HHS Public Access

Author manuscript

Tob Control. Author manuscript; available in PMC 2016 July 01.

Published in final edited form as:

Tob Control. 2015 July ; 24(0 3): iii76–iii82. doi:10.1136/tobaccocontrol-2014-052091.

Differential Responsiveness to Cigarette Price by Education and Income among Adult Urban Chinese Smokers

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Abstract

Background—There are few studies that examine the impact of tobacco tax and price policies in China. In addition, very little is known about the differential responses to tax and price increases based on socioeconomic status in China.

Objective—The goal of this study is to estimate the conditional cigarette consumption price elasticity among adult urban smokers in China using individual level longitudinal survey data. We also examine the differential responses to cigarette price increases among groups with different income and/or educational levels.

Methods—Multivariate analyses using the general estimating equations (GEE) method were conducted to estimate the conditional cigarette demand price elasticity using data from the International Tobacco Control (ITC) China Survey, a longitudinal survey of adult smokers in seven cities in China. The first three waves of the ITC China Survey data were used in this analysis. Analyses based on subsample by education and income were conducted.

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Contributor statement:
JH, FJC, RZ and GTF designed the study; GTF and YJ collected data; JH conducted data analysis; JH, RZ, and FJC contributed to data interpretation; JH wrote the first draft; JH, RZ, FJC and GTF revised the draft; The final version of this paper has been reviewed and approved by all coauthors

Competing Interest:
None

Patient consent:
Obtained

Ethics Approval:
The ITC China Surveys were cleared for ethics by Research Ethics Boards or International Review Boards at the University of Waterloo (Canada), Roswell Park Cancer Institute (US), and the Chinese Center of Disease Control and Prevention.

Provenance and Peer Review:
Not commissioned; externally peer reviewed.

Findings—Our results show that overall conditional cigarette demand price elasticity ranges from −0.12 to −0.14, implying a 10% increase in cigarette price would result in a reduction in cigarette consumption among adult urban Chinese smokers by 1.2% to 1.4%. No differential responses to cigarette price increase were found across education levels. The price elasticity estimates do not differ between high income smokers and medium income smokers. However, cigarette consumption among low income smokers did not seem to decrease after a price increase, at least among those who continued to smoke.

Conclusion—Relative to many other low- and middle-income countries, cigarette consumption among Chinese adult smokers is not very sensitive to changes in cigarette prices. The total impact of cigarette price increase would be larger if its impact on smoking initiation and cessation, as well as the price-reducing behaviors such as brand switching and trading down, were taken into account.

Keywords

Smoking; China; Price Elasticity; Cigarette Price; Cigarette Consumption

Background

Tobacco-caused diseases and mortality impose tremendous health and economic costs on China, the world's largest producer and consumer of tobacco.[1–5] With more than 300 million smokers, China manufactures and consumes one third (approximately 2.5 trillion cigarettes) of the world's annual cigarette production.[6] The number of deaths attributed to tobacco use in China has now reached 1.2 million annually, and is projected to rise to 2 million by the year 2025.[2,3] Meanwhile, the economic cost of smoking has increased from $17.1 billion in 2003 to $28.9 billion in 2008 in China.[4,5]

Several decades of research has established that significantly increasing tobacco product excise taxes and prices is one of the most effective ways to reduce tobacco use and tobacco-caused health and economic burdens.[7,8] In addition, studies have also found that smokers of different socio-economic status (SES) tend to have differential responses to cigarette tax and price increases.[8] This differential responsiveness to price change based on SES can also serve as an important avenue to reduce tobacco use, particularly among those who are most sensitive to cigarette price increases.

Unfortunately, with the exception of the 2009 tobacco tax adjustment, China has not increased its tobacco tax since it signed on WHO Framework Convention on Tobacco Control in 2003. Cigarette taxes in China today account for slightly over 40% of retail prices, far below the world median level of 65–70%.[9] One of the factors that might contribute to this inaction is the lack of certainty among policy-makers in projecting the impact of cigarette tax increase on cigarette consumption, smoking prevalence, government tax revenue, and tobacco-related employment, which is, in part, due to the paucity of China-specific studies that examine the effectiveness of tobacco tax/price and differential responses among smokers in China. To date, there only have been a handful of studies that examined the impact of tobacco tax/price policies in China.[9–17]

Moreover, very little is known about the differential responsiveness to tax and price increases based on SES in China. We are only aware of two studies that looked at price elasticity estimates by income levels. Mao et al. (2003) used a national tobacco consumption survey and found higher price elasticity is associated with the low-income group.[17] Mao et al. (2005) estimated the overall price elasticity of cigarettes (−0.5) and at various income levels (at the poverty level, −1.9; low-income, −0.8; high-income, −0.5) using individual level data from 16 counties in China in 1998.[16]

Building on these seminal studies, this paper aims to estimate the price elasticity for cigarette consumption among adult smokers in China using individual level longitudinal survey data. It will also examine the differential responses to cigarette price increases among groups with different income and/or educational levels. This paper contributes to the literature as follows: unlike previous studies relying on aggregated sales data or cross-sectional micro level data, we use individual level multi-wave longitudinal data to examine the impact of cigarette prices on cigarette consumption in China, which allow us to look at how the same individuals alter their cigarette consumption as cigarette prices change over time. Additionally, this paper pushes the envelope on what is known about the effect of cigarette price in China by examining the differential responsiveness to cigarette price increases based on income and educational levels.

Methods

Data

The analyses in this paper rely on the International Tobacco Control Policy Evaluation Project – China Surveys (the ITC China Survey). The ITC China Project, established in 2006, is a longitudinal cohort survey conducted in seven cities in China (Beijing, Changsha, Guangzhou, Kunming, Shanghai, Shenyang, and Yinchuan). These seven cities differ in their population sizes, areas, and levels of economic development. They are located in different geographic regions in China, and are good representatives of China's urban areas. Approximately 800 adult (aged 18 and above) smokers are recruited by probability sampling methods in each city. Respondents lost to attrition are replaced with comparable respondents so as to maintain city level representative samples. The retention rate of the ITC China survey was high, more than 80%. More detailed information on the ITC China survey sampling methodology can be found in Wu et al. (2010).[18]

This study utilized the first three waves of the ITC China Surveys, conducted in 2006, 2007/08, and 2009/10, respectively. The sample consisted of approximately 2,400 observations from each city (800 smokers in each wave) with the exception of Kunming, which was added to ITC China Survey in the third wave, with only 800 smokers. Because of the missing values (including nonresponses and refusals) in the key outcome variables, the final analytical sample consisted of approximately 13,700 smokers.

Measures

Dependent Variable—The dependent variable in our study is cigarette consumption, which measures the average number of cigarettes consumed per day (CPD) by a smoker.

This variable is derived from the ITC China survey questions that asked about the number of cigarettes smoked per day for daily smokers, and the number of cigarettes smoked per week for non-daily smokers. For non-daily smokers, the number of cigarettes smoked per week was converted into the average number of cigarettes consumed per day. Because the distribution of CPD was skewed, this measure was log transformed in the analyses.

Explanatory Variables—The key explanatory variable in this study is the price of a pack of cigarettes. The ITC China Survey asked smokers about their most recent cigarette purchase experience; in particular, how many cartons/packs of cigarettes they purchased and how much they paid in total. Based on the responses to those questions, we first constructed a measure of the self-reported price for a pack of cigarettes, derived from the total amount of money paid and the total number of packs bought in the most recent cigarette purchase. While the self-reported cigarette prices is useful in understanding smokers' purchase behaviour, it can reflect endogenous choices of cigarette brands, quality, and/or purchase methods. In other words, individuals exercise some choice over the price they pay for cigarettes, rather than the price they pay being determined exogenously. For example, ceteris paribus, heavy smokers may be more likely to smoke cheaper brands of cigarettes, purchase cigarettes in greater quantities, look for lower priced retailers, and/or take advantage of price promotions than individuals who smoke fewer cigarettes. As a result, the self-reported price can be correlated with unobserved differences in preferences and may be endogenous. As thus, treating an individual's self-reported price as an exogenous variable when examining his or her cigarette consumption will lead to an over (and biased)-estimate of the impact of price on reported cigarette consumption. To address this issue, we constructed an aggregated price measure at the city district level, which averaged the self-reported price of a pack of cigarettes among all smokers living in the same district in a city in a given survey wave. This price measure was subsequently adjusted for inflation using 2010 as the base year.

In addition to the cigarette price variable, we also included a number of key demographic and socio-economic individual-(or household) level characteristics such as age, gender, education, family income, marital status, and employment status, as well as interview waves/years, and city. Specifically, age was grouped into 18–24 years, 25–39 years, 40–54 years, and 55 years or older. Marital status was classified as: married; divorced, separated or widowed; and single. Education level was classified into three categories: less than high school, high school, and post-secondary education. Monthly household income was classified into three categories based on the cut-offs for urban areas from the 2010 China Statistics Yearbook: low income level (<1,000 Yuan), medium income level (1,000– 2,999 Yuan) and high income level (>=3,000 Yuan). Employment status was grouped into employed, unemployed, and retired.

Statistical Methodology

To estimate the cigarette demand function conditional on being a smoker, we estimated the following models:

$$\mathrm{Ln}\left(\mathrm{Q}_{\mathrm{ijt}}\right)=\beta_0+\beta_1\mathrm{Ln}\left(\mathrm{P}_{\mathrm{djt}}\right)+\beta_2\mathrm{ED}_{\mathrm{ijt}}+\beta_3\mathrm{INC}_{\mathrm{ijt}}+\beta_4\mathrm{X}_{\mathrm{ijt}}+\mathrm{s}_{\mathrm{it}}+\mathrm{y}_{\mathrm{ij}}+\mathrm{e}_{\mathrm{ijt}} \quad (1)$$

$Ln(Q_{ijt})$ is the average number of cigarettes consumed per day by the i_{th} individual in the j_{th} city in interview wave/year t, in log form. $Ln(P_{djt})$ is inflation adjusted average price of a pack of cigarettes in the d_{th} district in the j_{th} city in interview wave/year t, also in log. ED_{ijt} and INC_{ijt} represent, respectively, the education and income level for the i_{th} individual in the j_{th} city in interview wave/year t. X_{ijt} is a vector of individual demographic and socioeconomic characteristics such as age, gender, marital status, and employment status. s_{it} is city indicator for i_{th} individual in interview wave/year t. y_{ij} is interview wave/year indicator for i_{th} individual in the j_{th} city. And e_{ijt} is the idiosyncratic error term.

Because the ITC China Survey data are longitudinal in nature, errors are correlated within observations across waves for the same individual. As a result, the equation (1) was estimated using the general estimating equations (GEE) method (STATA version 12 xtgee command), which took into account the correlation in error terms among the same respondent across different interview waves. Because of the nature of the cigarette consumption variable, which is continuous, equation (1) was estimated using GEE model with an identify link, with no pre-imposed assumption on the structure of the covariance matrix of the error terms. Equation (1) was first estimated using the whole ITC China Survey sample (results shown in Table 2), it was then estimated using the subsamples by income level (Table 3) and education level (Table 4) to examine the potential differential responses to cigarette price changes by SES.

To test whether there were any differential price responses by SES, we estimated the following models:

$$\mathrm{Ln}\left(\mathrm{Q_{ijt}}\right)=\alpha_0+\alpha_1\mathrm{Ln}\left(\mathrm{P_{djt}}\right)+\alpha_2\mathrm{ED_{ijt}}+\alpha_3\mathrm{Ln}\left(\mathrm{P_{djt}}\right)*\mathrm{ED_{ijt}}+\alpha_4\mathrm{INC_{ijt}}+\alpha_5\mathrm{X_{ijt}}+{}_{\mathrm{it}}+\mathrm{y_{ij}}+\mathrm{e_{ijt}} \quad (2)$$

$$\mathrm{Ln}\left(\mathrm{Q_{ijt}}\right)=\gamma_0+\gamma_1\mathrm{Ln}\left(\mathrm{P_{djt}}\right)+\gamma_2\mathrm{INC_{ijt}}+\gamma_3\mathrm{Ln}\left(\mathrm{P_{djt}}\right)*\mathrm{INC_{ijt}}+\gamma_4\mathrm{ED_{ijt}}+\gamma_5\mathrm{X_{ijt}}+\mathrm{s_{it}}+\mathrm{y_{ij}}+\mathrm{e_{ijt}} \quad (3)$$

$Ln(P_{djt})*$ ED_{ijt} is the interaction term between cigarette price and education levels. $Ln(P_{djt})*INC_{ijt}$ is the interaction term between cigarette price and income levels. The estimated coefficient α_3 and γ_3 in equation (2) and (3) will reveal whether there exist any differential price responses by income and education levels. Results from equation (2) and (3) are presented in Table 2 (Model 4 – 7).

Results

Descriptive Statistics

Table 1 contains the descriptive statistics for the key variables used in this study. The calibration of the sample means used standard complex survey poststratification techniques for variance estimation, which took into account the complex survey/sampling strategies of the ITC China Surveys. In addition, those statistics were properly weighted using the sampling weights, described fully in the weighting methodology available at http://www.itcproject.org. Our smoker sample was evenly distributed across interview waves and cities, with the exception of the city of Kunming, which was added in the third wave. The urban smokers in our sample were predominantly male (95%). The age distribution in our

sample was skewed towards adults in prime and mature ages, with 18% of the smokers aged between 25 – 39, 46% aged 40–54, 34% aged 55 and above, and with only about 2% being young adults (aged 18 – 24). 88% of smokers were married at the time of the survey. 43% of the smokers reported to have an average family income per month between 1,000 – 2,999 Yuan. 15% of smokers' family income fell below 1,000 Yuan per month, and about 36% had income more than 3,000 Yuan per month, the remaining 6% smokers' family income were missing. 13% of smokers reported having less than a high school education, 65% of smokers having completed high school, and about 21% of smokers having some schooling beyond high school, which included 2-year colleges. The average number of cigarettes smoked per day among the ITC China Survey respondents was 17, with some respondents reporting smoking as much as five packs of cigarettes (or 100 cigarettes) per day. The inflation adjusted city district level average price for a pack of cigarettes was 6.5 Yuan, or approximately 1 U.S. dollar per pack.

Multivariate Analyses Results

Table 2 presents the results for equations (1) – (3) using the GEE methods, examining the impact of cigarette price on cigarettes smoked per day, as well as the demographic and SES factors associated with cigarette consumption among adult urban Chinese smokers. Model 1 controlled for both income and education levels. Model 2 controlled for income but not education, and Model 3 controlled for education but not income. Model 4 – 7 included the interaction terms between cigarette price and income (Model 4 and 5) and the interaction term between cigarette price and education (Model 6 and 7). Regardless of the model specifications, the overall conditional cigarette consumption price elasticity was consistently shown to be in a narrow range of −0.12 to −0.14, implying that a 10% increase in cigarette price would result in a reduction in cigarette consumption among adult urban Chinese smokers by 1.2% to 1.4%. In the models with interaction terms between cigarette price and income/education, none of the estimated coefficients for the interaction terms were statistically significant, with the exception of the coefficient for the interaction term between cigarette price and low income, which was marginally significant. These results imply that the conditional cigarette consumption price elasticities do not differ across education levels among adult urban Chinese smokers. In other words, while smokers do respond to a cigarette price increase by reducing the number of cigarettes smoked per day, those with low- or medium-level education do not reduce their cigarette consumption more than those with high level of education, everything else being constant. These results also imply that, at least in our sample, smokers with medium level income respond similarly to a cigarette price increase as those with high level income. However, those with low income level do not reduce the number of cigarettes smoked per day by as much as those smokers with medium- and high-level income, as shown by the positive coefficient on the price and low income interaction term.

Table 2 also reveals several additional interesting findings: female smokers smoke fewer cigarettes (approximately 36% less) per day than male smokers. There exists an age gradient in cigarette consumption among adult urban Chinese smokers: the numbers of cigarettes consumed per day were highest among those aged 40 and above, lower among those aged 25–39 (9% fewer CPD than those among aged 40+), and the lowest among young adults

aged 18–24 (33% fewer CPD than those among aged 40+). Additionally, while smokers with low levels of income smoke fewer cigarettes per day (8% fewer) than their high income counterpart (Model 1), smokers with low- and medium-level education smoke more (13% and 11% more CPD, respectively) cigarettes per day than smokers with post-secondary education, everything else being the same. Moreover, smokers who were unemployed at the time of the survey reported smoking more (6%) cigarettes per day than those who were employed, while smokers who were retired reported smoking fewer (11%) cigarettes per day.

Table 3 presents the GEE estimates from the subsample analyses by income levels based on equation (1). While the estimated price elasticities for high income and medium income smokers were similar in magnitude (in a narrow range of −0.14 to −0.15) and statistically significant, the estimated price elasticity for low income smokers did not statistically differ from 0, meaning that low income smokers do not significantly reduce their cigarette consumption when cigarette prices increases, at least among those who continue to smoke. This result mirrors the results from Table 2 (Model 4 and 5). Similarly, many of the results from the subsample analyses related to the association between the demographic and SES factors and cigarette consumption mirror those based on the entire sample: fewer CPD among female smokers, an age gradient in CPD, and higher consumption among smokers with low- and medium-level education, although not all these results were statistically significant in all subsamples.

The results from the analyses based on education subsamples were presented in Table 4. Across all three education levels, the estimated conditional cigarette consumption price elasticities were statistically significant. The magnitude of the estimated price elasticity range from −0.11 to −0.14, with the 95% confidence intervals overlapping across three education levels, consistent with the results from Model 6 and 7 in Table 2. Regardless of the education level, females smokers smoke fewer cigarettes per day than their male counterparts. Compared to other age groups, young adults smoke fewer cigarettes per day regardless education levels.

Conclusion and Discussion

Our analysis of the ITC China Survey data reveals that the overall conditional cigarette demand price elasticity ranges from −0.12 to −0.14, implying a 10% increase in cigarette price would result in a reduction in cigarette consumption among adult urban Chinese smokers by 1.2% to 1.4%. Relative to many other low- and middle-income countries, our results suggest that cigarette consumption among Chinese adult smokers is not very sensitive to changes in cigarette prices. Compared to the estimates of the price elasticity of demand for cigarettes in China from previous studies, which range from 0 to −0.8,[9–17] our estimates are at the lower end (in absolute value), and are similar to the results from two recent studies using national representative individual level cross-sectional data.[13,15] However, please note that our study only considered the impact of a cigarette price increase on those who continued to smoke. It left out the impact of a cigarette price increase on deterring youth smoking initiation and promoting quitting among smokers. Studies have shown that the impact of a cigarette price increase on smoking initiation and cessation could

be just as large, if not larger, as the impact on cigarette consumption among smokers.[8] As such, the total impact of cigarette price increases in China could be at least twice as large as what our estimates suggest. Additionally, several recent studies show that large cigarette price spread across brands in China were associated with brand switching behaviour, and that increasing cigarette price may also lead to trading down among smokers for low quality and high tar cigarettes.[11,19–21] Our estimates did not take into account the impact of brand switching and trading down, absence of such behaviours, our estimates would become larger.

Our results also revealed several important and interesting patterns related to the potential differential price impact by SES among Chinese smokers. We found that smokers with no high school qualification and with only a high school qualification smoke more cigarettes per day than those with post-secondary education. However, the estimated price elasticity of demand does not differ across education levels. In other words, when cigarette price increases, smokers across all education level reduce their cigarette consumption equally. Additionally, we found that smokers with low- and medium-income smoke fewer cigarettes than their high-income counterparts. When cigarette price increases, both high-income and medium-income smokers reduce their cigarette consumption. However, low-income smokers, at least among those who continue to smoke, did not seem to reduce their cigarette consumption after the price increase. Our finding that low-income smokes' cigarette consumption was less sensitive to price changes differs from the results from two previous studies which found the opposite.[16,17] There are at least two reasons that might explain this difference. First, our study did not look at the impact of price increase on smoking cessation. If low-income smokers respond to a price increase primarily through quitting rather than cutting down cigarette consumption, by only looking at those who continue to smoke after the price increase, our analyses left out those who quit smoking and hence underestimated the true impact of a price increase on low-income smokers. Second, two recent studies have shown that low-income Chinese smokers are more likely to engage in behaviours that reduce the price paid for purchasing cigarettes, such as switching to a cheaper brand.[19,21] Brand switching can enable low-income smokers to maintain the same level of consumption even when the average cigarette price increases. Because our analyses did not take into account the impact of such behaviour, our estimates likely underestimate the impact of cigarette price for low-income smokers. Consequently, the evidence presented in our study is, unfortunately, not sufficient to draw a clear conclusion on the regressivity of tobacco taxes in China. While we have shown that the conditional price elasticity on cigarette consumption is smaller among low-income smokers, the overall price elasticity of demand for cigarette could be larger for low-income smokers than for high- and middle-income smokers in China if the price impact on initiation and cessation were taken into account and/or if the opportunities for cost-minimizing behaviours were reduced.

In addition to the limitations discussed in the previous paragraphs, the representativeness and generalization of our findings is also limited by the fact that our smoker sample covers only 7 cities in China, and is older than the general adult smoker population in China.

Despite these limitations, our analyses provided evidence that cigarette consumption among Chinese adult urban smokers is sensitive to changes in cigarette prices. Smokers smoke fewer cigarettes after price increases, and the reduction in cigarette consumption was similar across all education levels. More research, however, is needed to examine the impact of cigarette price increase on smoking initiation among youth and long-term successful cessation among smokers in China. The results from our study also have important policy implications: first, to the extent that the availability of a wide range of low-cost cigarette brands, and the existence of brand switching and trading down behaviours may play a role in moderating the impact of a price increase, particularly among low income smokers, the results from our study suggest that a tobacco tax and price policy with a heavy specific tax component could have more beneficial impact in China, as an increase in a specific tax would raise the price of cheaper brands relative to premium brands to a greater extent than would an *ad valorem* tax. In addition, minimum price laws that prevent cigarette retail prices from falling below a threshold price regardless of brand could also be an effective policy tool to reduce cigarette consumption in China by discouraging brand switching and trading down.

Acknowledgments

Funding: This work was supported by the US National Cancer Institute at the National Institutes of Health (R01 CA100362, R01 CA125116 and P01 CA138389); the Roswell Park Transdisciplinary Tobacco Use Research Center (P50 CA111236)); Robert Wood Johnson Foundation (045734); Canadian Institutes for Health Research (57897,79551, and 115016); and Chinese Center for Disease Control and Prevention. Geoffrey T. Fong was supported by a Senior Investigator Award from the Ontario Institute for Cancer Research and a Prevention Scientist Award from the Canadian Cancer Society Research Institute. Additional support for this project was provided by a grant from the Canadian International Development Research Centre (Grant No. 106839-001), titled “Impact of Tobacco Tax and Price Policies on Tobacco Use in China” and a grant from the China National Nature Science Foundation (Grant No. 71373045), titled “An Empirical Study and Policy Evaluation of China Tobacco Tax System and Tobacco Control.” None of the funding agencies played any role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. The opinions expressed here are those of the authors, and do not necessarily reflect those of the sponsors.

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What the paper adds

- This is the first study that uses individual level multi-wave longitudinal data to examine the impact of cigarette prices on cigarette consumption in China and whether there are potential differential responses to cigarette price increases based on SES.
- We estimated that the conditional cigarette demand price elasticity ranges from −0.12 to −0.14 among adult urban Chinese smokers. Taking into account of the price impact on smoking initiation and cessation and price-reducing behavior could increase the magnitude of cigarette price elasticity.

Table 1

Descriptive Statistics

Variables	Obs	Mean/Proportion	
Cigarette Consumption			
Cigarettes consumption per day	14505	17.12	(0.1–100)
Ln(cigarettes consumption per day)	14460	2.61	(−2.3–4.6)
Cigarette Price			
Inflation adjusted cigarette per pack price	13950	6.51	(0.2–92.55)
Ln(cigarette price)	13950	1.71	(−1.61–4.54)
Gender			
Female	14561	0.04	
Age			
Aged 18–24	14561	0.02	
Aged 25–39	14561	0.18	
Aged 40–54	14561	0.46	
Aged 55+	14561	0.34	
Marital Status			
Married dummy	14514	0.88	
Single dummy	14514	0.05	
Divorced/Widowed dummy	14514	0.06	
Average total household income per month (in Yuan)			
>= 3000 (high income)	14561	0.35	
1000 – 2999 (medium income)	14561	0.43	
< 1000 (low income)	14561	0.15	
Missing Income dummy	14561	0.07	
Education			
College and above	14510	0.21	
High school	14510	0.65	
Less than high school	14510	0.13	
Employment Status			
Employed dummy	14509	0.59	
Unemployed dummy	14509	0.14	
Retired dummy	14509	0.27	
Interview Waves and Cities			
Wave 1 dummy	14561	0.32	
Wave 2 dummy	14561	0.32	
Wave 3 dummy	14561	0.36	
City Beijing dummy	14561	0.16	
City Shenyang dummy	14561	0.16	
City Shanghai dummy	14561	0.16	
City Changsha dummy	14561	0.15	
City Guangzhou dummy	14561	0.16	

Variables	Obs	Mean/Proportion
City Yinchuan dummy	14561	0.16
City Kunming dummy	14561	0.05

Table 2

Conditional Cigarette Consumption Price Elasticities Among Smokers (Whole Sample)

ln(Cigarettes)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Ln(price)	−0.126*** (0.019)	−0.141*** (0.019)	−0.118*** (0.019)	−0.127*** (0.019)	−0.141*** (0.019)	−0.127*** (0.019)	−0.119*** (0.019)
Ln(price) and low income interaction				0.181* (0.081)	0.177* (0.081)		
Ln(price) and medium income interaction				−0.058 (0.054)	−0.066 (0.054)		
Ln(price) and missing income interaction				0.126 (0.107)	0.093 (0.104)		
Ln(price) and less than high school interaction						−0.029 (0.121)	−0.033 (0.121)
Ln(price) and high school interaction						0.023 (0.046)	0.027 (0.046)
Female	−0.458*** (0.049)	−0.449*** (0.049)	−0.458*** (0.049)	−0.458*** (0.049)	−0.449*** (0.049)	−0.459*** (0.049)	−0.459*** (0.049)
Male (reference category)							
Aged 18–24	−0.399*** (0.093)	−0.415*** (0.091)	−0.395*** (0.093)	−0.396*** (0.092)	−0.413*** (0.090)	−0.399*** (0.093)	−0.396*** (0.093)
Aged 25–39	−0.092** (0.033)	−0.108** (0.033)	−0.091** (0.033)	−0.090** (0.033)	−0.107** (0.033)	−0.091** (0.033)	−0.091** (0.033)
Aged 40–54	0.049 (0.026)	0.046 (0.026)	0.044 (0.026)	0.047 (0.026)	0.045 (0.026)	0.049 (0.026)	0.045 (0.026)
Aged 55+ (reference category)							
Divorced/widowed dummy	0.031 (0.037)	0.033 (0.037)	0.016 (0.037)	0.031 (0.037)	0.033 (0.037)	0.030 (0.037)	0.016 (0.037)
Single dummy	−0.081 (0.045)	−0.089* (0.044)	−0.090* (0.045)	−0.083 (0.045)	−0.092* (0.044)	−0.081 (0.045)	−0.090* (0.045)
Married dummy (reference category)							
Low income dummy	−0.088** (0.033)	−0.067* (0.032)		−0.411* (0.160)	−0.382* (0.159)	−0.088** (0.033)	
Medium income dummy	−0.052* (0.024)	−0.036 (0.024)		0.054 (0.108)	0.085 (0.108)	−0.052* (0.024)	
Missing income dummy	−0.057 (0.037)	−0.047 (0.037)		−0.292 (0.210)	−0.221 (0.204)	−0.056 (0.037)	

ln(Cigarettes)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
High income dummy (reference category)							
Less than HS dummy	0.134*** (0.041)		0.115** (0.040)	0.135*** (0.041)		0.185 (0.219)	0.173 (0.219)
High school dummy	0.111*** (0.027)		0.098*** (0.026)	0.112*** (0.027)		0.068 (0.094)	0.046 (0.094)
College dummy (reference category)							
Unemployed dummy	0.060* (0.026)	0.071** (0.027)	0.043 (0.025)	0.061* (0.026)	0.072** (0.027)	0.061* (0.026)	0.044 (0.025)
Retired dummy	−0.124*** (0.027)	−0.120*** (0.027)	−0.125*** (0.027)	−0.125*** (0.027)	−0.120*** (0.026)	−0.124*** (0.027)	−0.125*** (0.027)
Employ dummy (reference category)							
Constant	2.739*** (0.050)	2.837*** (0.045)	2.708*** (0.051)	2.740*** (0.051)	2.836*** (0.046)	2.742*** (0.052)	2.713*** (0.052)
Observations	13,748	13,785	13,748	13,748	13,785	13,748	13,748

SE in parentheses; Interview wave and city dummies are not shown in the table;

* p<0.10

** p<0.05

*** p<0.01

Table 3

Conditional Cigarette Consumption Price Elasticities Among Smokers by Income Groups

	High Income subgroup	Medium Income subgroup	Low Income subgroup
Ln(price)	−0.150*** (−0.206; −0.094)	−0.142*** (−0.199; −0.086)	−0.111 (−0.223; 0.0002)
Female	−0.490*** (−0.636; −0.344)	−0.446*** (−0.586; −0.307)	−0.380*** (−0.576; −0.184)
Male (reference category)			
Aged 18–24	−0.463** (−0.747; −0.179)	−0.435*** (−0.677; −0.193)	−0.485** (−0.817; −0.154)
Aged 25–39	−0.137** (−0.234; −0.040)	−0.080 (−0.182; 0.022)	−0.124 (−0.279; 0.031)
Aged 40–54	−0.0258 (−0.108; 0.056)	0.093* (0.016; 0.170)	0.045 (−0.068; 0.157)
Aged 55 + (reference category)			
Divorce/widowed dummy	0.097 (−0.043; 0.236)	0.022 (−0.084; 0.128)	−0.033 (−0.177; 0.110)
Single dummy	-0.114 (−0.244; 0.016)	0.034 (−0.135; 0.203)	0.046 (−0.097; 0.189)
Married dummy (reference category)			
Less than HS dummy	0.136* (0.017; 0.254)	0.166* (0.035; 0.298)	0.029 (−0.221; 0.279)
High school dummy	0.119*** (0.051; 0.186)	0.132** (0.037; 0.227)	0.040 (−0.175; 0.255)
College dummy (reference category)			
Unemployed dummy	0.098 (−0.046; 0.242)	0.033 (−0.040; 0.106)	0.085 (−0.006; 0.176)
Retired dummy	−0.204*** (−0.291; −0.117)	−0.103* (−0.183; −0.024)	−0.096 (−0.226; 0.033)
Employed dummy (reference category)			
Constant	2.918*** (2.756; 3.081)	2.653*** (2.494; 2.813)	2.652*** (2.237; 3.066)
Observations	4,941	5,893	2,042

95% CI in parentheses; Interview wave and city dummies are not shown in the table;

* p<0.10

** p<0.05

*** p<0.01

Table 4

Conditional Cigarette Consumption Price Elasticities Among Smokers by Education Groups

	High Education Subgroup	Medium Education Subgroup (High School)	Low Education Subgroup (Less than High School)
Ln(Price)	−0.113** (−0.182; −0.045)	−0.107*** (−0.155; −0.059)	−0.143* (−0.257; −0.030)
Female	−0.375** (−0.617; −0.133)	−0.550*** (−0.676; −0.424)	−0.352*** (−0.515; −0.189)
Male (reference category)			
Aged 18–24	−0.414** (−0.669; −0.160)	−0.444*** (−0.683; −0.205)	−0.243* (−0.468; −0.017)
Aged 25–39	−0.178** (−0.310; −0.046)	−0.058 (−0.134; 0.017)	−0.005 (−0.245; 0.236)
Aged 40–54	0.0171 (−0.104; 0.138)	0.058 (−0.003; 0.118)	0.003 (−0.144; 0.149)
Aged 55 + (reference category)			
Divorce/widowed dummy	0.139 (−0.050; 0.329)	0.016 (−0.067; 0.099)	−0.007 (−0.161; 0.147)
Single dummy	−0.142* (−0.274; −0.011)	−0.024 (−0.131; 0.084)	−0.177 (−0.648; 0.294)
Married dummy (reference category)			
Low Income dummy	−0.132 (−0.374; 0.110)	−0.065 (−0.142; 0.013)	−0.110 (−0.242; 0.021)
Medium income dummy	−0.136* (−0.252; −0.021)	−0.039 (−0.097; 0.019)	−0.071 (−0.186; 0.045)
Missing income dummy	−0.041 (−0.209; 0.127)	−0.062 (−0.143; 0.020)	−0.026 (−0.182; 0.129)
High income dummy (reference category)			
Unemployed dummy	0.173* (0.026; 0.320)	0.045 (−0.011; 0.101)	0.050 (−0.091; 0.191)
Retired dummy	−0.130 (−0.278; 0.019)	−0.114*** (−0.181; −0.047)	−0.137* (−0.251; −0.023)
Employed dummy			
Constant	2.736*** (2.530; 2.941)	2.823*** (2.719; 2.927)	2.932*** (2.686; 3.178)
Observations	3,070	9,060	1,618

95% CI in parentheses; Interview wave and city dummies are not shown in the table;

* $p<0.10$