Gender Differences in the Response to Multiple-wave Tobacco Taxes: A Cohort Youth Longitudinal Analysis

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Abstract: Tobacco taxes have emerged as a policy basis for the prevention of smoking by many governments. The impact of raising tobacco taxes on reducing the smoking behaviors among the gender and the youth, however, is inconclusive. Lack of long-period longitudinal data to trace the persistent price impact on the trajectory of smoking behaviors among young male and female from their teen years to young adulthood are the main causes. In addition, to strengthen their impacts, some government may repeatedly raise the taxes on cigarette. The impact of multiple wave tobacco taxes on smoking behaviors is also unknown. In this study, by using two longitudinal survey of Taiwanese youths (TYP and EASA dataset), the dynamic impacts of three repeated waves of tobacco taxes levied during 2002~2009 in Taiwan on young male's and female's smoking behaviors from age 13 to age 22 are examined. The results show that the first-wave tobacco tax levied in the younger ages had a substantial and larger impact on female teen's smoking behavior, in which 10% rise in tobacco price will immediately reduce the probabilities of a female teen's smoking participation by 0.009. Two years later, the first-wave tobacco tax had persistent impact of -0.013 and -0.012 on female teens and male teens. As the teen became elder, the second- and the third- wave of tobacco taxes levied when they were aged 18~22, had insignificant impacts on female's smoking behavior, but significant impacts on male's. Furthermore, smoking behavior among both male and female youth had significant and substantial state dependence. This dependence is larger for females than for males.

Keywords: Gender difference, Multiple-wave tobacco taxes, youth's smoking, Cohort analysis

JEL Classification: H30, I12, I18

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1. Introduction

The effects of the tobacco tax and prevention act in reducing smoking behavior have been extensively examined, and tobacco taxes have been adopted as a policy basis for the prevention of smoking by many governments. This health policy support mainly comes from the evidences that higher taxes with raising cigarette prices are associated with the reduction of tobacco sales and adult smoking. The research on the impact of raising cigarette prices on discouraging the smoking behaviors among the gender and the young, however, is disproportionate and inconclusive (Douglas and Hariharan, 1994; Chaloipaka and Pacula, 1999; Hersch, 2000; DeCicca et al., 2002; Sherry Glied, 2002; Carpenter and Cook, 2008; DeCicca et al., 2008; Nonnemaker and Farrelly, 2011). The earlier study by Jones (1994) suggest that gender does not play a role in cigarette smoking in the UK. Chaloipaka and Pacula (1999) found young men are much more responsive to changes in the price of cigarettes than young women. The prevalence elasticity for young men is almost twice as large as that for young women. The results of Hersch (2000) suggest a significant and a larger absolute price elasticity for smoking participation and quantity of cigarettes smoked for women than for men. Yen (2005) found the gender differences in cigarette consumption and demand elasticities. DeCicca et al. (2002, 2008) found that higher taxes with raising cigarette prices does not play a role in reducing cigarette smoking among young population. All of these studies are based on cross-sectional data or short longitudinal data. However, cigarette smoking behavior has an additive nature. A few recent empirical studies (Gruber and Zinman, 2001; Gilleskie and Strumpf, 2005) suggest that there is a substantial intertemporal correlation (or state dependence) in the decision to smoke. Based on the findings of the Global Youth Tobacco Survey (GYTS) conducted by the World Health Organization (WHO) during 2000s, a large number of teen smokers in developing countries start using tobacco products between the ages of 13-15, becoming long-term tobacco users later in their lives. Thus, without longer longitudinal data to estimate and to distinguish the persistent addictive nature and the price impact on different trajectory of smoking behaviors among young male

and young female from their teen years to young adulthood, the role of tobacco taxes on reducing youth smoking behaviors will remain inconclusive.

In addition, to reinforce the impacts of tobacco tax and price on smoking behaviors, some governments may repeatedly raise the taxes on cigarette products. For example, during the years of 2002 and 2009, the Taiwanese government levied three-wave tobacco taxes to prevent tobacco hazards. The American Public Health Association adopted a policy statement favoring legislation to "substantially and repeatedly raise the tax on cigarettes" (American Public Health Association 1999, p.435). Lack of longer longitudinal data to trace the movement and the changes of individuals' smoking behaviors, the impacts of multiple wave tobacco taxes on smoking behaviors are also unknown. With the implementation of multiple-wave tobacco taxes and prevention act, Table 1 reveals that the smoking rates for male adults in Taiwan dropped from 43% in 2004 to 35% in 2010; while the smoking rates for male teens aged 12-15 increased from 8.5% in 2004 to 11.2% in 2010 and female teens lingered around 4.2%~4.9%. Their smoking prevalence rates increase double when they reach senior high school years. Does tobacco tax play no roles in reducing teens' smoking behaviors? In this study, by using ten-year longitudinal data and tracing three consecutive birth cohorts starting at ages of 12-15 for six to ten years, we investigate the dynamic impacts of multiple tobacco taxes levied during 2000s on Taiwanese teenagers' smoking behaviors. To estimate and to distinguish the persistent addictive nature and the price impact on different trajectory of smoking behaviors among young male and young female from their teen years to young adulthood are the focus of this study.

Tobacco products have the addiction characteristic which produces the periodic or chronic and repeated cigarette consumption by smokers. The addictive nature of smoking may become a negative force to mitigate the persistent effect of tobacco tax. On the other hand, the risk perception or health risk resulting from lung cancer and tobacco related diseases may enhance the motivation to quit or reduce smoking, and further increase the effect of tobacco tax. Thus the persistent impacts of tobacco tax are unclear and become an empirical issue. A single wave shock may only lessen

short-term tobacco consumption, but has no long-term effect on lowering the prevalence of smoking if the persistent effect is weak. In contrast, if government repeatedly imposed tobacco taxes, it may recover the disadvantage of weak persistent effect and make the tobacco control policy more efficiency on youth smoking control. Previous studies in terms of micro data, however, mainly focus on the concurrent impact of a certain tax implementation, except Glied (2002), in which she found that the antismoking policy has significant effect to reduce youth's smoking, but can't sustain for a long time. Therefore, to understand the impacts of tobacco taxes on a youth's smoking behavior, the persistent impact of single wave or the dynamic impacts for multiple waves of tobacco taxes shocks would be an important topic. The contribution of this study is to examine the dynamic impact of multiple-wave tax shocks on different trajectory of smoking behaviors among young males and young females from their teen years to young adulthood, and estimate the persistent and heterogeneous smoking behavior between young males and young females.

Two identification strategies are carried out in this study. First, to investigate the dynamic effects of a series Tobacco taxes on teenagers' smoking and further distinguish the concurrent effect from long-run effect of taxes, two rich longitudinal youth datasets –Taiwan Youth Project (TYP) Phase I and Etiology of Adolescent's Substance Abuse (EASA) – are used. TYP and EASA datasets are the only data sets that contains not only 6-10 years important life-spans for Taiwanese youths starting from age 13, but also covers the time periods of major smoking prevention policies in Taiwan. By using a dynamic panel discrete choice model with ten years longitudinal data, we are able to examine the impacts of three-wave tobacco tax. Second, three consecutive birth cohorts (1984, 1986 and 1988 birth cohorts) from EASA and TYP are compared to identify the impact of tax intervention on teenagers' smoking behaviors during different age periods. The 1988 cohort experienced the first, second, and third waves of tobacco tax shock when they were in the ages of 15, 19, and 22. While, the 1986 cohort encountered the first, second, and third waves of tobacco price shock when they were 17, 21, and 24 years old. The different exposure to tax implementation for 1984 and 1986 birth cohorts at the same ages of 1988 birth cohort can be served as control groups to identify the tax impacts.

The paper is structured as follows. Section 2 provides a review of tobacco tax effect on smoking behavior. Section 3 describes the Taiwan control policy and data. Section 4 examines the impacts of the first-wave tobacco tax. The impacts of the second- and third- wave tobacco taxes are investigated in Section 5. Finally, section 6 concludes the findings.

2. Recent Literature on Tobacco Tax, Gender Differences, and Youth Smoking

The research on the impact of raising cigarette prices on discouraging the smoking behaviors among the gender and the young is inconclusive. In earlier research, economist used either aggregate data or individual data taken from large-scale surveys to estimate the price elasticity of demand for cigarette. Many studies found that raising cigarette price by imposing higher tobacco taxes substantially lower the demand for cigarette. Youth are more price sensitive than Adults and price sensitivity is inversely related to age.[1] Furthermore, young male are responsive to price, while young women are generally insensitive to price. The rising young smoking rates in U.S. during 1990s, however, brought up the reconsideration on the effectiveness of raising tobacco taxes on deterring smoking behaviors in 2000s. A number of studies found that the tobacco taxes or price had insignificant influences on youth onset smoking (Douglas and Hariharane, 1994; Hariharan, 1994; Douglas, 1998; DeCicca et al., 2002; DeCicca et al., 2008a; DeCicca et al., 2008b). While, Glied (2002) shows that higher taxes were positive correlated with delaying smoking initiation. Laux (2000) considers the differences of young and adult initiation behaviors and suggests that youth were more reluctant to initiate smoking than adult when they faced higher taxes. By using the survival analysis, Forster and Jones (2001) and Nicolas (2002) found small but significant effect of tax and price on reducing smoking initiation.

Due to the biological and behavior factors, the males and the females behave differently in many aspects, such as difference in risk taking, risk perception, competition preference, smoking behavior, and mortality cost (Croson and Gneezy, 2009; Eckel and Grossman, 2008a, 2008b; Feingold, 1994; Lundborg and Andersson,

[1] An excellent review can be found in Chaloupka and Warner (2000)

2008). The gender difference in the response to cigarette price change is still unsettled. Based on the cross-sectional data, Chaloipaka and Pacula (1999) found young men are much more responsive to changes in the price of cigarettes than young women. The prevalence elasticity for young men is almost twice as large as that for young women. The results of Hersch (2000) suggest a significant and a larger absolute price elasticity for smoking participation and quantity of cigarettes smoked for women than for men. Cawley et al. (2004) focused on gender difference and found that males were more sensitive on price increment than females. Yen(2005) found the gender differences in cigarette consumption and demand elasticities, in contrast, the earlier study by Jones (1994) suggest that gender does not play a role in cigarette smoking in the UK. Nonemaker and Farrelly (2011), moreover, jointly examined the influence of cigarette price, tobacco taxes, and peer effect on youth smoking behavior. They found that peer effect has significantly influence on youth initiation smoking. Considering about the gender difference, cigarette prices both significantly reduce the onset smoking of male and female, and tobacco taxes only significantly decreased female initiation smoking and have no impact on male.

Limited studies examined the long term effect on tobacco taxes, and suggested that people faced the tobacco tax policy in youth may have no effect after adolescence (Orphanides and Zervos, 1995; Suranovic et al., 1999; Gruber and Koszegi, 2000). Similar topic was extended by Glied (2002), the study provided a new hypothesis and examined whether an enactment of a certain Tobacco tax, which reduced youth smoking initiation, will further lessen their lifetime smoking propensities. Condition on the people who faced taxes increment at age 14, the result showed that higher tax has a significant short-term effect on reducing smoking, but, in the long-term, the tobacco tax effect declined progressively with age increment. Respecting the result, she concluded that the tax policy may only reduce youth smoking behavior, but no sufficient effect to substantially reduce smoking in adulthood.

3. The Evolution of Taiwan Tobacco Control Policy and the Data

3.1 Tobacco Policy in Taiwan

To raise government revenue and to regulate cigarette production and

consumption, Taiwan government grant the permission of production and retail selling of the tobacco products solely to a state-owned enterprise, Taiwan Tobacco and Liquor Company (TTLC), since 1900 the Japanese colonial period. Since then, the tobacco industry and market for cigarette products remain a monopoly and monopsony market structure for almost one century until 1987, when the western cigarette retailers strongly request for market opening. Cigarettes per pack produced by TTLC were subjected to a unit tax of NT$11 known as monopoly profit. By allowing the imports of US and European cigarettes through trade negotiation, Taiwanese government grant the commercial channel of retailing for imported cigarettes solely to the TTLC, and levied additional NT5 dollars monopoly profit to imported cigarettes per pack to regulate the cigarette consumption and to protect domestic cigarette production in Taiwan (Hsieh et al, 1996; Tsai et al, 2003)[2]. To respond to the wave of globalization and to benefit from worldwide free trade, Taiwan government enter the World Trade Organization (WTO) in the January of 2002, and responsively terminate monopoly and monopsony market structure which was operated by TTLC for entire century. Instead of monopoly profit, Taiwan government start to levy several taxes on cigarette products since the January of 2002, which includes a NT11.8 dollars wine-and-tobacco tax, 5% ad valorem excise tax, 27% import tariff for imported cigarettes.

In addition, to promote the education of tobacco hazard, Taiwan government levied the first-wave of health and welfare surcharge, which amounted to NT$5 in the January of 2002. To strengthen the effectiveness of tobacco taxes on discouraging the smoking behaviors, the government raised health and welfare surcharge from NT$5 to NT$10 in January 2006, and from NT$10 to NT$20 in July 2009. Consequently, the price of tobacco products increased substantially in the years of 2002, 2006, and 2009. Figure 1 presents that, before 2002, tobacco price stay put for the entire period of regulation. To respond to the implementation of several tobacco taxes (i.e. wine-and-tobacco tax, ad valorem excise tax, import tariff for imported cigarettes, and health and welfare surcharge), the tobacco price index jump up almost 40% in January

[2] That is, the monopoly profit was NT16 dollars per pack for imported cigarette and NT11 dollars per pack for domestic cigarette

of 2002. With additional NT$5 health and welfare surcharge levied in January 2006, the second-wave tobacco tax induced the price jump up with a smaller 6%. In the July of 2009, the third-wave tobacco tax with additional NT$10 health and welfare surcharge stimulate cigarette price rising 22%. The first wave tobacco tax shock induced a larger tobacco price increase than the other two.

Beside the implementation of tobacco taxes, to prevent tobacco hazards, the government of Taiwan started to implement "Tobacco Hazards Prevention Act" in 1997 to set several restrictions on the advertising of tobacco products and to prohibit vending tobacco products to the young under ages of eighteen.[3] The Act has been revised several times and made a major milestone in January 2009 to completely prohibit smoking in public area and inside the buildings.[4]

3.2 Data

To investigate the tobacco tax effect of three consecutive shocks implemented in 2002, 2006, and 2009, three longitudinal surveys of Taiwanese teenagers are used and compared. The first and second panel survey data used are obtained from a longitudinal survey of "Taiwan Youth Project (TYP)" which comprise 1988 birth cohort (survey year from 2000 to 2009) and 1986 birth cohort (survey year from 2000 to 2008). The 1988 birth cohort was first interviewed in their first year of junior high school or 7^{th} grades with an average age of 13 years old in 2000. In the same year, the 1986 birth cohort was first surveyed in their 9^{th} grades (third year of junior high school) with an average age of 15 years old. The 1988 cohort is the one who experienced all three waves of tobacco taxes during 2000s, and considered as experiment group in this study. The 1988 cohort experienced the first, second, and third waves of tobacco tax shock when they were in ages of 14, 18, and 21. The 1986

[3] The act is as follows: (1) Tobacco products should not be sold via vending machines, mail orders, on-line shopping, or any other methods that cannot screen customers' age (Article 5); (2) the warning slogan of tobacco hazards are required to print on tobacco product containers (Article 7); (3) The level of nicotine and tar contained in the tobacco products should be indicated, in Chinese, on tobacco product containers (Article 8); (4) no advertisement of tobacco product promotion is allowed (Article 9); (5) People under the age of eighteen should not smoke, and tobacco products should not be provided to those under the age of eighteen (Article 11-12); (6) smoking is prohibited in specific places (Article 13-14); (7) educating and publicizing campaign against tobacco hazards (Article 17-19).

[4] The revision of the Act in 2009 focused on two aspects: (1) impose the health and welfare surcharge (tobacco tax) for NT$10 per package of 20 cigarettes (Article 4); (2) completely prohibit smoking in the public area (Article 15-16).

cohort encountered the first and second waves of tobacco tax shock when they were 17 and 21 years old. Since the survey of 1986 cohort started at their average age of 15, in order to have same comparison age with 1988 cohort, the third panel survey "The Etiology of Adolescent's Substance Abuse: A Social Learning Model (EASA)" was used. EASA dataset first interviewed 1984 birth cohort when they were in 7th grades with an average age of 13 years old in 1996. The 1984 birth cohort encountered the first waves of tobacco price shock when they were in age 17.[5] Since the teens of 1984 and 1986 birth cohorts have not encountered the first boost of tobacco price before age 17, they were referred as the control cohort for the first tobacco price shock. These three longitudinal surveys were conducted by Research Center for Humanities and Social Sciences of Academia Sinica in Taiwan. The detailed survey months and years for these three longitudinal datasets are presented in Appendix.

These three longitudinal surveys are all school based sampling and employs a multi-stage stratified sampling design to produce representative data on students aged 13 in the first year of junior high school. The first stage consists of a probabilistic selection of schools, and the urbanization degree and class size of schools in northern Taiwan were taken into account. The second stage consists of a random selection of 2 to 3 classes from the participating schools. All students in the selected classes are eligible for the survey. These three surveys interviewed teenagers from entire class provides us with complete information regarding the smoking history, individual and family characteristics of teenagers and their entire classmates.

The survey of 1988 and 1986 birth cohort samples 2696 and 2890 students from 81 classes in 40 schools, and the survey of 1984 birth cohort samples 1596 students from 44 classes in 33 schools.

3.3 Gender Differences in Smoking Behaviors under three –wave Tobacco Taxes

Figure 2 presents the trajectory of young males' and young females' smoking rates from age 13 to age 22 for 1988, 1986, and 1984 birth cohorts, and the ages when each cohort has been confronting with the levy of multiple-wave tobacco taxes. Due

[5] The accurate comparison between tobacco price shock and the age of three panel survey data please see Appendix.

to the different exposures of tobacco shocks in each age for 1988, 1986, and 1984 cohorts, the 1988 cohort was referred as experiment group, and both 1986 and 1984 cohorts were combined to be control groups. The 1988 cohort (experiment group) practiced the first wave of tobacco tax at the average age of 15 while the cohorts of control group (1984 and 1986 cohort) did not encountered the first price shock until the average ages of 17-18. The second wave of tax shock in the cohort of experiment group (1988 cohort) was between age 18 and age 19, while the cohorts of control group encountered the second wave of tax shock not until age 21-22. The third wave of tax shock in the cohort of experiment group was between the average ages of 21-22, but not the cohorts of control group during our sample years.

During ages of 13 and 14, neither cohorts had experienced any tobacco shocks. At these pre-tax ages, Figure 2 reveals the similarity of the smoking behaviors between experiment group (1988 cohort) and control group (984 cohort) for young males and young females. When the youth in control group reached age 15, the last year of junior high school and the year when the first national entrance exam approached, the smoking rates of male teens and female teens continue to rise from 0.091 to 0.105 and from 0.068 to 0.082, respectively. While, the youth in experiment group who had experienced the first-wave tobacco tax showed different trajectory of smoking behaviors between male teens and female teens. The smoking rate of male teens continued to increase from 0.099 to 0.120, on contrary, female teens reduced their smoking rate from 0.069 to 0.049. Two years later, when the youth participated in the senior secondary education and reached age 17, without encountering tobacco tax, the males in control group substantially rose their smoking participation to 0.179; while their female counterparts started to lower their smoking participation to 0.068. In comparison, the smoking rate for males in experiment group rose slowly from 0.120 to 0.128; while their female counter continue to drop slightly from 0.049 to 0.040.

Due to the data limitation, the smoking behaviors of 1984 cohort was replaced with those of 1986 cohort (control group) for the comparison with those of 1988 cohort (experiment group) for the second and the third tobacco taxes. When youth

reached ages 18 to 22, the youth in experiment group (1988 cohort) experienced the second-wave and the third-wave tobacco shocks, while those the control group (1986 cohort) only experienced the first-wave and the second-wave tobacco shocks, correspondingly. The smoking rates of young males continue to rise when they became elder. With the additional tax shock, the smoking participation in experiment group substantially lower than those in control group for young males. On the contrary, the smoking rate became stable at around 0.07~0.08 when young female became elder. The differences in smoking participation between experiment group and control group, however, are not significant.

Comparing with three waves of tax shock, we found that the amount of the first wave tax shock was the largest one, its impacts was substantial. Even though the amount of third wave tax shock was substantial, the impacts of tax increment were alleviated when the teens became older. During the second and third shock, the effects of tobacco tax policy were weaker on reducing young smoking.

3.4 Experiment Group vs. Control Group

The mean statistics of the background variables for both experiment and control groups are presented in Table 2. It shows that over ages 12-22, youths in control group had substantially larger smoking rates and slightly higher onset smoking rates than experiment group youth. Although the tobacco tax levied nation-widely at the same amount, tobacco prices may rise differently among urban and rural areas depending on the local demand and supply. Table 3 shows that tobacco price per pack is about NT$46 facing by control-group youth, which is substantially lower than experiment group.

Student characteristics include gender ratio, academic score in 7^{th} grade, and health condition. The academic score in 7^{th} grade was around 3.0 on a 5.0 scale, which represents absolute score points in the range of 70-79 on a 100-point base.[6] Variable “health conditions in the last year” includes mental disorder, physical

[6]The scale of academic score are defined as following: 5= 「100-90 points」, 4= 「89-80 points」, 3= 「79-70 points」, 2= 「69-60 points」, 1= 「59-0 points」.

disorder, and sleep disorder.[7] The three measures of "disorder" ascend with the degree of discomfort, and range from no distress (a score of 1) to very serious distress (a score of 5). The higher the score of the "disorder" is the more serious the distress reported by the youth. It shows that in general, youths in experiment group had similar individual characteristics as youths in control group. They had similar gender ratio, academic distribution and health condition.

In terms of family characteristics, the father's ancestry variables reveal that experiment- and control- group youths had similar Minnan ratio. Minnan is the major tribal group in Taiwan. Similarly, family income variables are statistically no differences between experiment and control groups. Father's education is slightly higher for control group, since 1984 cohort are mainly resided in Taipei city. In addition, intact family ratios between experiment and control group are similar.

4. Estimation Strategy

4.1 Pre-tax Comparison of Smoking Participation Behavior

Typically a difference in difference estimate compares the change in an outcome in the experiment group to the change in an outcome in the control group where the policy changed for the experiment group but did not change for the control group over the same time period. The assumption is that no omitted factor affecting the outcome changed differentially for the experiment and control groups over the time the policy was enacted and the outcome was measured. In this study, the experience group (1988 cohort) experienced the first, second, and third waves of tobacco tax shock when they were in ages of 14, 18, and 21; while the control group (1984 and 1986 cohorts) encountered the first and second waves of tobacco tax shock when they were 17 and 21 years old. By using different cohorts as the control group due to different exposure of tobacco taxes, we implicitly assume that the age effect in the control group will be the same as the age effect in the experiment group and that unobserved determinants

[7] "Mental disorder" measures the degree of loneliness and depression and is computed as the average of the self-reported measures of "loneliness" and "depression". "Physical disorder" measures the degree of physical discomfort and is classified and computed as the average of the self-reported measures of "something stuck in your throat", "weakness in some parts of the body", "headache", and "numbness in some parts of the body". "Sleep disorder" measures the degree of insomnia and is calculated by averaging the self-reported measures of "insomnia", "awake early in the morning and can't fall asleep", and "unstable to sleep or wake up often".

of smoking over the period that experiment group experienced were the same as unobserved determinants of smoking over period that control group experienced. To test this assumption, we run a placebo difference in differences estimation using the 1988 and 1984 cohorts, but with data from 7th and 8th grade when all observations are before the tax went into effect. Table 3 presents the pre-tax comparison between experiment and control group with school fixed effects or individual fixed effects being controlled. The intersect term of age dummy and cohort dummy in Table 3 reveals that experiment group and control group have the same age effect on smoking behavior.

4.2 Estimation Model

This estimation model is based on the framework characterized by the theoretical model of Becker and Murphy (1988), which were used by most empirical analysis of smoking. Becker and Murphy (1988) suggest that, with rational addiction, current period utility of smoking for an individual is influenced by his/her previous smoking. Individuals are also forward-looking and take into account the influence of current smoking on future smoking behavior and future smoking hazard. Thus, derived from maximization of discounted lifetime utility subject to per-period budget constraint, the first-order condition implies that current cigarette demand function contains the lagged smoking and expected future cigarette consumption. Since the optimal expected value is based on currently available information rather than the actual future value, the expected future cigarette consumption may contain information of lagged smoking. The estimation model can then be presented as follows.

$$y_{ia} = \alpha_0 + \alpha_1 y_{ia-1} + \sum_{a=15}^{22} \left(\beta_a \mathrm{AGE}_{ia} \times LnP_{ia} + \delta_a \mathrm{AGE}_{ia} \right) + X'_{ia}\gamma + u_i + \varepsilon_{ia}$$
$$i = 1, ..., N;\ a = 14, ...22$$

Where i=1,……..,N denotes an individual youth i with age a=14,…,22. Dependent variable y_{ia} is the dummy variable indicating the smoking behavior of a youth i at age a, which includes smoking participation, onset smoking and smoking cessation behaviors in this study. The coefficient of lagged dependent variable α_1 measures the persistence effect of smoking addiction nature. The variable P_{ia} measures tobacco price which a youth i faced at age a. The youth in 1984 and1986 cohorts experienced

a lower tobacco price at each age than the one in 1988 cohort. The different exposure of tobacco price for both 1984 and1986 cohorts can be served as control group. The set of β_a captures the price elasticity of smoking probabilities at age a, which indicates the changes of the probability of smoking participation, onset smoking, or cessation when tobacco price changes one percentage. The set of δ_a however, captures the smoking behaviors at different ages. AGE_{ia} is the age dummy variable, which equals to 1 if t=a, and 0 otherwise. X_{ia} is the youth's and family characteristics vector. u_i is the unobserved individual heterogeneity of a youth *i* and ε_{ia} is an error term.

Linear probability model was specified. To take into account the unobserved individual heterogeneity u_i, we use first difference (FD) estimation to control for u_i. With our dynamic specification, the FD method cause the endogeneity between the first difference of lagged dependent variable and the first difference of error term. The available IV are $z_{ia} = (y_{i13}, y_{i14}, ...y_{i20})$. The FD equation with instrument variables are used in this study.

5. Estimation Results

To investigate the impacts of multiple-wave tobacco taxes levied during 2002~2009 in Taiwan on the trajectory of young males' and young females' smoking behaviors from their teens years to young adulthood, data from 1984, 1986, and 1988 birth cohorts with more than 5000 youth at ages 14~22 are used. Among these three cohorts, we observe the smoking behavior of 1988 cohort for the entire ages 14~22. In contrast, the smoking behaviors of 1984 cohort and 1986 cohort were surveyed at ages 13~17 and ages 15~22, respectively. With the nature of unbalanced panel, the effects of the first-wave tax shock mainly come from the comparisons between 1988 cohort (experiment group) with 1984 (control group). While, the effects of the second-wave and the third-wave tax shocks mainly come from the comparisons between 1988 cohort (experiment group) with 1986 cohort (control group). To completely capture the movements of the smoking behaviors for young males and young females, the participation, onset smoking and cessation behaviors are considered in this study.

5.1 The Impact of the First-wave Tobacco Tax

Table 4 presents the estimation of the dynamic smoking behaviors when the teens encountered the first tax shock. To take into account the addiction nature, the persistence of smoking behaviors are controlled by the lag smoking participation. Column 1 and column 3 present the dynamic model without controlling for the unobserved heterogeneity, while Column 2 and column 4 present the ones with the unobserved heterogeneity being controlled for. Conditional on not been participating in smoking behaviors in the last period, the impacts on young males' and young females' onset smoking are presented in columns 5 and 6. Similarly, the impact on the smoking cessation was presented in columns 7 and 8. Table 4 shows that a youth's smoking behavior reveals a significant and strong persistent effect (state dependence) due to rational or myopic addiction. Being smoking in the last period has a substantial impact on the probability of being smoking in current period. After controlling for the unobserved heterogeneity, this persistent effect become smaller for both young males and young females, especially drops for young males. The probabilities of being smoking in current period are 0.325 for female teens and 0.251 for male teens when they committed to smoke in the last period. The persistent effect is strong for female than for male teens.

After controlling for the addiction nature of smoking behavior and the set of observed and unobserved individual heterogeneity, the immediate impact of the first-wave tobacco tax levied in 2002 via raising cigarette price are significantly reducing a young female smoking at age 15. While, this immediate tax effect cannot be found for a fifteen-year-old male. With a 10% rise in cigarette price, a fifteen-year-old female immediate respond to a 0.010 drop of smoking probability. The estimates of onset smoking and cessation behaviors reveals that rise in price in 2002 lower the probability of onset smoking for a fifteen-year-old female teen attribute the immediate effect of the first-wave tobacco tax. Two years later, the first-wave tax impact has a persistent and even larger effect to reduce a youth smoking behaviors. With a 10% rise in cigarette price, a seventeen-year-old female continues to respond to a 0.013 drop of smoking probability; while, a

seventeen-year-old male starts to respond to a 0.012 drop of smoking probability. Similarly, the price hike in 2002 lower the probability of onset smoking for a seventeen-year-old male teen attribute the defer effect of the first-wave tobacco tax on young male. The age dummies reveal that the smoking participation of a youth increases with age.

Regarding the association between individual and family characteristics with a youth smoking behavior, we found that pocket money are significantly and positively associated with a male teen's smoking participation. Raising a male teen's pocket money will increase the probability of onset smoking and decrease the probability of smoking cessation, thus increase the smoking participation. In contrast, pocket money play no role in affecting a female teen's smoking behavior. In addition, sleeping problem is also significantly and positively associated with both a male teen's and a female teen's onset smoking, thus smoking participation. Father education has a substantial influence on daughter's smoking behavior, but not on son's smoking. With higher father education, a female teen are less likely to initiate and participate in smoking.

5.2 The Impacts of the Second- and Third-wave Tobacco Taxes

The findings from the first-wave tax shock in 2002 show that cigarette price hike via a substantial tax shock at younger ages immediately, significantly and persistently depress the onset smoking and smoking participation for female teens. The impacts on a male teen are significant but deferrable. Will the consecutive taxes levied in later year when a teen transit into young adult further dampen his/her smoking behaviors? Table 5 presents the impacts of the second- and third-wave tobacco taxes levied in years of 2006 and 2009 on young males' and young females' smoking behavior. Table 5 reveals that the persistent effects of smoking behavior holds but inversely relates to age when a youth become elder, Being smoking in the last period increases 0.172 and 0.256 probabilities of being smoking in current period for young males and young females, respectively. The persistent effect is also strong for female than for male teens.

The second-wave tax shock levied in the year of 2006, when the youth in 1988

cohort (experiment group) turning into ages 19-20, stimulate only a 6%~ 7% price hike. Table 5 shows that, with this insignificant price hike, both young males and young females respond insignificantly. Taiwan government implemented the third tax shock in the July of 2009 intending to reinforce the impact of tobacco tax. The third-wave tax shock in 2009 raises additional 20% of cigarette price, and accompanies with an antismoking policy to completely forbid smoking in building and public area. After controlling for the addiction nature of smoking behavior and the set of observed and unobserved individual heterogeneity, the immediate impact of the third-wave tobacco tax significantly but marginally reducing a young male smoking at age 22~23. While, this immediate tax effect cannot be found for a twenty-two-year-old female. With a 10% rise in cigarette price, a twenty-two-year-old male immediate respond to a 0.023 drop of smoking probability. The estimates of onset smoking and cessation behaviors reveals that antismoking policy in 2009 increasing the probability of cessation smoking for a twenty-two-year-old male attribute the impact of the third-wave tobacco tax. The age dummies reveal that the smoking participation of a youth increases with age.

Similarly, pocket money are significantly and positively associated with a young male's smoking participation when he becomes elder. The variable "pocket money" includes only the money from parents when a youth was in their junior high school year (age 13~15). When a youth entered senior secondary education (age 16 and older), variable "pocket money" include money from parents, scholarship, loan, and part- and full-time employment. Raising a young male's pocket money will decrease the probability of smoking cessation, and thus increase the smoking participation. In contrast, pocket money play no role in affecting a female teen's smoking behavior. Furthermore, after controlling for the addiction nature of smoking behavior and the set of observed and unobserved individual heterogeneity, family characteristics play no role in influencing young adults' smoking behaviors.

6. Conclusion

Tobacco taxes have emerged as a policy basis for the prevention of smoking by many governments. The impact of raising tobacco taxes on reducing the smoking

behaviors among the gender and the youth, however, is inconclusive. Lack of long-period longitudinal data to trace the persistent price impact on the trajectory of smoking behaviors among young male and female from their teen years to young adulthood are the main causes. In addition, to strengthen their impacts, some government may repeatedly raise the taxes on cigarette. The impact of multiple wave tobacco taxes on smoking behaviors is also unknown. The contribution of this study to the existing literature is threefold. First, by using two longitudinal surveys of Taiwanese youths (TYP and EASA dataset) with six to ten years data, we estimate a dynamic model to estimate and distinguish the persistent effects from smoking addiction nature and immediate and persistent effects from taxes. Second, with six to ten years longitudinal data, we are able to investigate the impacts of three repeated waves of tobacco taxes levied during 2002~2009 in Taiwan on young male's and female's smoking behaviors from age 13 to age 22. Third, the different trajectories of smoking behaviors among young males and young females from their teen years to young adulthood are estimated.

The results show that a youth's smoking behavior reveals a significant and strong persistent effect (state dependence) due to rational or myopic addiction. Being smoking in the last period has a substantial impact on the probability of being smoking in current period. The persistent effect is strong for female than for male teens. After controlling for the addiction nature of smoking behavior and the set of observed and unobserved individual heterogeneity, the immediate impact of the first-wave tobacco tax levied in 2002 via raising cigarette price are significantly reducing a young female smoking at age 15. While, this immediate tax effect cannot be found for a fifteen-year-old male. Two years later, the first-wave tax impact has a persistent and even larger effect to reduce a youth smoking behaviors. The price hike in 2002 lower the probability of onset smoking for a seventeen-year-old male teen attribute the defer effect of the first-wave tobacco tax on young male.

With the insignificant price hike in the second-wave tax shock, both young males and young females respond insignificantly. The third-wave tax shock in 2009 raises additional 20% of cigarette price, and accompanies with an antismoking policy to

completely forbid smoking in building and public area. After controlling for the addiction nature of smoking behavior and the set of observed and unobserved individual heterogeneity, the immediate impact of the third-wave tobacco tax significantly but marginally reducing a young male smoking at age 22~23. While, this immediate tax effect cannot be found for a twenty-two-year-old female. The estimates of onset smoking and cessation behaviors reveals that antismoking policy in 2009 increasing the probability of cessation smoking for a twenty-two-year-old male attribute the impact of the third-wave tobacco tax. The age dummies reveal that the smoking participation of a youth increases with age.

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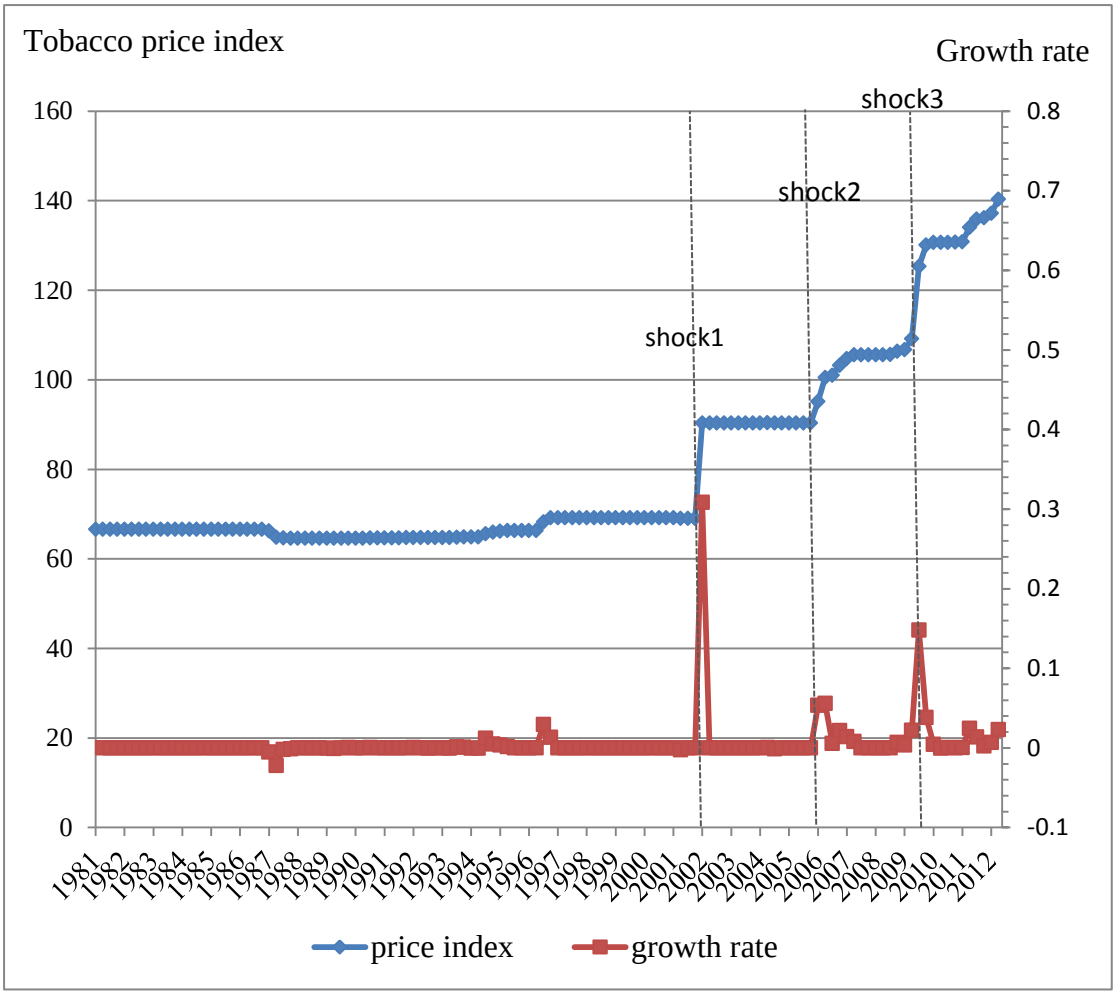

Figure 1. The Trend of Tobacco Price Index and Growth Rate

Table 1: National-wide Smoking Rates of Teenagers and Adults in Taiwan (Cross-sectional Data)

	Male	Female	Total
Global Youth Tobacco Survey-Taiwan (GYT) †			
Teen survey (age12 to 15)			
2004 survey	8.5	4.2	6.6
2006 survey	9.7	4.7	7.5
2008 survey	10.3	4.9	7.8
2010 survey	11.2	4.2	8.0
Young adulthood survey (age 16 to 18)			
2005 survey	21.1	8.5	15.2
2007 survey	19.3	9.1	14.8
2009 survey	19.6	9.1	14.8
Adult Smoking Behavior Surveillance System (ASBS)			
Adults survey			
2004 survey	42.9	4.6	24.1
2005 survey	40.0	4.8	22.7
2006 survey	39.6	4.1	22.1
2007 survey	39.0	5.1	22.3
2008 survey	38.6	4.8	21.9
2009 survey	35.4	4.2	20.0
2010 survey	35.0	4.1	19.8

Data resource: Both Global Youth Tobacco Survey and Adult Smoking Behavior Surveillance System are conducted by the Bureau of Health Promotion, Department of Health, Taiwan, R.O.C..

† The smoking rate of cross-section data of Global Youth Tobacco Survey are conducted based on following questions: “During the past 30 days (one month), have you ever smoked cigarettes?”.

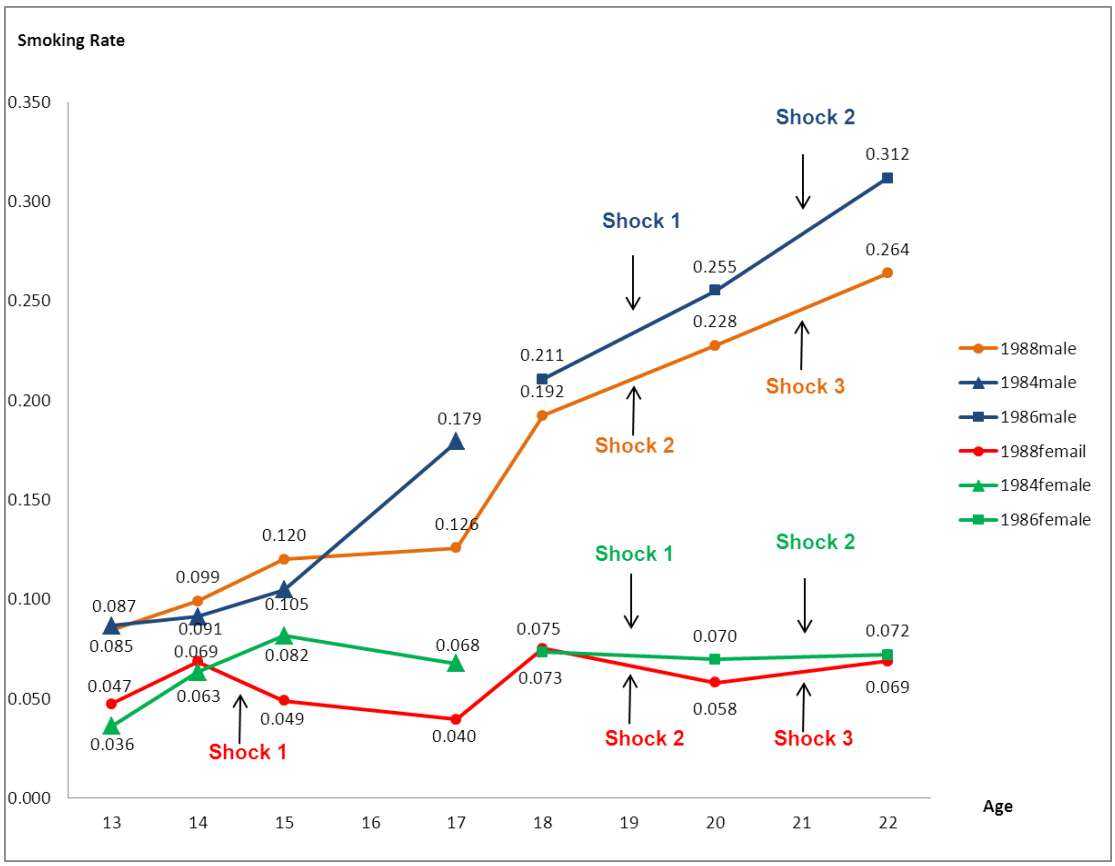

Figure 2. Three-wave tobacco taxes and gender trajectory difference in smoking rates during ages 13-22 among cohorts

Table 2. Mean Statistics of Smoking Behaviors and Control Variables

	Experiment Group	Control Group
Smoking ratio	0.097	0.120
Onset smoking ratio	0.041	0.045
Smoking cessation ratio	0.015	0.015
Tobacco price	50.940	46.248
Student's Characteristics		
Gender=1 if male	0.513	0.503
Academic score in the grade 7	2.896	2.918
Health condition		
Mental disorder in the last year	1.725	1.621
Physical disorder in the last year	1.469	1.382
Sleep disorder in the last year	1.397	1.328
Parent's characteristics		
Father's ancestry		
Minnan	0.724	0.739
Hakka	0.117	0.160
Mainlander	0.073	0.074
Native	0.010	0.008
Father's education		
Father junior middle school graduate and below	0.380	0.339
Father high school graduate	0.311	0.276
Father college graduate and above	0.267	0.322
Family Income (unit: NT1000)	64.032	64.655
Parental living		
Intact family	0.883	0.869
Non-intact families	0.067	0.077
Father or mother absent	0.050	0.054

Data resource: EASA survey (1984 cohort) and TYP survey (1986 and 1988 cohorts).
Note: Mental disorder combines two health measures: loneliness and depression. Physical disorder includes four health measures: “something stuck in your throat”、”weakness in some parts of the body”、”headache”、and “numbness in some parts of the body”. Sleep disorder includes three health measures: “insomnia”, “awake early in the morning and can’t fall asleep”、and “unstable sleep or wake up often”。Constant tern is included.

Table 3. Pre-tax Comparison of Smoking Behaviors for Teens Aged 13~14

	Male		Female	
Estimation procedure	OLS	FE	OLS	FE
Grade × Cohort	0.009	0.006	-0.004	-0.008
	(0.019)	(0.016)	(0.016)	(0.014)
Grade =1 if grade 8	0.009	0.013	0.026*	0.030**
	(0.016)	(0.013)	(0.013)	(0.012)
Cohort =1 if 1988 birth cohort	-0.022		0.008	
	(0.014)		(0.012)	
Student's characteristics:				
Pocket money	0.019***	-0.02	0.007**	-0.048**
	(0.003)	(0.025)	(0.003)	(0.022)
Academic score in last semester	-0.022***		-0.015***	
	(0.004)		(0.003)	
Mental disorder	0.007	-0.007	0.011**	0.006
	(0.007)	(0.009)	(0.005)	(0.007)
Physical disorder	0.028**	0.012	0.004	0.001
	(0.011)	(0.014)	(0.008)	(0.011)
Sleep disorder	0.028**	0.035**	0.025***	-0.002
	(0.009)	(0.011)	(0.007)	(0.010)
Family characteristics:				
Father high school graduate	-0.022**	0.121	-0.008	0.012
	(0.011)	(0.087)	(0.009)	(0.059)
Father junior college graduate	0.016	0.192	-0.009	-0.014
	(0.016)	(0.250)	(0.012)	(0.268)
Father college graduate and above	-0.028*	0.082	-0.02	-0.041
	(0.014)	(0.234)	(0.013)	(0.283)
Parental living arrangement:				
Noninact family	0.001	-0.073	0.065***	0.004
	(0.019)	(0.066)	(0.016)	(0.056)
Father absent	0.022	-0.074	0.025	0.135*
	(0.025)	(0.094)	(0.020)	(0.078)
F statistic (P-value)	11.348(0.000)	1.936(0.000)	7.669(0.000)	2.076(0.000)
Adjusted R^2/ R^2-within	0.037	0.012	0.025	0.014
R^2-between		0.006		0.001
R^2-overall		0.002		0
Number of observations	3794	3794	3590	3590

Data resource: EASA survey (1984 cohort) and TYP survey (1988 cohorts).
Note: Standard error in parentheses. Constant term is included.
***, **, and* denotes statistical significance at the 1%, 5% and 10% level.

Table 4. The Impacts of the First-wave Tobacco Tax on Teenagers' Smoking Behaviors at ages 14-17 (Age 14 vs. Ages 15-17)

	Smoke participation				Onset smoking		Cessation	
	male		female		male	female	male	female
	OLS	FD(IV)	OLS	FD(IV)	FE	FE	FE	FE
First tax impact at age15	0.007	0.069	-0.120**	-0.099**	0.004	-0.035	-0.006	-0.015
(Age15*ln Tobacco Price)	(0.052)	(0.063)	(0.040)	(0.045)	(0.066)	(0.050)	(0.054)	(0.044)
First tax impact at age17	-0.226***	-0.123*	-0.080*	-0.132**	-0.171**	-0.005	-0.068	-0.061
(Age17*ln Tobacco Price)	(0.061)	(0.069)	(0.047)	(0.050)	(0.073)	(0.055)	(0.059)	(0.049)
Age15=1 if age=15	-0.012	-0.243	0.450**	0.387**	-0.008	0.119	0.025	0.071
	(0.202)	(0.242)	(0.156)	(0.173)	(0.254)	(0.192)	(0.210)	(0.171)
Age17=1 if age=17	0.903***	0.536**	0.297	0.525**	0.691**	0.016	0.280	0.242
	(0.236)	(0.268)	(0.183)	(0.192)	(0.280)	(0.213)	(0.230)	(0.188)
Student's characteristics:								
Smoking in the previous year	0.423***	0.251***	0.365***	0.325***				
	(0.014)	(0.019)	(0.014)	(0.017)				
Pockey money	0.017***	0.013***	0.008***	0.003	0.013***	0.002	-0.005*	-0.003
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Mental disorder	0.007	0.003	0.003	0.005	0.008	0.003	0.004	0.005
	(0.006)	(0.008)	(0.004)	(0.004)	(0.008)	(0.005)	(0.007)	(0.004)
Physical disorder	0.002	-0.011	0.007	0.002	-0.024**	0.004	0.003	-0.006
	(0.010)	(0.012)	(0.007)	(0.007)	(0.012)	(0.008)	(0.010)	(0.007)
Sleep disorder	0.025**	0.014*	0.028***	0.017**	0.001	0.017**	0.012*	-0.006
	(0.008)	(0.009)	(0.005)	(0.006)	(0.009)	(0.006)	(0.007)	(0.006)
Family characteristics:								
Father high school graduate	-0.011	-0.079	-0.009	-0.087*	0.06	-0.081	-0.002	0.034
	(0.010)	(0.066)	(0.007)	(0.045)	(0.069)	(0.050)	(0.057)	(0.044)
Father junior college graduate	-0.024*	-0.068	-0.020*	-0.113*	0.049	-0.116*	-0.094	0.06
	(0.014)	(0.088)	(0.010)	(0.059)	(0.092)	(0.065)	(0.076)	(0.057)
Father college graduate and above	-0.030**	-0.095	-0.022**	-0.211**	-0.088	-0.188**	-0.012	0.11
	(0.012)	(0.100)	(0.010)	(0.071)	(0.104)	(0.079)	(0.087)	(0.069)

Parental living arrangement:								
Noninact family	0.028*	-0.124**	0.006	0.026	-0.068	0.009	0.06	-0.052
	(0.017)	(0.052)	(0.012)	(0.035)	(0.054)	(0.039)	(0.045)	(0.035)
Father absent	0.018	0.015	0.030**	-0.014	0.093	0.018	-0.144**	0.063
	(0.020)	(0.060)	(0.015)	(0.054)	(0.063)	(0.060)	(0.052)	(0.052)
F statistic (P-value)	75.32(0.00)	17.99(0.00)	54.55 (0.00)	28.13(0.00)	3.96(0.00)	1.94(0.00)	2.01(0.00)	1.46(0.00)
Adjusted R^2/ R^2-within	0.170	0.074	0.135	0.117	0.016	0.008	0.008	0.006
R^2-between		0.257		0.152	0.005	0.010	0.000	0.002
R^2-overall		0.053		0.031	0.006	0.005	0.001	0
Number of observations	5428	5428	5157	5157	5428	5157	5373	5127

Data resource: EASA survey (1984 cohort) and TYP survey (1988 cohorts).
Note: Standard error in parentheses. Constant term is included. Control variables also include constant and family income.
***, **, and* denotes statistical significance at the 1%, 5% and 10% level.

Table 5. The Impacts of the Second- and Third-wave Tobacco Taxes on Youth's Smoking Bahaviors at Ages 18-22
(Second-wave : Age 18 vs. Ages 20; Third-wave: Age 20 vs. Age 22)

	Smoke participation				Onset smoking		Cessation	
	male		female		male	female	male	female
	OLS	FD(IV)	OLS	FD(IV)	FE	FE	FE	FE
Second tax impact at age20	-0.097	-0.087	0.000	0.009	0.087	0.036	0.213**	-0.057
(Age20*ln Tobacco Price)	(0.106)	(0.134)	(0.071)	(0.089)	(0.155)	(0.095)	(0.100)	(0.078)
Third tax impact at age22	-0.171*	-0.225*	0.010	0.035	0.081	0.123	0.165*	0.093
(Age22*ln Tobacco Price)	(0.098)	(0.131)	(0.066)	(0.087)	(0.151)	(0.093)	(0.097)	(0.076)
Age20=1 if age=20	0.362	0.38	-0.05	-0.036	-0.344	-0.160	-0.850**	0.243
	(0.428)	(0.538)	(0.288)	(0.359)	(0.622)	(0.383)	(0.400)	(0.313)
Age22=1 if age=22	0.668	0.994*	-0.089	-0.134	-0.353	-0.522	-0.684*	-0.388
	(0.407)	(0.539)	(0.272)	(0.358)	(0.622)	(0.382)	(0.400)	(0.312)
Student's characteristics:								
Smoking in the previous year	0.706***	0.172***	0.529***	0.256***				
	(0.012)	(0.020)	(0.014)	(0.020)				
Pocket money	0.005***	0.002***	0.003***	0.001	0.000	0.001**	-0.001**	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Mental disorder	-0.012*	-0.009	-0.003	0.002	-0.012	-0.016**	0.015**	0.009**
	(0.007)	(0.008)	(0.004)	(0.005)	(0.010)	(0.005)	(0.006)	(0.004)
Physical disorder	-0.007	0.013	0.009	-0.007	-0.013	-0.002	0	-0.006
	(0.011)	(0.012)	(0.006)	(0.007)	(0.014)	(0.008)	(0.009)	(0.006)
Sleep disorder	0.019**	0.012	-0.001	-0.004	0.004	-0.008	-0.001	0.008*
	(0.008)	(0.009)	(0.005)	(0.006)	(0.011)	(0.006)	(0.007)	(0.005)
Family characteristics:								
Father high school graduate	-0.012	0.019	0.002	-0.017	0.017	-0.005	-0.004	0.005
	(0.012)	(0.027)	(0.008)	(0.017)	(0.031)	(0.018)	(0.020)	
Father junior college graduate	-0.039**	0.028	-0.008	-0.032	-0.011	-0.001	0.002	0.013
	(0.015)	(0.040)	(0.010)	(0.026)	(0.046)	(0.028)	(0.030)	(0.023)

Father college graduate and above	-0.043** (0.015)	0.028 (0.050)	0.014 (0.010)	-0.010 (0.034)	-0.018 (0.058)	-0.004 (0.037)	-0.017 (0.037)	-0.004 (0.030)
Parental living arrangement:								
Noninact family	-0.012 (0.018)	-0.022 (0.039)	0.044*** (0.012)	-0.001 (0.023)	-0.066 (0.045)	-0.012 (0.025)	-0.004 (0.029)	-0.012 (0.020)
Father absent	-0.005 (0.018)	0.017 (0.048)	0.031** (0.014)	-0.025 (0.039)	0.018 (0.056)	-0.022 (0.041)	0.054 (0.036)	0.084** (0.034)
F statistic (P-value)	257.52(0.00)	10.33(0.00)	108.28(0.00)	11.65(0.00)	1.24(0.00)	1.96(0.00)	1.56(0.00)	2.45(0.00)
Adjusted R^2/ R^2-within	0.458	0.059	0.266	0.067	0.007	0.011	0.009	0.014
R^2-between		0.494		0.433	0.001	0.000	0.001	0.000
R^2-overall		0.255		0.223	0.002	0.002	0.002	0.003
Number of observations	4553	4553	4451	4451	4553	4451	4562	4454

Data resource: TYP survey (1986 cohort and 1988 cohorts).
Note: Standard error in parentheses. Constant term is included. Control variables also include constant and family income.
***, **, and* denotes statistical significance at the 1%, 5% and 10% level.

Appendix I. Survey Years and Months of TYP Longitudinal Youth datasets

	Experiment Group	Control Group	
	1988 birth cohort (Survey year 2000-2009)	1986 birth cohort (Survey year 2000-2006)	1984 birth cohort (Survey year 1996-2002)
	Survey year and month	Survey year and month	Survey year and month
junior middle school:			
Age 13	2000.3		1996.9
Age 14	2001.3		1997.10
	(Tax Shock I)		
Age 15	2002.3	2000.3	1998.10
Senior high school:			
Age 16	2002.10	2000.10	1999.11
Age 17	2003.10	2001.10	2001.2
		(Tax Shock I)	**(Tax Shock I)**
Age 18	2005.3	2003.3	2002.3
	(Tax Shock II)		
College:			
Age 19	2006.3	2004.2	2002.10
Age 20	2007.6	2004.10	
Age 21			
	(Tax Shock III)	**(Tax Shock II)**	
Age 22	2009.6	2006.12	

Data resource: EASA survey (1984 cohort) and TYP survey (1986 and 1988 cohorts).

Note: the survey year and month are arranged from the internet of Taiwan Youth Project (TYP):

http://www.typ.sinica.edu.tw/newpage/1/researchstructure.htm