Socio-Economic Determents of Smoking and Drinking in China: Urban-Rural Difference*

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Abstract:

Despite numerous side effects associated with smoking and drinking, the appealand conditional demand of themin China are still in the ascendant. Though a heavy volume of literature has been found with respect to this issue, few empirical studies have been done on smoking and drinking in China. We attempt to bridge this gap by estimating two-part models of smoking and liquor drinking demand of urban and rural resident separately, wherein a large individual-level dataset from China Health and Nutrition Survey for years 1993,1997,2000, 2004, 2006 and 2009 is employed.Results show that education effects are a deterrent to both smoking and liquor drinking. The effects of education on smoking propensity of urban residents are larger than that of rural residents. It has been found that the deterrent effects of education on smoking have been steadily enhancing since 1993, in contrast to those of income increasewhich have appeared inconsistent. Income increase has reduced the probability of smoking and the deterrent effects have enhanced since 1993, but it has de facto uplift the conditional cigarette consumption level. Additionally, income has positive impacts on rural resident's liquor drinking propensity but wields slightly negative impacts on that of urban residents. The paper concluded that education can play an appreciable role in Chinese public policy designing in control of smoking and liquor drinking. The progress of urbanization in China also plays a role in reducing residents' unhealthy consuming behavior.

Key words: Smoking,Drinking, Education, Income, Urban, Rural

JEL codes: I10, I18, D12

*This study is supported by Chinese Universities Scientific Fund, Project No 2010JS024.

1. INTRODUCTION

Smoking and drinking are associated with numerous side effects on health. Based on the statistic disclosure of one million deaths between 1986 and 1988, Liu *et al.* (1998) estimated that tobacco would kill about 100 million of the 0.3 billion males aged 0-29 at that time, with half these deaths in middle age and half in old age if smoking uptake rates persist in China. Chen *et al*. (1997) concluded from a 16-year prospective analysis of middle-aged men in Shanghaithat tobacco will eventuallyaccounts forover 2 million deaths each year.

Similarly, drinking alcohol may cause oesophageal cancer, epileptic seizures, liver cirrhosis, chronic pancreatitis, etc. The global burden of alcohol use was estimated to be 4% of the total disability and adjusted life years lost--more damaging than tobacco (2.6%). Alcohol causes 1.8 million deaths (3.2% of total) annually worldwide, with 80% occurring in developing regions of (WHO, 2004).

Smoking and drinking also affect nonsmoking and nondrinking population. According to areport on Carcinogens by National Toxicology Program(2005), smoke contains at least 250 chemicals known to be toxic or carcinogenic. Nonsmokers suffer many diseasesinflicted byactive smoking when they takein smoke breathed out by smokers. Incidentally forced smoking is an independent risk for sudden infant death syndrome (SIDS) (Tong *et al*., 2005). Children exposed to cigarette smoke are more likely to have acute respiratory infections, ear problems, and severe asthma than children unexposed. Smoking by parents causes respiratory symptoms and lung undergrowth of their children. Exposure to cigarette smoke is also dangerous to adult non-smokers. California Environmental Protection Agency (2005) estimates that exposure to cigarette smoke causes approximately 3,400 lung cancer deaths and 22,700-69,600 heart disease deaths in adult nonsmokers in the United States each year.

In addition to health undermining, nonsmokers have to bear medical care costs as well. Smoking-related diseases ratchet uphealth care costs, and resultantly increase private health insurance premiums for non-smokers.

As well as smoking, drinking can cause social problems too, such as domestic violence, road injuries caused by drunken driving, homicide, etc.

Despite the lethalconsequences associated with smoking and drinking,consumption of alcohol and cigarette inChina has not witnessed any clue of decline.According theGlobal Adult Tobacco Surveyconducted in 2009 and 2010, smokers account for28.1% of the Chinese population, involving 52.9% of males and 2.4% of females. In a typical week, 70% of the adult nonsmokerswere exposed to cigarette smoke. The consumption of drinking was also not to be sneered at. According the 2009 China Health and Nutrition Survey,a massivepercentage (33.19%) of Chinese population indulged in drinking, including 59.44% of men and 9.01% of women. It is hence urgentto take immediate measures to control smoking and drinkingin China.

Tax increase is one of the most efficient ways to control smoking and drinking, as has been suggested bysolid researchin western countries(Stehr, 2007; Elder *et al*., 2010). But in China attempts of more tax on smoking and drinking are baffledfor several reasons: first, taxes on tobacco and alcohol are a significant portion of government revenue, especially in certain provinces. Imposing higher taxes will be boycotted by interested partiesfor fear that it may greatly reduce the demand of cigarette and alcohol; second, Chinese cultural norms encourage smoking and drinking as a means of socializing. Alcohol drinking and smoking are believed to help maintain good relations between bosses and employees as well as rapport between colleagues. In fact a bulk of the cigarettes and alcoholic drinks are bought as gifts with public funds, thus the price elasticity of alcoholic beverage and cigarette consumption in China is smaller than that of developed countries (Man *et al*., 2005; Hu and Sun, 2009; Tian and Liu, 2011).For all the reasons above, it would be safe to suggestcigarette and alcohol tax increase be accompanied by other control policies.

Socioeconomic status, mostly represented by income and education, wields significant impacts on smoking and drinking. Existing literature convincingly indicates that education serves asa deterrentto smoking (e.g. Farrell and Fuchs, 1982; Huisman*et al*., 2005; Wetter *et al*., 2005; Wetter *et al*., 2005; Grimard and Parent, 2007).To account for the endogeneity of smoking, Damien de Walque (2007) developed an instrumental variable approach which based on the fact that during the Vietnam War college attendance provided a strategy to avoid the draft. The results indicated that education did affect smoking decisions: educated individuals were less likely to smoke; and those who had initiated smokingwere more likely to quit.

In general, findingsof extant studies on the correlation between education and alcohol consumption show wide intellectual divides.Although some studies show that individuals from humble socioeconomic backgrounds tend to consume more alcohol compared with their better-off peers (Kuntsche*et al*., 2004; Leigh, 1996; Mossakowski, 2008), others suggest that the opposite may be true (Huerta and Borgonovi, 2010; Grossman *et al*., 1995; Maggs*et al*., 2008; Ornstein & Hanssens, 1985).

A relation between income and smoking was also found in existing literature. Almost all current research indicates a negative impact of income on smoking (Virtanen *et al*., 2007; Huisman *et al*., 2005; Siahpush *et al*., 2005; Fukuda*et al*., 2005). Income also has impact on drinking.Lower income was associated with higher possibilities ofeither abstinence or heavy drinking, relative to light/moderate drinking. (Cerd á*et al*., 2011)

There aregreat disparities between urban and rural China as regards income and education (Figure 1). Since the market reform in 1978, China has experienced dramatic economic growth over the last three decades, with GDP of more than 8% annually. At the same time, the income of individual Chinese households hasincreased dramatically, though unevenly distributed betweenurban and rural families.In 2010, annual income per capita of urban households averaged 19,109 RMB Yuanand that of rural households was only 5,919 RMB Yuan. The urban-rural income gap between 1978 and 2010 was steadily enlarged, with the income ratio at

2.4 and 3.2 separately (based on income data from China Statistical Yearbook 1996 and 2010).Education shows similar trend. The average years of schooling of Chinese population aged 6 and over increased from 6.8 years in 1996 to 8.4 years in 2009, but there is a great disparity between urban and rural China. Based on the 2005 National 1% Population Sample Survey Data in China, rural residentswere less likely than urban residents to have formal education (14% versus 6%) and were still lessto have high school education and above (7% versus 31%) for people aged 6 years and over.

There are a lot of research focusing on smoking and drinking in China.An epidemiological survey was conducted in the Huai-hua District of Hunan Province of China. The results show that consumption of alcohol and tobacco varies in the urban and rural areas in China (Xuhui Zhou, 2006).Relevant research (eg. Yang, 1997; Ma *et al*., 2005; Yang *et al*., 2005; Yan *et al*., 2004) analyzed Chinese smoking behavior and explored the alcohol involvement rate and conditional alcohol consumption level(eg. Lv *et al*., 2011; Ma *et al*., 2005). However, these studies are subject to several limitations. First, few studies analyze smoking and drinking behaviorbetween urban and rural subgroups in China using econometric method. Second, most research uses one year survey data or small sample size data. The contribution of our study is twofold. First, we deploy large individual level panel data and run regression to examine effects of income and education on smoking and drinking for urban and rural residents. Second, we use each year's cross-section data and run regression separately to examine if the effects of income and education on smoking and drinking change since 1993.There are many kinds of alcohol beverages, such as liquor, beer and wine. Chinese are used to binge on liquor, which is extremely harmful to drinkers' health, with friends, colleague or business partners. So this paper will focus on liquor drinking.The left part of this paper is followed by data and model, then results and conclusions.

2. DATA AND MODEL

Our data is drawn on the China Health and Nutrition Survey (CHNS) - a panel survey which began since 1989, with a sample of about 4400 households--16000 individuals in total. Follow-up surveys were administered in 1991, 1993, 1997, 2000, 2004, 2006 and 2009. The CHNS has a multi-stage random cluster design and covers nine provinces in China (Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou). These nine provinces, quite diverse in terms of economic development and geographic features, are selected to capture a wide range of socioeconomic and urban–rural characteristics in China.

Our study uses questions on smoking and drinking behavior schemed in wave 1993, 1997, 2000, 2004, 2006 and 2009 of the survey. These questions intend respondents to report whether or not they have been smoking ordrinkingin the past year, the average number of cigarettes they smoke per day, and the amount of alcoholic drinks they consume each week.

Analysis of alcohol and cigarettes demandusing individual level data is subject to the econometric problem of censoring that arises because a large proportion of those surveyed may

report zero consumption of alcohol or cigarettes during the survey period.The cumulative distribution of alcohol or cigarette consumption can be characterizedby a mixed distribution, one that is neither continuous nor discrete. Thepopular econometric procedures in accommodating such censoring in the dependentvariables include: 1)Tobit model (Madalla, 1983); 2) sample selection model; and 3) two-part model.Tobit model forces zero observations to representcorner solutions and presumes that the same set of variables and parameterestimates determine both the discrete probability of a nonzero outcome andthe level of positive outcome.This assumption is not realistic. Thus Tobit model is not appropriate for our analysis of alcohol and cigarettes demand.We adopt a double-hurdle model (Craig 1971, Jones 2000), which allows the possibility of a difference between the models which determine the censoring rule and the continuous observations.

The model consists of two parts. The first part is a participation decision:

$$Y_1 = X\alpha + \mu \quad (1)$$

The second part is a consumption decision:

$$Y_2 = Z\lambda + \upsilon \quad (2)$$

The observed consumption C is specified as:

$$C = Z\gamma + \upsilon \text{ if } X\alpha + \mu > 0 \quad (3)$$

= 0 otherwise

When the error termsμ and$v$are jointly normally distributed, the above is Heckman's sample selection model. Whenμ and$v$are independent, it is two-part model.

For the sample selection model, generally an exclusion restriction is required to correct for sampling selectivity and generate credible estimates: there must be at least one variable which appears with a non-zero coefficient in the participation equation but does not appear in the consumption equation, essentially an instrument. Practically in the analysis of alcohol and cigarettes demand, no such variable is available.A recent study also demonstrated that the two-part model performs better than the sample selection model.

We employ a two-part model to estimate the demand of alcohol,cigarettes and physical activities.

$$Y_{ijt} = \beta_0 + \sum_{1}^{n} \beta_m \times X_{ijt} + \beta_{n+1} T_t + \beta_{n+2} S_j + \varepsilon_{ijt} \quad (4)$$

The subscript i refers to individuals, j to provinces, and t to years. The first part of the model is a probit in which Y=1 if the respondent reports smoking cigarettes or drinking.

The second part of the model is anordinary least squares (OLS) regression in which Y is the amount of cigarettes smoked per day, conditional on smoking, or alcohol consumed each week, conditional on drinking. Due to right-skewed distribution of the dependent variable in the second part of the two-part model, a log transformation is conducted to satisfy normality

assumption of the error. However, when transforming back from log scale to original scale, an estimate of the error retransformation - Duan's smearing estimator, must be employed. But if there is heteroscedasticity across numerous subgroups or if heteroscedasticity exists for a continuous covariate, the retransformation can be extremely difficult. Alternatively, Manning and Mullahy (2001) proposed a generalized linear model estimator to yield unbiased and efficient estimates for conditional demand.

The regressors of interest areX, T and S. X includes gender, education year, individual income, marital status, household size, age and occupation.In the context of demand theory, these variables play the roles of preference and demand shifters and are commonly used in the lifestyle literature. For instance, occupation and marital status may reflect a lifestyle. Age is relevant as previous studies suggest a life-cycle pattern for smoking and drinking.

T is a set of year fixed effects. Year fixed effects allow us to control for any fixed year-specific characteristics that are correlated with the lifestyle. S is a set of province dummies. Individuals in some provinces may be more tolerant of smoking and drinking as a mode of social behavior.

3. RESULTS

3.1 Sample Characteristics

Table 1 presents basic descriptive statistics by urban and rural surveys respectively. The full sample has 43,640 observations in which17,274 (39.6%) are from urban communities and 26,366 (60.4%) are from rural areas. The sample is distributed roughly even across different provinces and waves of survey. Table 1 shows not only the participation rate, but also the level of conditional consumption of cigarettes and alcohol by rural residentsis higher than that by urban residents. For smoking, the participation rate is 32.2% and 29.6% for rural and urban residents separately; for liquor drinking, it is 28.5% and 27.6% for rural and urban residents respectively. In addition, among smokers, rural residents consume 1.3 more cigarettes per day than urban residents (16.8 versus 15.5 cigarettes per day); among liquor drinkers, rural residents consume 84.7 g more liquor per week than urban residents (577.1 versus 492.3 g liquor per week).

In our sample, the educational levelof rural residentsis lower than that of urban residents. The average schooling periodof rural residents is only 6.0 yearscompared to 9.6 years of urban residents.Similar situation is apparently observed as regards income, which stands higher among urban residents than rural residents.

3.2 Parameter estimates

Table 2 presents the estimates of the effect of education and income on smoking and liquor drinking using panel data. Years of schooling has a negative and statistically significant impact on both the participation rate and conditional demand level of smoking and liquor drinking. It shows that completing an additional year of school reduces not only the predicted probability of

smoking and liquor drinking participation, but also the consumption level of smokers and liquor drinkers.The coefficients of the interaction term of years of schooling and urban dummy on both the participation rate and the conditional demand level of smoking are negative and statistically significant. It indicates that the deterrent effect of education on smoking of urban residents is larger than that of rural residents. The coefficients of the interaction term on both the participation rate and the conditional demand level of liquor drinking are statistically insignificant. It indicates that the deterrent effect of education on liquor drinking is same to urban and rural residents.

The effects of income on smoking are inconsistent. It has a negative and statistically significant impact on participation rate, but a positive and statistically significant impact on conditional demand level. It shows that income increase reduces the predicted probability of smoking participation but increases theconditional consumption level. This result is perhaps not surprising given the particular nature of cigarette. On the one hand, the wealthier residents normally take greater care of their healthand less likely to participate in smoking which is an unhealthy consumption. On the other hand, nicotine addiction makes it very hard to quit smoking and smokers will consume more cigarettes with their purchasing power bolstered by income increases. The coefficients of the interaction term of income and urban dummy on both the participation rate and the conditional demand level of smoking are statistically insignificant. It indicates that the impact of income on smoking of urban resident is not appreciably different from that of rural residents. The coefficients of income on liquor drinking are positive and statistically significant, but those of the interaction term of income and urban dummy are negative and statistically significant. The sum of the coefficients of income and interaction term is negative but very close to zero. It means that the impacts of income on participation rate and conditional demand level of liquor drinking are different between urban and rural residents. Though income has positive impacts on liquor drinking for rural residents, it shows quite small negative impact for urban residents.

Table 3 presents the estimates of the effect of education and income on smoking and liquor drinking using cross-section data for years 1993, 1997, 2000, 2004, 2006, 2009 separately. All of the coefficients of years of schooling on smoking are negative and statistically significant. The coefficients of years of schooling on conditional cigarette demand level decrease from -0.0928 in 1993 to -0.2298 in 2009. Although the coefficients of years of schooling on smoking participation rate fluctuate from year to year, the trend of them is still obvious which decrease from -0.0207 in 1993 to -0.0287 in year 2009. It indicates that the deterrent effect of education on smoking is enhancingsince 1993. All of the coefficients of years of schooling on liquor drinking are negative except the coefficient of years of schooling on liquor drinking participation rate in year 1993, but they are no time trend and only part of them statistically significant. It indicates that the deterrent effect of education on liquor drinking has no obvious change since 1993.

All of the coefficients of income on smoking participation rate are negative and statistically significant except those of 1997 and 2000. Although the coefficients of income on smoking participation rate fluctuate from year to year, the decline trend of them is still obvious which decrease from -0.0215 in 1993 to -0.0389 in year 2009. It indicates that the deterrent effect of income on smoking participation is enhancing since 1993. Only parts of the coefficients of income on conditional cigarette consumption level and on liquor drinking are statistically significant. The magnitude of the coefficients also has no trend change. It indicates that the impacts of income on conditional cigarette consumption level and on liquor drinking have no obvious change since 1993.

4. CONCLUSION

Findings of this research suggest that socioeconomic status indicated by income and education is significantly related to the respondents' smoking and liquor drinking behavior. The effects changed since 1993 and a perceptible difference is found between urban and rural residents. First, education as a deterrentde facto to both smoking and liquor drinking has been enhancing since 1993, though weighing more heavily with urban residents than rural dwellers.Second, income increase serves as a double-edged sword—having been reducing the probability of smoking since 1993 on the one hand, while steadily escalating conditional cigarette consumption levels.As regards its influence on liquor drinking, incomeregisterspositiveeffects on rural residentsbut slightly negativeones on urban dwellers.

There are several policy implications derived from our findings. First, we suggest that education play a critical role in Chinese public policy designed to control smoking and liquor drinking. Second, we suggest the government to steadily promote urbanizationto reduce people' unhealthy consuming behavior.

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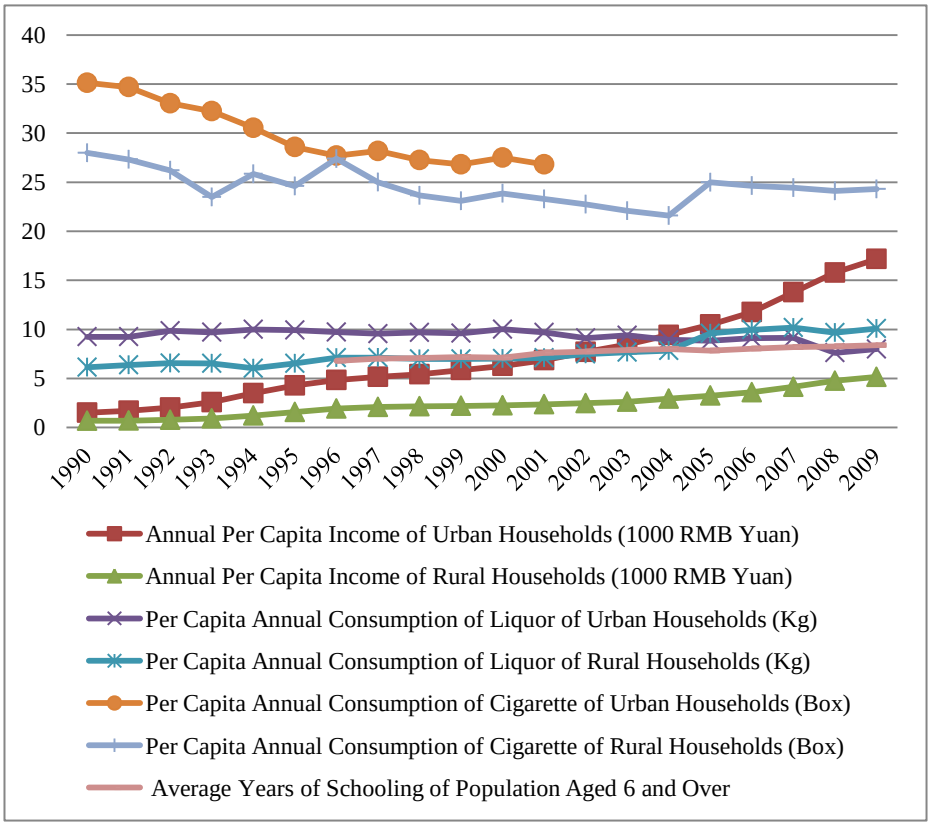

Figure 1. Income, education, cigarette and liquor consumption level of Chinese.Data source: Data of per capita annual consumption of cigarette of rural households are from China Rural Statistical Yearbook (1991 to 2010). Other data are from China Statistical Yearbook (1991 to 2010).

Table 1: Sample Statistics

Variables	Overall	Urban	Rural
Probability of cigarette smoking	0.311	0.296	0.322
Number of cigarettes per day, conditional on smoking	16.273	15.451	16.771
Probability of liquor drinking	0.281	0.276	0.285
Amount of liquor per week (50g), conditional on drinking	10.892	9.847	11.541
Years of schooling	7.448	9.604	6.035
Individual income (in 1000 RMB, inflated to 2009)	9.004	12.083	7.002
Men	0.504	0.530	0.487
Marital status			
- Never married (reference)	0.099	0.097	0.098
- married	0.840	0.832	0.849
- Widowed or divorced	0.060	0.071	0.053
Household size	3.902	3.492	4.167
Age			
- 18-25 (reference)	0.078	0.058	0.090
- 26-40	0.300	0.286	0.309
- 41-60	0.447	0.423	0.463
- 60 and older	0.176	0.233	0.138
Occupation			
- Occupation 0	0.193	0.300	0.123
- Occupation 1 (reference)	0.030	0.067	0.005
- Occupation 2	0.103	0.214	0.029
- Occupation 3	0.415	0.033	0.665
- Occupation 4	0.077	0.125	0.046
- Occupation 5	0.080	0.108	0.062
- Occupation 6	0.029	0.037	0.023
- Occupation 7	0.075	0.116	0.048
Province			
- Liaoning (reference)	0.093	0.127	0.072
- Heilongjiang	0.095	0.083	0.103
- Jiangsu	0.132	0.158	0.116
- Shandong	0.106	0.128	0.090

- Henan	0.106	0.083	0.122
- Hubei	0.115	0.104	0.122
- Hunan	0.099	0.121	0.084
- Guangxi	0.127	0.106	0.141
- Guizhou	0.126	0.089	0.150
Year			
- 1993 (reference)	0.158	0.149	0.165
- 1997	0.188	0.178	0.195
- 2000	0.167	0.165	0.164
- 2004	0.163	0.170	0.159
- 2006	0.156	0.164	0.152
- 2009	0.167	0.174	0.165
Sample size	43640	17274	26366

Note: The 8 categories of occupations are: 1 includes senior professional/technical worker (doctor, professor, lawyer, architect, engineer)；2 includes junior professional/technical worker (midwife, nurse, teacher, editor, photographer), administrator/executive/manager (working proprietor, government official, section chief, department or bureau director, administrative cadre, village leader), office staff (secretary, office helper); 3 includes farmer, fisherman, hunter; 4 includes skilled worker (foreman, group leader, craftsman), army officer, police officer, ordinary soldier, policeman and driver; 5 includes non-skilled worker (ordinary laborer, logger); 6 includes athlete, actor, musician; 7 includes service worker (housekeeper, cook, waiter, doorkeeper, hairdresser, counter salesperson, launderer, child care worker); 0 includes others.

Table 2: Estimation results using panel data

Dep. variable	Smoking		Liquor drinking	
	Probability	Conditional level	Probability	Conditional level
Yrs. of schooling	-0.0370***	-0.0568*	-0.0097**	-0.0963*
	(0.007)	(0.034)	(0.005)	(0.049)
(Yrs. of schooling).urban	-0.0164*	-0.1230***	0.0103	-0.0575
	(0.009)	(0.046)	(0.006)	(0.069)
Ln(Individual income)	-0.0163**	0.0843**	0.0115**	0.1278*
	(0.007)	(0.040)	(0.006)	(0.072)
Ln(Individual income).urban	-0.0048	0.0115	-0.0152**	-0.1398*
	(0.009)	(0.049)	(0.007)	(0.074)

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3: Estimation results using cross-section data in each year

Dep. variable		Cigarette	Cigarette	liquor	liquor
		Probability	Conditional level	Probability	Conditional level
Yrs. of schooling	1993	-0.0207***	-0.0928*	0.0009	-0.1165
		(0.006)	(0.055)	(0.006)	(0.088)
	1997	-0.0248***	-0.1000*	-0.0058	-0.1400*
		(0.006)	(0.054)	(0.006)	(0.084)
	2000	-0.0293***	-0.1035*	-0.0145**	-0.2416**
		(0.006)	(0.061)	(0.006)	(0.095)
	2004	-0.0300***	-0.1648***	-0.0057	-0.3238***
		(0.006)	(0.058)	(0.006)	(0.100)
	2006	-0.0244***	-0.1983***	-0.0061	-0.1779*
		(0.006)	(0.060)	(0.005)	(0.106)
	2009	-0.0287***	-0.2298***	-0.0073	-0.0098
		(0.006)	(0.066)	(0.005)	(0.084)
Ln(Individual income)	1993	-0.0215*	-0.0228	0.0124	-0.0772
		(0.012)	(0.099)	(0.011)	(0.179)
	1997	-0.0113	0.0638	0.0079	0.4325***
		(0.010)	(0.098)	(0.010)	(0.155)
	2000	-0.0075	0.1415	-0.0014	0.0426
		(0.012)	(0.132)	(0.012)	(0.196)
	2004	-0.0273***	-0.0110	-0.0072	0.2753*
		(0.009)	(0.086)	(0.009)	(0.153)
	2006	-0.0231**	0.2252**	-0.0014	-0.1909
		(0.010)	(0.108)	(0.010)	(0.202)
	2009	-0.0389***	0.2129*	0.0078	-0.1824
		(0.012)	(0.120)	(0.012)	(0.195)

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1