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The alcohol and tobacco use and labour market nexus in South Africa

Lateef Olalekan Bello

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Corresponding author: latbellolamilekan@gmail.com

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Abstract: Substance abuse is a significant public concern for global society. Using the National Income Dynamic Study wave four data, this study applies the multinomial endogenous switching regression technique to examine the impact of substance use (alcohol use and tobacco use) on labour market outcomes in South Africa. This method controls for any potential selection bias and endogeneity problems. The results from the regression (first stage of the multinomial endogenous switching regression) reveal that individuals' decisions to consume alcohol only, tobacco only, and a combination of both are driven by socioeconomic, health, and demographic factors. The estimated average treatment effect (second stage of the multinomial endogenous switching regression) shows that substance use reduces individuals' earnings in almost all cases and increases working hours. The findings suggest that efforts to control the use of alcohol and tobacco in South Africa should focus more on sensitization programmes which address the health, psychological, and economic implications of using these substances.

Key words: alcohol use, tobacco use, labour market outcomes, multinomial endogenous switching regression, South Africa

JEL classification: C21, D12, I15, J21

1 Introduction

Historically and currently, substance abuse[1] (such as the excessive use of alcohol, tobacco, cannabis, and drugs) has been a major public concern in many parts of the world. This has led to the reinforcement of private and government regulations to address its negative impact on individuals' health and community well-being (Cook and Moore 2002). Smoking has been seen worldwide, including in South Africa, as a health risk behaviour that requires preventive measures (Beaglehole et al. 2011; Wacker 2013). Smoking substances such as tobacco and cannabis has a negative effect on human health and is responsible for approximately 5 million deaths around the world each year (WHO 2009).

Tobacco[2] is a substance that is widely consumed by both the poor and the rich, mainly because of the addictive ingredient 'nicotine', which it contains (WHO 2019). Tobacco addiction leads to the substance being abused by users, which in turn has an adverse effect on health and the environment. Although tobacco users vary between being light, moderate, and heavy smokers, consumption of the substance has a consequential effect (such as damage to body organs). According to WHO (2020), direct usage of tobacco has claimed about 7 million deaths globally, while over 1 million deaths result from the environmental effects of smoking (non-smokers being exposed to second-hand smoke). Of the 1.3 billion users of tobacco globally, it is estimated that more than 80 per cent are domiciled in low- and middle-income countries such as South Africa (WHO 2020).

According to Smook et al. (2017), substance abuse prevalence statistics show that South Africa is among the world's top ten narcotic and alcohol abuse centres. In South Africa, alcohol is the most commonly abused substance, followed by cannabis (SACENDU 2012; SADSD 2013). The World Health Organization (WHO) reports on global health status (WHO 2011, 2018) ranked South Africa as the country with the highest alcohol consumption in Africa and one of the world's riskiest alcohol consumption patterns.

The economic impact of substance abuse in any nation cannot be overemphasized. Substance abuse tends to deteriorate people's health, which in turn affects the future potential of young people and the productivity of the labour force. It also increases government spending in the health sector, which may result in economic losses. In South Africa, employers lose millions of rand each year because of substance abuse (Smook et al. 2017). The losses are due to substance abuse among employees, which leads to low productivity, increased absenteeism and medical expenses, errors, accidents, and criminal activities in the workplace. There is an abundant literature on substance abuse in developed countries in Europe and the USA (Gjerde et al. 2010; Neumann 2013) as well as in developing countries in Africa, including South Africa (Lawana and Booysen 2018; Matzopoulos 2014; Peltzer et al. 2011). Some of these studies focus on the inequalities among consumers and the costs of harmful substance use, while others focus on the criminal implications of substance use. However, as there is a paucity of information on the impact of substance use on labour market outcomes in South Africa, this study aims to fill this research gap.

[1] This study focused on alcohol and tobacco only.

[2] Tobacco and cigarettes are used interchangeably in this study.

1.1 Substance use in sub-Saharan Africa

The health burden and negative consequences of substance use for global society have attracted a wide range of empirical studies on how to mitigate its effects on the increasing global population. Many of these studies have been carried out in high-income and developed countries (Bunn et al. 2006; Gjerde et al. 2010; Neumann 2013; Weng et al. 2013). However, recent studies have also emerged from developing and less-developed countries in sub-Saharan Africa.

Adekeye et al. (2015) used a descriptive approach to assess the consumption of alcohol and other substances among tertiary students in private institutions in southwest Nigeria. The results revealed that the prevalence of substance use among the respondents was 81 per cent for cigarettes and 72 per cent for alcohol consumption. Males were also found to consume more alcohol (85 per cent) and cigarettes (83 per cent). In contrast to these findings, Lo et al. (2013) found that alcohol and tobacco use increased among the older-women age group (over 59 years) and respondents with low socioeconomic status in rural western Kenya. Doku et al. (2012) used a logistic regression to analyse the socioeconomic differences in substance use among adolescents in Ghana. The results showed that alcohol use was associated with higher material affluence (measured at the level of resources owned) while the consumption of cannabis and other drugs was linked with lower material affluence. The results further revealed that low levels of father's education and occupation were associated with other drugs' abuse and that binge drinking was linked with a low level of father's education.

Empirical studies in Southern Africa have also shown the extent of the prevalence of substance abuse. Dada et al. (2018) used a multinomial logistic regression to analyse the use of alcohol and other drugs among women seeking substance abuse treatment in the Western Cape province of South Africa. The results indicated that the substance most abused by the respondents was alcohol, followed by methamphetamine. Smook et al. (2017) carried out a situation analysis to assess the nexus of substance use and the workplace in South Africa. The study provided results on limiting factors such as ignorance and identified the requirements for (e.g. workplace policies on substance use) and strengths (e.g. compliance with legal structure by the employers) in combating substance abuse in the workplace. Peltzer and Ramlagan (2007) used a descriptive approach to document the rate and effect of cannabis consumption on individuals in South Africa. The authors found that cannabis use was self-reported by 2 per cent of adults and 7.5 per cent of youths. The socioeconomic and demographic statistics further revealed that the consumption rate of cannabis was higher among males than females, higher among White and Coloured individuals than among other races, and higher in urban than rural areas, and that most users were found in the Gauteng and Western Cape provinces of the country.

Lawana and Booysen (2018) used multiple correspondence and the Erreygers concentration index to analyse the socioeconomic inequalities among men who consumed alcohol in South African informal urban settlements. The study found that alcohol consumption inequality was more pronounced among males aged 15–34 years and 35–44 years. Also, unemployment and being single were found to increase alcohol consumption inequality among males aged 15–34 years and 35–44 years. Peltzer et al. (2011) used the Alcohol Use Identification Test descriptive approach and an adjusted logistic regression to assess the level of alcohol use and drinking problems among South Africans. The results indicated that alcohol was consumed by 41.5 per cent and 17.1 per cent of the sampled men and women, respectively. Among men and women, binge or harmful drinking was reported by 9.17 per cent and 2.9 per cent, respectively. Binge drinking in males was linked with the 20–54 year age group, Coloured racial group, and low financial and education status. In females, harmful drinking was connected to those living in urban settlements, Coloured races, high income, and low education status.

Wilmans and Rashield (2020) applied an ordered probit regression to a panel of five waves of the National Income Dynamics Study (NIDS) data to test the relationship between cigarette smoking and life satisfaction in South Africa. The results revealed that smoking had a statistically significant and negative effect on life satisfaction, suggesting that individuals who smoked were less likely to report higher levels of life satisfaction than non-smokers. The results further showed that smoking was more prevalent among the poor, indicating that recent tobacco control policies (a huge increase in excise duties on cigarettes) in South Africa did not yield the expected result, i.e. a decline in tobacco consumption, especially among the low-income group.

There is limited literature on the performance of the labour force which consumes substances in Africa. It should be noted that most of the existing studies use either descriptive statistics or weak estimation techniques which may result in bias and inconsistent estimates. Information on labour market outcomes of substance users and non-users is vital for formulating government policy for economic growth and an effective health system in Africa. Therefore, this study aims to bridge the research gap by evaluating the impact of substance use (alcohol and smoking) on labour market outcomes in South Africa using the multinomial endogenous switching regression econometric technique.

2 Methodology

2.1 Conceptual and empirical framework

Substance abuse theoretically results from several factors, such as social and peer influence, income effects, and others. Social and environmental influence is one of the major contributors to substance abuse because it links the use of substance with the developmental stage of individuals. The literature on substance abuse (alcohol, tobacco, and other drugs) has found that individuals who start to consume substances regularly at a young age are more likely to abuse them during adulthood than non-users of substances before the age of 20 (Carell et al. 2011; Doku et al. 2012; Flisher et al. 2003).

This study considers substance users to be those individuals who drink and smoke,[3] while those who do not are considered non-users. The simultaneous consumption of substances such as alcohol and cigarettes leads to four possible combinations of decisions that an individual can make. These combinations of choices are: (i) consumption of cigarettes only (A_0C_1); (ii) consumption of alcohol only (A_1C_0); (iii) consumption of both alcohol and cigarettes (A_1C_1); and (iv) non-consumption of substances (i.e. alcohol and cigarettes) (A_0C_0). The combinations of these decisions are presented in Table 1.

However, individuals' final decisions about the choice of substance to consume are based on the expected benefits (leisure/networking, etc.) to be derived given their budget or existing constraints. Being a drinker or a smoker is likely to have a positive or negative labour market outcome. We cannot assume that being a substance user directly affects labour market outcomes. However, individuals' (substance/non-substance users) labour market outcomes may be influenced by inherent factors which can be observable or unobservable. This study models the impact of individuals' decisions about substance use on labour market outcome variables (monthly earnings

[3] Drinking and smoking are used interchangeably as the consumption of alcohol and cigarettes, respectively.

and weekly working hours) using a multinomial endogenous switching regression (MESR) framework.

In an experimental or controlled analysis, the causal effect of substance use on labour market outcomes can be assessed by comparing individuals who make different decisions on the set of options. However, this method is inappropriate for empirical analysis which involves observational data because of the self-selection problem. This is because deciding whether or not to consume a specific combination of substances is determined by the individuals themselves (self-selection). These decisions are usually influenced by unobserved factors, such as demotion and motivation, which might correlate with the labour market outcome variable. For example, a demotion at work will result in a pay cut, and the effect of this on the individual might lead to drinking or smoking. Also, individuals could be motivated to perform extremely well at work (increasing the labour market outcome) and enthusiastically during leisure, causing them to abuse substances.

Another major challenge in econometric impact analysis is missing data for the counterfactual because outcomes (consumption of alcohol only, cigarettes only, both, or none) can only be observed one at a time (Wooldridge 2003). Therefore, the counterfactuals for using each combination of substances for the same person are unobservable. The correlation between unobserved individuals' decisions and labour market outcomes leads to endogeneity problems which result in biased estimates of the outcome variable. To address these econometric challenges which could result in biased estimates, this study applies the endogenous switching regression technique which accounts for both self-selection bias and endogeneity. The method also captures the interaction between different alternatives of substance use and other covariates in the labour market functions.

In evaluating the impact of substance use on labour market outcomes, this study uses the MESR, which comprises two estimation technique stages. In the first stage, the multinomial logit model is used to assess the individuals' substance use combination. In the second stage, the impact on labour market outcomes of each combination of substances is analysed using the ordinary least squares (OLS) regression with a selectivity correction approach, as proposed by Dubin and McFadden (1984) (also referred to as the DM model) and Bourguignon et al. (2007). Bourguignon et al. (2007) posited that the parameter estimates from this approach are consistent and efficient even if the assumption of the independent and irrelevant alternatives is not fulfilled.

Table 1: Individuals' choice of substance use, combination-pooled sample

Choice (s)	Substance combination	Drinking		Smoking		Sample observation	Proportion
		A_0	A_1	C_0	C_1		
1	A_0C_0	✓		✓		2,838	0.5155
2	A_1C_0		✓	✓		1,138	0.244
3	A_0C_1	✓			✓	352	0.0641
4	A_1C_1		✓		✓	972	0.1764
Total						5,300	1

Note: the sample observations are computed using cross-sectional weights.

Source: author's computation based on NIDS data.

2.2 Multinomial logit model (MNL)

Consider an individual i with the primary objective of maximizing utility, U_i, by comparing the net benefits that individual derives by consuming n alternative substance options, including no substances. The individual's requirement to choose substance s over any alternative substance, n, is that $\Delta U_{in} = U_{is} - U_{in} > 0 \quad n \neq s$. Therefore, the index function for modelling the consumption options can be expressed as:

$$U_{is}^{*} = Z_i\beta_s + \mu_{is} \tag{1}$$

where U_{is}^{*} is the latent variable denoting the expected net benefits an individual derives from consuming substance s, Z_i represents observed exogenous variables (socioeconomic, health, location characteristics, among others), and β_s is the parameter associated with Z_i, which remains constant across alternatives. The parameter μ_{is} is an error term which captures the measurement of intrinsically random choice behaviour and the unobserved attributes of the other combinations.

If C is the index of an individual choice of substance, then:

$$C = \begin{cases} 1 \; if \; Ui_1^{*} > \max\,(U_{\text{in}}^{*}) \; or \; \vartheta_{i1} < 0 \\ \qquad\qquad for \; all \; n \neq s \\ s \; if \; U_{\text{is}}^{*} > \max\,(U_{\text{in}}^{*}) \; or \; \vartheta_{is} < 0 \end{cases} \tag{2}$$

According to Bourguignon et al. (2007), the index function in equation (2) implies that the i^{th} individual will use substance s if, and only if, s gives the individual the greatest expected benefit over any other alternative combination or substance n. Thus, $n \neq s$ if $\vartheta_{is} = \max\,(U_{is}^{*} - U_{in}^{*}) > 0$. Assuming the error term (μ_{is}) has an identical and independent Gumbel distribution, then the probability that an i^{th} individual will consume substance s can be expressed by a multinomial logit model, as indicated by McFadden (1973):

$$P_{is} = P_r\,(\vartheta_{is} < 0/Z_i) = \frac{\exp(Z_i\beta_s)}{\sum_{n=1}^{S}\exp\,(Z_i\beta_n)} \tag{3}$$

The parameters of the latent variable model are estimated using the maximum likelihood function.

2.3 Multinomial endogenous switching regression (MESR)

The study uses the OLS regression with selectivity correction in the second stage of the MESR to examine the relationship between the labour market outcome (earnings and working hours) and a set of exogenous variables for the selected choice of substance combinations. The substance use combinations, as indicated in Table 1, are the reference category, non-consumption of any substance (A_0C_0) represented as $s = 1$, alcohol only $s = 2$, cigarettes only $s = 3$, and both alcohol and cigarette consumption $s = 4$. The labour market outcome equation for each possible regime s is expressed as:

$$\begin{cases} Regime\ 1: L_{1_i} = \beta_1 X_{1_i} + \varphi_{i1}\ if\ C = 1 \\ \qquad\qquad : \qquad\qquad s = 2,3,4 \\ Regime\ S: L_{is} = \beta_S X_i + \varphi_{is}\ if\ C = S \end{cases} \tag{4}$$

where $(L_{is}'s)$ is the labour market outcome indicators of an i^{th} individual in regime s, $\beta's$ are the vectors of parameters, $X_i's$ are the set of exogenous covariates and φ_{i1} and φ_{is} are the random disturbance terms. The error terms $(\varphi_{is}'s)$ have distributions $E\,(\varphi_{is}|Z,X) = 0$ and var $(\varphi_{is}|Z,X) = \sigma_s^2$. where Z are observed variables from equation 1. In this case, L_{is} is observed if, and only if, a combination of substance s is used, where $U_{is}^* > max_{n\neq s}\,(U_{in}^*)$. The error term (φ_{is}) comprises unobserved individual effects and a random error term. Thus, if the error terms of substance use combinations $(\mu_{is}'s)$ and outcome $(\varphi_{is}'s)$ equations are not independent, the OLS estimates in equation (4) will be biased. Consistency in the estimation of β_s requires including the selection correction terms of the alternative combinations in equation (4). The DM model of linearity assumption is specified as:

$$E\,(\mu_{is}|\varphi_{i1} \dots \dots \varphi_{is}) = \sigma_s \textstyle\sum_{n\neq s}^{s} r_s\,(\varphi_{in} - E(\varphi_{in})) \tag{5}$$

With $\sum_{n=1}^{s} r_s = 0$, i.e. the correlation between $\varphi_{is}'s$ and $\mu_{is}'s$ sums up to zero by construction. Therefore, using this assumption, the MESR can be specified as:

$$\begin{cases} Regime\ 1: L_{1_i} = \beta_1 X_{1_i} + \sigma_1 \lambda\!\!\!^{-}_1 + \theta_{i1}\ if\ C = 1 \\ \qquad\qquad : \qquad\qquad s = 2,3,4 \\ Regime\ S: L_{iS} = \beta_s X_i + \sigma_s \lambda\!\!\!^{-}_s + \theta_{is}\ if\ C = S \end{cases} \tag{6}$$

where φ_{pi} is the error term with an expected value of zero, σ_s is the covariance between $\mu_{is}'s$ and $\varphi_{is}'s$, and $\lambda\!\!\!^{-}_s$ is the inverse mills ratio (IMR) computed from the estimated probabilities in equation (4). The IMR $(\lambda\!\!\!^{-}_s)$ is given as follows:

$$\lambda\!\!\!^{-}_s = \textstyle\sum_{n\neq s}^{s} \rho_s \left[\left[\frac{\hat{P}_{i_n} \ln(\hat{P}_{i_n})}{1-\hat{P}_{i_n}} + \ln(\hat{P}_{is})\right]\right] \tag{7}$$

where ρ is the correlation between $\mu_{is}'s$ and $\varphi_{is}'s$ and the error terms $\theta_{is}'s$ have expected zero value. Heteroscedasticity could occur when generating the regressor $\lambda\!\!\!^{-}_s$ for the IMR, which is due to the two-stage estimation procedure. However, this was accounted for by bootstrapping the standard errors in equation (6). Conversely, to avoid biased estimates of the IMR, it is vital for the explanatory variables in the MNL to include at least a selection instrument, apart from those automatically generated by the non-linearity of the selection model of substance combinations for the identification of the outcome equation (equation (6)). In this study, an instrumental variable (religion) is included in the MNL model but is excluded from the labour market outcome equation (equation (6)). Religion is known to influence individuals' way of life. Different religious groups

have their own beliefs about how to live. Therefore, individuals may decide to consume substances based on their faith or on the anticipated benefit to be derived from it. Thus, religion may not affect labour market outcomes directly (earnings and working hours) except through a substance combination chosen by an individual. For example, individuals may decide not to work in an establishment or at a particular time due to their religious beliefs.

2.4 Estimation of average treatment effect

The MESR framework described above is used to estimate the average treatment effects by comparing the expected values of the outcomes of the treated (consumers) and untreated (non-consumers) of substances in an actual and counterfactual situation, which can be specified as follows.

Actual substance consumption observed in the sample (substance users):

$$\begin{cases} E(L_{i2}|C=2) = \beta_2 X_{2_i} + \sigma_2 \lambda_2 & (7a) \\ \vdots & \\ E(L_{is}|C=S) = \beta_s X_{si} + \sigma_s \lambda_s & (7b) \end{cases} \tag{7}$$

Counterfactual expected outcomes (substance users, if they decide not to consume a substance):

$$\begin{cases} E(L_{i1}|C=2) = \beta_1 X_{2_i} + \sigma_1 \lambda_2 & (8a) \\ \vdots & \\ E(L_{i1}|C=S) = \beta_1 X_{si} + \sigma_1 \lambda_s & (8b) \end{cases} \tag{8}$$

Equations (7) and (8) are the expected observed and counterfactual outcomes, respectively. Thus, these expected values are used to derive unbiased estimates of the ATT. The ATT is therefore calculated as the difference between equation 7a/7b and equation 8a/8b. The ATT is specified as:

$$ATT = E(L_{i2}|C=2) - E(L_{i1}|C=2) = X_{2_i}(\beta_2 - \beta_1) + \lambda_2(\sigma_2 - \sigma_1) \tag{9}$$

From equation (9), the expected difference in the average outcome variable if substance users have similar characteristics and resources to non-users is captured by the first term (X_{s_i}) on the right-hand side of equation (9). The second term (λ_s) is the selection term which corrects for selection bias and endogeneity which originates from unobserved heterogeneity.

3 Data collection

The study uses the data from the NIDS[4] survey wave four (SALDRU 2016), which was conducted between September 2014 and August 2015 across all nine South Africa provinces. The sampled respondents consisted of members of private/local households, workers' residences, convents, and monasteries. Individuals living in accommodation such as student hostels, homes for the elderly, hospitals, prisons, and military barracks were excluded from the survey. A total of 5,300 respondents aged between 18 and 65 years were extracted from the data. The study sample size was restricted to this age group because it focuses on substance use and labour market outcomes (earnings and working hours). Thus, the respondents selected for this study are those who are part of the labour force and are therefore employed and legally permitted to consume alcohol and

[4] Additional details on the survey can be obtained from SALDRU (2016).

cigarettes. Cross-sectional weights[5] were constructed to make the data representative of the population of South Africa.

Figure 1: Map of South Africa

Source: map by Htonl, reproduced under the Creative Commons license CC BY-SA 3.0.

4 Results and discussion

4.1 Descriptive statistics

Table 2 presents the mean socioeconomic, health, race, and demographic characteristics of the sampled respondents. Unlike many previous studies, a mean comparison test (t-test) of the independent variables between each combination of substance (users) and non-users (A_0C_0) was performed under the assumption of unequal variances. This was done to ensure that there was a significant difference between both groups and, thus, to validate the need for evaluation of the study's econometric technique.

[5] Details of the cross-sectional weights used in the data can be obtained from Branson and Wittenberg (2019).

Table 2: Descriptive and summary statistics of sampled respondents

Variable descriptions	Mean values of substance combination				Sample means		
	A_0C_0	A_1C_0	A_0C_1	A_1C_1	Pooled	Male	Female
	N=2,838	*N*=1,138	*N*=352	*N*=972	*N*=5,300	*N*=2,692	*N*=2,608
Socioeconomic characteristics							
Age (years)	38.64	37.12[a]	35.29	36.38[a]	38.94	38.95	38.93
Gender (male = 1)	0.32	0.61[a]	0.74[a]	0.86[a]	0.56		
High school education (dummy = 1)	0.08	0.05[a]	0.11[c]	0.13[a]	0.06	0.07	0.05
Tertiary education (dummy = 1)	0.36	0.38[a]	0.21[a]	0.22[a]	0.41	0.39	0.44
Marital status (married = 1)	0.02	0.02	0.02	0.01	0.03	0.04	0.02
Computer literate (dummy = 1)	0.52	0.64[a]	0.45[a]	0.49[a]	0.63	0.62	0.64
Religion (dummy = 1)	0.96	0.91[b]	0.89[a]	0.86[a]	0.93	0.90	0.96
Health Characteristics							
Good health (dummy = 1)	0.95	0.96[a]	0.95	0.94	0.95	0.95	0.94
Fair health (dummy = 1)	0.05	0.04[a]	0.04	0.05[a]	0.05	0.04	0.05
Poor health (dummy = 1)	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Hypertension (dummy = 1)	0.10	0.10	0.09	0.07[a]	0.09	0.08	0.12
Asthma (dummy = 1)	0.02	0.02	0.01	0.01	0.02	0.01	0.04
Diabetes (dummy = 1)	0.03	0.03	0.02	0.02	0.03	0.04	0.03
Tuberculosis (dummy = 1)	0.03	0.03	0.06[b]	0.05[a]	0.03	0.03	0.02
Demographic characteristics							
Race							
African (dummy = 1)	0.87	0.78	0.54[a]	0.63[a]	0.76	0.76	0.77
White (dummy = 1)	0.01	0.06[a]	0.05[c]	0.04[c]	0.10	0.11	0.10
Coloured (dummy = 1)	0.11	0.15[b]	0.39[a]	0.31[a]	0.10	0.09	0.11
Indian (dummy = 1)	0.01	0.01[b]	0.02[c]	0.02	0.04	0.04	0.03
Location							
Western Cape (dummy = 1)	0.05	0.07	0.17[a]	0.12[a]	0.07	0.07	0.07
Eastern Cape (dummy = 1)	0.05	0.07[b]	0.04	0.05	0.06	0.06	0.06
Northern Cape (dummy = 1)	0.03	0.06[b]	0.07	0.07[a]	0.10	0.01	0.01
Free state (dummy = 1)	0.03	0.06[a]	0.03	0.05	0.03	0.03	0.03
KwaZulu-Natal (dummy = 1)	0.19	0.10[a]	0.13	0.11[a]	0.13	0.12	0.14
Northwest (dummy = 1)	0.04	0.04	0.04	0.03	0.04	0.05	0.03
Mpumalanga (dummy = 1)	0.05	0.06	0.03[c]	0.04	0.05	0.05	0.05
Limpopo (dummy = 1)	0.06	0.04	0.01[a]	0.04[c]	0.05	0.05	0.06
Gauteng (dummy = 1)	0.11	0.11	0.10	0.09[b]	0.23	0.23	0.22

Note: SD is standard deviation [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

The findings from Table 2 reveal that there are significant differences among substance users and non-users in almost all the variables included in the table. The mean age of the sampled respondents is 38 years. This indicates that most of the sampled respondents are in their youthful, energetic, and productive period of life. Middle-aged individuals are expected to be vibrant and to make an enormous contribution to the working environment. About 56 per cent of the respondents are male. However, there is a statistically significant difference by gender for both groups. Most non-users are female (68 per cent), whereas substance users are primarily male (ranging from 61 to 86 per cent).

Education is the foundation for individuals to learn about the predominant activities in society and around the world. About 7 per cent and 39 per cent of the respondents have high school and tertiary education, respectively. However, females have more tertiary education than males (44 per cent vs 39 per cent).

Technological innovation such as computers and the internet has made learning and the acquisition of information available to people in different parts of the world. There is a statistically significant difference for the computer literate variable between smokers and drinkers and their counterparts. More than half (63 per cent) of the sampled respondents are computer literate.

The religion variable is statistically significant in both groups. About 93 per cent of the sampled respondents have an affiliation with the religious organization (such as Islam, Christianity, Hinduism, Traditional, etc.) that they worship. About 95 per cent, 5 per cent, and 2 per cent of the respondents have good, fair, and poor health, respectively. Substance usage is a significant cause of some chronic diseases which lead to poor health conditions or death. Hypertension, asthma, diabetes, and tuberculosis are reported by 9 per cent, 2 per cent, 3 per cent, and 3 per cent of the respondents, respectively. There is a statistically significant difference for the race variable between substance users and non-users. The sampled respondents comprise 76 per cent, 10 per cent, 10 per cent, and 4 per cent of Africans, Whites, Coloured (mixed race), and Indian races. The majority (23 per cent) of the respondents reside in Gauteng province, while the least (3 per cent) live in the Free State province.

4.2 Determinants of substance use—multinomial logit model (MNL)

The results of the MNL used to explain the factors that influence substance use are presented in Tables 3, 4, and 5 for the pooled, male, and female samples, respectively. The base/reference category is non-consumption of substance (A_1C_0) against which results are compared. Marginal effect parameter estimates were used in the study because they are more suitable for interpreting the magnitudes in a probability model (Bello et al. 2020). The results from the Wald test $[x^2(69) = 902.18; p = 0.000]$ (pooled), $[x^2(69) = 322.22; p = 0.000]$ (males), and $[x^2(69) = 760.82; p = 0.000]$ (females) indicate that the model fits the data, and the coefficients of the variables jointly differ from zero.

Table 3: MNL estimates of the determinants of substance use versus no use, pooled sample

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	ME	SE	ME	SE	ME	SE
Socioeconomic characteristics						
Age (years)	0.004[a]	0.0006	-0.0003	0.0004	0.002[a]	0.0006
High school education (dummy = 1)	-0.041	0.026	0.002	0.012	0.093[a]	0.018
Tertiary education (dummy = 1)	0.012	0.013	-0.027[a]	0.009	-0.066[a]	0.013
Marital status (dummy = 1)	0.001	0.044	0.021	0.025	-0.093[c]	0.053
Computer literate (dummy = 1)	-0.051[a]	0.013	-0.021[a]	0.008	-0.017	0.012
Religion (dummy = 1)	-0.069 [a]	0.021	-0.040 [a]	0.011	-0.132[a]	0.016
Health characteristics						
Good health (dummy = 1)	0.103	0.078	-0.038	0.030	-0.007	0.058
Fair health (dummy = 1)	0.073	0.083	-0.041	0.034	0.045	0.063
Hypertension (dummy = 1)	0.069[a]	0.020	-0.020	0.013	-0.055[a]	0.021
Asthma (dummy = 1)	0.026	0.040	-0.018	0.028	-0.138[a]	0.052
Diabetes (dummy = 1)	-0.043	0.042	0.001	0.022	-0.015	0.038
Tuberculosis (dummy = 1)	0.011	0.307	0.022	0.015	0.052[b]	0.025
Demographic characteristics						
Race						
African (ref category)	0.104[a]	0.066	-0.071[a]	0.024	-0.140[a]	0.044
White (dummy = 1)	0.291[a]	0.072	-0.0007	0.029	0.020	0.052

Coloured (dummy = 1)	0.073	0.068	-0.004	0.025	0.002	0.045
Location						
Western Cape (dummy = 1)	-0.004	0.024	0.025[b]	0.011	0.018	0.019
Eastern Cape (dummy = 1)	0.029	0.024	-0.009	0.017	-0.012	0.024
Northern Cape (dummy = 1)	0.044	0.026[c]	-0.004	0.015	0.010	0.023
KwaZulu-Natal (dummy = 1)	-0.105	0.019	-0.003	0.011	-0.045[a]	0.017
Northwest (dummy = 1)	-0.013	0.030	0.026	0.018	0.011	0.029
Mpumalanga (dummy = 1)	0.014	0.025	-0.009	0.020	-0.005	0.026
Limpopo (dummy = 1)	0.016[b]	0.008	-0.063[b]	0.031	-0.009	0.028
Gauteng (ref category)	-0.020	0.019	0.020	0.012	0.001	0.019
Wald chi^2 [$x^2(69) = 902.18$; *p=0.000*]						
Number of observations = 5,300						

Note: ME is marginal effects; SE is standard error. [a], [b] and [c] denote significance level at 1%, 5% and 10%, respectively.

Source: author's computation based on NIDS data.

The estimated marginal effect of age is positive and statistically significant for drinking only **(**A_1C_0**)** and usage of both substances **(**A_1C_1**)**. The results suggest that older individuals are more likely to drink and consume both substances than young individuals. Conversely, a positive correlation of age with drinking is found in both the male and female models. However, older males are more likely to consume both alcohol and tobacco than young adult males. In contrast to this result, Barrett (2002) reported that the elderly are less likely to drink in Australia. However, this finding is similar to that of Peltzer et al. (2011) who found a positive association of alcohol with age in South Africa.

Tertiary education is the only education variable which statistically significantly influences all choices of substance consumption. Individuals with tertiary education are less likely to consume both substances and to smoke than uneducated individuals or those with lower qualifications. However, high school education increases the likelihood of both tobacco and alcohol consumption. The disparity between high school and tertiary education results may be because individuals with tertiary education are more enlightened about (i.e. have exposure to and advanced knowledge of) the effects of alcohol and tobacco use than individuals with higher school education. The significant positive association of education with drinking only is in line with Reena (2009) and Lye and Hirschberg (2010) but disagrees with Wolaver (2007) and Barett (2002). Computer literacy decreases the likelihood of drinking and smoking only. Being computer literate may make an individual more aware (through information from the internet) of the adverse effects of substance consumption. However, the positive relationship between drinking only and computer literacy (in both the male and female MNL models) may also be due to online advertisements which promote alcohol use and can influence individuals' decisions. This may also be one of the factors which influence substance usage among individuals with high school education. Contrary to this result, Doumas and Hannah (2008) reported a significant decrease in drinking among participants in a web-based alcohol feedback programme. Religion is found to decrease the likelihood of consuming all substance combinations (A_0C_1, A_1C_0**,** A_1C_1). Religious beliefs may influence individuals' decisions to consume a substance because most religions disapprove of substance usage.

Marriage comes with a significant level of responsibility and commitment as both male and female individuals have a different role (e.g., childbearing, bill payment, etc.) to discharge in the union. However, there are many single parents in South Africa. This study also confirms this, as just 3 per cent of the sampled respondents are married. The marital status variable is found to be negative

and statistically significant for both smoking and drinking. This means that being married significantly reduces the likelihood of both smoking and drinking. A plausible explanation for this is that married individuals can easily advise or caution themselves about the side effects of substance use. Also, married couples with children will want to lay a good legacy for their children, which may make them decide not to consume substances. This result agrees with those of Barrett (2002) and Lawana and Booysen (2018).

The results further show that the African racial group statistically influences all combinations of substances (A_1C_0, A_0C_1, A_1C_1). This suggests that Africans are less likely to smoke and consume both substances. Africans and the Whites racial group are more likely to drink only. However, the likelihood of drinking only is more pronounced among Whites. This may be because most White South Africans are the wealthiest race in the country and have more income to purchase alcohol. This finding is in line with that of Wilmans and Rashield (2020) for South Africa specifically.

Consumption of substances like alcohol and cigarettes is known to be one of the causes of diseases such as diabetes, tuberculosis, and hypertension (also known as high blood pressure) (WHO 2018). Surprisingly, tuberculosis has a positive and statistically significant relationship with both substance combinations (A_1C_1). Females with tuberculosis are also found to be more likely to smoke only. The hypertension variable is found to decrease the likelihood of consumption of both substances and is significantly but positively correlated with drinking only. Unfortunately, using these substances while suffering from an acute or chronic disease can lead to more secondary disease, thereby causing an untimely death. This places a burden on the health system and the employers of these individuals because they will be less productive at work and increase the healthcare budget (Bouchery et al. 2011).

The likelihood of smoking (A_0C_1) and drinking (A_1C_1) is higher in three of the nine provinces included in the model. This is not surprising because South Africa is one of the major countries in the world with a high consumption rate of substances such as alcohol and cigarettes. There is a positive correlation between the Western Cape province and smoking only. This suggests that individuals who reside in Western Cape are more likely to smoke. However, individuals who reside in the Limpopo and KwaZulu-Natal provinces are less likely to smoke only (A_0C_1) and consume both substances (A_1C_1). A plausible explanation for this is that there are more remote areas or villages in both the Limpopo and KwaZulu-Natal provinces, where most individuals are brought up in cultures which consider smoking to be an immoral act. This result is similar to that of Wilmans and Rashield (2020).

Table 4: MNL estimates of the determinants of substance use versus no use, males sample

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	ME	SE	ME	SE	ME	SE
Socioeconomic characteristics						
Age (years)	0.002[b]	0.0009	-0.001[c]	0.0006	0.002[a]	0.0009
High school graduate (dummy = 1)	-0.080[b]	0.038	-0.016	0.021	0.138[a]	0.031
Tertiary education (dummy = 1)	-0.040[b]	0.019	-0.017	0.014	-0.089[a]	0.010
Marital status (dummy = 1)	0.037	0.063	0.023	0.037	-0.552	10.77
Computer literate (dummy = 1)	0.055[b]	0.019	-0.007	0.008	-0.053[a]	0.020
Religion (dummy = 1)	-0.025	0.026	-0.035[a]	0.013	-0.090[a]	0.026
Health characteristics						
Good health (dummy = 1)	0.029	0.106	-0.063	0.050	0.023	0.101
Fair health (dummy = 1)	-0.047	0.116	-0.085	0.058	0.129	0.109
Hypertension (dummy = 1)	0.074[b]	0.033	-0.03827	0.025	-0.036	0.037
Asthma (dummy = 1)	0.006	0.081	0.012	0.054	-0.161	0.101
Diabetes (dummy = 1)	-0.053	0.064	-0.0003	0.040	-0.064	0.067
Tuberculosis (dummy = 1)	-0.061	0.042	-0.003	0.027	0.061	0.042
Demographic characteristics						
Race						
African (dummy = 1)	0.169[c]	0.090	-0.062	0.040	-0.130[c]	0.074
White (dummy = 1)	0.320[a]	0.099	-0.024	0.051	0.035	0.931
Coloured (dummy = 1)	0.062	0.093	- 0.026	0.043	0.007	0.077
Location						
Western Cape (dummy = 1)	0.004	0.037	0.057[a]	0.019	-0.014	0.035
Eastern Cape (dummy = 1)	0.081[b]	0.035	-0.010	0.028	-0.041	0.041
Northern Cape (dummy = 1)	0.055	0.040	-0.033	0.032	0.022	0.042
KwaZulu-Natal (dummy = 1)	-0.069[b]	0.028	0.013	0.018	-0.054[c]	0.028
Northwest (dummy = 1)	-0.042	0.044	0.031	0.028	0.008	0.046
Mpumalanga (dummy = 1)	0.020	0.035	-0.018	0.030	-0.023	0.411
Limpopo (dummy = 1)	-0.007	0.042	-0.081[c]	0.045	0.009	0.046
Gauteng (ref category)	-0.028	0.029	0.028	0.019	-0.016	0.031
Wald chi^2 [$x^2(69) = 332.22$; *p=0.000*]						
Number of observations = 2,692						

Note: ME is marginal effects; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table 5: MNL estimates of the determinants of substance use versus no use, females sample

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	ME	SE	ME	SE	ME	SE
Socioeconomic characteristics						
Age (years)	0.005[a]	0.001	-0.0001	0.0003	0.001	0.0004
High school graduate (dummy = 1)	-0.011	0.035	0.007	0.012	0.015	0.016
Tertiary education (dummy = 1)	0.011	0.017	-0.034[a]	0.010	-0.017[c]	0.010
Marital status (dummy = 1)	0.214	31.925	-0.326	77.245	-0.552	10.77
Computer literate (dummy = 1)	0.041[b]	0.018	-0.007	0.008	0.002	0.010
Religion (dummy = 1)	-0.042	0.039	0.001	0.020	0.002	0.024
Health characteristics						
Good health (dummy = 1)	0.192	0.139	-0.039	0.036	-0.031	0.048
Fair health (dummy = 1)	0.195	0.142	-0.018	0.038	-0.002	0.050
Hypertension (dummy = 1)	0.069[a]	0.023	-0.004	0.010	-0.013	0.014
Asthma (dummy = 1)	0.032	0.041	-0.011	0.022	-0.020	0.041
Diabetes (dummy = 1)	-0.046	0.055	0.003	0.020	0.011	0.025
Tuberculosis (dummy = 1)	-0.014	0.044	0.034[b]	0.013	0.012	0.020
Demographic characteristics						
Race						
African (dummy = 1)	0.088	0.102	-0.094[a]	0.026	-0.082[b]	0.034
White (dummy = 1)	0.292[a]	0.107	0.011	0.026	0.021	0.036
Coloured (dummy = 1)	0.114	0.104	0.002	0.025	0.011	0.034
Location						
Western Cape (dummy = 1)	-0.011	0.030	0.005	0.009	0.020[c]	0.011
Eastern Cape (dummy = 1)	-0.025	0.032	-0.012	0.017	0.011	0.017
Northern Cape (dummy = 1)	0.034	0.032	0.005	0.010	0.008	0.013
KwaZulu-Natal (dummy = 1)	-0.126[a]	0.027	0.008	0.017	-0.019	0.020
Northwest (dummy = 1)	0.179	22.579	0.113	15.416	-0.674	89.22
Mpumalanga (dummy = 1)	0.259	23.746	-0.320	59.835	-0.558	78.79
Limpopo (dummy = 1)	0.225	22.792	-0.301	57.640	-0.549	75.50
Gauteng (ref category)	-0.018	0.025	0.006	0.019	0.012	0.018
Wald chi^2 [$x^2(69) = 760.82$; *p=0.000*]						
Number of observations = 2,608						

Note: ME is marginal effects; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

4.3 Impact of substance use on labour market outcomes

The MESR (second stage regression) results are presented in the Appendix. The bottom part of the MESR model (Appendix Tables A1 to A6) shows that most of the estimated coefficient of correlation (λ) between the substance combination choice equation and the labour market outcome function is statistically and significantly different from 0. This suggests that observed and unobserved factors may influence the impact of substance usage combinations on labour market outcomes.

The conditional average effects (also known as the average treatment effect on the treated (ATT)) of the choice of substance usage combinations by individuals who consume substances was

estimated by comparing the outcome variables for individuals who had consumed any of the substance combination choices with the outcome variables of the same individuals if they had decided not to consume substance. The ATTs are the predicted outcomes from the MESR and are generated by applying equation (9). The estimated ATT results from the MESR are presented in Table 6.

Table 6: Impact of substance use on labour market outcomes, MESR

Labour market outcome	Substance combination (s)	Consumption status		Average treatment effects (ATT)
		Users(s=2,3,4)	Non-users (s=1)	
		(1)	(2)	(3) = (1) – (2)
Pooled sample				
Earnings (rands)	A_1C_0	4,065.36 (79.98)	4,341.07 (80.47)	-275.71[a] (29.39)
(monthly)	A_0C_1	3,228.62 (108.52)	3,579.51 (139.88)	-350.89[a] (65.87)
	A_1C_1	3,322.36 (62.61)	3,366.17 (69.62)	-43.82[c] (26.56)
Working hours	A_1C_0	41.81 (0.08)	40.43 (0.08)	1.38[a] (0.07)
(weekly)	A_0C_1	41.39 (0.19)	40.04 (0.15)	1.35[a] (0.21)
	A_1C_1	42.31 (0.10)	40.18 (0.09)	2.13[a] (0.10)
Males				
Earnings (rands)	A_1C_0	4,878.52 (113.54)	4,971.72 (108.06)	-93.20[c] (55.48)
(monthly)	A_0C_1	3,341.55 (135.67)	4,376.56 (171.52)	-1035.01[a] (113.25)
	A_1C_1	3,302.02 (64.97)	4,063.11 (77.07)	-761.09[a] (36.81)
Working hours	A_1C_0	43.08 (0.30)	43.49 (0.20)	-0.41 (0.33)
(weekly)	A_0C_1	43.97 (0.12)	43.37 (0.11)	0.60 (0.74)
	A_1C_1	43.01 (0.11)	43.65 (0.11)	-0.64[a] (0.15)
Females				
Earnings (rands)	A_1C_0	3,757.11 (126.41)	3,807.59 (130.08)	-50.48 (43.77)
(monthly)	A_0C_1	3,311.00 (366.67)	3,395.25 (332.77)	-84.25 (136.06)
	A_1C_1	3,517.67 (205.50)	3,736.09 (260.10)	-218.42[c] (123.65)
Working hours	A_1C_0	38.83 (0.17)	39.00 (0.15)	-0.17 (0.16)
(weekly)	A_0C_1	37.23 (0.74)	38.12 (0.39)	-0.89 (0.73)
	A_1C_1	39.58 (0.73)	38.30 (0.28)	1.28[c] (0.69)

Note: [a] and [c] denote significance level at 1% and 10%, respectively. Standard errors are in parentheses.

Source: author's computation based on NIDS data.

The results from the pooled sample indicate a negative impact of the three substance combinations (A_0C_1, A_1C_0, A_1C_1) on earnings. The mean earnings for individuals who consume cigarettes only (A_0C_1), alcohol only (A_1C_0), and both substances (A_1C_1) reduced by R275.71, R350.89, and R43.82, respectively. The reduction in earnings of substance users is in line with expectations because substance users may be limited to working in environments where there are strict restrictions on the consumption of substances. The greatest reduction in earnings among the combinations of substances used is in smoking only (A_0C_1). This is not surprising because smokers cannot work in some firms. For example, an addicted or average smoker will smoke every two to five hours during the day and will not spend less than five minutes smoking. However, some workplaces (such as factories, oil firms) do not permit employees to leave work at intervals or to smoke in the workplace. This therefore limits the opportunities for smokers to be employed in a suitable firm with high pay. This result is consistent with the findings of Bunn et al. (2006) and Wacker et al. (2013) who showed that productivity loss (decreased income) was more pronounced among smokers than non-smokers in the USA and Germany. However, this finding disagrees with

some empirical studies (i.e. Barrett 2002; Lee 2003; Lye and Hirschberg 2010; Peters 2004; van Ours 2004) which reported a positive effect of alcohol on earnings.

Surprisingly, the combinations of all substances (A_0C_1, A_1C_0, A_1C_1) have a positive and significant impact on individuals' working hours. A plausible explanation for this could be that substance users work extra hours (overtime) if they are employed in low-paying jobs. This result contrasts with the findings of Neuman (2013) who, using a fixed-effects approach, reported that smoking and drinking reduced the working hours of young adults in the USA. However, our study includes both young adults and employed adults.

The negative impact of the three combinations of substance use on earnings is similar for both males and females. However, unlike for males, a positive and significant effect of both drinking and smoking on working hours was found for females. As there are many single mothers in South Africa, these women are also known to be responsible for household needs. Thus, this might lead to an increase in the working hours of female substance users.

5 Conclusions and policy recommendations

Most of the empirical studies on substance use and labour market outcomes are from high-income and developed countries, and there is little or no information for developing countries, especially in Africa. This study contributes to the literature by evaluating the impact of substance use on labour market outcomes in South Africa by considering individuals' decisions on no substance use, smoking only, drinking only, and the combination of both smoking and drinking. This study used the MESR model to correct for any endogeneity and sample selection bias which might result from observed and unobserved heterogeneity. The multinomial logit model results reveal that the consumption of substances is influenced by socioeconomic, health, and demographic characteristics. Furthermore, the ATT effects show that the combination of the use of all substances significantly reduces individuals' earnings. However, the combination of the use of all substances was found to significantly increase the working hours of individuals.

This study's findings have important policy implications for the control of alcohol and cigarette consumption in South Africa. For instance, the statistically significant effects of education, computer literacy, and marital status on both drinking and smoking suggest the following. First, increased government spending on education could be an essential avenue for the control of substance use. The high school education curriculum could include subjects which extensively discuss substance use and this could help to prepare the minds of young individuals about its adverse effects. Second, awareness of the effects of using substances could be publicized through electronic billboards and media (television, radio, and social networks) as a large proportion of the population now use smartphones. Third, the advocacy of marriage by both governmental and non-governmental agencies could also improve the control of substance use. Overall, the findings suggest that policies for controlling substance use should focus more on sensitization programmes which address the health, psychological, and economic implications of drinking and smoking.

This study has some data limitations which could be further explored. As the levels of alcohol and tobacco consumption (i.e. light, moderate, and heavy) were not available for both substances. the study analysed the impacts of all users of these substances (irrespective of their level of usage) on labour market outcomes (earnings and working hours). Therefore, further studies could explore the relationship between the level of substance usage and the impact on labour market outcomes.

References

Adekeye, O.A., S.O.Adeusi, O. Chenube, F.O. Ahmadu, and M.A. Sholarin (2015). 'Assessment of Alcohol and Substance Use Among Undergraduates in Selected Private Universities in Southwest Nigeria'. *IOSR Journal of Humanities and Social Science*, 20(3): 1–7.

Barrett, G. (2002). 'The Effect of Alcohol Consumption on Earnings'. *Economic Record*, 78: 79–96. https://doi.org/10.1111/1475-4932.00041

Beaglehole, R., R. Bonita, R. Horton, C. Adams, G. Alleyne, P. Asaria, V. Baugh, H. Bekedam, N. Billo, S. Casswell, and M. Cecchini et al. (2011). 'Priority Actions for the Non-communicable Disease Crisis'. *The Lancet*, 377(9775): 1438–47. https://doi.org/10.1016/S0140-6736(11)60393-0

Bello, L.O., L.J. Baiyegunhi, and G. Danso-Abbeam (2020). 'Productivity Impact of Improved Rice Varieties' Adoption: Case of Smallholder Rice Farmers in Nigeria'. *Economics of Innovation and New Technology*, 1-17. https://doi.org/10.1080/10438599.2020.1776488

Bouchery, E.E., H.J. Harwood, J.J. Sacks, C.J. Simon, and R.D. Brewer (2011). 'Economic Costs of Excessive Alcohol Consumption in the U.S., 2006'. *American Journal of Preventive Medicine*, 41(5): 516–24. https://doi.org/10.1016/j.amepre.2011.06.045

Bourguignon, F., M. Fournier, and M. Gurgand (2007). 'Selection Bias Corrections Based on the Multinomial Logit Model: Monte-Carlo Comparisons'. *Journal of Economic Surveys*, 21(1): 174–205. https://doi.org/10.1111/j.1467-6419.2007.00503.x

Branson, N., and M. Wittenberg (2019). 'Longitudinal and Cross-sectional Weights in the NIDS Data 1-5'. Technical Paper 9. Cape Town: SALDRU, UCT.

Bunn III, W.B., G.M. Stave, K.E. Downs, J.M.J. Alvir, and R. Dirani (2006). 'Effect of Smoking Status on Productivity Loss'. *Journal of Occupational and Environmental Medicine*, 48(10): 1099–108. https://doi.org/10.1097/01.jom.0000243406.08419.74

Carrell, S.E., M. Hoekstra, and J.E. West (2011). 'Does Drinking Impair College Performance? Evidence from a Regression Discontinuity Approach'. *Journal of Public Economics,* 95(1–2): 54–62. https://doi.org/10.1016/j.jpubeco.2010.08.008

Cook, P.J., and M.J. Moore (2002). 'The Economics of Alcohol Abuse and Alcohol-control Policies'. *Health Affairs*, 21(2): 120–33. https://doi.org/10.1377/hlthaff.21.2.120

Dada, S., N.H. Burnhams, R. Laubscher, C. Parry, and B. Myers (2018). 'Alcohol and Other Drug Use Among Women Seeking Substance Abuse Treatment in the Western Cape, South Africa'. *South African Journal of Science*, 114(9-10): 1–7. https://doi.org/10.17159/sajs.2018/4451

Doku, D., L. Koivusilta, and A. Rimpelä (2012). 'Socioeconomic Differences in Alcohol and Drug Use Among Ghanaian Adolescents'. *Addictive Behaviors*, 37(3): 357–60. https://doi.org/10.1016/j.addbeh.2011.11.020

Doumas, D.M., and E. Hannah (2008). 'Preventing High-risk Drinking in Youth in the Workplace: A Web-based Normative Feedback Program'. *Journal of Substance Abuse Treatment,* 34(3): 263–71. https://doi.org/10.1016/j.jsat.2007.04.006

Dubin, J., and D. McFadden (1984). 'An Econometric Analysis of Residential Electric Appliance Holdings and Consumption'. *Econometrica*, 52(2): 345–62. https://doi.org/10.2307/1911493

Flisher, A.J., C.D.H. Parry, J. Evans, M. Muller, and C. Lombard (2003). 'Substance Use by Adolescents in Cape Town: Prevalence and Correlates'. *Journal of Adolescent Health,* 32(1): 58–65. https://doi.org/10.1016/S1054-139X(02)00445-7

Gjerde, H., A.S. Christophersen, I.S., Moan, B. Yttredal, J.M. Walsh, P.T. Normann, and J. Mørland (2010). 'Use of Alcohol and Drugs by Norwegian Employees: A Pilot Study Using Questionnaires and Analysis of Oral Fluid'. *Journal of Occupational Medicine and Toxicology*, 5(1)L 13. https://doi.org/10.1186/1745-6673-5-13

Intergate Immigration (2020). 'South African Provinces'. Available at: https://www.intergate-immigration.com/blog/south-african-provinces (accessed 3 May 2021)).

Lawana, N., and F. Booysen (2018). 'Decomposing Socioeconomic Inequalities in Alcohol Use by Men Living in South African Urban Informal Settlements'. *BMC Public Health*, 18(993): 1–9. https://doi.org/10.1186/s12889-018-5925-4

Lee, Y. (2003). 'Wage Effects of Drinking in Australia'. *Australian Economic Review*, 36(3): 265–82. https://doi.org/10.1111/1467-8462.00286

Lo, T.Q., J.E. Oeltmann, F.O. Odhiambo, C. Beynon, E. Pevzner, K.P. Cain, and P.A. Phillips-Howard 2013). 'Alcohol Use, Drunkenness and Tobacco Smoking in Rural Western Kenya'. *Tropical Medicine & International Health*, 18(4): 506–15. https://doi.org/10.1111/tmi.12066

Lye, J., and J. Hirschberg (2010). 'Alcohol Consumption and Human Capital: A Retrospective Study of the Literature'. *Journal of Economic Surveys*, 24(2): 309–38. https://doi.org/10.1111/j.1467-6419.2009.00616.x

Matzopoulos, R.G., S. Truen, B. Bowman, and J. Corrigall (2014). 'The Cost of Harmful Alcohol Use in South Africa'. *South African Medical Journal*, 104(2): 127–32.

McFadden, D. (1973). 'Conditional Logit Analysis of Qualitative Choice Behaviour'. In P. Zarembka (ed.), *Frontiers in Econometrics*. New York, NY: Academic Press.

Neumann, T.C. (2013). 'The Effect of Drinking and Smoking on the Labour Market Outcomes of Low-income Young Adults'. *Applied Economics*, 45(5): 541–53. https://doi.org/10.1080/00036846.2011.579063

Peltzer, K., A. Davids, and P. Njuho (2011). 'Alcohol Use and Problem Drinking in South Africa: Findings from a National Population-based Survey'. *African Journal of Psychiatry*, 14(1): 30–37.

Peltzer, K., and S. Ramlagan (2007). 'Cannabis Use Trends in South Africa'. *South African Journal of Psychiatry*, 13(4): 126–31.

Peters, B.L. (2004). 'Is There a Wage Bonus from Drinking? Unobserved Heterogeneity Examined'. *Applied Economics,* 36(20): 2299–315. https://doi.org/10.1080/0003684042000280526

Renna, F. (2009). 'Alcohol Abuse, Alcoholism, and Labor Market Outcomes: Looking for the Missing Link'. *Industrial & Labor Relations Review*, 62(1): 92–103. https://doi.org/10.1177/001979390806200105

SACENDU (South African Community Epidemiology Network of Drug Use) (2012). 'Monitoring Alcohol and Drug Abuse Trends in South Africa (July 1996–June 2012)'. SACENDU Research Brief*,* 15(2). Tygerberg: SACENDU.

SADSD (South Africa Department of Social Development) (2013). *National Drug Master Plan (NDMP) 2013-2017*. Pretoria: SADSD.

SALDRU (Southern Africa Labour and Development Research Unit) (2016). 'National Income Dynamics Study 2014–2015, Wave 4 [Dataset], Version 1.1'. Cape Town: SALDRU.

Smook, B., M. Ubbink, E. Ryke, and H. Strydom (2017). 'Substance Abuse and the Workplace: A Situation Analysis'. *Social Work*, 54(2): 194–209.

van Ours J. (2004). 'A Pint a Day Raises a Man's Pay; But Smoking Blows that Gain Away'. *Journal of Health Economics,* 23(5): 863–86. https://doi.org/10.1016/j.jhealeco.2003.12.005

Wacker, M., R. Holle, J. Heinrich, K.H. Ladwig, A. Peters, R. Leidl, and P. Menn.(2013). 'The Association of Smoking Status with Healthcare Utilization, Productivity Loss and Resulting Costs: Results from the Population-based KORA F4 Study'. *BMC Health Services Research*, 13(278): 1–9. https://doi.org/10.1186/1472-6963-13-278

Weng, S.F., S. Ali, and J. Leonardi-Bee (2013). 'Smoking and Absence from Work: Systematic Review and Meta-Analysis of Occupational Studies'. *Addiction*, 108(2): 307–19. https://doi.org/10.1111/add.12015

WHO (World Health Organization) (2009). *World Health Organization Report on the Global Tobacco Epidemic: Implementing Smoke-free Environments*. Geneva: WHO.

WHO (World Health Organization) (2011). *Global Status Report on Alcohol and Health*. Geneva: WHO.

WHO (World Health Organization) (2018). 'Reducing the Harmful Use of Alcohol: A Keystone in Sustainable Development. The Global Status Report on Alcohol and Health'. Geneva: WHO.

WHO (World Health Organization) (2020). 'World Health Organization Fact Sheets on Tobacco'. Available at: https://www.who.int/news-room/fact-sheets/detail/tobacco (accessed 3 May 2021).

Wilmans, G., and N. Rashied 2020. 'The Effect of Cigarette Smoking on Subjective Well-being in South Africa and Its Implications for Tobacco Control'. *Journal of Economic and Financial Sciences*, 13(1): 1–11. https://doi.org/10.4102/jef.v13i1.451

Wolaver, A. (2007). 'Does Drinking Affect Grades More for Women? Gender Differences in the Effects of Heavy Episodic Drinking in College'. *The American Economist*, 51(2): 72–88. https://doi.org/10.1177/056943450705100211

Wooldridge, J.M (2003). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Appendix

Table A1: Pooled sample—Full information maximum likelihood (FIML) estimates of MESR for earnings

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	0.005	0.015	-0.0531[c]	0.028	0.003	0.009
High school graduate (dummy = 1)	-1.007[b]	0.415	-0.635	0.546	-0.707[a]	0.266
Tertiary education (dummy = 1)	0.777[a]	0.185	0.099	0.424	0.512[a]	0.163
Marital status (dummy = 1)	0.623	0.444	1.430[c]	0.812	0.526	0.440
Computer literate (dummy = 1)	0.952[a]	0.269	-0.353	0.529	0.712[a]	0.185
Health characteristics						
Good health (dummy = 1)	0.318	0.905	-1.127	1.523	1.017[b]	0469
Fair health (dummy = 1)	-0.234	0.884	-1.179	1.648	0.522	0.527
Hypertension (dummy = 1)	0.743[b]	0.332	-0.301	0.659	-0.517[c]	0.294
Asthma (dummy = 1)	0.916 [b]	0.410	0.045	1.123	0.048	0.453
Diabetes (dummy = 1)	-0.792	0.496	0.722	0.829	-0.041	0.312
Tuberculosis (dummy = 1)	-0.051	0.290	0.334	0450	0.044	0.178
Demographic characteristics						
Race						
African (dummy = 1)	0.632	0.958	-2.190	1.354	0.314	0.603
White (dummy = 1)	2.435[c]	1.464	-1.167	1.563	1.676[b]	0.822
Coloured (dummy = 1)	-0.092	0.833	-1.024	0.867	-0.114	0.408
Location						
Western Cape (dummy = 1)	-0.082	0.239	0.754	0.558	-0.066	0.171
Eastern Cape (dummy = 1)	0.025[b]	0.281	-0.490	0.502	-0.172	0.194
Northern Cape (dummy = 1)	0.168	0.303	-0.278	0.511	0.239	0.228
KwaZulu-Natal (dummy = 1)	-0.627	0.414	0.669	0.590	-0.381[c]	0.230
Northwest (dummy = 1)	-0.109	0.326	0.439	0.655	-0.043	0.230
Mpumalanga (dummy = 1)	0.179	0.232	-0.136	0.568	0.414	0.181
Limpopo (dummy = 1)	-0.359	0.324	-1.500	1.631	-0.187[b]	0.265
Gauteng (ref category)	-0.316	0.219	0.402	0.540	-0.292[c]	0.174
Constant	-8.502	32.763	105.36[b]	51.98	12.63	17.85
λ	-1.099[b]	0.462	-1.091[c]	0.646	-1.226	0.156

Note: Coef is Coefficient; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table A2: Pooled sample—full information maximum likelihood (FIML) estimates of MESR for working hours.

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	-0.0003	0.005	-0.0531[c]	0.028	0.003	0.009
High school graduate (dummy = 1)	0.101	0.164	-0.635	0.546	0.078	0.180
Tertiary education (dummy = 1)	-0.039	0.093	0.099	0.424	0.0173	0.112
Marital status (dummy = 1)	-0.114	0.153	0.015[c]	0.358	0.205	0.211
Computer literate (dummy = 1)	-0.056	0.103	-0.353	0.529	-0.082[a]	0.005
Health characteristics						
Good health (dummy = 1)	-0.226	0.307	-1.127	1.523	0.385	0.378
Fair health (dummy = 1)	-0.217	0.270	-1.179	1.648	0.215	0.372
Hypertension (dummy = 1)	-0.164	0.178	-0.301	0.659	-0.062	0.192
Asthma (dummy = 1)	-0.006	0.167	0.045	1.123	0.053	0.317
Diabetes (dummy = 1)	0.118	0.132	0.722	0.829	-0.095	0.228
Tuberculosis (dummy = 1)	0.139	0.083	0.334	0450	-0.002	0.109
Demographic characteristics						
Race						
African (dummy = 1)	-0.204	0.295	-0.026	0.746	-0.171	0.329
White (dummy = 1)	-0.435	0.508	-0.125	0.640	-0.134	0.491
Coloured (dummy = 1)	-0.135	0.173	-0.270	0.320	-0.075	0.165
Location						
Western Cape (dummy = 1)	-0.045	0.077	-0.028	0.233	-0.024	0.024
Eastern Cape (dummy = 1)	-0.008	0.089	-0.051	0.266	-0.023	0.117
Northern Cape (dummy = 1)	-0.165	0.118	-0.020	0.216	0.005	0.092
KwaZulu-Natal (dummy = 1)	0.150	0.146	-0.208	0.300	0.013	0.125
Northwest (dummy = 1)	0.091	0.096	-0.388	0.383	0.126	0.113
Mpumalanga (dummy = 1)	-0.019	0.082	-0.041	0.291	0.059	0.082
Limpopo (dummy = 1)	-0.086	0.324	0.193	0.646	-0.050	0.131
Gauteng (ref category)	-0.316	0.219	0.201	0.219	-0.010	0.077
Constant	5.763	12.002	-3.188	20.65	6.256	8.700
λ	-0.662	3.179	-0.372[c]	0.211	0.744[b]	0.349

Note: Coef is Coefficient; SE is standard error. **[a]**, **[b]**, and **[c]** denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table A3: Males sample—full information maximum likelihood (FIML) estimates of MESR for earnings

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	0.032	0.025	-0.061	0.051	-0.014	0.014
High school graduate (dummy = 1)	-2.210[c]	1.248	-1.498	2.265	0.078	0.180
Tertiary education (dummy = 1)	1.654[b]	0.659	0.544	0.755	0.352	0.276
Marital status (dummy = 1)	1.279	1.224	1.953	1.982	0.535	0.664
Computer literate (dummy = 1)	2.222[a]	0.659	-0.253	1.099	0.480[b]	0.290
Health characteristics						
Good health (dummy = 1)	0.707	1.429	-1.970	2.491	0.394	0.687
Fair health (dummy = 1)	-1.054	1.777	-3.371	3.588	-0.022	0.875
Hypertension (dummy = 1)	2.224[b]	1.004	-0.130	1.192	0.241	0.398
Asthma (dummy = 1)	0.652	1.579	0.617	1.838	-0.032	0.612
Diabetes (dummy = 1)	-1.922	1.195	0.870	1.975	0.155	0.581
Tuberculosis (dummy = 1)	0.414	0.782	-0.362	1.083	0.028	0.319
Demographic characteristics						
Race						
African (dummy = 1)	3.880[c]	2.185	-1.149	2.265	-0.072	0.828
White (dummy = 1)	7.624	3.140[b]	-1.002	2.842	1.186	1.445
Coloured (dummy = 1)	0.635	1.379	-1.388	1.881	-0.215	0.648
Location						
Western Cape (dummy = 1)	-0.612	0.689	1.793	1.910	0.147	0.442
Eastern Cape (dummy = 1)	1.918[c]	1.144	-0.284	1.354	-0.263	0.397
Northern Cape (dummy = 1)	1.439[c]	0.795	-1.022	1.849	0.119	0.404
KwaZulu-Natal (dummy = 1)	-1.590[b]	0.887	0.578	1.112	-0.137	0.370
Northwest (dummy = 1)	-1.294	0.934	0.491	1.315	0.020	0.345
Mpumalanga (dummy = 1)	0.846	0.774	-0.232	1.123	0.330	0.286
Limpopo (dummy = 1)	0.339	0.324	-2.173	3.046	-0.289	0.406
Gauteng (ref category)	-1.15[c]	0.682	0.498	1.015	-0.212	0.327
Constant	-79.482	56.48	119.0	92.13	36.08	29.83
λ	267.22[b]	126.83	92.14	163.73	3.208[b]	1.321

Note: Coef is Coefficient; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table A4: Males sample—full information maximum likelihood (FIML) estimates of MESR for working hours

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	-0.004	0.009	0.011	0.020	-0.007	0.005
High school graduate (dummy = 1)	0.589	0.433	-0.214	0.499	-0.158	0.216
Tertiary education (dummy = 1)	-0.291	0.240	0.136	0.329	0.043	0.112
Marital status (dummy = 1)	-0.335	0.416	0.079	0.715	0.344	0.288
Computer literate (dummy = 1)	-0.347	0.238	0.313	0.505	0.144	0.160
Health characteristics						
Good health (dummy = 1)	-0.115	0.561	0.330	0.966	0.039	0.402
Fair health (dummy = 1)	0.403	0.667	0.330	1.280	-0.248	0.462
Hypertension (dummy = 1)	-0.461	0.332	0.484	0.789	-0.121	0.182
Asthma (dummy = 1)	-0.098	0.464	-0.067	0.635	0.252	0.288
Diabetes (dummy = 1)	0.227	0.411	-0.181	0.622	0.211	0.213
Tuberculosis (dummy = 1)	00.036	0.260	0.124	0.406	-0.124	0.143
Demographic characteristics						
Race						
African (dummy = 1)	-1.031	0.878	0.520	0.714	-0.285	0.393
White (dummy = 1)	-1.537	1.335	0.888	1.036	-0.287	0.526
Coloured (dummy = 1)	-0.309	0.635	-0.015	0.588	-0.161	0.250
Location						
Western Cape (dummy = 1)	-0.128	0.249	-0.199	0.664	0.236	0.158
Eastern Cape (dummy = 1)	-0.395	0.325	0.283	0.266	-0.091	0.188
Northern Cape (dummy = 1)	-0.318	0.267	0.371	0.216	-0.064	0.167
KwaZulu-Natal (dummy = 1)	0.342	0.249	-0.440	0.402	0.116	0.133
Northwest (dummy = 1)	0.285	0.305	-0.645	0.606	0.211	0.153
Mpumalanga (dummy = 1)	-0.079	0.220	-0.071	0.424	0.024	0.082
Limpopo (dummy = 1)	0.143	0.257	0.308	1.183	-0.181	0.131
Gauteng (ref category)	0.150	0.213	-0.383	0.473	-0.106	0.114
Constant	16.17	20.54	-18.06	35.45	18.79[c]	11.29
λ	-0.389[c]	0.215	5.340	22.90	2.733[b]	1.228

Note: Coef is Coefficient; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table A5: Female sample—full information maximum likelihood (FIML) estimates of MESR for earnings

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	0.053	0.109	-0.0531[c]	0.028	-0.024	0.081
High school graduate (dummy = 1)	-0.423	1.055	-0.635	0.546	-1.570	1.790
Tertiary education (dummy = 1)	0.496	0.445	0.099	0.424	1.622	1.524
Marital status (dummy = 1)	-0.770	2.280	0.253	0.215	0.205	0.211
Computer literate (dummy = 1)	1.056	0.958	-0.353	0.529	0.390[a]	0.067
Health characteristics						
Good health (dummy = 1)	2.362	2.589	-1.127	1.523	3.749	3.816
Fair health (dummy = 1)	2.708	2.737	-1.179	1.648	1.703	2.948
Hypertension (dummy = 1)	0.920	1.627	-0.301	0.659	0.731	1.039
Asthma (dummy = 1)	0.705	1.037	0.045	1.123	0.471	2.391
Diabetes (dummy = 1)	-0.500	1.573	0.722	0.829	-1.322	2.028
Tuberculosis (dummy = 1)	-0.094	1.026	0.334	0450	-1.024	1.350
Demographic characteristics						
Race						
African (dummy = 1)	0.168	2.060	15.34	21.52	3.594	6.014
White (dummy = 1)	4.440	6.014	-1.533	7.875	-0.2221	5.716
Coloured (dummy = 1)	1.487	2.726	-1.210	6.894	-1.001	3.980
Location						
Western Cape (dummy = 1)	-0.051	0.597	-0.678	2.141	-0.700	1.445
Eastern Cape (dummy = 1)	-0.748	0.905	2.441	4.215	-0.236	1.425
Northern Cape (dummy = 1)	0.346	1.163	-0.459	2.966	-0.170	1.026
KwaZulu-Natal (dummy = 1)	-1.691	2.831	-2.206	4.227	0.552	2.383
Northwest (dummy = 1)	0.008	0.636	-3.768	2.981	0.046	0.077
Mpumalanga (dummy = 1)	-0.475	0.631	0.047	0.112	0.059	0.082
Limpopo (dummy = 1)	-0.841	1.095	-0.221[c]	0.116	0.030	0.067
Gauteng (ref category)	-0.176	0.583	-0.813	2.764	-0.054	0.069
Constant	-108.07	230.38	-42.26	172.16	57.345	169.39
λ	23.49	194.34	267.34[b]	128.67	23.52[a]	1.751

Note: Coef is Coefficient; SE is standard error. **[a]**, **[b]**, and **[c]** denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.

Table A6: Females sample—full information maximum likelihood (FIML) estimates of MESR for working hours

Variable	Drinking (A_1C_0)		Smoking (A_0C_1)		Drinking and smoking (A_1C_1)	
	Coef	SE	Coef	SE	Coef	SE
Socioeconomic characteristics						
Age (years)	-0.004	0.021	-0.209[c]	0.108	-0.033	0.066
High school graduate (dummy = 1)	-0.005	0.187	0.539	1.151	-1.054	1.425
Tertiary education (dummy = 1)	-0.015	0.100	-2.797	3.110	1.239	1.332
Marital status (dummy = 1)	-0.185	0.568	0.015[c]	0.358	0.110	0.421
Computer literate (dummy = 1)	-0.013	0.196	-0.692	1.003	-0.231	0.619
Health characteristics						
Good health (dummy = 1)	-0.801	0.674	-1.127	1.820	2.687	3.199
Fair health (dummy = 1)	-0.903	0.791	-0.001	1.700	1.057	2.405
Hypertension (dummy = 1)	-0.172	0.301	-0.077	1.534	0.199	1.016
Asthma (dummy = 1)	0.019	0.218	-0.551	1.954	1.103	2.384
Diabetes (dummy = 1)	0.180	0.361	0.445	1.921	-1.422	1.557
Tuberculosis (dummy = 1)	0.023	0.199	2.926	3.256	-0.594[a]	0.134
Demographic characteristics						
Race						
African (dummy = 1)	-0.114	0.429	-9.095	8.797	4.170	5.430
White (dummy = 1)	-0.542	0.542	1.438	3.852	-1.919	3.827
Coloured (dummy = 1)	-0.142	0.142	0.489	3.309	-0.998	2.793
Location						
Western Cape (dummy = 1)	-0.059	0.155	0.171	1.084	-0.929	1.041
Eastern Cape (dummy = 1)	-0.0129	0.206	-1.056	1.994	-0.230	0.955
Northern Cape (dummy = 1)	-0.224	0.255	0.406	1.132	-0.678	0.989
KwaZulu-Natal (dummy = 1)	0.161	0.540	0.268	2.963	1.107	2.019
Northwest (dummy = 1)	0.049	0.178	0.977	2.217	0.148	0.130
Mpumalanga (dummy = 1)	-0.119	0.173	0.030	0.291	0.069	0.108
Limpopo (dummy = 1)	-0.030	0.217	-0.054	0.069	-0.124	0.231
Gauteng (ref category)	-0.037	0.140	0.440	2.495	-0.514	1.160
Constant	14.13	44.41	-1.669	122.00	75.37[b]	37.32
λ	0.868	6.485	-0.675[a]	0.256	43.11[a]	14.300

Note: Coef is Coefficient; SE is standard error. [a], [b], and [c] denote significance level at 1%, 5%, and 10%, respectively.

Source: author's computation based on NIDS data.