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An Empirical Analysis of Health and Labour Force Participation among the Young People in Taiwan

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***Abstract*— this paper investigates the influencing factors of health and labour force participation (LFP) among the young people in Taiwan. The data used are from the National Health Interview Survey and only focused on the youths sample as those aged 15 to 24 in 2005. The method uses the probit model to estimate the probability of work or not work. The main results find that young female workers, married workers, workers with higher income, and workers with excellent health are more likely to remain employed. In contrast, Mainlander workers and female Hakka workers are less likely to enter the labour force as more pursued higher education. For the health behaviours, young people concern more traffic safety, including using a car, motorcycle, and bicycle have a higher probability of LFP participation. Young people with smoking or chewing betel nuts have a higher probability of LFP participation. They may do some heavy work and need these habits to improve their power.**

***Keywords*—Health, Labour Force Participation, Probit Model.**

I. Introduction

This paper investigates the influencing factors of health and labour force participation among the young people in Taiwan. Fewer youths participated in the labour force as more pursued higher education, as well as youths who might be at risk of becoming economically vulnerable. Which factors are the determinants of labour force participation among the young people in Taiwan? Are the effects of economic variables symmetric, or do the characteristics of individuals affect their decisions? These and related questions are of inherent scientific interest, and are important for public policy. Recent reforms and proposed changes in high education system and individual health behaviours in Taiwan will alter the incentives and opportunities for the young people to coordinate their labour force behaviour.

The theoretical study has examined the determinants of labour force participation (hereafter, LFP), often modelling it as a trade-off between consumption and leisure utility, such as Killingsworth and Heckman (1986). Previous empirical studies on labour force participation in Taiwan were focused on the middle aged and elderly, such as Mete and Schultz (2002) presented that health and labour force participation of the elderly in Taiwan, Hung (2003) used probit to estimate of labour force participation for the middle aged and elderly in Taiwan.

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Sheu, Chang, and Kuo (2011) presented that the impact of National Health Insurance on labour force participation of old men in Taiwan, and Chiu and Chen (2012) noted that determinants of labour force participation of older married men in Taiwan. Furthermore, some empirical studies were focused on married women about ages 25 to 45, such as Chou and Staiger (2001) showed that health insurance and female labor supply in Taiwan. Jao (2010) noted that trends in the labour force participation of married women with preschool children in Taiwan. Jao and Li (2012) noted that trends in the employment of married mothers of preschool-aged children in Taiwan. However, few studies concerned the young people for their participating labour force, except Chen (2011) discussed the issues of young people not in employment, education or training (NEETs) by a quality analysis. Therefore, this paper uses the discrete choice model to investigate labour force participation determinants amongst the young people in Taiwan to fill this gap.

Factors such as personal characteristics, family factors, economic status, and employment opportunity have all been found to influence the LFP rate of the young people. In general, a probit model can simply examine the choice to work or not work. Furthermore, the factors affecting LFP decisions amongst the young people in Taiwan are found to vary by gender. This is because the Taiwanese labour market still has gender segregation. In fact, Taiwan exhibits the so-called core-periphery phenomenon, a society where males make up the core and females make up the periphery (Goodman and Peng, 1996). Traditionally, men are the income-earners while women stay at home. But the proportion of females in employment has been changed. Kuo (1997) noted that the emphasis on female education has already contributed to upgrading the social status of women, as can be seen in the increasing female participation in labour force rate, female employment, and female earnings. To reflect this effect, the estimates of young men and women are separated to analyse the effect on the LFP rate.

II. Some Basic Facts about Labour Force Participation among the Young People in Taiwan

According to a human resources survey by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, in the last thirty four years, the employment rates of 15-24 year olds has been gradually declined from 28.5% in 1978 to 7.2% in 2012.

In particular, the participation rate of workers aged 15 to 19 decreased from 13.5% in 1978 to 1.1% in 2012, and the aged 20 to 24 decreased from 14.9% in 1978 to 6.1% in 2012. During the same period and for the same age group, the participation rate of females are always large than males. These trends suggest that most young workers prefer to delay for entering the labour market. Female young workers have a relatively higher participation rate in employment. This raises interesting questions about the relationship between the labour force behaviour of male and female workers amongst the young people. Which factors are the determinants of labour force participation behaviour? Are the effects of economic variables symmetric, or do the characteristics of individuals affect their decisions? Except the educational reasons, we are interested to concern more health behaviours amongst the young people, including their health risk behaviours and health enhancing behaviours.

III. Methods

A. *Data Source*

The data used are from the National Health Interview Survey (hereafter, NHIS) in 2005. The NHIS survey collected information on demographic and socio-economic characteristics, the utilization of health services, health behaviors, health status, and the limitation of activity of the population in Taiwan. A total of 30,680 sampled individuals completed the questionnaires, representing a completion rate of 80.59%. In this analysis, the sample was restricted to individuals aged 15 to 24 years. In total, the effective sample size comprised 3413 individuals, of whom 1826 were males and 1587 females.

B. *Variables Specification*

Dependent Variable

The employment variable is a binary variable in the probit model which equals one if the individual is employed at the time of the interview and zero if the individual is unemployed or out of the labor force (Maddala, 1983).

Explanatory Variables

Explanatory variables include personal characteristics, family factors, economic factors, health status, and health behaviours. The Age variable only focuses on the ages from 15 to 24 for the young people in Taiwan. The Gender variable is coded 1 for female and 0 for male. Regarding the Race or Ethnicity groups, the codification in the NHIS survey has four groups, namely Race1 (Fujianese), Race2 (Hakka), Race3 (Mainlander), and Race4 (Aboriginal). The Education variable is coded into four levels according to the number of years of schooling, namely Edu1 (1 to 6 years), Edu2 (7 to 12 years), Edu3 (13 to 17 years) and Edu4 (17 and over years).

Regarding the marital status factor, this includes Marit1 (married), Marit2 (single), and Marit3 (divorced or separated) variables. For the economic factors, the NHIS has divided the family income into 7 categories, where the lowest income level is under NT$30,000 per month and the highest level is more than NT$200,000 per month. The income variable which denotes the family income by Logy is included in the model.

The self-assessment of health has five levels: Health1 (poor), Health2 (average), Health3 (good), Health4 (very good), and Health5 (excellent). Furthermore, for the health behaviours, including health risk behaviours, such as Safety1 (using safety belt for driving a car equals 1, and 0 otherwise), Safety2 (using safety helmet for driving a motorcycle equals 1, and 0 otherwise), Safety3 (using safety helmet for driving a bicycle equals 1, and 0 otherwise), Drinking (with drinking habit equals 1, and 0 otherwise), Smoking (with smoking habit equals 1, and 0 otherwise), Betel (with chewing betel nuts habit equals 1, and 0 otherwise); and health enhancing behaviour, such as Physical (with physical working equals 1, and 0 otherwise), and Exercise (with exercise habit equals 1, and 0 otherwise). All above dummy variables are included in the model. All above dummy variables are included in the model. A full definition of the variables and summary statistics of the sample are given in Table 1.

C. *Estimation Methods*

This section seeks appropriate ways to measure the effects of the determinants of labour force participation (LFP) among the young people in Taiwan. LFP research has commonly used global question such as, "Are you presently working?" Therefore, the model follows Jenkins (1992) and uses a probit model to estimate the probability of working or not working. The impact of gender on LFP decisions is also considered.

Let represent the labour force participation choice (if employment, 0 otherwise) and let the two outcomes be described by the state-specific utilities:

$$U^*_{y=1} = x'\beta_1 + u_1 \quad (1)$$

$$U^*_{y=0} = x'\beta_0 + u_0 \quad (2)$$

Where x' represents a common set of control variables, β_0 and β_1 are vectors of unknown parameters, u_0 and u_1 represent unobservable (state-specific) taste components. Under this characterization, an individual will choose to participate if the utility to be enjoyed when working (denoted $U^*_{y=1}$) exceeds the utility to be gained when not working (denoted $U^*_{y=0}$). A potential labour force participant will decide to work if $U^*_{y=1} > U^*_{y=0}$, and therefore the decision to work $y = 1\ (U^*_{y=1} - U^*_{y=0} > 0)$. consequently the observation rule (1) and (2) can be rewritten as:

$$\begin{aligned} y &= 1(U^*_{y=1} > U^*_{y=0}) \\ &= 1(x'\beta_1 + u_1 > x'\beta_0 + u_0) \\ &= 1\left[(u_1 - u_0) > -x'(\beta_1 - \beta_0)\right] \end{aligned} \quad (3)$$

Clearly, both sets of parameters β_0 and β_1 cannot be identified. However, the difference $\beta_1 - \beta_0$ can be identified, and implicitly parameterise the choice model as: $y = 1(y^* > 0)$ where $y^* = x'(\beta_1 - \beta_0) + (u_1 - u_0) = x'\beta + u.$, Maximum likelihood estimation considers the probability of

observing a sample of behavioural outcomes and characteristics. Consider a sample of n observations $\{y_i, x_i\}$ drawn at random from a population, where y_i is binary. Assuming the observability criterion $y_i = 1\,(y_i^* > 0)$ for a latent variable equation of the form $y_i^* = x_i'\beta + u_i$, and, assuming that the distribution of u_i is standard normal and independent across observations, MLE solves for the parameter vector β which is most likely to have generated the data $\{y_i, x_i\}$. For any vector β, the probability of observing the outcomes y_i conditional on the data x_i is

$$L(\beta \mid x_i) = \prod_{i=1}^{n} \Pr(y_i = 0 \mid x_i; \beta)^{1-y_i} \cdot \Pr(y_i = 1 \mid x_i; \beta)^{y_i} \quad (4)$$

Taking a natural log to obtain:

$$\ln L(\beta \mid x_i) = \sum_{i=1}^{n} \left[(1 - y_i) \cdot \ln \Pr(y_i = 0 \mid x_i; \beta) + y_i \cdot \Pr(y_i = 1 \mid x_i; \beta)\right] \quad (5)$$

For the probit model, the following conditions for probability have:

$$\Pr(y_i = 1 \mid x_i; \beta) = \Phi(x_i'\beta) \quad (6)$$

$$\Pr(y_i = 0 \mid x_i; \beta) = 1 - \Phi(x_i'\beta) \quad (7)$$

where $\Phi(x)$ is the standard normal cumulative distribution function. Substituting the above into (5) gives a conditional likelihood function of the form:

$$\ln L(\beta \mid x_i) = \sum_{i=1}^{n} \left\{(1 - y_i) \cdot \ln\left[1 - \Phi\left(x_i'\beta\right)\right] + y_i \cdot \ln \Phi\left(x_i'\beta\right)\right\}. \quad (8)$$

The first-order condition requires that:

$$\frac{\partial \ln L(\beta \mid x_i)}{\partial \beta} = \sum_{i=1}^{n} \frac{\left[y_i - \Phi\left(x_i'\beta\right)\right]}{\Phi\left(x_i'\beta\right) \cdot \left[1 - \Phi\left(x_i'\beta\right)\right]} \cdot \phi\left(x_i'\beta\right) \cdot x_i = 0. \quad (9)$$

yielding the ML estimate $\tilde{\beta}$.

IV. Empirical Results

Table 2 shows the coefficients estimates of LFP by the Probit model. From the results based on these estimates, the probability of LFP can be calculated for the benchmark individual and for other individuals with different demographic circumstances.

First, for the benchmark individual in the overall sample, all explanatory variables take a value of zero. The benchmark individual in all cases is an unmarried Fujianese man with primary school education, who is in low income and poor health status, with higher risk health behaviours, without smoking, without chewing betel nuts, with physical job, and usually doing exercise. This benchmark value is reflected in the constant variable in Table 2, where the probability is

$$\Pr(y_i = 1 \mid x_i; \beta) = \Phi(-2.882) = 0.002.$$

The effects on the probability of LFP can also be worked out for different demographic circumstances (Duncan, 2000). Holding other factors equal, how does the employment probability change for female workers and Mainlander workers? This situation models changes in the probability of LFP for female workers:

$$\Pr(y_i = 1 \mid x_i; \beta) = \Phi(-2.882 + 0.299) = 0.005.$$

That is, female workers will increase the probability of LFP from 0.002 to 0.005. This implies that female workers have a higher probability of LFP as shown in Table 2. The second situation presents the probability of LFP change for Mainlander workers, keeping other variables constant:

$$\Pr(y_i = 1 \mid x_i; \beta) = \Phi(-2.882 - 0.291) = 0.0008,$$

That is, Mainlander workers will decrease their probability of working from 0.002 to 0.0008, holding other variables equal. Therefore, if the estimated coefficients are positive, the probabilities of LFP increase. If the estimated coefficients are negative, then the probabilities of LFP decrease.

Furthermore, Table 3 also indicates marginal effect estimates that female workers have a probability of LFP which is 10.7 percentage points higher than males. The traditional social values may have been changed for the modern young females and tend to carry out outside work and often abstain from working domestic the home. Next, the marginal effect estimates indicate that, holding other variables equal, Mainlander workers have a probability of participation that is about 10.3 percentage points lower than Fujianese workers as shown in Table 3.

V. Conclusion

This paper aims at contributing to understanding the determinants of labour force participation by using probit model to investigate the influences on work or not work. The impact of gender is also considered on the decision of LFP. The results confirm that personal and family, economic, and health behaviour factors are all important determinants of labour force participation amongst the young people in Taiwan.

For the personal and family factors, young female workers, married workers, workers with higher income, and workers with excellent health are more likely to remain employed. More importantly, by comparing the participation rate of male and female workers, we find that young female workers have a higher probability of participation than males, other things being equal. The possible reasons include the restrictions of cultural attitudes to work or differences in family support arrangements. For example, there has been sex-discrimination against females in access to receive a high education and to participate in work as earlier as possible in Taiwan. Hence, sex-discrimination in the labour market means that for the jobs available to young female workers relatively high. Furthermore, for the race factor, Mainlander workers, female Hakka workers are less likely to enter the labour force as more pursued higher education. For the marital status factor, most married workers have a greater financial responsibility for their family and have a higher probability of participation, particularly for men.

Health behaviours have significant effects on labour force participation. For instance, this paper highlights the finding that young people concern more traffic safety, including using a car, motorcycle, and bicycle have a higher probability of LFP participation. Young people with smoking or chewing betel nuts have a higher probability of LFP participation.

Perhaps, they do some heavy work and need these habits to improve their power.

Table 1 Descriptive Statistics of Variables

Variables	Description	Mean	Std. Dev.
Employment	1 = Employed, 0 = Otherwise.	0.349	0.476
Age	Ages from 15 to 24.	19.648	2.944
Gender	1 = Female, 0 = Male.	0.464	0.498
Race1	1 = Fujianese, 0 = Otherwise.	0.769	0.420
Race2	1 = Hakka, 0 = Otherwise.	0.138	0.344
Race3	1 = Mainlander, 0 = Otherwise.	0.069	0.253
Race4	1 = Aboriginal, 0 = Otherwise.	0.022	0.149
Edu1	1 = 1 to 6 years of schooling, 0 = Otherwise.	0.002	0.045
Edu2	1 = 7 to 12 years of schooling, 0 = Otherwise.	0.598	0.490
Edu3	1 = 13 to 16 years of schooling, 0 = Otherwise.	0.382	0.486
Edu4	1 = 17 and over years of schooling, 0 = Otherwise.	0.016	0.128
Marit1	1 = Married, 0 = Otherwise.	0.040	0.197
Marit2	1 = Unmarried, 0 = Otherwise.	0.957	0.202
Marit3	1 = Divorce or separation, 0 = Otherwise.	0.002	0.045
Logy	Using log for the different income levels.	10.834	0.708
Health1	1 = Very Poor Health, 0 = Otherwise.	0.028	0.166
Health2	1 = Average Health, 0 = Otherwise.	0.288	0.452
Health3	1 = Good Health, 0 = Otherwise.	0.293	0.455
Health4	1 = Very Good Health, 0 = Otherwise.	0.317	0.465
Health5	1 = Excellent Health, 0 = Otherwise.	0.072	0.259
Safety1	1 = using safety belt for driving a car, 0 = Otherwise.	0.781	0.413
Safety2	1 = using safety helmet for driving a motorcycle, 0 = Otherwise	0.885	0.318
Safety3	1 = using safety helmet for driving a bicycle, 0 = Otherwise	0.724	0.446
Drinking	1 = with drinking habit, 0 = Otherwise.	0.276	0.447
Smoking	1 = with smoking habit, 0 = Otherwise.	0.181	0.385
Betel	1 = with chewing betel nuts habit, 0 = Otherwise.	0.048	0.214
Physical	1 = doing physical work, 0 = Otherwise.	0.257	0.437
Exercise	1 = with exercise habit, 0 = Otherwise.	0.685	0.464

Note: The effective sample only has 3413 observations, including 1826 males and 1587 females.

Table 2 Probit Coefficient Estimates of LFP

Sample	Overall		Females		Males	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Gender	0.299***	0.053				
Race2	-0.112	0.071	-0.201**	0.102	-0.009	0.100
Race3	-0.291***	0.101	-0.272*	0.146	-0.294**	0.141
Race4	0.263	0.161	0.201	0.234	0.416*	0.232
Edu2	-1.126**	0.547	-0.615	0.659	-7.525***	0.598
Edu3	-1.085**	0.549	-0.429	0.662	-7.631***	0.614
Edu4	-1.653***	0.587	-1.193	0.740	-8.062***	0.675
Marit1	0.241**	0.121	0.079	0.143	0.953***	0.284
Logy	0.248***	0.035	0.224***	0.051	0.280***	0.051
Health2	0.231	0.151	0.179	0.204	0.296	0.230
Health3	0.151	0.152	0.056	0.205	0.244	0.229
Health4	0.200	0.152	0.114	0.206	0.291	0.228
Health5	0.295*	0.172	0.111	0.244	0.486*	0.251
Safety1	0.134**	0.062	0.141	0.086	0.123	0.092
Safety2	0.271***	0.085	0.363***	0.130	0.206*	0.116
Safety3	0.556***	0.062	0.379***	0.090	0.736***	0.088
Smoke	0.680***	0.070	0.965***	0.144	0.573***	0.082
Betel	0.328***	0.125	-0.274	0.564	0.321**	0.133
Physical	0.542***	0.055	0.470***	0.087	0.593***	0.073
Exercise	-0.742***	0.052	-0.728***	0.072	-0.767***	0.077
Constant	-2.882***	0.676	-2.751***	0.864	3.067	.
N	3413		1587		1826	
Log likelihood	-1769.151		-891.807		-857.613	
Lr chi2 (20)	878.00		314.00		595.69	

Notes:

1. The effective sample only has 3413 observations, including 1826 males and 1587 females.
2. The omitted (reference) categories: An unmarried Fujianese man with primary school education, which is in low income and poor health status, with higher risk health behaviours, without smoking, without chewing betel nuts, with physical job, and usually doing exercise.
3. * Effect is significant at $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$.
4. Goodness of fit: the result of Log-likelihood ratio test can reject the hypothesis that all coefficients except the intercept are 0 at the 0.01 level. Considering the Gender variable, the LR chi2 of male and female samples is LR chi2 (19), respectively.

Table 3 Probit Marginal Effect Estimates of LFP

Sample	Overall		Females		Males	
Variables	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Gender	0.107***	0.018				
Race2	-0.040	0.025	-0.074**	0.038	-0.003	0.034
Race3	-0.103***	0.036	-0.101*	0.054	-0.101**	0.048
Race4	0.094	0.057	0.074	0.087	0.142*	0.079
Edu2	-0.402**	0.195	-0.228	0.245	-2.578***	0.204
Edu3	-0.387**	0.196	-0.159	0.246	-2.614***	0.210
Edu4	-0.590***	0.209	-0.443	0.275	-2.762***	0.230
Marit1	0.086**	0.043	0.029	0.053	0.326***	0.097
Logy	0.088***	0.012	0.083***	0.019	0.095***	0.017
Health2	0.082	0.054	0.066	0.076	0.101	0.078
Health3	0.053	0.054	0.021	0.076	0.083	0.078
Health4	0.071	0.054	0.042	0.076	0.099	0.078
Health5	0.105*	0.061	0.041	0.090	0.166*	0.086
Safety1	0.047**	0.022	0.052	0.032	0.042	0.031
Safety2	0.096***	0.031	0.135***	0.048	0.071*	0.039
Safety3	0.198***	0.022	0.140***	0.033	0.252***	0.029
Smoke	0.242***	0.025	0.359***	0.053	0.196***	0.028
Betel	0.117***	0.044	-0.102	0.209	0.110**	0.045
Physical	0.193***	0.019	0.174***	0.032	0.203***	0.025
Exercise	-0.264***	0.018	-0.270***	0.026	-0.263***	0.026
N	3413		1587		1826	
Log likelihood	-1769.151		-891.807		-857.613	
Lr chi2 (20)	878.00		314.00		595.69	
Predicted Probability	0.318		0.353		0.290	

Notes:
1. The dy/dx is for discrete change of dummy from 0 to 1.
2. The omitted (reference) categories: An unmarried Fujianese man with primary school education, which is in low income and poor health status, with higher risk health behaviours, without smoking, without chewing betel nuts, with physical job, and usually doing exercise.
3. * Effect is significant at $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$.

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