Senior Project

Department of Economics

PEER EFFECTS AND CIGARETTE USE AMONG COLLEGE STUDENTS

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Abstract: This study seeks to add to the collegiate cigarette demand literature by measuring the magnitude of peer effects upon individual cigarette use. The study employs data from the 2001 Harvard School of Health College Alcohol Survey to construct this peer effect measure and to study the effect of other variables upon a university student's decision to smoke. The main finding of this paper is that *moving a student from a university where no students smoke to an institution where 25 percent of the population smokes increases that student's probability of smoking by 20.94 percent*. College students with high grade point averages are also found less likely to smoke. This finding coincides with human capital theory which states persons who make positive investments in one aspect of themselves (education) are likely to make similar investments in other aspects (health). The results of this paper suggest the potential for universities to promote student-led smoke free organizations and stress the importance of academics through heightened scholarships and other rewards for successful students.

Keywords: peer effect, cigarette, college

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Peer Effects and Cigarette Use Among College Students
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I. Introduction

It is a well-documented fact that cigarette consumption imposes a great burden upon society. Smoking will directly contribute to the deaths of over 400,000 people in the United States each year[1]. In addition, it is estimated that approximately 50,000 persons die from second hand smoke related illnesses every year[1]. The annual health care costs of cigarette use are another detriment to society, resulting in $89.0 billion in public and private health care expenditures[1]. Cigarette smoking has also been shown to lower lifetime wages by 4-8 percent (Levine, Gustafson and Velenchik, 1997). Due to the severity of these costs, smoking is an important issue for economists to analyze. Smokers are assumed to be rational consumers even in light of such drastic costs (Becker and Murphy, 1988). Factors such as income, cigarette price and preferences will influence each individual's cost-benefit analysis when deciding whether to smoke.

A significant component of an individual's preferences towards a good are the actions of those around him or her. This influence attributed to an individual's peers is referred to as the peer effect. These peer effects have been the subject of a growing amount of economic research. Studies show that peer effects have a significant impact on a high school student's decision to smoke cigarettes (Kawaguchi, 2003; Powel et al., 2005). Significant peer effects have also been found at the college level with regard to alcohol use and subsequent decreases in GPA associated

[1] ImpacTeen. 2005. Toll of Tobacco in the United States of America

with such consumption (Kremer and Levy, 2003). Peer effects however, have not been analyzed with regards to the smoking behavior of college students. This paper seeks to discover the magnitude of peer effects upon a collegiate student's cigarette consumption level.

Section II of this study details the economic literature on peer effects and as well as other factors influencing cigarette consumption. Section III outlines the methodology of this paper along with the probit model that is used to estimate the probability that a college student will smoke. Section IV presents data and variables from the 2001 Harvard School of Public Health College Alcohol Study. Section V contains the results of the probit model and subsequent sensitivity analysis. Section VI draws the final conclusions derived from this study. Section IX contains tables detailing the results of the various probit models, goodness of fit measures for each model as well as statewide cigarette prices.

II. Background Literature

The literature available on the economics of cigarette smoking is extensive and well fortified. At first glance, smoking may be perceived as a grossly, self-damaging activity. However, Becker and Murphy (1988) show that persons engaged in the consumption of addictive goods such as cigarettes, behave in a rational manner. Under Becker and Murphy's theory, rational behavior is such that smokers will maximize their utility by consuming cigarettes at levels complementary to past levels of consumption (i.e. the more you have smoked in the past, the greater utility to be gained by smoking today). Smokers are assumed to have knowledge of the total costs related to cigarette consumption and will balance these costs against perceived benefits to be accrued from smoking. Rational addiction means that persons who heavily discount future costs, along with those who feel they will be able to easily quit, are more likely to become addicted. Such individuals include adolescents and young adults in high schools and

colleges. Smokers are responsive to permanent price increases because current consumption has also been shown to be complementary to future consumption. The theoretical implications of Becker and Murphy's model have held and been built upon throughout the subsequent literature (Chaloupka, 1991; Becker et al., 1994).

Peer effects have increasingly drawn the investigative eye of researchers because of their consequences upon youth behavior and substance abuse. Manski (1993) finds that the likelihood of an adolescent to engage in any activity is heavily influenced by the actions of that adolescent's peers. When changes arise in the peer group's behavior, such actions are shown to result in similar changes in each individual's behavior. Manski theorizes that the peer effect tends to get masked by other factors affecting individual behavior such price levels. This masking of the peer effect can cause the significance of other variables to be overestimated. Manksi also holds that other unobservable characteristics may play a large part in peer effects and individual behavior. Such factors include parents who have already moved their families to neighborhoods that best fit their child's existing behaviors and personality. In such instances, peer effects would be minimal since the individual's behavior already coincides with those around him.

Sacerdote (2001) continues the investigation of peer effects by examining random housing assignments at Dartmouth College. In his investigation of first year college roommates, he finds significant peer effects on first year grade point average and in decisions to join social groups such as fraternities and sororities. Weaker levels of peer effects are found in other facets of university life such as college major choice. Sacerdote's findings of robust peer effects on first year grade point average hold only at the individual dorm room level and do not extend to the entirety of each dormitory. Peer effects in Greek life housing are found to be present at both the individual room level and at the overall house level. Although the study does not focus on

university substance abuse, the findings of peer effects at the college level show that collegiate students are influenced by their peer's behavior.

Kawaguchi (2003) finds significant peer effects among students in middle school and high school with regards to substance abuse. He shows when peer substance use increases by 10 percent, a fellow high school student is 2-3 percent more likely to engage in substance abuse. Norton et al. (1998) have suggested that this increase is actually closer to 10 percent, significant at 1 percent. Such a strong relationship indicates the magnitude peer effects can have upon levels of adolescent and young adult substance use. Kawaguchi finds that current peer behavior has a greater effect on substance use than the background information of an adolescent's peers. He adds significant findings to the peer effect literature in that the strength of the peer effect is dependant on the demographic group to which the individual youth belongs. Peer effects regarding substance abuse are found to be most robust among white teenagers. Little in the way of peer effects is found among minority groups, namely Blacks, Hispanics and Asians. It is argued that minority teenagers may not derive the same amount of utility from mimicking their peers as white teens do. High school teenagers with both biological parents living together are found to be less responsive to peer effects regarding substance abuse.

Kremer and Levy (2003) extend the literature on substance use and peer effects to college students. Their study specifically focuses on alcohol and grade point average. They find that males, randomly assigned to a roommate who reported drinking the year before entering college, exhibit a ¼ point decrease in first year grade point average compared to males whose randomly assigned roommate did not report any previous drinking. Males who themselves drank the year before entering college, and were randomly assigned to a roommate who reported similar alcohol use, exhibited a ⅔ point decrease in first year grade point average. Kremer and Levy find no

evidence that the roommate's high school grades, admission test scores or family background have significant effects on the other roommate's first year grade point average. The decrease in the individual's grade point average due to the peer effect is thought to be the result of a decrease in study time or lack of concentration during such periods. Drinking roommates may be loud and distracting thereby preventing the study efforts of the other roommate. The drinking roommate may even persuade his living mate to join him in substance use, furthering the loss of study time and sleep.

Powell et al. (2005) incorporate cigarette prices and tobacco control policies into the peer effect model concerning high school substance abuse. They analyze the 1996 Audits & Surveys data of U.S. high school students. They find that peer effects play a significant role in adolescent and young adult substance abuse, as has been previously shown (Kawaguchi, 2003; Kremer and Levy, 2003). Their results hold that moving a student from a high school where no one smokes to a school in which 25 percent of the population smokes increases that student's likelihood of smoking by 14.5 percent. The sensitivity analysis conducted concludes that to leave price measures and tobacco control policies out of the model tends to overestimate the peer effect. They also find that omitting the peer effect measure leads to an overestimation of the effect cigarette prices have on consumption. Other results from their study regarding minorities and peer effects are in agreement with previous studies[2].

Potential sources of endogeneity concerning the peer effect have arisen and been dealt with throughout the literature (Powell et al., 2005; Lundberg, 2005; Norton et al., 1998). Just as the actions of one's peers affect an individual, the actions of the individual affect his or her peer group. Individuals may also behave in the same manner as their peers based on characteristics that are difficult to observe. Students may already have sorted themselves into universities or

[2] Kawaguchi, 2003

social cliques that fit their personalities. The aforementioned studies consider this potential bi-directionality of the peer effect through a two-stage generalized least squares. No significant bias is found when these two sources of endogeneity are considered.

III. Methodology

A. Cigarette demand equation

An examination of the determinants of cigarette consumption is rooted in the economic theory of demand. Assuming that cigarette smokers are rational utility maximizers as shown in the literature[3], the demand for cigarettes is a function of an individuals' income, the price of cigarettes and variables that govern preferences. The economic literature suggests that social interactions among one's peers have significant impacts on a person's preferences. Therefore, in the cigarette demand equation for this study, peer effects will be employed as a measure affecting personal preferences and tastes. Economic theory states that an increase in preferences towards an activity leads to an increase in demand for that activity. Thus, this paper hypothesizes that an increase in peer smoking among college students will result in a higher probability of smoking for the test individual.

B. Probit model

This paper employs a probit model on Equation 1 to estimate the probability of individual smoking by student i at university j. S_{ij} defines a dummy variable that takes the value of 1 for smoker and the value of 0 for non-smoker.

$$S_{ij} = \beta_0 + \beta_1 E_{ij} + \beta_2 X_{ij} + \beta_3 P_{ij} + \beta_4 N_{ij} + \epsilon_{ij} \quad (1)$$

[3] Becker and Murphy, 1988; Chaloupka, 1991; Becker et al., 1994

In Eq. 1, E_{ij} represents the peer effect measure for student i at school j. X_{ij} measures an array of student background characteristics such as the student's year in school, their living arrangements, who they live with, race etc. P_{ij} is a variable measuring the price level of cigarettes in the state of the respondent's university. N_{ij} is a measure of each student's reported annual income level from jobs and other sources such as an allowance from their parents.

C. Sensitivity analysis

Sensitivity analysis will be employed to determine the effect of price levels in the absence of the peer effect measure. The model for this sensitivity analysis is seen in Equation 2.

$$S_j = \beta_0 + \beta_1 X_{ij} + \beta_2 P_{ij} + \beta_3 N_{ij} + \epsilon_{ij} \quad (2)$$

Past studies[4] suggest peer effects may be masked by price increases in addictive substances. Such masking tends to overestimate the effect cigarette price has on consumption. Thus, this study predicts leaving out the peer effect measure will lead to an overestimation of the effectiveness of cigarette price increases. Such analysis is important considering the prevalence of government excise taxes placed upon cigarettes.

D. Edogeneity

In the analysis of Eq.1, two potential sources of edogeneity may arise that could bias the results. Foremost is the fact that the actions of student i may affect his peers just as their behavior influences his own decisions. Second, students may already have self-selected

[4] (Manksi, 1993; Powell et al., 2005) An example of this masking effect is the following: The price of cigarettes increases by 25 percent in a given state. A prominent member of a peer group quits smoking because of this price increase. The rest of the individual's peer group also quits smoking, not because of the price increase, but because smoking is no longer as popular due to their friend quitting. One could easily mistake this decrease in smoking behavior to be attributed to the price increases when in fact the peer effect measure caused the majority of this fall in smoking levels.

themselves into universities that have reputations, be it for partying or sobriety, that coincide with their existing personality. This study will not test these sources of endogeneity for any potential bias. However, previous studies (Powell et al., 2005; Lundberg, 2005, Norton et al., 1998) have shown there to be no endogeneity bias attributed to the bi-directionality of the peer effect variable.

See Section IV: *D. Cigarette price,* for discussion on further sensitivity analysis regarding price levels (Eq.3).

IV. Data

To fuel this study, data from the 2001 Harvard School of Public Health College Alcohol Study (2001 CAS) will be employed. This data set comes from an ongoing survey of over 14,000 students from 119 public and private, four-year universities across the United States. Although the survey primarily focuses on alcohol use and binge drinking, many other high-risk behaviors are analyzed, including individual tobacco use. The 2001 CAS was self-administered and individuals then mailed their completed document back to those who had distributed the questionnaire. All answers were guaranteed to be kept anonymous in order to assure the highest rate of honest reporting by those completing the study. Random sampling was employed, proportionate to the sampling size of each of the 119 schools polled. The restricted version of this data set containing the college_id variable was obtained from the Inter-University Consortium for Political and Social Research (ICPSR). The public version of the 2001 CAS does not contain this variable for privacy reasons. This college_id variable is needed for the construction of an accurate measure of peer effects. For summary statistics describing variables relevant to this study, see Table 1 in Section IX. Appendix of tables.

A. Smoking determinant (S_{ij})

In order to discover individual cigarette use, the 2001 CAS survey sought data on student cigarette consumption over a range of time periods. For the analysis conducted in this paper, a smoker is considered to be anyone who has consumed one or more cigarettes within the last 30 days. The question from the survey reads: "How often, if ever, have you used any of the drugs listed below?" with "cigarettes" being one of the options. Students could have responded that they "Never used', 'Used, but not in the past 12 months', 'Used but not in past 30 days' and 'Used in past 30 days." If the student replied that they had used cigarettes within the last 30 days, they are considered to be a smoker within this study. All other options are classified as non-smoker, thus making S_{ij} a dummy variable.

B. Peer effect measure (E_{ij})

The estimate of peer effects on the probability of student *i* smoking is formulated to be the prevalence of cigarette use at student *i's* university. The college_id variable obtained from the restricted version of the 2001 CAS is used to sort each student based upon what college they attended. Each student was then assigned a peer effect, corresponding to the mean level of cigarette usage at his or her school. Again, the definition of a smoker for this study is anyone who has consumed a cigarette within the last 30 days. The construction of this peer effect is very similar to the estimations used in previous studies[5]. The aforementioned study excludes the behavior of student *i* when constructing this peer effect measure. This paper is statistically unable to remove the behavior of the test individual from the peer effect estimation. That said, with such high numbers of respondents from each university, this statistical deficiency should

[5] Powell et al., 2005

not drastically alter the results. If there were only 5 respondents from student *i's* university then the deficiency would be a greater issue. Considering the number of respondents from each school in the 2001 CAS, the inclusion of the test individual in the peer effect estimation should not be overtly detrimental to this study.

C. Background characteristics (X_{ij})

The 2001 CAS collects numerous pieces of information regarding the respondent's background and socioeconomic status. This data includes the race of the individual, their class year, whom they live with, where they live during the school year and an array of information about their parents. The highest level of parental education will be considered in this study, as will a proxy for levels of parental substance use. The 2001 CAS is primarily focused on alcohol-related behavior and reports the level of parental alcohol consumption. Parental cigarette consumption is not reported. This study does not claim that alcohol use and cigarette use are synonymous. It does assume that alcohol use is an indicator of overall parental attitudes towards general substance use. With such assumptions in mind, parental alcohol use will be used as a proxy of general parental substance use. Grade point average is also considered in this study to test if students who make positive human capital investments in the classroom also make similar investments in their health. Human capital theory suggests that persons who positively invest in one aspect of themselves will invest in other portions of their human capital. This paper predicts that students displaying success in the classroom (an increase in grade point average) will exhibit a decrease in their probability of smoking.

D. Cigarette price (E_{ij})

The price of cigarettes is an integral part of any smoker's demand function. Cigarette control policies have also been shown to be important as well[6]. For the analysis here however, control policies will be dropped from consideration as it can be assumed that nearly all college students are of legal purchasing age. Even if an individual's school prohibits smoking in public buildings, this study assumes that students are free to purchase and subsequently smoke cigarettes outside classrooms, at their apartments or at parties and bars. In conclusion, if a college student wants to smoke, they are assumed to be able to find a place in which to do so.

State cigarette prices from extensive data collected by ImpacTeen are merged with the 2001 CAS. This organization monitors the price and tax levels of cigarettes and issues annual reports detailing the cost of cigarettes. The prices used for this study will be taken from the Tobacco Control Policy and Prevalence Data: 1991-2001. Prices are taken from the 2001 data series to coincide with the survey year from the 2001 CAS. The average price per pack, adjusted for inflation, is the price level chosen for this study.

The manner in which price levels are coded results in a potential source of bias. The variable college_id was simply an arbitrary number differentiating between each school. The name and/or location of each student's university are not explicitly listed in the 2001 CAS. This is why the following method of coding is employed. Respondents in the survey were asked whether the college they currently attend is located in the same state as their senior high school. Students were also asked what state their senior high school was located in. Thus, if the student reported not changing states from high school to college, the state of their current university was determined. Cigarette prices were then assigned to each individual based on what state he or she

[6] Powell et al., 2005

attends school in. This manner of coding excludes from consideration all students who reported changing states while transitioning from high school to college. There are 4,681 such individuals who reported moving out of state for college. Students who leave their home state to attend college are assumed more likely to attend a private institution than those who remain in the same state. Students who attend private institutions are assumed to be more affluent than students who attend public universities. To exclude the individuals who changed states could bias the results towards lower income students and towards students attending public universities. To control for such bias a third probit regression will be run using the following model.

$$S_{ij} = \beta_0 + \beta_1 E_{ij} + \beta_2 X_{ij} + \beta_3 N_{ij} + \epsilon_{ij} \quad (3)$$

Equation 3 does not include the price levels (P_{ij}). Thus, it does not exclude the ~ 4,000 individuals who moved out of state for college. By conducting this estimation, any bias on the model due to low income and/or private schooling will be eliminated.

E. Annual income (N_{ij})

Students were asked to report their weekly income levels from "A job or work" or "Other sources (allowances, etc…)." Respondents were able to choose between ranges of monetary options (e.g. option 1 being: $1-$10, option 2 being: $11-$20 etc…). The mean of each range is used for both job income and other income (e.g. $5.50 was assigned as the value for the response: $1-$10). The two measures, work and allowances, were then combined and multiplied by 52 (weeks) to construct the annual income variable.

V. Results

A. Equation 1: Full probit model

Section IX. Appendix of tables contains the results of the probit model employed to estimate the probability of smoking for student *i* at school *j*. The various goodness of fit measures for all three equations are presented in Table 3. For the full model (Eq. 1), 5212 observations were analyzed. The McFadden's LRI (Pseudo R^2) is 0.0918 and the Likelihood Ratio is reported as 551.14.

The parameter estimate of the peer effect in Eq.1 is quite large (2.8389) and significant at 1 percent. The marginal effect of the peer measure is quite large as well (0.8374). Thus, *moving student i from a university where no students smoke to an institute where 25 percent of the population smokes increases student i's probability of smoking by 20.94 percent.*

Grade point average is considered a barometer of each student's value of his or her human capital. Students who excel in the classroom are assumed to heavily value the future as seen by their investment in education. As the theory predicts, the marginal effect of grade point average is significant and negative regarding the probability that an individual will consume cigarettes. Such results suggest that students who make positive investments in one aspect of their human capital (education) make similar investments in other aspects of themselves (health).

Cigarette prices are not found to be significant in Eq. 1. However, the marginal effects of cigarette price are negative which is what demand theory predicts. Since price is found not significant, this suggests that the demand for cigarettes is relatively inelastic among college students. Cigarette smokers may easily become addicted just like other drug users are prone to become. Thus, smokers will be less responsive to short-term price increases because of the need to satiate their dependency. Smokers may also purchase cheaper brands of cigarettes when the

price level increases. Any compensation for such purchasing behavior is outside the scope of this study.

The annual income levels construed from the survey were tested for their effect on individual collegiate smoking levels. As predicted by demand theory, the marginal effect for income is positive (0.0321) and significant at 1 percent. College students who display an increase in annual income exhibit a complementary increase in their probability of smoking.

Analysis of class year found no significant results across the range of freshman to seniors. Race analysis here coincides with many previous studies in the literature. Eq. 1 finds that African Americans are 21 percent less likely to smoke than whites. Hispanics are found 6 percent less likely to smoke than whites.

Living location and living arrangements are analyzed in the probit model (Eq. 1) for any effects they may have on individual cigarette use. In Eq.1, dormitories are found to have no significance on a university student's smoking levels. Off campus housing is also not found to have any effects on smoking levels. Those living in fraternity and sorority housing are found 7.6 percent more likely to smoke. This finding coincides with previous studies that show peer effects to be significant among Greek life organizations[7]. Students who live with roommates are found 8.6 percent more likely to smoke than those living at home. No significant effect is found among students living alone.

Background characteristics of a student's parents are another component this paper considered in student *i's* smoking decision. This study uses parental alcohol use as a proxy for parental attitudes toward general substance use. Students who reported a father as a moderate or problem drinker are found more likely to smoke by 5 and 4 percent respectively; compared to those whose father was reported as an infrequent drinker. If a student's mother abstained from

[7] Sacerdote, 2001

alcohol use, that student was less likely to smoke by 4.5 percent. No such findings were found regarding students whose father abstained from alcohol use.

The educational levels of a student's parents were also considered in the full probit model (Eq. 1). Students whose parents did not finish high school displayed no significant increases in their probability of smoking. Similar results are found for those students whose parents did finish high school but never went to college. Oddly, student's whose fathers completed a four-year college degree or higher are 2 percent more likely to smoke than students whose parents only had some college experience. No such findings were present for students of a mother who completed a bachelors degree or higher.

B. Sensitivity analysis: Eq. 2: Peer effect omitted

Eq. 2 omitted the peer effect measure to test for an overestimation in the price of cigarettes. Parameter estimates and marginal effects of Eq. 2 may be found in Tables 4 and 6 respectively in Section IX. Cigarette price was previously found insignificant in Eq.1 when the peer effect measure was included in the probit model. When the peer effect measure is left out of the model, cigarette price becomes significant at 1 percent and both the parameter estimate (-0.1331) and the marginal effect (-0.0407) increase compared to their corresponding statistics from Eq.1. Such results coincide with this study's prediction that the omission of the peer effect leads to an overestimation of the cigarette price. These findings reinforce similar results found in the literature[8]. This overestimation is thought to be the result of the aforementioned masking effect that price levels have regarding peer effects. No other drastic changes occur in the model when the peer effect measure is dropped from consideration.

[8] Manksi, 1993; Powell et al., 2005

C. Sensitivity analysis: Eq. 3: Correcting bias for students who moved out of state

As mentioned in the variable description of cigarette price, the coding of this variable could cause Eq. 1 to be biased towards lower income students and towards students likely attending public universities. This bias occurs because students who changed states when going from high school to college were unable to have an accurate cigarette price assigned to them. By eliminating the cigarette price variable, the students who were excluded because of the coding deficiency (4,681 were omitted in total) were again considered regarding the peer effect. This raises the total number of respondents for Eq. 3 to 9,893. The results of Eq. 3 are nearly exact to those of Eq. 1 regarding the marginal effects of the peer measure (Eq. 1: 0.8374 vs. Eq. 3: 0.8238). Such findings show that even with the omission of students who changed states between high school and college, no bias results from such exclusion. Thus, the results of Eq. 1 are not biased towards lower income students and students who likely attend public universities. Just as with the previous model in Section V*: B. Sensitivity analysis: Eq. 2: Peer effect omitted*, no other variables displayed change worth noting.

VI. Conclusions

This paper offers new results in the growing field of peer effect literature. The paramount finding of this study is that the peer effect with regards to collegiate cigarette use is quite robust (Meff: 0.8374). Thus, *moving student i from a university where no students smoke to an institute where 25 percent of the population smokes increase student i's probability of smoking by 20.94 percent.* Students who exhibit positive investments in their human capital at school (increase in grade point average) are found to be less likely to smoke cigarettes. Such a conclusion is in sync with human capital theory. Although enodegeity is not specifically corrected for in this study, previous works show that endogeneity does not lead to bias in the

results. Sensitivity analysis is also conducted and finds that omitting the peer effect measure from the model results in an overestimation of the impact of cigarette price changes. Correction for potential bias due attributed to lower income students and public colleges shows that such bias is non-existent.

Since the collegiate demand for cigarettes is found relatively inelastic, price increases via excise taxation is not likely to cause the government's desired effect. Instead of the government instituting new excise taxation, universities themselves should enact new student-led programs to combat smoking levels. These programs should detail the harms and true costs that cigarettes inflict upon the consumer and to those around them. The presence of prominent members of the student body in these organizations would give rise to positive peer effects, thereby reducing the likelihood of student smoking. Clubs and other student-based organizations should emphasize these factors to all of their members as well.

The finding that students who exhibit an increase in grade point average smoke less, suggests that added emphasis on studies and academic performance could lead to a decrease in smoking levels. This added emphasis could come in the form of an increased number of scholarships for university students who are excelling the classroom. If such scholarship funds are not available, universities could offer free or discounted parking passes to students who make deans list, to name one option. With more students striving to perform well because of these added incentives, social multipliers could arise where these successful students have a positive influence upon their peer's substance use levels.

Further studies could attempt to assign an accurate measure of cigarette prices to those student's who reported moving out of state to attend college. This would increase the number of respondents in the full probit model (Eq.1) and explain more variable variation. The statistical

deficiency in the coding of the peer effect also needs to be corrected even though such revisions should not drastically alter the findings of this study. An investigation into whether students purchase cheaper brands of cigarettes as price levels rise could also be an interesting addition to the peer effect literature.

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IX. Appendix of tables

Table 1: Summary Statistics

Variable	Variable mean	Standard deviation
Smoke in last 30 days	0.264	0.4406
Peer Effect	0.264	0.1031
Grade Point Average	3.241	0.5616
Annual Income	$4,243.30	3171.48
Cigarette Price	$3.631	0.4209
Current school year		
Freshman	0.237	0.4251
Sophomore	0.217	0.4126
Junior	0.241	0.4278
Senior	0.229	0.4199
Race		
White	0.763	0.4253
Black	0.075	0.2637
Hispanic	0.072	0.2593
Living location		
Single sex dorm	0.131	0.3375
Mixed dorm	0.262	0.4399
Fraternity/sorority house	0.029	0.1664
Off campus housing	0.539	0.4985
Persons lived with		
Alone	0.137	0.3442
Roommate(s)	0.627	0.4835
Parents	0.148	0.3549
Spouse	0.100	0.3001
Father's level of alcohol use		
Abstainer	0.198	0.3983
Recovered problem drinker	0.033	0.1780
Moderate	0.198	0.3989
Problem	0.046	0.2101
Mother's level of alcohol use		
Abstainer	0.343	0.4747
Recovered problem drinker	0.011	0.1048
Moderate	0.096	0.2944
Problem	0.013	0.1131
Father's furthest education level		
Did not complete high school	0.056	0.2308
Completed high school	0.170	0.3758
Four year degree or more	0.503	0.5000
Mother's furthest education level		
Did not complete high school	0.047	.2124
Completed high school	0.206	0.4045
Four year degree or more	0.446	0.4976

Table 2: 2001 State cigarette prices: average price per pack adjusted for inflation [9]

State	Price	State	Price
Alabama	$3.24	Montana	$3.13
Alaska	$4.56	North Carolina	$3.05
Arkansas	$3.33	North Dakota	$3.45
Arizona	$3.77	Nebraska	$3.50
California	$4.04	New Hampshire	$3.62
Colorado	$3.19	New Jersey	$3.92
Connecticut	$3.57	New Mexico	$3.35
District of Columbia	$3.81	Nevada	$3.44
Delaware	$3.18	New York	$4.40
Florida	$3.38	Ohio	$3.15
Georgia	$3.17	Oklahoma	$3.29
Hawaii	$4.38	Oregon	$3.77
Iowa	$3.35	Pennsylvania	$3.30
Idaho	$3.21	Rhode Island	$3.79
Illinois	$3.55	South Carolina	$3.11
Indiana	$3.07	South Dakota	$3.38
Kansas	$3.22	Tennessee	$3.17
Kentucky	$3.01	Texas	$3.39
Louisiana	$3.26	Utah	$3.54
Massachusetts	$4.13	Virginia	$3.08
Maryland	$3.76	Vermont	$3.61
Maine	$3.86	Washington	$4.07
Michigan	$3.80	Wisconsin	$3.73
Minnesota	$3.57	West Virginia	$3.14
Missouri	$3.16	Wyoming	$3.21
Mississippi	$3.18		

Table 3: Goodness of fit measures for probit models (Eq. 1, 2, 3)

Descriptive Statistic	Eq. 1: Full Model	Eq. 2: Peer effect omitted	Eq. 3: Cigarette prices omitted
N	5212	5212	9893
McFadden's LRI (Pseudo R^2)	0.0918	0.0599	0.0707
Likelihood Ratio	551.14	359.62	786.97

[9] ImpacTeen. Tobacco Control Policy and Prevalence Data: 1991-2001.
< http://www.impacteen.org/tobaccodata.htm >

Table 4: Parameter estimates (Eq. 1, 2, 3)

Variable	Eq. 1: Parameter estimates	Eq 2: Parameter estimates Peer effect omitted	Eq. 3: Parameter estimates Cigarette price omitted
Peer Effect	2.8389***	*~Peer effect omitted~*	2.7950***
Grade Point Average	-0.2858***	-0.3047***	-0.2728***
Annual Income	0.1087***	0.1121***	0.0969***
Cigarette Price	-0.0378	-0.1331***	*~Cigarette price omitted~*
Current school year			
Freshman	0.1275	0.1468*	0.0999
Sophomore	0.0964	0.1047	0.0098
Junior	0.0211	0.0371	0.0017
Senior	0.0929	0.0938	0.0185
Race			
Black	-0.7163***	-0.7509***	-0.6335***
Hispanic	-0.2048**	-0.2040**	-0.1067
Living location			
Single sex dorm	-0.1026	-0.1384	-0.1120
Mixed dorm	-0.1009	0.0215	-0.0788
Fraternity/sorority house	0.2538*	0.3513***	0.2600***
Off campus housing	0.0979	0.2103**	0.1222
Persons lived with			
Alone	0.2865	0.2999*	0.0826
Roommate(s)	0.2903*	0.3187**	0.1043
Spouse or partner	0.0531	0.0419	-0.0992
Father's level of alcohol use			
Abstainer	0.0104	-0.0557	-0.0529
Recovered problem drinker	0.1870*	0.1720	0.1045
Moderate	0.1218**	0.1070**	0.1446**
Problem	0.1748***	0.1927***	0.1183***
Mother's level of alcohol use			
Abstainer	-0.1517***	-0.1777***	-0.1123***
Recovered problem drinker	-0.0259	-0.0920	0.2306
Moderate	0.1185	0.1070	0.1446***
Problem	0.1937*	0.1533*	0.2606***
Father's furthest education level			
Did not complete high school	0.0071	-0.0078	-0.0742
Completed high school	-0.0201	-0.0166	-0.0055
Four year degree or more	0.1006**	0.0760	0.0749**
Mother's furthest education level			
Did not complete high school	-0.1660	-0.1627	-0.0421
Completed high school	0.0368	0.0611	0.0323
Four year degree or more	-0.0203	-0.0217	0.0069

Note: (*), (**), (***) represent significance at levels of 10%, 5% and 1% respectively

Table 5: Parameter significance statistics (Eq. 1, 2, 3)

Variable	Eq.1: Pr > | t |	Eq.2: Pr > | t |	Eq. 3: Pr > | t |
Peer Effect	<.0001	~Peer effect omitted~	<.0001
Grade Point Average	<.0001	<.0001	<.0001
Annual income	<.0001	<.0001	<.0001
Cigarette Price	0.4344	0.0049	~Cigarette price omitted~
Current school year			
Freshman	0.1624	0.1011	0.1191
Sophomore	0.2657	0.2176	0.8732
Junior	0.8007	0.6502	0.9766
Senior	0.2649	0.251	0.7527
Race			
Black	<.0001	<.0001	<.0001
Hispanic	0.0421	0.0409	0.1276
Living location			
Single sex dorm	0.3859	0.2371	0.2013
Mixed dorm	0.3616	0.8442	0.3329
Fraternity/sorority house	0.0867	0.016	0.0193
Off campus housing	0.3557	0.0444	0.1162
Persons lived with			
Alone	0.1127	0.0934	0.5010
Roommate(s)	0.0972	0.0655	0.3772
Spouse or partner	0.7672	0.8132	0.4089
Father's level of alcohol use			
Abstainer	0.8652	0.3549	0.2236
Recovered problem drinker	0.091	0.114	0.2068
Moderate	0.0683	0.0409	0.0621
Problem	0.0191	0.0219	0.0298
Mother's level of alcohol use			
Abstainer	0.003	0.0004	0.0021
Recovered problem drinker	0.8915	0.6235	0.2606
Problem	0.2498	0.3536	0.0298
Moderate	0.0806	0.1093	0.0038
Father's furthest education level			
Did not complete high school	0.945	0.9395	0.3162
Completed high school	0.7484	0.7874	0.9019
Four year degree or more	0.049	0.1309	0.0407
Mother's furthest education level			
Did not complete high school	0.1529	0.1388	0.5932
Completed high school	0.5198	0.278	0.4286
Four year degree or more	0.6832	0.6584	0.8475

Table 6: Marginal effects (Eq. 1, 2, 3)

Variable	Eq.1: Marginal effects	Eq.2: Marginal effects	Eq.3: Marginal effects
Peer Effect	0.8374***	*~Peer effect omitted~*	0.8238***
Grade Point Average	-0.0843***	-0.0932***	-0.0804***
Annual income	0.0321***	0.0343***	0.0286***
Cigarette Price	-0.0112	-0.0407***	*~Cigarette price omitted~*
Current school year			
Freshman	0.0376	0.0449*	0.0295
Sophomore	0.0284	0.0320	0.0029
Junior	0.0062	0.0114	0.0005
Senior	0.0274	0.0287	0.0055
Race			
Black	-0.2113***	-0.2298***	-0.1867***
Hispanic	-0.0604**	-0.0624**	-0.0314
Living location			
Single sex dorm	-0.0303	-0.0423	-0.0330
Mixed dorm	-0.0298	0.0066	-0.0232
Fraternity/sorority house	0.0749*	0.1075***	0.0766***
Off campus housing	0.0289	0.0644**	0.0360
Persons lived with			
Alone	0.0845	0.0918*	0.0243
Roommate(s)	0.0856*	0.0975**	0.0307
Spouse or partner	0.0157	0.0128	-0.0292
Father's level of alcohol use			
Abstainer	0.0031	0.0170	-0.0156
Recovered problem drinker	0.0552*	0.0526	0.0308
Moderate	0.0516**	0.0590**	0.0208**
Problem	0.0359***	0.0360***	0.0349***
Mother's level of alcohol use			
Abstainer	-0.0447***	-0.0544***	-0.0331***
Recovered problem drinker	-0.0076	-0.0281	0.0683
Moderate	0.0349	0.0327	0.0426***
Problem	0.0571*	0.0469*	0.0768***
Father's furthest education level			
Did not complete high school	0.0021	-0.0024	-0.0219
Completed high school	-0.0059	-0.0051	-0.0016
Four year degree or more	0.0297**	0.0232	0.0221**
Mother's furthest education level			
Did not complete high school	-0.0490	-0.0518	-0.0124
Completed high school	0.0109	0.0187	0.0095
Four year degree or more	-0.0060	-0.0066	0.0021

Note: (*), (**), (***) represent significance at levels of 10%, 5% and 1% respectively