# Smoking and Labor Market Outcomes:

# Empirical Evidence from Taiwan

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**Abstract**: The goal of this study is to investigate the relationship between smoking and labor market outcomes, using data from Taiwan's Panel Survey of Family Dynamics (PSFD). A combined index of individual knowledge regarding effects of smoking on health is employed as an instrumental variable (IV) to circumvent potential endogeneity of smoking behavior. The estimation results show that smoking has a significant and negative impact on labor force participation for both males and females in Taiwan. In addition, we reject the hypothesis that smoking is exogenous in estimation of the earnings equation. The IV model finds that smoking working men, relative to their nonsmoking counterparts, earn 3.07% lower wages. The smoking earning penalty, however, does not apply to Taiwanese working females.

Keywords: smoking, labor force participation, earnings, Taiwan

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## I. Introduction

Tobacco use imposes economic burdens on the society through increased medical care costs, premature death and lower productivity. In Taiwan, currently 40% of males and 4% of females are smokers. It is, therefore, of great importance to investigate the relationship between smoking and economic burdens from the labor market angle. There are a variety of channels through which smoking behavior impacts labor market outcomes negatively. They include discrimination against smokers in work places, smokers are more likely to be unhealthy and less productive, smokers may cost employers more due to their frequent use of health care services, and some unobserved characteristics such as time preference affect smoking decision and labor market outcomes simultaneously.

Previous literature on estimation of earnings foregone due to smoking behavior largely focus on developed countries. Most studies support the smoking wage/earning penalty argument, while a few do not find significant effects of smoking behavior on labor market outcomes (Berger and Leigh, 1989). For instance, Levine et al. (1997) found that smokers, relative to nonsmokers, receive 4 to 8 percent lower wages in the U.S. Van Ours (2004) and Auld (2005) found negative smoking effects on earnings for Dutch and Canadian samples, respectively. Using the 2005 Albania Living Standard Monitoring Survey, Lokshin and Beegle (2006) supported the wage/earning penalty argument in developing countries also.

The goal of this paper is to provide new empirical evidence from Taiwan on the relationship between smoking behavior and labor market outcomes, using the instrumental variable (IV) method. To the best of our knowledge, this is the first study in Taiwan attempting to explore the relationship between unhealthy lifestyles and labor market outcomes. In this paper, a combined index of health knowledge is used as an IV since individuals' knowledge regarding adverse effects of smoking on health are highly correlated with individuals' decision to smoke or not to smoke, but are presumably less likely to be correlated with labor market outcomes.

The estimation results show that smoking has produced a significant and negative impact on labor force participation for both males and females. In addition, we reject the hypothesis that smoking participation is exogenous in estimation of the earnings equation. The IV model finds that smoking working men, relative to their nonsmoking counterparts, earn 3.07% lower wages. The smoking earning penalty, however, does not apply to Taiwanese working females. The next section describes the empirical model used for this study. Section III explains data, Section IV presents estimation results and Section V concludes the paper.

## II. Empirical Model

To estimate the impact of smoking on labor market outcomes, we propose the following equations:

$$L_i = \alpha_1 + \beta_1 X_{1i} + \gamma_1 S_{1i} + \varepsilon_{1i} \quad (1)$$

$$ln\ E_i = \alpha_2 + \beta_2 X_{2i} + \gamma_2 S_{2i} + \varepsilon_{2i} \quad (2)$$

Equation (1) estimates the effect of smoking-related variables on labor force participation. $L_i$ represents an individual's labor force participation decision. Equation (2) estimates the effect of smoking-related variables on log earnings for working population. $E_i$ represents an individual's earnings. $X_{1i}$ represents a vector of control variables including age, education level, marital status and number of children. $X_{2i}$ consists of age, education level, marital status, firm size, years of experience, years of experience squares, region, occupation, and year dummy variables. $S_i$ represents smoking participation and $\varepsilon_i$ represents a random disturbance term.

$\gamma_1$ represents the effect of smoking on labor force participation and $\gamma_2$ represents the effect of smoking on earnings. The ordinary least squares (OLS) estimates would be unbiased, if an individual's smoking behavior $S_i$ is exogenous (i.e. not correlated with $\varepsilon_i$). However, it is very likely that labor force participation and earnings might also affect smoking behavior. For instance, an individual with lower earnings might feel depressed and start smoking. Also, there might be some other factors affecting earnings and smoking behavior simultaneously. In such an instance, OLS estimates of $\gamma_1$ and $\gamma_2$ will be biased.

Studies in this line of research address potential endogeneity issues by controlling for time-invariant individual effects (Levine et al., 1997; Heineck and Schwarze, 2003) or employing an IV method (Van Ours, 2004; Auld, 2005; Lokshin and Beegle, 2006). Frequently used exogenous instrumental variables include religious status, price of substance, and smoking behavior of family members.

In this paper, we also use an IV method to remedy potential endogeneity problems. The potential IV of smoking is a combined index of an individual's knowledge regarding effects of smoking on health. Details of the IV are discussed in the data section.

**III. Data**

The primary data for this proposed study is from the Panel Study of Family Dynamics (PSFD) in Taiwan. The PSFD is a national representative longitudinal database which contains rich socio-economic information on sampled individuals and families.[1] In the OLS model, we pool the 1999, 2000 and 2004 waves of PSFD to estimate the impact of smoking on labor force participation and earnings for males and females in Taiwan. In the IV model, only the 2004 wave is used because variables we need for constructing IVs are available only in the 2004 wave.

Major dependent variables in this analysis include individuals' labor force participation and earnings. In the PSFD, sample respondents' labor market information, including whether or not respondents work, and their average monthly earnings, are provided in detail. The main independent variable is whether respondents smoke or not.

[1] For details of PSFD, please refer to http://psfd.sinica.edu.tw/index_e.htm.

A combined index of health knowledge variable (Sk Knowledge) is used as the IV. We construct six binary variables, according to the following survey questions. When respondents answer a question correctly, the variable is coded as 1. Otherwise, it is coded as 0. Sk Knowledge is a compound variable of six binary variables; Sk Knowledge ranges from 0 to 6.

1. Smoke_01: Have you ever heard that smoking may cause disease?
2. Smoke_02: Do you think that a packet of cigarettes everyday may cause serious disease?
3. Smoke_03: Do you think that smoking frequently can cause lung cancer?
4. Smoke_04: Among every 100 of those who smoke frequently, how many will suffer from lung cancer due to smoking?
5. Smoke_05: How many times more is the possibility to suffer from lung cancer, of those who smoke more than a packet of cigarettes compared to that of non-smokers?
6. Smoke_06: Do you think that secondhand smoke may cause serious disease?

Other socio-demographic variables such as age, marital status, educational attainment, regional dummy and occupation dummy, are taken into account in our econometric analysis.

**VI. Estimation Results**

The upper panel of Table 1 presents estimation results of effects of smoking on labor force participation for males and females. Hausman test statistics are not significant, so we cannot reject the hypothesis that smoking variables are exogenous. According to the OLS results for the linear probability models, after controlling for socio-demographic variables, men with smoking habits are less likely to participate in the labor force. A similar conclusion is drawn for Taiwanese females.

The lower panel of Table 1 presents estimation results of effects of smoking on earnings for working men and women. Since Hausman test statistics are significant, we reject the hypothesis that smoking variables are exogenous. The IV estimation result shows that smoking depresses males' monthly earnings by 3.07%. The magnitude of the negative smoking effect on male earnings is smaller than findings of previous research (Levine et al. 1997; Van Ours, 2004; Auld, 2005; Lokshin and Beegle, 2006). For the working female population, estimation results do not support the smoking earning penalty argument. This result is in line with findings of some previous studies (Van Ours, 2004).

As discussed earlier, a negative impact of smoking on labor market outcomes may indicate several possible causal effects. For instance, it may indicate the existence of discrimination against smokers in Taiwan's labor market, or present the possibility that smokers are more likely to be unhealthy, and have lower productivity. Despite the

inconclusive causality, it is important to incorporate the adverse effects of smoking on labor market outcomes when evaluating economic burdens of smoking behavior.

## VI. Conclusion

This is the first study in Taiwan aiming to explore the effects of smoking behavior on labor market outcomes. In order to remedy potential endogeneity of smoking behavior, a combined index of individual knowledge regarding effects of smoking on health is employed as an instrumental variable. In the estimation of effect of smoking on labor force participation, we cannot reject the hypothesis that smoking behavior is exogenous. However, the Hausman test favors the IV results in the earnings equation estimation.

According to the results, smoking produces a significant and negative effect on labor force participation for both males and females in Taiwan. Smokers, relative to nonsmokers, are less likely to participate in labor market. In addition, working males with smoking habit, relative to their nonsmoking counterparts, receive 3.07% lower earnings. In the case of Taiwanese working women, we do not find evidence of smoking earning penalty. These findings are comparable to previous studies using developed or developing countries data.

This paper not only complements current literature by using data from a fast-developing Asian country but also provides useful insights in the estimation of economic costs of smoking. We suggest that policy makers take into account the negative effects of smoking on labor force participation and male earnings when formulating health care financing and health promotion policies.

**References**


[1] Auld, C. (2005). Smoking, drinking and income. *Journal of Human Resources*, 40(2), 505-518.

[2] Berger, M., & Leigh, P. (1989). The effects of smoking and being overweight on current earnings. *American Journal of Preventive Medicine*, 5(1), 8-14.

[3] Heineck, G.., & Schwarze, J. (2003). Substance use and earnings: the case of smokers in Germany. *Discussion Paper*, 743, IZA, Germany.

[4] Levine, P., Gustafson, T., & Valenchik, A. (1997). More bad news for smokers? The effect of cigarette smoking on wages. *Industrial and Labor Relations Review*, 50, 493-509.

[5] Lokshin, M., & Beegel, K. (2006). Foregone earnings from smoking: evidence for a developing country. *World Bank Policy Research Working Paper*, 4018.

[6] Van Ours, J. (2004). A pint a day raises a man's pay; but smoking blows that gain away. *Journal of Health Economic*, 23(5), 863-886.

[7] White, H. (1980), A Heteroshedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroshedasticity, *Econometrica*, 48, 817-838.

# Table 1: Effects of Smoking on Labor Force Participation and Log Earings

| | **Dependent Variable: Labor Force Participation** | | | | | |
|---|---|---|---|---|---|---|
| | **Male** | | | **Female** | | |
| | (1) OLS | (2) OLS | (3) IV | (1) OLS | (2) OLS | (3) IV |
| Smoking | -0.0229 | -0.0426** | -0.1357* | 0.0020 | -0.0664* | -0.3526 |
| | (0.0155) | (0.0146) | (0.0787) | (0.0401) | (0.0371) | (0.3300) |
| Hausman Test Statistics | . | . | 4.040 | . | . | 3.730 |
| Number of Observations | 2812 | 2812 | 1291 | 3056 | 3056 | 1300 |
| | **Dependent Variable: Log Earnings** | | | | | |
| | **Male** | | | **Female** | | |
| | (4) OLS | (5) OLS | (6) IV | (4) OLS | (5) OLS | (6) IV |
| Smoking | -0.0920** | -0.0467 | -0.0307** | 0.0363 | 0.0280 | -0.2889 |
| | (0.0362) | (0.0331) | (0.0073) | (0.0998) | (0.0839) | (0.9309) |
| Hausman Test Statistics | . | . | 16.37* | . | . | 17.36** |
| Number of Observations | 1408 | 1408 | 768 | 951 | 951 | 513 |

Note: 1. "**" is significant at 0.05 and "*" is significant at 0.10 Type I error level. White (1980) robust standard errors are in parentheses.

2. Data used in models (1), (2), (4), and (5): 1999, 2000, and 2004 sample.
   Data used in models (3), and (6): 2004 sample

3. Control variables for Model (1): constant and smoking.
   (2): constant, smoking, age, years of education, married, and number of children.
   (3): constant, smoking, age, years of education, married, and number of children.
   (4): constant and smoking.
   (5): constant, smoking, years of education, married, firm size, years of experience, years of experience squares, geographic dummy, industry dummy, occupation dummy, and year dummy.
   (6): constant, smoking, years of education, married, firm size, years of experience, years of experience squares, geographic dummy, industry dummy, occupation dummy, and year dummy.

4. Instrumental variables for Models (3) and (6): the combined health knowledge variable (Sk_Knowledge).