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ABSTRACT

The Effects of Smoking Ban Regulations on Individual Smoking Rates*

This paper describes the dynamics of smoking behaviour in Australia and investigates what role smoking ban regulation has, if any, on individual level smoking patterns. The main argument to motivate the introduction of tougher smoking bans is the effect of second hand smoke on non-smokers. From a public policy perspective it is important to know if these policies also affect if a person smokes, or if they only influence when and where people smoke. We use data that tracks individual smoking behaviour over the period 2001 to 2003 during which separate smoking ban initiatives in Queensland, Victoria and the Northern Territory came into effect. We exploit this variation over time and across states as a natural experiment to assess the impact of tougher smoking regulations. Our findings indicate that the introduction of smoking ban regulations on individuals' smoking behaviour has the expected sign but is not significant for most types of individuals. Interestingly, we do find a significant 'rebellion' effect amongst 18 to 24 year old smokers, with the introduction of smoking bans found to increase the likelihood that they continue to smoke.

JEL Classification: C33, C35, I12, I18

Keywords: smoking, evaluation, transitions

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1. Introduction

Governments around the world seek to reduce the adverse health effects of smoking, both to smokers and non-smokers. Policies have focused on discouraging smoking through tobacco taxes, restrictions on tobacco advertising, providing services to assist smokers to quit and taking various steps to inform the community of the health risks associated with smoking. Many governments have also placed restrictions on the locations in which people can smoke, including government buildings, office buildings, shopping centres, restaurants and bars. While restrictions on where people can smoke have primarily been motivated by reducing harm caused by smoking to non-smokers, they have also been positioned, at least in Australia, as seeking to reduce smoking rates (see for example, Queensland Health, 2000).

There has been considerable research, both internationally and in Australia, into the determinants of smoking behaviour and, more particularly, the effects of government anti-tobacco policies. One consequence of this research is that the socio-demographic and other personal characteristics associated with smoking are reasonably well understood. However, despite this research, the determinants of both starting and quitting smoking are not so well understood, and there is also considerable debate about the relative merits of different types of anti-tobacco policies.

In this paper we seek to contribute to the literature by examining the determinants of starting and quitting smoking using a nationally representative longitudinal sample of Australians interviewed annually over the period 2001 to 2003. A primary focus of our investigation is on identifying the impacts on smoking behaviour of regulations banning smoking in public venues. There is scant research internationally on the effects on smoking behaviour of such regulations. Studies of restrictions on smoking have largely focused on workplace bans which, while likely to have parallels with a study of bans on smoking in other locations, are of a quite different nature to those being considered in this study. On the one hand, a smoker will generally have more discretion over time spent in entertainment venues than over time spent in the workplace. On the other hand, smokers who do not work, or do not work in a workplace where smoking can be restricted, may be unaffected by workplace bans but affected by bans on smoking in entertainment venues. While the implementation of smoking bans does not turn on whether smoking rates are affected, given that the primary objective is to protect non-

smokers from exposure to ‘second hand’ smoke, it is nonetheless an important question whether and to what extent these bans impact on smoking levels.¹

A key advantage of the data source we use is that it allows us to model transitions in individuals’ smoking status of all individuals in the Australian community. While a number of other studies have also modelled smoking transitions, a pitfall of many studies of the effects of workplace bans and other restrictions on smoking is that they examine samples drawn from subsets of the community. For example, studies often look at the effects of workplace bans on smoking behaviour at establishments affected by the ban, or by workers employed at the establishment. The essence of the problem is that the people who elect to remain working – or take up work – at an establishment may be affected by a workplace ban. Some smokers may choose to quit the firm rather than the habit, while new recruits may be disproportionately non-smokers because of the ban. Establishment based surveys will therefore in all likelihood overstate the effects of workplace bans.

To investigate the effects of smoking bans, we exploit a natural experiment provided by the variations across the states and territories of Australia in the timing and nature of regulations introduced over the period spanned by the data. Most of these newly introduced regulations involve restricting smoking in hospitality industry venues such as restaurants, bars and gambling venues. We interpret the differences across states and territories as providing a natural experiment because we are not aware of any other state-specific changes in the period we examine that could have impacted on smoking behaviour. Thus, the state-specific bans introduced over the period provide a valuable opportunity to produce credible estimates of the effects of smoking bans.

The modelling strategy we employ to investigate smoking transitions is borrowed from Jenkins and Cappellari (2004), who examine poverty status and transitions. This approach explicitly models endogenous selection into smoking status in the base year and endogenous attrition from the sample, both of which we would argue are important in the context of understanding smoking behaviour. While our main focus is on transitions in smoking status, and in particular, the effects of smoking bans on these transitions, a valuable by-product of

¹ We should also acknowledge that smoking bans may potentially impact on a range of other behaviours, including the extent and nature of social activity, which may in turn have implications for economic activity in some industries.

controlling for initial conditions and attrition is that the estimation results we obtain also provide estimates of the determinants of initial status and attrition status.

The contribution of this study to the existing literature stems from a combination of four (interconnected) factors: our focus on smoking bans, the natural experiment we are able to exploit, the nature of the data used, and the modelling strategy employed, which controls for initial conditions and attrition. Together, these factors mean this study sheds valuable new light on the determinants of starting and quitting behaviour, and in particular, the effects of smoking regulations.

The remainder of the paper is organised as follows. Section 2 provides cursory contextual information on smoking in Australia and relevant previous research on smoking behaviour. Section 3 briefly describes the current regulatory environment in Australia and the changes to tobacco regulations that have occurred in the period spanned by our data source – the HILDA Survey. Section 4 describes the methodology used to model individuals' smoking dynamics and discusses the issues of non-response and initial conditions. In Section 5 we present an overview of the data, followed by a discussion of the estimation results in Section 6. Section 7 concludes.

2. Background

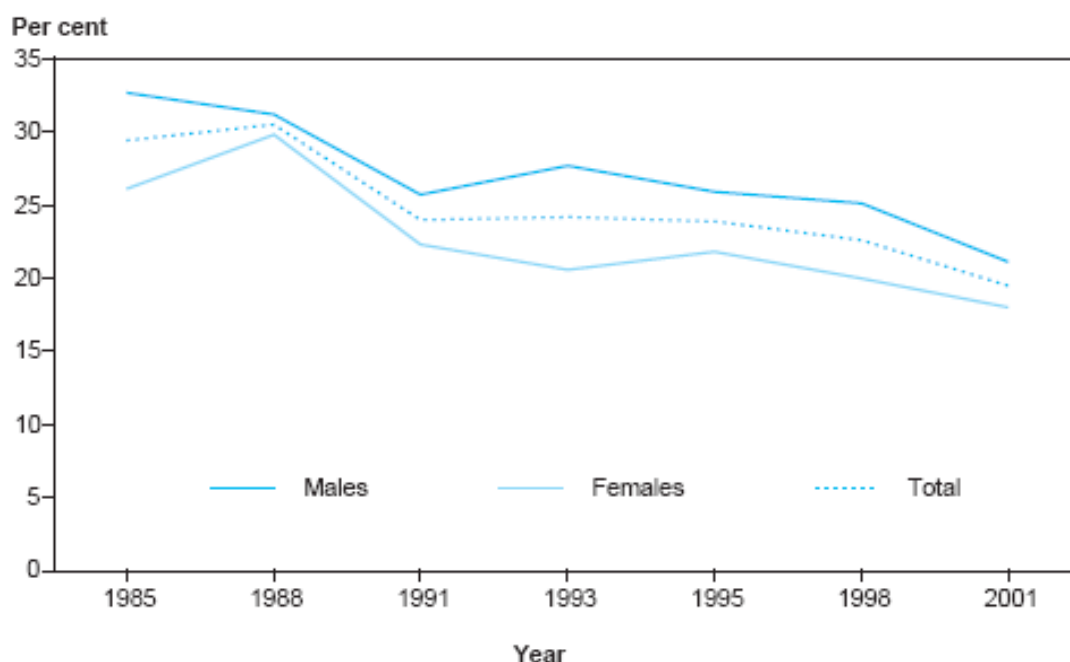
The proportion of individuals who smoke in Australia is low by both international and historical standards (see Table 1 and Figure 1), but is nonetheless still high in absolute terms. Nearly 20 per cent of adults are regular smokers, with females only slightly behind males in their rate of smoking. In light of the growing body of evidence on the adverse health consequences of smoking, the implication is that smoking remains one of the most important issues for public health policy in Australia. Table 2 presents smoking rates (prevalence) by smoking frequency in Australia over the period 1991 to 2004, derived from the National Campaign Against Drug Abuse Household Surveys in 1991 and 1993 and the National Drug Strategy Household (NDSH) Surveys in 1995, 1998, 2001 and 2004. Comparable estimates derived from the first three waves of the HILDA Survey are presented in the same table and appear broadly consistent with the NDSH Survey estimates.

Table 1: International comparisons of adult smoking rates (%)

	Total	Male	Female	Annual per person cigarette consumption
Australia	19.5	21.1	18.0	1907
New Zealand	25.0	25.0	25.0	1213
France	34.5	38.6	30.3	2058
UK	26.5	27.0	26.0	1748
USA	23.6	25.7	21.5	2255

Source: Table A in *The Demographics of Tobacco* (WHO 2002)

Figure 1: Daily smokers: proportion of people aged 14 years and over, 1985 to 2001



Source: Australian Institute of Health and Welfare (2005), originally sourced from National Campaign Against Drug Abuse Social Issues surveys 1985, 1988; National Campaign Against Drug Abuse Household surveys 1991, 1993; and National Drug Strategy Household surveys 1995, 1998, 2001.

Table 2: Smoking status of the Australian population aged 14 (15) years and over (%)

Smoking Status	1991 ^(a)	1993 ^(a)	1995 ^(a)	1998 ^(a)	2001 ^(a)	2001 ^(b)	2002 ^(b)	2003 ^(b)	2004 ^(a)
Daily	24.3	25	23.8	21.8	19.5	22.8*	18.7	18.4	17.4
Weekly	2.8	2.3	1.6	1.8	1.6	n.a.	2.4	2.2	1.6
Less than weekly	2.4	1.8	1.8	1.3	2	n.a.	1.9	1.8	1.6
Ex-smoker	21.4	21.7	20.2	25.9	26.2	26.2	27.1	27.0	26.4
Never smoked	49	49.1	52.6	49.2	50.6	51.0	50.0	50.6	52.9

Notes: ^(a) Sourced from Australian Institute of Health and Welfare 2005 (Table 3.1); ^(b) Authors' own estimates for the population aged 15 years and over using Waves 1 through 3 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey; * proportion identifying as smokers (smoking status was not differentiated by smoking frequency in Wave 1 of the survey).

There is a large international literature on the determinants of smoking behaviour, including the roles played by socio-demographic characteristics and government tobacco policies

(taxation, promotion of health risks of smoking and restrictions on advertising, sale and consumption of tobacco). Research on the impacts of bans on smoking in public places is limited, but a closely related literature focuses on workplace bans. Chapman et al (1999) report on the findings of nineteen studies of the effects of workplace bans in Australia and the US, all but one of which find they reduced smoking rates. Fichtenberg, C. and Glantz (2002) similarly undertake a meta analysis of 24 studies in Australia, the US, Canada and Germany (16 of which were covered by Chapman et al, 1999), estimating that workplace bans reduce smoking prevalence by 3.8 per cent and smoking consumption of continuing smokers by 3.1 cigarettes per day. Only three of the 27 studies examined by Chapman et al (1999) and Fichtenberg and Glantz (2002) use broad-based community-wide data, with most of the studies using workplace-level data on smoking behaviour.

In Australia, there have been relatively few broad-based studies of the determinants of smoking behaviour, and no studies of the effects of smoking bans using community-wide individual-level data that we are aware of. Bardsley and Olekalns (1999) use annual (macro) time series data to investigate the factors impacting on cigarette consumption over the period 1962-63 to 1995-96. Their analysis suggests that tobacco taxes, incomes and demographic effects were the most important factors explaining variation over time in aggregate tobacco consumption, while workplace smoking bans and health warnings on cigarette packs had a relatively minor impact. They find no evidence that advertising bans and government anti-smoking advertising affected consumption.

Kidd and Hopkins (2004) is the only study of smoking behaviour that we are aware of that draw on nationally representative *individual-level* data. Kidd and Hopkins use data from the 1990 National Health Survey and the 1998 National Drug Strategy Household Survey to examine starting and quitting behaviour. Although the two data sources used are cross-sectional, the retrospective information gathered on smoking behaviour allows them to employ duration analysis methods, modelling both the hazard of starting and the hazard of quitting smoking as a function of age. They find price plays a significant role in the decision to start smoking, but not in the decision to quit smoking.

3. Current tobacco regulation in Australia

3.1. The roles of the Commonwealth, state and territory governments

Tobacco production, sale and consumption in Australia are regulated by a combination of federal and state and territory laws.² Federal laws prohibit tobacco advertising, mandate health warnings on packaging and restrict smoking in Commonwealth-controlled domains, such as Commonwealth government buildings and passenger aircraft. The federal government also levies and collects taxes and customs duties on tobacco products. State and territory governments have advertising and promotional restrictions that complement federal regulations (covering aspects outside federal jurisdiction) and have furthermore enacted laws regulating smoking in workplaces and other public venues, prohibiting sale of tobacco to children and restricting modes of sale, point-of-sale advertising and promotional activity by sellers. Commonwealth, state and territory governments also all engage in public information campaigns on the health risks of smoking.

While there are many commonalities in state regulations, there are some important differences in existing regulations and – more importantly for our purposes – important differences in the timing of the introduction of regulations, most notably with respect to smoking in public venues.

3.2. The initiatives introduced coinciding with the availability of data

The important policy changes for our study are additional regulations implemented in Queensland and Victoria in 2002 and in the Northern Territory in 2003, which all fall within the period spanned by the first three waves of the HILDA Survey. We also consider the potential for the introduction of a voluntary agreement between businesses in the hospitality industry in New South Wales in 2003 to impact on smoking behaviour. Table 3 summarises the state and territory regulatory situation immediately prior to commencement of the HILDA Survey, while Table 4 presents a timeline of the relevant state and territory regulatory changes.

The regulatory environment prior to the first wave of the HILDA Survey was in general loosest in the Northern Territory, Queensland, and South Australia. Among these three

² Full details of Australian anti-tobacco regulations, including those introduced after the period spanned by the data we use, are provided in an appendix.

jurisdictions, the Northern Territory was the least regulated, followed by Queensland. The remaining states and territories had comparable levels of regulation, the most notable exception being that Victoria did not completely prohibit smoking in enclosed workplaces other than bars and nightclubs.

Table 4 shows that regulatory changes were implemented in Queensland and Victoria between the first two waves of the HILDA Survey, and regulatory changes were implemented in the Northern Territory between the second and third waves. In addition, a voluntary agreement was introduced in the hospitality industry in New South Wales between the second and third waves. The changes in Queensland and the Northern Territory are essentially of a 'catch-up' nature with respect to the rest of Australia, restricting smoking in enclosed public places and tightening controls at the point of sale. The changes in Victoria are probably most appropriately characterised as a move to tighter controls than in the rest of Australia, extending bans to gaming venues. However, whether this constitutes a tightening of regulations relative to other state and territories is in fact somewhat ambiguous, since some states impose tighter restrictions on the number of gaming venues permitted to operate.

The timing and different geographical areas in which these initiatives came into effect provide exogenous variation that is used as an instrument to estimate the effects of increased smoking regulation on individual smoking behaviour.

Table 3: State and Territory Laws and Regulations: The regulatory situation immediately prior to Wave 1 of the HILDA survey (October 2001)

	ACT	NSW	NT	Qld	SA	Tas	Vic	WA
Restrictions on vendors of tobacco products:								
Published and broadcast advertising	XX	XX	√	XX	XX	XX	XX	XX
Point of sale advertising (excluding limited price and product information)	XX	XX	√	X	√	XX	XX	XX
Sponsorship	XX	XX	XX	XX	XX	XX	XX	XX
Value-added promotions (free samples, competitions with tobacco prizes)	XX	XX	√	√	XX	XX	XX	X
Location of tobacco vending machines	X	X	√	√	X	X	X	X
Restrictions on locations smoking can take place:								
Smoking in enclosed public places (shops, restaurants, etc.)	XX	XX	√	√	XX (not shops)	XX	XX	XX
Bar areas of restaurants exempt from 'No Smoking' policy	No	Yes	NA	NA	Yes	Yes	Yes	Yes
Restaurants may apply for smoking areas	Yes	No	NA	NA	No	No	No	No
Pubs and Nightclubs exempt from 'No Smoking' policy	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes
Smoking in enclosed workplaces (except pubs and nightclubs)	XX	XX	√	√	√	XX	X	XX

Notes: XX – prohibited; X – restricted; √ – permitted/unlimited; NA – not applicable.

Table 4: Timeline of regulatory changes

1st September to 30th November 2001: Wave 1 of HILDA survey conducted
<p>31st May 2002, Queensland <i>Tobacco and Other Smoking Products (Prevention of Supply to Children) Act 2001</i> becomes effective:</p> <ul style="list-style-type: none"> • smoking prohibited in enclosed public places (i.e. shops, dining areas, gaming table areas of casinos, etc.) • exemptions apply to pubs and nightclubs, and bar and gambling machine areas of casinos • smoking prohibited in enclosed workplaces (except pubs and nightclubs) • point of sale advertising regulations more stringent • value-added promotions of tobacco products prohibited • location of self-serving tobacco vending machines becomes restricted
<p>1st September 2002, Victoria <i>Tobacco (Miscellaneous Amendments) Act 2002</i> becomes effective. This tightens regulations dealing with smoking in licensed premises that offer gaming rooms and machines:</p> <ul style="list-style-type: none"> • licensed gaming venues with two or more rooms required to designate one smoke-free room • in single gaming room venues, the gaming machine area required to be smoke-free • in gaming venues with two or more rooms, any room with gaming machines must be smoke-free at all times • in gaming venues with three or more rooms, one 'operating' room must be smoke-free in addition to the gaming room (i.e. two smoke-free rooms) • bingo centres must be smoke-free, and in other places where bingo is played, the area where bingo is played must be smoke-free during bingo sessions • smoking is prohibited on main gaming floors of the casino
1st September to 30th November 2002: Wave 2 of HILDA survey conducted
<p>1st January 2003, Northern Territory <i>Tobacco Control Act 2002</i> has initial clauses that become effective:</p> <ul style="list-style-type: none"> • Smoking prohibited in enclosed public places, such as; shops, restaurants, dining areas of hotels, bars and licensed clubs, and public transport, etc.
<p>31st May 2003, Northern Territory <i>Tobacco Control Act 2002</i> has further clauses that become effective:</p> <ul style="list-style-type: none"> • smoking is prohibited in enclosed workplaces, except for licensed premises (but proprietors of licensed premises are required to put in places measures to minimise employees' exposure to environmental tobacco smoke) • proprietors of licensed premises required to provide smoking and non-smoking areas of equal amenities within their facilities (specifically deals with gaming tables and machines) • published and broadcast tobacco advertising prohibited • point of sale advertising of tobacco products prohibited (except limited price and product information) • value-added tobacco promotions prohibited • self-serving tobacco vending machines restricted to adults-only sections of licensed premises within line of sight of staff
<p>1st July 2003, NSW Government and several industry unions initiate voluntary agreement that extends smoking restrictions:</p> <ul style="list-style-type: none"> • smoking prohibited at all counter areas, including where liquor is served • non-smoking area is to be designated in a bar area • in licensed venues with more than one bar area, proprietors are <i>encouraged</i> to make one bar area totally non-smoking
1st September to 30th November 2003: Wave 3 of HILDA survey conducted

4. Modelling smoking behaviour

We follow the same methodology as applied in Jenkins and Cappellari (2004) and break up the transitions from smoking to non-smoking and vice versa into three distinct building blocks. The first block consists of an equation to determine smoking status in the base year, the second block models retention in the sample from one wave to the next, and the final block models smoking status conditional on smoking status in the base year. These three blocks are not independent, but are modelled using a trivariate probit structure.

Let S_{it-1}^* , R_{it}^* , and S_{it}^* be the latent propensity to smoke in period t-1 (i.e. the base year), the latent propensity to remain in the sample from t-1 to t, and the latent propensity to smoke in period t, respectively. Using straightforward linear specifications we explicitly model the latent propensities as

$$S_{it-1}^* = \beta' x_{it-1} + \mu_i + \delta_{it-1} \quad (1)$$

$$R_{it}^* = \psi' w_{it-1} + \eta_i + \xi_{it} \quad (2)$$

$$S_{it}^* = [(S_{it-1}^*)\gamma_1' + (1 - S_{it-1}^*)\gamma_2'] z_{it-1} + \tau_i + \zeta_{it} \quad (3)$$

Each error consists of an individual fixed component and a pure white noise component and is assumed to follow a standard normal distribution. The joint distribution of the error terms is trivariate standard normal. The unobserved heterogeneity, i.e., the individual fixed components of the error terms, is thus parameterised through the normalised covariance matrix of the joint error distribution:

$$\rho_1 = \text{corr}(\mu_i + \delta_{it-1}, \eta_i + \xi_{it}) = \text{cov}(\mu_i, \eta_i) \quad (4)$$

$$\rho_2 = \text{corr}(\mu_i + \delta_{it-1}, \tau_i + \zeta_{it}) = \text{cov}(\mu_i, \tau_i) \quad (5)$$

$$\rho_3 = \text{corr}(\eta_i + \xi_{it}, \tau_i + \zeta_{it}) = \text{cov}(\eta_i, \tau_i) \quad (6)$$

These correlations capture the relationship between the unobserved individual specific factors that determine smoking status in the base year, smoking status in the subsequent year conditional on smoking status in the base year, and retention. For example, a positive (negative) ρ_1 implies that a person who initially was more likely to smoke in the base year is more (less) likely to be retained in the sample compared to a non-smoker.

The equation for smoking in the base year addresses the problem of initial conditions that arises if those smokers ‘at risk’ of quitting or those non-smokers ‘at risk’ of starting are not a

random sample of the population. Similarly, remaining in the sample from wave to wave may not be random and is hence also explicitly modelled. A person is not retained between waves if the person fails to fill out a self completion questionnaire in the second wave, if he or she does fill out the self completion questionnaire but gives multiple answers or no answer to the particular question on smoking, or if they do not respond in the second wave at all (i.e. genuine sample attrition). Non-retention rates between waves 1 and 2, 2 and 3, and 1 and 3 are 20.7 per cent, 15.4 per cent, and 23.9 per cent, respectively.³ Attrition rates of this magnitude highlight the need ex-ante to choose an approach that can account for non-retention.

Estimation is via maximum likelihood. The contribution to the log likelihood for an individual for whom we observe smoking status in Wave t-1 depends on the particular realised values of S_{it-1} , R_{it} , and S_{it} , but can always be expressed as a function of trivariate normal probabilities. The three waves of data generate two sets of data. The first set comprises all individuals in Wave 1 and their status in Wave 2. The second set of data consists of all those in Wave 2 who had been retained, plus any new persons that were added in Wave 2, and their status in Wave 3. The log likelihood is therefore described by:

$$\log L = \sum_i \sum_{t=2,3} \left[\begin{aligned} & Ln[\Phi_{TVN}(0,0,0;\Sigma) + \Phi_{TVN}(1,0,0;\Sigma)] * I(R_{it}=0 \ \& \ S_{it-1}=0) + \\ & Ln[\Phi_{TVN}(0,0,1;\Sigma) + \Phi_{TVN}(1,0,1;\Sigma)] * I(R_{it}=0 \ \& \ S_{it-1}=1) + \\ & Ln[\Phi_{TVN}(0,1,0;\Sigma)] * I(S_{it}=0 \ \& \ R_{it}=1 \ \& \ S_{it-1}=0) + \\ & Ln[\Phi_{TVN}(0,1,1;\Sigma)] * I(S_{it}=0 \ \& \ R_{it}=1 \ \& \ S_{it-1}=1) + \\ & Ln[\Phi_{TVN}(1,1,0;\Sigma)] * I(S_{it}=1 \ \& \ R_{it}=1 \ \& \ S_{it-1}=0) + \\ & Ln[\Phi_{TVN}(1,1,1;\Sigma)] * I(S_{it}=1 \ \& \ R_{it}=1 \ \& \ S_{it-1}=1) \end{aligned} \right]$$

with

$$\Sigma = \begin{pmatrix} 1 & \rho_3 & \rho_2 \\ \rho_3 & 1 & \rho_1 \\ \rho_2 & \rho_1 & 1 \end{pmatrix} \text{ and } \Phi_{TVN}(S_{it}, R_{it}, S_{it-1}; \Sigma) \text{ the trivariate normal distribution.}$$

(7)

³ The primary source of non-retention is genuine attrition, with non-return of the self-completion questionnaire also a significant contributor. Other factors, such as providing multiple answers, play only a minor role. See the appendix for more details.

Once the model has been estimated, predicted probabilities for starting or quitting smoking can be easily obtained. For instance, the predicted probability a non-smoker will pick up smoking is simply $\hat{\Phi}_{TVN}(1,0,0;\hat{\Sigma}) + \hat{\Phi}_{TVN}(1,1,0;\hat{\Sigma})$. Factors that influence starting and quitting behaviour will be discussed in Section 6.

Estimation of the three correlation coefficients allows us to test for the ‘ignorability’ of each of the three building blocks, indicating whether we could suffice with a less complicated model. Establishing ignorability of the retention block amounts to testing $\rho_1 = \rho_3 = 0$. Similarly, identifying the absence of a possible initial conditions problem is equivalent to testing $\rho_1 = \rho_2 = 0$.

5. Data

The data used come from the first three waves of the HILDA survey spanning the period September 2001 to November 2003. The HILDA sample is nationally representative and comprises about 14,000 individuals in 7,000 households. The survey is undertaken via personal interviews with all respondents, supplemented by self-completion questionnaires on topics less amenable to interview, for example, because of the personal and subjective nature of the information sought. Our dependent variables on smoking behaviour come from answers individuals provide in the self-completion part of the questionnaire. In wave 1 respondents were asked ‘Do you smoke cigarettes or other tobacco products?’ which can be answered ‘Yes’, ‘No, I have given up smoking’ or ‘No, I have never smoked’. In waves 2 and 3 the question remained the same but the choice of responses was changed to ‘No, I have never smoked’, ‘No, I no longer smoke’, ‘Yes, I smoke daily’, ‘Yes, I smoke at least weekly (but not daily)’ and ‘Yes, I smoke less often than weekly’. For compatibility across waves the three affirmative responses in waves 2 and 3 are collectively treated as equivalent to the singular ‘Yes’ response in wave 1. Respondents who respond ‘No’ are treated as non-smokers, irrespective of whether they are ex-smokers.

Table 5 contains descriptive statistics on smoking behaviour in the different States and consists of three blocks comparing Waves 1 and 2, Waves 2 and 3, and Waves 1 and 3, respectively. A quitter is defined as a smoker in one year and a non-smoker the next. A starter is defined as a non-smoker in one year and a smoker the next. Note, therefore, that the proportion of persons who are smokers in the base year is the sum of columns (1) and (3), while the proportion of persons who are smokers in the subsequent comparison year is the

sum of columns (2) and (3). The sample for Table 5 is restricted to those with valid data on smoking status and residing in the same state in both of the waves used for comparison.

Table 5: Smoking status by state of residence (proportion)

	Quitter	Starter	Smoker	Non-smoker	No. of observations
Waves 1 and 2					
NSW	0.049	0.043	0.139	0.769	3,568
Vic	0.051	0.040	0.152	0.757	3,035
Qld	0.040	0.052	0.198	0.710	2,275
SA	0.043	0.042	0.197	0.718	1,143
WA	0.044	0.036	0.157	0.763	1,193
Tas	0.035	0.058	0.252	0.655	345
NT	0.018	0.073	0.291	0.618	55
ACT	0.035	0.040	0.100	0.826	201
Total	0.046	0.044	0.164	0.746	11,815
Waves 2 and 3					
NSW	0.032	0.043	0.150	0.774	3,457
Vic	0.038	0.040	0.154	0.768	2,843
Qld	0.047	0.040	0.200	0.713	2,209
SA	0.050	0.051	0.182	0.716	1,096
WA	0.043	0.033	0.149	0.775	1,119
Tas	0.039	0.030	0.261	0.670	330
NT	0.068	0.068	0.254	0.610	59
ACT	0.042	0.042	0.099	0.817	191
Total	0.040	0.041	0.167	0.752	11,304
Waves 1 and 3					
NSW	0.045	0.046	0.145	0.764	3,346
Vic	0.057	0.044	0.151	0.747	2,767
Qld	0.054	0.056	0.184	0.706	2,104
SA	0.054	0.049	0.184	0.713	1,041
WA	0.054	0.030	0.152	0.764	1,098
Tas	0.038	0.057	0.244	0.661	316
NT	0.040	0.060	0.280	0.620	50
ACT	0.027	0.033	0.110	0.830	182
Total	0.051	0.046	0.162	0.741	10,904

Table 5 indicates that there is quite a high degree of churning in smoking status in the data, with 8 to 10 per cent of all persons either quitting or starting smoking from one year to the next. Indeed, the estimates imply that approximately 20 per cent of smokers in one wave quit smoking by the time of the next wave, approximately matched by a similar number taking up smoking between waves. There is also substantial variation in smoking rates across the states

and territories, with smoking rates highest in the Northern Territory and Tasmania, and lowest in the Australian Capital Territory and New South Wales.

6. Estimation results

Table 6 presents the estimation results.⁴ It consists of four column sets containing three columns each. Each column set contains the parameter estimates, the z-value, and the mean marginal effect.⁵ The first two column sets are the estimates for the effects of the explanatory variables on transition outcomes. Specifically, the first column set gives the effects on the probability of smoking in wave t given the individual was a smoker in Wave t-1. The second column set gives the effects on the probability of smoking in Wave t given the individual was a non-smoker in Wave t-1. Thus, the first column set provides estimates of the effects of the explanatory variables on the probability a smoker quits (albeit via estimates of the effects on the probability he or she does *not* quit), while the second column set provides estimates of their effects on the probability a non-smoker takes up smoking. The third column set gives estimates for the probability of retention in the sample – that is, it models attrition. The last column set gives estimates for initial conditions – that is, the effects of the explanatory variables on the probability an individual is a smoker in Wave 1. All explanatory variables are measured at time t-1, except the ‘life event’ variables, which are measured at time t, but refer to the period in-between Waves t-1 and t.

The factors associated with smoking in the base year (last column set) show a familiar pattern. Females are less likely to smoke, as are married individuals and people with higher levels of education. In terms of labour force status, the unemployed show the highest smoking rates. Individuals employed in the hospitality industry or who drink daily or weekly are also more likely to smoke. Children in the household do not deter smoking.

⁴ Estimates for variables included primarily as controls are reported in Table A6 in the appendix and are not discussed here

⁵ For binary variables, the mean marginal effect is in fact the mean effect on the predicted probability of changing the variable from zero to one, holding all other variable values constant. Mean marginal effects are, for all variables, evaluated over all observations in the sample.

Table 6: Model estimation results

	Smoking in period t conditional on						Retained between waves			Smoking in t-1		
	smoking in t-1			non-smoking in t-1								
	Coef.	z	MME	Coef.	z	MME	Coef.	z	MME	Coef.	z	MME
Female	-0.088 (1.46)		-0.020	-0.110 (2.24)**		-0.008	0.055 (2.40)**		0.014	-0.109 (3.82)***		-0.030
Age (60+ omitted)												
14-17	-0.198 (0.83)		-0.047	1.117 (6.91)***		0.179	-0.203 (2.83)***		-0.055	-0.028 (0.35)		-0.008
18-24	-0.434 (2.32)**		-0.097	0.797 (5.28)***		0.093	-0.453 (7.45)***		-0.132	0.798 (11.78)***		0.248
25-34	-0.239 (1.39)		-0.041	0.715 (5.20)***		0.073	-0.289 (5.49)***		-0.078	0.984 (16.55)***		0.302
35-44	-0.062 (0.39)		-0.002	0.507 (3.78)***		0.045	-0.084 (1.65)*		-0.022	0.884 (15.37)***		0.264
45-59	-0.166 (1.11)		-0.029	0.375 (3.13)***		0.032	0.004 (0.08)		0.001	0.598 (11.82)***		0.171
Wave 1-2 block	0.065 (1.26)			0.213 (5.03)***			-0.186 (9.24)***			-0.004 (0.22)		
Smoking legislation	-0.336 (1.69)*		-0.076	-0.044 (0.26)		-0.003	0.017 (0.26)		0.004			
.* Age 14-17	0.059 (0.19)		0.012	-0.275 (1.44)		-0.017	0.045 (0.47)		0.011			
.* Age 18-24	0.738 (3.22)***		0.109	0.170 (0.97)		0.015	-0.014 (0.19)		-0.004			
.* Age 25-34	0.370 (1.93)*		0.067	0.040 (0.25)		0.003	0.078 (1.21)		0.019			
.* Age 35-44	0.232 (1.23)		0.045	0.132 (0.84)		0.011	0.084 (1.30)		0.021			
.* Age 45-59	0.363 (1.85)*		0.067	-0.037 (0.24)		-0.003	-0.036 (0.57)		-0.009			
.* Socialise frequently	0.023 (0.15)		0.005	0.119 (1.02)		0.010	0.015 (0.25)		0.004			
.* Socialise regularly	-0.014 (0.10)		-0.003	0.039 (0.36)		0.003	0.006 (0.10)		0.001			
.* Drink daily	-0.050 (0.29)		-0.011	0.170 (1.10)		0.015	0.016 (0.20)		0.004			
.* Drink weekly	0.096 (0.86)		0.020	-0.018 (0.20)		-0.001	0.036 (0.85)		0.009			
.* Work in hospitality	-0.097 (0.37)		-0.022	-0.175 (0.74)		-0.012	-0.034 (0.33)		-0.009			
Location (major city omitted)												
Inner regional	-0.017 (0.26)		-0.004	-0.072 (1.40)		-0.005	0.075 (2.90)***		0.019	-0.056 (1.84)*		-0.015
Outer regional	0.027 (0.34)		0.007	0.010 (0.15)		0.000	-0.003 (0.09)		-0.001	0.080 (2.09)**		0.022
Marital status (never married omitted)												
Married	-0.029 (0.35)		-0.011	-0.114 (1.40)		-0.008	0.168 (4.79)***		0.043	-0.333 (8.03)***		-0.092
Defacto	0.090 (1.01)		0.020	0.117 (1.38)		0.009	0.046 (1.13)		0.011	0.123 (2.78)***		0.035
Divorced	0.125 (1.04)		0.028	0.155 (1.30)		0.013	0.072 (1.32)		0.018	0.189 (3.01)***		0.054
Separated	-0.007 (0.05)		0.001	0.322 (2.56)**		0.030	0.080 (1.23)		0.020	0.208 (3.04)***		0.060
Widowed	-0.182 (1.00)		-0.047	0.103 (0.68)		0.009	-0.013 (0.22)		-0.003	-0.256 (3.17)***		-0.065
Educational attainment (Below Year 12 omitted)												
Postgraduate	0.053 (0.36)		0.003	-0.298 (2.70)***		-0.017	0.175 (3.56)***		0.041	-0.609 (9.03)***		-0.138
Bachelor	-0.163 (1.85)*		-0.044	-0.059 (0.82)		-0.003	0.191 (5.68)***		0.046	-0.437 (10.53)***		-0.109
Advanced certificate	-0.042 (0.56)		-0.011	-0.045 (0.64)		-0.003	0.100 (3.12)***		0.024	-0.087 (2.33)**		-0.023
Certificate	0.094 (1.00)		0.019	-0.081 (0.98)		-0.006	0.070 (1.89)*		0.017	-0.082 (1.80)*		-0.022
Year 12	-0.055 (0.60)		-0.017	-0.068 (0.92)		-0.004	0.149 (4.11)***		0.036	-0.352 (7.99)***		-0.087
Labour force status (not in the labour force omitted)												
Employed full time	0.151 (1.24)		0.035	0.050 (0.45)		0.003	-0.022 (0.44)		-0.006	0.185 (3.42)***		0.051
Employed part time	0.123 (1.02)		0.028	0.093 (0.86)		0.007	0.08 (1.59)		0.020	0.155 (2.92)***		0.043
Unemployed	-0.010 (0.09)		0.002	0.236 (2.24)**		0.020	-0.028 (0.53)		-0.007	0.313 (5.86)***		0.092
Log(family income)	-0.050 (1.27)		-0.008	-0.023 (1.08)		-0.001	0.014 (1.31)		0.003	-0.046 (3.73)***		-0.009
Income imputation flag	0.034 (0.57)		0.007	-0.043 (0.90)		-0.003	-0.238 (11.01)***		-0.063	-0.062 (2.67)***		-0.017

Table 6 continued: Model estimation results

	Smoking in period t conditional on						Retained between waves			Smoking in t-1		
	smoking in t-1			non-smoking in t-1								
	Coef.	z	MME	Coef.	z	MME	Coef.	z	MME	Coef.	z	MME
Children under 4 present	-0.012 (0.16)		-0.009	0.061 (0.95)		0.005	0.021 (0.67)		0.005	-0.033 (0.93)		-0.009
Children 5-9 present	0.117 (1.52)		0.002	0.008 (0.12)		0.001	0.025 (0.80)		0.006	0.004 (0.12)		0.001
Children 10-14 present	-0.002 (0.03)		0.010	-0.015 (0.25)		-0.001	0.010 (0.34)		0.002	0.037 (1.09)		0.010
Works in hospitality	0.204 (1.22)		0.053	0.121 (0.88)		0.009	-0.017 (0.26)		-0.004	0.182 (2.99)***		0.052
Socialise frequently	0.038 (0.38)		0.013	-0.112 (1.44)		-0.009	0.018 (0.47)		0.005	0.046 (1.41)		0.013
Socialise regularly	-0.020 (0.22)		-0.006	-0.089 (1.27)		-0.007	0.056 (1.61)		0.014	-0.023 (0.80)		-0.006
Drink daily	-0.023 (0.19)		0.143	0.372 (3.43)***		0.034	0.053 (0.97)		0.013	0.481 (10.52)***		0.144
Drink weekly	-0.099 (1.41)		0.067	0.282 (4.75)***		0.022	-0.047 (1.71)*		-0.012	0.248 (9.71)***		0.069
Life events												
Got married	-0.172 (1.13)		-0.041	0.073 (0.53)		0.006						
Got separated/divorced	0.144 (1.35)		0.029	0.423 (4.96)***		0.044						
Got back together	-0.008 (0.05)		-0.002	0.170 (1.09)		0.015						
Got pregnant	-0.391 (4.01)***		-0.100	-0.217 (2.15)**		-0.014						
Got injured/very ill	-0.104 (1.26)		-0.024	0.083 (1.12)		0.007						
Friend got injured/sick	0.099 (1.45)		0.021	-0.030 (0.52)		-0.002						
Life event info NA	-0.071 (0.40)		-0.016	-0.034 (0.23)		-0.003						
Suspicious							-0.219 (4.30)***		-0.060			
Cooperative							0.440 (5.84)***		0.131			
Interview length (mins)							-0.004 (5.10)***		-0.011			
Poor understanding							-0.125 (2.50)**		-0.033			
Needed language support							-0.514 (6.02)***		-0.156			
Constant	2.003 (4.64)***			-2.048 (7.73)***			0.445 (2.99)***			-0.617 (4.38)***		
ρ_1	-0.054 (4.31)***											
ρ_2	-0.085 (2.36)**											
ρ_3	0.168 (1.65)*											
No. of observations	22,747											

Robust z statistics in parentheses, clustered on person identifier. * significant at 10%; ** 5%; *** 1%. MME – Mean Marginal Effect

The probability of being retained is negatively influenced by being young and lower from Wave 1 to 2 than from Wave 2 to 3. Higher levels of education and being married also increase the probability of being retained between waves. Having your income imputed rather than reported is a powerful predictor of not being retained between waves. The other powerful predictors stem from the interviewer's assessment. If the respondent was suspicious of the survey, took a long time completing it, needed language assistance or had a poor understanding of the questions, he or she was less likely to be retained.

In contrast to the equations for smoking in the base year and retention, where the model identifies many factors that can explain individuals' outcomes, fewer variables can explain

who smokes in the subsequent year once we condition on smoking status in the base year. The single biggest predictor for quitting is getting pregnant. The introduction of tougher smoking legislation also induces people to quit and is significant at the 10 per cent level. The implied mean marginal effect of introducing tougher smoking legislation is a reduction in the smoking probability by 7 percentage points. This is the impact on a non-drinking, non-socialising person aged 60 years or over, which is the reference group. When interacted with age group, the tougher smoking legislation no longer increases the probability to quit, except for 14 to 17 year old smokers, and is even reversed for 18 to 24 year olds. That is, 18 to 24 year old smokers are less likely to quit in states that introduced tougher smoking regulations than in states that did not, implying a type of defiance effect for this group. For persons working in the hospitality industry, or who drink daily or socialise regularly the higher quit probability is supported.

Conditional on being a non-smoker in the base year, we find that younger people are more likely to pick up smoking than our reference group, those aged 60 years and over. This is not surprising, since one would expect few non-smoking seniors to pick up the habit, relative to teenagers and young adults. The positive and significant coefficient on the dummy indicating the observation stems from the transition between Waves 1 and 2 could be related to the change in the questionnaire. It is possible that some who previously considered themselves to be a non-smoker now admit they do smoke less than weekly. Education does play a role in the decision not to start, at least for non-smokers with a postgraduate education. Being unemployed or drinking daily or weekly is also associated with starting to smoke. With respect to the life event variables, we see again that getting pregnant reduces the probability of picking up smoking, but that separating or getting divorced increases the probability of picking up smoking. One plausible explanation is that this can be driven by smokers who gave up the habit while in a relationship, due to pressure from their partner, but reverted back to their old habit once their relationship ended.

As a final point it should be pointed out that two of the three correlation coefficients are significant, although they are all small in magnitude. This highlights the importance of controlling for retention between waves and the initial conditions.

7. Summary and conclusions

In this study we have modelled the dynamics of smoking behaviour in Australia and investigated the role of smoking regulations, primarily restricting smoking in public venues,

in affecting individual-level smoking patterns. While the tightening of restrictions on where smoking can take place has been predominantly motivated by protecting non-smokers from second hand smoke, at least in Australia the argument has also been made that such restrictions also reduce smoking rates.

Our empirical research shows that the tightening of legislation does increase quit probabilities and reduces starting probabilities, but that these effects do not hold for everyone. The increased quit probability applies only to teenagers and seniors, is non-existent for all others and for the group of 18 to 24 year olds this effect is even reversed, which we interpret as a rebellion effect. Working in the hospitality sector strengthens the effects of tightening smoking regulations on quit and starting probabilities, which is consistent with a more intense exposure to the regulations for individuals employed in the sector that is most affected by the regulations.

In addition to our findings on the effects of regulations, we also find that those most at risk of starting to smoke are teenagers and young adults, and individuals who recently experienced a break up, who frequently consume alcohol, are unemployed, or have low educational attainment. This is consistent with the findings of previous research and reinforces the message that these individuals are particularly important target groups for anti-smoking policies.

References

Australian Institute of Health and Welfare (2005) *2004 National Drug Strategy Household Survey: First Results*, Canberra: AIHW (Drug Statistics Series No. 13).

Australian Institute of Health and Welfare (2005) *Australia's Health 2004*, Canberra: AIHW.

Bardsley, P. and Olekalns, N. (1999) "Cigarette and Tobacco Consumption: Have Anti-Smoking Policies Made a Difference?" *The Economic Record*, 75(230), 225-40.

Jenkins, S.P. and Cappellari, L (2004), Modelling Low Income Transitions, *Journal of Applied Econometrics* 19(5), 593-610.

Chapman, S., Borland, R., Scollo, M., Brownson, R., Dominello, A. and Woodward, S. (1999) "The Impact of Smoke-Free Workplaces on Declining Cigarette Consumption in Australia and the United States," *American Journal of Public Health*, 89(7), 1018-23.

Fichtenberg, C. and Glantz, S. (2002) "Effect of smoke-free workplaces on smoking behavior: systematic review," *British Medical Journal* 325: 188-191.

Kidd, M. and Hopkins, S. (2004) "The Hazards of Starting and Quitting Smoking: Some Australian Evidence," *The Economic Record*, 80(249), 177-92.

Queensland Health (2000) "Queensland Tobacco Action Plan 2000-01 to 2003-04," report on World Wide Web at <http://www.health.qld.gov.au/phs/Documents/atods/8260.pdf> on 23/8/05.

World Health Organization (2002) *The Tobacco Atlas*, Myriad Editions Limited, Brighton UK, ISBN 92 4156 209 9.

8. Appendix

8.1. Detailed smoking status transitions

The transition matrices in table A5 follow all responding persons in the base year (rows) and display the outcomes in the subsequent year. The reason why a person could have ‘No Info’ in the base year is either due to not filling out the self completion questionnaire altogether, refusing to answer the particular smoking question, or giving multiple responses. The persons in the base year for whom we do not have information on smoking status are included for completeness, but cannot be included in the estimation. Those persons for whom we do have information on smoking status in the base year are all included in the estimation, even if smoking status is missing in the subsequent wave due to not being retained. A person is not retained between waves if the person fails to fill out a self-completion questionnaire in the subsequent wave, if he or she gives multiple answers or no answer at all on the particular question related to smoking, or if the person is a complete non respondent (i.e., genuine sample attrition).⁶

⁶ Of the 12,960 valid observations in Wave 1, 1,636 have no information in Wave 2 due to non-response (i.e. genuine attrition). A further 946 have missing information in Wave 2 due to non-return of the self-completion questionnaire (which contains the question on smoking), and another 96 individuals are not retained because of invalid responses to the question on smoking (failure to answer the question, or selection of more than one of the mutually exclusive responses). For the 11,518 valid observations in Wave 2, the corresponding numbers in Wave 3 are 1,204, 462 and 112.

Table A5 Population weighted transition rates between waves (row percentages). Total represents the unweighted number of observations.

Wave 1 to Wave 2

Wave 1 status	Wave 2 status						Total
	No info	Never	No longer	Daily	Weekly	Less than weekly	
<i>No info</i>	59.67%	18.84%	10.26%	9.47%	0.54%	1.22%	1,005
Never	20.65%	72.66%	4.99%	0.59%	0.45%	0.66%	6,507
No longer	17.99%	5.96%	67.35%	4.57%	2.18%	1.95%	3,423
Yes	26.41%	1.33%	8.00%	57.21%	4.74%	2.31%	3,030
Total	3,268	5,188	3,009	2,058	251	195	13,969

Wave 2 to Wave 3

Wave 2 status	Wave 3 status						Total
	No info	Never	No longer	Daily	Weekly	Less than weekly	
<i>No info</i>	47.55%	26.92%	11.73%	11.29%	1.76%	0.76%	1,523
Never	15.46%	80.13%	3.18%	0.33%	0.33%	0.57%	5,633
No longer	13.90%	7.36%	73.08%	3.06%	1.10%	1.50%	3,138
Daily	19.60%	0.27%	7.86%	69.10%	2.33%	0.85%	2,255
Weekly	16.02%	2.54%	19.95%	29.48%	22.82%	9.19%	275
Less than weekly	18.19%	6.33%	23.30%	13.46%	15.51%	23.20%	217
Total	2,459	5,225	2,958	1,988	231	180	13,041

Wave 1 to Wave 3

Wave 1 status	Wave 3 status						Total
	No info	Never	No longer	Daily	Weekly	Less than weekly	
<i>No info</i>	61.94%	19.34%	7.83%	9.06%	0.46%	1.38%	1,005
Never	24.14%	69.71%	4.34%	0.78%	0.36%	0.67%	6,507
No longer	22.01%	5.28%	64.14%	5.18%	1.66%	1.73%	3,423
Yes	28.60%	1.19%	11.45%	52.56%	4.41%	1.80%	3,030
Total	3,700	5,003	2,930	1,948	217	171	13,969

Table A6: Additional model estimation results

	Smoking in period t conditional on							
	smoking in t-1		non-smoking in t-1		Retained between waves		Smoking in t-1	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
Victoria	-0.022	(0.30)	-0.044	(0.76)	0.028	(1.04)	0.069	(2.08)**
Queensland	0.009	(0.11)	-0.017	(0.29)	0.077	(2.57)**	0.064	(1.78)*
South Australia	0.094	(0.91)	-0.013	(0.16)	0.159	(4.02)***	0.035	(0.75)
Western Australia	-0.079	(0.78)	-0.019	(0.24)	0.082	(2.25)**	-0.037	(0.83)
Tasmania	0.052	(0.36)	0.306	(2.52)**	0.094	(1.47)	0.164	(2.32)**
Australian Capital Territory	-0.167	(0.79)	-0.038	(0.23)	0.245	(3.07)***	-0.099	(0.98)
Northern Territory	0.472	(1.28)	0.080	(0.22)	0.222	(1.93)*	0.227	(1.43)
New Zealand	-0.114	(0.29)	-0.008	(0.04)	-0.321	(2.78)***	-0.083	(0.64)
Northern Europe / US	-0.450	(1.31)	0.280	(1.27)	-0.079	(0.61)	-0.073	(0.43)
Southern Europe	-0.282	(0.66)	0.937	(2.83)***	-0.590	(3.88)***	0.438	(1.94)*
Former Eastern Block	-0.845	(2.64)***	0.634	(2.06)**	-0.449	(3.09)***	0.190	(0.97)
Asia	0.044	(0.17)	-0.122	(0.71)	-0.319	(4.24)***	-0.565	(5.19)***
Other foreign born	0.274	(0.86)	-0.279	(1.10)	-0.290	(2.95)***	-0.157	(1.35)
YSM*New Zealand	0.011	(0.55)	0.008	(0.93)	0.013	(1.81)*	-0.003	(0.51)
YSM*N. Europe / US	0.009	(0.91)	-0.002	(0.33)	0.000	(0.05)	0.004	(0.85)
YSM*Southern Europe	-0.007	(0.56)	-0.020	(1.67)*	0.005	(1.18)	-0.008	(1.12)
YSM*Former Eastern Block	0.017	(1.61)	-0.008	(0.71)	0.002	(0.57)	-0.001	(0.12)
YSM*Asia	0.002	(0.16)	-0.002	(0.22)	0.006	(1.64)	0.015	(2.55)**
YSM*Other foreign born	-0.010	(0.75)	0.008	(0.71)	0.007	(1.46)	0.013	(2.39)**
Managers & Administrators	-0.108	(0.71)	-0.069	(0.55)	-0.009	(0.14)	-0.362	(5.29)***
Professionals	-0.196	(1.43)	-0.131	(1.13)	0.054	(0.99)	-0.445	(7.37)***
Associate professionals	-0.147	(1.10)	-0.072	(0.60)	-0.045	(0.82)	-0.272	(4.62)***
Tradespersons & related workers	-0.058	(0.42)	-0.064	(0.52)	-0.021	(0.37)	-0.196	(3.22)***
Advanced clerical & service workers	-0.258	(1.38)	-0.072	(0.43)	-0.008	(0.10)	-0.321	(3.70)***
Intermediate clerical, sales & service workers	-0.086	(0.69)	-0.016	(0.14)	0.063	(1.20)	-0.257	(4.63)***
Intermediate production & transport workers	-0.065	(0.46)	-0.099	(0.79)	-0.002	(0.04)	-0.079	(1.27)
Elementary clerical, sales & service workers	-0.073	(0.52)	0.060	(0.52)	-0.011	(0.19)	-0.161	(2.56)**
Area Soc.Econ. decile1	0.003	(0.02)	0.015	(0.17)	0.031	(0.67)	0.054	(1.19)
Area Soc.Econ. decile 2	-0.065	(0.59)	-0.195	(2.20)**	0.017	(0.38)	0.050	(1.15)
Area Soc.Econ. decile 3	0.055	(0.50)	0.029	(0.35)	0.002	(0.05)	0.071	(1.62)
Area Soc.Econ. decile 4	0.002	(0.02)	-0.177	(2.04)**	0.112	(2.54)**	-0.014	(0.33)
Area Soc.Econ. decile 6	0.022	(0.19)	-0.266	(2.81)***	0.048	(1.05)	-0.037	(0.81)
Area Soc.Econ. decile 7	-0.253	(2.30)**	-0.142	(1.54)	-0.013	(0.28)	-0.002	(0.03)
Area Soc.Econ. decile 8	0.068	(0.57)	-0.114	(1.27)	0.017	(0.38)	0.033	(0.76)
Area Soc.Econ. decile 9	0.025	(0.21)	-0.175	(1.98)**	0.144	(3.18)***	-0.127	(2.79)***
Area Soc.Econ. decile 10	-0.206	(1.69)*	-0.261	(2.87)***	0.075	(1.63)	-0.134	(2.77)***
Father not employed							0.053	(0.69)
Father deceased							0.128	(1.70)*
Father not present							0.131	(1.69)*
Father's empl_status NA							0.017	(0.18)
Mother not employed							-0.102	(3.70)***
Mother deceased							-0.141	(1.31)
Mother not present							-0.156	(0.86)
Mother's empl status NA							-0.150	(2.13)**
Had stepmother at age 14							0.285	(2.27)**
Had stepfather at age 14							-0.024	(0.37)
Lived with father only at age 14							0.057	(0.59)
Lived with mother only at age 14							-0.008	(0.16)
Other parental status							0.339	(5.27)***
Parents divorced while resp. under 15							0.175	(4.18)***
Father unempl > 6 months							0.098	(2.19)**
Father unempl > 6 months NA							-0.004	(0.07)

8.2. *Smoking and tobacco products regulations in the states and territories of Australia – Current regulations and recent changes to regulations*

Commonwealth of Australia – Federal Legislation

- The taxation of tobacco products is prescribed and administered by the federal government, and collected by the Australian Taxation Office. Since November 1999, cigarettes (that contain 0.8 grams of tobacco or less) have been subject to a “per-stick” federal excise duty. All other tobacco products (e.g. pipe tobacco) have the duty calculated according to the weight of the tobacco. In addition, the Australian Customs Service is responsible for the collection of customs duty on imported tobacco products, set at the same rates as the excise duties. These rates are changed in line with movements in the Consumer Price Index in August and February of each year. The current excise and customs duties on tobacco products (as at 1st August 2005) are \$0.22915 per stick for cigarettes and \$286.44 per kg for loose tobacco, with the 10% Goods and Services Tax levied on the excise-inclusive prices of tobacco products. All taxes/duties are levied at the same rates across all the states and territories of Australia.
- Restrictions on the advertising of cigarettes in Australia were first introduced in 1973, with a series of incremental increases in restrictions to their current state occurring over the next 22 years. Currently, under the *Smoking and Tobacco Products Advertisements (Prohibition) Act 1989*, *Tobacco Advertising Prohibition Act 1992*, and further amendments and Acts in 1993 and 1995, all advertising and promotion of tobacco products is prohibited within Australia. These regulations cover both advertising in print and published media, as well as advertising in broadcast media.
- Health warnings on tobacco packaging were first required by federal law in 1973, with subsequent increases in requirements occurring in 1987 and 1995, since when there have been no changes in requirements.
- Federal legislation prohibits smoking in all Commonwealth government buildings, on all domestic and international flights, and in airports that are operated by the Federal Airports Corporation.

Australian Capital Territory

Tobacco Regulations 1991 (invoked under the *Tobacco Act 1927*) (effective 1st May 1991)

- In conjunction with Commonwealth legislation, the following activities with regards to tobacco products are prohibited by the regulations:
 - published and broadcast advertising
 - sponsorship (Minister may grant exemption)
 - point of sale advertising (except limited product display and price information)
 - value-added promotions
- Self-serve vending machines are permitted only in designated bar-rooms and places licensed to hold gaming machines.

Smoke-Free Areas (Enclosed Public Places) Act 1994 (effective 9th November 1994)

- Smoking prohibited in enclosed public places, such as shops, restaurants, workplaces (that are indoors), cinemas, libraries, buses, taxis, boats, nursing homes, hotels and motels, and sporting and recreational facilities.
- Common areas (other than dining areas, elevators, halls) in hotels, motels, and nursing homes may be exempt in circumstances where a similar area of the same standard is offered that is smoke-free within the facility.
- Restaurants and licensed premises may apply to be granted certificates of exemption, with the conditions being that 75% of a restaurant and 50% of a licensed establishment must remain smoke-free, and that both must have suitable ventilation systems (i.e. smoke-free areas must remain free of smoke at all times).

Smoking (Prohibition in Enclosed Public Places) Act 2003 (effective 1st December 2006)

- Will repeal the 1994 Act, prohibiting smoking in *all* enclosed public places (with some minor exceptions), including pubs and clubs.

- It will be an offence for proprietors of certain ‘public places’ to allow persons to smoke, thus placing the onus upon owners to ensure legislation is adhered to in their establishments.

New South Wales

Smoking Regulation Act 1997

- Smoking in public places prohibited, with an exemption for premises that are able to meet an air quality standard. However, as the required ‘air quality standard’ was not specified in this or any other regulation, this complete ban on smoking in public places was not enforced following enactment of the legislation.

Public Health (Tobacco) Regulation 1999 (invoked under the *Public Health Act 1991*) (effective 31st August 1999)

- In conjunction with Commonwealth legislation, the following activities with regards to tobacco products are prohibited under the regulations:
 - published and broadcast advertising
 - sponsorship (Minister may grant exemption)
 - point of sale advertising (except limited product display)
 - value-added promotions
- Self-serve vending machines are permitted only in restricted areas of licensed premises and staff amenity rooms.

Smoke-free Environment Act 2000 (effective 6th September 2000)

- Repealed the *Smoking Regulation Act 1997*. Many provisions remained similar to those in the repealed Act, the important change being removal of ‘air quality standards’ as the basis for enforcement of regulations.
- Under the new Act, smoking is prohibited in enclosed public places, such as shopping centres, restaurants and eating places, workplaces, cinemas, public transport, common areas in hotels and motels, recreational centres, childcare facilities and hospitals.
- Exemptions apply to areas of hotels, nightclubs, and registered clubs that are not used as sit-down dining areas, and casino areas used solely for gaming machines or bars. For the first year following effect of legislation all areas of hotels, registered clubs, nightclubs and reception areas and licensed bar areas of restaurants were regarded as ‘exempt areas’. Thus, dining areas of hotels, pubs, nightclubs and registered clubs, and licensed bar areas of restaurants were not required to be smoke-free until 6th September 2001.
- The legislation also includes a duty for owners of premises with smoke-free areas to take reasonable steps to prevent smoke from other areas of the premises entering the smoke-free areas, and to display ‘No Smoking’ signs in these areas.

Voluntary agreement between the NSW government and several industry unions (initiated in 2003)

- From 1st July 2003, smoking prohibited at all counter areas including where liquor is served, a non-smoking area is to be designated in a bar area, and in licensed venues with more than one bar area proprietors are ‘encouraged’ to make one bar area totally non-smoking.
- From 1st July 2004, in licensed venues with more than one bar room, one bar room is to be made non-smoking, and where more than one facility exists (eg. pool room, gambling area) proprietors are ‘encouraged’ to make one of each of these facilities non-smoking.

Northern Territory

Tobacco Control Act 2002 (effective 1st January 2003 and 31st May 2003)

- Smoking prohibited in restaurants, cafes, shopping centres, and dining areas of hotels, bars and licensed clubs, along with other enclosed public places such as theatres, and public transport. Smoking also prohibited on dance floors of licensed premises. (Effective 1/1/03)

- Workplaces became smoke-free, except for licensed premises, although proprietors of licensed premises are required to put in place measures to minimise employees' exposure to environmental tobacco smoke. (Effective 1/5/03)
- Proprietors of licensed premises (hotels, bars, clubs and casino) are required to provide smoking and non-smoking areas of equal amenity within their facilities, with specific mention made of the use of gaming tables and machines. Thus, in order for licensed premises to operate areas that are exempt from the smoke-free regulations they must provide areas that are of equal amenity (contains at least half the number of gaming machines that establishment possesses), and have in place (reasonable) measures to minimise the exposure of their employees to environmental tobacco smoke. (Effective 1/5/03)
- Effective 1/5/03, in conjunction with Commonwealth legislation, the following activities with regards to tobacco products are prohibited by the regulations:
 - published and broadcast advertising
 - point of sale advertising (except limited price and product description)
 - value-added promotions
 - tobacco advertising or naming associated with sponsorship
- Self-serve vending machines are restricted to adults-only sections of licensed premises within line of sight of staff. (Effective 1/5/03)

Queensland

Tobacco and Other Smoking Products Act 1998 (effective 31st May 1998)

- In conjunction with Commonwealth legislation, the following activities with regards to tobacco products are prohibited:
 - point of sale advertising (except limited price and product information)
 - published and broadcast advertising
 - sponsorship

Tobacco and Other Smoking Products (Prevention of Supply to Children) Act 2001 (effective 31st May 2002)

- This was an amendment and expansion upon the 1998 Act.
- The following activities with regards to tobacco products are prohibited under the Act:
 - point of sale advertising regulations more stringent (with only certain price and product information allowable)
 - value-added promotions
- Self-serve vending machines are limited to bar and gaming areas of liquor licensed premises in positions where they are easily observed by employees (except in casinos where positioning of vending machines is not regulated as minors are not permitted on premises).
- Smoking is prohibited in enclosed public places such as shopping centres, restaurants and cafes without a liquor license and workplaces. For licensed premises, smoking is prohibited in dining areas, along with bingo areas and at gaming table areas of casinos (thus, smoking is permitted in bar and gambling machine areas).

South Australia

Tobacco Products Regulation Act 1997 (effective 5th June 1997)

- In conjunction with Commonwealth legislation, the regulations under this Act prohibit the following activities with regard to tobacco products:
 - published and broadcast legislation
 - sponsorship
 - value-added promotions
- Self-serve vending machines are permitted only in licensed premises (a regulation that is slightly less stringent than in other states)
- Smoking prohibited in public transport, lifts and places of public entertainment

Tobacco Products Regulation Act 1997 (amendments effective 4th January 1999)

- Smoking is prohibited in enclosed public dining places such as restaurants, cafes, and meal areas of hotels, pubs and licensed clubs.

Tobacco Products Regulation (Further Restrictions) Amendment Act 2004

- Effective 6th December 2004:
 - Extends prohibitions on smoking to all enclosed workplaces and public areas, except licensed hospitality venues.
 - Requires one bar area in multi-bar venues to be non-smoking; in single bar venues, it requires that 50% of the floor area be non-smoking, including at least 50% of the bar. No smoking is permitted within 1 metre of service areas.
 - Requires 25% of gaming machines to be in non-smoking areas.
 - Increases regulations and penalties in relation to sales to children.
 - Bans mobile display units.
- Effective 31st March 2005:
 - Restricts tobacco vending machines to gaming rooms or employee assistance and permits one machine only per licensed premises.
 - Bans all forms of tobacco advertising in retail outlets.
- Effective 31st October 2005:
 - 50% of the gaming machines to be in non-smoking areas.
- Effective 31st October 2007:
 - Smoking in any enclosed public areas is to be prohibited, with no exemptions.

Tasmania

Public Health Act 1997 (effective 2nd April 1998)

- In conjunction with Commonwealth legislation, the Act prohibits the following activities relating to tobacco products:
 - published and broadcast advertising
 - sponsorship
 - point of sale advertising (except limited price and product information) (effective 1/11/2000)
 - value-added promotions
- Self-serve vending machines are permitted only in licensed premises in areas where staff can supervise their operation.

Public Health Amendment (Smoke-Free Areas) Act 2001 (effective 3rd September 2001)

- Smoking prohibited in enclosed public places and enclosed workplaces, with exemptions applying to gaming areas where food is not served, bars and licensed restaurants where food is not served, and individual prison cells and rooms in nursing homes and hotels.
- Bars must provide smoke-free facilities of equal amenity.

Public Health Amendment (Extension of Smoke Free Areas) Act 2003 (effective 1st January 2005)

- All enclosed public places and workplaces made smoke-free, with the partial removal of the exemptions from gaming and bar areas.
- 50 per cent of outdoor dining areas are required to be smoke-free
- In premises with more than one bar, there can only be one bar where smoking is allowed, and in this bar smoking is not permitted within 1 metre of the bar service area.
- In premises with only one bar, 50 per cent must be smoke-free and there must be no smoking within 1 metre of the bar service area.

Victoria

Tobacco Regulations 1997 and Tobacco (Amendments) Regulations 1998 (invoked under the *Tobacco Act 1987*) (latter regulations effective 27th 1998)

- In conjunction with Commonwealth legislation, the regulations prohibit the following activities with regards to tobacco products:

- published and broadcast advertising
- sponsorship (exceptions may be granted by Governor in Council)
- point of sale advertising (restricted)
- value-added promotions
- Self-serve vending machines permitted only in licensed premises, bingo centres and staff amenities rooms.

Tobacco (Amendment) Act 2000

- This was an amendment of the *Tobacco Act 1987*, under which:
 - Restaurants and eateries (which includes indoor dining areas in hotels and licensed clubs when the predominant activity in the area is consumption of food or non-alcoholic beverages) are required to be smoke-free (effective 1st July 2001).
 - Point of sale advertising prohibited (except price and product information) and regulation of the display of tobacco products in retail stores (effective 1st January 2002).

Tobacco (Further Amendment) Act 2001

- Prohibition on offering gifts with purchase of cigarettes (effective 1st July 2001)
- Signs outside retail outlets advertising “discount cigarettes” and “cheap smokes” banned (which is in addition to advertising containing tobacco trademarks and brands that was banned under the *Tobacco Act 1987*) (effective 1st October 2001).
- All enclosed shopping centres required to be smoke-free environments (effective 1st November 2001).

Tobacco (Miscellaneous Amendments) Act 2002 (effective 1st September 2002)

- Licensed venues with two or more rooms required to designate one smoke-free room.
- In single gaming room venues, the gaming machine area is required to be smoke-free (if bar not in gaming area then it is not required to be smoke-free).
- In gaming venues with two or more rooms, any room containing gaming machines is required to be smoke-free at all times.
- In gaming venues with three or more rooms, one ‘operating’ room in addition to gaming room is required to be smoke-free, such that two rooms will be smoke-free in these venues.
- Bingo centres required to be completely smoke-free.
- In other places where bingo is played, the area where bingo is played must be smoke-free during bingo sessions.
- In Crown casino, smoking is prohibited on main gaming floors (exemptions apply for TAB areas, bar areas and high roller rooms that have been specifically exempted by the Minister).

Regarding smoking in workplaces, the Victorian government appears to rely on the *Victorian Occupational Health and Safety Act*, asserting that under this legislation employers have a duty to provide a workplace that is free of hazards to the health of employees and those entering the premises. Nonetheless, it remains the case that there is no explicit legislation prohibiting smoking in all enclosed public places and workplaces.

Note also that Victoria has separate regulations for its Australian Formula One and Motorcycle Grand Prix events (*Tobacco (Grand Prix Events) Regulations 2003*) which outline the advertising, promotion and sponsorship details that must be adhered to during these events and short time periods that immediately surround them.

Western Australia

Tobacco Control Act 1990, Tobacco Control Amendment Act 1993

- In conjunction with Commonwealth legislation, prohibit the following activities with regards to tobacco products:
 - published and broadcast advertising
 - sponsorship (Minister may grant an exemption)
 - point of sale advertising regulated and restricted
- Self-serve vending machines are permitted in licensed premises and staff amenity areas.

- Value-added promotions such as free samples and competitions prohibited, but promotions such as free lighters and price discounting permissible.

Health (Smoking in Enclosed Public Places) Regulations 1999 (invoked under the *Health Act 1911*) (effective 29th March 1999)

- Smoking is prohibited in enclosed public places such as restaurants, cafes, and business premises. Exemptions apply to bar or lounge areas of licensed premises where meals not served and area adequately ventilated.
- Smoking permitted in single, separately enclosed areas of licensed restaurants where no meals are served if ventilation is adequate, and in covered outdoor areas of restaurants that are not substantially enclosed.

Occupational Health and Safety Regulations 1996 (invoked under the *Health Act 1911*) (effective 29th March 1999)

- Smoking prohibited in enclosed workplaces.
- Under certain circumstances, employer may establish a 'designated smoking area' where people may smoke, provided it has an effective exhaust system, smoke can not enter any other part of the workplace, and the designated area is not an enclosed public place where smoking is prohibited.

Health (Smoking in Enclosed Public Places) Regulations 2003 (invoked under the *Health Act 1911*)

- The Western Australian government announced a planned phase out of smoking areas in 2003, as follows:
 - Smoking permitted in one bar only in hotels, taverns and other licensed premises by 31st December 2006.
 - Smoke-free restrictions on floor space in nightclubs and cabarets to increase to 80 per cent by 30th June 2004, with nightclubs and cabarets required to be completely smoke-free by 31st December 2006.
 - Removal of the exemption for Burswood Casino gaming floors, with the exception of the International Room. (Due to public pressure, on 26th March 2001 Burswood Casino introduced smoke-free gaming areas on the main gaming floor, such that 50 per cent of gaming machines and cabaret lounge are in smoke-free areas.)