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Abstract

This paper examines evidence from Australia on the factors associated with binge drinking and several alcohol-related antisocial and unlawful behaviours. In particular, to quantify the negative externalities of excessive alcohol consumption by product type, our primary focus is the link with eleven types of alcoholic beverages. We also examine the role of binge drinking in increasing the likelihood for engaging in these antisocial and unlawful behaviours. We use individual-level data from a national representative survey and a multivariate probit model that allows unobservable factors for all negative behaviours to be correlated. Potential misclassification in the self-reported consumption data is accounted for. Results provide valuable evidence for more effective alcohol taxation as a tool for correcting differentiated negative externalities by beverage type.

JEL classification: C3, I1, K3

Keywords: Binge drinking, negative externalities, alcohol taxation, multivariate probit, misclassification

1 Introduction

Binge drinking and its related adverse effects have long been one of the major policy concerns in many countries. Although there has been evidence showing that moderate alcohol consumption benefits health among middle-aged and older people (for example Gaziano, Buring, and Breslow 1993, Rimm 1996, Fagrell, Faire, and Bondy 1999, and Malinski *et al.* 2004), the toll taken by excessive alcohol consumption or binge drinking on many societies significantly overtakes the benefit from moderate consumption. For instance, alcohol harm was responsible for 3.2% of the total burden of disease and injury in Australia in 2003, while it prevented 0.9% per cent of the total burden (Begg et al. 2007).

One of the main policy tools used by governments around the world for reducing alcohol abuse is alcohol taxation. The main rationale for alcohol tax is the 'sin tax' and market failure arguments. Excessive alcohol consumption is associated with a range of negative externalities in areas of road accidents, criminal activities, abuses of family members and others, health care, law enforcement costs, and some labour market participation and productivity implications (Freebairn 2010). As taxing by heterogeneous consumer types would not seem to be a feasible approach, an alternative way towards achieving the goal of correcting market failure more effectively is to examine the association of negative externalities with heterogeneous alcohol beverage types.

Alcohol taxation in Australia has long been the centre of debate among health professionals, welfare bodies, grape growers, and beer, wine and spirit producers. Australia has a complex alcohol tax system where beer and spirits are taxed by differentiated volumetric excise rates according to alcohol strength and wine is levied an *ad valorem* WET (wine equalisation tax) based on wholesale value. In spite of its reported effectiveness, taxation has been underutilised in Australia to reduce alcohol-related harm (Doran et al.

2010). From a public health and economic perspective, the current alcohol taxation regime in Australia is flawed. While there are some positive aspects to the current regime, such as the relatively lower rate of tax on low alcohol beer, there are large inconsistencies in the way different alcohol products are taxed; products are not consistently taxed according to their alcohol content level, nor their propensity to cause harm (NPHT 2009).

In a comprehensive review of the Australian tax system, namely the 'Henry Review" (Henry *et al.* 2010), a change to a flat rate volumetric tax system across all alcohol beverages has been advocated. In support of such a volumetric tax system, the Australian National Preventative Health Task Force highlights the need to encourage the production and consumption of low-alcohol products (NPHT 2009). These all seem to endorse the "equal alcohol, equal tax" argument regardless of product types, and to only associate the degree of negative externalities with the alcohol content in a product but take no account of its propensity to cause harm.

Notwithstanding a substantial body of empirical studies on the association of alcohol consumption with alcohol-related risky and abusive behaviours, they often have alcohol as an aggregated product (for example Jonah 1986, Greenfield and Weisner 1995, Weiser *et al.* 2006, Adlaf and Smart 1983, Yu and Williford 1993). Anecdotal evidence would suggest that different beverage types are more likely to be associated with certain types of abusive behaviours, but empirical studies for differentiated alcohol products are few and only relate to some negative behaviours (see Berger and Snortum 1985, Smart 1996, Norström 1998, Stockwell *et al.* 1998). To the best of our knowledge, Srivastava and Zhao (2010) has been the only recent study examining the association between differentiated alcohol beverage types and alcohol-related potential negative externalities in the Australian context. However,

they only use two-way data cross-tabulations without a formal econometric model to control for effects of other individual characteristics.

Aiming to fill this gap in the literature, this paper studies the association of binge drinking and a range of alcohol-related antisocial and unlawful behaviours with the types of alcohol beverages the drinker consumes, paying particular attention to drinker characteristics. In addition, we also examine how the likelihood for engaging in each of these negative behaviours is increased via the act of binge drinking. We use individual-level data from a national representative survey and employ a multivariate probit model that allows unobservable factors for all negative drinking behaviours to be correlated. As our data for these antisocial and unlawful behaviours are self-reported and subject to misclassification, we also explicitly allow for the possibility of misclassification using a modified maximum likelihood following Hausman, Abrevaya, and Scott-Morton (1998). Our results will provide useful evidence to contribute to the on-going discussion of alcohol tax reform in Australia.

The rest of this paper is set out as follows. Section 2 presents background information on harmful drinking and alcohol taxation in Australia. Section 3 details the data. Section 4 presents the econometric framework. The estimation results are discussed in Section 5, and Section 6 concludes this paper.

2 Harmful Drinking and Alcohol Taxation in Australia

Like in many other developed countries, alcohol consumption constitutes an integral part of Australian lifestyle. However, recent statistics show that consumption of alcohol at harmful levels in Australia is considerable. According to the 2010 Australian National Drug Strategy Household Survey (AIHW 2011), around 39.8% Australian people who are 14 years

or older drink, at least once in the previous 12 months, in a pattern that placed them at risk of an alcohol-related injury from a single drinking occasion.

Much of the recent concern arises from the evidence of a bingeing epidemic and an increasing popularity of premixed ready-to-drink (RTD) spirits, especially among youth and young adults. In 2010, almost two-thirds (64.6%) of males aged 18–19 years, and more than half (54.9%) of males aged 20–29 years placed themselves at risk of an alcohol-related injury at least once a month (AIHW 2011). Compared to other alcohol drinks, premixed spirit drinks were much preferred by the 12-17 age-group and were more likely to be nominated as the preferred drink by females than by males (62.1% for females compared with 38.2% for males) (AIHW 2011). Ramful and Zhao (2008) showed an evidence of an alarming proportion of young females engaging in spirits consumption as a result of the increasing popularity of premixed spirits drinks. Indeed, among heavy drinkers and bingers, youths and young adults are segments of the population that attract much of the attention, as they are more likely to take alcohol-related antisocial or risky behaviours (Gruber 2001).

In addition, these age groups are also more likely to indulge in alcohol abuses that result in a high incidence of fatal and nonfatal motor vehicle crashes, crime and violence. With regards to habit forming aspect of drinking, alcohol consumption in adolescence appears to be linked to alcohol use patterns in later life (see Rachal *et al.* 1980, Grossman, Chaloupka, and Sirtalan 1998, Cook and Moore 2001, Williams 2005). Youth drinking is also shown to have detrimental, and often irreversible, consequences in terms of health, human capital and social status (see Cook and Moore 1993, Kenkel *et al.* 1994, Dee and Evans 2003, Williams, Powell, and Wechsler 2003).

Taking on the challenge, the Australian Government has announced a new national strategy to address the binge drinking epidemic (ALP 2008). While a range of policy tools are

under debate, including regulations limiting place and time to sell alcohol, restrictions on underage drinking, enforcement of drink driving laws, restrictions on advertising, and anti-alcohol campaigns, raising alcohol prices via taxation is another option. The Labor government's abruptly increasing tax for the RTDs, has caused a flurry of responses from the many parties involved (producers including grape growers, and beer, wine and spirit companies, as well as health professionals and welfare bodies) as it has opened the 'can of worms' of the long-standing issue of the 'anomalies' of alcohol tax in Australia (Zhao and Wittwer 2007).

In Australia, beer and spirits are taxed by alcohol content with differentiated volumetric excise (VT) rates according to alcohol strength. Wine, on the other hand, is levied an ad valorem wine equalisation tax (WET) based on wholesale value. According to an update to Zhao and Wittwer (2007) based on 2007/08 data, cask wine pays effectively $3/LAL (per Litre of Alcohol), non-premium bottled wine $14/LAL, and premium bottled wine $33/LAL. In comparison, beers pay around $19/LAL (light and keg) to $31/LAL (premium), RTD light, $41/LAL, RTD dark, $43/LAL, and straight spirit, $66/LAL. The spirit industry has long pushed for the 'equal alcohol, equal tax' argument, while the wine industry emphasises its contribution in the vitality and employment in the Australian agricultural industry and externalities such as tourism. However, there has been consensus for the need of a comprehensive review of alcohol taxation by differentiated products. In the recently released 'Henry Review' of the Australian tax system, alcohol tax reform has become an important part and attracted much debate.

3 Data

The data we use in this study are drawn from the 2001, 2004, 2007 and 2010 waves of the Australian National Drug Strategy Household Survey (NDSHS), involving 106,193

individuals. The NDSHS is a nationally representative cross-sectional survey of the non-institutionalized Australian civilian population aged 12 years and older and is administered by the Australian Institute of Health and Welfare (AIHW). The survey provides information on drug use patterns, attitudes and behaviour. It also provides a wide range of information on respondents' demographic and socioeconomic backgrounds. We focus on the four most recent waves of the survey as they provide more detailed information on spirits consumption including premixed spirits drinks which have become increasingly popular in the last decade.

Key to our study is information on individuals' antisocial behaviours that they had undertaken under the influence of alcohol. Among these behaviours, those of major interest to us are: drove a motor vehicle, created a public disturbance or nuisance, caused damage to property, stole money, goods or property, verbally abused someone, and physically abused someone. In this study, for practical purposes, we categorized them into three groups according to similarities among some of these behaviours: Driving (drove a motor vehicle), Disturbance (created a public disturbance/nuisance, caused damage to property, or stole money, goods or property), and Abuse (verbally or physically abused someone).

Table 1 depicts the proportions of individuals in the sample who participated in each of the three groups of antisocial behaviours while under the influence of alcohol, across waves of survey dating 1993 through to 2010. Throughout these seven waves of survey, participation rates of drink driving dominate in each year. Clearly, Disturbance and Abuse show a declining trend, but the proportions are still quite significant.

In this study, drinkers are defined as those who have consumed alcohol in the past year and the rest are defined as abstainers. This results into a sub-sample of 82,053 drinkers. The harmful consequences pertaining to alcohol consumption are generally linked with heavy or binge drinking. Not only does binge drinking, especially among adolescents and young adults,

result in a high incidence of vehicle crashes, crime and violence, but it also has detrimental and often irreversible consequences in terms of health, human capital and social status.

Binge drinking is generally recognised as drinking heavily on an occasion; however, despite its intuitive sense, there appears to be a lack of consensus on its definition. The definition varies with, among others, the units of measurement of alcohol beverages and the number of drinks. In the absence of a unified measurement of binge drinking, in this study risk levels related to short-term harm of drinking, as defined in the 2001 National Health and Medical Research Council Alcohol Guidelines (NHMRC 2001), are used to group drinkers by different drinking patterns. Therefore, bingers are defined as those who indulge in medium-to-high-risk drinking: specifically, men drinking at least seven standard drinks and women drinking at least five standard drinks on a single occasion. This definition of binge or heavy drinking has also been adopted in several other studies on binge drinking (for example Chaloupka and Wechsler 1996, Williams, Chaloupka, and Wechsler 2002, Srivastava and Zhao 2010).[3]

In Table 2, we see that most of the respondents (about 80%) from each wave of the survey are drinkers. For obvious reasons, in this study drinkers are of principal interest to us. The observed unconditional correlation coefficients between the antisocial behaviours undertaken under the influence of alcohol and drinking pattern are presented in Table A1 in the Appendix. From this preliminary result it is clear that drinking pattern (binge or not) is correlated with alcohol-related antisocial behaviours.

[3] In March 2009, the NHMRC released a new set of guidelines on alcohol consumption and health risks. However, this new set of guidelines is controversial in that although, in recognition of the fact that the lifetime risk of harm from consuming alcohol increases progressively with the amount consumed (NHMRC 2009), the previous threshold-based definitions for risky or high-risk drinking were removed. In particular, the 2009 guidelines recommend that drinking no more than two standard drinks, for both men and women, on any day reduces the lifetime risk of harm from alcohol-related disease or injury. To conform to the definition of binge drinking conventionally used in previous studies we follow the 2001 guidelines.

In the survey, respondents were required to answer the question, "*What types of alcohol do you usually drink (Mark all the types of drinks apply)"*, to inform what they usually drink. We use this information to construct eleven dichotomous variables to indicate respondents' usual drinking preferences which we use as exogenous covariates in the model. These binary indicator variables are respectively: regular strength beer, middle strength beer, low strength beer, home brewed beer, cask wine, bottled wine, fortified wine, canned premixed spirits, bottled premixed spirits, bottled spirits and other.

Table 2 presents participation rates by types of alcoholic drinks for the drinkers. Specifically, regular strength beer, bottled wine, and bottled spirits are the three most preferred drinks. Premixed drinks which have recently become quite popular also demonstrate very high and increasing participation rates. In order to provide more insight on an individual's preference for an alcoholic product, the 82,053 drinkers are classified into 1,268 unique and mutually exclusive groups in terms of the different realizations of how respondents answered this survey question. When these groups are ranked by the number of drinkers they contain, the top ten groups together contain 43% of all drinkers. From Table A2 in the Appendix, we see that the majority of individuals from these ten groups have chosen only one or two drinks as what they usually drink.[4] Hence, we are confident that these drinking-preference indicator variables capture respondents' main drinking preferences quite adequately.

Table 3 presents participation rates for the 11 types of alcoholic drinks, by age and gender. As expected, canned premixed spirits and bottled premixed spirits are more popular among youth and young adults, compared to other age groups. The popularity of the two drinks clearly goes down with age. In contrast, bottled wine is more popular with middle-aged and elderly people. In terms of gender difference, regular strength beer is always more

[4] Full results are available upon request from the authors.

popular with men than with women, irrespective of age. In contrast, women have a higher preference for bottled wine than men across all age groups.

Our econometric model also controls for a range of individuals' socioeconomic, demographic and lifestyle factors. We also control for (aggregated) alcohol price. Details on all dependent and explanatory variables used in this study are presented in Tables A3 and A4 in the Appendix.

4 Estimation issues and Econometric framework

In the alcohol consumption literature, drinking patterns (e.g. bingeing in this study) have always been treated as exogenous (see, for example, Greenfield and Weisner 1995, Markowitz, Kaestner, and Grossman 2005, Salomé *et al.* 2005, Brown and Vanable 2007). However, individuals' inclination towards various antisocial behaviours under the influence of alcohol and their drinking patterns are very likely to be driven by a common set of unobservable factors, and thus it would be inappropriate to treat drinking patterns as exogenous. For instance, as Gottfredson and Hirschi (1990) argued that people who lack self-control are more likely to engage not only in antisocial or unlawful activities, but also negative behaviours such as drinking, gambling and smoking. In addition, some other personality traits linked to individuals' differences in behaviours, such as impulsiveness, risk-taking and sensation-seeking, are also believed to be related to alcohol use and abuse (Cherpitel 1993). Such confounding factors can potentially obscure the correlations and induce endogeneity or simultaneity bias (Hayashi 2000). [5] Exceptions in this literature are

[5] One may argue that consumers' drinking preferences are endogenous. However, addressing the potential endogeneity is almost an impossible task, because of the multitude of the beverage types considered, the dimension of the resulting multivariate system model and the difficulty with finding appropriate instruments. In order to examine the robustness of our results to the potential endogeneity of drinking preferences, the system is re-estimated for different subsets of the eleven beverage types, and the results seem to be reasonably robust to variations in the choice of drink types. Coefficient estimates for two different subsets are presented in Table A5 and Table A6 in the Appendix. They can be compared with the estimates for the full set of drinks presented in Table A7.

Chatterji *et al*. (2004) and Sen (2002), both of which used a recursive bivariate probit model to deal with endogeneity. However, they did not fully take the advantage of the system approach to discuss all results of interest.

To jointly study the association between binge drinking, alcohol-related antisocial behaviours and consumers' drinking preferences, a system of probit equations with a triangular endogenous structure[6] is specified that allows binge drinking to be determined endogenously. Let $Y^*_{i,B}, Y^*_{i,Driving}, Y^*_{i,Disturbance}$ and $Y^*_{i,Abuse}$ denote the propensity of the i^{th} individual in the sample to participate in binge drinking and the three alcohol-related antisocial behaviours under the influence of alcohol. The three latent variables are mapped to observed binary dummy variables $Y_{i,B}, Y_{i,Driving}, Y_{i,Disturbance}$ and $Y_{i,Abuse}$ using:

$$Y_{i,L} = \begin{cases} 1 \text{ if } Y^*_{i,L} > 0 \\ 0 \text{ if } Y^*_{i,L} \le 0 \end{cases} \tag{1}$$

where $L \in \{B, Driving, Disturbance, Abuse\}$, and $Y_{i,L} = 1$ to indicate participation and $Y_{i,L} = 0$ otherwise.

We specify the system of equation as follows:

$$\begin{cases} Y^*_{i,B} = X^{'}_{i,B}\beta_B + \varepsilon_{i,B} \\ Y^*_{i,Driving} = X^{'}_{i,Driving}\beta_{Driving} + \alpha_{Driving}Y_{i,B} + \varepsilon_{i,Driving} \\ Y^*_{i,Disturbance} = X^{'}_{i,Disturbance}\beta_{Disturbance} + \alpha_{Disturbance}Y_{i,B} + \varepsilon_{i,Disturbance} \\ Y^*_{i,Abuse} = X^{'}_{i,Abuse}\beta_{Abuse} + \alpha_{Abuse}Y_{i,B} + \varepsilon_{i,Abuse} \end{cases} \tag{2}$$

where $X'_{i,B}, X'_{i,Driving}, X'_{i,Disturbance}$ and $X'_{i,Abuse}$ are vectors of exogenous covariates. The error terms in the respective equations are assumed to independently and identically follow a multivariate normal distribution with mean zero and covariance matrix Σ, that is $(\varepsilon_{i,B}, \varepsilon_{i,Driving}, \varepsilon_{i,Disturbance}, \varepsilon_{i,Abuse})' \sim MVN(0, \Sigma)$, where

[6] For a similar bivariate case, see Greene (2007 p. 823) and Maddala (1983 p. 123).

$$\Sigma = \begin{pmatrix} 1 & \rho_{B,Driving} & \rho_{B,Disturbance} & \rho_{B,Abuse} \\ \rho_{B,Driving} & 1 & \rho_{Driving,Disturbance} & \rho_{Driving,Abuse} \\ \rho_{B,Disturbance} & \rho_{Driving,Disturbance} & 1 & \rho_{Disturbance,Abuse} \\ \rho_{B,Abuse} & \rho_{Driving,Abuse} & \rho_{Disturbance,Abuse} & 1 \end{pmatrix} \quad (3)$$

We assume $Var(\varepsilon_{i,L}) \equiv 1$ ($L \in \{B, Driving, Disturbance, Abuse\}$) in order for the parameters to be identified separately from the variance of ε (Greene 2007). Equations (1) - (3) together specify an endogenous multivariate probit (MVP) system model with a recursive simultaneous structure that jointly determines the binge drinking decision and the three decisions to participate in antisocial behaviours while under the influence of alcohol. Specifically, the MVP specification with potentially non-zero off-diagonal elements in Σ allows for correlations across the disturbances of the four latent equations. Note that when the off-diagonal elements in Σ equal zero the MVP model reduces to four independent probit models which are then estimated separately.

Given the potential endogeneity of drinking patterns, the estimates of the treatment effects of drinking patterns on individuals' antisocial behaviour participation under the influence of alcohol will be biased upwards. Besides relying on the functional form of the MVP for identification, we consider imposing exclusion restrictions (Heckman 1978, Maddala 1983, Monfardini and Radice 2008). Specifically, $X_{i,B}$ contains instruments which do not appear in $X'_{i,Driving}$, $X'_{i,Disturbance}$ and $X'_{i,Abuse}$. In the literature a wide range of variables have been used to instrument use of drugs such as tobacco, alcohol, marijuana, cocaine (see, for example, French and Popovici 2011). Typical instruments for alcohol consumption include family characteristics (e.g. parent with alcohol problems and parent smoking status), personal beliefs/characteristics (e.g. religiosity, smoked at age 18, and chronic disease/health), and state laws, taxes, policies and prices (e.g. state minimum legal drinking age, state beer taxes and alcohol prices). We use the Australian price index of

alcohol deflated using the all-good consumer price index, which varies by state of residence and year, as an instrument for alcohol consumption in this study (ABS 2011), and it is not implausible to assume that the price of alcohol indirectly affects individuals' antisocial behaviour participation only via its direct effect on individuals' drinking patterns.

An important limitation of our data is the measurement or 'misclassification' error in the alcohol consumption data. Misclassification refers to a response reported or recorded in the wrong category. The binge drinking variable is constructed from a survey question which asked respondents to report their drinking patterns in the last 12 months. Specifically, the following question was asked: *Please record how often in the last 12 months you have had each of the following number of standard drinks in a day?* Respondents had to then choose from a grid with the vertical array displaying the number of standard drinks such as "*20 or more drinks*", "*11-19 standard drinks*" to "*less than 1 standard drink*" or "*none*", and the horizontal array displaying the frequency such as "*everyday*", "*5 to 6 days a week*" to "*about once a month*", "*less often*" or "*never*". Given the multitude of alternatives and the long recall period, it is quite likely that the consumption data is subject to measurement error.

In a discrete-response model, misclassification of dependent variables renders coefficient estimates inconsistent when estimation techniques such as probit or logit are used. This has even worse consequences in the multivariate probit system specification with the alcohol consumption variable as an endogenous regressor. To correct for misclassification, a modified maximum likelihood approach proposed by Hausman, Abrevaya, and Scott-Morton (1998) is employed. This approach is further extended to dynamic discrete choice scenarios by Keane and Sauer (2009).

Specifically, let $\tilde{Y}_{i,B}$ denote the true response for the underlying latent variable $Y^{*}_{i,B}$, i.e.

$$\tilde{Y}_{i,B} = I(Y^*_{i,B} > 0), \tag{4}$$

where $I(E)$ is the indicator function equal to one if E is true and zero otherwise. Following Hausman, Abrevaya, and Scott-Morton (1998), the probability of misclassification of the bingeing dummy variable depends on the values of $\tilde{Y}_{i,B}$, and is assumed to be independent of the covariates and other dependent variables in the multivariate probit model. Accordingly, if $Y_{i,B}$ denotes the observed bingeing indicator variable, the misclassification probabilities are

$$\begin{aligned} \alpha_0 &= \Pr(Y_{i,B} = 1 \mid \tilde{Y}_{i,B} = 0), \\ \alpha_1 &= \Pr(Y_{i,B} = 0 \mid \tilde{Y}_{i,B} = 1). \end{aligned} \tag{5}$$

where α_0 is the probability that a zero is misclassified as a one, and α_1 is the probability that a one is misclassified as a zero.

Given a random sample of *N* households, assuming that error terms in (2) follow a multivariate normal distribution, the system of equations can be consistently and efficiently estimated by maximising the following modified log-likelihood function that is corrected for misclassification:

$$\sum_{i=1}^{N}\sum_{l=0}^{1}\sum_{m=0}^{1}\sum_{n=0}^{1}\sum_{k=0}^{1} d_{i,lmnk} \log\{P(\tilde{Y}_{i,B} = l, Y_{i,Driving} = m, Y_{i,Disturbance} = n, Y_{i,Abuse} = k \mid X_{i,B}, X_{i,Driving}, X_{i,Disturbance}, X_{i,Abuse}) \cdot (1-\alpha_l) + P(\tilde{Y}_{i,B} = 1-l, Y_{i,Driving} = m, Y_{i,Disturbance} = n, Y_{i,Abuse} = k \mid X_{i,B}, X_{i,Driving}, X_{i,Disturbance}, X_{i,Abuse}) \cdot \alpha_{1-l}\} \tag{6}$$

where l, m, n and $k \in \{0,1\}$, $d_{i,lmnk} = I(Y_{i,B} = l, Y_{i,Driving} = m, Y_{i,Disturbance} = n, Y_{i,Abuse} = k)$ and for $\eta \in \{l, 1-l\}$,

$$P(\tilde{Y}_{i,B}=\eta, Y_{i,Driving}=m, Y_{i,Disturbance}=n, Y_{i,Abuse}=k \mid X_{i,B}, X_{i,Driving}, X_{i,Disturbance}, X_{i,Abuse})$$
$$=\Phi_4[(2\eta-1)X'_{i,B}\hat{\beta}_B, (2m-1)(X'_{i,Driving}\hat{\beta}_{Driving}+\hat{\alpha}_{Driving}\eta), (2n-1)(X'_{i,Disturbance}\hat{\beta}_{Disturbance}+\hat{\alpha}_{Disturbance}\eta),$$
$$(2k-1)(X'_{i,Abuse}\hat{\beta}_{Abuse}+\hat{\alpha}_{Abuse}\eta); \hat{\Sigma}],$$

where

$$\hat{\Sigma}=\begin{pmatrix} 1 & (2\eta-1)(2m-1)\hat{\rho}_{B,Driving} & (2\eta-1)(2n-1)\hat{\rho}_{B,Disturbance} & (2\eta-1)(2k-1)\hat{\rho}_{B,Abuse} \\ (2\eta-1)(2m-1)\hat{\rho}_{B,Driving} & 1 & (2m-1)(2n-1)\hat{\rho}_{Driving,Disturbance} & (2m-1)(2k-1)\hat{\rho}_{Driving,Abuse} \\ (2\eta-1)(2n-1)\hat{\rho}_{B,Disturbance} & (2m-1)(2n-1)\hat{\rho}_{Driving,Disturbance} & 1 & (2n-1)(2k-1)\hat{\rho}_{Disturbance,Abuse} \\ (2\eta-1)(2k-1)\hat{\rho}_{B,Abuse} & (2m-1)(2k-1)\hat{\rho}_{Driving,Abuse} & (2n-1)(2k-1)\hat{\rho}_{Disturbance,Abuse} & 1 \end{pmatrix},$$

and $\Phi_4(.,\hat{\Sigma})$ is a four-variate standard normal cumulative distribution function (cdf) with the variance-covariance matrix $\hat{\Sigma}$. Hausman, Abrevaya, and Scott-Morton (1998) point out that the only assumption required for identification of this model (besides the usual condition that $E(X'X)$ exists and is of full rank) is $\alpha_0+\alpha_1<1$. This implies that classification problem cannot be so severe that respondents are misclassified more often than not, which is certainly a mild assumption.

Our system model is estimated using Stata 13. Since the estimation of the complex model involves evaluating a four-variate standard normal cdf, a recursive conditioning procedure known as the GHK smooth recursive probability simulator (Geweke 1989, Borsch-Supan and Hajivassiliou 1993, Keane 1994) is employed. The computation of marginal effects and treatment effects is complex given the endogenous structure of the model and the presence of common variables across the four equations. This results in joint and conditional probabilities that are highly non-linear functions of *X* making analytical solutions of marginal effects and treatment effects difficult to obtain. We therefore estimate them on GAUSS 11

via numerical derivatives of the multivariate normal distribution function with respect to the exogenous variables. Standard errors of the estimated marginal effects and treatment effects are computed using the delta method.

5 Results

Tables A7 and A8 in the Appendix present the estimated parameters and corresponding standard errors of the endogenous multivariate probit (MVP) system model presented in Eqs. (1) – (3). We begin by examining pair-wise correlation coefficients between the error terms in the four equations in Table A8. The correlations between the three antisocial behaviour equations are all statistically significant at the 1% level, justifying the use of the MVP approach. Among these correlations, the one between Disturbance (created a public disturbance/nuisance, caused damage to property, or stole money, goods or property) and Abuse (verbally or physically abused someone) is the highest at 0.491, which is consistent with intuition and with observed correlations in Table A1. However, the correlations of binge drinking with the antisocial behaviours are all small and statistically insignificant, suggesting a weak case for its endogeneity.

Table A7 reports the estimated coefficients and corresponding standard errors. Whilst the coefficients are not very meaningful in probit models, they can only indicate the direction of relationships with the latent dependent variables. Marginal effects, on the other hand, are more meaningful in probit models in that they indicate probability changes rather than changes in the latent propensity. Due to the endogenous structure of the model and the presence of common variables, the marginal effect of an exogenous explanatory variable is computationally complex as it has a direct and an indirect component. Consider, for example, a common covariate X that appears in all four equations. If we were to compute the total marginal effect of X on, say, the probability of one of the antisocial behaviours, i.e. drink

driving, this would comprise a direct effect of X on the probability of drink-driving and an indirect effect through the binge drinking equation (see, for example, Greene 2007). This indirect effect may either counter-effect or reinforce the direct effect.

5.1 Effect of bingeing on antisocial behaviours:

Tables 4 and 5 report the marginal effects of all exogenous variables in the model. The first column shows marginal effects in the binge drinking equation while the remaining columns present marginal effects related to the three antisocial behaviour equations. Given the presence of an endogenous variable in each of the antisocial behaviour equations the marginal effects comprise three components: direct, indirect and total effect. We also report in the first row of Table 4 the treatment effect of binge drinking on the alcohol-related antisocial behaviours. As expected, bingers are more likely to exhibit all three types of antisocial behaviours while under the influence of alcohol. In particular, bingers are more likely to drink and drive (14.0 percentage points [pp]), create a public disturbance/nuisance, cause damage to property, or steal money, goods or property (1.9 pp), and verbally or physically abuse someone (6.8 pp), while under the influence of alcohol. This is consistent with other studies which have found a strong association between drink-driving and binge drinking (see, for example, Quinlan *et al*. 2005).

5.2 Effects of consumers' drinking preferences:

A central question from an alcohol tax perspective is the extent of the association of binge drinking and antisocial behaviours with the types of alcoholic drinks consumed. We first turn to the results in the binge drinking equation. Our results indicate that individuals who mainly drink regular strength beer have the highest probability (26 pp) to engage in binge drinking relative to all other alcohol types. In contrast, individuals who mainly consume drinks which are very high in alcohol strength, such as bottled spirits and liqueurs,

are 9.8 pp more likely to binge. Interestingly, drinkers whose main preference is wine have relatively smaller probabilities of engaging into binge drinking, with a 7 pp higher probability in the case of cask wine, 6.4 pp for fortified wine, and 1.6 pp for bottled wine. Turning towards premixed spirits which is of even greater interest from a policy perspective, our results show that individuals whose main preference are premixed spirits in a can are 12.8 pp more likely to engage in binge drinking, while the association with premixed spirits in a bottle is small and statistically insignificant.

We next turn to the marginal effects of these drinking preferences on the antisocial behaviours undertaken under the influence of alcohol. While we also report direct and indirect effects, for brevity we focus on the total marginal effects. Starting with drink driving, we find that those who usually drink regular strength beer are 7.4 pp more likely to drink and drive, followed by pre-mixed spirits in a can (5.2 pp), bottled wine (3.0 pp), cask wine (2.8 pp), and mid strength beer (2.7 pp). On the other hand, high strength (e.g. fortified wine) and low strength (e.g. low strength beer) alcohol products are negatively associated with drink driving. We find similar associations of regular strength beer and premixed drinks with the other two antisocial behaviours Disturbance and Abuse, although the effects are of smaller magnitudes. Stealing, damaging and public disturbance and physical and verbal abuse are also associated with home brewed beer, cask wine and bottled spirits.

Our overall findings indicate that, in general, binge drinking and antisocial behaviours are more strongly related to the consumption of low strength alcohol products such as regular strength beer and premixed drinks in a can than high strength products such as bottled and fortified wine. Some of these findings contrast with those of Srivastava and Zhao (2010) who find that risky and unlawful activities such as drink driving, alcohol-related damage to properties, stealing, and verbal and physical abuse are more likely to be linked to those who

drink mid strength beer, bottled spirits, premixed drinks. However, Srivastava and Zhao (2010) do not control for individuals' characteristics in their study.

5.3 Demographic and socioeconomic effects:

Now, we turn towards the demographic and socioeconomic effects. Most of the significant variables in Tables 4 and 5 have the expected signs. Age is a significant determinant in all four equations. To allow for a more flexible age profile for participation, we enter age bands (instead of continuous age) in the model. As expected, youth and young adults are more likely to engage in binge drinking and alcohol-related antisocial behaviours. Specifically, compared to individuals aged over 60 which is the reference group, young adults (aged 20 to 29) are 44.5 pp and 9.8 pp more likely to exhibit binge drinking and drink driving, respectively. We find more or less similar age patterns with the antisocial behaviours Disturbance and Abuse, with the 12-29 age groups being more likely to engage in such activities.

It is interesting to note some of the contrasting findings relating to the direct and indirect effects across the same variables. Let us take the marginal effect of the 12-19 age group on the probability of drink driving as an example. Being in the 12-19 age group is associated with a 1.9 pp lower probability of drink driving, overall. This is a result of the 6.6 pp lower direct effect of this age group on drink driving (because of, say, being less likely to drive, supervised driving or driving restrictions in this young age group) being offset by a positive indirect effect of 4.7 pp on drink driving via the binge drinking equation (most likely because the 12-19 years old have a higher probability to binge and engage into antisocial behaviours). This highlights the advantage of our system model which addresses the endogeneity of binge drinking. Treating drinking patterns as exogenous and disregarding their indirect effect would have led to a larger negative effect of this age group on drink driving.

With regard to gender, while we do not observe any statistically significant effect on binge drinking, males are more likely to participate in all three alcohol-related antisocial behaviours, with marginal effects ranging from 0.7 pp for Disturbance, 1.2 pp for Abuse to 7 pp for Driving. In terms of marital status, being married is associated with a lower probability of binge drinking and antisocial behaviours. We also observe some significant effects of household structure, race and remoteness on binge drinking and antisocial behaviours. Specifically, those coming from households with dependent children are less likely to binge and participate in antisocial behaviours. Being an aboriginal or Torres Strait islander is positively associated with binge drinking and Abuse (verbally or physically abusing someone), while the effects on Driving and Disturbance are statistically insignificant. Living in capital cities is associated with a lower probability of binge drinking and drink driving, but has no significant impact on Disturbance and Abuse.

The effects of individuals' main occupation are varied across binge drinking and the antisocial behaviours although we find a consistent association of unemployment status with most activities. Relative to those who are retired, on pension or engaged in home duties, both those who work and those who are unemployed are more likely to binge and more likely to drink and drive. While the effects on Disturbance are statistically insignificant, we find that relative to the reference group, those who are unemployed are more likely, while those who study are less likely, to be engaged in activities such as verbally or physically abusing someone. Where significant, unemployment status also has the largest effect on the activities. Specifically, relative to the reference group, those who are unemployed are 6 pp, 3.3 pp, and 1.8 pp more likely to binge and engage in Driving and Abuse, respectively.

Education can be considered as a proxy for social class. Consistent with intuition, being educated is negatively related to binge drinking and antisocial behaviours such as

Disturbance and Abuse. However, we find a positive association of education with drink driving. In particular, relative to those with less than year 12 qualifications, those who have a tertiary degree are 6.6 pp, 0.2 pp and 1.8 pp less likely to engage in binge drinking, Disturbance and Abuse, respectively, but 2.6 pp more likely to drink and drive.

Next, we look at the impact of income on binge drinking and the antisocial behaviours. The inclusion of both a linear and a quadratic term of the logarithm of household real income in the analysis allows for a more flexible effect of income on the probability of engaging into the four activities. A more sensible illustration of the impact of income is a plot of the predicted participation probabilities for the real income range covered by the sample. Figures 1-4 depict the plots of the predicted probabilities for the four activities. Except for Driving, we find a U-shaped relationship between income and the other three activities, that is, individuals at both ends of the income distribution have higher probabilities of engaging in binge drinking, Disturbance and Abuse. In contrast, an increasing income profile of Driving indicates that individuals with higher income are more likely to drink and drive.

Finally, we turn towards our price variable which we use as instrument in the binge drinking equation. As expected, the marginal effect of price is negative and statistically significant. Specifically, a one-percent increase from the mean of the aggregate real price will reduce the probability of binge drinking by 0.3 pp. Equivalently, evaluated at the sample mean of the aggregate real price the marginal effect represents a participation elasticity of -0.69. Note that probability elasticity represents a percentage change rather than an absolute change in drinking probability in response to a one-percent change in price. Here, a price probability elasticity of -0.69 indicates that a one-percent rise in the price index of alcohol will result in a 69-percent reduction in the probability of binge drinking. Since the price variable only appears in the binge drinking equation, it has an indirect effect on the antisocial

behaviours. Our results show that a one-percent increase in the price index of alcohol will reduce drink driving probability by 24%. A similar price increase will result in 18% and 34% reduction in the probability of Disturbance and Abuse, respectively. We also re-estimated the model using the price indices of three alcohol subcategories, beer, wine and spirits, and our results are found to be quite robust.[7]

6. Conclusion

This paper uses a multivariate probit system model with a recursive structure and unit record data from the Australia National Drug Strategy Household Surveys to study the association of alcohol-related antisocial and unlawful behaviours and binge drinking, with individuals' alcoholic beverage consumption types. Specifically, we investigate how the beverage types directly and indirectly (via bingeing) contribute to the incidence of these negative behaviours. Our modelling approach accommodates potential endogeneity of bingeing and the intrinsic correlation across all four alcohol-related negative behaviours via unobserved individual heterogeneity. Given the complexity of the data collection process for alcohol consumption, there is a potential for misclassification. This is addressed using a modified maximum likelihood function allowing for misclassification probabilities to be estimated. The significant misclassification probability estimates justify the necessity of our misclassification specification, and the significance of the estimated correlation coefficients between the three antisocial and unlawful behaviour participation equations also serves to justify our system approach. Interestingly, whilst bingeing significantly increases the probabilities of all three groups of negative behaviours as shown by the significant and positive treatment effects, its error terms do not seem to be significantly correlated with the

[7] These results are available from the authors upon request.

three other structural error terms once bingeing explicitly enters these equations, suggesting a weak case for its endogeneity.

The detailed results on the association of individual drinker demographic and socioeconomic characteristics with the four groups of negative drinking related behaviours are valuable information for better targeted alcohol educational campaigns. We show that teenagers are most likely among all age groups to be involved in binge drinking, creating public disturbance/nuisance, stole money, goods or property, or verbally or physically abuse someone while under the influence of alcohol. On the other hand, the 20-49 year age groups are more likely to be drink-driving than other age groups. In terms of the total effect on the probabilities of negative behaviours, male, unmarried, unemployed, being less educated, and aboriginal or Torres Strait islanders are more likely to be engaged in physical and verbal abusive behaviours while drinking.

As a tool for correcting market failure, an alcohol tax policy is most effective if it is designed to tax where the negative externalities are incurred but not the normal consumers with no additional societal costs. Quantifying the external societal cost for individual alcohol beverage types on a per litre alcohol basis is an almost impossible task. However, this paper contributes in that direction to the alcohol taxation debate by providing individual level empirical evidence on the association of eleven types of alcoholic beverage drinks with four groups of negative drinking related behaviours including binge drinking, drink driving, stealing, damaging properties and public disturbances, and physical and verbal abuse.

In terms of total marginal effects on the probabilities of negative behaviours, our results show that regular strength beer and premixed spirits in cans have the strongest links to all four types of negative behaviours. Home brewed beer and bottled spirits are next on the link to binge drinking; cask wine, home brewed beer, and bottled spirits to stealing/damaging,

public disturbance, and physical and verbal abuse; and bottled and cask wine and mid strength beer are next in line for drink driving. Interestingly, these *ceteris paribus* marginal effect results have some significant differences from those in Srivastava and Zhao (2010) where other drinker characteristics are not controlled.

These results seem to indicate that the percentage of alcohol in a beverage type is not strictly associated with the probabilities of negative behaviours. In particular, drinkers of some lower strength alcohol drinks, such as regular strength beer (around 5% alcohol) and canned premixed spirits (5% alcohol, are much more likely to binge and to participate in antisocial and unlawful behaviours while under the influence of alcohol than drinkers of some high strength alcohol drinks, such as bottled wine (13%) and fortified wine (20%). Therefore a proposed flat volumetric tax rate for all beverage types is far from the implied existing tax rate, and does not seem to be a most efficient policy for taxing by negative externalities as the evidence in this study suggests that the same amount of alcohol appearing in different beverage forms may not generate the same amount of negative social costs.

Appendix

Table A1: Observed Correlation across Bingeing and

Antisocial Behaviours for the Drinkers

	Driving	Disturbance	Abuse	Binge
Driving	1.000			
Disturbance	0.160	1.000		
Abuse	0.206	0.444	1.000	
Binge	0.249	0.183	0.237	1.000

Notes: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. *Data source*: NDSHS (1993-2010).

Table A2: Top Ten Groups Ordered by Participation Rates

	Regular strength beer	Middle strength beer	Low strength beer	Home brewed beer	Cask wine	Bottled wine	Fortified wine	Canned premixed spirits	Bottled spirits	Bottled premixed spirits	Other	PR*
G 1	0	0	0	0	0	1	0	0	0	0	0	12.43%
G 2	1	0	0	0	0	0	0	0	0	0	0	5.59%
G 3	0	0	0	0	0	1	0	0	1	0	0	4.66%
G 4	0	0	0	0	0	0	0	0	1	0	0	4.54%
G 5	1	0	0	0	0	1	0	0	0	0	0	3.33%
G 6	0	0	1	0	0	0	0	0	0	0	0	3.30%
G 7	0	0	0	0	1	0	0	0	0	0	0	2.38%
G 8	0	1	0	0	0	0	0	0	0	0	0	2.27%
G 9	0	0	1	0	0	1	0	0	0	0	0	2.25%
G 10	0	0	0	0	1	1	0	0	0	0	0	2.08%
											Total	42.83%

Note: 82,053 drinkers are classified into 1,268 unique and mutually exclusive groups. The top ten groups which have the largest participation rates are reported; * PR: Participation Rate. *Data source*: NDSHS (1993-2010).

Table A3: Definition of Variables

Variable	Variable description
Binge	Equals 1 if one is a binger, 0 otherwise
Regular strength beer	Equals 1 if one usually drinks regular strength beer, 0 otherwise
Mid strength beer	Equals 1 if one usually drinks mid strength beer, 0 otherwise
Low strength beer	Equals 1 if one usually drinks low strength beer, 0 otherwise
Home brewed beer	Equals 1 if one usually drinks home brewed beer, 0 otherwise
Cask wine	Equals 1 if one usually drinks cask wine, 0 otherwise
Bottled wine	Equals 1 if one usually drinks bottled wine, 0 otherwise
Fortified wine	Equals 1 if one usually drinks fortified wine, 0 otherwise
Canned premixed spirits	Equals 1 if one usually drinks pre-mixed spirits in a can, 0 otherwise
Bottled spirits	Equals 1 if one usually drinks bottled spirits and liqueurs, 0 otherwise
Bottled premixed spirits	Equals 1 if one usually drinks pre-mixed spirits in a bottle, 0 otherwise
Other alcohol drinks	Equals 1 if one usually drinks others, 0 otherwise
Driving	Equals 1 if one undertook drink driving in the year prior to survey, 0 otherwise
Disturbance	Equals 1 if one created a public disturbance/nuisance, caused damage to property, or stole money, goods or property under the influence of alcohol in the year prior to survey, 0 o/w
Abuse	Equals 1 if one verbally or physically abused someone while under the influence of alcohol in the year prior to survey, 0 otherwise
Year 2001	Equals 1 for year 2001, 0 otherwise
Year 2004	Equals 1 for year 2004, 0 otherwise
Year 2007	Equals 1 for year 2007, 0 otherwise
Year 2010	Equals 1 for year 2010, 0 otherwise (omitted)
Aged 12 to 19	Equals 1 if one's age $\leq$19 & $\geq$12, 0 otherwise
Aged 20 to 29	Equals 1 if one's age $\leq$29 & $\geq$20, 0 otherwise
Aged 30 to 39	Equals 1 if one's age $\leq$39 & $\geq$30, 0 otherwise
Aged 40 to 49	Equals 1 if one's age $\leq$49 & $\geq$40, 0 otherwise
Aged 50 to 59	Equals 1 if one's age $\leq$59 & $\geq$50, 0 otherwise
Aged 60	Equals 1 if one's age$\geq$60, 0 otherwiae (omitted)
Log of real income	Natural logarithm of real household income
(Log of real income)^2	The square of log of real income
Non dependent children	Equals 1 if the household has non-dependent child(ren), 0 otherwise
With dependent children	Equals 1 if the household has dependent child(ren), 0 otherwise
No children	Equals 1 if the household has no children, 0 otherwise (omitted)
Male	Equals 1 if male, 0 for female
Married	Equals 1 if married or de facto, 0 otherwise
Work	Equals 1 if working part-time or full-time, 0 otherwise
Unemployed	Equals 1 if unemployed, 0 otherwise
Studying	Equals 1 if studying, 0 otherwise
Other	Equals 1 if retired, on pension or performing home duties, 0 otherwise (omitted)
Tertiary degree	Equals 1 if highest qualification is a tertiary degree, 0 otherwise
Diploma	Equals 1 if highest qualification is a diploma or certificate, 0 otherwise
Year 12	Equals 1 if highest qualification is year 12, 0 otherwise
Below Year 12	Equals 1 if highest qualification is below year 12, 0 otherwise (omitted)
Aboriginal or Torres Strait origin	Equals 1 if respondent is of Aboriginal or Torres Strait Islander origin, 0 otherwise
Living in capital	Equals 1 if respondent lives in a capital city, 0 otherwise
Log price of alcohol drinks	Natural logarithm of price index of alcohol deflated using the all-good consumer price index

Table A4: Summary Statistics of Variables

	Mean	SD	Minimum	Maximum
Dependent variables				
Binge	0.438	0.496	0	1
Driving	0.172	0.378	0	1
Disturbance	0.032	0.176	0	1
Abuse	0.061	0.240	0	1
Beverage types				
Regular strength beer	0.310	0.463	0	1
Mid strength beer	0.142	0.349	0	1
Low strength beer	0.183	0.387	0	1
Home brewed beer	0.034	0.182	0	1
Cask wine	0.171	0.376	0	1
Bottled wine	0.560	0.496	0	1
Fortified wine	0.134	0.340	0	1
Canned premixed spirits	0.194	0.396	0	1
Bottled spirits	0.421	0.494	0	1
Bottled premixed spirits	0.174	0.379	0	1
Other alcohol drinks	0.069	0.254	0	1
Price variables				
Log price of alcohol drinks	5.137	0.116	4.957	5.377
Time variables				
Year 2001	0.263	0.440	0	1
Year 2004	0.267	0.443	0	1
Year 2007	0.222	0.415	0	1
Year 2010	0.250	0.433	0	1
Demographic variables				
Aged 12 to 19	0.035	0.185	0	1
Aged 20 to 29	0.153	0.360	0	1
Aged 30 to 39	0.226	0.418	0	1
Aged 40 to 49	0.205	0.404	0	1
Aged 50 to 59	0.179	0.384	0	1
Aged 60	0.225	0.418	0	1
Log of real income	10.514	0.761	6.645	11.598
(Log of real income)^2	111.114	15.552	44.153	134.524
With dependent children	0.376	0.485	0	1
Non dependent children	0.113	0.317	0	1
No children	0.510	0.500	0	1
Male	0.683	0.465	0	1
Married	0.024	0.154	0	1
Work	0.017	0.128	0	1
Unemployed	0.277	0.447	0	1
Studying	0.257	0.437	0	1
Other	0.310	0.462	0	1
Tertiary degree	0.383	0.486	0	1
Diploma	0.129	0.336	0	1
Year 12	0.231	0.422	0	1
Below Year 12	0.282	0.450	0	1
Aboriginal or Torres Strait origin	0.012	0.111	0	1
Living in capital	0.641	0.480	0	1

Table A5 Coefficient estimates for drink subset one

	Binge		Driving		Disturbance		Abuse	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Binge			0.647	(0.041)***	1.029	(0.099)***	0.968	(0.068)***
Regular strength	0.675	(0.019)***	0.184	(0.018)***	0.298	(0.032)***	0.254	(0.025)***
Mid strength beer	0.235	(0.019)***	0.077	(0.018)***	0.003	(0.035)	0.014	(0.026)
Low strength beer	-0.106	(0.017)***	-0.061	(0.018)***	-0.170	(0.041)***	-0.153	(0.028)***
Cask wine	0.179	(0.017)***	0.089	(0.018)***	0.191	(0.037)***	0.152	(0.026)***
Bottled wine	0.044	(0.014)***	0.138	(0.015)***	-0.095	(0.029)***	-0.124	(0.021)***
Canned premixed spirits	0.356	(0.019)***	0.169	(0.019)***	0.191	(0.031)***	0.245	(0.024)***
Bottled premixed spirits	0.059	(0.018)***	-0.064	(0.020)***	0.021	(0.033)	-0.023	(0.026)
Other alcohol	0.014	(0.025)	0.045	(0.026)*	0.161	(0.042)***	0.119	(0.034)***
Aged 12 to 19	0.904	(0.048)***	-0.315	(0.053)***	1.673	(0.113)***	0.768	(0.066)***
Aged 20 to 29	1.186	(0.037)***	0.178	(0.035)***	1.287	(0.106)***	0.608	(0.055)***
Aged 30 to 39	0.890	(0.033)***	0.189	(0.032)***	0.830	(0.105)***	0.355	(0.053)***
Aged 40 to 49	0.676	(0.031)***	0.229	(0.030)***	0.542	(0.107)***	0.270	(0.052)***
Aged 50 to 59	0.359	(0.027)***	0.160	(0.028)***	0.378	(0.109)***	0.155	(0.050)***
Log of real	-1.313	(0.168)***	-0.008	(0.191)	-0.711	(0.319)**	-0.636	(0.244)***
(Log of real	0.074	(0.008)***	0.005	(0.009)	0.034	(0.016)**	0.030	(0.012)**
With dependent	-0.137	(0.015)***	-0.041	(0.016)**	-0.145	(0.031)***	-0.012	(0.023)
Non dependent	-0.114	(0.021)***	-0.090	(0.023)***	-0.015	(0.043)	0.075	(0.032)**
Year 2001	-0.174	(0.053)***	0.198	(0.019)***	-0.027	(0.038)	0.129	(0.028)***
Year 2004	-0.038	(0.039)	0.170	(0.019)***	0.042	(0.036)	0.126	(0.027)***
Year 2007	-0.056	(0.028)**	0.130	(0.020)***	0.069	(0.039)*	0.119	(0.029)***
Male	-0.012	(0.015)	0.343	(0.016)***	0.340	(0.031)***	0.160	(0.023)***
Married	-0.225	(0.016)***	-0.191	(0.016)***	-0.264	(0.031)***	-0.173	(0.023)***
Work	0.167	(0.018)***	0.100	(0.021)***	-0.056	(0.049)	-0.026	(0.032)
Unemployed	0.153	(0.042)***	0.121	(0.045)***	0.064	(0.076)	0.187	(0.056)***
Studying	-0.018	(0.052)	-0.017	(0.058)	0.061	(0.076)	-0.146	(0.066)**
Tertiary degree	-0.176	(0.020)***	0.172	(0.022)***	-0.026	(0.045)	-0.098	(0.033)***
Diploma	-0.006	(0.017)	0.087	(0.019)***	-0.047	(0.037)	0.013	(0.026)
Year 12	0.039	(0.022)*	0.095	(0.024)***	-0.012	(0.041)	0.004	(0.032)
Aboriginal or	0.184	(0.055)***	0.079	(0.057)	0.098	(0.086)	0.288	(0.064)***
Living in capital	-0.168	(0.014)***	-0.011	(0.015)	0.013	(0.028)	0.043	(0.021)**
Price of alcohol	-0.814	(0.169)***						
Constant	8.916	(1.253)***	-2.512	(0.980)**	0.019	(1.627)	0.534	(1.243)
α_0	0.016	(0.009)*						
α_1	0.036	(0.007)***						

Note: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table A6 Coefficient estimates for drink subset two

	Binge		Driving		Disturbance		Abuse	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Binge			0.652	(0.041)***	1.041	(0.100)***	0.972	(0.067)***
Regular strength	0.672	(0.019)***	0.185	(0.018)***	0.288	(0.032)***	0.256	(0.024)***
Mid strength beer	0.217	(0.019)***	0.070	(0.018)***	-0.041	(0.035)	-0.007	(0.026)
Low strength beer	0.348	(0.038)***	0.008	(0.034)	0.128	(0.054)**	0.036	(0.044)
Bottled wine	0.050	(0.014)***	0.140	(0.015)***	-0.089	(0.029)***	-0.110	(0.021)***
Fortified wine	-0.156	(0.019)***	0.002	(0.020)	-0.030	(0.042)	-0.052	(0.031)*
Canned premixed spirits	0.335	(0.018)***	0.151	(0.018)***	0.178	(0.029)***	0.241	(0.023)***
Bottled spirits	0.253	(0.014)***	0.021	(0.014)	0.104	(0.029)***	0.016	(0.021)
Other alcohol	0.007	(0.025)	0.037	(0.026)	0.159	(0.041)***	0.127	(0.034)***
Aged 12 to 19	0.862	(0.048)***	-0.341	(0.052)***	1.657	(0.112)***	0.759	(0.065)***
Aged 20 to 29	1.133	(0.035)***	0.156	(0.034)***	1.264	(0.105)***	0.595	(0.054)***
Aged 30 to 39	0.855	(0.032)***	0.176	(0.031)***	0.818	(0.105)***	0.347	(0.053)***
Aged 40 to 49	0.657	(0.030)***	0.224	(0.030)***	0.539	(0.106)***	0.269	(0.052)***
Aged 50 to 59	0.350	(0.027)***	0.158	(0.028)***	0.377	(0.108)***	0.155	(0.050)***
Log of real	-1.319	(0.169)***	0.014	(0.191)	-0.693	(0.319)**	-0.609	(0.244)**
(Log of real	0.074	(0.008)***	0.004	(0.009)	0.033	(0.016)**	0.029	(0.012)**
With dependent	-0.134	(0.015)***	-0.042	(0.016)**	-0.147	(0.031)***	-0.015	(0.023)
Non dependent	-0.116	(0.022)***	-0.091	(0.023)***	-0.019	(0.043)	0.072	(0.032)**
Year 2001	-0.140	(0.053)***	0.204	(0.019)***	-0.027	(0.038)	0.134	(0.028)***
Year 2004	-0.001	(0.039)	0.175	(0.019)***	0.051	(0.037)	0.132	(0.027)***
Year 2007	-0.028	(0.028)	0.134	(0.020)***	0.082	(0.039)**	0.124	(0.029)***
Male	-0.033	(0.015)**	0.342	(0.016)***	0.323	(0.031)***	0.148	(0.023)***
Married	-0.216	(0.016)***	-0.189	(0.016)***	-0.265	(0.031)***	-0.173	(0.023)***
Work	0.162	(0.018)***	0.095	(0.021)***	-0.066	(0.049)	-0.035	(0.032)
Unemployed	0.153	(0.042)***	0.122	(0.045)***	0.062	(0.076)	0.190	(0.056)***
Studying	-0.021	(0.053)	-0.017	(0.058)	0.059	(0.076)	-0.147	(0.066)**
Tertiary degree	-0.171	(0.020)***	0.172	(0.022)***	-0.034	(0.045)	-0.102	(0.032)***
Diploma	-0.006	(0.017)	0.086	(0.019)***	-0.052	(0.037)	0.014	(0.026)
Year 12	0.040	(0.022)*	0.096	(0.024)***	-0.009	(0.041)	0.009	(0.032)
Aboriginal or	0.183	(0.055)***	0.077	(0.057)	0.109	(0.085)	0.287	(0.063)***
Living in capital	-0.170	(0.014)***	-0.010	(0.015)	0.011	(0.028)	0.043	(0.021)**
Price of alcohol	-0.771	(0.170)***						
Constant	8.721	(1.259)***	-2.607	(0.981)***	-0.056	(1.628)	0.422	(1.244)
α_0	0.014	(0.009)*						
α_1	0.040	(0.007)***						

Note: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table A7: Results of Structure Model: Coefficients

	Binge		Driving		Disturbance		Abuse	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Binge			0.646	(0.041)***	1.016	(0.098)***	0.955	(0.067)***
Regular strength beer	0.666	(0.019)***	0.183	(0.018)***	0.292	(0.032)***	0.257	(0.024)***
Mid strength beer	0.219	(0.019)***	0.075	(0.018)***	-0.010	(0.036)	0.014	(0.026)
Low strength beer	-0.105	(0.017)***	-0.062	(0.018)***	-0.181	(0.042)***	-0.153	(0.028)***
Home brewed beer	0.338	(0.038)***	0.008	(0.034)	0.131	(0.055)**	0.039	(0.044)
Cask wine	0.179	(0.017)***	0.088	(0.018)***	0.182	(0.037)***	0.154	(0.027)***
Bottled wine	0.042	(0.014)***	0.136	(0.015)***	-0.105	(0.030)***	-0.120	(0.022)***
Fortified wine	-0.165	(0.019)***	0.000	(0.020)	-0.038	(0.043)	-0.057	(0.031)*
Canned premixed spirits	0.328	(0.019)***	0.165	(0.019)***	0.174	(0.031)***	0.245	(0.024)***
Bottled spirits	0.250	(0.014)***	0.026	(0.015)*	0.102	(0.029)***	0.017	(0.021)
Bottled premixed spirits	0.016	(0.019)	-0.069	(0.021)***	0.003	(0.033)	-0.024	(0.026)
Other alcohol drinks	-0.005	(0.026)	0.042	(0.026)	0.147	(0.042)***	0.122	(0.034)***
Aged 12 to 19	0.860	(0.048)***	-0.319	(0.052)***	1.661	(0.113)***	0.765	(0.065)***
Aged 20 to 29	1.143	(0.036)***	0.175	(0.035)***	1.279	(0.106)***	0.607	(0.055)***
Aged 30 to 39	0.866	(0.032)***	0.187	(0.032)***	0.832	(0.105)***	0.356	(0.053)***
Aged 40 to 49	0.663	(0.031)***	0.228	(0.030)***	0.547	(0.107)***	0.272	(0.052)***
Aged 50 to 59	0.353	(0.027)***	0.159	(0.028)***	0.382	(0.109)***	0.156	(0.050)***
Log of real income	-1.360	(0.169)***	-0.008	(0.191)	-0.731	(0.319)**	-0.645	(0.244)***
(Log of real income)^2	0.076	(0.008)***	0.005	(0.009)	0.035	(0.016)**	0.031	(0.012)**
With dependent	-0.132	(0.015)***	-0.040	(0.016)**	-0.144	(0.031)***	-0.012	(0.023)
Non dependent	-0.114	(0.022)***	-0.090	(0.023)***	-0.018	(0.043)	0.074	(0.032)**
Year 2001	-0.153	(0.053)***	0.199	(0.019)***	-0.028	(0.038)	0.131	(0.028)***
Year 2004	-0.011	(0.039)	0.172	(0.019)***	0.050	(0.037)	0.129	(0.027)***
Year 2007	-0.034	(0.028)	0.131	(0.020)***	0.080	(0.039)**	0.121	(0.029)***
Male	-0.008	(0.015)	0.344	(0.016)***	0.337	(0.031)***	0.161	(0.023)***
Married	-0.218	(0.016)***	-0.191	(0.016)***	-0.262	(0.031)***	-0.173	(0.023)***
Work	0.170	(0.018)***	0.100	(0.021)***	-0.053	(0.049)	-0.024	(0.032)
Unemployed	0.153	(0.042)***	0.121	(0.045)***	0.058	(0.076)	0.188	(0.056)***
Studying	-0.014	(0.053)	-0.015	(0.058)	0.065	(0.076)	-0.144	(0.066)**
Tertiary degree	-0.169	(0.020)***	0.172	(0.022)***	-0.028	(0.045)	-0.098	(0.033)***
Diploma	-0.008	(0.017)	0.086	(0.019)***	-0.051	(0.037)	0.014	(0.026)
Year 12	0.036	(0.022)	0.095	(0.024)***	-0.015	(0.041)	0.005	(0.032)
Aboriginal or Torres	0.187	(0.055)***	0.079	(0.057)	0.104	(0.086)	0.289	(0.064)***
Living in capital	-0.171	(0.014)***	-0.011	(0.015)	0.010	(0.028)	0.042	(0.021)**
Price of alcohol	-0.775	(0.170)***						
Constant	8.890	(1.259)***	-2.520	(0.981)**	0.090	(1.630)	0.568	(1.244)
α_0	0.015	(0.009)*						
α_1	0.039	(0.007)***						

Note: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table A8: Estimated Correlation Coefficients for the Structure Model

	Driving	Disturbance	Abuse	Binge
Driving	1	0.263***	0.269***	0.005
		(0.015)	(0.011)	(0.022)
Disturbance		1	0.491***	0.010
			(0.011)	(0.037)
Abuse			1	0.040
				(0.031)
Binge				1

Notes: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table 1: Sample Participation in Antisocial Behaviours for the Drinkers (per cent)[a]

	1993	1995	1998	2001	2004	2007	2010
Driving	14.79	14.71	23.98	16.6	16.33	14.73	13.36
Disturbance	8.81	6.91	8.04	3.82	3.87	3.27	2.90
Abuse	12.66	9.86	14.04	7.08	7.07	5.80	4.82

Notes: Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. [a] The remarkable increase in participation rates in 1998 results from the sample design in this particular wave. According to the AIHW, in order to obtain more reliable estimates, in particular for illicit drugs, 40% of the sample in this survey year was targeted towards young people aged 14-39 years old who resided in capital cities (AIHW 2011). From 2001 onwards, such a sampling method was no longer required because the overall sample size was increased to more than double the size of the 1998 wave. Data source: NDSHS (1993-2010).

Table 2: Participation Rates by types of Alcoholic Drinks for the Drinkers (Per cent)

	1993	1995	1998	2001	2004	2007	2010
Abstainer	15.97	20.11	14.23	19.36	19.42	21.23	22.79
Drinker	84.03	79.89	85.77	80.64	80.58	78.77	77.21
Beer							
Regular strength beer	25.07	35.36	37.61	31.00	29.19	29.56	34.24
Mid strength beer	N/A	N/A	13.71	12.58	13.23	13.81	17.14
Low strength beer	16.50	23.35	17.36	20.54	19.20	16.53	16.58
Home brewed beer	N/A	N/A	N/A	4.27	3.26	2.73	3.32
Wine							
Cask wine	N/A	N/A	21.26	21.24	18.34	15.30	12.95
Bottled wine	N/A	N/A	49.51	51.38	55.51	57.76	59.75
Fortified wine	N/A	N/A	N/A	13.83	13.71	12.71	13.05
Spirits							
Canned premixed spirits	N/A	N/A	N/A	17.02	21.06	19.98	19.69
Bottled premixed spirits	N/A	N/A	N/A	16.44	19.02	16.34	17.68
Bottled spirits	N/A	N/A	44.91	42.78	40.96	39.21	45.12
Other	3.07	5.43	26.32	6.60	5.74	5.73	9.63

Notes: Figures pertain to percentages out of the whole sample of a specific year. Note that proportions do not add up to 100% for a given year because individuals might choose multiple drinks. *Data source*: NDSHS (1993-2010).

Table 3: Participation Rates by Age and Gender for the Drinkers (Per cent)

Age	Gender	Beer				Wine			Spirits			Other
		Regular	Middle	Low	Home brewed	Cask	Bottled	Fortified	Canned premixed	Bottled	Bottled premixed	
12-19	Male	57.3	22.8	15.0	6.8	10.3	17.3	6.1	56.7	54.4	35.0	12.5
	Female	18.9	9.8	6.9	2.9	14.5	25.2	6.4	60.8	65.3	71.2	13.3
20-29	Male	69.1	21.6	14.2	7.4	8.0	37.6	10.3	41.2	56.4	23.8	9.7
	Female	28.8	10.1	8.2	2.4	12.6	60.0	8.1	36.2	61.4	47.6	11.9
30-39	Male	62.1	25.5	21.8	6.3	8.9	48.3	14.1	26.3	43.4	11.0	7.0
	Female	21.5	9.3	10.8	1.8	14.9	67.7	10.4	22.0	47.8	27.5	8.6
40-49	Male	50.7	24.2	26.8	4.8	13.5	51.2	14.2	16.7	36.3	5.9	4.7
	Female	13.7	6.4	11.9	1.2	18.4	69.6	12.1	14.2	41.7	17.5	6.8
50-59	Male	42.0	22.6	31.5	4.6	16.7	52.6	16.2	8.9	32.3	2.8	4.3
	Female	8.6	4.8	12.2	1.3	22.3	72.5	15.0	7.2	36.4	10.0	5.8
60+	Male	29.8	19.2	37.1	4.8	23.9	48.7	17.7	3.2	29.7	0.9	3.2
	Female	5.8	4.3	13.8	1.0	27.6	66.1	18.8	2.3	29.3	3.2	4.4

Data source: NDSHS (1993-2010)

Table 4: Results of structure model: marginal effects-direct and indirect effects

	P(Binge=1)				P(Driving=1)			P(Disturbance=1)			P(Abuse=1)		
	M.E.	D.E.	I.E.	T.E	D.E.	I.E.	T.E	D.E.	I.E.	T.E	D.E.	I.E.	T.E
Binge				0.140			0.019			0.068			
				(0.009)***			(0.002)***			(0.006)***			
Regular strength beer	0.260	0.038	0.036	0.074	0.007	0.005	0.011	0.019	0.018	0.037			
	(0.007)***	(0.004)***	(0.003)***	(0.003)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.002)***	(0.002)***			
Mid strength beer	0.085	0.015	0.012	0.027	0.000	0.002	0.001	0.001	0.006	0.007			
	(0.007)***	(0.004)***	(0.002)***	(0.004)***	(0.001)	(0.000)***	(0.001)	(0.002)	(0.001)***	(0.002)***			
Low strength beer	-0.041	-0.013	-0.006	-0.018	-0.004	-0.001	-0.005	-0.012	-0.003	-0.014			
	(0.007)***	(0.004)***	(0.001)***	(0.004)***	(0.001)***	(0.000)***	(0.001)***	(0.002)***	(0.001)***	(0.002)***			
Home brewed beer	0.132	0.002	0.018	0.020	0.003	0.002	0.005	0.003	0.009	0.012			
	(0.015)***	(0.008)	(0.005)***	(0.007)***	(0.002)	(0.004)	(0.002)**	(0.004)	(0.002)***	(0.004)***			
Cask wine	0.070	0.018	0.010	0.028	0.004	0.001	0.005	0.012	0.005	0.016			
	(0.007)***	(0.004)***	(0.001)***	(0.004)***	(0.001)***	(0.000)***	(0.001)***	(0.002)***	(0.001)***	(0.002)***			
Bottled wine	0.016	0.028	0.002	0.030	-0.002	0.000	-0.002	-0.009	0.001	-0.008			
	(0.005)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.000)**	(0.001)***	(0.002)***	(0.000)***	(0.002)***			
Fortified wine	-0.064	0.000	-0.009	-0.009	-0.001	-0.001	-0.002	-0.004	-0.004	-0.009			
	(0.007)***	(0.004)	(0.001)***	(0.004)**	(0.001)	(0.001)*	(0.001)**	(0.002)*	(0.001)***	(0.002)***			
Canned premixed spirits	0.128	0.034	0.018	0.052	0.004	0.002	0.006	0.018	0.009	0.027			
	(0.007)***	(0.004)***	(0.002)***	(0.004)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.001)***	(0.002)***			
Bottled spirits	0.098	0.005	0.014	0.019	0.002	0.002	0.004	0.001	0.007	0.008			
	(0.005)***	(0.003)*	(0.001)***	(0.003)***	(0.001)***	(0.000)***	(0.001)***	(0.002)	(0.001)***	(0.002)***			
Bottled premixed spirits	0.006	-0.014	0.001	-0.013	0.000	0.000	0.000	-0.002	0.000	-0.001			
	(0.007)	(0.004)***	(0.001)	(0.004)***	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)			
Other alcohol drinks	-0.002	0.009	0.000	0.008	0.003	0.000	0.003	0.009	0.000	0.009			
	(0.010)	(0.006)	(0.002)	(0.006)	(0.001)***	(0.001)	(0.002)*	(0.003)***	(0.001)	(0.003)***			
Aged 12 to 19	0.335	-0.066	0.047	-0.019	0.037	0.006	0.043	0.058	0.023	0.081			
	(0.018)***	(0.011)***	(0.004)***	(0.011)*	(0.001)***	(0.001)***	(0.001)***	(0.005)***	(0.002)***	(0.005)***			
Aged 20 to 29	0.445	0.036	0.062	0.098	0.029	0.008	0.037	0.046	0.031	0.076			
	(0.013)***	(0.007)***	(0.004)***	(0.006)***	(0.001)***	(0.001)***	(0.001)***	(0.004)***	(0.003)***	(0.004)***			
Aged 30 to 39	0.337	0.038	0.047	0.086	0.019	0.006	0.025	0.027	0.023	0.050			
	(0.012)***	(0.006)***	(0.004)***	(0.006)***	(0.002)***	(0.001)***	(0.002)***	(0.004)***	(0.002)***	(0.004)***			
Aged 40 to 49	0.258	0.047	0.036	0.083	0.012	0.005	0.017	0.020	0.018	0.038			
	(0.011)***	(0.006)***	(0.003)***	(0.006)***	(0.002)***	(0.001)***	(0.002)***	(0.004)***	(0.002)***	(0.004)***			
Aged 50 to 59	0.138	0.033	0.019	0.052	0.009	0.003	0.011	0.012	0.009	0.021			
	(0.010)**	(0.006)***	(0.002)***	(0.006)***	(0.002)***	(0.000)***	(0.002)***	(0.004)***	(0.001)***	(0.004)***			
Log of real income	-0.530	-0.002	-0.074	-0.076	-0.016	-0.010	-0.026	-0.049	-0.036	-0.085			
	(0.065)***	(0.039)	(0.010)***	(0.039)*	(0.007)**	(0.002)***	(0.007)***	(0.018)***	(0.005)***	(0.018)***			

Notes: M.E.: marginal effect; D.E.: direct effect; I.E.: indirect effect; T.E.: total effect. Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table 5: Results of structure model: marginal effects-direct and indirect effects (cont.)

	P(Binge=1)		P(Driving=1)		P(Disturbance=1)			P(Abuse=1)		
	M.E.	D.E.	I.E.	T.E	D.E.	I.E.	T.E	D.E.	I.E.	T.E
(Log of real income)^2	0.030	0.001	0.004	0.005	0.001	0.001	0.001	0.002	0.002	0.004
	(0.003)***	(0.002)	(0.001)***	(0.002)***	(0.000)**	(0.000)***	(0.000)***	(0.001)***	(0.000)***	(0.001)***
With dependent children	-0.051	-0.008	-0.007	-0.015	-0.003	-0.001	-0.004	-0.001	-0.004	-0.004
	(0.006)***	(0.003)**	(0.001)***	(0.003)***	(0.001)***	(0.000)***	(0.001)***	(0.002)	(0.001)***	(0.002)**
Non dependent children	-0.045	-0.018	-0.006	-0.025	0.000	-0.001	-0.001	0.006	-0.003	0.003
	(0.008)***	(0.005)***	(0.001)***	(0.005)***	(0.002)	(0.001)	(0.001)	(0.002)**	(0.001)***	(0.003)
Year 2001	-0.060	0.041	-0.008	0.032	-0.001	-0.001	-0.002	0.010	-0.004	0.006
	(0.020)***	(0.004)***	(0.003)***	(0.005)***	(0.001)	(0.000)***	(0.001)*	(0.002)***	(0.001)***	(0.003)**
Year 2004	-0.004	0.035	-0.001	0.035	0.001	0.000	0.001	0.010	0.000	0.009
	(0.015)	(0.004)***	(0.002)	(0.004)***	(0.001)	(0.000)	(0.001)	(0.002)***	(0.001)	(0.002)***
Year 2007	-0.013	0.027	-0.002	0.025	0.002	0.000	0.002	0.009	-0.001	0.008
	(0.011)	(0.004)***	(0.002)	(0.004)***	(0.001)	(0.000)	(0.001)*	(0.002)***	(0.001)	(0.002)***
Male	-0.003	0.071	0.000	0.070	0.008	0.000	0.007	0.012	0.000	0.012
	(0.006)	(0.003)***	(0.001)	(0.003)***	(0.001)***	(0.000)	(0.001)***	(0.002)***	(0.000)	(0.002)***
Married	-0.085	-0.039	-0.012	-0.051	-0.006	-0.002	-0.007	-0.013	-0.006	-0.019
	(0.006)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.000)***	(0.001)***	(0.002)***	(0.001)***	(0.002)***
Work	0.066	0.021	0.009	0.030	-0.001	0.001	0.000	-0.002	0.005	0.003
	(0.007)***	(0.004)***	(0.001)***	(0.004)***	(0.001)	(0.000)***	(0.001)	(0.002)	(0.001)***	(0.002)
Unemployed	0.060	0.025	0.008	0.033	0.001	0.001	0.002	0.014	0.004	0.018
	(0.017)***	(0.010)**	(0.005)	(0.011)***	(0.002)	(0.003)	(0.003)	(0.004)***	(0.002)**	(0.005)***
Studying	-0.005	-0.003	-0.001	-0.004	0.001	0.000	0.001	-0.011	0.000	-0.011
	(0.021)	(0.013)	(0.006)	(0.013)	(0.004)	(0.002)	(0.002)	(0.005)**	(0.002)	(0.005)**
Tertiary degree	-0.066	0.035	-0.009	0.026	-0.001	-0.001	-0.002	-0.007	-0.005	-0.012
	(0.008)***	(0.004)***	(0.001)***	(0.005)***	(0.001)	(0.000)***	(0.001)	(0.003)***	(0.001)***	(0.003)***
Diploma	-0.003	0.018	0.000	0.017	-0.001	0.000	-0.001	0.001	0.000	0.001
	(0.007)	(0.004)***	(0.001)	(0.004)***	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)	(0.002)
Year 12	0.014	0.019	0.002	0.021	0.000	0.000	0.000	0.000	0.001	0.001
	(0.008)	(0.005)***	(0.002)	(0.005)***	(0.001)	(0.000)	(0.001)	(0.003)	(0.001)	(0.003)
Aboriginal or Torres Strait origin	0.073	0.016	0.010	0.027	0.002	0.001	0.004	0.022	0.005	0.027
	(0.022)***	(0.013)	(0.007)	(0.017)	(0.004)	(0.003)	(0.005)	(0.006)***	(0.004)	(0.006)***
Living in capital	-0.067	-0.002	-0.009	-0.012	0.000	-0.001	-0.001	0.003	-0.005	-0.001
	(0.005)***	(0.003)	(0.001)***	(0.003)***	(0.001)	(0.000)***	(0.001)	(0.002)**	(0.001)***	(0.002)
Price of alcohol drinks	-0.302		-0.042	-0.042		-0.006	-0.006		-0.021	-0.021
	(0.066)***		(0.010)***	(0.010)***		(0.001)***	(0.001)***		(0.005)***	(0.005)***

Notes: M.E.: marginal effect; D.E.: direct effect; I.E.: indirect effect; T.E.: total effect; Driving: drove a motor vehicle; Disturbance: created a public disturbance/nuisance, caused damage to property, or stole money, goods or property; Abuse: verbally or physically abused someone. Standard errors are given in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Figure 1: Income impact on Binge

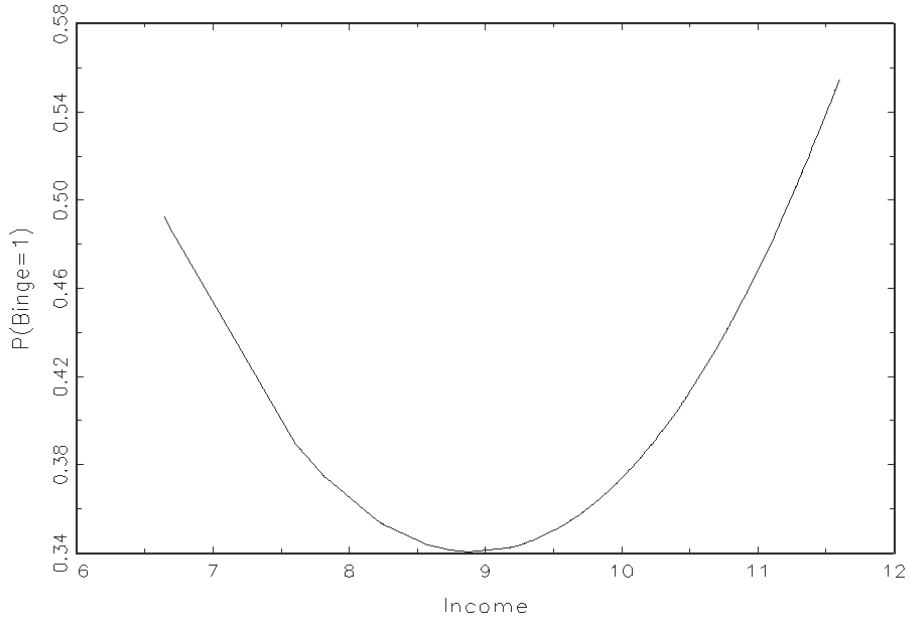
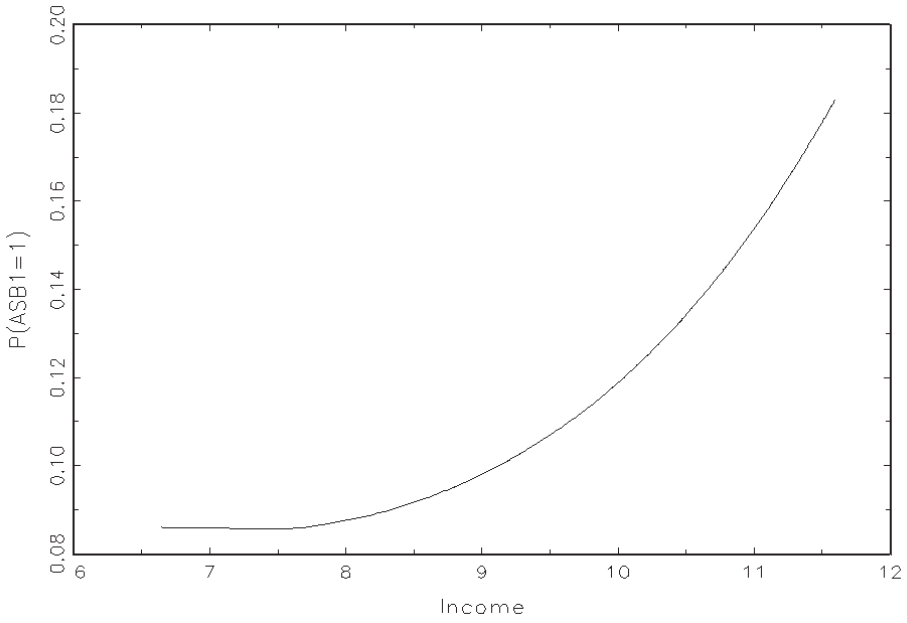
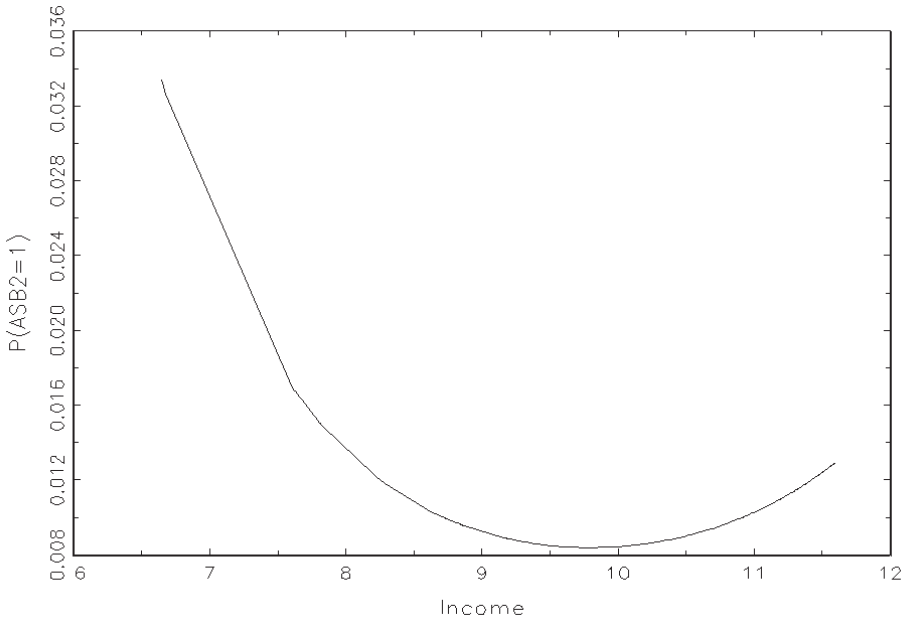


Figure 2: Income impact on Driving



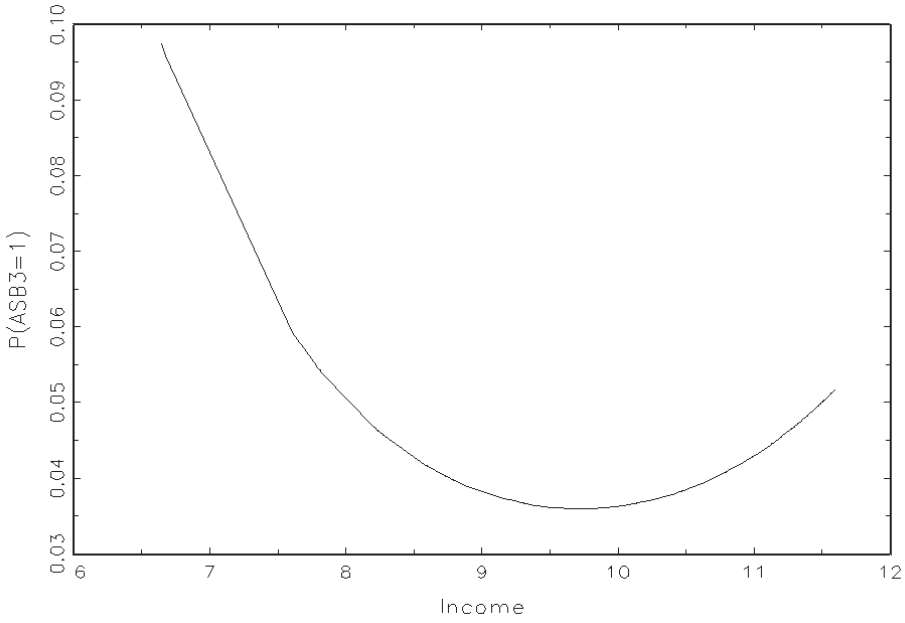
Note: Driving: drove a motor vehicle.

Figure 3: Income impact on Disturbance



Note: Disturbance: created public disturbance/nuisance, caused damage to property, or stole money, goods or property.

Figure 4 Income impact on Abuse



Note: Abuse: verbally or physically abused someone.

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