

An investigation into the effect of alcohol consumption on health status and health care utilization in Ireland

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Abstract

This paper presents a study of the effect of alcohol consumption on individual health status and health care utilization in Ireland using the 2007 Slán National Health and Lifestyle Survey, while accounting for the endogenous relationship between alcohol and health. Drinkers are categorized as those who never drank, non-drinkers, moderate drinkers, or heavy drinkers, based on national recommended weekly drinking levels in Ireland. The drinking-status equation is estimated using an ordered probit model. Predicted values for the inverse mills ratio are generated, which are then included in the health and health-care utilization equations. Differences in health status for each category of drinker are examined, and the relationship between both alcohol consumption and health with a host of other personal and socio-economic variables is also identified. Given that the measure of health status available is self-assessed, the effect of alcohol consumption on health-care utilization is also analyzed as an alternative measure of health. Findings show that in Ireland, moderate drinkers enjoy the best health status. More moderate drinkers report having very good or excellent health compared with heavy drinkers, non-drinkers, or those who never drank. While heavy drinkers do not report having as good a health status as moderate drinkers, they are better off in terms of health when compared with non-drinkers and those who are lifetime abstainers.

Highlights

- The effects of alcohol consumption on health status in Ireland are examined.
- Individuals are categorized as those who never drank, non-drinkers, moderate drinkers, or heavy drinkers.
- Endogeneity and selection bias of alcohol consumption are accounted for.
- The findings are that a higher number of non-drinkers and those who never drank report poorer health compared with moderate or heavy drinkers.
- The findings highlight concerns with the implementation of population-based policies as recently proposed in Ireland.

Keywords: Economics; Economic Methodology; Health-Care System; Social Policy; Socio-Economics; Statistics

DRAFT

1. Introduction

The World Health Organization (2014) states that the harmful use of alcohol causes a large disease, social, and economic burden in societies. They state that in 2012, about 3.3 million deaths, or 5.9% of all global deaths, were attributable to alcohol consumption, and 5.1% of the global burden of disease and injury were attributable to alcohol consumption. The WHO (2014) also reports that there is a wide geographical variation in the proportion of alcohol-attributable deaths and Disability Adjusted Life Years (DALYs), with the highest alcohol-attributable fractions reported in the WHO European Region. A report commissioned by the Department of Health in Ireland (2014) states that a total of €793 million was spent on health and social care expenditure related to alcohol misuse in Ireland in 2013.

This paper investigates the effect of alcohol consumption on health status in Ireland while accounting for the potential endogenous relationship between alcohol and health. Drinkers are categorized into four categories based on the recommended weekly drinking levels of the Irish Health Promotion Unit (Health Service Executive [(2008)] in Ireland at the time of the survey: those who never drank, current non-drinkers, moderate drinkers, and heavy drinkers. Differences in health status for each of the categories are examined, and the relationship between both alcohol status and health with a host of other personal and socio-economic variables such as age, gender, marital status, employment status, and level of education, among others, is also identified. The burden of alcohol consumption on medical care is also assessed.

Sample selection bias arises when a sector selection is non-random due to individuals choosing a particular sector because of their personal characteristics (Heckman, 1979; Zhang, 2004). In relation to categorizing individuals based on their levels of alcohol consumption, selection bias may arise as people may select into a particular drinker group because they know

that by doing so it will not have a negative effect on them (Barrett, 2002; Di Pietro & Pedace, 2008; Hamilton & Hamilton, 1997).

Endogeneity is the situation in which an independent variable included in the model is potentially a choice variable and is determined within the context of the model (Chenhall & Moers, 2007). In relation to the study of a lifestyle variable such as alcohol on health, alcohol consumption is governed in part by unobserved factors, which may also be important determinants of the dependent variable 'health', implying the possibility that alcohol consumption may be correlated with the error term of the conditional-demand equation (Kenkel, 1995). If endogeneity occurs and is not accounted for, it would mean that alcohol is determined within the model used to estimate health status, resulting in the estimates received being inaccurate.

The remainder of this paper is presented as follows. Section 2 presents the theory in relation to the issue of the factors affecting health status and health-care utilization and the impact alcohol has on both. Section 3 outlines the empirical model used to analyze the effect of drinking status on health while controlling for selection bias and endogeneity. Section 4 identifies and describes the data and empirical results. Section 5 concludes the paper.

2. Health Production Framework

2.1 Grossman's Human Capital Model

Michael Grossman's human capital model of the demand for health states that individuals derive utility from the services that health capital yields and from the consumption of other commodities (Gerdtham, Johannesson, Lundberg, & Isacson, 1999; Wagstaff, 1986). The determinants of health constitute an issue of vital importance to health policy. The stock of health capital depreciates over time, and the consumer can produce gross investments in it

according to a household production function using medical care and their own time as inputs. Grossman (1972) argues that if one can improve one's health status, they are then in a position to work more, are absent from work less, and are more productive, which results in higher income. Grossman adds to this theory by saying that an increased wage rate results in one's returns from healthy days increasing, and hence workers will therefore tend to increase their optimal capital stock of health. Consumers are viewed as producing gross investments in health using inputs of medical care and their own time.

2.2 Self-rated health

The World Health Organization defines health as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Health is a resource for everyday life, not the objective of living.

Self-Assessed Health is probably the most common measure of health in general-purpose surveys and is often the only available indicator of the respondent's health (Jürges, 2008). The Self-Assessed Health measure is widely used both as an outcome variable in studies of social influences on health (Contoyannis & Jones, 2004; Jürges, 2008; Kiuila & Miesztowski, 2007) and as an explanatory variable in other studies (Disney, Emmerson, & Wakefield, 2006; Wang, 1997). Fayers and Sprangers (2002) state that in relation to the question *'What do you think about your health in general? Very good, Good, Fair, Poor, Very Poor?'* there is widespread agreement that this simple global question provides a useful summary of how patients perceive their overall health status.

Health status is highly correlated with health-care utilization. The most immediate determinant of utilization is health status (Gruber & Kiesel, 2010).

2.3 Health-Care Utilization

Numerous studies find that the health status variables are strongly associated with both visits to general practitioners (GPs) and specialists. Individuals who report a poorer health status are more likely to report greater use of physician services (Dunlop, Coyte, & McIsaac, 2000; Laroche, 2000). Madden, Nolan, and Nolan (2005) assessed the impact of health status on health services in Ireland by looking at a range of different illnesses and find a positive relationship between each illness and the utilization of GP services, highlighting that people in poor health use GP services more. Rotermann (2006) found that in Canada, seniors who perceive their health as fair or poor are heavy users of health-care services. Similarly, Finkelstein (2001) found that the mean expenditure on physicians is substantially higher among those who reported poorer health status and that self-reported health status is significantly related to the probability of seeing a specialist.

The World Health Organization (2011) states that health is a positive concept emphasizing social and personal resources, as well as physical capacities. Rivera (2001) states that health is affected by many factors, which can be divided into four groups of variables: biological, socio-economic, lifestyle, and medical resources.

2.4 Alcohol and Health Status

The effects of alcohol on one's health status have been the subject of much research. In general, findings tend to be that moderate levels of alcohol consumption are beneficial toward one's health status, compared with abstaining from or consuming heavy amounts of alcohol, which has a negative effect on health status (Bau, Bau, Rosito, Manfroi, & Fuchs, 2007; Berger et al., 1999; Klatsky, Armstrong, Friedman, & Sidney, 2001). This gives rise to a U-shaped curve or a partial U-shaped curve referred to as a J-shaped curve, showing a reduced relative risk given

diseases, and, in general, better health for moderate consumers of alcohol compared with abstainers or heavy drinkers (Bau et al., 2007; Berger et al., 1999; Klatsky et al. 2001). Studies looking at the relationship between alcohol consumption and specific illnesses have similar findings, in that moderate consumers of alcohol are at lower risk. Wannamethee and Shaper (1999), Rimm and Moats (2007), Bryson et al. (2006), and Klatsky et al. (2005) found this in relation to coronary heart disease. Becker et al. (1996) found this in relation to liver disease, and Berger et al. (1999), Mukamel (2007), and Klatsky et al. (2001) found this in relation to the risk of stroke. Green and Polen (2001) found that light to moderate drinkers of alcohol appear to be in better health, both mentally and physically, have better functional status, and are also more likely to engage in preventative health care services, compared with abstainers or heavy drinkers.

Similarly, in relation to alcohol consumption and the utilization of health services, findings are that male non-drinkers are more likely to use GP services. Female non-drinkers are more likely to have visited a GP when compared with moderate drinkers, but a female who has 12 drinks or more per week is more likely to have visited a GP six times or more in the previous year when compared with either non-drinkers or moderate drinkers.

Many studies have been carried out regarding the effect of alcohol consumption on income, and findings show that moderate consumers of alcohol have higher incomes (Barrett, 2002; Hamilton & Hamilton, 1997; Ormond & Murphy, 2016). All these studies argue that a possible explanation for this is based on the fact that medical literature states that there are health benefits to moderate levels of alcohol consumption, and referring to the Grossman (1972) theory, this would result in efficiency levels improving, hence incomes increasing.

3. Empirical Model

The relationship between alcohol consumption and health status is examined. Alcohol consumption is estimated as an ordered probit model. The range of values for drinking status is divided into four intervals, each corresponding to a different category of drinker: those who never drank, non-drinkers, moderate drinkers, and heavy drinkers; the natural ordering of these four categories of drinkers seems reasonable (Harris, Ramful, & Shao, 2006). The threshold values correspond to the cut-offs where an individual moves from reporting one category of drinker to another. Health Status and Health-Care Utilization are also estimated by ordered probit.

3.1 Selection Bias

In the estimation of the effect of alcohol status on health, the issue of the endogeneity and possible selection bias of alcohol consumption arises. This occurs when individuals self-select into different drinking categories, and because of this, the outcome differences may potentially be explained as a result of pre-existing differences between the groups, as opposed to the actual levels of alcohol consumed; hence, this would not be a random selection (Di Pietro & Pedace, 2008). The error terms in both the alcohol-consumption equation and the health-status equation would then be correlated, and failure to account for non-random selection in drinking status will lead to biased estimates. Many studies into the effect of alcohol consumption on health status have not only failed to account for selection bias but also for the heterogeneity in health and drinking history among non-drinkers. These studies have combined current former drinkers and lifetime abstainers, and as a result have failed to account for the fact that former drinkers may have quit due to illness, and this in turn could increase the risk in the non-drinker category and underestimate the adverse effects of alcohol consumption on health if illnesses leading to abstention are alcohol-related (Green & Polen, 2001). The econometric techniques used in this

study account for possible selection bias whereby respondents self-select into drinking categories including the selection bias that may occur in relation to former drinkers.

One way of accounting for potential bias is to use the standard Heckman two-step estimation whereby selection bias can be approached as an omitted variable problem (Vella, 1998). A variety of extensions to the Heckman model (1979) has been developed for ordered-choice models. One method for addressing such selection bias is to use an ordered probit extension of the Heckman correction (Greene & Hensher, 2010). Where the selection equation is an ordered probit, the two-step method involves estimating the participation equation by first using an ordered probit model and then computing an estimate of the inverse mills ratio for each individual in the selected sample. The inverse mills ratio is then included as an additional regressor in Step 2 of the estimation, which is estimated by ordered probit in relation to health.

3.2 Endogeneity

Kenkel (1995) states that in the estimation of alcohol status on health status, endogeneity could exist and should be accounted for. Both Hamilton and Hamilton (1997) and Barrett (2002) in their studies into the effect of alcohol status on earnings argue that alcohol consumption could be endogenous, and suggest that this is controlled for by treating alcohol endogenously and estimating earnings by drinker type using the two-step method proposed by Heckman or a similar method proposed by Lee.

Chiburis and Lokshin (2007) estimated the wage equations in the public, private, and informal sectors for male workers in India. Selection bias and endogeneity could occur in relation to the sectors in which the individuals work. On that basis, they carry out this estimation based on the ordered probit selection rule, where in the first step of the analysis the three categories of workers are estimated by using an ordered probit analysis.

3.3 Techniques used in the study of the effect of alcohol consumption on health

3.3.1 Alcohol-Status Equation (Step One)

Alcohol consumption is estimated by an ordered probit model. Drinkers are divided into four categories: those who never drank, non-drinkers, moderate drinkers, and heavy drinkers. An individual's level of alcohol consumption, c_i , is dependent on a range of independent variables, s , each of which is thought to affect a person's level of alcohol consumption. It is assumed that the independent variables s_i and the categorical variables c_i are observed. In this model, individuals i are sorted into J categories of drinkers 1,2,3,4, which correspond to those who never drank, non-drinkers, moderate drinkers, and heavy drinkers. Categorization is done based on an ordered probit selection rule.

$$c_i^* = \alpha' s_i + \varepsilon_i \quad i = 1, \dots, n \quad (1)$$

$$\begin{aligned} c_i = 1 & \quad \text{if} \quad -\infty < c_i^* \leq \mu_1 \\ c_i = 2 & \quad \text{if} \quad \mu_1 < c_i^* \leq \mu_2 \\ c_i = 3 & \quad \text{if} \quad \mu_2 < c_i^* \leq \mu_3 \\ c_i = 4 & \quad \text{if} \quad \mu_3 < c_i^* \leq \infty \end{aligned}$$

Where:

c	category of drinker
α	is an unknown vector of parameters
s	independent variables
ε	is a standard normal shock
μ_J	cut-offs
i	indexes individuals
n	sample observations

The ordered probit of c on s is estimated yielding consistent estimation of α . In the ordered probit selection model it is important that there is at least one variable in the selection model s that has no effect on health status, h , except through its effect on alcohol, c . Otherwise,

the identification of the coefficient β_j in the health-status equation would be weak (Chiburis & Lokshin, 2007). In this study, the variable describing whether or not people regularly partake in church activities is used, as this variable can have an effect on alcohol consumption but not on health status. Hence, it is included in the alcohol-status equation only.

In the first step of the two-step estimation method, alcohol status is estimated by an ordered probit regression to compute estimates of α . Level of choice is based on its c_i value relative to the thresholds for each of the categories of drinkers, which are maximum likelihood estimates from the selection equation. An estimation of the inverse mills ratio, λ_i , is then computed for each individual in the sample. By estimating the inverse mills ratio, selection bias and possible endogeneity of alcohol consumption are accounted for. The equation setting out how the inverse mills ratio is derived is shown in Appendix A.

3.3.2 Health-Status Equation (Step Two)

In the second step of the two-step estimation, the health-status equation is estimated by an ordered probit regression, and the inverse mills ratio, λ , is also included in this equation as an additional regressor similar to that set out by Greene and Hensher (2010).

$$h_{ij}^* = x_j \beta_j + u_{ij} \quad i = 1, 2, \dots, N \quad j = 1, 2, 3, 4 \quad (2)$$

What is observed for h is:

$$\begin{aligned} h_i = 1 & \quad \text{if} \quad -\infty < h_i^* \leq \mu_1 \\ h_i = 2 & \quad \text{if} \quad \mu_1 < h_i^* \leq \mu_2 \\ h_i = 3 & \quad \text{if} \quad \mu_2 < h_i^* \leq \mu_3 \\ h_i = K & \quad \text{if} \quad \mu_{K-1} < h_i^* \leq \infty \end{aligned}$$

Where:

- h health measure of individual
- x vector of independent variables
- β coefficients on the observable characteristics
- u_{ij} error term
- i indexes individuals

j indexes drinking status
 k categories of health status

The health-status equation is estimated for each category of drinker c . The coefficients of x_i depend on the category c_i . Each of the u_{ij} terms are normal error terms with a variance σ_j^2 . One assumes that the selection into the drinking status group is associated with health status, which means that ε_i and each of the terms u_{ij} are correlated with correlation ρ_j .

The Inverse Mills Ratio estimated in Step 1 is then included in the estimation of the primary equation of interest, the health-status equation, in Step 2 to account for the potential selection bias. This equation is set out in Appendix A.

By estimating the selection correction term and including this as an additional regressor in the health-status equation, selection bias and endogeneity of alcohol consumption are controlled for (Hamilton & Hamilton, 1997).

3.3.3 Health-Care Utilization Estimation

Health-Care Utilization is estimated in the same manner as health status and hence controls for selection bias and endogeneity. The dependent variable 'Health-Care Utilization' is based on the number of GP consultations respondents had prior to the survey.

4. Data and Empirical Results

4.1 Data

The data to be used in this research will be taken from the 2007 Slán National Health and Lifestyle Survey, which was commissioned by the Department of Health and Children in Ireland. This survey is a cross section of the Irish adult population, aged 18 and over, and consists of

10,364 people (62% response rate). The selection is a random sample that is proportionately distributed across counties, localities, gender, urban/rural locations, age groups, and social classes.

The dependent variables used in this study are alcohol and health. Respondents are divided into one of four categories of drinkers: those who never drank, non-drinkers, moderate drinkers, and heavy drinkers, based on the recommendations of the Irish Health Promotion Unit within the Health Service Executive in Ireland (2008). Moderate drinkers are defined as those who had a drink in the previous month, or in the week prior to the survey, a woman who had up to 14 standard drinks or a man who had up to 21 standard drinks. Heavy drinkers are women who drank more than 14 drinks in the week prior to the survey and men who drank more than 21 drinks. Non-drinkers are those who did not have a drink in the month prior to the survey but cannot say that they never drank, and those who are categorized as having never drank are lifetime abstainers. Dummy variables for the four categories of drinkers are established.

Health Status is also treated as an ordered probit. In the Slán survey, respondents are asked to describe their health by selecting one of the following categories: Excellent, Very Good, Good, Fair, or Poor, which then results in the health status being divided into five intervals.

Similarly, Health-Care Utilization is also estimated by an ordered probit. Respondents are classified into one of five categories based on the number of times they visited a general practitioner: never visited a GP = 1, visited a GP more than 2 years ago = 2, visited a GP between 1 and 2 years ago = 3, visited a GP between 1 and 12 months ago = 4, and visited a GP within the last 4 weeks = 5.

The Slán survey includes a large number of socio-demographic characteristics, a number of which are used as explanatory variables and are shown in Table 1. The drinking-status

equation contains all the variables that are in the health-status and health-care utilization equations. By including all of these variables in the drinking-status choice equation, the effect of health status on drinking behavior is controlled for, which is similar to what Hamilton and Hamilton (1997) and Barrett (2002) did in their studies on the effect of alcohol status on income.

Table 1. Descriptive statistics

Variable Definitions	Drinking Status Equation	Health Status Equation	Health Care Utilization	Mean	Standard Deviation
Dependent Variables					
Alcohol Status: Never Drank = 1; Non Drinkers = 2, Moderate Drinkers = 3, Heavy Drinkers = 4				1.796	.545
Health Status = Self-Assessed Health Status (1 = poor health status to 5 = excellent health status)				3.61	1.03
Health-Care Utilization = Last time an individual visited a GP (1 = never and 5 = in the last 4 weeks)				3.94	0.95
Independent Variables					
Males = Individuals who are male, 0 = female	X	X	X	0.427	0.495
Age 18-29 = those who are aged 18 to 29, 0 = otherwise	X	X	X	0.174	0.379
Age 30-39 = those who are aged 30 to 39, 0 = otherwise	X	X	X	0.219	0.414
Age 40-49 = those who are aged 40 to 49, 0 = otherwise	X	X	X	0.191	0.393
Age 50-59 = those who are aged 50 to 59, 0 = otherwise	X	X	X	0.154	0.361
Age 60-69 = those who are aged 60 to 69, 0 = otherwise*	X	X	X	0.130	0.336
Age 70 plus = those who are aged 70 plus, 0 = otherwise	X	X	X	0.132	0.338
Married = Individuals who are married, 0 = otherwise	X	X	X	0.506	0.500
Widowed = Individuals who are widowed, 0 = otherwise	X	X	X	0.087	0.281
Sep/Div = Individuals who are separated or divorced, 0 = otherwise	X	X	X	0.063	0.243
Single/Never Married = Individuals who are single/never married, 0 = otherwise	X	X	X	0.280	0.449
Cohabiting = Individuals who are cohabiting, 0 = otherwise*	X	X	X	0.062	0.242
Ed primary = Individuals who have primary school education only, 0 = otherwise*	X	X	X	0.174	0.379
Educ. Secondary = Individuals who have completed secondary education only, 0 = otherwise	X	X	X	0.441	0.497
Educ. Diploma = Individuals who have a diploma or certificate, 0 = otherwise	X	X	X	0.185	0.388

Table 1 continued. Descriptive statistics

Variable Definitions	Drinking Status Equation	Health Status Equation	Health Care Utilization	Mean	Standard Deviation
Educ. Primary Degree = Individuals who have a primary degree, 0 = otherwise	X	X	X	0.104	0.306
Educ. Post Graduate = Individuals who have completed a postgraduate/higher degree, 0 = otherwise	X	X	X	0.096	0.296
Employee= those whose current employment situation is an employee at work, 0 = otherwise	X	X	X	0.458	0.498
Self-employed = those whose current employment situation is self-employed or in farming, 0 = otherwise	X	X	X	0.115	0.320
Disability = those whose current employment situation is unable to work owing to permanent sickness/disability, 0 = otherwise*	X	X	X	0.038	0.192
State Training/Student = those who are students or on a state training program, 0= otherwise	X	X	X	0.037	0.189
Unemployed = those whose current employment situation is unemployed, 0 = otherwise	X	X	X	0.030	0.170
Homemaker = those whose current employment situation is Homemaker, 0 = otherwise	X	X	X	0.140	0.347
Retired = those whose current employment situation is wholly retired, 0 = otherwise	X	X	X	0.169	0.375
Other = those whose current employment situation is classified as other, 0 = otherwise	X	X	X	0.010	0.097
Race White = those who are white or white Irish, 0 = otherwise	X	X	X	0.970	0.169
Race Black = those who are black or white Irish, 0 = otherwise	X	X	X	0.008	0.089
Race Asian = those who are Asian or Asian Irish, 0 = otherwise	X	X	X	0.008	0.089
Race Other = those who are from another or a mixed background, 0 = otherwise*	X	X	X	0.006	0.077
Log income is the log of household income			X	6.398	.713
Total in hh = total number of people in household	X	X	X	5.811	3.189
Open country = individuals living in the open country, 0 = otherwise*	X	X	X	0.309	0.462
Village = individuals living in a village, 0 = otherwise	X	X	X	0.107	0.309
Town = individuals living in a town, 0 = otherwise	X	X	X	0.243	0.429
City other than Dublin = individuals living in a city other than Dublin, 0 = otherwise	X	X	X	0.106	0.307

4.2 Results

In the first step of the two-step model, alcohol status is estimated by an ordered probit generating the Inverse Mills Ratio. Results from both alcohol status regressions in the estimation of health status and health-care utilization are set out in the Appendix. The coefficients listed indicate the effect each variable has on the probability of an individual being in a higher drinking

category. The corresponding z statistics, testing the null hypothesis of statistical significance of the variables in the alcohol-status equation, are also given along with the marginal effects.

4.2.1 Results from the estimation of Health Status

Results for the selection-corrected health-status equations estimated in Step 2 are presented in Table 2.

Table 2. Results-ordered probit model estimating health status

	Never Drank		Non-Drinkers		Moderate Drinkers		Heavy Drinkers	
	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat
Educ. Secondary	0.467	4.22*	0.148	1.53	0.222	3.78*	0.307	1.07
Educ. Diploma	0.416	2.68*	0.413	3.12*	0.234	3.51*	0.259	0.74
Educ Prim Dgre	0.528	2.69*	0.524	3.18*	0.338	4.57*	0.273	0.72
Educ Post Grad	0.377	2.14**	0.314	2.02**	0.393	5.17*	0.170	0.5
Age18-29	1.516	5.84*	0.805	4.29*	0.429	5.2*	0.737	1.4
Age 30-39	0.941	5.06*	0.584	3.97*	0.328	4.63*	0.826	2.27
Age 40-49	0.661	3.72*	0.516	3.5*	0.253	3.56*	0.832	2.28
Age 50-59	0.568	3.87*	0.057	0.44	0.005	0.07	0.426	1.27
Age 70plus	-0.580	-3.48*	-0.249	-1.73	0.080	0.86	-0.201	-0.4
Employee	1.620	7.76*	1.135	6.8*	1.140	11.26*	1.393	3.53*
Self employed	1.262	5.8*	1.181	6.48*	1.185	10.92*	1.187	2.99*
State Training or Student	1.826	5.48*	1.031	4.11*	1.131	8.9*	1.341	2.26**
Unemployed	1.284	4.84*	0.916	3.61*	1.285	9.19*	1.214	2.84*
Homemaker	1.143	6.38*	0.932	5.32*	1.081	10.33*	0.810	2.17**
Retired	1.244	6.28*	0.797	4.51*	0.873	7.59*	1.253	2.63*
Other	0.954	3.52*	1.009	3.04*	1.387	7.73*	-0.755	-1.26
Log income	0.332	3.28*	0.077	0.91	0.120	3.74*	0.246	1.21

Table 2 continued. Results-ordered probit model estimating health status

	Never Drank		Non-Drinkers		Moderate Drinkers		Heavy Drinkers	
	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat
Race White	0.260	1.1	0.155	0.55	-0.076	-0.61	0.563	1.13
Race Black	-0.606	-1.68	0.497	1.18	-0.215	-0.9	Omitted	
Race Asian	-1.784	-3.9*	-0.151	-0.31	-0.108	-0.4	-0.377	-0.38
Male	0.453	2.55**	-0.020	-0.19	-0.137	-3.69*	0.057	0.16
Married	-0.152	-0.86	0.360	2.19**	0.119	1.92	-0.029	-0.15
Widowed	-0.030	-0.15	0.594	2.95*	0.036	0.4	0.026	0.07
Separated/ divorced	0.020	0.08	0.370	1.89	0.116	1.38	-0.077	-0.3
Single/never married	-0.093	-0.53	0.232	1.41	0.105	1.74	-0.120	-0.6
Total in h.hold	-0.013	-1.04	0.016	1.2	-0.009	-1.56	0.015	0.83
Village	0.070	0.56	-0.043	-0.39	-0.043	-0.81	-0.019	-0.08
Town	-0.064	-0.63	0.110	1.16	-0.096	-2.34**	0.020	0.1
City not Dublin	0.451	2.29	0.128	0.9	0.058	1.05	0.207	0.61
Dublin city	0.270	1.84	0.073	0.67	0.007	0.17	0.078	0.27
Smoker	0.214	1.18	-0.133	-1.17	-0.279	-7.37*	-0.040	-0.11
Weight right	0.440	3.11*	0.004	0.02	-0.042	-0.57	0.132	0.43
Weight too heavy	0.240	1.45	-0.388	-2.29**	-0.345	-4.5*	-0.161	-0.43
Weight too light	0.026	0.13	-0.796	-3.41*	-0.307	-2.8*	-0.287	-0.76
Medical Card Holder	-0.130	-1.49	-0.214	-2.36**	-0.223	-5.16*	0.188	1.26
Health Insurance	0.335	-4.29*	0.069	0.8	0.087	2.44**	0.143	1.05
Correction sel.	-1.769	-3.04*	-0.492	-0.99	-0.399	-1.63	0.852	0.69
Cut Off 1	0.199		-0.425		-0.680		3.537	
Cut Off 2	1.217		0.561		0.297		4.673	
Cut Off 3	2.218		1.569		1.437		5.861	
Cut Off 4	3.289		2.681		2.566		6.880	

Table 2 continued. Results-ordered probit model estimating health status

Never Drank	Non-Drinkers	Moderate Drinkers	Heavy Drinkers
Number of obs = 1305	Number of obs = 1067	Number of obs = 5596	Number of obs = 551
Wald chi2(37) = 435.11	Wald chi2(37) = 358.28	Wald chi2(37) = 1098.49	Wald chi2(35) = 132.65
Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000
Pseudo R ² = 0.1112	Pseudo R ² = 0.1306	Pseudo R ² = 0.0801	Pseudo R ² = .0745
Log Pseudolikelihood	Log Pseudolikelihood	Log Pseudolikelihood	Log Pseudolikelihood
= -1719.7519	= -1393.208	= -6950.4236	= -695.97783

*** indicates significance at 1% and 5% level**

Note: Physically active dropped due to multicollinearity.

Race Black for heavy drinkers dropped due to multicollinearity.

Looking at the different categories of drinkers, 5,596 respondents are classified as moderate drinkers, 1,305 as never having drunk, 1,067 as non-drinkers, and 551 as heavy drinkers. The Wald Test shows that the models are statistically significant and rejects the null hypothesis that coefficients of the variables are equal to zero.

Education is a very significant variable in terms of health status for those who never drank, non-drinkers, and moderate drinkers. Individuals in these three categories with a third-level education, either a higher diploma, primary degree or a postgraduate degree, are more likely to report having a better health status compared with those who have a second level of education only. Previous studies also find that education strongly contributes to better health (Behrman & Wolfe, 1989; Berger & Leigh, 1989; Gilleskie & Harrison, 1998; Hartog & Oosterbeek, 1998; Kenkel, 1991, 1995; Leigh, 1998).

This study finds that all ages are significant in terms of the health status of those who never drank. In particular, individuals in this category who are aged 18–29 years are very likely to report excellent health status, and those aged 70 years or over are 4.4% more likely to report

poorer health status. This is similar to previous studies by Lin (2008), Wilson, Rosenberg, & Abonyi, (2011), Yen, Shaw, & Yuan (2010) which all find that older people report poorer health. Non-drinkers and moderate drinkers aged 18–49 years are most likely to report a higher category of Health Status. For heavy drinkers, age is not a significant variable.

The employment status variables are in general statistically significant in the determination of health status across all categories of drinkers. All variables describing employment status are positively correlated with health status holding other variables constant for all categories of drinkers.

Log of income is a very significant positive variable in the health-status equation for both those who never drank and moderate drinkers. Particularly in relation to those who never drank, they are likely to report a higher category of self-assessed health associated with higher income. These findings are generally consistent with previous findings showing that those with lower income also reported a lower self-reported health (Buckley, Denton, Robb, & Spencer, 2004; Yen et al., 2010). Tremblay, Ross, & Berthelot (2002) show this is also the case in relation to household income.

Race is not significant in the determination of health status of non-drinkers, moderate drinkers, and heavy drinkers. For those who never drank, the only race variable that is significant is that describing those of Asian race, and for this variable the coefficient is negative, showing that those of Asian race who never drank are 39.8% more likely to report a poor category of self-assessed health. Results from previous studies vary in relation to the effect of race on health status. Many studies show that the black race tends to have poorer health when compared to other races (Thompson, 2011). In contrast, Habicht and Kunst (2005) found that ethnic differences were generally very small, with no consistently higher use by one group.

Gender is a significant determinant of health status of those who never drank and moderate drinkers. Males who never drank and female moderate drinkers are more likely to report a higher category of health status. Male non-drinkers are just over 2% less likely than females to report poor health status. Lin (2008), Kwan (2010), Liu (2008), Lahelma, Markikainen, Rahkonen, & Silventoinen (1999), and Lianga, Bennett, Sugisawac, Kobayashid, & Fukayad (2003) all found that males report better health than females.

In terms of marital status, non-drinkers who are married or widowed are likely to report a higher health status, which is in contrast to previous findings such as those of Wilson et al. (2011). For both moderate and heavy drinkers as well as those who never drank, marital status is not a significant determinant of health status. Numerous studies found that married individuals are healthier than single individuals (Rosengren, Wedel, & Wilhelmsen, 1989; Zick & Smith, 1991). Number of people living in the household is not significant for any category of drinker.

Where one lives can also affect one's health status. In this study, it appears that the variables describing where respondents live does not have a significant impact on health status. Findings from other studies show that the health status varies across the urban/rural divide for the different drinking categories. Findings from previous studies are varied. Wilson et al. (2011) showed that those living in rural areas are more likely to report fair/poor health than those living in urban areas, whereas contrary to this, Lin (2008) showed that people living in urban areas in Taiwan are more likely to report poorer health.

In terms of the Lifestyle variables, smoking is only significant in the health-status equation for moderate drinkers. Moderate drinkers who smoke are likely to report being in the lower categories of health status, i.e., they are 0.7% more likely to report poor health. Previous literature finds that smoking has a negative effect on health status (Ho, Lam, Fielding, & Janus,

2003; Holman et al., 1988; Manning, Keeler, Newhouse, Sloss, & Wasserman, 1991; Mathers & Loncar, 2006; WHO, 2009; Yen et al., 2010).

The variable describing whether respondents are physically active is dropped for all categories of drinkers due to colinearity. Those who never drank and who describe their weight as 'just right' tend to report higher categories of health status and are 2.9% less likely to report poor health. Moderate drinkers who describe their weight as 'too heavy' or 'too light' tend to report a lower category of health status and are approximately 1% more likely to report poor health. Both these variables are significant in the health-status equation of moderate drinkers. Previous findings were similar and found that those who are overweight tend to have a poorer health status, particularly in relation to males (Lin, 2008). Contoyannis and Jones (2004) also found that those who are not obese have a higher reporting of excellent or good health.

Individuals with a medical card, which is a means-tested entitlement to the majority of health services free of charge, is significant for non-drinkers and moderate drinkers. Both non-drinkers and moderate drinkers who have a medical card are likely to report having lower categories of health. Similarly, health insurance is also significant for those who never drank and moderate drinkers. Moderate drinkers with health insurance are likely to report having poorer health, while those who never drank are 2% less likely to report poor health. Harmon and Nolan (2001) and Hurd and McGarry (1997) found that those in better health are more likely to be insured, or at least there is no evidence for adverse selection. Höfter (2006) also finds that people with private health insurance tend to be healthier individuals.

The selection correction terms, inverse mills ratio, are significant only for those who never drank but not significant for the other three categories of drinkers. In relation to those who never drank, the coefficient is negative, which indicates that individuals who self-select into

being a lifetime abstainer are 10.8% more likely to have poorer health status on average than an individual with identical observable characteristics drawn at random would have as a non-drinker. Individuals who decide or have a preference to be a non-drinker also tend to be individuals with a poor health status.

4.2.2 Overall Health Status by Drinker Type

In relation to all four categories of drinkers, the majority of respondents report good or very good health status. Table 3 shows the percent breakdown of the self-assessed health for each category of drinker.

Table 3. Results of health status by drinker type

Never Drank	
Poor Health Status	5.31%
Fair Health Status	16.99%
Good Health Status	30.54%
Very Good Health Status	30.26%
Excellent Health Status	16.91%
Non Drinkers	
Poor Health Status	6.97%
Fair Health Status	17.14%
Good Health Status	29.69%
Very Good Health Status	30.30%
Excellent Health Status	15.90%
Moderate Drinkers	
Poor Health Status	1.89%
Fair Health Status	8.40%
Good Health Status	28.73%
Very Good Health Status	37.78%
Excellent Health Status	23.19%
Heavy Drinkers	
Poor Health Status	1.71%
Fair Health Status	9.85%
Good Health Status	32.14%
Very Good Health Status	34.23%
Excellent Health Status	22.07%

While the majority of respondents report good or very good health in each category of drinker, this percentage is higher for both moderate and heavy drinkers compared with non-drinkers and those who never drank.

Looking at those who report excellent health across all four categories, a higher percentage of moderate drinkers, 23.19%, report excellent health compared with 22.07% of heavy drinkers, 15.9% of non-drinkers, and 16.91% of those who never drank.

Combining respondents who report good, very good, and excellent health, those who never drank are at 77.71%, non-drinkers are at 75.89%, moderate drinkers are at 89.7%, and heavy drinkers are at 88.44%.

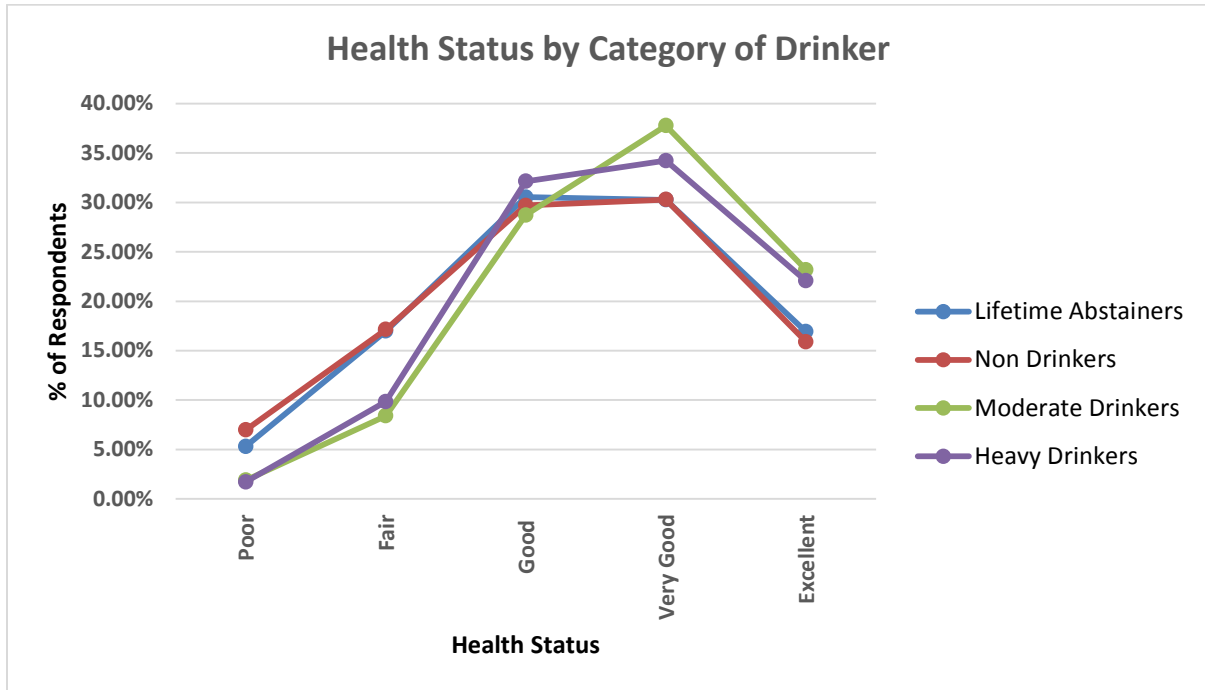
Percentage of respondents who report poor and fair health status is significantly different between the different groups. 22.29% of those who never drank report having poor or fair health, 24.11% of non-drinkers, 10.3% of moderate drinkers, and 11.56% of heavy drinkers.

These findings show that moderate drinkers report having the best health status compared with all other categories of drinkers, with more moderate drinkers reporting having excellent health status. Similarly, by combining good, very good, and excellent health status, more moderate drinkers again report being in this group. Fewer moderate drinkers report having poor/fair health status compared with the other three categories of drinkers.

Looking at non-drinkers and those who never drank (abstainers), the percentage reporting excellent health is substantially less and those reporting poor and fair health is substantially more when compared to moderate and heavy drinkers.

Heavy drinkers do report a better health status compared with non-drinkers and those who never drank. However, they do not enjoy a health status as good as that of moderate drinkers. These results are also depicted in Fig. 1.

Figure 1: Health Status by Drinker Category



In general, these findings show that the health status of non-drinkers, those who never drank, and heavy drinkers is not as good as that of moderate drinkers. These findings are similar to the findings of other studies, which show that moderate consumers of alcohol tend to have better health (Bau et al., 2007; Berger et al., 1999; Klatsky et al., 2001).

4.2.3 Health-Care Utilization – Consultations with the GP

Health-Care Utilization is estimated by an ordered probit accounting for the potential selection bias of drinking status by including the selection correction terms from the alcohol status estimation. Health-Care Utilization is measured by looking at the number of times a person consulted with a general practitioner.

Results from the estimation of health care utilization are set out in the Appendix.

The results showing the level of GP consultation by the four drinker types are set out in Table 4.

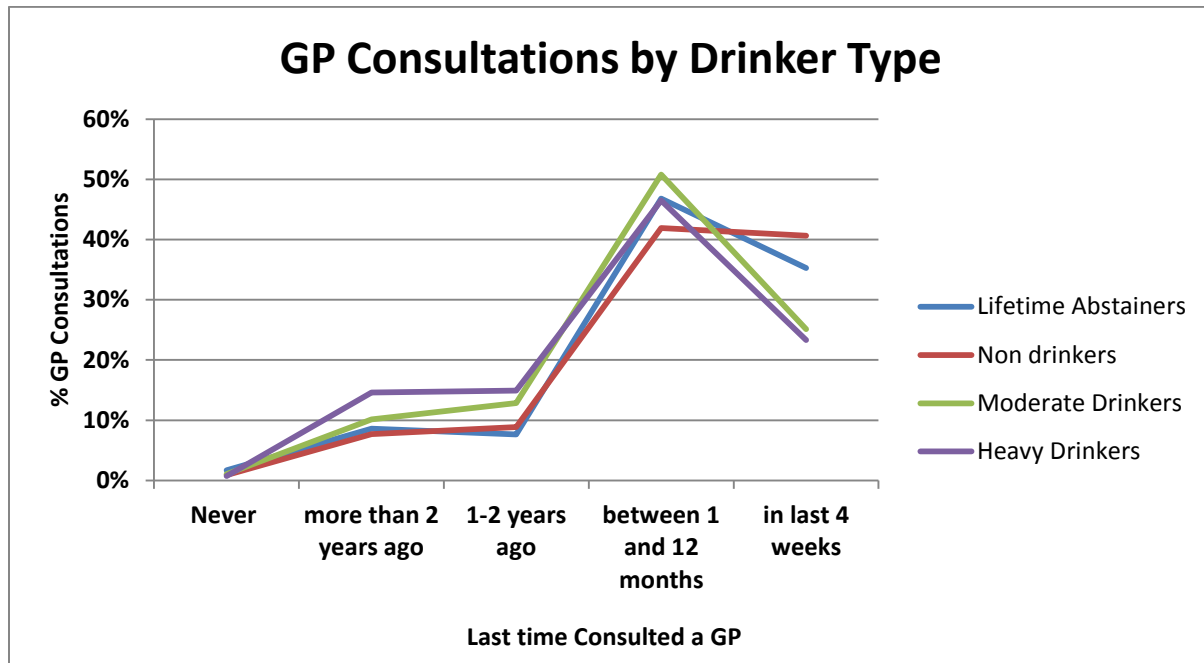
Table 4. Results of GP consultations by drinker type

Last time consulted GP	Never Drank	Non-Drinker	Moderate Drinker	Heavy Drinker
Never	2%	1%	1%	1%
more than 2 years ago	9%	8%	10%	15%
1-2 years ago	8%	9%	13%	15%
between 1 and 12 months	47%	42%	51%	46%
in last 4 weeks	35%	41%	25%	23%

Results show that more non-drinkers and those who never drank consulted a GP in the 4 weeks prior to the survey than either moderate or heavy drinkers. Moderate drinkers utilized the GP slightly more than heavy drinkers in the 4 weeks prior to the survey.

In the year prior to the survey, non-drinkers and those who never drank utilized GP services the most, with 82% of those who never drank and 83% of non-drinkers reporting having visited a GP in this period, compared with 76% of moderate drinkers and 70% of heavy drinkers. In looking at those who visited a GP one year ago or more, heavy drinkers had the highest percentage of visits.

Figure 2: GP Consultations by Drinker Category



Generally, usage of GP Services is very similar across drinker types. However, more non-drinkers and those who never drank visited a GP in the 4 weeks prior to the survey compared with both moderate and heavy drinkers. This is similar to the findings of Dunlop et al. (2000), who found that male non-drinkers visit a GP more than drinkers, and female non-drinkers visit a GP more than those who drink moderately but not more than those who are heavy drinkers. These findings are in agreement with the findings on health status, whereby more non-drinkers tend to report poorer health. However, in relation to health status, moderate drinkers reported having better health status compared with heavy drinkers, yet in looking at the number of visits

to a GP, heavy drinkers visited a GP fewer times in the year prior to the survey compared with moderate drinkers.

4.3 Post-Estimation Diagnostics in both the Estimation of Health Status and Health-Care Utilization

4.3.1 Testing the Specification of the Model

The significance of each of the variables is assessed using the z statistic along with the Likelihood Ratio Test to evaluate the variables in the model. The Wald Test shows that the models are statistically significant. Due to the lack of suitable instruments for the potentially endogenous lifestyle variables smoking, physical activity, and weight, this study was unable to account for this possible endogeneity. Similar to Kenkel (1995), the alcohol-status equation and the health-status equations are estimated omitting these, showing no difference to the results.

Establishing the direction of causality between health and income also poses significant problems (Kiuila & Mieszkowski, 2007). Being unable to instrument for income due to the lack of instrumental variables, including the variables describing the respondent's employment status (Kiuila & Mieszkowski, 2007) and education (Contoyannis & Jones, 2004) allows for only partial control for the possible effect of poor health on low income.

The null hypothesis that the cut-offs are equal to each other is tested in both the alcohol status and health status-ordered probit models. The null hypothesis is rejected in all cases, showing that the cut-offs are not equal to each other and hence that categories should not be merged.

5. Conclusion

This paper presents an empirical study of the effect of alcohol consumption on individual health status and health-care utilization in Ireland. The endogenous relationship between alcohol and health is accounted for, including the possible heterogeneity between health and drinking history among non-drinkers.

Overall findings show that moderate drinkers have the best health in Ireland. While the health status of moderate and heavy drinkers is similar, slightly more moderate drinkers report very good/excellent health. Previous studies found a U-shaped curve depicting moderate drinkers having better health compared with abstainers or heavy drinkers (Bau et al., 2007; Berger et al., 1999; Klatsky et al., 2001), and this study is similar. However, the substantial drop in the health status of heavy drinkers is not evident. The difference between the health status of moderate drinkers and non-drinkers is greater than that of moderate drinkers and heavy drinkers.

In relation to health-care utilization, results show that more non-drinkers and those who never drank consulted a GP in the 4 weeks prior to the survey than either moderate drinkers or heavy drinkers. Both moderate and heavy drinkers utilized a GP approximately the same amount in the 4 weeks. In the year prior to the survey, non-drinkers and those who never drank utilized the GP services slightly more than both moderate and heavy drinkers.

The WHO (2007) states that there is a large body of evidence showing that not only do alcohol policies and interventions targeted at vulnerable populations prevent alcohol-related harm, but that policies targeted at the population at large can also have a protective effect on the population as a whole. Adams and White (2005) suggest that population-based approaches to policy aimed at reducing alcohol consumption may result in some individuals, namely moderate consumers of alcohol, being harmed or disadvantaged from such an approach.

It is imperative that individuals who drink more than what is recommended are targeted in order to ensure that the consumption of alcohol is done in a safe manner that benefits all. However, given the findings of this study showing that moderate consumers of alcohol enjoy a better health status, it is recommended that both population-based policies and target-based policies be considered in relation to alcohol consumption in Ireland.

DRAFT

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Appendices

Appendix A. Equations used in the estimation of the effect of alcohol consumption on health status

Equation 1: Deriving the Inverse Mills Ratio

$$\hat{\lambda}_i \equiv \frac{\phi(\hat{\mu}_j - \hat{\alpha}'s_i) - \phi(\hat{\mu}_{j+1} - \hat{\alpha}'s_i)}{\Phi(\hat{\mu}_{j+1} - \hat{\alpha}'s_i) - \Phi(\hat{\mu}_j - \hat{\alpha}'s_i)} \quad \text{where } j = c_i$$
$$= \frac{\phi(\hat{\mu}_j - \hat{c}_i) - \phi(\hat{\mu}_{j+1} - \hat{c}_i)}{\Phi(\hat{\mu}_{j+1} - \hat{c}_i) - \Phi(\hat{\mu}_j - \hat{c}_i)}$$

Where:

- α is an unknown vector of parameters in the alcohol equation
- s independent variables in the alcohol equation
- μ_j cut-offs
- c category of drinker
- i indexes individuals
- ϕ probability density function
- Φ cumulative distribution function

Equation 2: Estimation of the Primary Equation of Interest, Health Status, which included the inverse mills ratio.

$$E(h_i | x_i, s_i, c_i = j) = \beta_j x_i + \rho_j \sigma_j \lambda_j'$$

Where:

- h health measure of individual
- x vector of independent variables
- s independent variables in the selection equation
- c category of drinker
- β coefficients on the observable characteristics
- ρ_j correlation of the error terms ε_i and each of the u_{ij} terms
- σ_j standard deviation
- λ_i ordered probit extension of the Inverse Mills Ratio
- ϕ probability density function
- Φ cumulative distribution function
- i indexes individuals

Appendix B

Table B1. Results of the ordered probit regression of alcohol status in Step 1 of the estimation of the effect of alcohol consumption on health status

Table B1. Ordered probit model estimating drinking status results

	Coefficient	z stats	dy/dx
male	0.345	11.96*	-0.069*
Married	-0.032	-0.57	0.007
Widowed	-0.059	-0.8	0.013
Sep/div	0.119	1.62	-0.023
Single/never married	-0.047	-0.87	0.010
Educ. Secondary	0.199	4.69*	-0.041*
Educ. Diploma	0.269	5.3*	-0.050*
Educ. Primary Degree	0.314	5.29*	-0.056*
Educ. Post Graduate	0.236	3.95*	-0.044*
Age 18-29	0.395	5.79*	-0.070*
Age 30-39	0.232	3.97*	-0.044*
Age 40-49	0.237	4.03*	-0.045*
Age 50-59	0.204	3.58*	-0.039*
Age 70 plus	-0.319	-5.4*	0.075*
Employee	0.262	3.63*	-0.053*
Self employed	0.240	3.04*	-0.044*
State Training or student	0.463	4.58*	-0.074*
Unemployed	0.241	2.15**	-0.044**
Homemaker	0.127	1.68	-0.025
Retired	0.236	2.93*	-0.044*
Other	0.152	1.05	-0.029
Log income	0.180	6.63*	-0.037*
Race White	0.323	2.75*	-0.078**
Race Black	-0.498	-2.94*	0.132**
Race Asian	-0.895	-4.63*	0.273*
Total in hh	-0.004	-0.74	0.001
Village	0.163	3.6*	-0.031*
Town	0.149	4.19*	-0.029*
City other than Dublin	0.319	6.74*	-0.057*

Table B1 continued. Ordered probit model estimating drinking status results

	Coefficient	z stats	dy/dx
Dublin city	0.248	6.68*	-0.047*
Smoker	0.349	11.29*	-0.066*
Weight right	0.184	3.19*	-0.038*
Weight too heavy	0.265	4.45*	-0.052*
Weight too light	0.174	1.96	-0.033**
Medical Card Holder	0.027	0.68	-0.006
Health Insurance	0.077	2.47**	-0.016
Church activities	-0.147	-4.47*	0.032*
Cut Off 1	1.444		
Cut Off 2	1.942		
Cut Off 3	4.271		

No. of Observations = 8519

Wald chi2 (37) = 1358.82

Prob > chi2 = 0.0000

Pseudo R² = .0853

Log Pseudolikelihood = -7798.4575

Marginal effects after oprobit y = Pr(alcohol status = 1) = .12559

(*) dy/dx is for discrete change of dummy variable from 0 to 1

*** indicates significance at 1% and 5% level**

Note: The average price of alcohol was included as a variable in the alcohol-status equation. The price was derived by dividing the total values of sales in the year 2006 by the total volume sold for each type of alcohol in 2006. Price was dropped due to colinearity and the variable Physically Active was also dropped due to colinearity.

The first independent variable considered is gender, whereby the results show that this is a statistically significant variable in the alcohol-status equation. Males are more likely to be in a higher drinking category than females, which is similar to the findings in previous studies (Oslin et al., 2005; Fillmore, Golding, Leino, Ager, & Ferrer, 1994; Moore et al., 2005; Mullahy & Sindelar, 1996). Females are less likely to be in a higher drinking category than males and are more likely to be non-drinkers or moderate drinkers. Marginal effects show that males are 6.9% less likely to never having drank.

None of the variables describing marital status is significant in terms of alcohol status.

The explanatory variables describing individuals' levels of education are all significant and all are positively correlated with alcohol status. Those with a primary degree are more likely to be

heavy drinkers which is different from the findings of Hamilton and Hamilton (1997), who found that higher-educated people, those with third-level degrees, tend to consume moderate amounts of alcohol and they are less likely to abstain or be heavy drinkers.

The variable 'Age' is also significant in terms of alcohol consumption. All ages up to 59 years are positively correlated with alcohol status. In particular, those aged 18–29 years are more likely to be in a higher drinking category and are 7% less likely to be lifetime abstainers. Similar to the findings of Hamilton and Hamilton (1997) and Barrett (2002), those aged 70 years or over are less likely to be in a higher drinking category and are 7.5% more likely to never having drank.

All the variables describing Employment Status are significant except those in the 'Other' category. In particular, those on state training schemes (government-subsidized training programs) or students are more likely to be in a higher category of drinking, with marginal effects showing that they are 7.4% less likely to be lifetime abstainers. Homemakers are the least likely to be in a higher drinking category.

Log of income is statistically significant. As income increases, the respondents are more likely to be in a higher drinking category, hence showing a positive correlation between income and drinking.

The explanatory variables describing race are all significant. A white person, either white Irish or a person of any other white background, is more likely to be in a higher drinking category compared with those of other races. They are 7.8% less likely to be a non-drinker. Both Blacks and Asians are less likely to be in a higher drinking category. Blacks are 13.2% more likely to never have been drinkers, and Asians are 27.3% more likely to never have drank. Similarly, Mullahy and Sindelar (1996) and Moore et al. (2005) found that white people tend to consume greater amounts of alcohol and that those who abstain from alcohol tend less often to be white.

Total number of people in the household is not significant in the determination of alcohol consumption.

Where a person lives is a significant variable in terms of alcohol consumption. Those who live in Dublin are 4.7% less likely to be lifetime abstainers of alcohol and those living in a city other than Dublin are 5.7% less likely to be lifetime abstainers and more likely to be in a higher drinker category, which is similar to the findings of Su and Yen (2000).

In terms of the lifestyle variables, smoking is highly significant and is positively correlated with alcohol consumption. A smoker is 6.6% less likely to never have drunk compared with a non-smoker, which is similar to previous findings (Burton & Tiffany, 1997; Gulliver, Kamholz, & Helstrom, 1995).

The variable 'Physically Active' is dropped due to colinearity. The variables describing self-assessed weight as being right or too heavy are significant. In particular, those who described their weight as too heavy are more likely to consume higher amounts of alcohol. Previous studies show that alcohol has only a slight effect on weight (Williamson et al., 1987).

Having health insurance is significant. Those with health insurance are 1.6% less likely to be a lifetime abstainer. Having a medical card is not significant.

The additional explanatory variable that is included in the alcohol-status equation but not in the health-status equation is whether respondents regularly partake in church activities. This is a highly significant variable with a p value of 0. Church activities are negatively correlated with alcohol consumption. Those who regularly partake in church activities are less likely to be in a higher drinking category, compared with those who do not regularly partake in church activities, and are in fact 3.2% more likely to be a non-drinker, which is similar to what Hamilton and Hamilton (1997) found in their study.

Table B2. Marginal effects of ordered probit regression of health status by drinker type

Variable	Never Drank		Non Drinkers		Moderate Drinkers		Heavy Drinkers	
	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat
edseco~y*	-0.027	-3.87*	-0.010	-1.54	-0.005	-3.58*	-0.006	-0.97
eddipl~t*	-0.019	-3.39*	-0.023	-3.68*	-0.004	-3.81*	-0.004	-0.85
edprim~e*	-0.021	-3.91*	-0.025	-4.36*	-0.005	-5.13*	-0.004	-0.88
edpost~e*	-0.017	-2.87*	-0.017	-2.53*	-0.006	-5.78*	-0.003	-0.58
age18~29*	-0.036	-6.92*	-0.034	-5.5*	-0.007	-5.46*	-0.010	-1.4
age30~39*	-0.031	-6.3*	-0.032	-4.42*	-0.006	-4.73*	-0.010	-1.95
age40~49*	-0.026	-4.93*	-0.027	-4.2*	-0.005	-3.83*	-0.010	-1.96
age50~59*	-0.024	-4.74*	-0.004	-0.45	0.000	-0.07	-0.006	-1.41
age70p~s*	0.044	2.73*	0.021	1.49	-0.002	-0.92	0.005	0.33
employee*	-0.064	-6.28*	-0.070	-5.44*	-0.032	-6.53*	-0.040	-1.91
selfem~r*	-0.033	-6.79*	-0.040	-6.57*	-0.011	-8.15*	-0.010	-2.39**
statet~d*	-0.029	-6.99*	-0.031	-6.1*	-0.009	-7.97*	-0.008	-2.36**
unempl~d*	-0.028	-7.04*	-0.030	-5.87*	-0.009	-7.95*	-0.008	-2.38**
homema~r*	-0.042	-6.34*	-0.040	-5.91*	-0.011	-7.98*	-0.007	-2.34**
retired*	-0.061	-5.48*	-0.039	-5.15*	-0.010	-7.55*	-0.009	-2.37**
other*	-0.025	-6.21*	-0.030	-5.85*	-0.008	-7.83*	0.036	0.65
loginc~e	-0.020	-3.13*	-0.005	-0.9	-0.003	-3.5*	-0.005	-1.11
racewh~e*	-0.020	-0.9	-0.013	-0.48	0.002	0.67	-0.021	-0.65
raceblack	0.064	1.11	-0.023	-1.97	0.006	0.71		
raceas~n*	0.398	2.27**	0.012	0.27	0.003	0.36	0.011	0.26
male*	-0.024	-2.78*	0.001	0.19	0.003	3.4*	-0.001	-0.15
married*	0.009	0.85	-0.026	-2.13**	-0.003	-1.86	0.001	0.15
widowed*	0.002	0.15	-0.028	-4.03*	-0.001	-0.41	0.000	-0.07
sepdiv*	-0.001	-0.09	-0.020	-2.54**	-0.002	-1.55	0.002	0.28
single~d*	0.006	0.5	-0.015	-1.54	-0.002	-1.79	0.002	0.58

Table B2 continued. Marginal effects of ordered probit regression of health status by drinker type

Variable	Never Drank		Non Drinkers		Moderate Drinkers		Heavy Drinkers	
	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat
totali~h	0.001	1.03	-0.001	-1.19	0.000	1.54	0.000	-0.78
village*	-0.004	-0.6	0.003	0.38	0.001	0.78	0.000	0.08
town*	0.004	0.6	-0.007	-1.21	0.002	2.15**	0.000	-0.1
cityot~n*	-0.019	-3.31*	-0.008	-0.98	-0.001	-1.1	-0.003	-0.68
dublin~y*	-0.014	-2.14**	-0.005	-0.69	0.000	-0.17	-0.001	-0.28
smoker*	-0.011	-1.38	0.010	1.09	0.007	5.22*	0.001	0.11
we~right*	-0.029	-2.68*	0.000	-0.02	0.001	0.57	-0.002	-0.42
weight~y*	-0.013	-1.55	0.031	2.04**	0.009	3.68*	0.003	0.4
we~light*	-0.002	-0.13	0.108	2.18**	0.009	2.03**	0.007	0.56
medcar~r*	0.008	1.49	0.015	2.26**	0.005	4.13*	-0.003	-1.27
health~e*	-0.020	-4.02*	-0.005	-0.8	-0.002	-2.34**	-0.003	-0.95
Mills Ratio	0.108	2.91*	0.035	0.97	0.009	1.61	-0.016	-0.67

Never Drank $y = \Pr(\text{healthstatusoprobit}==1)$ (predict) = 0.02640702

Non-Drinkers $y = \Pr(\text{healthstatusoprobit}==1)$ (predict) = .0315208

Moderate Drinkers $y = \Pr(\text{healthstatusoprobit}==1)$ (predict) = 0.00790495

Heavy Drinkers $y = \Pr(\text{healthstatusoprobit}==1)$ (predict) = 0.00661192

(*) dy/dx is for discrete change of dummy variable from 0 to 1

* indicates significance at 1% and 5% level

Appendix C. Results in the estimation of health care utilization

In the estimation of the effect of alcohol on health-care utilization, both alcohol and health status are estimated as an ordered probit. The results of the ordered probit estimates of the alcohol-status equation estimated in Step 1 along with the marginal effects are set out below. The results of the health-care utilization estimation and the marginal effects estimated in Step 2 are also set out below.

Table C1. Results of the ordered probit regression of alcohol status in the estimation of the effect of alcohol consumption on health care utilization

Variable	Coefficient	z-stat	dy/dx
healthexce~t	0.335	4.05*	-0.06*
healthvery~d	0.329	4.14*	-0.06*
healthgood	0.336	4.27*	-0.06*
healthfair	0.223	2.73*	-0.04*
edsecondary	0.183	4.24*	-0.04*
eddiplomac~t	0.257	5.03*	-0.05*
edprimaryd~e	0.301	5.03*	-0.05*
edpostgrad~e	0.222	3.68*	-0.04*
age18to29	0.389	5.64*	-0.07*
age30to39	0.224	3.82*	-0.04*
age40to49	0.234	3.97*	-0.04*
age50to59	0.217	3.79*	-0.04*
age70plus	-0.307	-5.15*	0.07*
employee	0.164	2.16**	-0.03**
selfemplin~r	0.142	1.72	-0.03
statetrain~d	0.359	3.42*	-0.06*
unemployed	0.141	1.22	-0.03
homemaker	0.039	0.5	-0.01
retired	0.156	1.87	-0.03**
other	0.056	0.38	-0.01
logincome	0.173	6.37*	-0.04*
racewhite	0.339	2.86*	-0.08**
raceblack	-0.494	-2.89**	0.13**
raceasian	-0.912	-4.66**	0.28*
male	0.352	12.09*	-0.07*

Table C1 continued. Results of the ordered probit regression of alcohol status in the estimation of the effect of alcohol consumption on health care utilization

Variable	Coefficient	z stat	dy/dx
married	-0.027	-0.49	0.01
widowed	-0.060	-0.79	0.01
sepdv	0.117	1.59	-0.02
singleneve~d	-0.043	-0.78	0.01
totalinhh	-0.004	-0.75	0.00
village	0.164	3.63*	-0.03*
town	0.152	4.27*	-0.03*
cityothert~n	0.317	6.68*	-0.06*
dublincity~y	0.250	6.69*	-0.05*
smoker	0.354	11.36*	-0.07*
weightright	0.162	2.8*	-0.03*
weighttooh~y	0.251	4.19*	-0.05*
weighttool~t	0.176	1.96*	-0.03**
medcardhol~r	0.036	0.89	-0.01
healthinsu~e	0.071	2.29**	-0.01**
churchact	-0.155	-4.67*	0.03*
/cut1	1.615		
/cut2	2.113		
/cut3	4.448		

Number of obs = 8455 LR Chi2 (41) = 1375.45 Prob > Chi2 = 0

Log Pseudolikelihood = 0.0863 Pseudo R² = .0863

Marginal effects after oprobit y = Pr(alcohol status==1) = .124601

(*) dy/dx is for discrete change of dummy variable from 0 to 1

*** indicates significance at 1% and 5% level**

Note: variable 'Physically Active' dropped due to colinearity

Table C2. Ordered probit regression of health-care utilization by drinker type

Variable	Never Drank		Non Drinkers		Moderate Drinkers		Heavy Drinkers	
	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat
healthexce~t	-1.226	-5.25*	-0.907	-4.82*	-1.206	-7.93*	-1.690	-2.89*
healthvery~d	-1.058	-4.7*	-0.840	-4.85*	-1.044	-6.96*	-1.492	-2.63*
healthgood	-0.844	-3.85*	-0.685	-4.06*	-0.837	-5.61*	-1.272	-2.21**
healthfair	-0.494	-2.41**	-0.105	-0.6	-0.382	-2.49**	-1.077	-2.16**
edsecondary	0.137	1.26	0.028	0.27	0.017	0.29	0.087	0.32
eddiplomac~t	0.310	1.99**	0.049	0.36	0.048	0.72	-0.105	-0.3
edprimaryd~e	0.403	2.08**	0.123	0.72	0.000	-0.01	0.042	0.1
edpostgrad~e	0.034	0.19	0.109	0.58	0.060	0.8	0.265	0.79
age18to29	-0.041	-0.16	0.667	3.23*	-0.178	-2.07	-0.269	-0.5
age30to39	-0.259	-1.39	0.314	2.01**	-0.184	-2.52**	-0.161	-0.44
age40to49	-0.287	-1.65	0.023	0.15	-0.251	-3.45*	-0.176	-0.46
age50to59	-0.292	-1.81	0.085	0.6	-0.136	-1.91	0.042	0.12
age70plus	-0.209	-1.3	0.098	0.7	0.143	1.6	0.601	1.18
employee	-0.218	-0.98	-0.689	-3.85*	-0.514	-4.84*	0.146	0.47
selfemplin~r	-0.545	-2.31**	-0.835	-4.17*	-0.492	-4.4*	0.220	0.71
statetrain~d	-0.911	-2.84*	-0.777	-2.78*	-0.479	-3.62*	0.214	0.43
unemployed	-0.350	-1.27	-0.879	-3.37*	-0.353	-2.47**	-0.132	-0.4
homemaker	-0.423	-2.02	-0.793	-4.31*	-0.424	-3.75*	0.579	1.77
retired	-0.279	-1.32	-0.514	-2.69*	-0.343	-2.81*	0.340	0.87
other	-0.391	-1.13	-0.743	-1.75	-0.573	-3.07*	-0.222	-0.21
logincome	0.199	1.9	0.018	0.22	0.011	0.35	-0.025	-0.11
racewhite	0.306	1.26	-0.284	-1.03	0.080	0.58	-0.001	0
raceblack	0.054	0.14	-0.405	-1.01	0.155	0.66		
raceasian	-0.112	-0.24	-0.838	-2.18**	-0.613	-1.93	-1.720	-1.49

Table C2 continued. Ordered probit regression of health-care utilization by drinker type

Variable	Never Drank		Non Drinkers		Moderate Drinkers		Heavy Drinkers	
	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat	Coefficient	z stat
male	-0.106	-0.6	-0.323	-2.88*	-0.359	-9.35*	-0.339	-0.83
married	0.098	0.43	0.540	3.15*	0.034	0.56	0.012	0.06
widowed	-0.030	-0.12	0.614	2.95*	-0.053	-0.55	0.207	0.59
sepdv	0.035	0.13	0.340	1.66	-0.044	-0.53	0.065	0.24
singleneve~d	-0.144	-0.62	0.175	1.05	-0.049	-0.8	-0.084	-0.47
totalinhh	-0.014	-1.01	-0.036	-2.69*	-0.009	-1.43	0.001	0.04
village	0.078	0.59	-0.090	-0.72	-0.080	-1.43	-0.257	-1.03
town	0.003	0.03	0.160	1.58	-0.083	-1.93	-0.063	-0.27
cityothert~n	0.154	0.83	-0.051	-0.38	-0.023	-0.39	0.019	0.05
dublincity~y	0.091	0.63	-0.008	-0.07	-0.027	-0.61	0.045	0.14
smoker	0.098	0.55	0.011	0.09	-0.020	-0.51	-0.048	-0.12
weightright	-0.072	-0.5	0.244	1.58	-0.016	-0.21	-0.419	-1.03
weighttooh~y	-0.050	-0.3	0.297	1.81	0.054	0.68	-0.191	-0.41
weighttool~t	0.226	1.04	-0.137	-0.56	-0.167	-1.52	0.053	0.12
medcardhol~r	0.631	6.6*	0.318	3.14*	0.331	7.12*	0.675	4.59*
healthinsu~e	0.148	1.85	0.095	1.06	0.142	3.86*	0.334	2.37**
mills_alco~1	-0.332	-0.58	-0.210	-0.4	-0.098	-0.39	-0.122	-0.09
/cut1	-2.301		-3.707		-3.991		-4.663	
/cut2	-1.326		-2.584		-2.826		-3.066	
/cut3	-0.928		-2.097		-2.273		-2.494	
/cut4	0.564		-0.749		-0.761		-1.042	

Table C3. Marginal effects of ordered probit regression of health-care utilization by drinker type

Variable	Never Drank		Non-Drinkers		Moderate Drinkers		Heavy Drinkers	
	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat	dy/dx	z stat
healthexce~t	0.075	2.45**	0.024	2.05**	0.055	3.77*	0.071	1.06
healthvery~d	0.042	2.48**	0.016	2.28**	0.030	3.95*	0.034	1.07
healthgood	0.029	2.23**	0.012	2.08**	0.026	3.25*	0.027	0.96
healthfair	0.016	1.59	0.001	0.54	0.010	1.72	0.033	0.86
edsecondary	-0.003	-1.24	0.000	-0.27	0.000	-0.29	-0.001	-0.32
eddiplomac~t	-0.005	-2.23	0.000	-0.38	-0.001	-0.74	0.001	0.27
edprimaryd~e	-0.006	-2.59**	-0.001	-0.79	0.000	0.01	0.000	-0.11
edpostgrad~e	-0.001	-0.2	-0.001	-0.66	-0.001	-0.84	-0.002	-0.97
age18to29	0.001	0.15	-0.004	-2.67*	0.004	1.74	0.003	0.4
age30to39	0.007	1.09	-0.003	-1.92	0.004	2.16**	0.002	0.37
age40to49	0.008	1.27	0.000	-0.16	0.005	2.75*	0.002	0.39
age50to59	0.008	1.36	-0.001	-0.64	0.003	1.67	0.000	-0.13
age70plus	0.005	1.11	-0.001	-0.74	-0.002	-1.82	-0.003	-1.41
employee	0.005	0.84	0.010	2.06**	0.009	3.93*	-0.001	-0.46
selfemplin~r	0.020	1.42	0.023	1.95	0.014	2.79*	-0.001	-0.83
statetrain~d	0.054	1.43	0.023	1.3	0.015	2.23**	-0.001	-0.55
unemployed	0.011	0.88	0.030	1.47	0.010	1.69	0.001	0.32
homemaker	0.012	1.44	0.018	2	0.011	2.52**	-0.002	-1.58
retired	0.007	1.11	0.009	1.59	0.008	2.04**	-0.002	-1.07
other	0.013	0.76	0.022	0.85	0.021	1.78	0.003	0.16
logincome	-0.004	-1.69	0.000	-0.22	0.000	-0.35	0.000	0.11
racewhite	-0.009	-0.91	0.002	1.33	-0.002	-0.53	0.000	0
raceblack	-0.001	-0.15	0.007	0.62	-0.002	-0.81	0.140	0.55
raceasian	0.003	0.21	0.028	1.02	0.023	1.09	0.002	0.8

Table C3 continued. Marginal effects of ordered probit regression of health-care utilization by drinker type

	Never Drank		Non Drinkers		Moderate Drinkers		Heavy Drinkers	
	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
male	0.002	0.57	0.004	1.88	0.007	6.08*	0.000	-0.06
married	-0.002	-0.42	-0.006	-2.22**	-0.001	-0.56	-0.001	-0.73
widowed	0.001	0.12	-0.004	-2.63*	0.001	0.52	0.000	-0.26
sepdv	-0.001	-0.13	-0.002	-1.95	0.001	0.5	0.001	0.45
singleneve~d	0.003	0.56	-0.002	-1.13	0.001	0.77	0.000	-0.04
totalinhh	0.000	0.97	0.000	2.07**	0.000	1.41	0.003	0.69
village	-0.001	-0.62	0.001	0.65	0.002	1.31	0.001	0.25
town	0.000	-0.03	-0.002	-1.5	0.002	1.79	0.000	-0.05
cityothert~n	-0.003	-0.96	0.001	0.36	0.000	0.39	0.000	-0.14
dublincity~y	-0.002	-0.66	0.000	0.07	0.000	0.6	0.000	0.12
smoker	-0.002	-0.58	0.000	-0.09	0.000	0.5	0.071	1.06
Weightright	0.001	0.5	-0.003	-1.35	0.000	0.21	0.004	0.92
weighttooh~y	0.001	0.29	-0.003	-1.67	-0.001	-0.69	0.002	0.38
weighttool~t	-0.004	-1.31	0.002	0.48	0.004	1.25	0.000	-0.12
medcardhol~r	-0.015	-3.55*	-0.003	-2.12**	-0.005	-5.74*	-0.004	-1.78
healthinsu~e	-0.003	-1.73	-0.001	-0.99	-0.003	-3.4*	-0.003	-1.49
mills_alco~l	0.007	0.57	0.002	0.39	0.002	0.39	0.001	0.09

Never Drank $y = \Pr(\text{healthstatusoprobit}==1) (\text{predict}) = 0.007471$

Non-Drinkers $y = \Pr(\text{healthstatusoprobit}==1) (\text{predict}) = 0.003514$

Moderate Drinkers $y = \Pr(\text{healthstatusoprobit}==1) (\text{predict}) = 0.00624$

Heavy Drinkers $y = \Pr(\text{healthstatusoprobit}==1) (\text{predict}) = 0.002681$

(*) dy/dx is for discrete change of dummy variable from 0 to 1

*** indicates significance at 1% and 5% level**