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Editor's Note: Drs. Lee and Chen provide data on the effects of price and smoking characteristics and their relationship to smuggled cigarettes in Taiwan. Smuggled cigarette smoking increased for each NT$1 increase in the price of legal cigarettes.

Globally, cigarette smuggling as a percent of consumption varies widely. In Israel, it is estimated that 44% of the cigarettes are smuggled (1999 WHO). In Hungary, the rate is 9% and in Egypt it is slightly above 1%. Researchers estimate that 30% of the internationally exported cigarettes (about 355 billion cigarettes) are lost to smuggling.

This trend is seen globally, both in the developed and developing world. Cigarette taxes are often used to plug holes in budgets at all levels of government. Here in my home state of New Jersey, for instance, the newly proposed tax for July 2006 on a pack of cigarettes is $2.75, up from the current $2.40 USD per pack.

Initially, state and federal governments benefited from the increased revenue, and we saw the desired decrease in cigarette consumption. But over time, sales of legal cigarettes decreased and illegal cigarettes were smuggled into the higher tax states for resale.

A report from Tobacco Free Kids estimates that approximately one-quarter of all legally exported cigarettes end up smuggled across international borders.

The World Bank (Joossens, 1999; De Beyer, 2002) has identified countries with high and low smuggling rates. Sweden, Denmark, Norway, France, Finland, and Ireland—all with high cigarette prices and taxes—are reported to have low smuggling rates (<5%). Countries with low cigarette prices and taxes are reported to have higher smuggling rates (>10%): Spain, Italy, Pakistan, Nigeria, Yugoslavia, Ukraine, Moldova, Columbia, Iran, Austria, and Cambodia.

Similar to the recommendations made by other researchers, the authors sanction better controls, forgery-proof tobacco tax stamps, and other regulatory systems. The task will be difficult given that we estimate overall smoking prevalence is still about 29% globally, with more than 82% of smokers belonging to low- and middle-income groups.

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EFFECT OF PRICE AND SMOKING CHARACTERISTICS ON THE DECISION TO SMOKE SMUGGLED CIGARETTES IN TAIWAN

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Many scholars have studied the effects of cigarette price on cigarette consumption. Their conclusions clearly confirm that increases in cigarette prices and cigarette tax bring about significant reductions in cigarette consumption.[1–8] Nevertheless, cigarette tax hikes causing increases in cigarette prices are also widely thought to cause surges in cigarette smuggling. In addition, the threat of increased cigarette smuggling may weaken the government's ability to use cigarette tax hikes as a tobacco control policy tool. After Canada (1994) and Sweden (1998) reduced cigarette taxes to curb rising cigarette smuggling, cigarette prices fell to a level lower than when no smuggling occurred.[9] We are therefore concerned about whether cigarette price increases cause consumption of smuggled cigarettes to rise. And since non-price-related personal smoking characteristics such as personal income, level of addiction, area of residence, and living environment may affect the decision to smoke smuggled cigarettes,[10,11] we have also assessed the effect of both price and non-price factors on consumption of smuggled cigarettes.

Estimates of cigarettes smuggled into Taiwan derived from worldwide export volume statistics suggest that smuggled cigarettes account for approximately 14% of all cigarettes sold on the market. In comparison with the corresponding figures of 4% for China and 10% for Hong Kong, Taiwan's figure of 14% is rather high.[12] The implementation of a new cigarette tax system following Taiwan's accession to the World Trade Organization (WTO) on January 1, 2002, caused a significant increase in cigarette prices. In addition, concurrent changes in the wine and tobacco management system and sharp reductions in criminal penalties created greater incentives to engage in smuggling. The quantity of smuggled cigarettes intercepted by the

government averaged over 15 million packs per year from 2000 to 2004, and this annual figure was over five times greater than the 2.4 million packs intercepted in 1986. This suggests that the smuggling of cigarettes has become increasingly prevalent. Besides disrupting market price mechanisms, the smuggling of cigarettes also poses a major threat to citizens' health and safety, while causing the government to lose tax revenue.[13] If we assume that the quantity of seized contraband cigarettes is equivalent to one-fourth of the total quantity of smuggled cigarettes entering the market, then based on the 2002 cigarette tax of NT$16.8 per pack, the government lost more than NT$5 billion in revenue over the five-year period of 2000–2004.

In addition to causing tax revenue losses, the smuggling of cigarettes has also been implicated in many health-related issues.[14] First, empirical research has confirmed that a high level of tobacco consumption is linked with a high incidence of smoking-related diseases and a high death rate. Since young people and low-income citizens in particular are relatively sensitive to cigarette prices, low-price smuggled cigarettes may have a significant impact on the health of young and poor smokers. Second, since sellers of legal cigarettes must compete against the black market in smuggled cigarettes, they may be tempted to sell cigarettes to young people less than 18 years of age. Young people will increase their tobacco consumption when they find it easy to procure cigarettes. Third, packs of smuggled cigarettes often do not carry health warnings, and the absence of appropriate warnings may lead to an increase in cigarette consumption. Finally, the profitability of cigarette smuggling may spur the rapid growth of organized crime networks; this can lead to many social problems, as when distributors and sellers of legal cigarettes are induced to sell black market cigarettes in the face of competition from smuggled products.[15]

After studying consumption of smuggled cigarettes using data from a 2000 nationwide survey of cigarette use, Tsai et al. (2003) discovered that cigarette price hikes are the main factor prompting smokers to purchase smuggled cigarettes.[16] Wiltshire (2001) studied the consumption of smuggled cigarettes in two areas of Edinburgh with different socioeconomic conditions, and found that low-income smokers perceive the use of smuggled cigarettes as their main method of easing smoking costs.[17] Taylor (2005) investigated the effect of demographic characteristics on the purchase of smuggled cigarettes in the area under the jurisdiction of England's Hull & East Riding Health Authority; this study found that users of smuggled cigarettes are usually heavy smokers with relatively high levels of addiction living in poorer areas; most have jobs. However, these persons smoke smuggled cigarettes as a way of saving money and feeding their smoking habit. While most literature on smuggled cigarettes has chiefly explored the effect of rising cigarette prices on use of smuggled cigarettes, some recent studies have looked at the effect of non-price factors—specifically smoking characteristics—on the use of smuggled cigarettes.[11–17] These studies have discovered that personal factors such as level of addiction, income, and area of residence may all exert an effect on consumption of smuggled cigarettes.

Taiwan's new tax system, implemented following its accession to the WTO in 2002, imposed an NT$11.8 wine and tobacco tax charge and an NT$5 tobacco product health levy charge, along with a 5% sales tax charge, on each pack of imported or domestic cigarettes. The 2002 tax increases caused the average price of a pack of domestic cigarettes to rise by approximately NT$8. Cigarette price increases may induce users of smuggled cigarettes to increase their consumption of smuggled cigarettes, and also cause smokers who do not use smuggled cigarettes to begin smoking smuggled cigarettes. In addition to continuing to assess the effect of cigarette price increases on smokers' decision to smoke smuggled cigarettes, we further divided smokers into three groups: non-users of smuggled cigarettes, occasional users of smuggled cigarettes, and regular users of smuggled cigarettes. We then used the probit model to analyze the effect of price and smoking characteristics on users and regular users of smuggled cigarettes. We expect the results of this research to facilitate understanding of the characteristics of users of smuggled cigarettes and provide information to guide government health agencies in the drafting of tobacco control policies.

METHODS

Data collection

This study's survey targeted current smokers aged 15 years and above in 23 counties and cities throughout Taiwan. The survey was conducted from April to July, 2004, via telephone interviews. The subjects consisted of male and female smokers in numbers proportional to their relative percentage of the population. There was an effective sample of 1,345 subjects. This study defined smuggled cigarettes as illegal smuggled cigarettes not bearing the tax seal and on which no tax had been paid. Smuggled cigarettes included both imported and domestic brands. Current smokers were defined as daily or occasional smokers who had smoked at least 100 cigarettes in their lifetime.[18]

Of the 1,345 respondents, 67.5% (n=888) had not smoked smuggled cigarettes and 32.5% (n=457) had smoked smuggled cigarettes. Respondents who had not smoked smuggled cigarettes were defined as persons who had smoked less than 100 smuggled cigarettes or who had not smoked for the previous 30 days. Of the respondents who had smoked smuggled cigarettes, the 20% (n=70) who regularly smoked smuggled cigarettes admitted to smoking and regularly purchasing smuggled cigarettes; the remaining 80% (n=387) occasionally smoked smuggled cigarettes, but did not regularly purchase them. This study defined regular smokers of smuggled cigarettes as those persons who had smoked at least 100 smuggled cigarettes in their lifetime, and had smoked smuggled cigarettes almost every day in the last 30 days. Occasional smokers of smuggled cigarettes were defined as those persons who had smoked at least 100 smuggled cigarettes in their lifetime, and had smoked smuggled cigarettes 1 to 29 of the last 30 days.

The survey consisted of two major parts. The first part was a survey of cigarette prices, including the prices of both legal and smuggled cigarettes. The second part addressed smoking characteristics, including demographic factors, economic factors, and smoking behavioral factors. Demographic factors included the smoker's age, marital status, education, and area of residence. Economic factors included monthly income and weekly cigarette expenditure. Behavioral factors included number of cigarettes smoked daily, motivation to smoke smuggled cigarettes, and place where smuggled cigarettes were obtained.

Data analysis

We classified smokers as non-smokers of smuggled cigarettes, occasional smokers of smuggled cigarettes, and regular smokers of smuggled cigarettes in order to explore current smokers' different motivations for smoking smuggled cigarettes. Basic descriptive analytical methods included percentage, mean, χ^2, and t tests of the foregoing groups. Probit regression was used to investigate the likelihood of smoking smuggled cigarettes with regard to the following independent variables.

The following three groups of independent variables were used in statistical analysis and the probit model: (*1*) demographic factors—age, marital status, education, place of residence; (*2*) economic factors—personal monthly income and legal/smuggled cigarette price reported by the individual smoker; and (*3*) smoking characteristics—daily cigarette smoking, motivation for smoking smuggled cigarettes, and place of purchase of smuggled cigarettes. The smokers' places of residence consist of the two choices of non-southern and southern Taiwan. Smokers' personal incomes were classified in four levels: less than NT$10,000/month, NT$10,000–30,000/month, NT$30,000–49,000/month, and over NT$50,000/month.

The prices of legal and smuggled cigarettes were determined on the basis of individual smokers' self reporting of the price they paid in their last cigarette purchase. Smokers of smuggled cigarettes were asked: "What has strongly motivated you to smoke smuggled cigarettes?" Response options included "cheaper price," "good quality," "strengthens sexual ability," and "curiosity." The last three motivations were considered "non-price" factors in the smokers' decision to smoke smuggled cigarettes. Smokers of smuggled cigarettes were also asked: "Where do you usually purchase smuggled cigarettes?" Response options were "KTVs" (karaoke television establishments, including pubs and MTVs [music video establishments]), "friends," and "betel nut vendors." Table 1 provides definitions and explanations of the variables used in our empirical models.

Model specification

The probit model was used to estimate the effect of two types of decisions on the smoking of smuggled cigarettes. The respondent's actual cigarette consumption, denoted as y^*, was defined as a linear function of the covariates, indicated as X in model 1 and model 2. Our models were structured as follows:

$$y^* = X\beta + \varepsilon,$$

where ε is an unobserved component. However, only the frequency of consumption, y, is utilized according to the following rule:

$$y=0 \text{ if } y^* \leq 0,$$
$$y=1 \text{ if } y^* > 0,$$

In model 1, y=0 indicates a smoker not smoking smuggled cigarettes and y=1 indicates a current smoker of smuggled cigarettes (both daily and occasional smokers). However, in model 2, y=0 indicates a smoker who has smoked any smuggled cigarettes and y=1 indicates a smoker who regularly smokes smuggled cigarettes. Assuming ε is normally distributed, the probability of observing a current smoker is given by:

$$\Pr[y=1|X] = \Phi(X\beta)$$

where $\Phi(.)$ is the standard normal distribution. Robust standard errors were calculated to allow arbitrary correlations in the state level.

Table 1. Definition and explanation of variables in empirical models

Variable	*Definition*	*Explanation*
Dependent variables		
Occasional smokers of smuggled cigarettes	Current smoker who occasionally smokes smuggled cigarettes	Dummy, 1 if current smoker who occasional smokes smuggled cigarettes and 0 if current smoker who has never smoked smuggled cigarettes
Regular smokers of smuggled cigarettes	Current smoker who regularly smokes smuggled cigarettes	Dummy, 1 if current smoker who regularly smokes smuggled cigarettes and 0 if current smokers who occasionally smokes smuggled cigarettes
Independent variables		
Demographic factors		
Male	Current smoker is male	Dummy, 1 if current smoker is male and 0 if current smoker is female
Age<35	Current smoker's age is under 35 years of age	Dummy, 1 if current smoker's age is under 35 years of age and 0 otherwise
Marital status (married)	Current smokers get married	Dummy, 1 if current smoker is married and 0 otherwise
Education level		
Junior high school or below	Current smoker's education level is junior high school or below	Dummy, 1 if current smoker's education level is junior high school or below and 0 otherwise
Senior high school	Current smoker's education level is senior high school	Dummy, 1 if current smoker's education level is senior high school and 0 otherwise
College or above	Current smoker's education level is college or above	Dummy, 1 if current smoker's education level is college or above and 0 otherwise
Residence in southern Taiwan	Current smoker's residence	Dummy, 1 if current smoker's residence is in the southern area of Taiwan and 0 otherwise
Economic factors		
Personal monthly income (NT$)	Current smoker's personal monthly income	1=<NT$10K, 2=NT$10–29K, 3=NT$30–49K, 4=50K
Legal cigarette price	Price reported by current smoker on survey	Continuous value
Smuggled cigarette price	Price reported by current smoker on survey	Continuous value
Smoking characteristics		
Motivations		
Cheaper price	Current smoker purchased smuggled cigarettes due to cheaper price	Dummy, 1 if current smoker purchased smuggled cigarettes due to the cheaper price and 0 otherwise
Better taste	Current smoker purchased smuggled cigarettes due to better taste	Dummy, 1 if current smoker purchased smuggled cigarettes due to the better taste and 0 otherwise
Good quality	Current smoker purchased smuggled cigarettes due to good quality	Dummy, 1 if current smoker purchased smuggled cigarettes due to the good quality and 0 otherwise
Strengthens sexual ability	Current smoker purchased smuggled cigarettes due their strengthening sexual ability	Dummy, 1 if current smoker purchased smuggled cigarettes due to their strengthening sexual ability and 0 otherwise
Curiosity	Current smoker purchased smuggled cigarettes due to curiosity	Dummy, 1 if current smoker purchased smuggled cigarettes due to curiosity and 0 otherwise
Purchasing places		
KTVs (including pubs and MTVs)	Current smoker purchased smuggled cigarettes from KTVs (including Pubs and MTVs)	Dummy, 1 if current smoker purchased smuggled cigarettes from KTVs and 0 otherwise
Friends or relatives	Current smoker purchased smuggled cigarettes from friends or their relatives	Dummy, 1 if current smoker purchased smuggled cigarettes from friends or their relatives and 0 otherwise
Betel nut vendors	Current smoker purchased smuggled cigarettes from betel nut vendors	Dummy, 1 if current smoker purchased smuggled cigarettes from betel nut vendors and 0 otherwise

KTV = karaoke television [establishment]

MTV = music video [establishment]

RESULTS

Table 2 shows the major characteristics of current smokers who never, occasionally, and regularly smoke smuggled cigarettes. The results of the χ^2 statistical significance test of different smoking characteristics indicate that the three different smoker classifications are completely appropriate for our empirical estimations. The primary demographic characteristics of 70 current smokers who regularly smoked smuggled cigarettes were as follows: 50% were between 19 and 34 years old, 52.86% were unmarried, 61.43% had a junior high school education degree or below (excluding. elementary school degree), 77.14% lived in a southern area of Taiwan, and 57.14% had a personal monthly income of less than NT$10,000. The average self-reported smuggled cigarette price was NT$49.27 per pack, with a standard deviation of 19; 55.71% smoked less than 20 cigarettes daily, and most (59.42%) spent less than NT$300 per week on smoking; 32.86% and 25.71% were motivated to smoke smuggled cigarettes by better taste and good quality, respectively; 32.86% received their smuggled cigarettes from their friends, and 27.14% purchased them from the betel nut vendors common along roadsides in Taiwan.

In comparison with the regular smokers of smuggled cigarettes, the 387 current smokers who occasionally smoked smuggled cigarettes were characterized as follows: 55.56% were between 19 and 34 years old and 52.71% were unmarried—similar to the statistics for regular smokers of smuggled cigarettes; 41.60% had received a senior high school degree; 81.65% lived in southern areas of Taiwan; 30.49% had a personal monthly income between NT$10,000 and NT$29,000; most (63.57%) spent less than NT$300 per week on smoking; 32.04% smoked smuggled cigarettes for their better taste compared with domestic cigarettes; 34.63% obtained smuggled cigarettes from friends or relatives, and another 30.23% purchased them from roadside betel nut vendors.

Table 3 shows the empirical results of the probit model, which illuminate the relationship between current smokers of smuggled cigarettes and major explanatory variables. Model 1 compares smokers of smuggled cigarettes with smokers who never use smuggled cigarettes in terms of demographic factors (sex, age, marital status, and residence), legal cigarette price reported by the respondents in logarithmic form, level of personal monthly income, weekly smoking expenditure, and other independent variables.

We used the Inverse Mill's Ratio (IMR) Model 1 as a proxy for the possibility that current smokers who never smoke smuggled cigarettes may begin doing so. Model 2 explores the different motivations of smokers who regularly and occasionally smoke smuggled cigarettes. Explanatory variables motivating smoking of smuggled cigarettes—such as better taste, good quality, strengthens sexual ability, and curiosity—were considered and their effects estimated. The probit model results are better interpreted in terms of the concept of marginal probability, which here is used to represent changes in the probability of smoking smuggled cigarettes with respect to each explanatory variable. Marginal probabilities are calculated using the probit model and reported in Table 3. The goodness-of-fit for the two models is generally reasonable when judged by higher value of MacFadden R^2 for Model 1(0.449) and Model 2 (0.580). This indicates that our empirical model provides ideal adequacy and yields reliable results.

Model 1 shows higher cigarette price levels increasing the probability that current smokers will purchase smuggled cigarettes by 26.1%. The likelihood that current smokers will smoke smuggled cigarettes is positively correlated with male gender, unmarried status, residence in southern Taiwan, weekly smoking expenditure, and legal cigarette price as well, and negatively correlated with age and education level. The marginal effects of gender and marital status suggest that being male and married increase the probability of smoking smuggled cigarettes by 14.8% and 6.1% respectively. On the other hand, the marginal effect of age suggests that lower age increases the probability of smoking smuggled cigarettes by 32.7%. A lower education level, specifically junior high and below, implies a 19.8% greater propensity to smoke smuggled cigarettes, while residence in southern Taiwan increases likelihood of smoking smuggled cigarettes by 9.6%.

When we investigated how much the possibility that current smokers' may smoke smuggled cigarettes matters in Model 1, the fact that the estimated value of IMR is positive and statistically significant implies that current smokers who never smoke smuggled cigarettes clearly have the potential to start smoking smuggled cigarettes. The IMR marginal effect, which expresses the potential to smoke smuggled cigarettes, suggests that the probability that current smokers will smoke smuggled cigarettes is 63.6%. This finding implies that current smokers who have never smoked smuggled cigarettes have a notable probability of eventually smoking smuggled cigarettes.

The differences in individual smoking behavior between regular and occasional smokers of smuggled cigarettes are presented and explained in Model 2. Regular smokers of smuggled cigarettes are more likely to be male, young, married, and lower-educated, have lower monthly income, and higher weekly smoking

Table 2. Descriptive statistics

Explanatory variables	Current smokers: Regularly smokes smuggled cigarettes (n=70)	Occasionally smokes smuggled cigarettes (n=387)	Never smoked smuggled cigarettes (n=888)	χ^2 test
Demographic factors				
Age (years)				351.20***
<18	42.86	2.07	2.25	
19–34	50.00	55.56	32.09	
35	7.14	42.38	65.65	
Marital status				35.59***
Unmarried	52.86	52.71	69.26	
Married	47.14	47.29	30.74	
Education				50.56***
Junior high school or below	61.43	21.71	32.43	
Senior high school	12.86	41.60	34.35	
College	21.43	32.82	28.60	
Graduate school	4.29	3.88	4.62	
Residence				7.68**
Non-Southern	22.86	18.35	13.63	
Southern	77.14	81.65	86.37	
Economic factors				
Personal monthly income				31.74***
<NT$10K	57.14	27.65	29.84	
NT$10–29K	18.57	30.49	25.23	
NT$30–49K	18.57	24.81	24.10	
NT$50K	5.71	17.05	20.83	
Cigarette price per pack (in NT$)				
Legal (mean/std)	52.11/9.28			
Smuggled (mean/std)	49.27/19.00			
Smoking characteristics				
Number of cigarettes smoked daily				19.35***
<20	55.71	71.88	71.07	
20–39	20.00	19.53	20.21	
40	24.29	8.59	8.73	
Weekly smoking expenditure (NT$)				16.58***
<NT$300	59.42	63.57	71.20	
NT$300–499	34.78	33.33	27.55	
NT$500	5.80	3.10	1.25	
Motivations				109.34***
Cheaper price	12.86	4.39	—	
Better taste	32.86	32.04	—	
Good quality	25.71	24.81	—	
Strengthens sexual ability	15.71	10.59	—	
Curiosity	12.86	28.16	—	
Purchasing places				38.57***
KTVs (including pubs and MTVs)	18.57	9.56	□	
Friends or relatives	32.86	34.63	□	
Betel nut vendors	27.14	30.23	□	
Other places (for example, convenience stores or night markets)	21.43	25.57	□	

NOTES: ** and *** denote 5% and 1% levels of significance respectively. "□" indicates data unavailable for analysis.

KTV = karaoke television [establishments]

MTV = music video [establishment]

expenditure; they are also significantly clustered in southern Taiwan. Respondents' self-reported smuggled cigarette prices were negatively correlated with being regular smokers of smuggled cigarettes, relative to being occasional smokers of smuggled cigarettes. This evidence reveals that the prices of smuggled cigarettes have a clear effect on smoking behavior. The smoking behavior of regular smokers of smuggled cigarettes is basically associated with the lower cigarette price, but not totally correlated with cheaper price. Respondents indicated that friends, relatives, and roadside betel nut vendors were their main sources of smuggled cigarettes.

In contrast to the differences in marginal effect between regular and occasional smokers of smuggled cigarettes, the factors of age and education are negatively correlated with smoking more smuggled cigarettes among regular smokers of smuggled cigarettes; the probability that regular smokers of smuggled cigarettes would smoke more smuggled cigarettes increased 6% and 0.4% with lower age and lower education level respectively. Being male increased the probability that regular smokers of smuggled cigarettes would smoke more smuggled cigarettes by a large 15.1%. The marginal effect of number of cigarettes smoked daily and weekly smoking expenditure for smuggled cigarettes

Table 3. Probit estimates of factors affecting decision to smoke smuggled cigarettes

Explanatory variables	*Model 1 Occasionally vs. never smoking smuggled cigarettes*			*Model 2 Regular vs. occasionally smoking smuggled cigarettes*		
	Coefficient	*Asymptotic t ratio*	*Marginal effect*	*Coefficient*	*Asymptotic t ratio*	*Marginal effect*
Constant	−6.009***	−8.265	□	−8.783	−0.125	□
Economic factors						
Legal cigarette price (NT$)	0.887*	1.664	0.261	□	□	□
Smuggled cigarette price (NT$)	□	□	□	−1.693***	−3.083	−0.056
Personal monthly income (NT$)	−0.262***	−6.113	−0.081	−0.519***	−3.830	−0.017
Demographic factors						
Male	0.503***	2.957	0.148	4.594	0.066	0.151
Age<35	1.112***	8.379	0.327	1.815***	4.846	0.060
Marital status (married)	0.207**	1.800	0.061	0.118	0.479	0.004
Education level						
Junior high school or below	0.675***	2.535	0.198	2.148***	4.591	0.071
Senior high school	0.355	1.378	0.104	0.673	1.552	0.022
College or above	0.141	0.542	0.041	0.608	1.358	0.020
Residence in southern Taiwan	0.327***	2.807	0.096	0.689***	2.699	0.023
Smoking characteristics						
Number of cigarettes smoked daily	0.471***	4.790	0.138	0.566***	2.613	0.019
Weekly smoking expenditure (NT$)	0.171**	2.159	0.050	0.326**	2.161	0.011
Motivations						
Cheaper price	□	□	□	0.228	0.931	0.008
Better taste	□	□	□	0.923***	3.625	0.030
Good quality	□	□	□	1.109***	3.257	0.036
Strengths sexual ability	□	□	□	1.308***	3.364	0.043
Curiosity	□	□	□	0.806***	2.347	0.026
Purchasing places						
KTVs (including pubs and MTVs)	□	□	□	0.813**	1.811	0.027
Friends or relatives	□	□	□	0.759***	2.658	0.025
Betel nut vendors	□	□	□	0.603**	2.133	0.020
Inverse Miller's Ratio (IMR)	2.166***	17.652	0.636	□	□	□
Log-likelihood	−475.540			−81.462		
MacFadden R^2	0.449			0.580		

NOTES: ** and *** denote 5% and 1% levels of significance, respectively. "□" indicates data unavailable for analysis.

KTV = karaoke television [establishment]

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indicate that these factors cause respective 1.9% and 1.1% increases in the smoking of smuggled cigarettes among regular smokers of smuggled cigarettes. Furthermore, the factors of better taste, good quality, curiosity, and, in particular, strengthened sexual ability play an important role in inducing regular smokers of smuggled cigarettes to decide to smoke smuggled cigarettes. The marginal effect of place of purchase increases by 2.7%, 2.5%, and 2.0% for KTVs, friends and relatives, and roadside betel nut vendors respectively.

DISCUSSION

In view of the fact that empirical research on the consumption of smuggled cigarettes is rather sparse, we investigated the effect of price and smoking characteristics on the decision to smoke smuggled cigarettes from a new angle. We discovered that for each NT$1 increase in the price of legal cigarettes, the probability that smokers who previously did not smoke smuggled cigarettes would shift to smoking smuggled cigarettes increased by 26.1%. Apart from cases where the rising price of legal cigarettes caused the probability that smokers would shift to smoking smuggled cigarettes to increase, such smoker characteristics as being male, under age 35, with an education of junior high or below, residence in southern Taiwan, relatively low income, high cigarette consumption, and high level of expenditure on cigarettes were associated with a higher likelihood of smoking smuggled cigarettes. The results of our study imply that non-price-related smoking characteristics also have an important effect on the decision to smoke smuggled cigarettes. Our findings support the results of Chaloupka (1999) and Taylor (2005) that purchasers of smuggled cigarettes are usually men, have relatively high levels of addiction, are heavy smokers, and have relatively low incomes.[10,19] Users of smuggled cigarettes may do so as a way of saving money while feeding their smoking habit.

A comparison of regular and occasional users of smuggled cigarettes revealed that smokers who occasionally smoke smuggled cigarettes have a 5.6% greater probability of becoming regular smokers of smuggled cigarettes for each NT$1 drop in the price of smuggled cigarettes. Among occasional smokers of smuggled cigarettes, those having characteristics such as age under 35, low income, education of junior high or less, residence in southern Taiwan, relatively low income, high cigarette consumption, and high level of expenditure on cigarettes are most likely to become regular smokers of smuggled cigarettes. Smokers who occasionally smoke smuggled cigarettes due to curiosity, good quality, or search for a special effect have a 2.6% to 4.3% greater likelihood of becoming regular smokers of smuggled cigarettes.

Cigarettes smuggled into Taiwan mainly originate from China and the Philippines. While most cigarettes smuggled from the Philippines are grey market Western brands, many cigarettes smuggled from China are substandard counterfeits. While smuggled cigarettes are ordinarily cheaper than legal cigarettes, there are some exceptions. For instance, some smuggled "grey market" foreign cigarettes fetch retail prices even higher than those of legal taxed imported cigarettes. Curiosity and a search for high quality motivate smokers to buy these smuggled cigarettes. Furthermore, unscrupulous merchants occasionally take advantage of men's erroneous sexual beliefs to promote the smoking of smuggled cigarettes as "boosting virility." This can make smuggled cigarettes very popular among heavy smokers, and even perversely cause smuggled cigarettes to be more expensive than legal cigarettes. As a consequence, the surges in cigarette smuggling that follow cigarette tax hikes may have an adverse effect on the health and safety of smokers. Government health authorities should therefore strive to increase awareness of the health risks of smoking smuggled cigarettes or of smoking in general, and attempt to draw more public attention to the health issues connected with smoking.

Our estimate of 0.62 for the IMR marginal effect suggests that current smokers who do not smoke smuggled cigarettes have a 62% probability of smoking smuggled cigarettes in the future. We estimated a smuggled cigarette smoking rate of approximately 34% by dividing the current smoker population by the number of smokers who used smuggled cigarettes. Assuming Taiwan's smoking population to be 4.89 million,[20] approximately 1.56 million smokers have used smuggled cigarettes, and of these, roughly 254,500 are regular smokers of smuggled cigarettes. There is therefore a population of roughly 3.13 million smokers who do not smoke smuggled cigarettes but may potentially do so in the future. In addition, we estimate that the government suffers economic losses on the order of NT$1.1 billion annually due to the 254,500 regular smokers of smuggled cigarettes (254,500 persons × (15 cigarettes/day × 365 days/20 cigarettes per pack) × NT$16.5/pack) and total economic losses of NT$3.4 billion annually due to smuggled cigarettes (254,500 persons × (15 cigarettes/day × 365 days/20 cigarettes) × NT$48.5/pack).

In order to reduce the number of persons smoking smuggled cigarettes, the government should try to limit the supply of smuggled cigarettes by adopting measures aimed at decreasing the profitability of

cigarette smuggling and thereby making it more difficult and costly to smuggle and sell such cigarettes. A good first step would be to mark cigarette packs in a way that makes it easier to detect smuggled products. For instance, forgery-proof, tax-paid labels could be affixed inside each pack's cellophane wrapper, while tax-exempt tobacco products could be required to bear special markings. Cigarettes intended for export should display the export destination and that country's specific warning label on the packaging carton. In addition, all cigarette manufacturers, importers, exporters, wholesalers, shippers, warehouse operators, and retailers should be required to possess a license before handling relevant tobacco products; these licenses will facilitate the government's identification and monitoring of personnel involved in the distribution of tobacco products. The license of anyone found to be engaging in smuggling activities should be revoked. These steps will deter most persons engaged in smuggling and effectively curb the rampant smuggling of cigarettes.

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