.1489 (0.0984)	-0.1048** (0.0504)	0.0010 (0.0745)
Age 35-39	0.0062 (0.1207)	-0.1395*** (0.0513)	-0.0544 (0.0810)
Age 45-49	0.0343 (0.1233)	-0.1049** (0.0497)	0.0074 (0.0783)
Age 50-59	-0.1040 (0.1127)	-0.2408*** (0.0718)	0.0748 (0.0929)
Age 60-64	0.1192 (0.1410)	-0.1705*** (0.0585)	0.0986 (0.0958)
Single	-0.1385** (0.0692)	-0.1021** (0.0467)	-0.1007** (0.0458)
Immigrant English-speaking	0.0308 (0.0707)	-0.0188 (0.0484)	0.0167 (0.0834)
Immigrant other	0.1200 (0.1129)	-0.1191* (0.0630)	-0.0551 (0.0844)
VIC	0.0770 (0.0896)	-0.0570 (0.0420)	-0.0704 (0.0569)
QLD	0.1392 (0.0982)	-0.0711 (0.0442)	0.0097 (0.0623)
SA	-0.0093 (0.1209)	-0.1317*** (0.0493)	-0.1959** (0.0870)
WA	0.1221 (0.1128)	0.0676 (0.0544)	0.0929 (0.0841)
TAS	-0.0979 (0.1506)	-0.1638** (0.0801)	0.0090 (0.0994)
NT	-0.0950 (0.1891)	0.0641 (0.2219)	-0.0641 (0.1744)
ACT	0.2140 (0.1572)	-0.0901 (0.0736)	0.2574 (0.2197)
Regional	-0.0032 (0.0730)	-0.0771** (0.0339)	-0.0921 (0.0565)
Remote	-0.1313 (0.1819)	-0.1270 (0.1486)	-0.0588 (0.1859)
Postgraduate degree	0.2480 (0.1581)	0.2770*** (0.0773)	0.2409** (0.1225)
Undergraduate	0.0886 (0.0839)	0.1538*** (0.0536)	0.0208 (0.0720)
Year 12	-0.0328 (0.0704)	-0.0102 (0.0504)	-0.0930 (0.0823)
Did not complete High School	-0.2737*** (0.0978)	-0.0797 (0.0511)	-0.1487*** (0.0559)
Manager	0.0300 (0.1133)	0.0543 (0.0473)	-0.0489 (0.0856)
Technicians & Trades	-0.1863 (0.1168)	-0.0831 (0.0547)	-0.3002*** (0.0793)
Community & Personal Services	-0.0519 (0.1083)	-0.1226* (0.0726)	-0.1493 (0.1045)
Clerical & Administrative	-0.1735 (0.1102)	-0.1043** (0.0531)	-0.1273 (0.0844)
Sales worker	-0.1383 (0.1365)	-0.3242*** (0.0833)	-0.1933 (0.1266)
Machinery operator	-0.0648 (0.1083)	-0.0166 (0.0729)	-0.2872*** (0.0908)
Labourer	-0.4270** (0.1902)	-0.1406** (0.0701)	-0.3046*** (0.0942)
Public sector	0.0453 (0.0572)	0.0099 (0.0318)	0.0142 (0.0546)
Number of observations	438	1241	473
R-squared	0.2685	0.2087	0.1734

Finally, looking at the estimated coefficients for some of the occupation dummy variables, it seems as though the earnings returns may differ substantially between drinker types. For example, for the *labourer* variable there is an earnings penalty, relative to working as a professional, across all three drinker types that is also statistically significant for all three drinker types at at least the 5 percent level. However, this penalty is twice as large for heavy

drinkers as it is for moderate drinkers and is half as large again for abstainers. Another example is for the *machinery operator* dummy, for which the earnings penalty relative to professionals is by far the largest for heavy drinkers. This may reflect that job performance as a machinery operator or driver is severely affected by the consumption of alcohol and that there may be testing regimes at some workplaces where the impact of alcohol consumption on job performance would be a critical health and safety issue.

Clearly, by simply examining the differences between the estimated coefficients of each drinker type, it is very difficult to determine the overall pattern in how returns to characteristics differ between the three groups. As such, it is instructive to look at the earnings decompositions, presented in the section 7.3.

Looking now at the IMR for each log earnings regression, the estimated coefficient is only statistically significant for the abstainers regression and even then, only at the 10 percent level. These imprecise estimates potentially indicate that sample selection bias is not present, as the null hypothesis that there is no correlation between the unobservables in the selection equation and the log earnings equation cannot be rejected. However this result does not necessarily indicate that the IMR is not important and this issue is further investigated as part of the sensitivity analysis in Section 7.5.

The magnitudes of the estimated coefficient for the IMRs are economically significant for each drinking status log earnings regression. For the non-drinker and heavy drinker groups, the suggested signs of the coefficients on the IMRs do reflect the hypothesised sample selection effect. The negative estimated coefficient for the heavy drinker IMR indicates positive self-selection may exist. This result indicates that if a randomly selected person were

allocated heavy drinking status, they would earn less than those who have self-selected into heavy drinking. It also indicates that heavy drinkers may have unobserved characteristics associated with higher earnings. For abstainers the opposite may be true, whereby if a randomly selected person were made to be abstain from drinking alcohol, they would earn more than someone who chose to abstain themselves.

7.3 Earnings decomopositions

The log earnings regression results for each drinker type are used to calculate unconditional earnings decompositions, for three pairwise comparisons between drinker types. The results of these earnings decompositions can be found in Table 9. These results summarise to what extent differences in earnings can be attributed to differences in the average level of characteristics of each drinker type, and to what extent differences in earnings are due to differences in returns to those characteristics.

Table 9: Earnings Decompositions

Differential	Difference in characteristics	Difference in returns to characteristics	Total Difference
Abstainers-Moderate drinkers	-0.0532	-0.4310	-0.4842
Heavy drinkers-Moderate drinkers	-0.0848	-0.0135	-0.0983
Abstainers-Heavy drinkers	0.0568	-0.4427	-0.3859

The overall difference in earnings is the largest between moderate drinkers and abstainers, then between heavy drinkers and abstainers and finally between moderate drinkers and heavy drinkers.

The decompositions suggest that when comparing the contribution of overall differences in characteristics to earnings, moderate drinkers have higher levels of characteristics than both abstainers and heavy drinkers. However, these differences in characteristics make up a

relatively small part of the overall differences in earnings. When comparing heavy drinkers and abstainers, it is abstainers who appear to have higher overall levels of observable characteristics.

However, the more interesting aspect of the earnings decompositions is to compare the difference in returns to the average levels of characteristics between drinker types. The results suggest that the overall returns to observable characteristics are highest for moderate drinkers, followed by heavy drinkers, then by abstainers. However, the difference in returns to characteristics between moderate and heavy drinkers appears to be quite small and the main source of lower earnings from heavy drinking appears to arise from differences in levels of characteristics. This indicates that heavy drinking, relative to moderate drinking, does not have much effect on productivity returns.

The biggest difference between drinker types looks to be that associated with the returns to characteristics between moderate drinkers and abstainers. Moderate drinkers, on average, have substantially larger returns to observable characteristics than do abstainers. This result supports the hypothesis that moderate drinkers attract productivity benefits through both health and social networking effects. The sensitivity of these results to changes in the definitions of drinking status will be explored in section 7.5.3.

7.4 Sensitivity analysis of the Heckman selection estimation

The initial results presented in section 7.2 point towards three main areas where an analysis of the sensitivity of results is important. The first of these is to see how the assumption of exogenous selection affects results, by estimating the log earnings regressions without the IMRs. Secondly, given the strong apparent effect of *religious attendance* on drinking status

choice in the selection regression relative to the other religion variables, an argument could be made that religious attendance is endogenous to drinking status through possible reverse causality. Finally, the sensitivity of the results to alternative demarcations between drinking status definitions will be explored.

7.4.1 Exogenous selection

The three log earnings regressions were estimated assuming exogeneity of sample selection by estimating them without the IMR. The results for these regressions can be found in Appendix 9 and can be compared to the original estimations presented in Table 8. These results are qualitatively similar across all drinker types when compared with the original estimations. All estimated coefficients maintain the same sign are estimated with a similar magnitude.

However, there are some variables for which the estimated coefficients change slightly in magnitude when estimated under exogenous selection. For example, the constant terms among the three different drinker type are much closer in size under exogenous sampling than when they are estimated using the Heckman selection model. This movement is in the direction expected for each drinking status now that selection bias is not being controlled for. So, for example the constant increases for abstainers now that the estimates are not corrected for negative self-selection. For moderate and heavy drinkers, the constants decrease now that the estimates are not corrected for positive self-selection. These changes imply that the results are sensitive to the inclusion of the IMR. The implication is that the inclusion of the IMR is important in correcting for self-selection bias. Hence, in spite of the imprecise estimates of the IMRs in section 7.2.2, they still constitute an important component of the estimates.

7.4.2 Exclusion of religious attendance

In order to determine whether the results are sensitive to the inclusion of *religious attendance* as part of the group of religion instrumental variables, the Heckman selection model was estimated excluding this variable in the selection equation. The rationale for this is that *religious attendance* is potentially endogenous to drinking status choice. This endogeneity problem might occur if people select their religious attendance based upon their drinking status. For instance, those who have a religious background and may otherwise be practicing might not actually attend religious services if their preference is to drink moderately or heavily. It is not instantly clear whether this reverse causality may be a problem, hence the second part of the sensitivity analysis is to see whether the results are sensitive to the inclusion of the *religious attendance* variable.

The results for selection equation are presented in Table 10 and the results for the log earnings regressions are presented in Appendix 6. These can be compared to the original results presented in Tables 7 and 8.

A quick look at the marginal effects and estimated coefficients shows that the results are qualitatively similar to those obtained when *religious attendance* was included. None of the estimated coefficients change sign and all of them stay within a similar magnitude. However, the estimated coefficients do seem to have moved around slightly for some variables. Perhaps the only notable change is that the *religious importance* coefficient for the abstainer outcome has increased nearly 50 percent in magnitude, from 0.0946 to 0.1402 and from having statistical significance at the 5 percent level to having statistical significance at the 1 percent level. This change suggests that *religious importance* may be capturing some of the effects of *religious attendance* under this specification.

Table 10: Results of Multinomial Logit Selection Equation

(*Religious Attendance* Excluded)

Variable	Abstainers Coefficient (Standard Error)	Heavy Drinkers Coefficient (Standard Error)	Marginal effects on probabilities		
			Abstainer	Moderate Drinker	Heavy Drinker
			Predicted Probability		
Constant	-0.8909*** (0.3238)	-1.3906*** (0.3371)	0.2352	0.5881	0.1767
			Marginal Effect		
Age 25-29	-0.4884* (0.2711)	0.2643 (0.2365)	-0.0889	0.0274	0.0615
Age 30-34	-0.5310** (0.2497)	0.1301 (0.2285)	-0.0909	0.0504	0.0405
Age 35-39	-0.1260 (0.2381)	-0.1927 (0.2290)	-0.0148	0.0370	-0.0221
Age 45-49	-0.3729 (0.2502)	-0.3180 (0.2242)	-0.0518	0.0823	-0.0305
Age 50-59	-0.5909** (0.2364)	-0.3393 (0.2488)	-0.0840	0.1109	-0.0269
Age 60-64	-0.2509 (0.3127)	-0.3565 (0.2695)	-0.0306	0.0697	-0.0390
Single	0.4598** (0.1854)	0.3634** (0.1574)	0.0696	-0.1028	0.0332
Immigrant English-speaking	-0.2740 (0.2263)	-0.0661 (0.2198)	-0.0440	0.0431	0.0009
Immigrant other	0.7075*** (0.2384)	-0.6079* (0.3117)	0.1699	-0.0695	-0.1004
VIC	-0.2237 (0.1946)	-0.0045 (0.1806)	-0.0389	0.0305	0.0084
QLD	-0.2682 (0.2215)	-0.3038* (0.1823)	-0.0353	0.0674	-0.0321
SA	-0.5576** (0.2750)	-0.3022 (0.2682)	-0.0789	0.1022	-0.0233
WA	0.1893 (0.2526)	-0.1347 (0.2486)	0.0412	-0.0147	-0.0265
TAS	-0.5073 (0.4255)	-0.4582 (0.3738)	-0.0672	0.1112	-0.0440
NT	-0.9103 (0.8292)	1.0172* (0.5297)	-0.1554	-0.0843	0.2396
ACT	-0.0353 (0.4365)	-1.4047** (0.6154)	0.0300	0.0988	-0.1288
Regional	-0.1573 (0.1714)	0.4061*** (0.1440)	-0.0449	-0.0248	0.0697
Remote	-0.3023 (0.5293)	0.6064 (0.4153)	-0.0753	-0.0457	0.1210
Postgraduate degree	-1.1985*** (0.3703)	-0.5546 (0.3609)	-0.1473	0.1895	-0.0422
Undergraduate	-0.4982** (0.2146)	-0.2737 (0.2088)	-0.0737	0.0942	-0.0204
Year 12	0.0422 (0.2410)	-0.0053 (0.2258)	0.0079	-0.0053	-0.0025
Did not complete High School	0.2860 (0.2147)	0.5149*** (0.1829)	0.0277	-0.0956	0.0679
Managers	-0.2164 (0.2623)	-0.2089 (0.2258)	-0.0297	0.0509	-0.0211
Technicians & Trades	0.0651 (0.2386)	0.1305 (0.2274)	0.0062	-0.0227	0.0166
Community & Personal Services	0.7342** (0.3648)	0.0175 (0.3580)	0.1517	-0.1186	-0.0331
Clerical & Administrative	0.3147 (0.2980)	0.0733 (0.2805)	0.0568	-0.0532	-0.0036
Sales	0.3256 (0.3388)	-0.1156 (0.4205)	0.0684	-0.0386	-0.0298
Machinery operators	0.5817** (0.2754)	0.2463 (0.2763)	0.1032	-0.1107	0.0076
Labourers	0.4164 (0.3050)	0.2639 (0.3062)	0.0677	-0.0872	0.0194
Public sector	-0.0583 (0.1965)	-0.0561 (0.1878)	-0.0081	0.0139	-0.0057
Religious importance	0.1402*** (0.0359)	-0.0481 (0.0380)	0.0272	-0.0144	-0.0128
Catholic	0.1794 (0.3481)	0.1320 (0.2614)	0.0272	-0.0388	0.0116
Other Christian	0.3793 (0.7153)	-1.0287 (0.6973)	0.1103	0.0067	-0.1171
Other religion	-0.4904 (0.7309)	-1.2158* (0.6771)	-0.0503	0.1656	-0.1153
No religion	0.1194 (0.2458)	0.2157 (0.1842)	0.0123	-0.0392	0.0269
*Catholic*importance*	-0.0772 (0.0617)	0.0014 (0.0607)	-0.0139	0.0105	0.0034
*Other Christian*importance*	-0.0407 (0.0989)	0.1340 (0.1076)	-0.0129	-0.0083	0.0212
*Other religion*importance*	0.0685 (0.1041)	0.1396 (0.1176)	0.0065	-0.0240	0.0175
*No religion*importance*	0.0422 (0.0834)	-0.0159 (0.0901)	0.0083	-0.0042	-0.0041
Smoke18	-0.2967* (0.1600)	0.7164*** (0.1412)	-0.0827	-0.0357	0.1184
Number of observations	2152				
Log-likelihood	-1928.2518				

Looking at the results for the log earnings regressions when *religious attendance* is excluded from the selection equation, the estimated coefficients remain very similar for all variables except the IMR. This result suggests that the unconditional earnings decompositions will show very similar results to those calculated when *religious attendance* is included in the selection equation. However, while the exclusion of *religious attendance* doesn't affect the precision of the IMR estimates, it decreases the magnitude of the estimated coefficients slightly for abstainers and moderate drinkers and increases it slightly for heavy drinkers. It was not possible to test explicitly for the endogeneity of *religious attendance*, without estimating a selection equation for the choice of *religious attendance* and finding suitable instrumental variables. As such, it is inconclusive as to whether this variable is endogenous to drinking status choice. However, because other coefficient estimates have not been greatly affected and the IMRs have greater explanatory power when estimations are performed using it as an instrument, its inclusion is the preferred specification of the model.

7.4.3 Drinking status definition

The results were also estimated under two different definitions of drinking status, one more strict on safe drinking limits and one more lenient towards safe drinking limits. The former reflects the current NHMRC (2009) guidelines and the latter reflects the demarcations used in previous research by Barrett (2002) and Hamilton & Hamilton (1997). The former will hereby be referred to as the NHMRC definition and the latter as the alternative definition.

Under the 2009 NHMRC guidelines, anything more than two standard drinks per sitting is considered to be unsafe drinking and, using this definition, over half the sample is classified as heavy drinkers. Referring back to Table 2, all those who were previously classified as heavy drinker will still be classified as heavy drinkers. In addition, those individuals who fall

in the “3 to 4” or “5 to 6” standard drinks columns and were not already classified as heavy drinkers, are now classified as heavy drinkers. Under this definition, 52.56 percent of the sample are defined as heavy drinkers, 26.91 percent as moderate drinkers and 20.53 percent as abstainers.

Under the demarcations used by Barrett (2002) and Hamilton & Hamilton (1997), an individual can have up to seven standard drinks in one sitting before being classified as a heavy drinker. The impact of this change on the proportions of the sample in each category is less severe. Looking at Table 2, those who were previously classified as heavy drinkers and who drank 5 to 6 standard drinks either 5 to 6 days per week or everyday are now classified as moderate drinkers. Similarly, those who were previously classified as heavy drinkers because they drank more than 6 standard drinks at least weekly, even though they would otherwise have been considered moderate drinkers, are now classified as moderate drinkers. The resulting breakdown of the sample using this definition is that 9.52 percent are classified as heavy drinkers, 65.23 percent are classified as moderate drinkers and 25.25 percent are classified as abstainers.

The log earnings regressions were again estimated for all three drinker types using the Heckman selection method. The results of the selection equation and log earnings regressions for the NHMRC definition can be found in Appendix 7 and for the alternative definition the results can be found in Appendix 8.

I find that the estimation of the log earnings regressions is sensitive to the definition of the drinking status groups. The effect on the estimation of the IMR is particularly notable. Under the NHMRC definition, the estimated coefficients of the IMR become even less precise.

While they all maintain the same sign, and for moderate drinkers and heavy drinkers they stay within the same magnitude, the IMR decreases in magnitude significantly for abstainers. Conversely, using the alternative definition no further precision is lost and magnitude of the IMR for abstainers and heavy drinkers increases. This indicates that the self-selection bias had been amplified under this definition.

Clearly, under the assumptions of this model, these shifts in the demarcations between different drinker types should have an impact on the estimated returns to observable characteristics for each group. As the NHMRC definition results in the majority of the sample being classified as heavy drinkers, it is expected that the differences in returns to characteristics will not be clear-cut as in the original estimations. Similarly, under the alternative definition the differences in returns to observable characteristics should be more stark. Under this definition, it is really only those who consume alcohol in quantities a good deal greater than the current NIH guidelines who are classified as heavy drinkers and as such, the relationship found using the NIH definition should be more pronounced under this definition. As was the case under the original estimation, the best way to get a sense of how drinking status affects differences in earnings is through earnings decompositions, the results of which are presented in Table 11. These can be compared to the original earnings decompositions presented in Table 9.

Under the NHMRC definition, the results appear as though individuals have been randomly allocated to each group. There is very little difference in earnings overall and the small difference that does exist is mostly attributable to differences in levels of characteristics, rather than returns to those characteristics. This finding is in contrast to that found using the NIH definition of drinking status. These results suggest that using the NHMRC definition for

heavy drinking, with a very low threshold of maximum daily consumption, there is no apparent labour market effect of drinking status. If the NHMRC guidelines are correct from a health standpoint, the implication is that the threshold for safe drinking levels in a purely health-related or physiological sense is much lower than that for labour market returns.

Table 11: Earnings Decompositions for Change in Drinking Status Definitions

	Differential	Difference in characteristics	Difference in returns to characteristics	Total Difference
NHMRC	**Abstainers-Moderate drinkers**	0.0574	0.0185	0.0759
	Heavy drinkers-Moderate drinkers	-0.0141	0.0218	0.0078
	Abstainers-Heavy drinkers	0.0461	0.0002	0.0463
Alternative	**Abstainers-Moderate drinkers**	0.1725	-0.6222	-0.4497
	Heavy drinkers-Moderate drinkers	0.1706	-0.2140	-0.0435
	Abstainers-Heavy drinkers	-0.0061	-0.4002	-0.4062

The earnings decompositions under the alternative definition of drinker types also provides some interesting results. The total difference in earnings for the three pairwise comparisons remains roughly unchanged under the alternative definition. However, the breakdown of this difference between levels of characteristics and returns to those characteristics changes significantly.

When comparing moderate drinkers to both abstainers and heavy drinkers, the difference in the average level of characteristics changes from being in favour of moderate drinkers in each case, to being in favour of abstainers and heavy drinkers. The difference in levels of characteristics also changes from being slightly in favour of abstainers relative to heavy drinkers to being roughly equal for those two groups.

The premium received by moderate drinkers relative to abstainers in terms of returns to observable characteristics increases by nearly 50 percent under the alternative definition. This premium relative to heavy drinkers also increases dramatically. However, the earnings

decompositions still show that heavy drinkers are not penalised in terms of returns to characteristics relative to abstainers. In fact, they still have much larger returns to observable characteristics than do abstainers.

This increase in the productivity returns to observable characteristics for moderate drinkers under this definition suggests that those who were previously classified as heavy drinkers, should be classified as moderate drinkers from a labour market perspective as they receive higher productivity returns than those now classified as abstainers or heavy drinkers. The implication seems to be that there are continued productivity benefits from heavier levels of drinking, potentially from social networking, even though these levels of drinking may be damaging to health. This change in demarcation also shows much lower productivity returns to heavy drinking relative to moderate drinking. The magnitude of the difference increases more than two-fold. Presumably, at a certain threshold, heavy drinkers will also have lower productivity returns than abstainers. A potential extension of this sensitivity analysis, given the findings, might be to vary the threshold of alcohol consumption for heavy drinking to determine where the largest difference between the productivity returns of moderate and heavy drinking lies and where heavy drinking is penalised relative to abstention. However, as the threshold for heavy drinking is increased, the number of individuals left in the heavy drinker sub-sample will decrease and it will become more difficult to obtain precise estimates. Hence, it may be necessary to obtain a larger sample in order to perform such an analysis.

8. CONCLUSION

The excessive consumption of alcohol in Australia has come under scrutiny recently. This attention has been accompanied by public discussion, a large program of Federal government spending on awareness campaigns and a recent downwards revision of the NHMRC safe drinking guidelines. While the damaging effects of problem drinking on health and personal relationships are widely known, there is a growing literature on the economic costs to individuals of problem drinking or alcohol dependency. Conversely, there has been active debate in the medical literature for some time now about the potential positive health benefits of moderate alcohol consumption. Flowing on from the medical literature is also a growing literature about the potential positive economic effects of moderate alcohol consumption.

This thesis contributes to the economics literature about alcohol consumption and its effect on earnings in Australia. The focus is on the effect of alcohol consumption on earnings for those who are already in full-time employment, rather than its effect on the probability of being employed. Through positive health and social networking effects, moderate alcohol consumption is thought to have a positive impact on earnings, relative to abstention from alcohol consumption. However, due to the negative health impacts of excessive drinking, it is hypothesised that heavy drinkers will receive an earnings penalty relative to both moderate drinkers and abstainers.

Recent literature in this area tends to find an earnings premium for moderate drinking, which is reduced for heavy levels of drinking. The literature that focuses only on alcohol dependency finds a definite earnings penalty for this population. In order to reflect this hypothesised U-shaped effect of alcohol consumption on personal well-being, three different categories of drinking status are used to classify individuals as part of this research:

abstainers, moderate drinkers and heavy drinkers. These classifications are made according to the current NIH guidelines to safe drinking levels.

The potential endogeneity of alcohol consumption and earnings is a major problem in the estimation of this effect. Given the population of interest is those who are already in full-time work, it is likely that individuals self-select their drinking status. For example, those who are heavy drinkers and who work full-time may be those individuals in society who are best able to cope with higher levels of alcohol consumption. They may also be those individuals who drink as a coping mechanism for the stress of their employment. As such, it is important to use an econometric model that is able to account for this potential endogeneity problem.

As a result of the categorical nature of drinking status in this research, and in order to cater to the potential endogeneity problem, my econometric analysis uses an extension of the Heckman selection model. This requires an estimation of the selection of individuals into drinking status and the estimation of a separate log earnings regression for abstainers, moderate drinkers and heavy drinkers. As such, it is possible to compare the average productivity returns to each drinking status as indicated by the estimated coefficients in each log earnings regression. By calculating earnings decompositions, it is possible to get an overall sense of the differences in these returns between drinker types.

My results show that there is an earnings premium for moderate drinkers relative to abstainers and a small earnings penalty for heavy drinkers relative to moderate drinkers, but not relative to abstainers. The premium for moderate drinkers relative to abstainers appears to stem mostly from returns to observable characteristics, rather than differences in the level of those characteristics. My results also show that there is a very small earnings penalty for

heavy drinking relative to moderate drinking, however this stems mostly from differences in the level of characteristics between the two groups and very little is attributable to differences in productivity returns. Due to the small size of this penalty, my results suggest that even heavy drinkers earn a premium relative to abstainers.

These results are sensitive to the definition of drinking status. When the threshold for heavy drinkers is lowered to the daily consumption levels currently recommended by the NHMRC, over half the sample is classified as heavy drinkers and the earnings premium for drinking effectively disappears. This result may be because the sample is effectively randomly divided into three sub-groups under this definition. However, when the safe drinking threshold is increased, relative to the original definition, the differences in productivity returns that were found using the original estimations become more stark. Moderate drinkers have even higher returns to observable characteristics relative to abstainers and heavy drinkers have much lower returns relative to moderate drinkers. However, heavy drinkers still do have higher productivity returns than do abstainers.

This shift suggests that those individuals previously classified as heavy drinkers, but who were at the lower end of alcohol consumption of this group, were actually receiving relatively high productivity returns. As such, from a health perspective they would be classified as heavy drinkers, but in terms of the economic benefits they should be classified as moderate drinkers. This finding suggests that it would be possible to adjust the threshold between moderate and heavy drinking in order to determine at what stage the greatest difference between the productivity returns of moderate and heavy drinking occurs. Presumably, at some point, the returns to heavy drinking would also fall below those of abstainers.

These findings raise the issue of why the economic penalty of heavy drinking occurs at a much higher threshold than that for negative health effects. It is possible that the negative health impacts of heavy drinking are not easily identified by the labour market. It is also possible that, strictly in terms of labour market returns, the social networking benefits of heavier alcohol consumption outweigh the health costs within the range of drinking that has been analysed as part of this research. Another possibility is that the instrumental variables used in this analysis were insufficient in combating the potential self-selection bias. While it was possible to show that the instruments used were highly relevant to the selection equation, it was not possible to test their exogeneity in the log earnings estimates as the model was just identified.

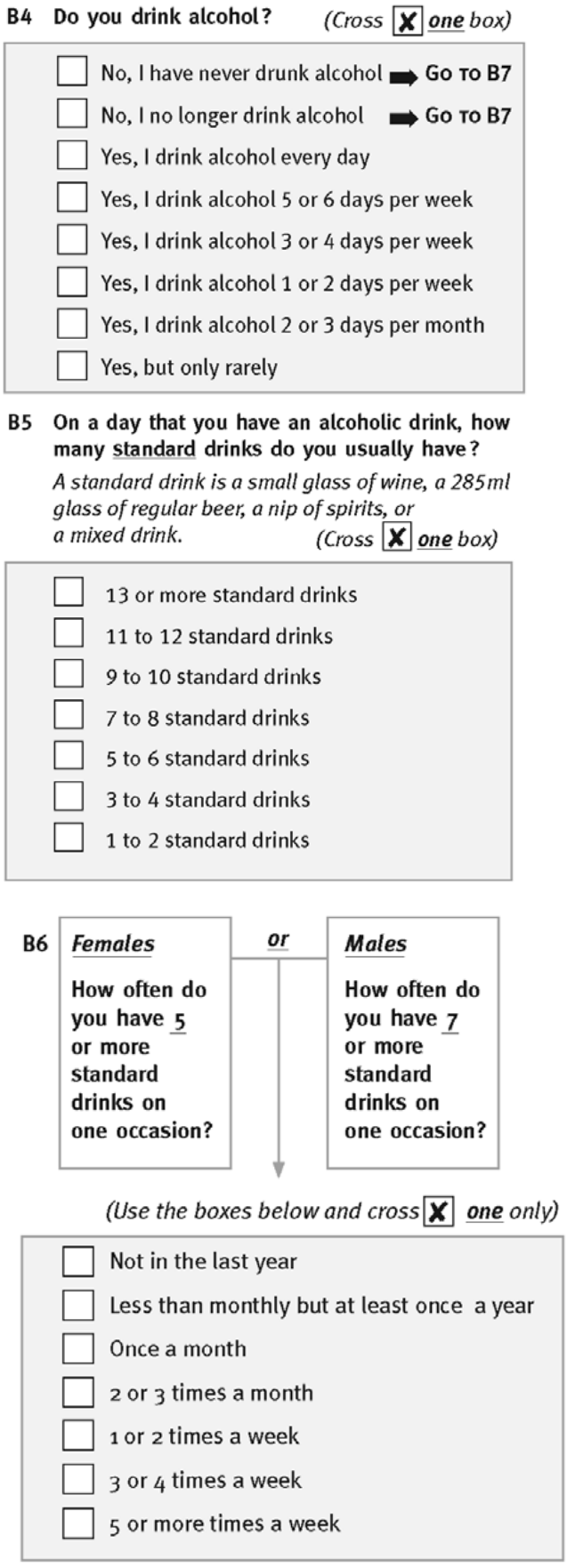
This potential instrumental variable problem is one limitation of this study and one of the further possible avenues for future research. Given the panel data nature of the HILDA dataset, it would be possible to estimate a fixed effects model and to avoid the use of instrumental variables. However, one problem with this would be the loss of precision in the construction of the preferred definition of the drinking status categories, given that the variable indicating frequency of excessive alcohol consumption is not available in previous waves. Furthermore, an analysis of the effects of drinking status on the probability of being promoted might offer further insight into the specific social networking effect of alcohol consumption on earnings. Finally, there is one important avenue of potential future research, using this data that was beyond the scope of this work. The HILDA dataset would allow an analysis of the broader effect of alcohol consumption on earnings through its effect on the probability of actually being employed. Further research in this area would help to complete the picture of the overall effects of alcohol consumption on earnings in Australia.

9. APPENDICES

Appendix 1: Comparison of means for missing data

Variable	Mean	
	Full sample	Restricted Sample
ln earnings	7.0264	7.0391
Age 25-29	0.1510	0.1340
Age 30-34	0.1625	0.1609
Age 35-39	0.1568	0.1548
*Age 40-44**	0.1579	0.1598
Age 45-49	0.1549	0.1565
Age 50-59	0.1263	0.1363
Age 60-64	0.0905	0.0978
*Married**	0.7325	0.7492
Single	0.2675	0.2508
*Australian-born**	0.7491	0.7631
Immigrant English-speaking	0.1008	0.0994
Immigrant other	0.1501	0.1375
*NSW**	0.3271	0.3140
VIC	0.2504	0.2586
QLD	0.2036	0.1989
SA	0.0653	0.0713
WA	0.1032	0.1058
TAS	0.0210	0.0231
NT	0.0080	0.0089
ACT	0.0213	0.0194
*City**	0.7035	0.7042
Regional	0.2781	0.2781
Remote	0.0184	0.0177
Postgraduate degree	0.0535	0.0540
Undergraduate	0.2254	0.2241
*Diploma**	0.4180	0.4313
Year 12	0.1296	0.1220
Did not complete High School	0.1735	0.1686
Managers	0.1545	0.1577
*Professionals**	0.2339	0.2324
Technicians & Trades	0.2286	0.2192
Community & Personal Services	0.0589	0.0625
Clerical & Administrative	0.0909	0.0980
Sales	0.0387	0.0415
Machinery operators	0.1186	0.1117
Labourers	0.0759	0.0770
Public sector	0.1966	0.2054
Number of observations	2,517	2,152

Appendix 2: Survey questions about alcohol consumption



B4 **Do you drink alcohol?** *(Cross ☒ one box)*

- ☐ No, I have never drunk alcohol ➡ **Go to B7**
- ☐ No, I no longer drink alcohol ➡ **Go to B7**
- ☐ Yes, I drink alcohol every day
- ☐ Yes, I drink alcohol 5 or 6 days per week
- ☐ Yes, I drink alcohol 3 or 4 days per week
- ☐ Yes, I drink alcohol 1 or 2 days per week
- ☐ Yes, I drink alcohol 2 or 3 days per month
- ☐ Yes, but only rarely

B5 **On a day that you have an alcoholic drink, how many standard drinks do you usually have?**

A standard drink is a small glass of wine, a 285ml glass of regular beer, a nip of spirits, or a mixed drink. *(Cross ☒ one box)*

- ☐ 13 or more standard drinks
- ☐ 11 to 12 standard drinks
- ☐ 9 to 10 standard drinks
- ☐ 7 to 8 standard drinks
- ☐ 5 to 6 standard drinks
- ☐ 3 to 4 standard drinks
- ☐ 1 to 2 standard drinks

B6

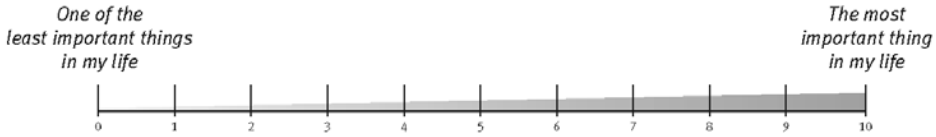
Females	***or***	***Males***
How often do you have 5 or more standard drinks on one occasion?		**How often do you have 7 or more standard drinks on one occasion?**

(Use the boxes below and cross ☒ one only)

- ☐ Not in the last year
- ☐ Less than monthly but at least once a year
- ☐ Once a month
- ☐ 2 or 3 times a month
- ☐ 1 or 2 times a week
- ☐ 3 or 4 times a week
- ☐ 5 or more times a week

Appendix 3: Survey questions about religion

B26 **On a scale from 0 to 10, how important is religion in your life? The more important it is, the higher the number of the box you should cross. The less important it is, the lower the number of the box you should cross.**



*(Cross ☒ **one** box)*

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

B27 **Which of the following best describes your religion?** *(Cross ☒ **one** box)*

☐ **No religion**

Christian religions:

☐ Anglican (Church of England)
☐ Baptist
☐ Catholic
☐ Lutheran
☐ Greek Orthodox
☐ Other Orthodox
☐ Presbyterian / Reformed
☐ Uniting Church
☐ Other Christian religion *(Please specify in the box below):*

Other religions:

☐ Buddhism
☐ Hinduism
☐ Islam
☐ Judaism
☐ Other non-Christian religion *(Please specify in the box below):*

B28 **How often do you attend religious services? Please do not include ceremonies like weddings or funerals.**

*(Cross ☒ **one** box)*

☐ Never
☐ Less than once a year
☐ About once a year
☐ Several times a year
☐ About once a month
☐ 2 or 3 times a month
☐ About once a week
☐ Several times a week
☐ Every day

Appendix 4: Full list of variables and their definitions

Variable	Source[6]	Definition
ln (earnings)	gwscei	Log of earnings from current weekly gross wages & salary - all jobs
Age 25-29	ghhiage	=1 if aged 25-29
Age 30-34		=1 if aged 30-34
Age 35-39		=1 if aged 35-39
*Age 40-44**		=1 if aged 40-44
Age 45-49		=1 if aged 45-49
Age 50-59		=1 if aged 50-59
Age 60-64		=1 if aged 60-64
*Married**	gmrcurr	=1 if married or de facto
Single		=1 if never married, widowed, separated or divorced
*Australian-born**	ganbcob	=1 if born in Australia
Immigrant English-speaking		=1 if born in main English-speaking country
Immigrant other		=1 if born in other country
*NSW**	ghhstate	=1 if live in New South Wales
VIC		=1 if live in Victoria
QLD		=1 if live in Queensland
SA		=1 if live in South Australia
WA		=1 if live in Western Australia
TAS		=1 if live in Tasmania
NT		=1 if live in Northern Territory
ACT		=1 if live in Australian Capital Territory
*City**	ghhra	=1 if live in major city
Regional		=1 if live in inner or outer regional Australia
Remote		=1 if live in remote or very remote Australia
Postgraduate degree	gedhigh	=1 if highest qualification is masters or doctorate
Undergraduate		=1 if highest qualification is Bachelor, Honours, grad diploma or grad certificate
*Diploma**		=1 if highest qualification is advanced diploma, Certificate I, II, III or IV or Certifciate not defined
Year 12		=1 if highest qualification is Year 12
Did not complete High School		=1 if highest qualification is Year 11 or below
Managers	gjbmo61	=1 if occupation is manager under ANZSCO 2006
*Professionals**		=1 if occupation is professional under ANZSCO 2006
Technicians & Trades		=1 if occupation is technician or tradesperson under ANZSCO 2006
Community & Personal Services		=1 if occupation is community or personal services worker under ANZSCO 2006
Clerical & Administrative		=1 if occupation is clerical or administrative worker under ANZSCO 2006
Sales		=1 if occupation is sales worker under ANZSCO 2006
Machinery operators		=1 if occupation is machinery operator or driver under ANZSCO 2006
Labourers		=1 if occupation is labourer under ANZSCO 2006

[6] Name of variable in HILDA dataset from which the variable is derived.

Full list of variables and their definitions (continued)

Variable	Source[7]	Definition
Religious attendance	grelat	=1 if attends religious services at least weekly
Religious importance	grelimp	Continuous variable indicating importance of religion in life on scale of 0 to 10
*Protestant * *Catholic* *Other Christian* *Other religion* *No religion*	greligb	=1 if religion indicated as Anglican, Baptist, Brethren, Lutheran, Presbyterian, Seventh-Day Adventist, Uniting Church, Pentecostal or other Protestant =1 religion indicated as if Catholic =1 if religion indicated as Christian (nfi), Churches of Christ, Jehovahs Witnesses, Mormon, Salvation Army, Other Christian, Orthodox or Greek Orthodox =1 if religion indicated as Buddhism, Hinduism, Islam, Judaism, Other religion, Non-Christian (nfi) or multiple religions =1 if indicated no religion
*Protestant*importance ** *Catholic*importance* *Other Christian*importance* *Other religion*importance* *No religion*importance*	grelimp, greligb	Interaction variable between religion dummy and religious importance variable
Smoke18	glssm100, glssmfir,	=1 if had smoked a whole cigarette by age 18 and has smoked at least 100 cigarettes in entire life, =0 otherwise

[7] Name of variable in HILDA dataset from which the variable is derived.

Appendix 5: Log earnings results assuming exogenous selection

Variable	Abstainer Coefficient (Standard Error)	Moderate Drinker Coefficient (Standard Error)	Heavy Drinker Coefficient (Standard Error)
Constant	7.0142*** (0.1659)	7.3424*** (0.0593)	7.3095*** (0.0930)
Age 25-29	-0.0273 (0.1359)	-0.3522*** (0.0529)	-0.0118 (0.0775)
Age 30-34	-0.1133 (0.1004)	-0.0942* (0.0487)	0.0110 (0.0717)
Age 35-39	0.0133 (0.1220)	-0.1297*** (0.0502)	-0.0632 (0.0814)
Age 45-49	0.0551 (0.1257)	-0.0883* (0.0463)	0.0017 (0.0781)
Age 50-59	-0.0734 (0.1154)	-0.2162*** (0.0664)	0.0672 (0.0918)
Age 60-64	0.1426 (0.1428)	-0.1569*** (0.0557)	0.0831 (0.0947)
Single	-0.1554** (0.0702)	-0.1232*** (0.0412)	-0.0915** (0.0440)
Immigrant English-speaking	0.0388 (0.0703)	-0.0105 (0.0481)	0.0212 (0.0840)
Immigrant other	0.0330 (0.0906)	-0.1418*** (0.0541)	-0.0936 (0.0655)
VIC	0.0937 (0.0897)	-0.0491 (0.0406)	-0.0664 (0.0565)
QLD	0.1545 (0.0983)	-0.0576 (0.0414)	0.0026 (0.0611)
SA	0.0290 (0.1194)	-0.1100** (0.0437)	-0.2005** (0.0891)
WA	0.1302 (0.1126)	0.0604 (0.0543)	0.0900 (0.0833)
TAS	-0.0694 (0.1435)	-0.1384* (0.0749)	-0.0014 (0.0953)
NT	-0.0066 (0.1614)	0.0275 (0.2126)	-0.0131 (0.1649)
ACT	0.2168 (0.1554)	-0.0713 (0.0693)	0.2097 (0.2044)
Regional	0.0099 (0.0737)	-0.0844** (0.0328)	-0.0771 (0.0551)
Remote	-0.0777 (0.1905)	-0.1369 (0.1460)	-0.0407 (0.1833)
Postgraduate degree	0.3053* (0.1554)	0.3227*** (0.0601)	0.2285* (0.1211)
Undergraduate	0.1174 (0.0862)	0.1757*** (0.0468)	0.0104 (0.0694)
Year 12	-0.0378 (0.0700)	-0.0099 (0.0506)	-0.0931 (0.0824)
Did not complete High School	-0.2706*** (0.0985)	-0.1051** (0.0427)	-0.1326** (0.0547)
Managers	0.0495 (0.1135)	0.0645 (0.0478)	-0.0546 (0.0854)
Technicians & Trades	-0.1733 (0.1181)	-0.0875 (0.0537)	-0.2934*** (0.0786)
Community & Personal Services	-0.0834 (0.1064)	-0.1485** (0.0652)	-0.1540 (0.1045)
Clerical & Administrative	-0.1791 (0.1098)	-0.1144** (0.0509)	-0.1362 (0.0849)
Sales	-0.1700 (0.1317)	-0.3275*** (0.0831)	-0.2131* (0.1233)
Machinery operators	-0.0806 (0.1080)	-0.0413 (0.0661)	-0.2789*** (0.0904)
Labourers	-0.4504** (0.1952)	-0.1633** (0.0642)	-0.2949*** (0.0936)
Public sector	0.0498 (0.0574)	0.0127 (0.0320)	0.0120 (0.0549)
Number of observations	438	1241	473
R-Squared	0.2628	0.2078	0.1721

Appendix 6: Log earnings results (*religious attendance* excluded)

Variable	Abstainer Coefficient (Standard Error)	Moderate Drinker Coefficient (Standard Error)	Heavy Drinker Coefficient (Standard Error)
Constant	6.8418*** (0.2175)	7.4310*** (0.1340)	7.4775*** (0.1589)
IMR	0.1589* (0.0955)	-0.1166 (0.1645)	-0.1228 (0.0999)
Age 25-29	-0.0585 (0.1334)	-0.3588*** (0.0533)	-0.0285 (0.0784)
Age 30-34	-0.1440 (0.0984)	-0.1031** (0.0511)	-0.0038 (0.0737)
Age 35-39	0.0076 (0.1211)	-0.1375*** (0.0514)	-0.0482 (0.0811)
Age 45-49	0.0358 (0.1230)	-0.1009** (0.0496)	0.0115 (0.0784)
Age 50-59	-0.1035 (0.1135)	-0.2351*** (0.0707)	0.0814 (0.0928)
Age 60-64	0.1204 (0.1416)	-0.1674*** (0.0581)	0.1066 (0.0965)
Single	-0.1376** (0.0690)	-0.1077** (0.0473)	-0.1045** (0.0452)
Immigrant English-speaking	0.0303 (0.0708)	-0.0168 (0.0485)	0.0161 (0.0830)
Immigrant other	0.1157 (0.1135)	-0.1242* (0.0635)	-0.0304 (0.0851)
VIC	0.0760 (0.0887)	-0.0550 (0.0420)	-0.0724 (0.0569)
QLD	0.1398 (0.0980)	-0.0678 (0.0443)	0.0145 (0.0618)
SA	-0.0071 (0.1206)	-0.1264** (0.0499)	-0.1923** (0.0862)
WA	0.1240 (0.1125)	0.0654 (0.0543)	0.0943 (0.0843)
TAS	-0.1004 (0.1485)	-0.1573** (0.0799)	0.0166 (0.1008)
NT	-0.0853 (0.1932)	0.0541 (0.2221)	-0.0911 (0.1755)
ACT	0.2191 (0.1587)	-0.0858 (0.0740)	0.2772 (0.2220)
Regional	-0.0036 (0.0732)	-0.0791** (0.0338)	-0.0995* (0.0557)
Remote	-0.1180 (0.1805)	-0.1303 (0.1479)	-0.0727 (0.1857)
Postgraduate degree	0.2534* (0.1537)	0.2883*** (0.0771)	0.2497** (0.1218)
Undergraduate	0.0900 (0.0848)	0.1594*** (0.0533)	0.0235 (0.0712)
Year 12	-0.0326 (0.0710)	-0.0101 (0.0505)	-0.0923 (0.0824)
Did not complete High School	-0.2758*** (0.0983)	-0.0858* (0.0506)	-0.1564*** (0.0546)
Managers	0.0332 (0.1131)	0.0567 (0.0474)	-0.0488 (0.0853)
Technicians & Trades	-0.1836 (0.1166)	-0.0841 (0.0546)	-0.3045*** (0.0789)
Community & Personal Services	-0.0465 (0.1102)	-0.1297* (0.0722)	-0.1506 (0.1038)
Clerical & Administrative	-0.1689 (0.1108)	-0.1072** (0.0527)	-0.1285 (0.0844)
Sales	-0.1388 (0.1374)	-0.3248*** (0.0835)	-0.1844 (0.1270)
Machinery operators	-0.0607 (0.1092)	-0.0233 (0.0724)	-0.2914*** (0.0900)
Labourers	-0.4229** (0.1908)	-0.1462** (0.0701)	-0.3102*** (0.0940)
Public sector	0.0448 (0.0571)	0.0105 (0.0320)	0.0168 (0.0545)
Number of observations	438	1241	473
R-squared	0.2673	0.2083	0.1751

Appendix 7: Heckman selection results using NHMRC definition

Variable	Abstainers Coefficient (Standard Error)	Heavy Drinkers Coefficient (Standard Error)	Marginal effects on probabilities		
			Abstainer	Moderate Drinker	Heavy Drinker
			Predicted Probability		
Constant	-0.4523 (0.4002)	0.2775 (0.3034)	0.1860	0.2638	0.5503
			Marginal Effect		
Age 25-29	-0.6081* (0.3560)	0.3636 (0.2476)	-0.1065	-0.0326	0.1391
Age 30-34	-0.3979 (0.3060)	0.1962 (0.2204)	-0.0719	-0.0128	0.0846
Age 35-39	-0.2229 (0.2855)	-0.0693 (0.2079)	-0.0257	0.0210	0.0046
Age 45-49	-0.3942 (0.2953)	-0.3719* (0.2136)	-0.0225	0.0776	-0.0551
Age 50-59	-0.7306** (0.2872)	-0.5220** (0.2205)	-0.0551	0.1210	-0.0659
Age 60-64	-0.2157 (0.3747)	-0.2026 (0.2529)	-0.0122	0.0415	-0.0293
Single	0.5031** (0.2253)	0.3718** (0.1631)	0.0384	-0.0749	0.0365
Immigrant English-speaking	-0.2401 (0.2740)	0.0087 (0.1994)	-0.0350	0.0097	0.0252
Immigrant other	0.3869 (0.2813)	-0.5058** (0.2418)	0.1241	0.0440	-0.1681
VIC	-0.3107 (0.2292)	0.0099 (0.1656)	-0.0458	0.0130	0.0327
QLD	-0.3998 (0.2661)	-0.0708 (0.1868)	-0.0498	0.0293	0.0205
SA	-0.6548* (0.3385)	-0.0703 (0.2416)	-0.0776	0.0388	0.0388
WA	0.2117 (0.2986)	0.0668 (0.2229)	0.0262	-0.0200	-0.0062
TAS	-1.0362** (0.4763)	-0.5678* (0.3264)	-0.0839	0.1468	-0.0629
NT	-1.0035 (0.9146)	0.0952 (0.6422)	-0.1140	0.0180	0.0960
ACT	-0.0384 (0.5168)	-0.3002 (0.3749)	0.0245	0.0464	-0.0709
Regional	-0.0246 (0.2021)	0.3140** (0.1473)	-0.0353	-0.0441	0.0794
Remote	0.5282 (0.6903)	1.1194** (0.4948)	-0.0464	-0.1488	0.1951
Postgraduate degree	-1.1745*** (0.4033)	-0.3931 (0.2638)	-0.1066	0.1169	-0.0103
Undergraduate	-0.4292* (0.2523)	-0.3884** (0.1774)	-0.0258	0.0812	-0.0554
Year 12	0.0878 (0.3087)	-0.0558 (0.2098)	0.0195	0.0035	-0.0230
Did not complete High School	0.4479* (0.2715)	0.5871*** (0.2062)	0.0042	-0.0978	0.0936
Managers	-0.1859 (0.2964)	-0.1185 (0.1890)	-0.0158	0.0268	-0.0110
Technicians & Trades	0.3128 (0.2793)	0.5341*** (0.2054)	-0.0097	-0.0872	0.0968
Community & Personal Services	1.5487*** (0.4444)	0.8648*** (0.3277)	0.1690	-0.1616	-0.0074
Clerical & Administrative	0.6148* (0.3712)	0.4466* (0.2440)	0.0482	-0.0862	0.0380
Sales	0.0878 (0.3938)	-0.3780 (0.3331)	0.0544	0.0490	-0.1034
Machinery operators	0.7395** (0.3525)	0.4399 (0.2712)	0.0712	-0.0914	0.0201
Labourers	0.6073 (0.3747)	0.2357 (0.3143)	0.0750	-0.0616	-0.0134
Public sector	-0.0474 (0.2313)	0.0410 (0.1705)	-0.0112	-0.0037	0.0149
Religious attendance	0.6184** (0.3003)	-0.3926 (0.3018)	0.1606	0.0092	-0.1698
Religious importance	0.0710 (0.0451)	-0.0840** (0.0349)	0.0193	0.0087	-0.0281
Catholic	0.2912 (0.4081)	0.0582 (0.2633)	0.0396	-0.0229	-0.0167
Other Christian	0.6538 (0.8199)	-0.1336 (0.5835)	0.1363	-0.0236	-0.1127
Other religion	-0.7844 (0.9038)	-0.9804 (0.6293)	-0.0314	0.2083	-0.1769
No religion	0.1397 (0.2938)	0.0649 (0.1866)	0.0146	-0.0162	0.0016
*Catholic*importance*	-0.0698 (0.0693)	0.0626 (0.0555)	-0.0170	-0.0057	0.0226
*Other Christian*importance*	-0.0497 (0.1139)	0.0900 (0.0921)	-0.0167	-0.0106	0.0274
*Other religion*importance*	0.2372* (0.1290)	0.2998*** (0.1007)	0.0052	-0.0551	0.0499
*No religion*importance*	0.1778 (0.1151)	0.1525 (0.0950)	0.0113	-0.0309	0.0196
Smoke18	-0.2696 (0.1965)	0.5837*** (0.1275)	-0.0991	-0.0708	0.1699
Number of observations	2152				
Log-likelihood	-1934.1088				

Variable	Abstainer Coefficient (Standard Error)	Moderate Drinker Coefficient (Standard Error)	Heavy Drinker Coefficient (Standard Error)
Constant	6.9539*** (0.2189)	7.4787*** (0.2075)	7.4125*** (0.0831)
IMR	0.0473 (0.0861)	-0.1878 (0.1594)	-0.0765 (0.0801)
Age 25-29	-0.1420 (0.1735)	-0.3239*** (0.0808)	-0.1604*** (0.0503)
Age 30-34	-0.1470 (0.1232)	-0.1163 (0.0713)	-0.0307 (0.0487)
Age 35-39	0.0282 (0.1474)	-0.1944** (0.0799)	-0.0458 (0.0501)
Age 45-49	0.0743 (0.1385)	-0.1801** (0.0701)	0.0070 (0.0489)
Age 50-59	-0.1169 (0.1361)	-0.3103*** (0.1068)	-0.0133 (0.0575)
Age 60-64	0.1759 (0.1731)	-0.1479* (0.0872)	-0.0532 (0.0518)
Single	-0.1730** (0.0844)	-0.0274 (0.0739)	-0.1706*** (0.0324)
Immigrant English-speaking	0.0483 (0.0819)	0.0297 (0.0772)	0.0008 (0.0460)
Immigrant other	0.0071 (0.1171)	-0.1024 (0.0776)	-0.0579 (0.0550)
VIC	0.1429 (0.1083)	-0.0571 (0.0618)	-0.0589 (0.0367)
QLD	0.2088* (0.1178)	0.0246 (0.0628)	-0.0809** (0.0373)
SA	0.0705 (0.1476)	-0.0740 (0.0645)	-0.1735*** (0.0484)
WA	0.1466 (0.1312)	0.0174 (0.0824)	0.0959* (0.0541)
TAS	-0.0794 (0.1737)	-0.1821** (0.0874)	-0.0742 (0.0800)
NT	0.0435 (0.1979)	0.0038 (0.2428)	-0.0279 (0.1444)
ACT	0.2955* (0.1677)	-0.0384 (0.1015)	-0.0335 (0.0893)
Regional	0.0118 (0.0935)	-0.1161** (0.0525)	-0.0567* (0.0332)
Remote	-0.0753 (0.2083)	-0.5325 (0.3334)	-0.0477 (0.1155)
Postgraduate degree	0.3393** (0.1716)	0.3131*** (0.0858)	0.2577*** (0.0802)
Undergraduate	0.1493* (0.0879)	0.1683** (0.0759)	0.0923** (0.0450)
Year 12	-0.0171 (0.0833)	0.0326 (0.0783)	-0.0516 (0.0455)
Did not complete High School	-0.3825*** (0.1192)	-0.0455 (0.0923)	-0.1570*** (0.0352)
Managers	0.0451 (0.1241)	0.1580** (0.0665)	-0.0530 (0.0479)
Technicians & Trades	-0.1805 (0.1272)	-0.0497 (0.0809)	-0.2167*** (0.0510)
Community & Personal Services	-0.0259 (0.1267)	-0.1574 (0.1007)	-0.1497** (0.0663)
Clerical & Administrative	-0.1954* (0.1103)	-0.0360 (0.0707)	-0.1701*** (0.0550)
Sales	-0.2278 (0.1472)	-0.4290*** (0.1024)	-0.1568** (0.0791)
Machinery operators	-0.0953 (0.1187)	-0.0225 (0.1070)	-0.1547*** (0.0597)
Labourers	-0.4248* (0.2274)	-0.1784* (0.0914)	-0.2670*** (0.0638)
Public sector	-0.0022 (0.0647)	0.0826* (0.0489)	-0.0042 (0.0343)
Number of observations	351	606	1195
R-squared	0.3076	0.2419	0.1911

Appendix 8: Heckman selection results using alternative definition

Variable	Abstainers Coefficient (Standard Error)	Heavy Drinkers Coefficient (Standard Error)	Marginal effects on probabilities		
			Abstainer	Moderate Drinker	Heavy Drinker
			Predicted Probability		
Constant	-1.0027*** (0.3181)	-2.8795*** (0.5372)	0.2341	0.7025	0.0634
			Marginal Effect		
Age 25-29	-0.4110 (0.2677)	0.5679* (0.3129)	-0.0762	0.0276	0.0486
Age 30-34	-0.4987** (0.2451)	0.3334 (0.3004)	-0.0858	0.0558	0.0300
Age 35-39	-0.0938 (0.2354)	-0.1737 (0.3101)	-0.0142	0.0227	-0.0086
Age 45-49	-0.3713 (0.2500)	-0.4987 (0.3143)	-0.0565	0.0782	-0.0218
Age 50-59	-0.5590** (0.2310)	-0.4851 (0.3864)	-0.0845	0.1037	-0.0193
Age 60-64	-0.1818 (0.3070)	-0.3651 (0.3676)	-0.0269	0.0440	-0.0171
Single	0.4485** (0.1822)	0.6462*** (0.1942)	0.0725	-0.1075	0.0350
Immigrant English-speaking	-0.3032 (0.2245)	-0.4020 (0.3467)	-0.0463	0.0639	-0.0176
Immigrant other	0.7985*** (0.2385)	-0.3086 (0.3999)	0.1686	-0.1409	-0.0277
VIC	-0.2323 (0.1935)	0.1438 (0.2476)	-0.0425	0.0301	0.0124
QLD	-0.2075 (0.2183)	0.0540 (0.2478)	-0.0367	0.0304	0.0063
SA	-0.4722* (0.2691)	-0.0591 (0.3479)	-0.0749	0.0723	0.0026
WA	0.2673 (0.2494)	0.4447 (0.3261)	0.0420	-0.0671	0.0252
TAS	-0.3442 (0.4228)	0.3074 (0.4670)	-0.0606	0.0338	0.0267
NT	-0.9574 (0.7671)	1.5130** (0.6040)	-0.1517	-0.0494	0.2011
ACT	0.1428 (0.4401)	-0.7194 (0.8232)	0.0351	-0.0020	-0.0330
Regional	-0.2203 (0.1681)	0.3686* (0.1932)	-0.0440	0.0168	0.0272
Remote	-0.5011 (0.5335)	0.0982 (0.5585)	-0.0794	0.0663	0.0131
Postgraduate degree	-1.1957*** (0.3771)	-0.2279 (0.5592)	-0.1546	0.1561	-0.0015
Undergraduate	-0.4817** (0.2179)	0.0102 (0.3076)	-0.0804	0.0731	0.0073
Year 12	0.0716 (0.2416)	0.2332 (0.2848)	0.0092	-0.0229	0.0137
Did not complete High School	0.1926 (0.2089)	0.5203** (0.2336)	0.0261	-0.0581	0.0320
Managers	-0.1509 (0.2625)	0.0046 (0.3244)	-0.0264	0.0239	0.0025
Technicians & Trades	0.0339 (0.2387)	0.2277 (0.3432)	0.0025	-0.0162	0.0137
Community & Personal Services	0.8728** (0.3638)	0.6510 (0.4765)	0.1681	-0.1927	0.0247
Clerical & Administrative	0.3512 (0.2967)	-0.0315 (0.4175)	0.0681	-0.0608	-0.0073
Sales	0.3197 (0.3373)	-0.6650 (0.8256)	0.0704	-0.0370	-0.0334
Machinery operators	0.6323** (0.2710)	0.8383** (0.3932)	0.1064	-0.1545	0.0481
Labourers	0.4129 (0.2965)	0.6753 (0.4249)	0.0654	-0.1062	0.0408
Public sector	-0.0195 (0.1949)	0.0735 (0.2444)	-0.0046	-0.0002	0.0047
Religious attendance	0.7022*** (0.2670)	-0.7907 (0.7541)	0.1550	-0.1125	-0.0425
Religious importance	0.0927** (0.0390)	-0.0679 (0.0590)	0.0176	-0.0122	-0.0054
Catholic	0.1025 (0.3337)	-0.1984 (0.3301)	0.0215	-0.0088	-0.0127
Other Christian	0.5672 (0.6839)	-0.9501 (0.9948)	0.1272	-0.0837	-0.0435
Other religion	-0.4045 (0.7174)	-0.6515 (0.8703)	-0.0594	0.0865	-0.0271
No religion	-0.0345 (0.2402)	0.0516 (0.2542)	-0.0069	0.0033	0.0036
*Catholic*importance*	-0.0509 (0.0599)	0.1245 (0.0808)	-0.0110	0.0028	0.0081
*Other Christian*importance*	-0.0682 (0.0948)	0.2102 (0.1592)	-0.0153	0.0019	0.0135
*Other religion*importance*	0.0775 (0.1029)	-0.2426 (0.2525)	0.0175	-0.0019	-0.0155
*No religion*importance*	0.0863 (0.0818)	-0.1528 (0.1332)	0.0177	-0.0074	-0.0104
Smoke18	-0.3787** (0.1594)	0.5743*** (0.1908)	-0.0760	0.0353	0.0407
Number of observations	2152				
Log-likelihood	-1615.609				

Variable	Abstainer Coefficient (Standard Error)	Moderate Drinker Coefficient (Standard Error)	Heavy Drinker Coefficient (Standard Error)
Constant	6.8226*** (0.2197)	7.4060*** (0.0936)	7.3073*** (0.3201)
IMR	0.1829* (0.0996)	-0.1140 (0.1538)	-0.1003 (0.1367)
Age 25-29	-0.0658 (0.1299)	-0.3055*** (0.0482)	0.0134 (0.1105)
Age 30-34	-0.1524 (0.0960)	-0.0593 (0.0444)	-0.0282 (0.1024)
Age 35-39	0.0050 (0.1198)	-0.1313*** (0.0460)	0.0771 (0.0982)
Age 45-49	0.0318 (0.1211)	-0.0933** (0.0438)	0.1773 (0.1109)
Age 50-59	-0.1048 (0.1100)	-0.1847*** (0.0642)	0.1551 (0.1143)
Age 60-64	0.1163 (0.1395)	-0.1136** (0.0498)	0.0375 (0.1681)
Single	-0.1362** (0.0683)	-0.0855** (0.0395)	-0.1320** (0.0667)
Immigrant English-speaking	0.0282 (0.0707)	-0.0171 (0.0448)	0.0955 (0.1445)
Immigrant other	0.1288 (0.1181)	-0.1114 (0.0699)	-0.0451 (0.1007)
VIC	0.0743 (0.0886)	-0.0558 (0.0371)	-0.0158 (0.0868)
QLD	0.1379 (0.0976)	-0.0584 (0.0378)	0.0401 (0.0821)
SA	-0.0129 (0.1190)	-0.1649*** (0.0462)	0.0211 (0.1155)
WA	0.1249 (0.1117)	0.0935* (0.0557)	0.0883 (0.0808)
TAS	-0.0978 (0.1496)	-0.1548** (0.0674)	0.1269 (0.1158)
NT	-0.1104 (0.1957)	-0.0225 (0.1947)	0.0686 (0.2008)
ACT	0.2147 (0.1566)	-0.0425 (0.0695)	0.0045 (0.2430)
Regional	-0.0066 (0.0719)	-0.0710** (0.0299)	-0.1121 (0.0798)
Remote	-0.1393 (0.1804)	-0.1728 (0.1284)	0.2988 (0.1887)
Postgraduate degree	0.2401 (0.1602)	0.2617*** (0.0668)	0.4453** (0.1768)
Undergraduate	0.0845 (0.0835)	0.1373*** (0.0461)	0.0449 (0.0894)
Year 12	-0.0320 (0.0705)	-0.0306 (0.0465)	-0.0338 (0.0967)
Did not complete High School	-0.2752*** (0.0977)	-0.1316*** (0.0399)	-0.0484 (0.0778)
Managers	0.0267 (0.1131)	0.0459 (0.0436)	-0.0549 (0.1274)
Technicians & Trades	-0.1888 (0.1165)	-0.1398*** (0.0483)	-0.1924* (0.1132)
Community & Personal Services	-0.0495 (0.1082)	-0.1297* (0.0753)	-0.1548 (0.1463)
Clerical & Administrative	-0.1748 (0.1097)	-0.0984** (0.0474)	-0.1987 (0.1266)
Sales	-0.1365 (0.1361)	-0.3025*** (0.0731)	-0.0124 (0.1928)
Machinery operators	-0.0638 (0.1080)	-0.0319 (0.0697)	-0.3711*** (0.1261)
Labourers	-0.4233** (0.1869)	-0.1630** (0.0669)	-0.3556*** (0.1138)
Public sector	0.0471 (0.0570)	0.0019 (0.0305)	0.1227 (0.0748)
Number of observations	439	1489	224
R-squared	0.2700	0.1930	0.2629

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