Final Research on Underage Cigarette Consumption

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Abstract Over decades, we witness a significant increase in amount of research on cigarette consumption. Among these researches, many are focusing on the effects of cigarette prices on the cigarette consumptions among adults and adolescents. A majority of these researches reach conclusions such as the prices of cigarettes are significant determinants of its purchases.

While many economic researchers has established many economic relationships between the good and its various determinants, this paper will examine the association between the age and tobacco use. It provides a comprehensive review of the data on cigarettes consumption levels at different age in the United States of America. It hypothesizes that smoking is more common and prevalent in the older age groups where accessibility of tobacco is relatively high and easy.

In modern times, the social gradient of smoking is well established for our citizens: smoking has been widespread for several decades and its health-retarding effects can also be measured reliably. Thus, throughout our times, many researchers, scientists and academic elites have attempted to understand the motivations and rationale behind the consumption of cigarettes. What are the determinants? What are its impacts on society besides its hazardous effect to our health? As a lot of researches have been done on the relationship between health, prices, elasticity and income, our group will attempt to delve into the relationship between consumption of cigarettes and underage consumers in the United States. We aim to construct a model via using US country-level data of underage tobacco consumption and see an indication of significant association between the older age group and the higher number of healthy-damaging behavior in the form of cigarette consumption.

Introduction

It is hard to deny that the prevalence of cigarette consumption among American teenagers has been rising since the 1990s. In fact, the proportion of 8th and 10th graders as current cigarette smokers has increase dramatically between the years 1991 and 1996, according to the Monitoring the Future Surveys (MTFS). Similarly, the proportion of current smokers in the 12th grade has also increased significantly between the years 1992 and 1994.[1]

This phenomenon has caused a great deal of concern among public healthy advocates as well as parents of these young smokers. As a result, many researchers have looked into this upward trend of cigarette smoking through investigating its relationship with factors including effects of prices, taxes, income and policy as well as many other economic and noneconomic factors. As many people have already known, the varied health related indications of consumption of cigarettes include life expectancy, infant mortality, HIV infection rates, robbery rates, low birth weight, and the list goes on and on. However, as the endless health-retarding effects of tobacco consumption have been made clear to the public, the consumption of cigarettes has yet to undergo any dramatic decrease in our society. In fact, we often see youngsters these days having cigarettes between their fingers. Another interesting fact our team found out through extensive research is that while numerous determinants as mentioned above have been studied widely, age does not seem to have been considered as a major variable that carry big significance. Therefore our team believes it would be useful and enlightening to study the association between age of the underage population and cigarette smoking after taking into consideration standard determinations of smoking. We will start our research and examination by using US country-level data for underage tobacco consumption, cigarettes price per pack, Trends in harmfulness of Drugs as perceived by different graders (raging from Gr.8 to Gr.12) and trends in availability of drugs as perceived by different graders (raging from Gr.8 to Gr.12) income level and cigarettes consumption.

As we all know, because cigarette is an age conscious consumer good, age thus is a major determinant of its consumption. Domestic (within United States) comparisons and data show a strong association between the age of the underage consumers and the level of consumption. Within the United States for which data exists, lower age groups embody lower volume of tobacco consumption, at any given age, than do the older age groups. Therefore, we know that age affects cigarettes consumption

In addition to the age determinants, eighth, tenth and twelfth graders will be our focus for this research paper. The differences in tobacco consumption levels between different age groups will be discussed and used as evidence to test our hypothesis. We will close with a short discussion of the possible reasons why the relatively older underage individuals smoke more than the younger ones. Finally, if our hypothesis is proven right, the paper will conclude that the health-retarding behavior are concentrated more heavily on the elder underage group in the United States. If other wise, the paper will reject the proposed hypothesis and explain why the hypothesis is to be rejected..

We believe that by understanding the initiation of the youth smoking will help the society to take actions in improving the current situation. Through investigating the determinants of smoking ignition among underage smokers, we will be able to understand the factors that affect youth's decisions to start smoking.

[1] "University of Michigan Institute for Social Research." University of Michigan Institute for Social Research. N.p., n.d. Web. 6 Dec. 2013.

Literature Review

Underage crime rate, drug usage and cigarette consumption have always been the concerns of our modern society. Many research have shown a strong association between the age indicators and the consumption of tobacco consumption. In "Key Findings on Adolescent Drug Use" by Lloyd D. Johnson, the researchers established their findings regarding to illicit drug, smoking, and drinking problems among youth population. They related the perceived effect of these drugs by youth population to the actual usage of drugs and concluded that both 8th graders and 10th graders are showing evidences of a slight decrease in smoking since mid-1990s with the increase in perceived risk. Therefore, proving a positive relationship between perceived riskiness by the underage drug users and their actual consumptions. Similarly in the article of "Teen smoking continues to Decline" published by Institute for Social Research, researchers also found a statically significant drop in the teenage cigarette consumption.

The Model

a) The Variables

In our model, have specified that year and price of cigarette per pack are two of the main variables. And within the underage group, we have divided to three parts- grade 8, grade 10 and grade 12, because we consider teens who are under grade 8 (correspond to Age 12) are hard to choose to smoke themselves. Furthermore, we will also includes Trends in Harmfulness of Drugs as Perceived by different grade level of teenagers. Lastly, Trends in Availability of Drugs as Perceived by different groups of teens are also important to the underage smoke rate. We hypothesize that if there is a high availability of drugs to teens which means they are under more exposure, one may expect positive relation between this trend in availability and underage cigarette consumption.

b) The Equation

$L(CONSi) = \alpha 1 + \alpha 2L(Grade\ 8) + \alpha 3L(Grade\ 10) + \alpha 4L\ (Price) + \alpha 5L(TIH) + \alpha 6L(\ TIA) + \alpha 7L(YEAR^*) + ui$

CONSi= portion of investigated entity consuming cigarettes

Grade 8 and Grade 10= dummy variables coded 0 and 1 (0 = no, 1=yes)

Price = average price of cigarettes

TIH= portion of investigated entity considering cigarettes to be harmful

TIA= percentage of investigated entity considering cigarette to be easy to get

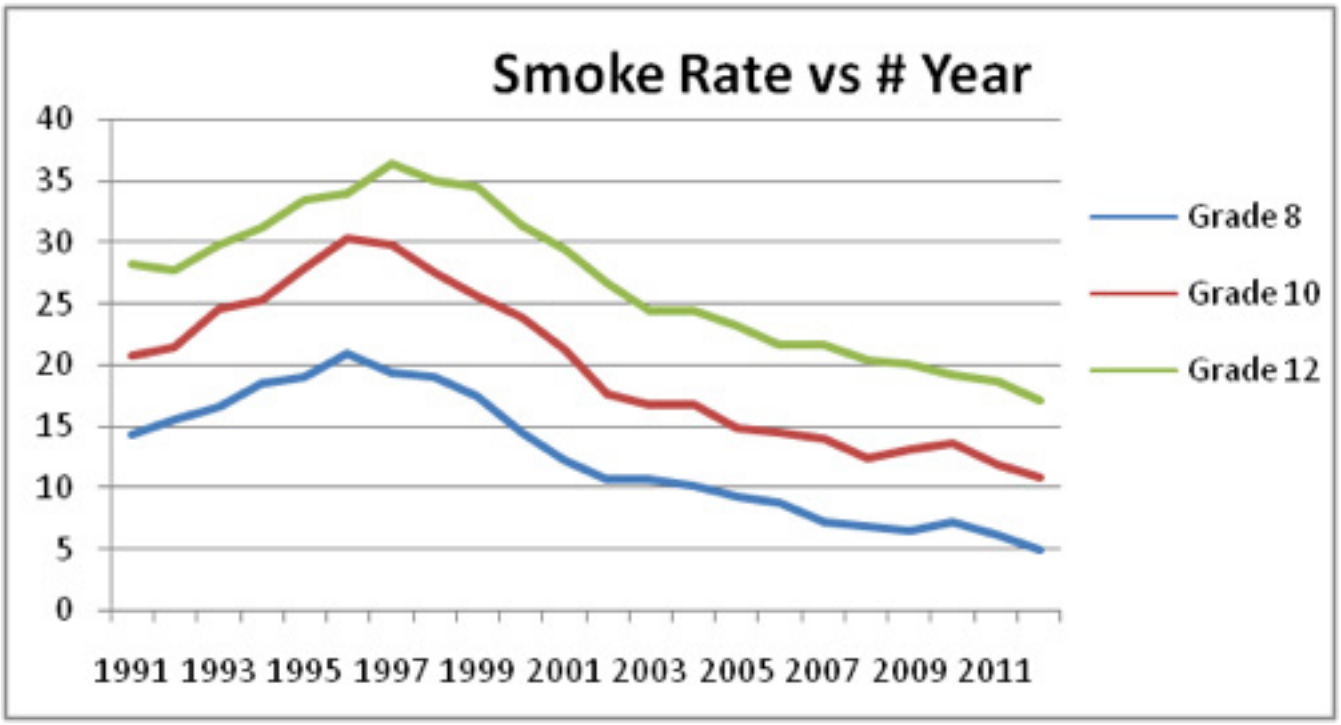
Year*=the number of year-1990

Ui= residual

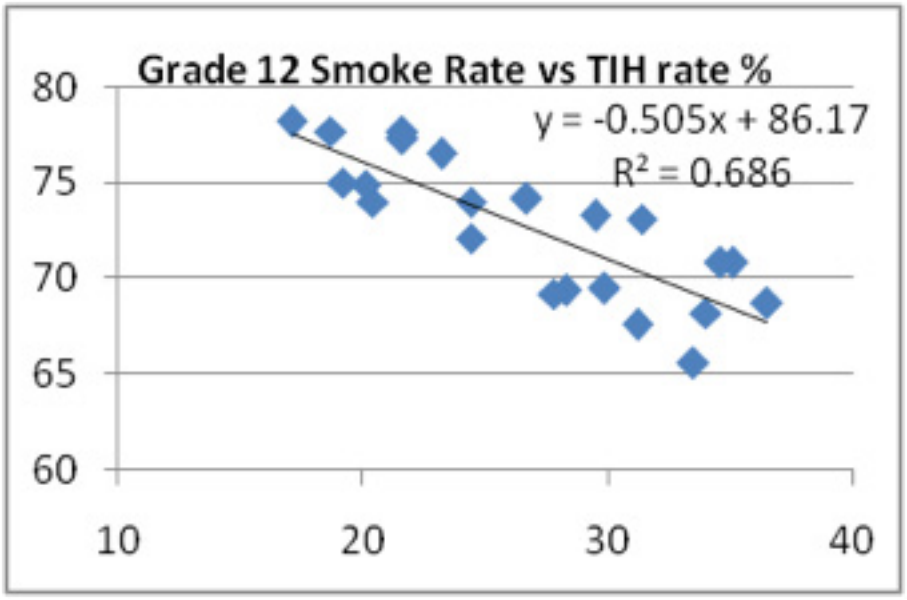
Data

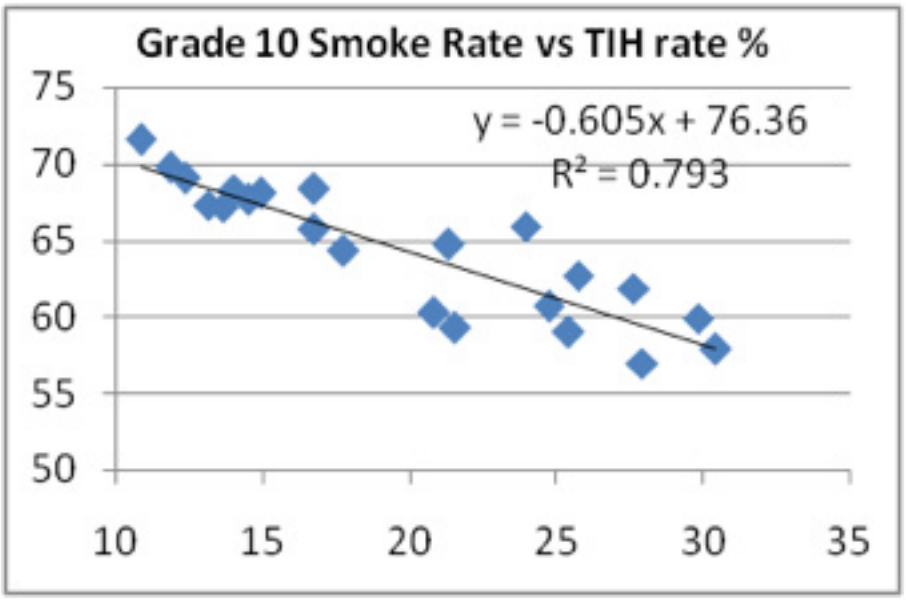
The data from Table 1 represents the values for the independent variables we chose. Those data are collected by the University of Michigan Institute for social research. it consists of over 45,000 students for 395 secondary schools and it has lasted for over 20 years since 1991.[2] Out data set contains the data collected since 1991 to 2012 and is divided by 3 age groups, which include the 8th, Grade, the 10th Grade and the 12th Grade. We also includes the statistic information: Trends in Harmfulness of Drugs and Trends in Availability of Drugs, those two kinds of variable are all extracted from the original data source by Johnston, Lloyd. For the average price of cigarette, we extracted the number from the report of "The Economics of Tobacco Control" written by Frank J. Chaloupka. We will analyze each of the factors below and compare them with Smoke Rate-CONSi separately.

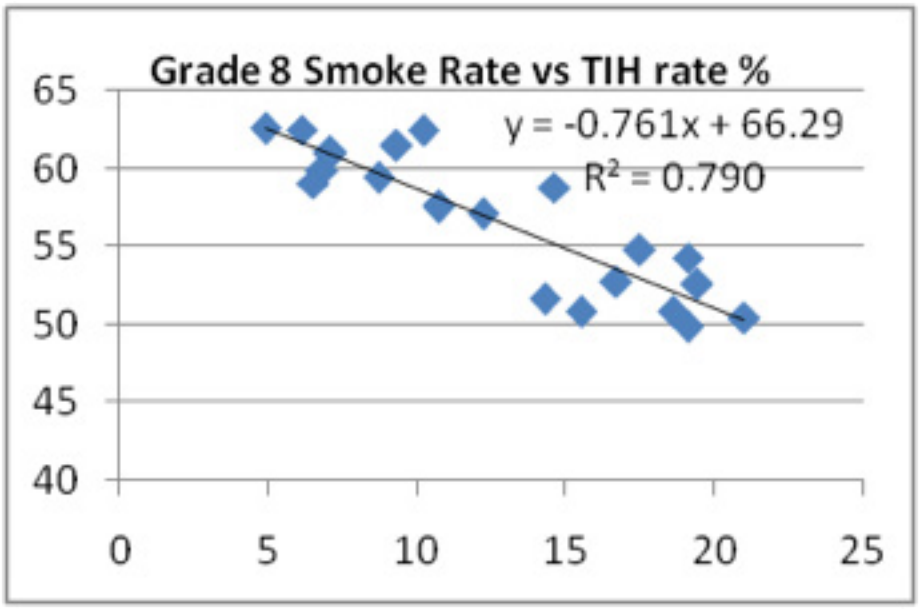
[2] Johnston, Lloyd D., Patrick M. O'Malley, Jerald G. Bachman, and John E. Schulenberg. "Key Findings on Adolescent Drug Use." (n.d.): 8-9.Http://www.monitoringthefuture.org/. Web.



As it is shown in the graph above, we observed there is a negative correlation between number of year and smoke rate, and there is a increasing trend as grade goes up. So we expected there is a negative sign for the coefficient of the variable YEAR*.



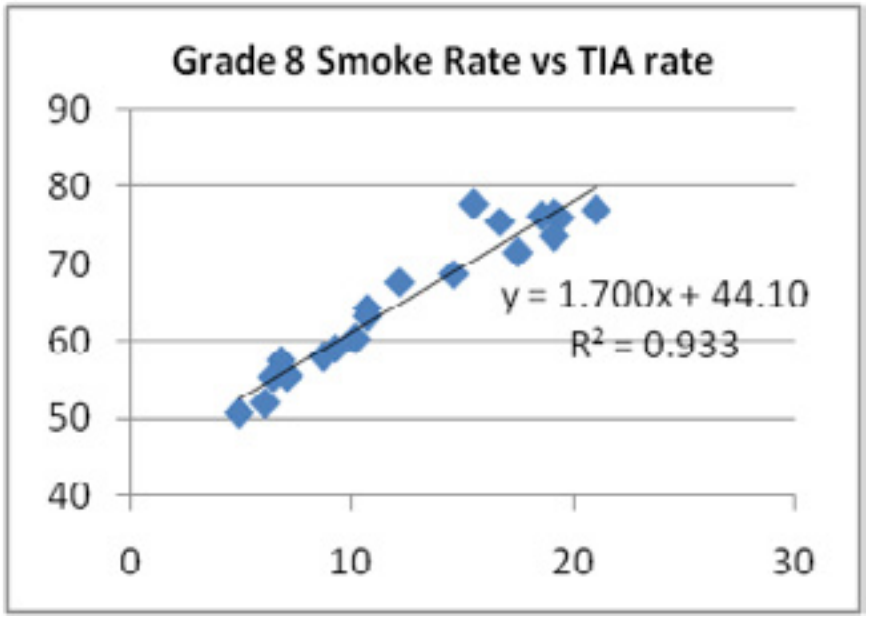


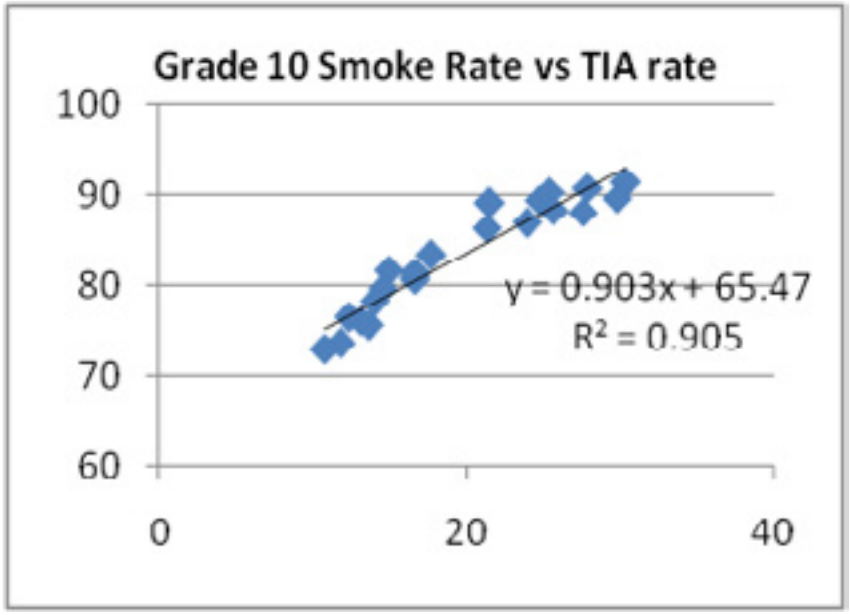


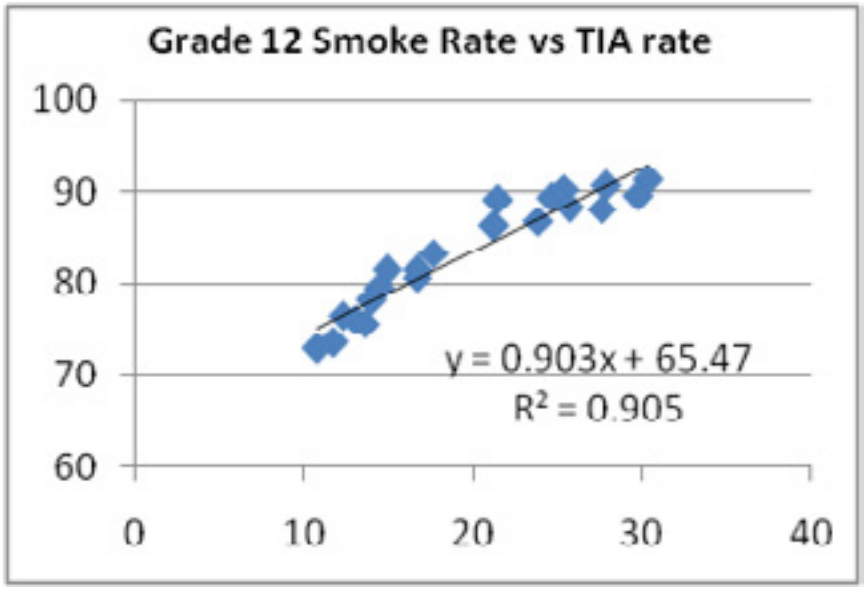
From these three graphs above, it can be observed that there is also a negative correlation between Smoke Rate and Trends in Harmfulness of Drugs. And as knowledge about harmfulness increase as the grade level goes up, the smoke rate decrease. Therefore, we expected that there would be a negative sign for the coefficient of Trends in Harmfulness of Drugs.

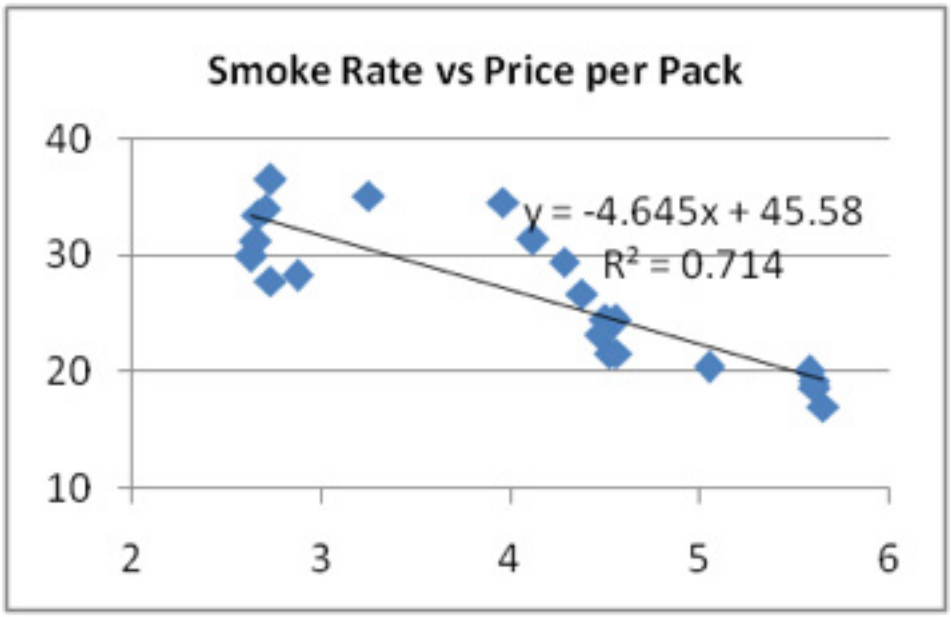
From these three graphs on the following page, it can be observed that there is also a negative correlation between Smoke Rate and Trends in Availability of Drugs. And as the availability of drug increase as the grade level goes up, the smoke rate also goes up. Therefore, we expected that the sign of the coefficient of Trends in Availability of Drugs would be positive.

It can be observed from the graph of Smoke Rate vs Cigarette price that as the price of cigarette goes up, the smoke rate goes down. So we expected there would be a negative coefficient for the variable Price per pack.


Grade 8 Smoke Rate vs TIA rate
90
80
70
60
50
40
0
10
20
30
y = 1.700x + 44.10
R² = 0.933


Grade 10 Smoke Rate vs TIA rate
100
90
80
70
60
0
20
40
y = 0.903x + 65.47
R² = 0.905


Grade 12 Smoke Rate vs TIA rate
100
90
80
70
60
0
10
20
30
40
y = 0.903x + 65.47
R² = 0.905



Dependent Variable: CONSI
Method: Least Squares
Date: 12/08/13 Time: 20:14
Sample: 1 66
Included observations: 66

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-415.8242	397.7721	-1.045383	0.3001
PRICE	-3.426155	1.193591	-2.870461	0.0057
GRADE10	-8.412972	2.498397	-3.367348	0.0013
GRADE8	-15.04285	5.341920	-2.816002	0.0066
TIA	0.216556	0.107754	2.009729	0.0490
TIH	-0.436082	0.215805	-2.020724	0.0479
YEAR	0.233753	0.200754	1.164374	0.2490

R-squared	0.904865	Mean dependent var	19.70303
Adjusted R-squared	0.895190	S.D. dependent var	8.230001
S.E. of regression	2.664409	Akaike info criterion	4.897845
Sum squared resid	418.8454	Schwarz criterion	5.130081
Log likelihood	-154.6289	Hannan-Quinn criter.	4.989613
F-statistic	93.52849	Durbin-Watson stat	0.695711
Prob(F-statistic)	0.000000		

To test the significance of each variable independently, we have run OLS six times and the regression results, which are listed in the Appendix, are all significant at 1%, 5%, 10% levels.

Regression Results

At the first time, we have tested the model uses the variable year as the actual year rather "the number of the year-1990".

As the result shown in table in we found that there is a huge std-error in the intercept parameter C. After experiments, we consider the huge variability may be due to the large numbers appeared in the equation, such as the number of year. So we use the variable YEAR* calculated by "number of year-1991") to substitute the original variable-YEAR. So we ran our second equation.

From the Table2, it can be observed that the std.error of the intercept get significantly decreased.

In this regression result, the variable-PRICE, dummy variable GRADE8 and GRADE10 and the intercept- C are significant at 1% level. The variable Trend in Harmfulness of Drugs and the variable Trend in Availability of Drugs are significant at 5% level. And, the variable- YEAR* is not significant. However, from the graph which shows the relation between number of year and CONSi, which shows a clear negative relation, so we still decide to add this variable in our model.

Using the method of ordinary least squares we are able to obtain the following regression model:

L(CONSi) =49.34 -15.04L(Grade 8)-
8.41L(Grade 10) -3.43L (Price) -0.44L(TIH) +
0.22L(TIA) + 0.23L(YEAR*) + ui

Dependent Variable: CONSi
Method: Least Squares
Date: 12/08/13 Time: 20:01
Sample: 1 66
Included observations: 66

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49.34449	20.50730	2.406192	0.0193
PRICE	-3.426155	1.193591	-2.870461	0.0057
GRADE10	-8.412972	2.498397	-3.367348	0.0013
GRADE8	-15.04285	5.341920	-2.816002	0.0066
TIA	0.216556	0.107754	2.009729	0.0490
TIH	-0.436082	0.215805	-2.020724	0.0479
YEAR*	0.233753	0.200754	1.164374	0.2490

R-squared	0.904865	Mean dependent var	19.70303
Adjusted R-squared	0.895190	S.D. dependent var	8.230001
S.E. of regression	2.664409	Akaike info criterion	4.897845
Sum squared resid	418.8454	Schwarz criterion	5.130081
Log likelihood	-154.6289	Hannan-Quinn criter.	4.989613
F-statistic	93.52849	Durbin-Watson stat	0.695711
Prob(F-statistic)	0.000000		

Table 2

Heteroskedasticity Test: White

F-statistic	2.177296	Prob. F(24,4
Obs*R-squared	36.98283	Prob. Chi-S
Scaled explained SS	26.34191	Prob. Chi-S

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/08/13 Time: 20:39
Sample: 1 66
Included observations: 66
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Err
C	-8250.887	3933.1
PRICE	535.5492	303.45
PRICE^2	20.69088	15.449
PRICE*GRADE10	-66.42960	36.559
PRICE*GRADE8	-140.4308	78.396
PRICE*TIA	-1.565882	1.6184
PRICE*TIH	-6.497115	3.5077
PRICE*YEAR1	-7.220135	4.0228
GRADE10	484.4501	802.92
GRADE10*TIA	-3.984351	5.3458
GRADE10*TIH	1.952822	7.8178
GRADE10*YEAR1	-4.394067	7.7102
GRADE8	2718.088	1757.4
GRADE8*TIA	-22.71116	13.663
GRADE8*TIH	-4.547699	16.034
GRADE8*YEAR1	-14.48360	16.533
TIA	119.9538	52.779
TIA^2	-0.416549	0.2097
TIA*TIH	-0.473788	0.2797
TIA*YEAR1	-0.689295	0.4093

Correlation Table

CONSI	1.000000	-0.615821	0.006428	-0.619285	0.894776	0.2
PRICE	-0.615821	1.000000	-6.66E-18	-6.66E-18	-0.205580	0.2
GRADE10	0.006428	-6.66E-18	1.000000	-0.500000	0.143824	-0.0
GRADE8	-0.619285	-6.66E-18	-0.500000	1.000000	-0.322520	-0.2
TIA	0.894776	-0.205580	0.143824	-0.322520	1.000000	0.3
TIH	0.280659	0.283905	-0.017495	-0.224995	0.314651	1.0

When using the White test we find again that the p-value and chi-squared value are insignificant on the 95%, 99% confidence interval. We do not reject the null hypothesis that this regression is homoskedastic and we can conclude that this regression does not feature heteroskedasticity.

From the correlation metrics table, it can be observed that excluded the variable- year*, there is considerable low correlation between different variable, which means there is no significant correlation problem within the model.

Summary and Conclusion

From our model through which we ran the regression, we are able to reach the following conclusion:

1. Our regression model is
   L(CONSi) =49.34 -15.04L(Grade 8)-8.41L(Grade 10) -3.43L (Price) -0.44L(TIH) + 0.22L(TIA) + 0.23L(YEAR*) + ui
2. The price of cigarette has a strong effect on the teenagers' consumption rate. As price goes higher, the underage smoke rate goes down.
3. The underage smoke rate is highly correlated with the number of the year. As years go up, the consumption rate goes down.
4. Higher grades get higher consumption rate, from 8th grade to 12 grade.
5. Higher rate of perception of the harmfulness of cigarette, the lower consumption rate.
6. Higher rate of availability to drugs, the higher consumption rate.

Through the conclusion, we see a matching result with the former research done by Lloyd D. Johnson

References:

"University of Michigan Institute for Social Research." University of Michigan Institute for Social Research.

Johnston, Lloyd D., Patrick M. O'Malley, Jerald G. Bachman, and John E. Schulenberg. "Key Findings on Adolescent Drug Use." (n.d.): .Http://www.monitoringthefuture.org/. Web.

Chaloupka, Frank J. "The Economics of Tobacco Control." : .Www.bridgingthegapresearch.org. Web.