SMOKING, DRINKING, AND BINGE DRINKING: AN EMPIRICAL STUDY OF THE ROLE OF PRICE ON CONSUMPTION BY HIGH SCHOOL SENIORS

by

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Abstract

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Advisor: Professor Michael Grossman

In this study, I estimate time-series demand functions using Ordinary Least Squares in order to examine the effects of real cigarette and alcohol prices on their respective consumption. My targeted population is high school seniors in the United States. The data I use come from Monitoring the Future, The Tax Burden on Tobacco, and the Bureau of Labor Statistics. Using the Ordinary Least Squares real price coefficients, I evaluate how much of the observed change in consumption is explained by the observed change in real price during a particular period of time between 1976 and 2008. Then, I repeat the same calculations for subsamples of male, female, white, and nonwhite high school seniors. Moreover, I incorporate a risk variable measuring whether or not subjects believe there is a great risk of harm when consuming cigarettes or alcohol in moderate or excessive quantities.

Among high school seniors, my findings reveal that 73 percent of the observed decrease in cigarette consumption during 1997-2008, 28 percent of the observed decrease in alcohol consumption during 1989-1992, and 70 percent of the observed decrease in excessive alcohol consumption also during 1989-1992 are explained by increments in their respective real prices. The percentage of change in cigarette, alcohol, and excessive alcohol consumption explained by changes in their respective real prices remain substantial even after controlling for risk perceptions associated

with these activities. Furthermore, greater awareness of the risks associated with smoking, drinking, and binge drinking strengthen the effect of real price on consumption.

Dedication

This dissertation is dedicated to my partner, Jamie Polaski, whose unconditional love and support gave me the motivation I needed to advance in my academic career. For his love and patience, I am eternally grateful.

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1. Introduction

Cigarette smoking is one of the most preventable causes of lung cancer deaths, heart disease-related deaths, and other respiratory illnesses. According to the United States Department of Health and Human Services (1989, 1998), tobacco products are linked to more deaths than any other product. Cigarettes, which account for 95 percent of tobacco product sales in the Unites States, are recognized as the cause of approximately one-fifth of the deaths per year in the United States (Chaloupka and Warner 2000). Alcohol consumption has health and socioeconomic consequences that are also far from trivial. Cook and Moore (2000) point out concerns associated to excessive alcohol consumption such as crime and early death. These concerns have stimulated public and government support to treat alcohol and tobacco different than other commodities.

In order to deter the consumption of cigarettes and alcohol, the United States Government set minimum legal smoking and drinking ages, restricted smoking in confined public areas (workplaces, schools, etc.), sternly punished driving under the influence of alcohol, and applied high excise taxes to these commodities. Two particular reasons that motivated these actions are the addictive characteristic of smoking cigarettes and drinking alcoholic beverages and the negative externalities that these two activities impose on bystanders.

Current literature in the field of economics of substance abuse shows new theories that predict that addictive goods (such as cigarettes and alcohol) should be more sensitive to price changes than previously believed. For example, Becker and Murphy (1988) propose a model of rational addiction where they state that for rational (farsighted) individuals, the demand for addictive goods might not be perfectly inelastic, as it is commonly assumed. They state that the quantity demanded of addictive goods might respond to changes in their prices and that the cross-price elasticity of quantities of addictive goods consumed in different periods is negative. Becker,

Grossman, and Murphy (1994) do an empirical test on this model of rational addiction and find that the cross-price elasticity of quantities consumed in different periods is indeed negative. They also find that long-run responses exceed short-run responses, which makes the long-run increase in tax revenue from an increase in the Federal excise tax on cigarettes considerably smaller than the short-run increase.

In addition to the negative health consequences of smoking cigarettes, the social cost of cigarette consumption due to the negative externalities related to this activity is a public health concern. Public health advocates demand that people who consume cigarettes and alcohol pay the full price of these commodities. That is, people who consume cigarettes and alcohol should pay a price that reflects the harm imposed on bystanders (or external costs) in addition to the harm imposed on the consumer of these goods (or internal costs). However, as it is usually the case for any other good with a negative consumption externality, determining the full price for cigarettes and alcohol is not an easy task.

Additional public health concerns are the severe consequences of alcohol consumption. For instance, excessive alcohol consumption has been linked to lost productivity, disability, early death, crime, neglect of family responsibilities, personality deterioration, and other problems (Cook and Moore 2000). Economists have analyzed positive and negative consequences borne by those who consume alcoholic beverages and those around them. Researchers at the United States Centers for Disease Control and Prevention (CDC) found more than a 50 percent increase in reports of alcohol-impaired driving since 1994 (Shults, Kresnow, and Lee 2009). Additionally, the CDC associated alcohol with 4.9 percent of all the deaths in 1987 (Centers for Disease Control and Prevention 1990). As highlighted by Cook and Moore (2000), even though these estimates show that alcohol consumption is less menacing than cigarette consumption, alcohol consumption is a greater problem than drug abuse. Two benefits of alcohol consumption are the prevention of coronary heart disease

when consumed in moderation (Camargo et al. 1997; Criqui et al. 1987; Klatsky, Armstrong, and Friedman 1990; Shaper, Wannamethee, and Walker 1988; Stampfer et al. 1988; Yano, Rhoads, and Kagan 1977) and its role as an acceptable substitute for uncontaminated beverages in places where drinking water is polluted (Vallee 1998).

Cook and Moore (2000) divide the consequences of alcohol consumption in short-term consequences of excessive alcohol consumption (traffic crashes, alcohol overdose, drowning, and intentional violence) and long-term consequences of persistent excessive alcohol consumption (damage to the liver and other organs, impaired cognition and immune-system function, and alcohol dependence). Furthermore, alcohol consumption during pregnancy may impair the child's healthy development (Larkby and Day 1997). Some of these consequences are clear evidence that the negative externalities related to alcohol consumption are an unquestionable public health concern.

Taxation, an approach taken by the United States to decrease cigarette and alcohol consumption, increases the nominal price of cigarettes and alcoholic beverages. It is also one of the most efficient ways to alter nominal cigarette and alcohol prices. As Grossman, Chaloupka, Saffer, and Laixuthai (1994) point out, the administrative and enforcement costs of policies that curb people's consumption of cigarettes and alcohol other than taxation are possibly more expensive. For this reason and Becker and Murphy's (1988) model of rational addiction, I pay particular attention to the response in cigarette and alcohol consumption due to changes in cigarette and alcohol prices. This response to price is crucial to determine an effective tax policy for cigarettes and alcohol to price them at their full price (money price plus external and internal costs). If changes in cigarette and alcohol prices explain a significant fraction of the changes in their consumption, then the United States Government's allocation of resources to cigarettes and alcohol tax programs would be justified.

In this study, I examine three particular outcomes: cigarette smoking, moderate alcohol consumption, and excessive alcohol consumption, which I will also refer to as smoking, drinking, and binge drinking, respectively. I estimate time-series demand functions for smoking, drinking, and binge drinking using Ordinary Least Squares (OLS). Then, I use these OLS price coefficients to calculate the price elasticities of demand for smoking, drinking, and binge drinking evaluated at the sample mean levels. Furthermore, I estimate these time-series demand functions for smoking, drinking, and binge drinking in a double log functional form in order to obtain price coefficients that represent price elasticities of demand with respect to the money price.[1] Then, I compare these new price elasticity estimates with the price elasticities evaluated at the sample mean levels.

Besides emphasizing the role of price on smoking, drinking, and binge drinking, I focus on high school seniors because the consumption of cigarettes and alcohol are habits that start developing at this age (Grossman et al. 1994) and individuals at this age are more responsive to price changes than adults (Gruber and Zinman 2000). Particularly, Lewit et al. (1981) point out that due to the addictive nature of smoking, adult smokers are less likely to adjust quickly to changes in the price of cigarettes than young smokers because young smokers have been smoking for less time. Furthermore, they point out that peer behavior is much more relevant among young smokers than adults. Bauman and Ennett (1996) reaffirm the central role of peer pressure in youth alcohol consumption. Grossman and Chaloupka (1997) point out two additional reasons to focus on young smokers. First, they indicate that the fraction of disposable income a young smoker spends on cigarettes is probably higher than the fraction of disposable income spent by an adult smoker. Second, they indicate that younger individuals are more present-oriented. Also, the habit-forming nature of alcohol consumption and its relevance in social gatherings are major reasons to focus on alcohol consumption among high school seniors.

[1] See Appendix.

A novel aspect in my study is the inclusion of a variable that measures high school seniors' perceptions of the risk of harm associated with smoking, drinking, and binge drinking. This risk variable measures the percentage of high school seniors who consider smoking, drinking, or binge drinking an activity of great risk. In addition to serving as a control for the risk perceptions of consumers, this risk variable allows me to tests the explanatory power of real price on consumption.

When estimating the demand functions for smoking, drinking, and binge drinking, I also estimate separate demand functions for subsamples of male, female, white, and non-white high school seniors in order to obtain the effects of real prices on the consumption of cigarettes and alcohol for these particular subgroups. Furthermore, I estimate demand functions for subsamples composed of those who consider smoking, drinking, or binge drinking a great risk and those who do not. Then, I evaluate the effect of price on consumption for these two particular subgroups.

The reminder of this paper is organized as follows. Section 2 presents a brief literature review. Sections 3 and 4 discuss the data and model specification, respectively. Section 5 presents the empirical results for cigarette, alcohol, and excessive alcohol consumption for the whole sample and male, female, white, and nonwhite subsamples. I also present results obtained when the whole sample and subsamples are separated into those who consider smoking, drinking, or binge drinking a great risk and those who do not. Section 6 concludes with an evaluation of the effect of real cigarette and alcohol prices on cigarette, alcohol, and excessive alcohol consumption. This section also discusses how the effect of price on consumption changes when high school seniors are more aware of the risks associated with smoking, drinking, or binge drinking.

2. Literature Review

The health consequences of cigarette and alcohol consumption have received significant scientific attention. The first studies that linked smoking with lung cancer were published in the 1950's (Doll and Hill 1954, 1956; Hammond and Horn 1958b, 1958a; Wynder and Graham 1950). Today, lung cancer is recognized as the reason for 30 percent of all cancer deaths in the United States (U.S. Department of Health and Human Services 1989). Moreover, cigarette smoking has been recognized as the leading cause for approximately 90 percent of lung cancer deaths in the United States (Chaloupka and Warner 2000) and one of the main reasons for heart disease.

In the case of alcohol consumption, drinking by youths has gotten a lot of attention. Grossman et al. (1994) points out that compared to adults, youths are more prone to binge drinking because they discount their future more heavily, and they are also involved in more motor-vehicle accidents and violent crimes. Cook and Moore (1993) point out that alcohol consumption is a habit-forming activity, and that it sets the pattern for future consumption among youths. They also mention negative consequences of alcohol consumption for human capital and family formation. A number of studies using different data sets conclude that the incidences of moderate and excessive alcohol consumption are related to price and the legal minimum drinking age (Grossman et al. 1994). Chaloupka and Wechsler (1996), however, found that the price of beer does not have a discernable effect on alcohol consumption among male college students.

When it comes to public health, one of the biggest concerns is the chronic inhalation of environmental tobacco smoke, which causes lung cancer in nonsmokers as well as other diseases in the children of smokers (Environmental Protection Agency 1994). According to Glantz and Parmley (1995), environmental tobacco smoke might be responsible for tens of thousands of heart disease-

related deaths per year. Another public health concern is the motor-vehicle accidents involving alcohol impaired drivers and intentional violence.

Conventional studies of cigarette demand show price elasticity of demand estimates that fall in a range from -0.5 to -0.3 (Chaloupka and Warner 2000). Quasi-experimental studies based on aggregate data that compared changes in cigarette consumption in states that increased the taxes on cigarettes and those that did not yield price elasticities of demand that range from -0.56 to -0.17 (Baltagi and Goel 1987; Peterson et al. 1992). Some of the difficulties in studies using time-series data involve high correlations among some the key explanatory variables and price, sensitivity of the estimates of the effect of cigarette price on cigarette consumption, and multicollinearity and unstable estimates of the parameters of interest due to including highly correlated variables. Numerous studies using sophisticated econometric techniques have addressed these issues (Barnett, Keeler, and Hu 1995; Flewelling et al. 1992; Keeler et al. 1996; Seldon and Boyd 1991; Simonich 1991; Sung, Hu, and Keeler 1994) and found estimates for the price elasticity of demand within a narrow range centered on -0.4.

Price elasticity of demand estimates for alcohol consumption vary over time, place, data set, and estimation method. However, price elasticities of demand for alcohol are negative in almost every case (Cook and Moore 2000). Cook and Moore (2000) point out econometric studies that estimate price elasticities of demand for beer, wine, and spirits differ widely and in some instances, they are not negative. Furthermore, Clements et al (1997) calculate price elasticities of demand for Australia, Canada, Finland, New Zealand, Norway, Sweden, and the United Kingdom. Using a system of demand equations based on aggregate data, they find average price elasticities of demand for beer, wine, and spirits. These average price elasticities of demand are -0.35, -0.68, and -0.98, respectively.

3. Data

I use national time-series data to estimate time-series demand functions for smoking, drinking, and binge drinking. Two benefits of using national-level data to estimate the effects of price on consumption are that they allow me to analyze a continuous period of time including the most recent data, and they also allow me to observe whether or not changes in real cigarette and alcohol prices throughout time had the expected effect on their respective consumption levels. The most prominent limitations of these time-series data are that there are a small number of observations and the variables used in my model are correlated.

Time-series data on yearly national nominal cigarette prices from 1976 to 2008 are obtained from *The Tax Burden on Tobacco* by Orzechowski and Walker (2008).[2] National time-series data on the yearly nominal prices of alcoholic beverages such as beer, wine, and spirits from 1976 to 2008 are taken from the Bureau of Labor Statistics (BLS). The Consumer Price Index[3] (used to calculate real prices) is also taken from the BLS.

Figure 1 shows the real prices of cigarettes, beer, wine, and spirits from 1976 to 2008. This period includes most of the anti-smoking campaign in the United States, which started with the first Surgeon General's Report on Smoking and Health in 1964. It also includes campaigns to reduce deaths from motor vehicles accidents by discouraging alcohol abuse (out-reach programs on college campuses and "zero tolerance" laws, for example). In Figure 1, we see a somewhat steady increase in the real cigarette price. Figure 1 also shows that the real cigarette price dropped by 14 percent from 1976 to 1980 and rose by 88 percent from 1980 to 1992. This significant increase in the real cigarette

[2] Nominal prices for cigarettes are the weighted average (median) price per package for all states as of November of year t. Starting in 1990, generic brands are not included in the average calculation. Moreover, average prices do not include all the cigarette taxes that are imposed by one or more municipalities in six out of the 50 states plus D.C. Price does include state sales taxes, where applicable.

[3] Not seasonally adjusted.

price is due, in part, to the increases in Federal excise tax rates on cigarettes.[4] In 1993, Philip Morris Companies cut the nominal price of a pack of Marlboro cigarettes by 40 cents as a strategy against generic brand cigarettes, which were just introduced into the market. This action was hastily followed by its competitors, resulting in the 12 percent decrease in the real price for cigarettes from 1992 to 1997. A 72 percent increase in the real cigarette price, the second highest increase in the real cigarette price since 1976, happened from 1997 to 2002. This time, this significant increase in the real cigarette price was due to a Federal excise tax rate increase[5] and also due to a number of state tax increases. Additionally, this hike in the real cigarette price reflects the Master Settlement Agreement, which is the settlement of lawsuits filed by 46 state attorneys general against cigarette companies to recover Medicaid funds spent treating smoking-related diseases (Grossman 2004). After 2002, the real price of cigarettes decreased by 4 percent until 2006 and then increased by 3 percent, which almost leaves the real price of cigarettes unchanged.

Figure 1 also shows a steady decline in the real price of alcoholic beverages such as beer, wine, and spirits. Before Federal tax rates increased for these three goods in 1991, the real prices of beer, wine, and spirits decreased by 20, 28, and 30 percent, respectively. After this tax increase, real prices decreased again by 13 percent for beer, 18 percent for wine, and 16 percent for spirits.

The data on consumption of cigarettes, beer, wine, and spirits came from Monitoring the Future (MTF), a project conducted by the Institute of Social Research of the University of Michigan. The MTF project provides long and consistent time-series data on the behavior of students regarding their consumption of cigarettes and alcohol. It consists of cross-sectional yearly surveys answered by secondary school students since 1976. A concern with self-reported consumption of

[4]There was an increase of 16 cents per pack of cigarettes in 1983 and an increase of 20 cents per pack of cigarettes in 1991.

[5]There was an increase of 34 cents per pack of cigarettes in 2000 and an increase of 39 cents per pack of cigarettes in 2002.

alcohol is that respondents are likely to understate actual consumption. Compared to the National Longitudinal Survey of Youth (NLSY), which is perhaps the most complete panel data set based on youths, the MTF project generated much higher estimates of drinking and binge drinking incidences (Cook and Moore 2000). One plausible explanation is that the MTF surveys were answered in the classroom, whereas the NLSY surveys were answered at home.

In the MTF project, students answer questions such as "how frequently have you smoked cigarettes during the past thirty days?," "on how many occasions have you had alcoholic beverages to drink (more than a few sips) during the last twelve months?," and "in the last two weeks, how many times have you had five or more drinks[6] in a row?" The MTF project uses the answers to these questions to measure smoking, drinking, and binge drinking participation, respectively. I use these participation measures among high school seniors to create dummy variables indicating those who smoked cigarettes in the past thirty days (even if it was less than one cigarette a day), consumed an alcoholic beverage at least once in the past twelve months, or consumed five or more drinks in a row on at least one day in the past two weeks. Then, I use these dummy variables to calculate the annual fraction of high school seniors that engaged in smoking, drinking, and binge drinking activities.[7] Finally, I use these fractions to express the yearly percentages of high school seniors who smoked cigarettes in the past thirty days (even if it is less than one cigarette a day), consumed an alcoholic beverage at least once in the past twelve months, or had five or more drinks in a row on at least one day in the past two weeks. When estimating the times-series demand functions for smoking, drinking, or binge drinking, these yearly percentages (or yearly participation rates) represent the dependent variables (consumption), and they are labeled smoking, drinking, and binge drinking, respectively.

[6] A drink is a bottle of beer, a glass of wine, a wine cooler, a shot glass of liquor, or a mixed drink.

[7] This calculation is the weighted average of individual participation measured by the dummy variables. The weights are sampling weights provided by the MTF project.

Figure 2 shows these yearly participation rates for smoking, drinking, and binge drinking from 1976 to 2008 among high school seniors. In Figure 2, we can see a decrease in smoking, drinking, and binge drinking participation of 47, 24, and 33 percent, respectively, from 1976 to 2008. Smoking participation, which has the largest decrease, follows through with the significant increase in the real cigarette price. However, drinking and binge drinking participation do not show such a strong correlation with their respective real prices. It is important to remember, however, that nominal prices were not the only tool used to reduce the consumption of cigarettes and alcohol. Anti-smoking and anti-drinking campaigns also had an effect on the consumption of these substances.

The MTF project also provides data on the risk perceptions of consuming cigarettes and alcohol among high school seniors, which is also a relevant determinant of the consumption of these goods. In the MTF surveys, the respondents answer questions such as "how much do you think people risk harming themselves if they smoke one or more packs of cigarettes per day?," "how much do you think people risk harming themselves if they take one or two drinks nearly every day?," and "how much do you think people risk harming themselves if they take five or more drinks once or twice each weekend?" I use the MTF data on risk perceptions to calculate the yearly percentage of high school seniors who consider smoking, drinking, and binge drinking, respectively, a great risk in a similar manner as I calculate the yearly participation rates for smoking, drinking, and binge drinking. When constructing the dummy variables for risk perceptions, these dummy variables equaled one only if the respondent the activity in discussion a great risk. Figure 3 shows these percentages from 1976 to 2008.

Figure 3 shows that the risk perceptions of smoking among high school seniors have significantly increased relative to those for drinking and binge drinking. Their risk perceptions of smoking steadily rose by 31 percent from 1976 to 2008, while their risk perceptions of drinking rose

by 55 percent from 1976 to 1991, and then steadily decreased by 40 percent until 2003. Then, their risk perceptions of drinking started rising again by 23 percent. Their risk perceptions of binge drinking rose from 1976 to 1996 by 34 percent. Then it sharply declined by 14 percent from 1996 to 1998, and then it rose again by 10 percent until 2008.

Furthermore, the MTF project provides data on variables that could affect the respondent's consumption of cigarettes or alcohol. The MTF project provides data at the individual level for variables such as the respondent's self-rated intelligence and self-rated school ability compared to others of the same age, the highest level of schooling completed by the respondent's mother, the highest level of schooling completed by the respondent's father, the amount of time that the respondent's mother spent at a paid job (half-time or more) during the time when the respondent was growing up, the importance of religion in the respondent's life, the presence of the respondent's mother in his or her household, the presence of the respondent's father in his or her household, the presence of any siblings in the respondent's household, the amount of time needed for the respondent to graduate from high school, the amount of money the respondent gets from a job or other work, and the amount of money the respondent gets from other sources such as allowances. However, given the small number of years for which these data are available, I only consider variables that show the highest of variation from 1976 to 2008 and that affect consumption of cigarettes and alcohol the most. These variables are the maximum amount of education obtained by the respondent's father, the maximum amount of education obtained by the respondent's mother, the amount of time the respondent's mother spent working, the amount of money the respondent gets from a job or other work during an average week, and the amount of money the respondent gets from other sources such as allowances during an average week. For questions in the MTF questionnaire that involved the respondent's mother or father, the respondent was given an option such as "don't know or does not apply" to answer these questions. Therefore, the absence of any of

the parents in the respondent's household did not affect the variables measuring the education level of the respondent's parents nor the amount of time the respondent's mother spent working.

I use the MTF data on the maximum amount of education obtained by the respondent's father to construct a dummy variable that equals one if the respondent's father had some college education, finished college, or attended grad school after college. Otherwise, this dummy variable is zero. Then, I use this dummy variable to calculate the annual fraction of high school seniors' fathers that had some college education, finished college, or attended grad school after college.[8] Finally, I express this fraction in yearly percentages. I create a similar variable using the MTF data on the maximum amount of education obtained by the respondent's mother. For simplicity, I will refer to these variables as *father's education* and *mother's education*, respectively. Similarly, I use the MTF data on the amount of time the respondent's mother spent working to create a dummy variable that equals one if the respondent's mother worked most, all, or nearly all of the time while the respondent was growing up. Otherwise, this dummy variable is zero. Then, I use this dummy variable to calculate the annual fraction of high school seniors' mothers that worked most, all, or nearly all of the time while the respondent was growing up. Then, I express this fraction in yearly percentages. I will refer to this variable as *mother's employment*. Regarding the respondent's income, the MTF project collects data on the amount of money the respondent gets from a job or other work during an average week. Additionally, the MTF project collects data on the amount of money the respondent gets from other sources such as allowances during an average week. The MTF project collects these data by asking two different questions. To answer each of these questions, the respondent had alternatives such as 1: $0, 2: $1-$5, 3: $6-$10, etc. I combine these data to create an income variable for the respondent by replacing the label of each alternative (1, 2, 3, etc.) with the midpoint value of their respective

[8] This calculation is the weighted average of the dummy variable. The weights are sampling weights provided by the MTF project. *Mother's education* and *mother's employment* are based on the same procedure.

intervals[9] ($0, $3, $8, etc.). Then, I add the frequencies of the option chosen by the respondent to answer each of the two questions. With this new combined income per week variable at the individual level, I calculate the weighted weekly average income for each year and then express it in real terms. I will refer to this variable as *real income*. Figure 4 shows time trends for these four variables.

Furthermore, when estimating the demand function for drinking and binge drinking, I include the minimum legal age to purchase beer with 3.2 percent or lower alcohol by weight in the demand equation. I will refer to this variable as *legal age*. This variable is a population-weighted average of the minimum legal age needed to purchase alcoholic beverages effective in all states in the United States in a given year. For this measure, the weights are the fraction of the United States' population residing in each state in a given year. Even though all states imposed a minimum legal drinking age of 21 years old by 1988, many states also passed "grandfather clauses." These clauses were exceptions for state residents who happened to be of legal drinking age before the new legal drinking age of twenty-one was imposed. Thus, twenty-one did not become the official minimum drinking age across the United States until 1991. For this reason, the variable for minimum legal drinking age is lagged one year before it is incorporated into the model. This method allows for the delay in obtaining a consistent minimum drinking age in all states. I obtained this minimum legal drinking age variable from Saffer, Chaloupka, and Grossman (1993).

Missing values at the individual level were carefully addressed when creating these aggregated variables from the MTF data. Observations with missing variables where only dropped when those variables were essential to the analysis. In other words, I only dropped observations with data missing on gender, race, and risk perceptions associated to smoking, drinking, or binge drinking when separating the data in subsamples of male, female, white, and nonwhite high school seniors as

[9] For open intervals such as the last option provided to answer these questions, the closest multiple of 10 greater than the lower limit of the interval was chosen as the "midpoint value."

well as subsamples composed of those who believe these are activities of great risk and those who do not.

Tables 1, 2, and 3 show summary statistics for the variables used to estimate the time-series demand functions for smoking, drinking, and binge drinking, respectively. These tables also show summary statistics for subsamples of males, females, whites, and nonwhites as well as subsamples composed of those who believe these are activities of great risk and those who do not. Table 1 shows a peculiarity of the data set. In 1992, in order to separate the sample into male and female high school seniors, I dropped the observations that did not have data on gender. After dropping these observations, the weighted means for the male and female high school seniors subsamples were lower than the weighted mean for the whole sample. The cigarette consumption means for male and female high school seniors in Table 1 are below the cigarette consumption mean for the whole sample because of this peculiarity of the weighted means calculated in 1992.

4. Methodology

4.1. Econometric approach

As pointed out previously, I use OLS to estimate time-series demand functions for smoking, drinking, and binge drinking for high school seniors in the United States from 1976 to 2008. In these demand functions, cigarette, alcohol, and excessive alcohol consumption are the dependent variables. Cigarette consumption (or smoking) is the percentage of high school seniors who smoked cigarettes in the past thirty days (even if it was less than one cigarette a day), alcohol consumption (or drinking) is the percentage of high school seniors who consumed an alcoholic beverage at least once in the last twelve months, and excessive alcohol consumption (or binge drinking) is the percentage of high school seniors who had five or more drinks in a row on at least one day in the past two weeks. My main approach is to estimate these time-series demand functions for smoking, drinking, and binge drinking using OLS. I use the OLS price coefficients to calculate price elasticities of demand for smoking, drinking, and binge drinking evaluated at their respective sample means. In my second approach, I use a double log model to estimate regression coefficients that represent elasticities. I use these price elasticity estimates to corroborate the price elasticities of demand evaluated at the means obtained from the OLS model.

In my main approach, the time-series demand equation used for smoking, drinking, and binge drinking specifies the yearly percentage of high school seniors who participate in these activities as a function of their respective real price, time trends, their respective perception of risk, and a set of additional covariates that includes real income, father's and mother's education, and mother's employment. When estimating the demand functions for drinking and binge drinking, the minimum legal drinking age is included in the demand functions. This time-series demand function specification can be expressed as,

$$C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \beta_5 risk_t + x_t' \delta + \varepsilon_t$$

For cigarette consumption, C_t is the percentage of high school seniors who smoked cigarettes in the past thirty days in year t, p_t is the real price of cigarettes (a proxy used for the cost of smoking) assigned for year t, t is a linear time trend, t^2 is a quadratic time trend, t^3 is a cubic time trend, $risk_t$ is a risk variable measuring the percentage of high school seniors who consider smoking an activity of great risk (a measure of risk perception) in year t, and x_t is a column vector of covariates including real weekly income in year t, father's education in year t, mother's education in year t, and mother's employment in year t (δ is a column vector of unknown coefficients). For simplicity, I will refer to this column vector of covariates x_t as "the additional covariates."

As I mentioned previously, I use the real cigarette price as a proxy for the cost of smoking when estimating its demand function. In the MTF project, high school seniors answer questionnaires while at school between March 15 and April 30 of year t, and their answers reflect their cigarette consumption in the past thirty days. Because Orzechowski and Walker (2008) publish their data on nominal cigarette prices in November of every year, the cigarette consumption reported by high school seniors is subject to the nominal cigarette price published in year $t-1$. Therefore, the real cigarette price used in the demand equation for smoking is the real price as of November of year $t-1$. Also, nominal cigarette prices were adjusted for changes throughout time using the following criteria developed by Grossman (2004): four cents were added to the November 1982 nominal price to reflect the eight-cent increase in the Federal tax on a package of cigarettes on January 1, 1983. Two cents were added to the November 1990 and November 1992 nominal prices to reflect the four-cent increase in the Federal tax on January 1, 1991 and 1993. Five cents were added to the November 1999 nominal price to reflect the ten-cent increase in the Federal tax on January 1, 2000. Two cents were added to the November 2002 nominal price to reflect the five-cent

increase in the Federal tax on January 1, 2003. Then, 31.1 cents were added to the November 1998 price to reflect the 45-cent increase in the nominal price in late November 1998. This last increase reflects the Master Settlement Agreement.[10]

The time-series demand function specifications for alcohol consumption and excessive alcohol consumption use basically the same variables as the demand function specification for cigarette consumption. The difference is that C_t and p_t have different meanings and there is an additional variable in the column vector of covariates x_t. For alcohol consumption, C_t is the percentage of high school seniors who consumed an alcoholic beverage at least once in the last twelve months in year t. For excessive alcohol consumption, C_t is the percentage of high school seniors who had five or more drinks in a row on at least one day in the past two weeks in year t. p_t is the real price of beer (a proxy used for the cost of drinking and binge drinking) assigned for year t. The additional variable included in x_t is the minimum legal drinking age in year t.

I use the real beer price as a proxy for the cost of drinking and binge drinking because there is evidence in the literature showing that beer is the drink of choice among young people who consume alcoholic beverages (Grossman, Chaloupka, and Sirtalan 1998). For alcohol consumption, the real beer price used in the demand equation is lagged by one year because drinking is measured during the past year. For excessive alcohol consumption, which is measured in the last two weeks, the real beer price used in the demand equation is the arithmetic average of the real beer price in the fourth quarter of year $t-1$ and the first quarter of year t.[11] From this point forward, I will not make an explicit distinction between the lagged real beer price (proxy used for the cost of alcohol

[10] The logic of these adjustments is that smoking decisions reported in the MTF project during year t were subject to the nominal prices effective from October in the year $t-1$ to March of year t.

[11] Estimates using just the real beer price in the first quarter of year t were also calculated. Since they yield very similar results, this study follows the approach found in the literature and presents the results found using the arithmetic average of the real beer price in the fourth quarter of year $t-1$ and the first quarter of year t.

consumption) and the arithmetic average of the real beer price in the fourth quarter of year $t-1$ and the first quarter of year t (proxy used for the cost of binge drinking). When discussing the demand equations for drinking or binge drinking, I will refer to both as the real beer price.

To circumvent the correlation between price and time, I experiment with linear, quadratic, and cubic time trends and pay very careful attention to the sensitivity of my results to these alternative specifications. Including these time trends allows me to obtain lower residual variances when estimating the demand functions for smoking, drinking, and binge drinking. This is an approach similar to the one used by Grossman (2004). For cigarette consumption, alcohol consumption, and excessive alcohol consumption, including these three time trend specifications lowered the residual variance of the regressions without significantly changing the price coefficient (as well as other coefficients). Therefore, when estimating the demand for smoking, drinking, and binge drinking, I only present the results of specifications that include the three time trends. These results are discussed in detail in section 5.

In my second approach, I estimate time-series demand functions for smoking, drinking, and binge drinking using a double log model to obtain regression coefficients that reflect elasticities. This approach will allow me to obtain new elasticity estimates that I will compare with the elasticity estimates measured at the sample means obtained from the OLS approach. The main equation for smoking, drinking, and binge drinking in this model specifies the natural log of the yearly percentage of high school seniors who participate in these activities as a function of the natural log of real price, time trends, perceptions of risk, and a set of additional covariates that includes the natural log of real income, father's and mother's education, mother's employment, and the minimum legal drinking age, which is only included when estimating the demand functions for drinking and binge drinking. This time-series demand function specification can be expressed as,

$$\ln C_t = \beta_0 + \beta_1 \ln p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \beta_5 risk_t + x_t' \delta + \varepsilon_t$$

The regression specification in this approach is the same one as in the first approach except that, for smoking, $\ln C_t$ is the natural log of the percentage of high school seniors who smoked cigarettes in the past thirty days in year t, $\ln p_t$ is the natural log of the real cigarette price (a proxy used for the cost of smoking) assigned for year t, and x_t includes the natural log of real income in year t. For alcohol consumption, $\ln C_t$ is the natural log of the percentage of high school seniors who consumed an alcoholic beverage at least once in the last twelve months in year t. For excessive alcohol consumption, $\ln C_t$ is the natural log of the percentage of high school seniors who had five or more drinks in a row on at least one day in the past two weeks in year t. $\ln p_t$ is the natural log of the real price of beer, and it is used as a proxy for the cost of drinking and binge drinking for year t. The proxies used for the real prices of smoking, drinking, and binge drinking are the same as the ones explained in the first approach. Finally, for alcohol and excessive alcohol consumption, x_t includes the natural log of real income in year t.

For both approaches, I use different regression specifications. I start with a basic specification where I estimate smoking, drinking, and binge drinking based on their respective real prices and time trends. I use this basic specification as a base case, which I use to compare with three additional specifications. The next two specifications deal with the possible endogeneity of the risk variable and its possible correlation with the real price variable (see next section for a detailed explanation). The second specification allows for a direct effect of real price on consumption by estimating smoking, drinking, and binge drinking based on their respective real prices, time trends, and the additional covariates, while keeping risk constant. The third specification allows for an indirect effect of real price on consumption by estimating smoking, drinking, and binge drinking based on time trends, their respective perceptions of great risk of consumption, and the additional covariates, while keeping real price constant. The fourth specification includes real price, time trends,

risk variable, and the additional covariates as explanatory variables. Finally, I use two more specifications to estimate smoking, drinking, and binge drinking. These fifth and sixth specifications are the same as the second specification, except that they are based, respectively, on subsamples of high school seniors whose perceptions of the risk associated with smoking, drinking, and binge drinking are great and those whose perceptions of risk are not great. This analysis is repeated for subsamples composed of male, female, white, and nonwhite high school seniors.

4.2. Potential issues

One potential issue when estimating demand functions for smoking, drinking and binge drinking is the endogeneity of the price variable due to the simultaneous determination of price and quantity demanded. This problem is what the literature refers to as the identification problem. However, characteristics of the supply of cigarettes in the United States mitigate this identification problem.

For instance, given the efforts of the United States Government to set production quotas and price supports for tobacco production to guarantee a fixed market price for tobacco, most of the cigarettes sold in the United States use tobacco grown also in the United States (Womach 2003). Therefore, cigarette producers face a constant price for tobacco, which is the main input in cigarette production. Chaloupka and Warner (2000) state that the costs of other inputs in cigarette production are essentially constant and that cigarette producers face virtually constant costs measured on a per-pack basis. Moreover, Coats (1995) argues that even though the price of tobacco and other inputs change from year to year, on a given year, the supply curve for cigarettes is essentially perfectly

elastic. Using the evidence in the literature, I assume a perfectly elastic supply curve for cigarettes and therefore an exogenous price variable. I make the same assumption for alcohol.[12]

Another potential issue arises when including the risk variable in the demand equation. The risk variable can be correlated with an unmeasured characteristic of the respondent (a thrill-seeking personality, for example). Also, there is a plausible reverse causality from consumption to risk perceptions. For instance, if a teenager's risk perception of smoking, drinking, or binge drinking is low, then that person might be more likely to engage in these activities. Similarly, a teenager who smokes, drinks, or binge drinks may be less likely to perceive these activities as risky activities. These issues make the risk variable endogenous and render its regression coefficient biased and inconsistent.

Moreover, price can be correlated with risk. That is, a lower price increases consumption and therefore lowers the risk perception of high school seniors because they see more people smoking, drinking, or binge drinking. If price is correlated with risk, then the real price coefficient will also be biased. This correlation between price and risk can allow price to affect cigarette and alcohol consumption directly and indirectly through the risk perception variable. In this case, the logical approach would be to use an Instrument Variables model. However, no instrument for price is considered in this study. Instead, as mentioned in the previous section, I include a third and fourth specification, which allow a direct effect of real price on consumption by keeping risk constant and an indirect effect of real price on consumption by keeping real price constant, respectively. These two regression specifications will allow me to observe the importance of real price as a determinant of consumption and to determine how real price coefficients change when risk perception is included or excluded from the regression.

[12] If the supply function for cigarettes or alcohol is upward sloping, then the price effects will be understated in absolute value.

To address issues regarding heteroscedasticity and autocorrelation, I obtain Newey-West (1987) t-ratios for the regression coefficients when estimating the demands for smoking, drinking, and binge drinking. The standard errors on which these Newey-West t-rations are based allows for heteroscedasticity and autocorrelation up to and including a lag of three (Davidson and MacKinnon James 1993).[13]

4.3. Expected relationships

Expected relationships between consumption (C_t) and real price (p_t), risk ($risk_t$), and the additional covariates (x_t) are the same for the OLS and double log models. For cigarette consumption, price is expected to have a negative effect on smoking, which leads to a negative price elasticity of demand estimates. Price elasticity of demand estimates are also expected to be similar to the evidence present in the literature, so they should be close to -0.4.

Risk is expected to have a negative effect on smoking. As one would assume, perceptions of great risk associated with smoking should decrease smoking participation. In general, real income is expected to have a negative effect on smoking (Townsend, Roderick, and Cooper 1994; Wasserman et al. 1991). However, among high school seniors, real income is expected to have a positive effect on smoking because they discount the future more heavily (Grossman and Chaloupka 1997). This will make income elasticity estimates positive.

Father's and mother's education are expected to have negative signs. Since smoking is more common among people with less education (Chaloupka and Warner 2000), high school seniors with more educated parents will be more likely to be discouraged from smoking by their parents. Finally,

[13] Current practice is to use the smallest integer greater than or equal to $T^{1/4}$, where T is the end of the time period.

mother's employment is expected to positively affect smoking since one would expect unsupervised high school seniors to smoke more than those under more constant supervision.

For alcohol consumption and excessive alcohol consumption, real beer price is expected to be negatively correlated with drinking and binge drinking, which leads to negative price elasticity of demand estimates. Risk is expected to have a negative effect on binge drinking because high school seniors who associate this activity with a great risk of harm are less likely to partake in it. However, risk is not expected to have such a clear effect on drinking since drinking in moderation can have positive health outcomes such as reducing the probability of coronary heart disease, as pointed out by Klatsky, Armstrong, and Friedman (1990), for example. Also, higher risk perception when it comes to alcohol can reinstate patterns of moderate drinking and therefore increase alcohol consumption in moderate quantities. Real income is expected to have a positive effect on drinking and binge drinking among high school students because they discount the future more heavily. This positive relationship will make income elasticity estimates positive. Father and mother's education are expected to have a positive sign for drinking since moderate alcohol consumption is expected to be more common among parents with higher education–a habit that can subconsciously educate their children about moderate alcohol consumption. Similarly, father and mother's education is expected to have a negative sign for binge drinking since excessive alcohol consumption is expected to be far less common among highly educated parents, which is a habit that can subconsciously teach their children not to consume alcohol excessively. Finally, mother's employment is expected to positively affect drinking and binge drinking since one would expect unsupervised high school seniors to be more prone to drink and binge drink than those under more constant supervision.

5. Empirical Results

The OLS and double log approaches will be used to estimate time-series demand functions for smoking, drinking, and binge drinking. Sections 5.1-5.3 present the main results using the OLS approach. Section 5.4 present results using the double log approach.

5.1. Cigarette consumption

As mentioned in the previous section, I estimate the demand function for smoking using the following regression specifications:

1. $C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \varepsilon_t$
2. $C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + x_t' \delta + \varepsilon_t$
3. $C_t = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 + \beta_4 risk_t + x_t' \delta + \varepsilon_t$
4. $C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \beta_5 risk_t + x_t' \delta + \varepsilon_t$
5. $C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + x_t' \delta + \varepsilon_t$
6. $C_t = \beta_0 + \beta_1 p_t + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + x_t' \delta + \varepsilon_t$

where regression 1 shows the base model. Regression 2 adds the additional covariates to the base model, and it allows a direct effect of price on consumption. Regression 3 adds the risk perceptions of smoking to the demand equation and excludes the real cigarette price in the regression, allowing an indirect effect of price on consumption through the risk variable. Regression 4 evaluates the effect of price on consumption while the risk variable is included in the demand equation. Regressions 5 and 6 are respectively based on a subsample of high school seniors that believe smoking is an activity of great risk and a subsample of high school seniors that do not believe smoking is an activity of great risk. I perform the same analysis for the double log approach with the appropriate changes to the variables, as stated in the previous section.

Table 4 shows OLS regressions for smoking. In general, we can see that the real price coefficient remains negative and significant in all the regressions, except regression 6, where the real price coefficient is not significant. The risk perception coefficients in regressions 3 and 4 are negative, as expected, and significant. Price elasticities of demand evaluated at the means range from -0.63 to -0.23 when the additional covariates are present in the demand equation. The real income coefficients are significant and positive in all the regressions and income elasticities range from 0.25 to 0.48, indicating that cigarettes are considered a normal good among those high school seniors who smoke.

Although the coefficients of the additional covariates are insignificant in their majority, their inclusion in the regressions shows that the real price coefficient is a robust estimator because it remained negative and significant after including all these control variables. In particular, regression 2 shows that after adding just the additional covariates, a 10-percentage point increase in the real cigarette price decreases cigarette consumption among high school seniors by 1.25 percentage points.

Regression 3, which allows for an indirect effect of real cigarette price on smoking through the risk variable, shows a significant and negative risk coefficient. In particular, a 10-percentage point increase in the percentage of high school seniors who believe smoking is associated with a great risk of harm decreases cigarette smoking by 7.69 percentage points. In regression 4, where the risk variable is present in the demand equation along with the real cigarette price, the absolute value of the real cigarette price coefficient decreased from 0.125 to 0.110. Additionally, the absolute value of the price elasticity of demand reduced from 0.56 to 0.50, and the absolute value of the risk coefficient decreased from 0.769 to 0.278.

Moreover, high school seniors whose risk perceptions of smoking are great clearly respond more to a price increase than high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.63 and 0.23.

5.1.1. Males and females

Table 5 shows OLS regressions for smoking among male high school seniors. In general, we can see that the real price coefficient remains negative and significant in all the regressions. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, but significant only in regression 3. The price elasticities of demand evaluated at the means range from -0.84 to -0.32 when the additional covariates are present in the regression. The real income coefficients are positive, but only significant in regression 5. The income elasticities range from 0.15 to 0.45.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real cigarette price decreases cigarette smoking among male high school seniors by 1.24 percentage points.

Regression 3, which allows for an indirect effect of real cigarette price on smoking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of male high school seniors who believe smoking is associated with a great risk of harm decreases their cigarette smoking by 3.18 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real cigarette price, the absolute value of the real cigarette price coefficient decreased from 0.124 to 0.119. Additionally, the absolute value of the price elasticity of demand reduced from 0.57 to 0.55, and the absolute value of the risk coefficient decreased from 0.318 to 0.142.

Moreover, male high school seniors whose risk perceptions of smoking are great clearly respond more to a price increase than male high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.84 and 0.32.

Table 6 shows OLS regressions for smoking among female high school seniors. On a general overview, we can see that the real price coefficient remains negative and significant in all the

regressions. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, and they are also significant. The price elasticities of demand evaluated at the means range from -0.57 to -0.33 when the additional covariates are included in the demand equation. The real income coefficients are positive in all specifications and also significant, except in regression 6. The income elasticities range from 0.21 to 0.57, which indicates that cigarettes are considered a normal good among female high school seniors who smoke.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real cigarette price decreases cigarette smoking among female high school seniors by 1.25 percentage points. Also, including the additional covariates increased the price elasticity of demand, in absolute value, from 0.55 to 0.57.

Regression 3, which allows for an indirect effect of real cigarette price on smoking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of female high school seniors who believe smoking is associated with a great risk of harm decreases their cigarette smoking by 7.51 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real cigarette price coefficient decreased from 0.125 to 0.098. Additionally, the absolute value of the price elasticity of demand reduced from 0.57 to 0.44, and the absolute value of the risk coefficient decreased from 0.751 to 0.371.

Moreover, the response to a price increase among female high school seniors whose risk perceptions of smoking are great is clearly stronger than the response of female high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.53 and 0.33.

5.1.2. Whites and nonwhites

Table 7 shows OLS regressions for smoking among white high school seniors. In general, we can see that the real price coefficient remains negative and significant in all the regressions. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, but significant only in regression 3. The price elasticities of demand evaluated at the means range from -0.62 to -0.32 when the additional covariates are present in the demand equation. The real income coefficients are positive in all the regression specifications and not significant only in regression 6. The income elasticities are positive and range between 0.17 and 0.24, indicating that among white high school seniors who smoke, cigarettes are a normal good.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real cigarette price decreases cigarette smoking among white high school seniors by 1.50 percentage points. Also, including the additional covariates increased the price elasticity of demand, in absolute value, from 0.60 to 0.62.

Regression 3, which allows for an indirect effect of real cigarette price on smoking through the risk variable, shows a negative and significant, risk coefficient. In particular, a 10-percentage point increase in the percentage of white high school seniors who believe smoking is associated with a great risk of harm decreases their cigarette smoking by 8.55 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real cigarette price, the absolute value of the real cigarette price coefficient decreased from 0.150 to 0.124. Additionally, the absolute value of the price elasticity of demand reduced from 0.62 to 0.51, and the absolute value of the risk coefficient decreased from 0.855 to 0.300.

Moreover, white high school seniors whose risk perceptions of smoking are great clearly respond more to a price increase than white high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.62 and 0.32.

Table 8 shows OLS regressions for smoking among nonwhite high school seniors. In general, we can see that the real price coefficient remains negative and significant in all the regressions, except in regression 6. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, and significant. The price elasticities of demand evaluated at the means range from -0.75 to -0.51 when the additional covariates are included in the demand equation. The real income coefficients are positive and not significant in any of the regression specifications. The income elasticities are positive and range from 0.20 to 0.58.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real cigarette price decreases cigarette smoking among nonwhite high school seniors by 0.92 percentage points. The effect of price on consumption seems to be smaller in absolute value among nonwhite high school seniors. Also, the price elasticity of demand decreased from 0.78 to 0.75 when the additional covariates are included in the regression.

Regression 3, which allows for an indirect effect of real cigarette price on smoking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of nonwhite high school seniors who believe smoking is associated with a great risk of harm decreases their cigarette smoking by 2.96 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real cigarette price coefficient decreased from 0.092 to 0.078. Additionally, the absolute value of the price elasticity of demand reduced from 0.75 to 0.64, and the absolute value of the risk coefficient decreased from 0.296 to 0.175.

Moreover, the response to a price increase among nonwhite high school seniors whose risk perceptions of smoking are great is larger than the response of nonwhite high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.66 and 0.51.

5.1.3. Elasticities

If we exclude the price elasticities of demand calculated using the real price coefficient from the base model (regression 1), the price elasticities of demand for smoking range from -0.63 to -0.23 for the whole sample. For subsamples of male, female, white, and nonwhite high school seniors, they range from -0.84 to -0.32, from -0.57 to -0.33, from -0.62 to -0.32, and from -0.75 to -0.51, respectively. Overall, the price elasticities remain somewhat consistent across specifications. When comparing male and female high school seniors, their price elasticities of demand do not clearly indicate which subsample responds more to changes in real cigarette prices. There is no consensus among these elasticities since they vary, although slightly, depending on the regression specification. However, it seems to be clear that male and female high school seniors respond more to an increase in the real cigarette price when they associate smoking with a great risk of harm.

When comparing white and nonwhite high school seniors, their price elasticities of demand clearly indicate that nonwhite high school seniors are more responsive to a real cigarette price increase than white high school seniors. Moreover, both white and nonwhite high school seniors respond more to an increase in real cigarettes price when they associate smoking with a great risk of harm.

5.2. Alcohol consumption

Tables 9-13 present the empirical results for alcohol consumption using the same regression specifications used for smoking and adding the minimum legal drinking age to the additional covariates.

Table 9 shows OLS regressions for drinking. In general, we can see that the real price coefficient remains negative and significant in all the specifications, except in regression 5, where the

real price coefficient is not significant. The risk perception coefficients in regressions 3 and 4 are negative, as expected, and significant. Price elasticities of demand evaluated at the means range widely from -0.42 to -0.31 when the additional covariates are present in the regression. The real income coefficients are positive in all regression specifications and also significant, except when the sample is separated into high school seniors who believe drinking is an activity of great risk and those who do not think drinking is an activity of great risk. The income elasticities range from 0.08 to 0.22, which indicates that alcohol is considered a normal good among those high school seniors who drink alcoholic beverages.

Regression 2 shows that after adding just the additional covariates, a 10-percentage point increase in the real beer price decreases drinking among high school seniors by 3.40 percentage points. Also, including the additional covariates in the regression decreased the price elasticity of demand, in absolute value, from 0.56 to 0.42.

Regression 3, which allows for an indirect effect of real beer price on drinking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of high school seniors who believe drinking is associated with a great risk of harm decreases their drinking by 3.52 percentage points. In regression 4, where the risk variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient decreased from 0.340 to 0.316. Additionally, the absolute value of the price elasticity of demand decreased from 0.42 to 0.39, and the risk coefficient decreased from 0.352 to 0.314 in absolute value.

Moreover, regressions 5 and 6 show that high school seniors whose risk perceptions of drinking are great respond more to a price increase than high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.36 and 0.31.

5.2.1. Males and females

Table 10 shows OLS regressions for drinking among male high school seniors. In general, we can see that the real price coefficient remains negative and significant in all the regressions except in regression 5, where the real price coefficient is not significant. The risk perception coefficients are not significant, and they are negative. The price elasticities of demand evaluated at the means range from -0.55 to -0.24 when the additional covariates are present in the demand equation. The real income coefficients are positive in all specifications and also significant, except in regressions 5 and 6, where the real income coefficient is not significant. The income elasticities range from 0.05 to 0.20, which indicates that alcohol is considered a normal good among those high school seniors who drink alcoholic beverages.

Regression 2, where the additional covariates are added to the basic regression specification, indicates that a 10-percentage point increase in the real beer price decreases drinking among male high school seniors by 3.85 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 0.63 to 0.48.

Regression 3, which allows for an indirect effect of real beer price on drinking through the risk variable, shows a negative and not significant risk coefficient. In particular, a 10-percentage point increase in the percentage of male high school seniors who believe drinking is associated with a great risk of harm decreases their drinking by 2.42 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient decreased from 0.385 to 0.375. Additionally, the absolute value of the price elasticity of demand decreased from 0.48 to 0.46, and the risk coefficient also decreased, in absolute value, from 0.242 to 0.180.

Moreover, regressions 5 and 6 show interesting results. Male high school seniors whose risk perceptions of drinking are great respond less to a price increase than male high school seniors

whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.24 and 0.55.

Table 11 shows OLS regressions for drinking among female high school seniors. On a general overview, we can see that the real price coefficients are negative in all the regression specifications except for regression 6, where the only high school seniors taken into consideration are females who do not consider drinking a great risk. The risk perception coefficients are significant and negative. Except for regression 6, the price elasticities of demand evaluated at the means range from -0.35 to -0.29 when the additional covariates are included in the demand equation. The real income coefficients are positive and only significant in regressions 3 and 6. Income elasticities range between 0.03 and 0.17.

Regression 2, where the additional covariates are added to the basic regression specification, shows that a 10-percentage point increase in the real beer price decreases drinking among female high school seniors by 2.52 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 0.47 to 0.32.

Regression 3, which allows for an indirect effect of real beer price on drinking through the risk variable, shows a slightly positive, not significant risk coefficient. In particular, regression 3 indicates that a 10-percentage point increase in the percentage of female high school seniors who believe drinking is associated with a great risk of harm decreases their drinking by 2.29 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real beer price coefficient increased from 0.252 to 0.274. Additionally, the absolute value of the price elasticity of demand increased from 0.32 to 0.35, and the absolute value of the risk coefficient increased from 0.229 to 0.245.

5.2.2. Whites and nonwhites

Table 12 shows OLS regressions for drinking among white high school seniors. On a general overview, we can see that the real price coefficient remains negative and significant in all the regressions, except in regression 5, where the real price coefficient is not significant. The risk perception coefficients are negative and significant. The price elasticities of demand evaluated at the means range from -0.41 to -0.27 when the additional covariates are present in the demand equation. The real income coefficients are positive and significant except in regressions 5 and 6, where they are not significant.

Regression 2, where the additional covariates are added to the basic regression specification, indicates that a 10-percentage point increase in the real beer price decreases drinking among white high school seniors by 3.33 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 0.55 to 0.40.

Regression 3, which allows for an indirect effect of real beer price on drinking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of white high school seniors who believe drinking is associated with a great risk of harm decreases their drinking by 4.41 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient decreased from 0.333 to 0.312. Additionally, the absolute value of the price elasticity of demand decreased from 0.40 to 0.37, and the risk coefficient decreased, in absolute value, from 0.441 to 0.421.

Moreover, regressions 5 and 6 show that white high school seniors whose risk perceptions of drinking are great respond more to a price increase than those whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 0.41 and 0.27.

Table 13 shows OLS regressions for drinking among nonwhite high school seniors. In general, we can see that the real price coefficient is not significant and negative in most, but not all the regression specifications. The risk perception coefficients are negative, but only significant in regression 4. The price elasticities of demand evaluated at the means range widely when the additional covariates are included in the regression, and it is positive in regression 5, where the real price coefficient is positive.

Regression 2, where the additional covariates are added to the basic regression specification, indicates that a 10-percentage point increase in the real beer price decreases drinking among nonwhite high school seniors by 0.01 percentage points. Regression 3, which allows for an indirect effect of real beer price on drinking through the risk variable, shows a negative, not significant risk coefficient. In particular, regression 3 indicates that a 10-percentage point increase in the percentage of nonwhite high school seniors who believe drinking is associated with a great risk of harm decreases their drinking by 0.82 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient increased from 0.001 to 0.018. Additionally, the absolute value of the price elasticity of demand increased from 0.002 to 0.028, and the risk coefficient barely increased, in absolute value, from 0.082 to 0.083.

5.2.3. Elasticities

If we exclude the price elasticities of demand calculated using the real price coefficient from the base model (regression 1), the price elasticities of demand for drinking range from -0.42 to -0.31 for the whole sample. For subsamples of female and nonwhite high school seniors, the price elasticity of demand is positive for two particular regression specifications that include the additional covariates. With the exception of these two cases, the price elasticities of demand for subsamples of

male, female, white, and nonwhite high school seniors range from -0.55 to -0.24, from -0.35 to -0.29, from -0.41 to -0.27, and from -0.16 to -0.002, respectively. When comparing male and female high school seniors, their price elasticities from regressions 2 and 4 agree that male high school seniors respond more to changes in real beer prices than female high school seniors. However, no clear conclusion can be reached when looking at subsamples of male and female high school seniors that consider drinking an activity of great risk and male and female high school seniors that do not consider drinking an activity of great risk. When comparing white and nonwhite high school seniors, their price elasticities of demand indicate that white high school seniors respond more to changes in real beer prices than nonwhite high school seniors. Also, it is clear that white high school seniors respond more to an increase in the real beer price when they associate drinking with a great risk of harm. However, this conclusion cannot be reached for nonwhite high school seniors.

5.3. Excessive alcohol consumption

Using the same regression specifications used for alcohol consumption, Tables 9-13 present the empirical results for excessive alcohol consumption. Table 14 shows OLS regressions for binge drinking. On a general overview, we can see that the real price coefficient remains negative and significant in all the regressions. The risk perception coefficients in regressions 3 and 4 are negative, as expected, and significant. Price elasticities of demand evaluated at the means range from -1.76 to -0.58 when the additional covariates are present in the demand equation. The real income coefficients are positive, except in regression 6, and none of them are significant. Income elasticities range from 0.01 to 0.13, and it is -0.08 in regression 6.

Although the coefficients of the additional covariates are insignificant in their majority, their inclusion in the regressions shows that the real price coefficient is a robust estimator because it remained negative and significant in the great majority of cases after including all these control

variables. In particular, regression 2 shows that after adding just the additional covariates, a 10-percentage point increase in the real beer price decreases binge drinking among high school seniors by 5.64 percentage points. Also, including the additional covariates in the demand equation decreased the price elasticity of demand, in absolute value, from 2.26 to 1.67.

Regression 3, which allows for an indirect effect of real beer price on binge drinking through the risk variable, shows a significant and negative risk coefficient. In particular, a 10-percentage point increase in the percentage of high school seniors who believe binge drinking is associated with a great risk of harm decreases their binge drinking by 4.88 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient decreased from 0.564 to 0.453. Additionally, the absolute value of the price elasticity of demand reduced from 1.67 to 1.34, and the absolute value of the risk coefficient decreased from 0.488 to 0.248.

Moreover, high school seniors whose risk perceptions of binge drinking are great respond more to a price increase than high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 1.76 and 0.58.

5.3.1. Males and females

Table 15 shows OLS regressions for binge drinking among male high school seniors. On a general overview, we can see that the real price coefficient remains negative in all the regressions, and it is significant in all the regressions except in regression 5. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, and significant. The price elasticities of demand evaluated at the means range from -1.24 to -0.51 when the additional covariates are present in the demand equation. The real income coefficients are positive, except for regression 6, and only significant in regression 2. Thus, with the exception of high school seniors who do not consider

binge drinking an activity of great risk, binge drinking is a normal good among male high school seniors who binge drink.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real beer price decreases binge drinking among male high school seniors by 5.17 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 1.91 to 1.24.

Regression 3, which allows for an indirect effect of real beer price on binge drinking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of male high school seniors who believe binge drinking is associated with a great risk of harm decreases their binge drinking by 4.54 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real beer price, the absolute value of the real beer price coefficient decreased from 0.517 to 0.417. Additionally, the absolute value of the price elasticity of demand decreased from 1.24 to 1.00, and the absolute value of the risk coefficient decreased from 0.454 to 0.251.

Moreover, male high school seniors whose risk perceptions of binge drinking are great respond more to a price increase than male high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 1.01 and 0.51.

Table 16 shows OLS regressions for binge drinking among female high school seniors. On a general overview, we can see that the real price coefficient remains negative and significant in all the regressions. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, and significant only in regression 3. The price elasticities of demand evaluated at the means range from -2.22 to -0.98 when the additional covariates are included in the demand equation. The real income coefficients are positive and not significant in any of the regression specifications. Income elasticities range from 0.06 to 0.33.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real beer price decreases binge drinking among female high school seniors by 5.01 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 2.67 to 1.93.

Regression 3, which allows for an indirect effect of real beer price on binge drinking through the risk variable, shows a negative and significant risk coefficient. In particular, a 10-percentage point increase in the percentage of female high school seniors who believe binge drinking is associated with a great risk of harm decreases their binge drinking by 2.47 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real beer price coefficient decreased from 0.501 to 0.455. Additionally, the absolute value of the price elasticity of demand decreased from 1.93 to 1.75, and the absolute value of the risk coefficient decreased from 0.247 to 0.150.

Moreover, the response to a price increase among female high school seniors whose risk perceptions of binge drinking are great is stronger than the response of female high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 2.22 and 0.98.

5.3.2. Whites and nonwhites

Table 17 shows OLS regressions for binge drinking among white high school seniors. On a general overview, we can see that the real price coefficient remains negative in all the regressions and significant in all the regressions except in regression 6. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, and significant. The price elasticities of demand evaluated at the means range from -3.37 to -0.12 when the additional covariates are present in the demand

equation. The real income coefficients are not significant, and they are positive except in regressions 5 and 6.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real beer price decreases binge drinking among white high school seniors by 6.99 percentage points. Also, including the additional covariates decreased the price elasticity of demand, in absolute value, from 2.33 to 1.85.

Regression 3, which allows for an indirect effect of real beer price on binge drinking through the risk variable, shows a negative and significant, risk coefficient. In particular, a 10-percentage point increase in the percentage of white high school seniors who believe binge drinking is associated with a great risk of harm decreases their binge drinking by 5.49 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real beer price coefficient decreased from 0.699 to 0.530. Additionally, the absolute value of the price elasticity of demand reduced from 1.85 to 1.40, and the absolute value of the risk coefficient decreased from 0.549 to 0.259.

Moreover, white high school seniors whose risk perceptions of binge drinking are great respond more to a price increase than white high school seniors whose risk perceptions are not great. The absolute value of their respective price elasticities of demand are 3.37 and 0.12.

Table 18 shows OLS regressions for smoking among nonwhite high school seniors. On a general overview, we can see that the real price coefficients are not significant in any of the regressions, and they are negative, except in regression 5. The risk perception coefficients in regressions 3 and 4 are negative, as it was expected, but not significant. The price elasticities of demand evaluated at the means range from -0.76 to -0.03 when the additional covariates are included in the demand equation, except for regression 5, where the price elasticity of demand is

positive. The real income coefficients are not significant in any of the regressions and positive in all the regressions, except in regression 5.

When the additional covariates are added to the basic regression specification, a 10-percentage point increase in the real beer price decreases binge drinking among nonwhite high school seniors by 0.05 percentage points. The effect of price on consumption seems to be smaller in absolute value among nonwhite high school seniors. Also, the price elasticity of demand decreased, in absolute value, from 0.19 to 0.03 when including the additional covariates.

Regression 3, which allows for an indirect effect of real beer price on binge drinking through the risk variable, shows a negative, but not significant risk coefficient. In particular, a 10-percentage point increase in the percentage of nonwhite high school seniors who believe binge drinking is associated with a great risk of harm decreases their binge drinking 0.92 percentage points. In regression 4, where the risk perception variable is present in the demand equation along with the real price, the absolute value of the real beer price coefficient increased from 0.005 to 0.025. Additionally, the absolute value of the price elasticity of demand barely increased from 0.03 to 0.16, and the absolute value of the risk variable increased from 0.092 to 0.095.

5.3.3. Elasticities

If we exclude the price elasticities of demand calculated using the real price coefficient from the base model (regression 1), the price elasticities of demand for binge drinking range from -1.76 to -0.58 for the whole sample. For subsamples of male, female, white, and nonwhite high school seniors, they range from -1.24 to -0.51, from -2.22 to -0.98, from -3.37 to -0.12, and from -0.76 to -0.03 (except for regression 5), respectively. Overall, the price elasticities remain consistently greater than 1 in absolute value, except for nonwhite high school seniors. When comparing male and female high school seniors, their price elasticities of demand indicate that female high school seniors

respond more to changes in the real beer price than male high school seniors. It also seems to be clear that male and female high school seniors respond more to an increase in the real beer price when they associate binge drinking with a great risk of harm. When comparing white and nonwhite high school seniors, their price elasticities of demand clearly indicate that white high school seniors are more responsive to a real beer price increase than nonwhite high school seniors. Also, it is clear that white high school seniors respond more to an increase in the real beer price when they associate binge drinking with a great risk of harm. However, this conclusion cannot be reached for nonwhite high school seniors.

5.4. Double log model

As stated previously, the double log model yields regression coefficients that represent price elasticities of demand evaluated at the money price. I use these price elasticity estimates to corroborate the price elasticities of demand at the sample means obtained from the OLS model.

Tables 19-23 show the results of double log estimations of the demand function for smoking based on the whole sample and subsamples of male, female, white, and nonwhite high school seniors. Tables 24-28 show the results of double log estimations of the demand function for drinking based on the whole sample and subsamples of male, female, white, and nonwhite high school seniors. Finally, Tables 29-33 show the results of a double log estimations of the demand function for binge drinking based on the whole sample and subsamples of male, female, white, and nonwhite high school seniors. For smoking, drinking, and binge drinking, the price elasticities of demand for the whole sample and subsamples are negative and significant (with only one exception). The price elasticity estimates obtained from this approach are slightly different than the price elasticities obtained from the OLS model. Depending on the regression specification, the price elasticities from the double log model are sometimes higher than the price elasticities of demand

obtained from the OLS model. In other instances, they are lower. In general terms, however, they are very similar to the ones obtained in the first approach.

5.5. Predicted change in consumption

One way to evaluate the results in the previous sections is to calculate how much of the change in consumption throughout a particular time period can be attributed to a change in price throughout the same time period. For this calculation, I multiply the real price coefficients obtained from the different regression specifications in the OLS model with the observed change in the real price from a specific period within 1976 and 2008. Estimates of how much of the change in consumption throughout a particular time period can be attributed to a change in risk perceptions during the same time period are calculated similarly.

For cigarette consumption, I will emphasize two time periods: Period 1, from 1992 to 1997, and Period 2, from 1997 to 2008. Period 1 is particularly interesting because there is a decrease in the real cigarette price of 7 percent (see Figure 1). This decrease in the real cigarette price can be attributed to Phillip Morris Companies decreasing the nominal price of a pack of Marlboro cigarettes by 40 cents in April 1993. With this price cut, Phillip Morris Companies attempted to protect against newly-introduced generic cigarette brands. However, Phillip Morris Companies' competitors hastily followed its strategy and decrease their prices. The resultant 7 percent decrease in the real cigarette price during this time period happened alongside with a 32 percent increase in cigarette consumption among high school seniors. For subsamples of male, female, white, and nonwhite high school seniors, cigarette consumption increased by 27, 37, 34, and 83 percent, respectively, during this time period. Conversely, Period 2 is interesting because it shows a sharp increase in real cigarette price of 75 percent (see Figure 1). This increase in real cigarette price is a response to the Master Settlement Agreement, which is a settlement of the lawsuits filed against

cigarette makers in order to recover Medicaid funds spent treating diseases associated to smoking. During Period 2, cigarette consumption decreased by 44 percent among high school seniors. For subsamples of male, female, white, and nonwhite high school seniors, the 75 percent increase in the real cigarette price can be responsible for a decrease in cigarette consumption of 42, 45, 43, and 13 percent, respectively.

For alcohol consumption and excessive alcohol consumption, I will emphasize only one period, from 1989 to 1992. During this time period, there was an increase in Federal tax rates, which disrupted a steady decrease in the real prices of beer. For alcohol consumption, this increase in Federal tax rates caused a 5 percent increase in the real price of beer after being adjusted to represent the cost of drinking (see section 4.1). At the same time, there was a 7 percent decrease in alcohol consumption among high school seniors. For subsamples of male, female, white, and nonwhite high school seniors there was a decrease in alcohol consumption of 8, 6, 8, and 5.3 percent, respectively. For excessive alcohol consumption, the same increase in Federal tax rates also caused a 7 percent increase in the real price of beer after being adjusted to represent the cost of binge drinking (see section 4.1). At the same time, there was a 16 percent decrease in excessive alcohol consumption among high school seniors during this time period. For subsamples of male, female, white, and nonwhite high school seniors, there was a decrease in excessive alcohol consumption of 14, 19, 16, and 37 percent, respectively.

5.5.1. Predicted change in cigarette consumption

Let's start by discussing the results based on the whole sample. Panel A in Table 34 shows the change in cigarette consumption predicted by the different regression specifications of the OLS approach in Period 1. Regression 2 predicts an increase in cigarette consumption of 1.16 percentage points based on the real cigarette price reduction during this time period. Therefore, approximately

13 percent of the observed 8.9-percentage point increase in cigarette consumption during Period 1 is explained by the corresponding decrease in the real cigarette price. Regression 4, which adds the risk variable to regression 2, predicts an increase in cigarette consumption of 1.03 percentage points based on the observed reduction in real cigarette price during this period. This is approximately 12 percent of the observed increase in cigarette smoking, and it explains 11 percent less of the observed increase in cigarette smoking when compared to regression 2, where risk is not included. As expected, real cigarette price explains less of the change in cigarette consumption when risk is included in the demand equation. In regression 3, risk is added to the demand equation and the real cigarette price is not included to allow for an indirect effect of price on consumption through the risk variable. This regression specification predicts a 0.13-percentage point increase in cigarette consumption explained by the decrease in risk perceptions during Period 1. This is approximately 1.5 percent of the observed increase in cigarette consumption.

Similarly, for subsamples of male and female high school seniors, we can see in regression 2 that real price explains as much of the observed increase in cigarette consumption for male as for female high school seniors. For subsamples of white and nonwhite high school seniors, the results in the same regression specification imply that real price predicts more of the observed increase in cigarette consumption among white high school seniors than among nonwhite high school seniors. Moreover, as it was the case for the whole sample, real price explains less of the observed increase in cigarette consumption when the risk variable is added to the demand equation for all the subsamples.

Panel B in Table 34 shows the change in cigarette consumption predicted by the different regression specifications of the first model in Period 2. Regression 2 predicts a decrease in cigarette consumption of 11.72 percentage points based on the price increase during this time period. Therefore, approximately 73 percent of the observed 16.14-percentage point decrease in cigarette consumption during Period 2 is due to the corresponding increase in the real cigarette price.

Regression 4 predicts a decrease in cigarette consumption of 10.31 percentage points based on the observed increase in real cigarette price during this period. This is approximately 64 percent of the observed decrease in cigarette smoking and it explains 12 percent less of the observed decrease in cigarette smoking when compared to regression 2, where risk is not included. As expected, price explains less of the change in cigarette consumption when risk is included in the demand equation. Regression 3 predicts a 4.35-percentage point decrease in cigarette consumption explained by the increase in risk perceptions during Period 2. This is approximately 27 percent of the observed decrease in cigarette consumption.

For subsamples of male and female high school seniors, we can see in regression 2 that real cigarette price explains slightly more of the observed decrease in cigarette consumption among female high school seniors than among male high school seniors. For subsamples of white and nonwhite high school seniors, the results from the same regression specification imply that real cigarette price predicts more of the observed decrease in cigarette consumption among white high school seniors than among nonwhite high school seniors. Moreover, as it was the case when analyzing the results based on the whole sample, real cigarette price explains less of the observed decrease in cigarette consumption when the risk variable is added to the demand equation for all the subsamples.

5.5.2. Predicted change in alcohol consumption

Table 35 shows the change in alcohol consumption predicted by the different regression specifications of the OLS approach. From 1989 to 1992, alcohol consumption among high school seniors decreased by approximately 6 percentage points. Regression 2 predicts a decrease in alcohol consumption of 1.67 percentage points based on the real beer price increase during this time period. Thus, approximately 28 percent of the observed decrease in alcohol consumption during this period

is explained by the increase in the real beer price. Regression 4, where the risk variable is added to regression 2, predicts a decrease in alcohol consumption of 1.55 percentage points based on the real beer price increase during this period. This is 26 percent of the observed decrease in alcohol consumption. In regression 3, risk is added to the demand equation and the real beer price is not included to allow for an indirect effect of price on consumption through the risk variable. This regression specification predicts a 0.66-percentage point decrease in alcohol consumption explained by the increase in risk perceptions during this time period. This is approximately 11 percent of the decrease in alcohol consumption.

For subsamples of male and female high school seniors, we can see in regression 2 that real beer price explains more of the observed decrease in alcohol consumption among male high school seniors than among female high school seniors. For subsamples of white and nonwhite high school seniors, the results in the same regression specification imply that real beer price predicts more of the observed decrease in alcohol consumption among white high school seniors than among nonwhite high school seniors.

5.5.3. Predicted change in excessive alcohol consumption

Table 36 shows the change in excessive alcohol consumption predicted by the different regression specifications of the first approach. From 1989 to 1992, excessive alcohol consumption among high school seniors decreased by 5.3 percentage points. Regression 2 predicts a decrease in excessive alcohol consumption of 3.75 percentage points based on the real beer price increase during this time period. Therefore, approximately 70 percent of the observed 5.3-percentage point decrease in excessive alcohol consumption is explained by the corresponding increase in the real beer price. Regression 4, which adds the risk variable to the specification in regression 2, predicts a decrease in excessive alcohol consumption of 3.01 percentage points based on the observed increase

in real beer price during this time period. This is approximately 56 percent of the observed increase in binge drinking, and it explains approximately 20 percent less of the observed increase in binge drinking when compared to regression 2, where risk is not included. As expected, real beer price explains less of the increase in excessive alcohol consumption when risk is included in the demand equation. In regression 3, risk is added to the demand equation and the real beer price is not included to allow for an indirect effect of price on consumption through the risk variable. This regression specification predicts a 2.81-percentage point decrease in excessive alcohol consumption explained by the increase in risk perceptions during this time period. This is approximately 53 percent of the decrease in excessive alcohol consumption.

For subsamples of male and female high school seniors, we can see in regression 2 that real beer price explains more of the observed decrease in excessive alcohol consumption among male high school seniors than among female high school seniors. For subsamples of white and nonwhite high school seniors, the results in the same regression specification imply that real beer price predicts more of the observed decrease in excessive alcohol consumption among white high school seniors than among nonwhite high school seniors. Moreover, as it was the case when analyzing the results based on the whole sample, real beer price explains less of the observed decrease in binge drinking when the risk variable is added to the demand equation for all the subsamples, except for nonwhite high school seniors.

6. Conclusions

Harmful and addictive goods such as cigarettes and alcohol are responsive to changes in their prices. Therefore, government policies that increase their nominal prices are effective methods to deter the consumption of these two goods. Particularly, smoking and binge drinking are activities of great public health concern because of their harmful nature and the external harm they impose on bystanders. Tables 34 and 36 evaluate the effects of price on smoking and binge drinking. These tables show the effects of price on cigarette consumption and excessive alcohol consumption by focusing on the change in smoking and binge drinking that is predicted by each different specification of the OLS model. In this study, albeit limited, I provide empirical proof that the percentage of high school seniors that smoke and binge drink consistently reduce when the real prices of these activities increase. Between 1992 and 1997, a decrease in the real cigarette price explains approximately 13 percent of the 8.9-percentage point increase in the percentage of high school seniors who smoked cigarettes. Between 1997 and 2008, a sharp increase in real cigarette price explains approximately 73 percent of the 16.1-percentage point decrease in the percentage of high school seniors who smoked cigarettes. The clear effect of real cigarette prices on smoking in both periods is still evident after controlling for individuals' risk perceptions associated with smoking. After controlling for risk perceptions, the price variable explains more of the change in consumption than the risk variable. Furthermore, empirical results based on subsamples of male, female, white, and nonwhite high school seniors concur with these conclusions.

The empirical results for excessive alcohol consumption also prove the relevance of price on consumption. Between 1989-1992, an increase in the real beer price, a proxy used for the cost of binge drinking, explains approximately 70 percent of the 5.3-percentage point decrease in the percentage of high school seniors who excessively drank alcoholic beverages. This effect of price on

binge drinking remains significant even after controlling for individuals' risk perceptions associated with binge drinking. As was the case for cigarette consumption, price has a smaller effect on excessive alcohol consumption after controlling for risk perceptions, but the price variable seems to explain significantly more of the change in consumption than the risk variable. Subsamples of male, female, and white high school seniors yield results that support the same implications.

Price elasticities of demand for smoking among high school seniors are consistent across specifications and they are fairly similar in the OLS and double log models. The price elasticities obtained from the double log model reinsures the implications of the OLS model. The OLS approach for cigarette consumption shows that price elasticities reduce, in absolute value, when the risk variable is included in the demand equation. Moreover, it is unclear who reacts more to a change in real cigarette price, male or female high school seniors. However, the OLS approach shows clear results indicating that nonwhite high school seniors are more susceptible to real cigarette price changes than white high school seniors.

With only few exceptions, the OLS approach for excessive alcohol consumption shows price elasticities of demand for excessive alcohol consumption that are greater than 1 in absolute value. Also price elasticities reduce, in absolute value, when the risk variable is included in the regression. Furthermore, it is clear that female high school seniors are more susceptible to a change in real beer price than male high school seniors. Analogously, white high school seniors seem to react more to a change in real beer price then nonwhite high school seniors.

These results advocate for the use of taxes to increase the nominal price of cigarettes and alcohol and therefore deter their consumption. Attitudinal effects such as the effect of risk perceptions should not be underestimated because they also have a significant effect on cigarette and alcohol consumption. In particular, they have more prominent effects on smoking and binge drinking. Furthermore, greater awareness of the risks associated with smoking and binge drinking

clearly strengthen the effect of real price on consumption for high school seniors in general and for male, female, white, and nonwhite high school seniors. For drinking however, this effect is clear for high school seniors in general, but not for male, female, white, nor nonwhite high school seniors.

Table 1 - Summary Statistics for Cigarette Consumption

	High School Seniors											
					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Smoking	29.93	4.67	20.50	38.77	22.72	3.90	15.04	29.36	45.13	4.49	36.33	53.96
Real Price	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57
Risk	69.07	5.66	57.42	78.66								
Real Income	49.19	7.92	35.98	68.18	47.89	7.75	34.51	67.55	52.87	8.20	35.80	72.74
Father's Education	51.31	6.18	36.81	59.11	53.99	5.81	42.97	62.03	46.11	5.98	31.68	53.89
Mother's Education	49.33	10.21	30.51	62.07	51.31	9.98	33.43	65.55	45.21	10.75	26.18	61.26
Mother's Employment	52.55	11.86	31.51	68.09	53.56	12.21	32.45	69.34	53.68	11.92	31.59	71.76
	Male High School Seniors											
Smoking	29.52	4.48	21.56	37.78	22.02	3.93	14.90	32.14	44.73	5.58	35.25	56.53
Real Price	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57
Risk	66.38	4.61	56.35	74.95								
Real Income	53.83	10.39	38.19	79.20	52.40	10.08	37.60	78.00	57.36	10.91	38.26	83.72
Father's Education	53.04	6.48	37.12	60.61	55.91	6.15	43.96	65.68	47.95	6.44	33.56	59.52
Mother's Education	50.49	10.64	30.11	63.86	52.81	10.58	33.50	68.41	46.03	11.50	25.80	63.92
Mother's Employment	51.35	11.99	30.22	67.18	52.57	12.24	30.77	69.06	52.23	12.32	29.88	71.60
	Female High School Seniors											
Smoking	29.79	5.42	19.24	39.91	23.30	4.62	13.47	31.50	45.26	4.46	36.93	53.89
Real Price	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57
Risk	72.05	7.11	58.59	83.85								
Real Income	44.63	5.69	33.76	57.78	43.66	5.53	31.84	56.39	47.84	6.13	33.42	61.08
Father's Education	50.00	6.06	36.70	57.88	52.51	5.81	41.58	59.83	44.04	6.42	29.81	55.81
Mother's Education	48.46	9.98	30.91	60.97	50.29	9.71	33.37	63.42	44.20	10.20	25.20	59.29
Mother's Employment	53.63	11.77	32.62	69.05	54.34	12.25	33.70	70.65	55.28	12.09	33.01	78.48

Table 1 - (continuation)

	White High School Seniors											
					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Smoking	32.95	4.58	24.30	42.48	24.76	4.22	17.36	34.73	50.04	4.63	41.84	63.06
Real Price	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57
Risk	68.52	5.56	57.30	78.25								
Real Income	48.98	8.03	35.95	69.09	47.26	7.90	34.25	67.79	53.41	8.13	35.95	75.03
Father's Education	55.14	6.66	39.53	62.84	58.26	6.29	46.77	66.05	48.70	6.65	33.44	60.56
Mother's Education	51.97	10.94	32.41	66.86	54.33	10.73	35.37	72.35	47.15	11.64	27.27	66.50
Mother's Employment	49.76	12.95	27.29	66.33	50.27	13.16	28.13	67.80	51.92	13.26	26.31	72.07
	Nonwhite High School Seniors											
Smoking	16.64	7.56	8.19	39.57	14.03	7.57	5.07	37.22	23.99	9.04	8.46	41.48
Real Price	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57	135.25	49.95	76.46	221.57
Risk	72.12	6.14	57.48	80.56								
Real Income	50.75	6.19	37.05	63.04	51.18	7.28	35.81	68.24	51.21	8.43	37.49	76.85
Father's Education	36.45	8.18	20.32	49.00	37.82	8.92	20.08	56.43	35.10	9.11	14.16	56.26
Mother's Education	44.77	11.29	23.24	60.25	45.32	11.78	19.78	63.23	42.31	12.43	18.02	63.78
Mother's Employment	71.54	7.42	55.62	80.55	73.57	7.57	58.32	86.29	70.44	7.76	49.89	85.15

Table 2 - Summary Statistics for Alcohol Consumption

	High School Seniors											
					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Drinking	78.33	7.56	65.42	88.06	63.36	11.95	42.54	80.11	83.99	6.46	72.33	92.47
Real Price	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84
Risk	24.58	3.43	18.84	33.54								
Real Income	49.19	7.92	35.98	68.18	47.51	7.53	32.71	66.05	50.11	8.29	35.42	70.74
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	51.31	6.18	36.81	59.11	51.73	5.90	39.19	60.77	51.53	6.34	37.54	59.68
Mother's Education	49.33	10.21	30.51	62.07	49.24	9.34	31.47	62.91	49.44	10.97	30.23	64.91
Mother's Employment	52.55	11.86	31.51	68.09	53.03	11.70	29.52	69.46	53.76	12.29	32.33	69.89
	Male High School Seniors											
Drinking	79.40	8.13	65.40	89.91	59.53	15.25	32.36	82.27	85.29	6.73	72.49	94.30
Real Price	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84
Risk	19.57	2.65	14.86	24.79								
Real Income	53.83	10.39	38.19	79.20	52.45	9.66	37.10	74.90	54.54	10.71	38.10	81.62
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	53.04	6.48	37.12	60.61	53.44	6.03	41.98	66.42	53.09	6.51	37.95	61.72
Mother's Education	50.49	10.64	30.11	63.86	50.04	10.09	30.05	66.83	50.56	11.50	29.88	67.93
Mother's Employment	51.35	11.99	30.22	67.18	51.21	11.93	24.79	72.78	52.80	12.44	30.10	68.80
	Female High School Seniors											
Drinking	77.29	7.09	65.54	86.48	65.51	10.41	46.49	79.99	82.68	6.20	71.88	91.34
Real Price	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84
Risk	29.28	4.60	21.09	42.66								
Real Income	44.63	5.69	33.76	57.78	44.23	6.26	30.19	58.34	45.13	5.92	33.00	58.42
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	50.00	6.06	36.70	57.88	50.74	6.46	37.46	59.31	50.03	6.32	37.52	57.50
Mother's Education	48.46	9.98	30.91	60.97	49.05	9.31	31.84	63.28	48.40	10.58	29.57	62.15
Mother's Employment	53.63	11.77	32.62	69.05	54.18	12.17	28.31	69.28	54.70	12.20	33.51	72.04

Table 2 (continuation)

					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
White High School Seniors												
Drinking	81.55	7.31	69.17	90.36	65.63	12.75	44.32	81.35	86.63	6.14	75.69	94.28
Real Price	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84
Risk	22.18	3.60	15.55	31.71								
Real Income	48.98	8.03	35.95	69.09	46.59	7.99	30.16	65.31	50.00	8.25	36.05	72.01
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	55.14	6.66	39.53	62.84	56.81	6.90	41.45	69.56	54.91	6.85	40.99	63.90
Mother's Education	51.97	10.94	32.41	66.86	52.45	10.33	34.63	71.21	51.87	11.66	31.99	70.46
Mother's Employment	49.76	12.95	27.29	66.33	48.48	12.23	24.53	64.48	51.40	13.32	27.88	68.68
Nonwhite High School Seniors												
Drinking	64.60	6.05	55.31	74.34	55.42	10.22	34.59	74.80	71.14	6.74	56.67	83.64
Real Price	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84	97.78	7.12	88.34	117.84
Risk	34.03	5.69	23.42	47.82								
Real Income	50.75	6.19	37.05	63.04	51.71	7.52	37.43	67.36	51.00	7.48	34.41	71.91
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	36.45	8.18	20.32	49.00	38.64	10.10	17.97	60.06	36.12	8.21	17.25	48.50
Mother's Education	44.77	11.29	23.24	60.25	45.14	12.48	21.36	65.19	44.48	11.70	24.73	63.93
Mother's Employment	71.54	7.42	55.62	80.55	71.28	9.01	46.69	86.72	73.50	7.54	57.06	86.03

Table 3 - Summary Statistics for Excessive Alcohol Consumption

	High School Seniors											
					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Binge Drinking	32.95	5.38	24.78	41.37	16.15	3.81	10.77	22.07	46.42	5.49	38.58	54.77
Real Price	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08
Risk	43.14	4.59	34.96	50.29								
Real Income	49.19	7.92	35.98	68.18	46.77	7.29	33.69	65.14	51.49	8.43	35.79	72.39
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	51.31	6.18	36.81	59.11	50.88	6.46	39.39	59.55	52.08	6.25	37.00	60.63
Mother's Education	49.33	10.21	30.51	62.07	48.90	10.25	31.29	65.11	49.84	10.92	29.59	66.35
Mother's Employment	52.55	11.86	31.51	68.09	54.30	11.84	32.09	69.34	53.09	12.28	30.95	70.22
	Male High School Seniors											
Binge Drinking	40.71	7.26	28.53	52.15	19.48	6.31	10.92	30.67	53.11	6.53	43.55	65.15
Real Price	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08
Risk	36.21	4.13	28.39	42.35								
Real Income	53.83	10.39	38.19	79.20	51.69	9.52	36.28	76.13	55.52	10.77	38.50	82.55
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	53.04	6.48	37.12	60.61	53.14	6.84	40.38	63.65	53.18	6.39	38.12	62.78
Mother's Education	50.49	10.64	30.11	63.86	50.38	10.77	31.30	66.29	50.61	11.60	28.92	68.55
Mother's Employment	51.35	11.99	30.22	67.18	53.07	11.97	29.10	68.77	52.15	12.50	28.60	70.16
	Female High School Seniors											
Binge Drinking	25.27	3.64	20.17	31.07	13.56	2.57	9.23	18.81	38.34	4.63	30.11	47.60
Real Price	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08
Risk	49.72	5.18	39.34	59.60								
Real Income	44.63	5.69	33.76	57.78	43.22	5.87	31.23	56.46	46.47	5.95	33.11	59.51
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	50.00	6.06	36.70	57.88	49.55	6.71	37.40	59.28	50.88	6.20	36.30	60.16
Mother's Education	48.46	9.98	30.91	60.97	48.13	10.19	30.95	64.72	49.04	10.36	29.72	64.83
Mother's Employment	53.63	11.77	32.62	69.05	55.08	11.92	34.33	69.59	54.18	12.30	31.90	71.10

Table 3 (continuation)

	White High School Seniors											
					Great Risk				No Great Risk			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
Binge Drinking	36.75	5.10	29.13	45.24	17.57	4.08	10.95	24.27	50.38	4.93	42.86	58.11
Real Price	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08
Risk	40.03	4.53	32.58	47.76								
Real Income	48.98	8.03	35.95	69.09	45.89	7.48	32.49	65.34	51.45	8.37	36.61	73.46
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	55.14	6.66	39.53	62.84	55.51	7.13	43.61	67.41	55.21	6.82	39.72	65.40
Mother's Education	51.97	10.94	32.41	66.86	51.67	11.00	32.38	68.78	52.32	11.67	31.35	71.96
Mother's Employment	49.76	12.95	27.29	66.33	50.12	13.04	25.66	66.27	51.22	13.19	28.00	70.16
	Nonwhite High School Seniors											
Binge Drinking	15.02	2.91	10.33	20.02	9.63	3.42	1.77	15.11	23.88	5.18	12.58	36.76
Real Price	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08	97.27	6.53	88.75	115.08
Risk	57.78	4.54	47.16	65.88								
Real Income	50.75	6.19	37.05	63.04	50.47	6.61	36.52	65.40	52.25	8.32	35.61	75.94
Legal Age	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00	20.41	0.82	18.92	21.00
Father's Education	36.45	8.18	20.32	49.00	36.82	8.65	18.62	55.21	37.25	9.88	13.48	57.64
Mother's Education	44.77	11.29	23.24	60.25	45.02	11.34	24.12	61.18	44.23	13.23	20.32	65.96
Mother's Employment	71.54	7.42	55.62	80.55	72.82	7.89	55.29	86.77	72.58	8.33	52.40	85.88

Table 4 - Cigarette Consumption OLS Regressions, High School Seniors

	(1) Smoking	(2) Smoking	(3) Smoking	(4) Smoking	(5)[a] Smoking	(6)[b] Smoking
Real Price	-0.124***	-0.125***		-0.110***	-0.107***	-0.077
	[0.014]	[0.014]		[0.019]	[0.018]	[0.047]
Time	-3.997***	-3.950***	-1.852	-2.967***	-2.581***	-4.167***
	[0.288]	[0.592]	[1.547]	[0.613]	[0.446]	[0.804]
Time Squared	0.272***	0.253***	0.138***	0.217***	0.224***	0.258***
	[0.019]	[0.025]	[0.030]	[0.023]	[0.022]	[0.038]
Time Cubed	-0.005***	-0.004***	-0.003***	-0.004***	-0.004***	-0.004***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Risk			-0.769***	-0.278*		
			[0.259]	[0.141]		
Real Income		0.175***	0.290**	0.234***	0.198*	0.216**
		[0.031]	[0.132]	[0.047]	[0.105]	[0.081]
Father's Education		0.317	0.049	0.044	-0.319	0.259
		[0.347]	[0.818]	[0.352]	[0.256]	[0.197]
Mother's Education		-0.545	0.189	-0.203	0.249	-0.116
		[0.329]	[0.636]	[0.308]	[0.211]	[0.320]
Mother's Employment		0.484*	0.044	0.248	-0.214	0.224
		[0.245]	[0.457]	[0.225]	[0.197]	[0.368]
Price Elasticity[c]	-0.560	-0.564		-0.497	-0.634	-0.231
Income Elasticity[d]		0.287	0.477	0.384	0.417	0.253
R-sq	0.932	0.951	0.898	0.956	0.880	0.721
F-Statistic	95.699	58.424	26.410	54.951	21.930	7.736
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider smoking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 5 - Cigarette Consumption OLS Regressions, Male High School Seniors

	(1) Smoking	(2) Smoking	(3) Smoking	(4) Smoking	(5)[a] Smoking	(6)[b] Smoking
Real Price	-0.125***	-0.124***		-0.119***	-0.136***	-0.107**
	[0.020]	[0.018]		[0.019]	[0.027]	[0.045]
Time	-4.397***	-5.340***	-4.096**	-4.539***	-2.825***	-5.426***
	[0.314]	[0.502]	[1.784]	[0.752]	[0.803]	[0.975]
Time Squared	0.314***	0.313***	0.232***	0.283***	0.238***	0.357***
	[0.019]	[0.020]	[0.042]	[0.025]	[0.039]	[0.039]
Time Cubed	-0.006***	-0.005***	-0.004***	-0.005***	-0.004***	-0.006***
	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]
Risk			-0.318*	-0.142		
			[0.169]	[0.126]		
Real Income		0.081	0.131	0.143	0.191**	0.146
		[0.057]	[0.145]	[0.088]	[0.077]	[0.137]
Father's Education		0.665**	0.787	0.506	-0.241	0.147
		[0.244]	[0.634]	[0.313]	[0.288]	[0.134]
Mother's Education		-0.689***	-0.409	-0.530**	0.037	0.029
		[0.224]	[0.400]	[0.253]	[0.289]	[0.233]
Mother's Employment		0.739***	0.390	0.593**	0.140	0.199
		[0.260]	[0.569]	[0.254]	[0.143]	[0.279]
Price Elasticity[c]	-0.573	-0.567		-0.545	-0.838	-0.322
Income Elasticity[d]		0.149	0.239	0.260	0.454	0.187
R-sq	0.903	0.930	0.843	0.932	0.743	0.722
F-Statistic	65.045	39.602	16.164	35.285	8.692	7.796
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider smoking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 6 - Cigarette Consumption OLS Regressions, Female High School Seniors

	(1) Smoking	(2) Smoking	(3) Smoking	(4) Smoking	(5)[a] Smoking	(6)[b] Smoking
Real Price	-0.120***	-0.125***		-0.098***	-0.092***	-0.110**
	[0.015]	[0.014]		[0.021]	[0.017]	[0.044]
Time	-3.549***	-2.672***	-1.297*	-1.871**	-2.673***	-2.037***
	[0.414]	[0.530]	[0.658]	[0.741]	[0.270]	[0.657]
Time Squared	0.228***	0.194***	0.121***	0.171***	0.210***	0.153**
	[0.027]	[0.025]	[0.021]	[0.026]	[0.016]	[0.055]
Time Cubed	-0.004***	-0.004***	-0.003***	-0.003***	-0.004***	-0.002**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Risk			-0.751***	-0.371**		
			[0.121]	[0.172]		
Real Income		0.289***	0.274***	0.283***	0.302**	0.203
		[0.063]	[0.076]	[0.060]	[0.137]	[0.124]
Father's Education		-0.346	-0.299	-0.366	-0.126	-0.009
		[0.316]	[0.527]	[0.354]	[0.180]	[0.202]
Mother's Education		0.044	0.324	0.151	0.081	-0.047
		[0.367]	[0.484]	[0.388]	[0.144]	[0.214]
Mother's Employment		0.101	-0.113	-0.106	-0.207	-0.183
		[0.270]	[0.280]	[0.315]	[0.189]	[0.170]
Price Elasticity[c]	-0.547	-0.569		-0.443	-0.532	-0.328
Income Elasticity[d]		0.434	0.411	0.425	0.565	0.214
R-sq	0.924	0.950	0.926	0.959	0.906	0.546
F-Statistic	85.178	56.680	37.726	59.272	28.857	3.604
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider smoking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 7 - Cigarette Consumption OLS Regressions, White High School Seniors

	(1) Smoking	(2) Smoking	(3) Smoking	(4) Smoking	(5)[a] Smoking	(6)[b] Smoking
Real Price	-0.146***	-0.150***		-0.124***	-0.113***	-0.117**
	[0.019]	[0.023]		[0.025]	[0.027]	[0.048]
Time	-3.899***	-3.529***	-0.943	-2.531***	-2.088***	-3.352***
	[0.315]	[0.658]	[1.342]	[0.726]	[0.532]	[0.568]
Time Squared	0.293***	0.269***	0.149***	0.229***	0.237***	0.276***
	[0.021]	[0.032]	[0.031]	[0.038]	[0.024]	[0.038]
Time Cubed	-0.005***	-0.005***	-0.003***	-0.004***	-0.005***	-0.005***
	[0.000]	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]
Risk			-0.855***	-0.300		
			[0.232]	[0.186]		
Real Income		0.159***	0.283**	0.219***	0.294**	0.162
		[0.052]	[0.115]	[0.067]	[0.113]	[0.104]
Father's Education		0.103	-0.134	-0.076	-0.122	0.071
		[0.388]	[0.603]	[0.405]	[0.209]	[0.176]
Mother's Education		-0.199	0.484	0.060	0.177	-0.256
		[0.358]	[0.559]	[0.383]	[0.199]	[0.250]
Mother's Employment		0.198	-0.474	-0.025	-0.385	0.037
		[0.305]	[0.492]	[0.240]	[0.234]	[0.151]
Price Elasticity[c]	-0.598	-0.615		-0.511	-0.619	-0.316
Income Elasticity[d]		0.236	0.421	0.325	0.561	0.173
R-sq	0.909	0.922	0.866	0.929	0.892	0.665
F-Statistic	70.317	35.615	19.398	33.581	24.698	5.946
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider smoking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 8 - Cigarette Consumption OLS Regressions, Nonwhite High School Seniors

	(1) Smoking	(2) Smoking	(3) Smoking	(4) Smoking	(5)[a] Smoking	(6)[b] Smoking
Real Price	-0.096***	-0.092***		-0.078***	-0.069**	-0.090
	[0.016]	[0.015]		[0.017]	[0.033]	[0.093]
Time	-5.196***	-4.909***	-3.619***	-4.426***	-4.947***	-4.637***
	[0.273]	[0.240]	[0.375]	[0.346]	[0.565]	[1.020]
Time Squared	0.245***	0.251***	0.167***	0.223***	0.224***	0.237***
	[0.018]	[0.018]	[0.029]	[0.022]	[0.047]	[0.079]
Time Cubed	-0.003***	-0.004***	-0.002***	-0.003***	-0.003***	-0.003*
	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]	[0.002]
Risk			-0.296***	-0.175***		
			[0.057]	[0.051]		
Real Income		0.100	0.191	0.141	0.054	0.099
		[0.081]	[0.118]	[0.092]	[0.149]	[0.132]
Father's Education		0.095	0.319	0.142	0.132	0.300
		[0.246]	[0.268]	[0.239]	[0.192]	[0.244]
Mother's Education		-0.209	-0.221	-0.215	0.015	-0.529***
		[0.233]	[0.229]	[0.205]	[0.118]	[0.145]
Mother's Employment		-0.053	-0.238**	-0.067	-0.081	0.145
		[0.114]	[0.103]	[0.088]	[0.116]	[0.247]
Price Elasticity[c]	-0.782	-0.749		-0.637	-0.662	-0.509
Income Elasticity[d]		0.304	0.581	0.430	0.198	0.211
R-sq	0.972	0.977	0.968	0.980	0.876	0.631
F-Statistic	246.896	124.824	89.819	122.529	21.274	5.136
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider smoking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 9 - Alcohol Consumption OLS Regressions, High School Seniors

	(1) Drinking	(2) Drinking	(3) Drinking	(4) Drinking	(5)[a] Drinking	(6)[b] Drinking
Real Price	-0.448***	-0.340***		-0.316***	-0.234	-0.266***
	[0.089]	[0.082]		[0.073]	[0.311]	[0.060]
Time	-0.846*	1.778**	3.706***	2.104**	2.758	-0.159
	[0.491]	[0.827]	[0.707]	[0.849]	[1.636]	[0.653]
Time Squared	-0.017	-0.101***	-0.200***	-0.128***	-0.171***	-0.039
	[0.028]	[0.034]	[0.037]	[0.042]	[0.054]	[0.024]
Time Cubed	0.000	0.001*	0.003***	0.002**	0.003***	0.001
	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]
Risk			-0.352**	-0.314*		
			[0.164]	[0.165]		
Legal Age		-0.084	2.630	3.225*	-1.375	0.669
		[1.430]	[2.343]	[1.736]	[3.692]	[0.899]
Real Income		0.217**	0.344***	0.217**	0.109	0.132
		[0.090]	[0.100]	[0.089]	[0.146]	[0.098]
Father's Education		-1.433***	-1.505***	-1.398***	-0.152	-0.328
		[0.334]	[0.391]	[0.343]	[0.356]	[0.232]
Mother's Education		1.331***	1.130**	1.226***	0.093	0.359***
		[0.362]	[0.410]	[0.306]	[0.239]	[0.100]
Mother's Employment		-0.703**	-0.580*	-0.783**	-0.572**	-0.088
		[0.292]	[0.309]	[0.286]	[0.235]	[0.146]
Price Elasticity[c]	-0.559	-0.424		-0.394	-0.361	-0.310
Income Elasticity[d]		0.136	0.216	0.136	0.081	0.079
R-sq	0.969	0.985	0.983	0.988	0.952	0.979
F-Statistic	220.380	164.940	147.203	176.934	50.888	117.408
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 10 - Alcohol Consumption OLS Regressions, Male High School Seniors

	(1) Drinking	(2) Drinking	(3) Drinking	(4) Drinking	(5)[a] Drinking	(6)[b] Drinking
Real Price	-0.509***	-0.385***		-0.375***	-0.144	-0.483***
	[0.086]	[0.079]		[0.091]	[0.443]	[0.089]
Time	-1.486***	1.496	3.865***	1.614	3.537	-1.299
	[0.463]	[1.091]	[1.118]	[1.141]	[2.270]	[0.851]
Time Squared	0.016	-0.060	-0.159***	-0.072	-0.229**	0.025
	[0.026]	[0.041]	[0.046]	[0.051]	[0.102]	[0.029]
Time Cubed	-0.000	0.000	0.002**	0.001	0.004*	-0.001
	[0.000]	[0.001]	[0.001]	[0.001]	[0.002]	[0.000]
Risk			-0.242	-0.180		
			[0.274]	[0.238]		
Legal Age		-0.541	-0.345	0.816	-4.890*	0.137
		[1.528]	[3.306]	[2.163]	[2.797]	[1.018]
Real Income		0.175**	0.293**	0.173**	0.171	0.075
		[0.084]	[0.120]	[0.083]	[0.164]	[0.095]
Father's Education		-0.963**	-1.055**	-0.920**	-0.128	-0.099
		[0.374]	[0.453]	[0.393]	[0.303]	[0.219]
Mother's Education		0.727***	0.698**	0.708**	-0.254	0.186
		[0.252]	[0.329]	[0.264]	[0.294]	[0.151]
Mother's Employment		-0.725***	-0.775***	-0.786***	-0.142	-0.086
		[0.239]	[0.262]	[0.259]	[0.090]	[0.175]
Price Elasticity[c]	-0.627	-0.475		-0.461	-0.237	-0.553
Income Elasticity[d]		0.118	0.198	0.117	0.151	0.048
R-sq	0.971	0.981	0.974	0.982	0.942	0.956
F-Statistic	235.079	132.657	97.395	118.070	41.834	55.049
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 11 - Alcohol Consumption OLS Regressions, Female High School Seniors

	(1) Drinking	(2) Drinking	(3) Drinking	(4) Drinking	(5)[a] Drinking	(6)[b] Drinking
Real Price	-0.368***	-0.252		-0.274**	-0.192	0.014
	[0.098]	[0.152]		[0.129]	[0.305]	[0.115]
Time	-0.160	1.303	2.543***	1.442	0.882	1.205*
	[0.552]	[1.050]	[0.610]	[0.913]	[1.573]	[0.681]
Time Squared	-0.052	-0.103*	-0.173***	-0.119**	-0.125**	-0.103***
	[0.032]	[0.052]	[0.034]	[0.049]	[0.059]	[0.023]
Time Cubed	0.001*	0.001	0.003***	0.002**	0.002*	0.002***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]
Risk			-0.229**	-0.245**		
			[0.093]	[0.088]		
Legal Age		-0.816	1.693	2.706	-1.095	0.810
		[1.503]	[2.064]	[1.599]	[3.919]	[1.081]
Real Income		0.228	0.295**	0.186	0.050	0.226**
		[0.138]	[0.109]	[0.118]	[0.175]	[0.105]
Father's Education		-0.784*	-0.903*	-0.771*	-0.166	-0.398**
		[0.449]	[0.450]	[0.444]	[0.254]	[0.191]
Mother's Education		0.918**	0.835*	0.823**	0.478*	0.260*
		[0.413]	[0.422]	[0.343]	[0.243]	[0.127]
Mother's Employment		-0.397	-0.304	-0.522	-0.050	-0.063
		[0.316]	[0.281]	[0.305]	[0.232]	[0.175]
Price Elasticity[c]	-0.465	-0.318		-0.347	-0.287	0.017
Income Elasticity[d]		0.132	0.170	0.107	0.034	0.124
R-sq	0.957	0.971	0.971	0.975	0.921	0.959
F-Statistic	154.162	84.253	86.729	85.962	29.972	59.527
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 12 - Alcohol Consumption OLS Regressions, White High School Seniors

	(1) Drinking	(2) Drinking	(3) Drinking	(4) Drinking	(5)[a] Drinking	(6)[b] Drinking
Real Price	-0.455***	-0.333***		-0.312***	-0.277	-0.240***
	[0.098]	[0.099]		[0.085]	[0.302]	[0.084]
Time	-0.452	2.467**	4.529***	2.905***	3.824*	0.115
	[0.550]	[1.099]	[0.797]	[0.994]	[2.152]	[0.720]
Time Squared	-0.037	-0.130**	-0.233***	-0.154**	-0.267**	-0.041
	[0.031]	[0.053]	[0.046]	[0.057]	[0.097]	[0.036]
Time Cubed	0.001	0.002*	0.003***	0.002**	0.004**	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]
Risk			-0.441**	-0.421*		
			[0.213]	[0.216]		
Legal Age		0.401	4.884	5.196**	2.520	-0.180
		[2.027]	[2.853]	[2.231]	[4.446]	[1.271]
Real Income		0.277*	0.357***	0.243**	0.237	0.122
		[0.135]	[0.116]	[0.103]	[0.162]	[0.112]
Father's Education		-1.167***	-1.298***	-1.162***	-0.398	-0.223
		[0.394]	[0.356]	[0.330]	[0.388]	[0.182]
Mother's Education		1.000**	0.795*	0.883**	0.051	0.380***
		[0.413]	[0.406]	[0.342]	[0.291]	[0.109]
Mother's Employment		-0.667**	-0.722**	-0.940**	-0.441	-0.164
		[0.277]	[0.320]	[0.365]	[0.328]	[0.157]
Price Elasticity[c]	-0.546	-0.399		-0.374	-0.412	-0.271
Income Elasticity[d]		0.167	0.214	0.146	0.168	0.070
R-sq	0.952	0.973	0.975	0.980	0.940	0.967
F-Statistic	140.258	92.116	99.258	105.267	39.740	73.873
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 13 - Alcohol Consumption OLS Regressions, Nonwhite High School Seniors

	(1) Drinking	(2) Drinking	(3) Drinking	(4) Drinking	(5)[a] Drinking	(6)[b] Drinking
Real Price	0.046	-0.001		-0.018	0.196	-0.115
	[0.110]	[0.220]		[0.208]	[0.430]	[0.337]
Time	0.361	0.666	0.540	0.463	-0.608	-0.495
	[0.393]	[0.931]	[0.363]	[0.837]	[2.267]	[1.451]
Time Squared	-0.079***	-0.070**	-0.065***	-0.062**	-0.030	-0.017
	[0.021]	[0.032]	[0.022]	[0.029]	[0.092]	[0.061]
Time Cubed	0.002***	0.001**	0.001**	0.001**	0.001	0.001
	[0.000]	[0.001]	[0.000]	[0.001]	[0.002]	[0.001]
Risk			-0.082	-0.083*		
			[0.052]	[0.047]		
Legal Age		-0.368	0.657	0.773	-0.447	1.657
		[2.098]	[1.234]	[1.643]	[5.095]	[3.198]
Real Income		0.011	0.024	0.019	-0.072	0.248**
		[0.123]	[0.091]	[0.129]	[0.194]	[0.120]
Father's Education		0.232	0.197	0.192	-0.170	0.471***
		[0.212]	[0.215]	[0.241]	[0.342]	[0.161]
Mother's Education		-0.184	-0.214	-0.206	0.373*	-0.457**
		[0.363]	[0.311]	[0.379]	[0.217]	[0.200]
Mother's Employment		-0.247	-0.198	-0.204	-0.139	-0.171
		[0.250]	[0.217]	[0.269]	[0.226]	[0.235]
Price Elasticity[c]	0.070	-0.002		-0.028	0.346	-0.158
Income Elasticity[d]		0.008	0.019	0.015	-0.067	0.178
R-sq	0.926	0.939	0.942	0.942	0.717	0.707
F-Statistic	87.737	39.606	41.348	35.615	6.481	6.160
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 14 - Excessive Alcohol Consumption OLS Regressions, High School Seniors

	(1) Binging	(2) Binging	(3) Binging	(4) Binging	(5)[a] Binging	(6)[b] Binging
Real Price	-0.765***	-0.564***		-0.453***	-0.292**	-0.276**
	[0.082]	[0.049]		[0.087]	[0.113]	[0.131]
Time	-2.192***	0.217	1.761***	0.267	0.565	0.389
	[0.370]	[0.548]	[0.464]	[0.393]	[0.693]	[1.108]
Time squared	0.055**	-0.000	-0.082***	-0.011	-0.053	-0.005
	[0.022]	[0.017]	[0.019]	[0.012]	[0.035]	[0.033]
Time cubed	-0.001*	-0.000	0.001***	-0.000	0.001	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Risk			-0.488***	-0.248**		
			[0.118]	[0.096]		
Legal Age		-5.604***	-4.315**	-4.351***	-2.069	-7.049***
		[0.636]	[1.556]	[0.605]	[1.523]	[1.023]
Real Income		0.067	0.055	0.004	0.046	-0.071
		[0.050]	[0.097]	[0.043]	[0.125]	[0.075]
Father's Education		-0.529**	-0.133	-0.317	0.170	0.343
		[0.241]	[0.301]	[0.247]	[0.197]	[0.205]
Mother's Education		0.727**	0.293	0.565*	-0.230	0.070
		[0.277]	[0.383]	[0.280]	[0.190]	[0.089]
Mother's Employment		-0.477**	-0.152	-0.401**	0.057	-0.395*
		[0.216]	[0.179]	[0.191]	[0.120]	[0.214]
Price Elasticity[c]	-2.258	-1.666		-1.337	-1.762	-0.579
Income Elasticity[d]		0.100	0.082	0.006	0.134	-0.079
R-sq	0.941	0.983	0.971	0.987	0.878	0.942
F-Statistic	112.421	145.317	86.892	161.465	18.392	41.722
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider binge drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 15 - Excessive Alcohol Consumption OLS Regressions, Male High School Seniors

	(1) Binging	(2) Binging	(3) Binging	(4) Binging	(5)[a] Binging	(6)[b] Binging
Real Price	-0.801***	-0.517***		-0.417***	-0.203	-0.279*
	[0.103]	[0.071]		[0.090]	[0.241]	[0.140]
Time	-2.747***	0.632	2.355***	0.709	1.032	1.173
	[0.417]	[0.754]	[0.625]	[0.590]	[1.404]	[0.865]
Time squared	0.078***	-0.004	-0.081***	-0.015	-0.081*	-0.022
	[0.025]	[0.022]	[0.021]	[0.020]	[0.046]	[0.040]
Time cubed	-0.001**	-0.001*	0.001**	-0.000	0.001*	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Risk			-0.454***	-0.251**		
			[0.082]	[0.107]		
Legal Age		-6.918***	-5.298***	-5.211***	-1.247	-6.679***
		[0.547]	[1.481]	[0.861]	[2.761]	[1.852]
Real Income		0.088*	0.121	0.063	0.035	-0.007
		[0.048]	[0.094]	[0.040]	[0.128]	[0.091]
Father's Education		-0.590**	-0.262	-0.402**	0.284	0.112
		[0.229]	[0.257]	[0.194]	[0.215]	[0.191]
Mother's Education		0.752***	0.467*	0.625***	-0.399	-0.111
		[0.214]	[0.242]	[0.184]	[0.268]	[0.128]
Mother's Employment		-0.585***	-0.566***	-0.588***	-0.055	-0.428**
		[0.164]	[0.154]	[0.148]	[0.188]	[0.195]
Price Elasticity[c]	-1.914	-1.236		-0.996	-1.012	-0.510
Income Elasticity[d]		0.116	0.160	0.083	0.092	-0.007
R-sq	0.953	0.988	0.982	0.991	0.865	0.942
F-Statistic	143.039	211.892	139.541	233.877	16.420	41.764
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider binge drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 16 - Excessive Alcohol Consumption OLS Regressions, Female High School Seniors

	(1) Binging	(2) Binging	(3) Binging	(4) Binging	(5)[a] Binging	(6)[b] Binging
Real Price	-0.692***	-0.501***		-0.455***	-0.310**	-0.385
	[0.074]	[0.039]		[0.061]	[0.150]	[0.243]
Time	-1.582***	0.194	1.831***	0.241	0.789	0.295
	[0.396]	[0.306]	[0.434]	[0.290]	[0.831]	[1.824]
Time squared	0.030	-0.006	-0.091***	-0.012	-0.048	-0.036
	[0.023]	[0.017]	[0.018]	[0.014]	[0.029]	[0.062]
Time cubed	-0.000	-0.000	0.001***	0.000	0.001	0.001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Risk			-0.247*	-0.150		
			[0.142]	[0.100]		
Legal Age		-5.400***	-5.282***	-4.628***	-3.867***	-4.308**
		[0.744]	[1.520]	[0.676]	[1.225]	[1.649]
Real Income		0.081	0.122	0.012	0.018	0.273
		[0.076]	[0.149]	[0.088]	[0.089]	[0.167]
Father's Education		-0.047	-0.229	-0.022	0.106	0.041
		[0.240]	[0.281]	[0.246]	[0.179]	[0.301]
Mother's Education		0.255	0.382	0.279	0.102	0.049
		[0.268]	[0.373]	[0.262]	[0.159]	[0.260]
Mother's Employment		-0.252	-0.014	-0.252	-0.071	0.033
		[0.195]	[0.212]	[0.186]	[0.140]	[0.279]
Price Elasticity[c]	-2.665	-1.927		-1.752	-2.222	-0.977
Income Elasticity[d]		0.144	0.216	0.022	0.058	0.331
R-sq	0.874	0.948	0.919	0.954	0.735	0.773
F-Statistic	48.625	46.990	29.008	45.387	7.081	8.688
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider binge drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 17 - Excessive Alcohol Consumption OLS Regressions, White High School Seniors

	(1) Binging	(2) Binging	(3) Binging	(4) Binging	(5)[a] Binging	(6)[b] Binging
Real Price	-0.879***	-0.699***		-0.530***	-0.608***	-0.061
	[0.091]	[0.070]		[0.127]	[0.131]	[0.123]
Time	-2.207***	0.385	1.890***	0.418	-0.019	2.428***
	[0.410]	[0.774]	[0.472]	[0.589]	[0.746]	[0.862]
Time squared	0.055**	0.001	-0.078***	-0.005	-0.035	-0.044
	[0.025]	[0.026]	[0.024]	[0.021]	[0.039]	[0.032]
Time cubed	-0.001	-0.001	0.001*	-0.000	0.001	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Risk			-0.549***	-0.259**		
			[0.109]	[0.108]		
Legal Age		-6.457***	-4.494*	-5.131***	-1.942	-7.274***
		[0.766]	[2.187]	[0.865]	[1.692]	[1.889]
Real Income		0.071	0.020	0.000	-0.035	-0.049
		[0.066]	[0.098]	[0.050]	[0.093]	[0.081]
Father's Education		-0.580**	-0.071	-0.328	0.212	-0.007
		[0.245]	[0.280]	[0.209]	[0.129]	[0.214]
Mother's Education		0.806***	0.158	0.561**	-0.060	0.052
		[0.243]	[0.442]	[0.270]	[0.169]	[0.150]
Mother's Employment		-0.548**	-0.133	-0.445**	-0.083	-0.715***
		[0.232]	[0.181]	[0.200]	[0.147]	[0.173]
Price Elasticity[c]	-2.328	-1.851		-1.404	-3.366	-0.118
Income Elasticity[d]		0.095	0.026	0.000	-0.092	-0.050
R-sq	0.913	0.972	0.958	0.977	0.849	0.919
F-Statistic	73.833	88.751	58.817	95.401	14.395	29.025
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider binge drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 18 - Excessive Alcohol Consumption OLS Regressions, Nonwhite High School Seniors

	(1) Binging	(2) Binging	(3) Binging	(4) Binging	(5)[a] Binging	(6)[b] Binging
Real Price	-0.029	-0.005		-0.025	0.158	-0.186
	[0.101]	[0.114]		[0.120]	[0.168]	[0.453]
Time	0.123	1.046	1.102**	1.007	0.897	1.685
	[0.447]	[0.677]	[0.423]	[0.726]	[0.724]	[1.635]
Time squared	-0.047*	-0.063**	-0.065***	-0.062**	-0.030	-0.139*
	[0.025]	[0.024]	[0.016]	[0.026]	[0.026]	[0.079]
Time cubed	0.001**	0.001***	0.001***	0.001**	0.000	0.003*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Risk			-0.092	-0.095		
			[0.129]	[0.129]		
Legal Age		-0.556	-0.334	-0.201	-3.986	1.370
		[1.689]	[1.262]	[1.473]	[2.506]	[3.377]
Real Income		0.085	0.087	0.080	-0.053	0.052
		[0.092]	[0.088]	[0.103]	[0.104]	[0.129]
Father's Education		0.194	0.175	0.172	0.004	0.179
		[0.149]	[0.164]	[0.162]	[0.107]	[0.126]
Mother's Education		-0.050	-0.063	-0.057	0.059	-0.129
		[0.218]	[0.227]	[0.222]	[0.147]	[0.151]
Mother's Employment		-0.459**	-0.403**	-0.404**	-0.201	-0.171
		[0.184]	[0.191]	[0.193]	[0.135]	[0.234]
Price Elasticity[c]	-0.189	-0.031		-0.160	1.595	-0.756
Income Elasticity[d]		0.287	0.293	0.270	-0.277	0.113
R-sq	0.647	0.762	0.768	0.768	0.588	0.274
F-Statistic	12.818	8.193	8.437	7.271	3.645	0.965
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider binge drinking a great risk.

[c] Price elasticities are evaluated at the mean values.

[d] Income elasticities are evaluated at the mean values.

Table 19 - Cigarette Consumption Double Log Regressions, High School Seniors

	(1) LN Smoking	(2) LN Smoking	(3) LN Smoking	(4) LN Smoking	(5)[a] LN Smoking	(6)[b] LN Smoking
LN Real Price	-0.495***	-0.486***		-0.400**	-0.622***	-0.265*
	[0.130]	[0.133]		[0.164]	[0.136]	[0.143]
Time	-0.126***	-0.140***	-0.053	-0.099***	-0.114***	-0.092***
	[0.011]	[0.020]	[0.045]	[0.026]	[0.020]	[0.017]
Time Squared	0.009***	0.009***	0.004***	0.007***	0.010***	0.006***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Time Cubed	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.024***	-0.011*		
			[0.008]	[0.006]		
LN Real Income		0.310***	0.567**	0.443***	0.532**	0.244*
		[0.063]	[0.208]	[0.115]	[0.242]	[0.125]
Father's Education		0.020	0.001	0.008	-0.016	0.006
		[0.013]	[0.023]	[0.014]	[0.013]	[0.004]
Mother's Education		-0.023*	0.005	-0.009	0.015	-0.003
		[0.011]	[0.018]	[0.011]	[0.011]	[0.007]
Mother's Employment		0.021**	0.001	0.011	-0.006	0.004
		[0.008]	[0.013]	[0.007]	[0.009]	[0.008]
R-sq	0.920	0.943	0.918	0.949	0.878	0.719
F-Statistic	80.559	49.761	33.477	47.176	21.621	7.689
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider smoking a great risk.

Table 20 - Cigarette Consumption Double Log Regressions, Male High School Seniors

	(1) LN Smoking	(2) LN Smoking	(3) LN Smoking	(4) LN Smoking	(5)[a] LN Smoking	(6)[b] LN Smoking
LN Real Price	-0.425**	-0.417**		-0.394**	-0.677***	-0.311**
	[0.167]	[0.152]		[0.162]	[0.213]	[0.120]
Time	-0.139***	-0.192***	-0.134**	-0.172***	-0.123***	-0.126***
	[0.013]	[0.021]	[0.052]	[0.031]	[0.038]	[0.022]
Time Squared	0.010***	0.011***	0.008***	0.010***	0.011***	0.008***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]
Time Cubed	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.009*	-0.003		
			[0.005]	[0.005]		
LN Real Income		0.099	0.279	0.191	0.504**	0.175
		[0.137]	[0.264]	[0.211]	[0.240]	[0.177]
Father's Education		0.031***	0.026	0.028**	-0.011	0.004
		[0.010]	[0.018]	[0.013]	[0.015]	[0.003]
Mother's Education		-0.026***	-0.015	-0.022**	0.006	0.001
		[0.009]	[0.012]	[0.010]	[0.015]	[0.005]
Mother's Employment		0.028***	0.013	0.024**	0.005	0.005
		[0.010]	[0.017]	[0.010]	[0.006]	[0.006]
R-sq	0.873	0.908	0.869	0.910	0.682	0.718
F-Statistic	47.986	29.739	19.958	25.751	6.434	7.624
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider smoking a great risk.

Table 21 - Cigarette Consumption Double Log Regressions, Female High School Seniors

	(1) LN Smoking	(2) LN Smoking	(3) LN Smoking	(4) LN Smoking	(5)[a] LN Smoking	(6)[b] LN Smoking
LN Real Price	-0.551***	-0.545***		-0.405***	-0.558***	-0.383*
	[0.123]	[0.121]		[0.140]	[0.101]	[0.193]
Time	-0.114***	-0.093***	-0.038	-0.058**	-0.113***	-0.047***
	[0.015]	[0.019]	[0.023]	[0.027]	[0.012]	[0.015]
Time Squared	0.008***	0.007***	0.004***	0.006***	0.009***	0.004**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Time Cubed	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.024***	-0.015**		
			[0.005]	[0.006]		
LN Real Income		0.492***	0.496***	0.492***	0.660**	0.193
		[0.090]	[0.124]	[0.083]	[0.273]	[0.135]
Father's Education		-0.008	-0.011	-0.010	-0.011	-0.000
		[0.011]	[0.017]	[0.012]	[0.009]	[0.005]
Mother's Education		-0.001	0.010	0.004	0.006	-0.002
		[0.013]	[0.016]	[0.014]	[0.006]	[0.005]
Mother's Employment		0.009	-0.002	-0.000	-0.006	-0.004
		[0.010]	[0.009]	[0.011]	[0.009]	[0.004]
R-sq	0.918	0.944	0.933	0.956	0.918	0.544
F-Statistic	78.346	50.591	41.790	55.151	33.402	3.581
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider smoking a great risk.

Table 22 - Cigarette Consumption Double Log Regressions, White High School Seniors

	(1) LN Smoking	(2) LN Smoking	(3) LN Smoking	(4) LN Smoking	(5)[a] LN Smoking	(6)[b] LN Smoking
LN Real Price	-0.487***	-0.479***		-0.319	-0.580***	-0.297**
	[0.148]	[0.156]		[0.187]	[0.163]	[0.134]
Time	-0.113***	-0.123***	-0.035	-0.073**	-0.092***	-0.073***
	[0.011]	[0.023]	[0.035]	[0.027]	[0.021]	[0.014]
Time Squared	0.009***	0.008***	0.005***	0.006***	0.010***	0.006***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Time Cubed	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.023***	-0.013*		
			[0.006]	[0.007]		
LN Real Income		0.191*	0.452**	0.354**	0.665***	0.151
		[0.100]	[0.164]	[0.131]	[0.228]	[0.149]
Father's Education		0.011	-0.002	0.002	-0.005	0.002
		[0.013]	[0.015]	[0.013]	[0.009]	[0.003]
Mother's Education		-0.007	0.011	0.004	0.011	-0.004
		[0.011]	[0.015]	[0.012]	[0.008]	[0.005]
Mother's Employment		0.009	-0.011	-0.002	-0.011	0.002
		[0.011]	[0.013]	[0.008]	[0.010]	[0.003]
R-sq	0.883	0.897	0.890	0.912	0.886	0.653
F-Statistic	52.661	26.122	24.204	26.459	23.430	5.646
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider smoking a great risk.

Table 23 - Cigarette Consumption Double Log Regressions, Nonwhite High School Seniors

	(1) LN Smoking	(2) LN Smoking	(3) LN Smoking	(4) LN Smoking	(5)[a] LN Smoking	(6)[b] LN Smoking
LN Real Price	-1.168***	-1.101***		-1.011***	-1.048**	-0.973*
	[0.254]	[0.222]		[0.224]	[0.484]	[0.547]
Time	-0.231***	-0.190***	-0.094***	-0.163***	-0.241***	-0.180***
	[0.028]	[0.020]	[0.032]	[0.027]	[0.055]	[0.052]
Time Squared	0.012***	0.011***	0.004*	0.010***	0.012**	0.010**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.005]	[0.004]
Time Cubed	-0.000***	-0.000***	-0.000	-0.000***	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.019***	-0.010**		
			[0.005]	[0.004]		
LN Real Income		0.718*	0.971	0.831*	0.661	0.378
		[0.392]	[0.575]	[0.437]	[0.720]	[0.326]
Father's Education		0.007	0.016	0.009	0.010	0.017
		[0.021]	[0.022]	[0.020]	[0.015]	[0.011]
Mother's Education		-0.016	-0.010	-0.016	-0.003	-0.029***
		[0.018]	[0.020]	[0.017]	[0.013]	[0.007]
Mother's Employment		-0.010	-0.025**	-0.010	-0.010	0.010
		[0.008]	[0.011]	[0.007]	[0.011]	[0.014]
R-sq	0.916	0.935	0.900	0.939	0.762	0.583
F-Statistic	76.248	43.335	27.023	39.388	9.619	4.201
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider smoking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider smoking a great risk.

Table 24 - Alcohol Consumption Double Log Regressions, High School Seniors

	(1) LN Drinking	(2) LN Drinking	(3) LN Drinking	(4) LN Drinking	(5)[a] LN Drinking	(6)[b] LN Drinking
LN Real Price	-0.574***	-0.372***		-0.354***	-0.262	-0.270***
	[0.118]	[0.118]		[0.100]	[0.507]	[0.087]
Time	-0.010	0.028**	0.048***	0.031***	0.047*	0.002
	[0.006]	[0.010]	[0.008]	[0.010]	[0.023]	[0.008]
Time Squared	-0.000	-0.001***	-0.002***	-0.002***	-0.003***	-0.001*
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.000]
Time Cubed	0.000	0.000**	0.000***	0.000**	0.000**	0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.004**	-0.004*		
			[0.002]	[0.002]		
Legal Age		0.000	0.034	0.040*	-0.022	0.010
		[0.017]	[0.026]	[0.020]	[0.060]	[0.011]
LN Real Income		0.180**	0.259***	0.174***	0.115	0.119
		[0.065]	[0.062]	[0.060]	[0.116]	[0.072]
Father's Education		-0.019***	-0.020***	-0.018***	-0.004	-0.004
		[0.004]	[0.004]	[0.004]	[0.006]	[0.003]
Mother's Education		0.017***	0.014***	0.015***	0.002	0.004***
		[0.004]	[0.005]	[0.004]	[0.004]	[0.001]
Mother's Employment		-0.009**	-0.008*	-0.010**	-0.009**	-0.001
		[0.004]	[0.004]	[0.004]	[0.004]	[0.002]
R-sq	0.969	0.986	0.985	0.989	0.948	0.980
F-Statistic	217.022	180.272	170.508	189.913	46.220	122.795
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider drinking a great risk.

Table 25 - Alcohol Consumption Double Log Regressions, Male High School Seniors

	(1) LN Drinking	(2) LN Drinking	(3) LN Drinking	(4) LN Drinking	(5)[a] LN Drinking	(6)[b] LN Drinking
LN Real Price	-0.648***	-0.419***		-0.412***	-0.227	-0.521***
	[0.115]	[0.111]		[0.117]	[0.861]	[0.112]
Time	-0.018***	0.027*	0.052***	0.028*	0.054	-0.010
	[0.006]	[0.013]	[0.012]	[0.014]	[0.041]	[0.011]
Time Squared	0.000	-0.001*	-0.002***	-0.001*	-0.003*	0.000
	[0.000]	[0.001]	[0.001]	[0.001]	[0.002]	[0.000]
Time Cubed	-0.000	0.000	0.000**	0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.002	-0.002		
			[0.003]	[0.003]		
Legal Age		-0.006	-0.002	0.009	-0.068	0.002
		[0.018]	[0.038]	[0.027]	[0.055]	[0.012]
LN Real Income		0.177**	0.269***	0.173**	0.190	0.097
		[0.066]	[0.089]	[0.062]	[0.193]	[0.081]
Father's Education		-0.013***	-0.014**	-0.012**	-0.005	-0.001
		[0.004]	[0.005]	[0.005]	[0.006]	[0.002]
Mother's Education		0.009***	0.008**	0.009**	-0.003	0.002
		[0.003]	[0.004]	[0.003]	[0.006]	[0.002]
Mother's Employment		-0.010***	-0.010***	-0.011***	-0.002	-0.001
		[0.003]	[0.003]	[0.003]	[0.002]	[0.002]
R-sq	0.969	0.981	0.977	0.982	0.926	0.956
F-Statistic	218.287	134.030	107.655	118.530	32.025	55.646
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider drinking a great risk.

Table 26 - Alcohol Consumption Double Log Regressions, Female High School Seniors

	(1) LN Drinking	(2) LN Drinking	(3) LN Drinking	(4) LN Drinking	(5)[a] LN Drinking	(6)[b] LN Drinking
LN Real Price	-0.471***	-0.290		-0.326*	-0.179	0.045
	[0.130]	[0.213]		[0.185]	[0.450]	[0.143]
Time	-0.002	0.019	0.032***	0.021*	0.016	0.016*
	[0.007]	[0.013]	[0.008]	[0.012]	[0.021]	[0.008]
Time Squared	-0.001	-0.001*	-0.002***	-0.002**	-0.002**	-0.001***
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]
Time Cubed	0.000	0.000	0.000***	0.000*	0.000*	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.003**	-0.003**		
			[0.001]	[0.001]		
Legal Age		-0.009	0.023	0.034	-0.021	0.014
		[0.019]	[0.025]	[0.020]	[0.062]	[0.014]
LN Real Income		0.154	0.191***	0.126	0.049	0.152*
		[0.090]	[0.066]	[0.078]	[0.106]	[0.074]
Father's Education		-0.010*	-0.012*	-0.010*	-0.003	-0.005**
		[0.006]	[0.006]	[0.006]	[0.004]	[0.002]
Mother's Education		0.011**	0.010*	0.010**	0.007*	0.003
		[0.005]	[0.005]	[0.004]	[0.004]	[0.002]
Mother's Employment		-0.005	-0.004	-0.007	-0.000	-0.000
		[0.004]	[0.004]	[0.004]	[0.004]	[0.002]
R-sq	0.957	0.971	0.972	0.975	0.920	0.958
F-Statistic	156.379	86.748	89.672	86.547	29.440	58.661
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider drinking a great risk.

Table 27 - Alcohol Consumption Double Log Regressions, White High School Seniors

	(1) LN Drinking	(2) LN Drinking	(3) LN Drinking	(4) LN Drinking	(5)[a] LN Drinking	(6)[b] LN Drinking
LN Real Price	-0.556***	-0.308**		-0.305***	-0.349	-0.242**
	[0.123]	[0.131]		[0.101]	[0.500]	[0.117]
Time	-0.005	0.038***	0.056***	0.041***	0.058*	0.004
	[0.006]	[0.013]	[0.009]	[0.012]	[0.034]	[0.009]
Time Squared	-0.000	-0.002***	-0.003***	-0.002***	-0.004**	-0.001
	[0.000]	[0.001]	[0.000]	[0.001]	[0.002]	[0.000]
Time Cubed	0.000	0.000**	0.000***	0.000**	0.000**	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.005*	-0.005*		
			[0.002]	[0.003]		
Legal Age		0.009	0.059*	0.061**	0.042	-0.000
		[0.023]	[0.030]	[0.025]	[0.072]	[0.015]
LN Real Income		0.233**	0.268***	0.202***	0.183	0.112
		[0.091]	[0.071]	[0.068]	[0.131]	[0.085]
Father's Education		-0.015***	-0.016***	-0.015***	-0.007	-0.003
		[0.004]	[0.004]	[0.004]	[0.006]	[0.002]
Mother's Education		0.011**	0.009*	0.010**	0.001	0.004***
		[0.005]	[0.005]	[0.004]	[0.005]	[0.001]
Mother's Employment		-0.008**	-0.009**	-0.011**	-0.006	-0.002
		[0.003]	[0.004]	[0.004]	[0.006]	[0.002]
R-sq	0.952	0.977	0.979	0.982	0.932	0.968
F-Statistic	138.578	106.975	119.216	118.229	35.139	77.226
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider drinking a great risk.

Table 28 - Alcohol Consumption Double Log Regressions, Nonwhite High School Seniors

	(1) LN Drinking	(2) LN Drinking	(3) LN Drinking	(4) LN Drinking	(5)[a] LN Drinking	(6)[b] LN Drinking
LN Real Price	0.099	0.000		-0.025	0.370	-0.180
	[0.170]	[0.342]		[0.323]	[0.789]	[0.523]
Time	0.009	0.013	0.011*	0.010	-0.005	-0.005
	[0.006]	[0.013]	[0.006]	[0.012]	[0.038]	[0.020]
Time Squared	-0.001***	-0.001**	-0.001***	-0.001**	-0.001	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]	[0.001]
Time Cubed	0.000***	0.000**	0.000***	0.000**	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.001	-0.001		
			[0.001]	[0.001]		
Legal Age		-0.001	0.014	0.016	-0.015	0.032
		[0.030]	[0.019]	[0.023]	[0.086]	[0.047]
LN Real Income		0.018	0.029	0.025	-0.128	0.176
		[0.098]	[0.072]	[0.102]	[0.188]	[0.109]
Father's Education		0.004	0.003	0.003	-0.004	0.006**
		[0.003]	[0.004]	[0.004]	[0.007]	[0.002]
Mother's Education		-0.003	-0.004	-0.004	0.007	-0.006**
		[0.006]	[0.005]	[0.006]	[0.004]	[0.003]
Mother's Employment		-0.004	-0.004	-0.004	-0.002	-0.003
		[0.004]	[0.003]	[0.004]	[0.004]	[0.004]
R-sq	0.922	0.938	0.941	0.941	0.690	0.687
F-Statistic	82.403	38.945	40.573	34.943	5.682	5.598
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider drinking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider drinking a great risk.

Table 29 - Excessive Alcohol Consumption Double Log Regressions, High School Seniors

	(1) LN Binging	(2) LN Binging	(3) LN Binging	(4) LN Binging	(5)[a] LN Binging	(6)[b] LN Binging
LN Real Price	-2.312***	-1.735***		-1.449***	-1.662**	-0.610*
	[0.295]	[0.209]		[0.326]	[0.751]	[0.303]
Time	-0.064***	0.012	0.057***	0.010	0.041	0.008
	[0.013]	[0.018]	[0.017]	[0.013]	[0.044]	[0.025]
Time squared	0.002**	-0.000	-0.003***	-0.000	-0.003	-0.000
	[0.001]	[0.001]	[0.001]	[0.000]	[0.002]	[0.001]
Time cubed	-0.000*	-0.000	0.000**	-0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.014***	-0.007**		
			[0.004]	[0.003]		
Legal Age		-0.161***	-0.119**	-0.122***	-0.091	-0.147***
		[0.018]	[0.052]	[0.020]	[0.094]	[0.024]
LN Real Income		0.142	0.170	0.028	0.319	-0.084
		[0.086]	[0.199]	[0.079]	[0.400]	[0.116]
Father's Education		-0.019**	-0.008	-0.013*	0.008	0.008
		[0.007]	[0.009]	[0.007]	[0.013]	[0.005]
Mother's Education		0.024***	0.012	0.020**	-0.017	0.002
		[0.008]	[0.012]	[0.009]	[0.013]	[0.002]
Mother's Employment		-0.017**	-0.006	-0.014**	0.003	-0.009*
		[0.007]	[0.006]	[0.006]	[0.008]	[0.005]
R-sq	0.937	0.980	0.967	0.984	0.866	0.934
F-Statistic	104.685	127.782	74.819	136.750	16.555	35.887
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of high school seniors who do not consider binge drinking a great risk.

Table 30 - Excessive Alcohol Consumption Double Log Regressions, Male High School Seniors

	(1) LN Binging	(2) LN Binging	(3) LN Binging	(4) LN Binging	(5)[a] LN Binging	(6)[b] LN Binging
LN Real Price	-1.930***	-1.225***		-0.987***	-0.325	-0.509
	[0.283]	[0.223]		[0.270]	[1.361]	[0.300]
Time	-0.064***	0.024	0.064***	0.024	0.096	0.021
	[0.012]	[0.022]	[0.016]	[0.017]	[0.070]	[0.018]
Time squared	0.002***	-0.000	-0.002***	-0.000	-0.006**	-0.000
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]	[0.001]
Time cubed	-0.000**	-0.000*	0.000	-0.000	0.000*	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.011***	-0.007**		
			[0.002]	[0.003]		
Legal Age		-0.161***	-0.115***	-0.114***	-0.056	-0.122***
		[0.015]	[0.039]	[0.025]	[0.128]	[0.034]
LN Real Income		0.178**	0.257	0.128*	0.422	-0.040
		[0.082]	[0.161]	[0.064]	[0.444]	[0.124]
Father's Education		-0.017**	-0.009	-0.012**	0.014	0.003
		[0.006]	[0.006]	[0.005]	[0.013]	[0.004]
Mother's Education		0.019***	0.011*	0.015***	-0.022	-0.002
		[0.006]	[0.006]	[0.005]	[0.016]	[0.003]
Mother's Employment		-0.016***	-0.015***	-0.016***	-0.005	-0.008**
		[0.005]	[0.004]	[0.005]	[0.011]	[0.004]
R-sq	0.950	0.985	0.980	0.988	0.862	0.938
F-Statistic	132.652	164.580	124.885	178.324	15.985	38.434
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of male high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of male high school seniors who do not consider binge drinking a great risk.

Table 31 - Excessive Alcohol Consumption Double Log Regressions, Female High School Seniors

	(1) LN Binging	(2) LN Binging	(3) LN Binging	(4) LN Binging	(5)[a] LN Binging	(6)[b] LN Binging
LN Real Price	-2.800***	-2.113***		-1.968***	-3.012**	-1.047
	[0.352]	[0.213]		[0.290]	[1.140]	[0.645]
Time	-0.061***	0.007	0.071***	0.007	0.026	0.009
	[0.017]	[0.013]	[0.019]	[0.011]	[0.059]	[0.048]
Time squared	0.001	-0.000	-0.004***	-0.000	-0.003	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Time cubed	-0.000	-0.000	0.000***	-0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.009	-0.006		
			[0.006]	[0.004]		
Legal Age		-0.207***	-0.198***	-0.175***	-0.243**	-0.102**
		[0.029]	[0.063]	[0.028]	[0.088]	[0.043]
LN Real Income		0.178	0.307	0.037	0.052	0.416*
		[0.149]	[0.323]	[0.185]	[0.300]	[0.230]
Father's Education		-0.004	-0.012	-0.003	0.012	0.001
		[0.010]	[0.011]	[0.010]	[0.013]	[0.008]
Mother's Education		0.013	0.019	0.015	0.005	0.001
		[0.011]	[0.015]	[0.011]	[0.013]	[0.007]
Mother's Employment		-0.012	-0.001	-0.012	-0.003	0.001
		[0.008]	[0.009]	[0.008]	[0.010]	[0.008]
R-sq	0.862	0.942	0.905	0.947	0.717	0.763
F-Statistic	43.874	41.383	24.426	39.473	6.485	8.226
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of female high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of female high school seniors who do not consider binge drinking a great risk.

Table 32 - Excessive Alcohol Consumption Double Log Regressions, White High School Seniors

	(1) LN Binging	(2) LN Binging	(3) LN Binging	(4) LN Binging	(5)[a] LN Binging	(6)[b] LN Binging
LN Real Price	-2.372***	-1.851***		-1.462***	-3.719***	-0.095
	[0.280]	[0.246]		[0.418]	[0.827]	[0.245]
Time	-0.058***	0.019	0.055***	0.016	-0.007	0.049**
	[0.012]	[0.022]	[0.015]	[0.018]	[0.048]	[0.018]
Time squared	0.001**	-0.000	-0.002***	-0.000	-0.002	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]	[0.001]
Time cubed	-0.000	-0.000	0.000*	-0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.014***	-0.007*		
			[0.003]	[0.003]		
Legal Age		-0.167***	-0.110*	-0.132***	-0.076	-0.143***
		[0.019]	[0.063]	[0.026]	[0.103]	[0.038]
LN Real Income		0.170	0.114	0.056	0.032	-0.054
		[0.107]	[0.186]	[0.088]	[0.266]	[0.103]
Father's Education		-0.018**	-0.005	-0.012*	0.012	-0.000
		[0.007]	[0.008]	[0.006]	[0.008]	[0.004]
Mother's Education		0.023***	0.007	0.017**	-0.004	0.001
		[0.007]	[0.013]	[0.008]	[0.011]	[0.003]
Mother's Employment		-0.016**	-0.004	-0.013**	-0.005	-0.015***
		[0.007]	[0.006]	[0.006]	[0.010]	[0.003]
R-sq	0.907	0.969	0.953	0.974	0.815	0.913
F-Statistic	67.990	80.728	52.375	83.094	11.230	26.916
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of white high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of white high school seniors who do not consider binge drinking a great risk.

Table 33 - Excessive Alcohol Consumption Double Log Regressions, Nonwhite High School Seniors

	(1) LN Binging	(2) LN Binging	(3) LN Binging	(4) LN Binging	(5)[a] LN Binging	(6)[b] LN Binging
LN Real Price	-0.166	-0.011		-0.152	3.664	-0.544
	[0.756]	[0.871]		[0.930]	[2.595]	[2.290]
Time	0.018	0.086	0.089***	0.084	0.229*	0.087
	[0.032]	[0.051]	[0.031]	[0.055]	[0.117]	[0.071]
Time squared	-0.004**	-0.005**	-0.005***	-0.005**	-0.008*	-0.007*
	[0.002]	[0.002]	[0.001]	[0.002]	[0.004]	[0.003]
Time cubed	0.000***	0.000***	0.000***	0.000**	0.000	0.000*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk			-0.006	-0.006		
			[0.009]	[0.009]		
Legal Age		-0.034	-0.017	-0.010	-0.712	0.092
		[0.121]	[0.089]	[0.105]	[0.468]	[0.149]
LN Real Income		0.302	0.308	0.284	-0.840	0.206
		[0.361]	[0.326]	[0.402]	[0.867]	[0.331]
Father's Education		0.012	0.010	0.010	-0.011	0.011
		[0.010]	[0.011]	[0.011]	[0.017]	[0.006]
Mother's Education		0.000	-0.001	-0.000	0.019	-0.009
		[0.015]	[0.015]	[0.015]	[0.020]	[0.008]
Mother's Employment		-0.035***	-0.032**	-0.032**	-0.028	-0.009
		[0.012]	[0.013]	[0.013]	[0.017]	[0.012]
R-sq	0.620	0.750	0.755	0.755	0.431	0.331
F-Statistic	11.443	7.654	7.868	6.779	1.935	1.263
N	33	33	33	33	33	33

* p<0.1, ** p<0.05, *** p<0.01

Note: Newey-West (1987) t-statistics are given in brackets. Intercepts are not shown.

[a] Regression based on a subsample of nonwhite high school seniors who consider binge drinking a great risk.

[b] Regression based on a subsample of nonwhite high school seniors who do not consider binge drinking a great risk.

Table 34 - Predicted Change in Cigarette Consumption

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: change in consumption predicted by the model between 1992-1997						
Observed change in smoking among high school seniors = 8.94						
Real Price	1.16	1.16		1.03	1.00	0.72
Risk			0.13	0.05		
Observed change in smoking among male high school seniors = 8.05						
Real Price	1.16	1.16		1.11	1.27	1.00
Risk			0.22	0.10		
Observed change in smoking among female high school seniors = 9.45						
Real Price	1.12	1.16		0.91	0.86	1.03
Risk			0.05	0.03		
Observed change in smoking among white high school seniors = 10.71						
Real Price	1.36	1.40		1.16	1.05	1.09
Risk			1.10	0.39		
Observed change in smoking among nonwhite high school seniors = 6.82						
Real Price	0.89	0.86		0.73	0.64	0.84
Risk			0.46	0.27		
Panel B: change in consumption predicted by the model between 1997-2008						
Observed change in smoking among high school seniors= -16.14						
Real Price	-11.62	-11.72		-10.31	-10.03	-7.22
Risk			-4.35	-1.57		
Observed change in smoking among male high school seniors = -15.80						
Real Price	-11.72	-11.62		-11.15	-12.75	-10.03
Risk			-1.71	-0.76		
Observed change in smoking among female high school seniors = -16.05						
Real Price	-11.25	-11.72		-9.19	-8.62	-10.31
Risk			-4.41	-2.18		
Observed change in smoking among white high school seniors = -18.18						
Real Price	-13.69	-14.06		-11.62	-10.59	-10.97
Risk			-5.65	-1.98		
Observed change in smoking among nonwhite high school seniors = -1.96						
Real Price	-9.00	-8.62		-7.31	-6.47	-8.44
Risk			-1.72	-1.02		

Note: Predicted changes in cigarette consumption in columns 5 and 6 are based on high school seniors that consider smoking a great risk and those who do not, respectively. This applies for the whole sample and each subsample. Column 1 does not include the additional covariates.

Table 35 - Predicted Change in Alcohol Consumption

Change in consumption predicted by the model between 1989-1992						
Observed change in drinking among high school seniors = -5.95						
	(1)	(2)	(3)	(4)	(5)	(6)
Real Price	-2.20	-1.67		-1.55	-1.15	-1.31
Risk			-0.66	-0.59		
Observed change in drinking among male high school seniors = -6.48						
Real Price	-2.50	-1.89		-1.84	-0.71	-2.37
Risk			-0.20	-0.15		
Observed change in drinking among female high school seniors = -5.15						
Real Price	-1.81	-1.24		-1.35	-0.94	0.07
Risk			-0.64	-0.69		
Observed change in drinking among white high school seniors = -6.79						
Real Price	-2.23	-1.64		-1.53	-1.36	-1.18
Risk			-0.85	-0.81		
Observed change in drinking among nonwhite high school seniors = -3.50						
Real Price	0.23	0.00		-0.09	0.96	-0.56
Risk			-0.45	-0.45		

Note: Predicted changes in alcohol consumption in columns 5 and 6 are based on high school seniors that consider drinking a great risk and those who do not, respectively. This applies for the whole sample and each subsample. Column 1 does not include the additional covariates.

Table 36 - Predicted Change in Excessive Alcohol Consumption

Change in consumption predicted by the model between 1989-1992						
Observed change in binge drinking among high school seniors = -5.34						
	(1)	(2)	(3)	(4)	(5)	(6)
Real Price	-5.09	-3.75		-3.01	-1.94	-1.83
Risk			-2.81	-1.43		
Observed change in binge drinking among male high school seniors = -5.86						
Real Price	-5.32	-3.44		-2.77	-1.35	-1.85
Risk			-1.43	-0.79		
Observed change in binge drinking among female high school seniors = -4.81						
Real Price	-4.60	-3.33		-3.02	-2.06	-2.56
Risk			-2.03	-1.24		
Observed change in binge drinking among white high school seniors = -5.76						
Real Price	-5.84	-4.65		-3.52	-4.04	-0.41
Risk			-4.08	-1.92		
Observed change in binge drinking among nonwhite high school seniors = -6.20						
Real Price	-0.19	-0.03		-0.17	-1.05	-1.24
Risk			-0.44	-0.46		

Note: Predicted changes in excessive alcohol consumption in columns 5 and 6 are based on high school seniors that consider binge drinking a great risk and those who do not, respectively. This applies for the whole sample and each subsample. Column 1 does not include the additional covariates.

Figure 1 - Real Cigarette and Alcohol Prices, 1976-2008

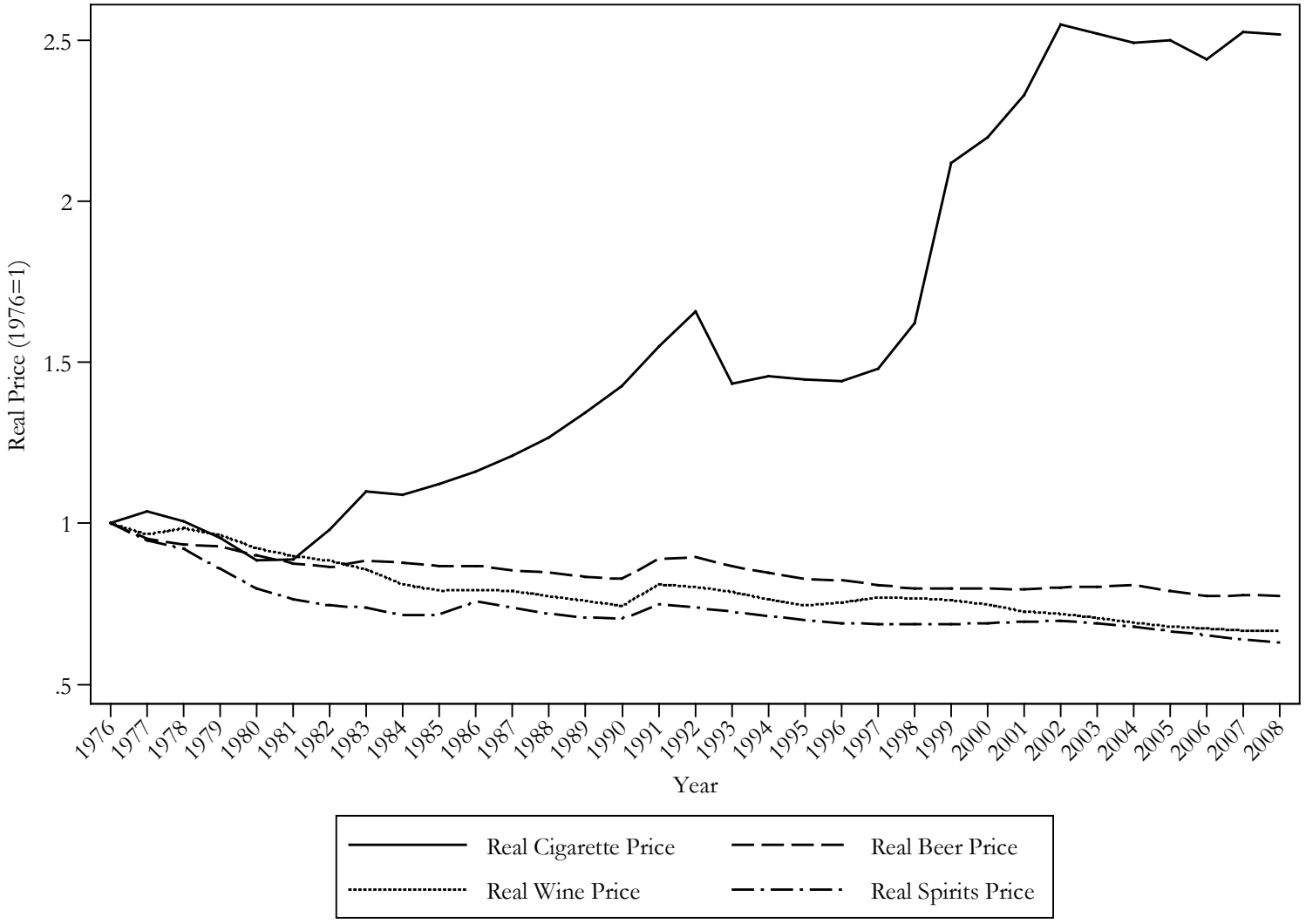


Figure 2 - Participation Rates for Smoking, Drinking, and Binge Drinking Among High School Seniors, 1976-2008

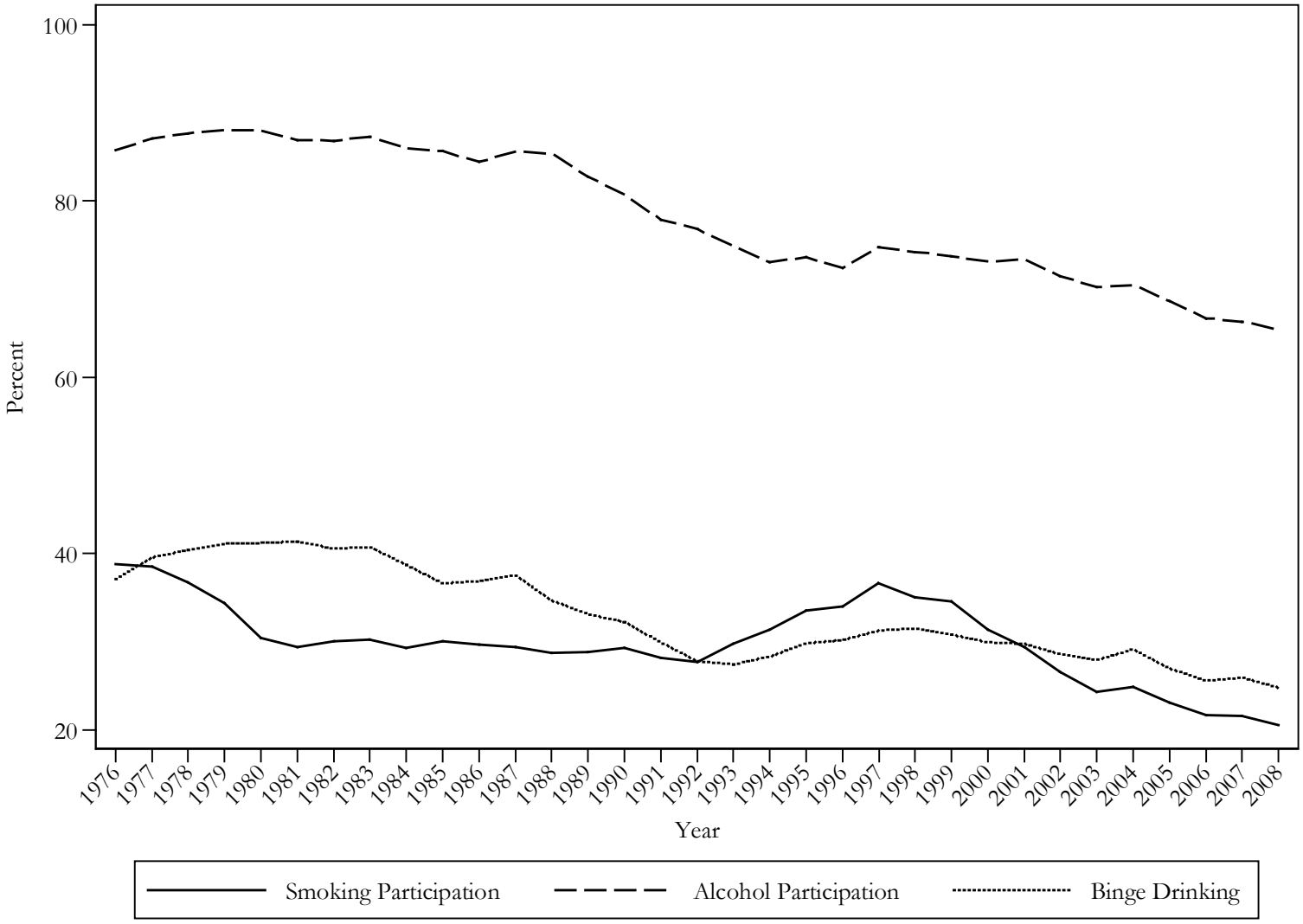
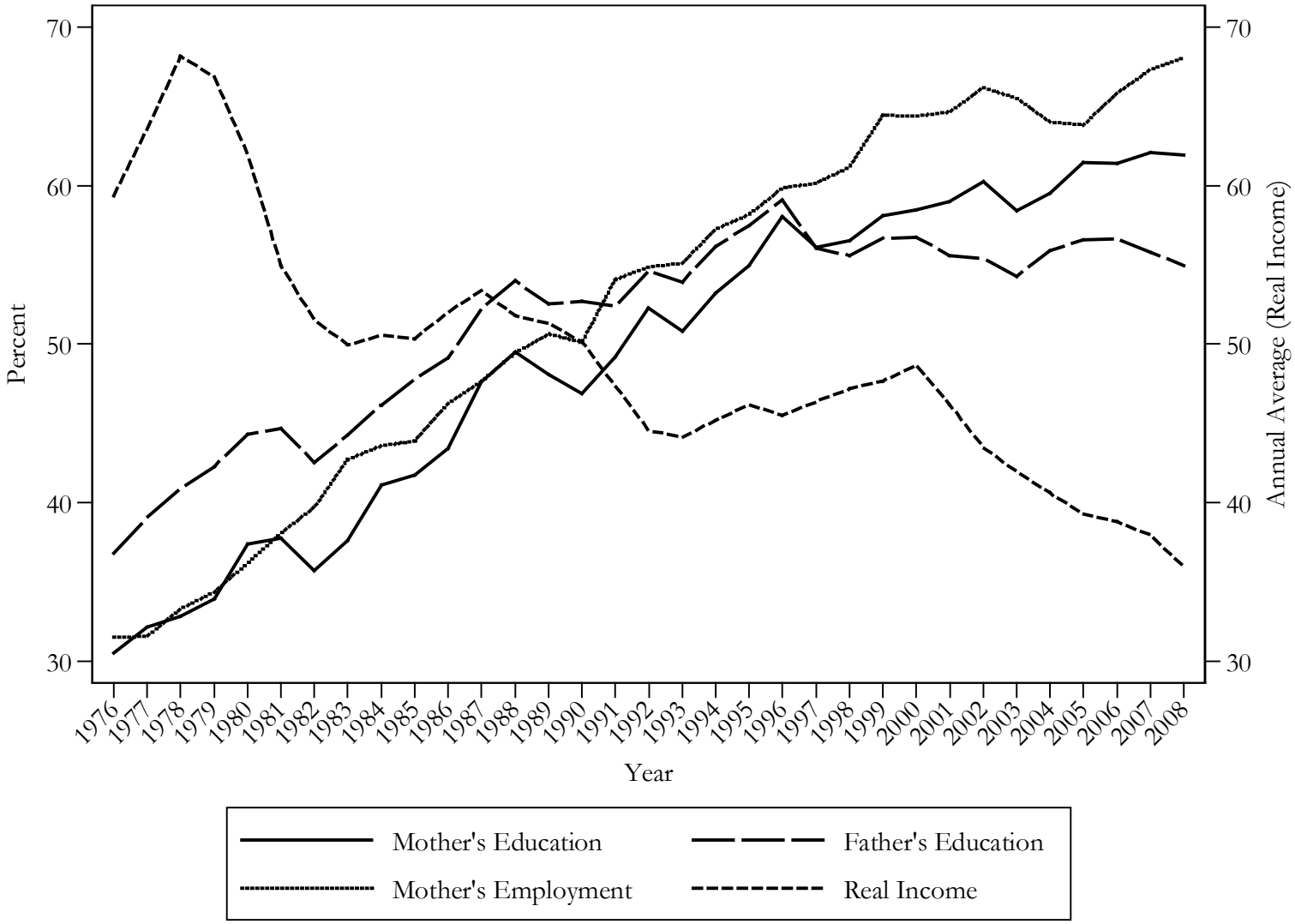


Figure 3 - Percentage of High School Seniors Who Consider Smoking, Drinking, or Binge Drinking a Great Risk, 1976-2008

Figure 4 - Time Trends for the Additional Covariates, 1976-2008



APPENDIX

A harmful good has a full price π such as:

$$\pi = p + h$$

where p is the money price and h is the expected monetary value of the harm associated with the consumption of this harmful good. Then, the demand function for this harmful good is

$$x = f(\pi)$$

$$= f(p + h)$$

If ε is the price elasticity of demand for $x$with respect to π, then

$$\varepsilon \equiv \frac{\partial x}{\partial \pi}\frac{\pi}{x}$$

$$\equiv \frac{\partial x}{\partial (p + h)}\frac{(p + h)}{x}$$

and e is the price elasticity of demand$x$ with respect to p, then

$$e \equiv \frac{\partial x}{\partial p}\frac{p}{x} = \frac{\partial x}{\partial (p + h)}\frac{\partial (p + h)}{\partial p}\frac{p}{x}$$

Multiplying the right hand side of the equation by $(p + h)/(p + h)$ and rearranging yields:

$$e = \frac{\partial x}{\partial (p + h)}\frac{(p + h)}{x}\frac{\partial (p + h)}{\partial p}\frac{p}{(p + h)}$$

where $p/(p + h)$ is the share of money price with respect to the full price of the good (let's call it k). Then, if h is held constant, $\partial (p + h)/\partial p = 1$, so

$$e = \varepsilon k$$

If ε is independent of x, an increase in k will increase e in absolute value. In other words, when the price elasticity of demand of a harmful good with respect to its full price does not depend

on the amount consumed, consumers that ignore or strongly underestimate the harm associated with the consumption of a harmful good will have a more elastic demand function.

Assuming a demand function for a harmful good with the following specification:

$$\begin{aligned}\ln x &= \alpha + \varepsilon \ln \pi \\ &= \alpha + \varepsilon \ln(p + h) \\ &= \alpha + \varepsilon(\ln(p + h) + \ln p - \ln p) \\ &= \alpha + \varepsilon \ln \frac{p + h}{p} + \varepsilon \ln p\end{aligned}$$

where ε is less than 0 and the price elasticity of demand for x with respect to π. Since proxies for h are imperfect or not usually available, estimating $\ln x$ while omitting h (and therefore making $\ln((p + h)/p)$ equal to 0) yields

$$\ln x = a + b \ln p$$

According to omitted variable formula, the expected value of b is

$$E(b) = \varepsilon + \varepsilon c$$

where c is the coefficient of $\ln p$ in the following regression:

$$\ln \frac{p + h}{p} = c \ln p$$

Then,

$$c \equiv \frac{\partial \ln \left({}^{p + h}/_{p} \right)}{\partial \ln p} = \frac{1}{\left({}^{p + h}/_{p} \right)} \frac{\partial \left({}^{p + h}/_{p} \right)}{\partial \ln p}$$

$$= \frac{1}{\left(p + h/p\right)} \left(\frac{\partial \ln p}{\partial \left(p + h/p\right)} \right)^{-1}$$

$$= \frac{p}{p+h} \left(\frac{1}{p} \frac{\partial p}{\partial \left(p + h/p\right)} \right)^{-1}$$

$$= \frac{p}{p+h} p \frac{\partial \left(p + h/p\right)}{\partial p}$$

$$= \frac{p}{p+h} p(-hp^{-2})$$

$$= -\frac{h}{p+h}$$

Since $k = p/(p+h)$:

$$c = \frac{-h + p - p}{p+h}$$

$$= \frac{p}{p+h} - 1$$

$$= k - 1$$

Then,

$$E(b) = \varepsilon + \varepsilon(k-1)$$

$$= \varepsilon k$$

$$= \left(\frac{\partial x}{\partial \pi} \frac{\pi}{x}\right) \left(\frac{p}{p+h}\right)$$

If $h = 0$ due to unreliable proxies for the expected monetary value of the harm associated with the consumption of harmful good, then

$$E(b) = \left(\frac{\partial x}{\partial p}\frac{p}{x}\right)$$

$$= e$$

which is the price elasticity of demand with respect to money price.

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