CHAPTER 3

The Recommended Policies Designed to Increase Health Inducing Behavior for Thailand

This chapter is developed from the original paper "The recommended policies designed to increase health inducing behavior for Thailand" by Suknark, Sirisrisakulchai and Sriboonchitta (2015) presented at the Conference of Actual Economy: Local Solutions for Global Changes 2016, published in "ACTUAL PROBLEMS OF ECONOMICS", Issue 10, October 2016. This paper can be found in the appendix A.

3.1 Introduction

Global health care costs are rising and become a big problem for developing countries. Health promotion and disease prevention are considered as the approaches to reduce health care costs.

The explicit burden on society due to health-risk behaviors, particularly alcohol and tobacco consumption, includes health care costs, productivity loss, property damage costs, costs of criminal justice as well as law enforcement. To reduce health-risk behaviors, Thailand should aim to reduce alcohol consumption and prevent initiation of drinking. While Thailand already implements alcohol related policies, such as high alcohol taxation, restricted alcohol sale times, more effective measures at the societal level to control alcohol consumption and alcohol-related harms are still required. The national survey in 2011 reported that about 17.7 million people or 20.8% of the population aged 15 years and over are alcohol users. Men used alcohol at a higher rate than women (The National Statistical Office, 2011). Equally, tobacco consumption control policies have been implemented to reduce tobacco consumption and prevent initiation of smoking, especially in younger people. Current policies

include high rates of tobacco taxation, control of tobacco advertising, non-smoking areas and bans on smoking in public places. These policies have been shown to be successful in decreasing the proportion of smokers in the Thai population (aged 15 years and older) from 32 % in 1991 to 20% in 2013 (NSO, 2011).

On the other hand, the Thai Health Promotion Foundation has promoted physical activity in the Thai population by sponsoring and supporting several public campaigns nationally on the benefits of physical activity and advising people on the effective levels of frequency, duration and intensity required to achieve physical fitness since 2010. Such programs have also been supported at the local and regional level in many areas of the country. Most of the projects are mainly focused on increasing perceptions, attitudes, and practices related to physical activity generally (Katewongsa et al, 2014).

The previous studies on the factors affecting alcohol consumption, tobacco consumption, and physical activity were based on a single equations (Katewongsa et al, 2014) (Suwannashote, 2009) (Praponsin, 2007) and (Sirirassamee et.al, 2009).

In this paper, we simultaneously determined the factors affecting including alcohol-consumption, tobacco-consumption and physical activity to quantify the factors affecting health behaviors have to be well specified before considering the optimal health promotion and prevention policy. Investing in lower cost-effectiveness policies may not give the economic benefit as expected and attempted to quantify the dependence measures between these pairs using the copula approach. This paper proposes a new method to analyze the factors affecting health behaviors by accounting for the dependence between each health behavior. The proposed model will give more efficient parameter estimates in comparison with the traditional models. Moreover, understanding the dependencies between choices for each health behaviors gives useful information for designing more efficient health promotion and disease prevention programs.

Table 3.1 Main statistics and description of variables

variables	Description	Mean	SD	Min.	Max.
Y1	1 if individual consume alcohol; 0 otherwise	0.446	0.627	0	1
Y2	1 if individual consume tobacco; 0 otherwise	0.052	0.339	0	1
Y3	1 if individual has physical activity in leisure time; 0 otherwise	2.201	0.845	0	1
Sex	1 if individual is male; 0 otherwise	0.524	0.499	0	1
Age	in Year	52.917	18.236	14	98
Income	in 1,000 Baht	3.310	5.698	0	32,480
bachelor	1 if individual graduated from Bachelor degree or higher; 0 otherwise	0.061	0.24	0	1
Age	1 if individual works in agricultural sector; 0 otherwise	0.176	0.381	0	1
Whi	1 if individual is white-collar worker	0.035	0.184	0	1
police	1 if individual works as police or soldier; 0 otherwise	0.012	0.108	0	1
Labor	1 if individual is in labor sector; 0 otherwise	0.48	0.499	0	1
Married	Marital status where 1 indicates married; 0 otherwise	0.636	0.481	0	1
Pe_bmi25	1 if individual has body mass index more than 25; 0 otherwise	0.348	0.476	0	1
Pe_tc200	1 if individual has chloresterol level more than 200; 0 otherwise	0.561	0.496	0	1
qlhealth	Self health quality assessment, where 5 is the highest level	3.708	0.867	0	5
NCD	Number of chronic diseases	0.632	0.959	0	10

3.2 Data

The data used in this study are from the Thai National Health Examination Survey, No.4 (NHES IV) from 2009. The data consists of a sample of 20,450 individuals. The ordered dependent variables are alcohol consumption (Y1), tobacco smoking (Y2), and physical activity in leisure time (Y3). The independent variables are sex, age, income, chronic diseases, marital status, education level, and occupation. The alcohol consumption variable (Y1) were: 0 for non-alcohol consumption; 1 for alcohol consumption. For the tobacco consumption variable (Y2) were: 0 for non-smoking; 1 for smoking. For the physical activity variable (Y3), the levels of physical activity or exercise in leisure time were: 0 for non-physical activity; 1 for physical activity. Table 3.1 presents a description of the variables and related statistics.

3.3 Methods

3.3.1 Binary Choice Models

The health behaviors that we are going to analyze are binary choices of alcohol consumption, tobacco consumption, and physical activity. Let $Y_i = \{0,1\}$,for i = 1, 2, and 3, be the binary choices, where 1 , 2, and 3 indicate alcohol consumption, tobacco consumption, and physical activity choices, respectively. For the set $\{0,1\}$ of each choice outcome, 0 indicates individual has not chosen that choice and 1 indicates individual has chosen that choice. Let X_i ,for i = 1, 2, and 3,where 1, 2, and 3, are previously defined, be the vector of all the explanatory variables thought to explain health behaviors, and β_i are the vector of the parameters to be estimated corresponding to X_i. For each Y_i, we can think of this random variable as being generated from the following binomial distribution:

$$f(k;n,p) = \Pr(Y = k) = \binom{n}{k} p^k (1-p)^{n-k}, \text{ for } k = 0,1,2,\ldots,n, \qquad (3.1)$$

where $\binom{n}{k} = \frac{n!}{k!(n-k)!}$, in which n is the number of trials and p is the probability of choosing this choice. Note that we drop the subscript i for the sake of simplicity.

In our case, we assume that individual make choice only once, hence $n = 1$ (which is called Bernoulli distribution), and if p is assumed to be a standard normal distribution (Φ), we can derive the probability distribution as follows:

$$\Pr(Y = 1 | X, \beta) = \Phi(X\beta), \tag{3.2}$$

$$\Pr(Y = 0 | X, \beta) = 1 - \Phi(X\beta) \tag{3.3}$$

The above marginal distribution model has exactly the same functional form as probit model. We introduce the idea of viewing binary choice model as derivation from binomial distribution in contrast with derivation from latent continuous variable to model the multivariate joint distribution using discrete copula.

3.4 Empirical Results

We select Frank copula for all bivariate copula that building up to approximate the multivariate joint distribution of multivariate binary probit models.

3.4.1 Factors Affecting Alcohol Consumption, Tobacco Consumption, and Physical Activity Behaviors

Table 3.2 presents the results of estimation of the multivariate binary probit models for alcohol consumption, tobacco consumption, and physical activity choices. The first dependent variable to be discussed is alcohol consumption level. The explanatory variables included in the model that significant are age, income, high cholesterol, gender, non-communication diseases, occupation, and married status. The coefficient interpretations are: 1) young individuals, individuals with higher income, individuals with lower cholesterol of 200 mg/dl or a lower number of chronic diseases,

Table 3.2 Presents the results of estimation of the multivariate binary probit models for alcohol consumption, tobacco consumption, and physical activity choices.

Variables	**Y1**		**Y2**		**Y3**	
	Coeff.	**Std.err**	**Coeff.**	**Std.err**	**Coeff.**	**Std.err**
age	-0.0122*	0.0007	-0.009*	0.0015	-0.0086*	0.0007
income	0.0000*	0.0000	0.0000	0.0000	-0.0000*	0.0000
pe_tc200	-0.0507*	0.0201	0.0507	0.0433	-0.0138	0.0209
qlhealth	0.0032	0.0111	-0.0963*	0.0249	0.1781*	0.0125
sex	0.9327*	0.0202	1.427*	0.0885	0.3800*	0.0209
NCD	-0.1042*	0.0118	-0.0854*	0.0296	0.0698*	0.0115
agr	0.3053*	0.0324	0.2449*	0.0709	-0.1988*	0.0348
white	0.1866*	0.0619	0.0071	0.1318	-0.0621	0.0636
police	0.3109*	0.0886	0.1578	0.1536	-0.3393*	0.0991
labor	0.1623*	0.0290	0.1419*	0.0663	-0.0142	0.0299
married	0.0580*	0.0218	-0.0802	0.0504	-0.0891*	0.0221
bachalor	-0.0411	0.0452	-0.5405*	0.1287	0.2943*	0.0442
pe_bmi25	-0.0362	0.0214	-0.1751*	0.0511	0.0698*	0.0219
θ_1	0.9121*	0.1974				
θ_2	-0.5775*	0.2093				
θ_3	-0.0270	0.1349				

* significant 0.01

and married are more likely to alcohol consumption; 2) males are more likely to consume alcohol than females; 3) individuals who work in the agricultural sector and work in risky occupations such as police and soldiers are more likely to consume alcohol than white-collar workers and those from the labor sector.

The second dependent variable is the level of tobacco consumption, the explanatory variables included in the model that significant are age, quality of health assessment, gender, non-communication diseases, occupation only agriculture and labor, married, and Body Mass Index. The coefficient interpretations are: 1) Young individuals, individuals who lower health quality assessment or lower number of chronic diseases, individuals who education lower than bachelor degree, and individuals who non-obese (BMI < 25) are more likely to tobacco consumption; 2) male are more likely to alcohol consumption than female; 3) individuals who work in agricultural sector are more likely to tobacco consumption than labor sector.

The third dependent variable is physical activity level in leisure time. The explanatory variables included in the model that are significant are age, income, health quality assessment, gender, non-communicable diseases, occupation only agriculture and police, married status, education, and Body Mass Index. The coefficient interpretations are: 1) young individuals, individuals with higher income, number of chronic diseases, individuals who are non-married, individuals who education in bachelor degree, and individuals who are obese (BMI > 25) are more likely to undertake physical activities; 2) males are more likely to undertake physical activities than females; 3) individuals who work in the agricultural sector are more likely to undertake physical activities than those from the risky occupations such as police and soldiers.

3.4.2 Dependence Measures of Health Behaviors Pairs

The two for three dependence parameter estimated from the Frank copula multivariate ordered probit are significant. Firstly, the dependence parameter estimated for alcohol consumption and physical activity behavior is 0.912, that can be interpreted as the positive correlation between alcohol consumption and physical activity behaviors. The secondly, the dependence parameter estimated for tobacco consumption

and physical activity behaviors is -0.577, that can be interpreted as the negative correlation between alcohol consumption and physical activity behaviors.

3.5 Concluding Remarks

From the empirical results previously discussed, the followings are the recommended policies designed to reduce health-risk behavior and increase health inducing behavior for Thai citizens:

a) The policies should be focus on children and teenage more than adult stage to reduce alcohol and tobacco consumption, because of the empirical results show that the young individuals are more likely to alcohol consumption, tobacco consumption, and more likely to physical activity in leisure time.

b) Campaigns aimed at reducing alcohol consumption should have a greater focus on workers in the agricultural sector and in risky occupations.

c) The empirical results show that there is a negative correlation between tobacco consumption behavior and physical activity behavior. Thus, anti-smoking policies would have a more positive impact when the policy makers promote physical activity campaign.

d) Thai citizens should be know about their health status, because of the empirical results show that the individuals who are low health status, for example, obese, high cholesterol, more non-communication diseases, have less health-risk behaviors and more health behaviors.

For further study, the copula-based ordered probit model should be generalized to a multivariate model that increase the level of ordinal outcomes. However, the empirical results of this paper cannot confirm that there is some dependence between alcohol and tobacco consumption as discussed in the Alcohol Alert No.71 (U.S. Department of Health & Human Services 2007). That study found that people who smoke are much more likely to drink, and people who drink are much more likely to smoke.