Health Insurance and Health Care Utilization: Evidence of Moral Hazard and Price Effects

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ABSTRACT

We examine the empirical possibility of *ex ante* moral hazard behavior and the price effect in the health insurance market. There is a lack of consensus in the existing literature on the effect of health insurance on medical care utilization. In large part, this ambiguity stems from the difficulties posed by the endogeneity of health insurance status. We circumvent this endogeneity problem by focusing on 4-year college students. While college students make their own health care utilization decisions, we believe that their health insurance status is plausibly exogenous. This is based on the assumption that health insurance status for college students is determined either by their parents' plan or college-mandated insurance, or by a family's inability to afford insurance. We make a contribution to the existing literature by distinguishing between *ex ante* moral hazard behavior and the price effect (often erroneously termed *ex post* moral hazard) by introducing this novel approach to the endogeneity problem. We find evidence for the presence of both *ex ante* moral hazard and the price effect.

I. Introduction

Does the presence of health insurance influence an individual's health behavior as well as his/her decisions to go to the doctor? In 2010, the Obama Administration introduced the Affordable Health Care Act to expand health care coverage, which represents the biggest piece of health care legislation ever introduced in the United States. Critics of Obamacare claim that it will mainly serve to increase health care costs without additional benefits (Kuttner, 2010). While the results of the Act are still too premature to analyze, this piece of legislation begs an interesting question: if increased health insurance coverage for all Americans indeed results in more costs, can we then conclude that these increased costs are due to negative, behavior distorting effects of health insurance which may cause people to partake in riskier behavior (*ex ante moral hazard)* or make frivolous doctor's visits (*ex post* moral hazard)? Furthermore, can we also (or perhaps instead) conclude that due to the decreased cost of treatments, people visit the doctor more often, holding their injury and illness rate constant (price effect)?

While a change in health behaviors and a change in the propensity to see a doctor certainly go hand-in-hand, there are two related but separate mechanisms that theoretically work to influence an individual's behavior. The first mechanism is *ex ante* moral hazard, which is the concept that an individual's behavior is more likely to be distorted as s/he is protected from bearing the full costs of his/her behavior; as such, an individual may partake in riskier behavior. Evidently, *ex ante* moral hazard is an unintended consequence of health insurance.

A second channel through which insurance may affect health care utilization is through influencing the demand for health care, which occurs once an individual has sustained an injury or illness. Changes to the post-injury or illness demand for health care occur through two mechanisms. The first mechanism is *ex post* moral hazard, or the falsifying or exaggerating of

claims. Due to the payment structure of health insurance, it is very difficult for patients to falsify claims to insurance providers as it is the doctors, not the patients, who provide the evidence for patient treatments. However, it is more likely that patients with insurance make more "frivolous" doctors visits when covered by insurance. The second mechanism involved in increasing the post-injury or illness demand for health care is the price effect. The price effect is when a decrease in the cost of treatment shifts out an individual's demand for health care. This is not the same as *ex post* moral hazard because the doctor's visits are not necessarily frivolous. Far too many articles in the current literature confuse *ex post* moral hazard with the price effect (Dionne, 2000).

Of course what constitutes a "frivolous" visit to the doctor is a normative question and thus beyond the scope of this paper. As such, distinguishing between *ex post* moral hazard and the price effect is beyond our capacity. However, in the sense that *ex post* moral hazard is a subcategory of the price effect (or perhaps an extreme case of the price effect), we will refer to the entire increase in health care utilization given a change in insurance status as the price effect.

This paper focuses on the effects of health insurance on health care utilization by isolating the effects, if there are any, of the price effect and *ex ante* moral hazard. This distinction is imperative as it will inform policymakers whether increasing health care coverage increases the accessibility of health insurance through the price effect (perhaps with the unintended consequence of more frivolous claims, or *ex post* moral hazard), or whether it works mainly to make the general population less healthy by encouraging riskier behavior through *ex ante* moral hazard behavior.

a. *Ex Ante* Moral Hazard and the Price Effect in Health Care

An explication of *ex ante* moral hazard and the price effect specifically in health care is merited given that health care insurance markets differ from other insurance markets in significant ways. As in any insurance market, *ex ante* moral hazard in health care refers directly to the engaging of risky behavior, for example, deciding to go skiing because an insured individual knows that s/he will not have to bear the full cost of an injury.

However, we contend that the concept of *ex post* moral hazard is different in health care markets as compensation structures are significantly different than in other insurance markets. Take, for example, the auto insurance market. *Ex post* moral hazard, resulting from information asymmetries between the car owner and the insurance company, refers to the action of falsifying or exaggerating claims (Di Mauro, 2002). Simply put, the car owner has the incentive to make fraudulent claims to the insurance provider in order to receive more compensation. However, in the health insurance market, a patient makes the decision to see a doctor not based on how much money s/he could potentially claim from the insurance company (for the most part).[1] While great information asymmetries exist between the patient and the doctor, there is no information asymmetry between the patient and the insurance company in the actual process of submitting claims. As such, there is no way for a patient to falsify or exaggerate claims to health insurance providers to receive more compensation, unlike in the auto insurance market.

Ex post moral hazard in the health insurance market then simply refers to the action of seeking frivolous health care *not* in order to receive greater monetary compensation, but for other

[1] Another important consideration when examining health care costs is the ordering of superfluous tests and performing of unnecessary procedures; in other words, moral hazard on the part of the doctor in order to receive greater compensation. While it is imperative to consider the doctor-insurer relationship when designing health care policy that minimizes total cost expenditures, medical professionals' moral hazard is beyond the scope of this paper.

psychological phenomena. For example, an extremely risk averse individual or a hypochondriac may utilize health care that doctors would term "frivolous." Another example is a perfectly healthy person who pays for health insurance and falls victim to the "sunk cost" fallacy, seeking unnecessary medical care as they think, "I paid for the policy, I might as well put that money to use." This seems to be a clear-cut case of a frivolous visit to the doctor that counts as *ex post* moral hazard because the extra visit to the doctor is not necessitated by medical reasons. Thus, while *ex post* moral hazard in health care does not exist as the falsification of claims, it may exist as the frivolous utilization of health care.

In addition to *ex post* moral hazard, there is also the classic price effect: an insured person may seek more medical care because, with the reduction in the cost of treatment due to insurance, the benefit of treatment exceeds the costs (Dionne, 2000). As previously noted, it is possible to view *ex post* moral hazard as a subcategory of the price effect. For example a hypochondriac may make an extreme cost-benefit assessment (a type of price effect); however, an additional visit to the doctor may be seen as frivolous by most doctors (a type of *ex post* moral hazard). Due to the normative nature in distinguishing *ex post* moral hazard from the price effect, we continue our analysis by naming any increase in post-injury or illness demand for health care as the price effect.

b. Measuring *Ex Ante* Moral Hazard and the Price Effect

The main issue with trying to determine a causal relationship between health insurance and health care utilization is that insurance status is an endogenous variable; in other words, one's health status and other factors may affect the decision to obtain health insurance. We contribute to the existing literature by using a novel method of addressing the endogeneity issue of insurance status; that is, by focusing on a sample of 4-year college students. College students

represent a unique subpopulation as they are legally adults and thus make autonomous health care consumption decisions yet they do not determine their own health insurance status. We believe that insurance status is plausibly exogenous because if a student is insured, then we assume that s/he is either still insured by his/her parents' policies or by the college's mandatory insurance programs. However, if the student is uninsured, the literature and our data indicate that insurance status is due to poor socioeconomic backgrounds; thus such students are forced to not have health insurance. Given a college student's lack of choice for health insurance, it follows that health insurance is exogenous to health care utilization factors.

We first aim to measure *ex ante* moral hazard by comparing the different effects of insurance status on the total number of injuries or illnesses between our control group (uninsured 4-year college students) and our treatment group (insured 4-year college students). We then attempt to measure the price effect by looking not at the total number of injuries or illnesses, but instead at the following ratio: (the number of illness or injuries *treated* by a doctor/nurse) / (total number of injuries or illnesses). By exploiting the plausibly exogenous variation of health insurance status among 4-year college students, we hope to determine whether health insurance status causes *ex ante* moral hazard, and whether there is evidence of the price effect.

II. **Literature Review**

The literature on the impact of health insurance on moral hazard behavior varies highly in methodology and findings. As stated previously, the major difficulty with health insurance status is its inherent endogeneity, which makes it difficult to determine a causal relationship between health insurance status and health care utilization. However, finding a causal relationship is imperative in determining health care policy.

Although the literature stresses the great difficulty of finding an exogenous measure of health insurance, it is important to highlight several papers that have attempted to do so, albeit with varying levels of success. Here, we introduce three methods used in the literature that attempt to eliminate the endogeneity concern: (1) the use of instrumental variables, (2) the selection of a population with mandated health care, and (3) the use of randomized health insurance experiments. We contribute to the existing literature by proposing a fourth method: (4) the use of a subpopulation whose insurance status is determined by others yet who makes autonomous health care utilization decisions.

1. The Instrumental Variable Technique:

One way of addressing the endogeneity issue is through the use of instrumental variables. By finding an instrumental variable that is highly correlated with health insurance status, but only affects health care outcomes through its correlation with insurance status, one can attempt to eliminate the problem of endogeneity. Although this technique has been largely unsuccessful in the current literature, it deserves a brief overview.

In an attempt to measure the effects of health insurance on the probability of being obese, Rashad and Markowitz (2007) use firm size as an instrument for health insurance status. Their rationale is that, given the close relationship between health insurance and employment in the United States, and the fact that people who are employed in larger firms are more likely to have health insurance, firm size can be used to predict an employee's health insurance status (Fronstin, 2006). While this instrument seems theoretically sound, they find the instrument to be very weak empirically, thus producing unreliable estimates.

Other researchers have attempted to use socioeconomic variables as instruments for health insurance status. Vera-Hernandez (1999) uses social class and the occupation of the

household head as an instrument for the health insurance status of non-household heads in Catalonia, Spain. He claims that this instrument is highly correlated with the insurance status of non-household heads, but has no direct mechanism to affect the non-household head's health care utilization, except through the non-household head's insurance status. With such an assumption, Vera-Hernandez finds evidence of a positive effect of increased health insurance coverage on visits to specialists for non-household heads. However, Barros et al. (2008) criticize this method as producing "coefficient estimates [that] suffer from high standard deviations that hamper any meaningful conclusions."

2. The Selection of a Population with Mandated Health Care

Another method to circumvent the endogeneity issue is to look at populations who have mandated health insurance, thereby eliminating the problem of individual choice. One of the most notable studies in this domain is by Barros et al. (2008), which examines the causal relationship between the intensity of health insurance status and health care utilization in Portugal. Their control group is the general Portuguese population who is covered by the universally mandated National Health System (NHS), while their treatment group consists of civil servants and their dependents who receive additional health insurance (ADSE) on top of NHS insurance. Barros et al. (2008) argue that this double coverage is an exogenous variable, as the already comprehensive nature of the NHS deters citizens from deciding to become civil servants just to receive better health insurance.[2] While Barros et al. (2008) find a large positive effect of insurance status on certain health care utilization measures, their results indicate that there is largely no effect. While the authors make a good case for the exogeneity of insurance

[2] Furthermore, the authors claim that government-hiring decisions are independent of health status, and thus adverse selection of civil servants based on pre-existing conditions is not a salient concern.

status among civil servants, we believe that there may still be a degree of endogeneity. If the NHS is as comprehensive as the authors claim, then why would ADSE, the additional health insurance, be offered to civil servants, if not to incentivize them to work for the government? We believe that it is indeed possible that individuals choose to work for the government precisely to obtain better quality insurance.

Dave and Kaestner (2009) employ a similar approach to Barros et. al. (2008) by restricting their sample to those aged 65 and above, and thus receives mandatory Medicare, to examine Medicare's effect on *ex ante* moral hazard. They note the lack of empirical consensus on *ex ante* moral hazard and cite the endogenous nature of health insurance as the major culprit. However, the insurance status of elderly Medicare recipients, they contend, is plausibly exogenous as the receipt of this universal health insurance is not determined by health status. By comparing changes in post-65 health behavior between those who were insured and those were not insured before 65, Dave and Kaestner (2009) find that obtaining Medicare reduces preventive behaviors and increases unhealthy behavior among elderly men.

3. The Use of Randomized Health Insurance Experiments

A very different approach to the endogeneity issue of health insurance status is to use the results from a randomized experiment wherein subjects are artificially assigned to varying levels of health insurance, ranging from free health care to varying levels of cost sharing. The largest of these studies is the RAND Health Insurance Experiment (RHIE), conducted for 15 years from 1971, which aimed to see how much health care people would utilize if it were to be provided for free. There is a wide body of literature that employs the RHIE data, citing its truly randomized and thus exogenous nature. However, it also has its weaknesses. First, randomized experiments are extremely costly (in the millions of dollars) and thus cannot be replicated with frequency.

The RHIE, which has only been conducted once, remains outdated and thus studies using it are less pertinent to today. Second, there was no group of uninsured participants in the RHIE, making it impossible for our purposes to compare the differences of having insurance with not having any at all.[3] Third, there are questions about the design of the RHIE. Nyman (2007) criticizes the fact that many participants dropped out of the cost-sharing arm of the experiment, thus biasing the results.

Overall, the literature remains clearly mixed in both methodology and results. While most studies tend to concur that having health insurance results in increased medical care utilization, the distinction between and evidence about *ex ante* moral hazard and the price effect remain very unclear. As noted above, making this distinction between the two types of behavior, in addition to eliminating the endogenous nature of insurance status in order to obtain empirically sound results, is important with regards to making policy recommendations.

III. **Data**

We use data from the National Longitudinal Survey of Youth (NLSY 97), sponsored by the Bureau of Labor Statistics (BLS). This survey provides a nationally representative sample of 9,000 youths who were between the ages of 12 and 16 on December 31, 1996. The first survey took place in 1997, and thereafter, interviews were conducted on an annual basis. The NLSY 97 is a comprehensive data set that collects information on factors including, but not limited to, respondents' educational, socioeconomic, and demographic characteristics, in addition to health insurance status and family/community backgrounds. While the survey began in 1997, it was

[3] Although this experiment was more focused on the intensity of insurance, given that it is a famous experiment in the health insurance literature, we report its basic findings. They find that individuals who have cost sharing insurance, as opposed to free care, have fewer doctors' visits and hospitalizations. Additionally, they find that as the level of cost sharing decreased, individuals were more likely to spend greater amounts on health care due to using more services in general, and not necessarily from using more expensive services (RAND website).

only from 2002 when data on health care utilization began to be collected. In 2002, individuals were between the ages of 18 and 22; in 2003, between 19 and 23; in 2004, between 20 and 24. As the years pass, the number of 4-year college students decreases in our sample. Thus, we restrict our analysis to the years 2002, 2003, and 2004, when we still have a relatively large sample size. Table 1 shows our summary statistics.

As stated above, the endogeneity of insurance status is a persistent and prevalent issue in all studies concerning health care utilization. We acknowledge the concerns associated with this variable, but feel that we can overcome this issue by restricting our sample to 4-year college students who do not have pre-existing health conditions. This is due to our belief that these students face *exogenous* health insurance choices. Here, putting ourselves into the shoes of a 4-year college student, we interpret *exogenous* as the following: "I do not have the choice of whether to have health insurance or not. Some 'external force' is determining my insurance status." This 'external force' for insured students can be either: (1) (a continuation of) their parent's plan or, (2) a college-mandated health insurance plan.[4] [5] In contrast, this 'external force' for uninsured students is low household incomes,[6] which make health insurance unaffordable

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[4] In the past decade, there has been a strong national movement towards mandating health insurance for all 4-year college students. A March 2008 study, conducted by the Government Accountability Office (GAO), on college-specific health insurance plans in a random sample of 340 colleges, found that 82% of 4-year public institutions and 71% of 4-year private colleges required health insurance as a condition for enrollment for the academic year 2007-08. With this survey, the GAO estimates that about 30% of colleges nationwide required their students to have health insurance. Furthermore, the American College Health Association (ACHA) expects that 33% more colleges will have mandatory health insurance in the future (http://www.acha.org/Topics/insurance.cfm).

[5] We will address the possible heterogeneity of insurance coverage in section VI.

[6] We can make this demographic assumption regarding the uninsured for two reasons. Firstly, in our sample, there is a drastic difference in household incomes between those who are insured and those who are not. For the uninsured, the average household income per person is $9,900, whereas for the uninsured, the average more than doubles to $21,318. Secondly, the March 2008 GAO study found that "Certain groups of students...such as nonwhite students and students from families with lower incomes - were more likely than others to be uninsured. The characteristics of uninsured students are consistent with those of the uninsured found in the general US population."

and thus prevents parents from being able to provide insurance for their child or enrolling him/her in a college-specific plan. In both the insured and uninsured cases, individuals face *exogenous* health insurance decisions (i.e. for the insured, they are *automatically* enrolled, and for the uninsured, they *cannot* afford it), and thus we feel that our assumption regarding 4-year college students remains valid.[7]

Additionally, since college students in our sample are all legally adults, they make independent health care utilization choices from their parents. This is an important assumption to ensure the exogeneity of health insurance status because, as is the case for young children living with their parents, if a parent decides what risky activities his/her child can participate in and when his/her child should go to the doctor, then the parent's decision to get insurance may be endogenous to what they allow their child to do. For example, a mother who lets her child skateboard may also obtain health insurance in anticipation of needing more health care, or an especially paranoid father may obtain insurance in anticipation of sending his child to the doctor for every bruise and scratch. However, once a child is out of the house and in college, there is a unique window of opportunity where health insurance is mandated but students are making autonomous health care consumption decisions. It is plausible that college students make their own choices to participate in risky behavior because their parents are not present to monitor their behavior. Furthermore, it is plausible to assume that college students make autonomous decisions to seek medical care. Since college students are legally adults, their health information is, by law, no longer remitted to their parents. While a college student may consult her parents when making

[7] We acknowledge there may be systemic differences between students who go to schools that have mandated insurance and those who do not. Indeed, the March 2008 GAO study reports that "students who enroll in plans offered by colleges with health insurance requirements generally are healthier than those who voluntarily enroll in plans offered by colleges without a requirement."

a health care decision, ultimately it is the college student's decision whether or not to seek health care.

One major assumption we are forced to make, given the limitations of our data set, is that insurance plans are the same. If we had more granular data on each individual's insurance policy, then we could incorporate a measure for the quality of health insurance, similar to what the RAND Health Insurance Experiment accomplished by assigning differing levels of health care intensity to participants. However, we believe that treating all college student health insurance plans as homogeneous[8] is not an implausible assumption given that most insured college students are covered through "employer sponsored plans" in other words, the plans of their parents. A U.S. Government Accountability Office Study (2006) of 340 colleges found that roughly 84% of insured college students are covered through their parents' plans, while the rest are insured under private (college health insurance) and public (Medicare) health insurance plans. While there are certainly differences within employer-sponsored plans, we believe that employer-sponsored plans are likely to be more homogeneous than if one were to compare public, private, and employer- sponsored insurance plans. Thus, given that most college students are covered under their parents' plans, we believe the assumption of health insurance homogeneity is plausible.

IV. **Model**

In order to determine which appropriate controls to include in our empirical specification, we rely on research by Grimsmo and Siem (1984) and Hall et al. (2008) on the determinants of

[8] It is important to note that we are able to control for the type of college (private or public) in our regressions. As college health care plans may differ in quality and coverage between public and private colleges, this control allows us to incorporate some measure for the quality of health insurance.

health care utilization. We use three broad categories of variables: (1) need factors and (2) sociodemographic factors.[9]

Need factors are those that affect the actual and perceived health status of individuals. We construct our sample to exclude pregnant women from our sample as they require more medical care than non-pregnant women. A major consideration when dealing with health insurance markets is that individuals with chronic conditions may be denied coverage; in other words, that insurance markets exhibit adverse selection. If adverse selection is present, then including individuals with chronic health conditions would bias our sample. In order to test for adverse selection within our sample, we run summary statistics to examine whether exclusion and inclusion of such individuals produces significantly different results, particularly for variables such as health insurance that are most likely affected by chronic health conditions. As can be seen from Table 2, including people with chronic health conditions in our sample barely changes the percentage of people insured, hence adverse selection in the insurance market for our sample does not appear to be an issue. Another justification for including individuals with chronic conditions in our sample is that by excluding them, the number of treated injuries and illnesses decreases, which indicates that dropping these individuals from the sample would bias our results. Given the above considerations, we decide to include individuals with chronic conditions in our sample.

While other studies, such as Barros et al. (2008) use smoking and exercise as determinants of an individual's health, we decide to exclude such variables given that our sample

[9] A third type broad category that affects health care utilization is organizational factors (Grimsmo and Siem 1984). Organizational factors measure the availability of primary health care through examining distance to closest physician, number of doctors available, and wait times among other variables. We decide not to include organizational factors in our study because we believe that college students have equal access to health care facilities.

population is young adults rather than older individuals. In the case where the elderly is the sample population (Dave and Kaestner, 2009), it is important to include controls for smoking and exercise because of the cumulative effects of both healthy and unhealthy behavior that appear later in life. However, for youth we believe it is implausible that the effects of lack of exercise or smoking manifest themselves in physical ailments.

The other category of need factors is perceived health status, which is important to health care utilization as a person's propensity to seek treatment is greatly affected by perceived susceptibility to and seriousness of illness or injury (Grismo and Siem 1984). This self-reported general health variable was constructed by asking respondents, "In general, how is your health?" and included five responses ranging from poor to excellent. We create dummy variables for each condition of health, and include the excellent, good, fair, and poor health responses, and exclude the very good health response in our regressions.

Sociodemographic factors include the obvious variables that account for differences in health care utilization between different groups, including gender, race, household income per person, and residential parent's highest degree completed (Vera-Hernandez, 1999). We log the household income per person variable as we are interested in the semi-elasticity of household income per person with respect to the dependent variable, or in other words, the percentage change of household income per person associated with a unit change in the health care utilization variable. It is important to note that household income may be interpreted in different ways by college students. For example, some may view household as their own family at home, while others may interpret it as their own individual income. A tabulation of our household income per person variable reflects the ambiguity behind this question, as some college students

answer dollar figures in the tens, hundreds, and thousands.[10] We create dummy variables for race (Black, Hispanic, non-Hispanic mixed race, non-Black non-Hispanic) and for residential parent's highest degree completed (father/mother is high school dropout, father/mother is college dropout, father/mother has college degree or higher). Further, we create dummy variables for type of college, either private or public, to incorporate some measure of the quality of health insurance plans. As stated previously, this is based on the assumption that there is a difference in insurance quality between private and public colleges.

Finally, before we begin to interpret our results, it is important to note the different number of observations we have for our *ex ante* and price effect regressions. Specifically, the *ex ante* regressions (whose dependent variable is the total number of injuries and illnesses[11]) has more observations than the price effect regressions (whose dependent variable is the ratio of the number of *treated* injuries or illnesses to the total number of injuries or illnesses). This is because the *ex ante* regressions include all those who answered either of the questions: (1) "During the past 12 months, how many times were you injured or ill and had to *be treated* by a doctor or nurse?" (2) "Some injuries are not treated by a doctor or nurse. During the past 12 months, how many times were you injured or ill so that you missed at least one full day of usual activities such as work or school, but were *not treated* by a doctor or nurse?" On the other hand, *price effect* regressions include only those who answered (1) because the dependent variable is a ratio that has (1) as its numerator. Hence our *price effect* regressions have fewer observations than our *ex ante* regressions.

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[10] We acknowledge the weakness in this variable, as what household income per person refers to is unspecified in the survey. There is a large distribution of responses, containing extremely small values, which leads us to conclude that while some people referred to their parental household income, others referred only to their individual income.

[11] This variable was constructed by adding the following two variables: number of treated injuries or illnesses; number of untreated injuries or illnesses.

V. **Results**

***Ex Ante* Moral Hazard**

To examine whether there is empirical evidence for *ex ante* moral hazard, we utilize the total number of times the respondent was injured or ill in one year as the dependent variable, ranging from none to eight times. We regress total injuries or illnesses on the following vector of controls**:** gender, race (three dummies), highest degree completed of residential father and mother (two dummies each), general health (four dummies), log household income per person, and private college. We run three separate OLS regressions, one for each year from 2002 to 2004.

Our main results are reported in Table 3. The p-values are two-sided. We find that the coefficient of insurance status is positive and statistically significant at the 5% level in 2002 and 2004, yet it is positive but statistically insignificant in 2003. For 2002 and 2004, the positive coefficient is evidence for the presence of *ex ante* moral hazard behavior, or the tendency for insured individuals to engage in riskier behavior and increase their probability of becoming injured or ill. Our results indicate that, for a college student in 2002 and 2004, having health insurance results in respectively .482 and .384 more injuries or illnesses annually, holding all else constant.

There are some further interesting results in Table 3. Firstly, the dichotomous variable Male is statistically significant at the 1% level for all three years. Our results indicate that for each year, being male causes respectively .597, .838, and .830 fewer injuries or illnesses, ceteris paribus. Given that conventional stereotypes of males tell us that men are more likely to engage in riskier behavior, this is illuminating. This view is reflected by some insurance markets such as car insurance, where providers often charge higher premiums for males relative to females. We

speculate that in our sample, males reported less injuries or illnesses not necessarily because they actually had fewer, but because they underreported the actual number, or that females over reported their numbers. It is critical to note that this cultural factor is purely our speculation.

Secondly, the dichotomous variable Black is statistically significant at the 1% level for all three years as well. Table 3 shows that if a respondent was black, their race caused them to have respectively .574, .692, .826 fewer injuries or illnesses for each year, ceteris paribus. Here again, we can consider the involvement of cultural factors or simply the nature of the individuals in our sample. Additionally, our data show that the mean household income per person was $17,607 for black students, and $22,154 for non-black students from 2002 to 2004. Such a difference may result in lower quality health insurance, which may affect their probabilities of engaging in risky behavior. We speculate that these differences in household income per person, and the possibility of cultural and data sample factors, resulted in blacks reporting less injuries or illnesses, holding all else constant.

Another variable that is statistically significant at the 1% level for all three years is the Excellent Health variable. Table 3 shows that respondents who reported "Excellent Health" as their general health status had respectively .533, .387, .667 fewer injuries or illnesses each year, ceteris paribus. These results are as expected since we would imagine that respondents who report to be in excellent health to have fewer injuries or illnesses than their self-reportedly less-healthy counterparts. Furthermore, the Good Health and Fair Health variables were both statistically significant at the 5% level for two years. In 2002 and 2003, "Good Health" respondents reported respectively .424 and .317 more injuries or illnesses, ceteris paribus. In 2003 and 2004, "Fair Health" respondents reported respectively .803 and 1.453 more injuries or illnesses, ceteris paribus. As we dropped the "Very Good Health" variable from our regression to

avoid the dummy variable trap, we speculate that once a respondent's health status goes below "Very Good Health," s/he begins to experience more injuries or illnesses.[12]

The Price Effect

To verify empirically the existence of the price effect, we create a dependent variable that is the ratio of the total number of treatments received by a doctor or nurse for an injury or illness, to the total number of all injuries or illnesses, both treated and untreated, if the respondent was injured or sick at least once in that year. We include the same vector of controls as in the *ex ante* moral hazard regression. Here, as the dependent variable is binary and thus between 0 and 1, we run a logit regression, which is used to predict the probability of an event by fitting data onto a logistic curve. Unlike OLS regressions, which we used to examine *ex ante* moral hazard, logit regressions do not assume a linear relationship between the independent and dependent variables, normally distributed variables, nor homoskedasticity, and thus we utilize different interpretation methods.[13]

Our main results are reported in Table 4. We find that the coefficient of insurance status is positive and statistically significant at the 5% level for all three years, hinting at the existence of price effect behavior if one is insured. In other words, an insured college student, relative to her uninsured counterparts, is more likely to seek more medical care as the cost of treatment has gone down due to insurance, holding the rate of injuries and illnesses constant. Specifically, the logit coefficients of .603, .526, and .564 for the years 2002, 2003, and 2004, indicate that the

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[12] Indeed, when we include the Very Good Health variable and drop Good Health from our regressions, we find that for all three years, Very Good Health respondents report fewer injuries or illnesses. These results are as expected, similar to the Excellent Health variable. Specifically, at the 5% significance level, Very Good Health respondents reported .424, .317, and .006, respectively, fewer injuries or illnesses each year, ceteris paribus. .

[13] We use exponential functions to interpret logit coefficients. If b is the logit coefficient, exp(b) is the effect of the independent variable on the odds ratio (the probability of the event divided by the probability of the nonevent). Calculating the probability of the event allows us to interpret the coefficients.

probability of an insured student being treated when injured or ill is 64.6%, 62.9%, and 63.7% greater, respectively, than uninsured students, ceteris paribus.

Similar to our *ex ante* moral hazard regressions, the variable Male is negative for all three years at the 5% level. This indicates that if a respondent is male, he is less likely to be treated for injuries or illnesses than females, holding all other factors constant. Calculations using exponential functions tell us that the probability of a male student being treated when injured or ill in 2002, 2003, and 2004 is 35.8%, 41.0%, and 40.2%, respectively, less than his female counterparts, holding all else constant. Similar to our *ex ante* regressions, these results are interesting when one considers car insurance providers who perceive males as taking on more risk than females and thus charge males a higher premium. Again, perhaps these results are a product of males underreporting their actual number of treatments, or females over reporting.

Further Analysis

To further analyze the presence of *ex ante* moral hazard and the price effect, we run stacked regressions by combining data for all three years and increasing prediction accuracy. We add in fixed time effects to ensure that specific years did not increase the rate of injuries or illnesses for our entire sample (for example, one may theorize that people are less likely to go to the doctor in a recession year). In both regressions, the coefficients for the year dummy variables are insignificant, validating our usage of stacked regressions.

Our results are summarized in Table 5,[14] where Column 1 tests for *ex ante* moral hazard and Column 2 for the price effect. In Column 1, we can observe that the coefficient for insurance is positive and significant at the 1% level, indicating that having insurance resulted in .313 more

[14] Here, the number of observations for all three years is simply the sum of each year from Tables 3 (*ex ante* moral hazard) and Table 4 (price effect). .

injuries or illnesses, holding all else constant. Again, this hints at the existence of *ex ante* moral hazard behavior among insured individuals. The coefficients for Male, Black, Hispanic, and Excellent Health were significant and negative at the 1% level, whereas the coefficients for Good Health, Fair Health, and Poor Health were significant and positive at the 1% level. These results were as expected and add more validity to the regression results we obtained in Table 3.

Column 2 shows the results for the logit regression testing for the presence of the price effect. As in Column 1, the coefficient for insurance is significant and positive at the 1% level. An insured student had a 62.9% greater probability of receiving treatment for an injury or illness as compared to an uninsured counterpart, holding all else constant. We speculate that this is due to a student's increased demand for health care due to the decreased cost of treatment through insurance, i.e. the price effect. Furthermore, the Male coefficient is significant and negative at the 1% level, an expected result given our findings in the previous logit regressions. This tells us that a male student had a 39.3% lower probability of being treated for an injury or illness relative to a female student, ceteris paribus. Our results also indicate that being Hispanic resulted in a 42.8% lower probability, and being in fair health resulted in a 82.1% greater probability, of being treated for an injury or illness, holding all other factors constant.

VI. **Discussion**

There are several limitations of our study that we would like to highlight. Future studies could try to circumvent these issues by obtaining different data.

(i) Homogeneity of Health Insurance

One important issue is that there are many different types of health insurance; however, due to limitations of our data, we are forced to treat health insurance as homogeneous except for the private/public college distinction, as we assume that the quality differs between the two types

of colleges. Within private insurance alone, there are HMO, PPO, short-term health plans, high deductible plans, among others. These insurance plans have different rates, payment structures, and deductibles that make insurance a highly varied product. This may pose problems as a person with limited health insurance may act more like a person without insurance, which would downplay the effect of health insurance coverage on health care utilization. One way to circumvent this issue would be to use a more comprehensive data set that has more granular information on health insurance status. Another possibility is to replicate this study using RHIE data which randomized participants to varying levels of health insurance coverage.

(ii) Reporting Bias

Another possible issue with our data is the self-reported nature of the sick or injured variable. There are many reasons why a person may not accurately report sicknesses or injuries. It is possible that people are forgetful and cannot exactly remember what happened in the past year. It is also possible that the definition of sickness or injury is subject to interpretation since there are so many different types and levels of seriousness. However, as long as there is no systematic misrepresentation of this variable, then the errors should remain uncorrelated and this should not pose a problem for our analysis.

(iii) Detail of Data

Furthermore, the fact that the data only exists for illnesses and injuries combined posses a limitation to our study. While illness and injury are indeed two major reasons for going to the doctor, they are fairly different concepts. For example, physical risk taking and negligent behavior may have a more direct link to physical injuries than it does to sicknesses. So perhaps if we could obtain data on sicknesses and injuries separately, we would see differing effects of moral hazard and price effect behavior on these ailments. Another consideration is that sickness

is an ambiguous term that involves both physical sicknesses, such as a cold or infection, and mental illnesses, such as depression. Whether insurance status can have an effect on mental illnesses through the channel of moral hazard is highly questionable given that we generally believe the onset of mental illness to be beyond the control of an individual. If many college students seek treatment for mental illnesses, then our results are less sound.

(iv) Generalizability

Lastly, our results are only generalizable to a very specific population, that is, 4-year college students. In order to meaningfully inform policy recommendations for the population as a whole, we would want to examine other populations.

(v) Future Steps

As noted in our footnote in the Data section, the national movement toward mandating health insurance for 4-year college students is rapidly expanding. If health insurance *were* to become compulsory for *all* 4-year college students in the future, and if we could obtain panel data that tracks students whose health insurance status changed pre- and post-enrollment in college, we could exploit this exogenous variation to further our findings. This would be a significant improvement over our data for the following reasons.[15] Firstly, an individual's health insurance status would become unambiguously exogenous, eliminating the prevalent endogeneity issue that we have highlighted in this study.[16] Secondly, there would not be any risk

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[15] Here, the control group would be those would had insurance pre-enrollment, while the treatment group would be those would did not. This is important to note as after enrollment, all individuals in our sample would have health insurance.

[16] Furthermore, this national movement would eliminate the issue that it is theoretically possible that a student could go to a college that does not mandate insurance and then decide to purchase insurance in subsequent years. While we make the assumption that if the student did not have health insurance pre-college, it was because he was too poor to afford it and thus would not be able to afford it later in college, there are cases in which this assumption could be violated.

of losing from our sample low-income students who *were* accepted into a 4-year college but could not afford health insurance, and thus could not become a 4-year college student as insurance was a condition for enrollment.

VII. Policy Implications

The most obvious implication of our findings is that providing health insurance will, for the most part, increase health care utilization. However, it is uncertain whether this increase in doctors' visits is mainly through the price effect, i.e. decreasing the price of health care (increased availability of medical care when needed), or mainly a product of distorted behavior (*ex ante* moral hazard), as we find evidence for both. No matter what the mechanism, a very probable implication of increased health care utilization is increased health care costs for insurers and the government. Hence health care policy that increases insurance coverage by the government should pay special attention to devising a health insurance scheme that works to minimize the behavior distorting aspects of health insurance in order to minimize costs.

Singapore's health insurance perfectly illustrates an insurance system that minimizes moral hazard in health care. Proponents of Singapore's health system argue that "the price mechanism and keen attention to incentives facing individuals are relied upon to discourage excessive consumption and to keep waste and costs in check by requiring co-payment by users," (Hartford, 2006). In short, the government pays for 80% of basic health care services while requiring Mandatory Savings Accounts (MSA) for health purposes and allowing only certain expenses to be deduced from these accounts (Singapore Ministry of Health). These MSAs serve three main purposes: (1) to encourage savings for unexpectedly high health care costs, (2) to mobilize more funds for health care systems, and (3) to enlist consumers in controlling their own health care costs (Hanvoravongchai, 2002).

By making insured consumers more aware of their health care expenditures, MSAs may work to keep moral hazard in check (Hanvoravongchai, 2002). The argument for MSAs is that because consumers would need to dip into their own pockets for frivolous expenses, they would be less likely to engage in *ex ante* and *ex post* moral hazard, while still providing consumers with the option to use health insurance when needed. The fact that Singapore has similar health outcomes to the US despite the fact that it spends only 3.1% of its GDP on health care as compared to 15.7% in the US (World Health Organization) suggests that a cost effective health insurance system decreases health care utilization by preventing moral hazard, not by blocking individuals in need from obtaining health care.

VIII. **Conclusion**

We find evidence for the existence of *ex ante* moral hazard and the price effect among 4-year college students. The signs of our coefficient of interest, health insurance status, are all positive which indicates the existence of these effects, although the insurance coefficient for 2003 in our *ex ante* moral hazard regression is not statistically significant at conventional levels. While our results are, for the most part, statistically significant, there are many weaknesses in our study that need to be addressed. Further research should attempt to use more granular data on health insurance intensity, which may allow researchers to observe more significant results. Additionally, perhaps future changes to national health care policy for colleges may provide researchers with more opportunities to examine exogenous health insurance. However, in the meantime, our results do not discredit the possibility of *ex ante* moral hazard and the price effect due to health insurance as possible effects on health care utilization.

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Table 1: Descriptive Statistics for 4-year college students, 2002-2004

	2002			2003			2004		
	Total	**Insured**	**Uninsured**	**Total**	**Insured**	**Uninsured**	**Total**	**Insured**	**Uninsured**
Variable Name	Obs=1078	Obs=975	Obs=103	Obs=1216	Obs=1077	Obs=139	Obs=1027	Obs=893	Obs=134
Total number of injuries/illnesses	2.000	2.051	1.484	2.082	2.105	1.870	2.081	2.136	1.631
Ratio of treated to total injuries/illnesses	0.514	0.519	0.442	0.478	0.490	0.348	0.482	0.494	0.371
Treated number of injuries/illnesses	0.965	0.999	0.607	0.952	0.984	0.664	0.948	0.996	0.553
Untreated number of injuries/illnesses	1.037	1.052	0.877	1.130	1.122	1.205	1.133	1.140	1.077
Household income ($)	79596	83128	41449	71123	74398	41066	77215	81780	39775
Household size (people)	3.600	3.614	3.467	3.421	3.450	3.155	3.183	3.197	3.072
Household income per person ($)	21862	22809	11644	20080	20832	13174	25415	26811	13966
Dichotomous indicators									
Insurance	0.915			0.902			0.891		
Private college	0.278	0.283	0.224	0.252	0.261	0.173	0.234	0.237	0.213
Male	0.433	0.426	0.507	0.453	0.441	0.564	0.468	0.461	0.525
Black	0.100	0.098	0.129	0.106	0.099	0.165	0.098	0.092	0.151
Hispanic	0.065	0.060	0.116	0.076	0.067	0.154	0.083	0.073	0.170
Non-Hispanic mixed-race	0.012	0.012	0.012	0.010	0.010	0.012	0.013	0.011	0.033
Non-Black non-Hispanic	0.823	0.830	0.744	0.809	0.824	0.668	0.805	0.825	0.645
Dad is high school dropout	0.424	0.038	0.092	0.038	0.035	0.071	0.039	0.037	0.055
Dad is college dropout	0.385	0.380	0.443	0.363	0.364	0.357	0.368	0.365	0.396
Dad has college degree or higher	0.396	0.417	0.166	0.403	0.418	0.258	0.407	0.429	0.228
Mom is high school dropout	0.053	0.046	0.134	0.048	0.038	0.147	0.054	0.047	0.115
Mom is college dropout	0.497	0.492	0.547	0.501	0.504	0.471	0.503	0.494	0.577
Mom has college degree or higher	0.391	0.407	0.221	0.386	0.403	0.231	0.379	0.402	0.194
Excellent health	0.379	0.381	0.359	0.366	0.379	0.253	0.375	0.379	0.340
Very good health	0.415	0.411	0.460	0.415	0.410	0.464	0.418	0.420	0.402
Good health	0.182	0.182	0.180	0.190	0.187	0.219	0.180	0.175	0.227
Fair health	0.020	0.022	0.000	0.027	0.023	0.064	0.025	0.025	0.031
Poor health	0.004	0.004	0.000	0.001	0.001	0.000	0.001	0.001	0.000

Notes:
All estimates are weighted with sampling weights provided in the NLSY 97 dataset. This provides a weight for everyone who participated in that particular round of surveying, using a special method that combines cross-sectional and over-sample cases.
As the ratio of treated to total injuries/illnesses exists only for those who validly answered the question (see IV. Model section), the number of observations for the ratio for those who did answer validly are as follows. In the order of total, insured, uninsured: 2002 (721, 665, 56); 2003 (822, 737, 85); 2004 (688, 608, 80).

Table 2: Descriptive Statistics for 4-year college students, 2002-2004
Exclusion and inclusion of students with chronic health conditions

	2002		2003		2004	
	Exclude	**Include**	**Exclude**	**Include**	**Exclude**	**Include**
	Obs=971	Obs=1078	Obs=1100	Obs=1216	Obs=932	Obs=1027
Insurance	0.933	0.928	0.912	0.908	0.891	0.901
Excellent health	0.349	0.330	0.334	0.324	0.316	0.316
Very good health	0.434	0.441	0.439	0.440	0.467	0.457
Good health	0.197	0.202	0.197	0.205	0.181	0.192
Fair health	0.018	0.022	0.030	0.030	0.034	0.034
Poor health	0.002	0.005	0.001	0.001	0.002	0.002
Treated number of injuries/illnesses	1.375	1.410	1.299	1.326	1.377	1.378
Untreated number of injuries/illnesses	1.505	1.509	1.554	1.573	1.620	1.651

Notes: All estimates are weighted with sampling weights provided in the NLSY 97 dataset. This provides a weight for everyone who participated in that particular round of surveying, using a special method that combines cross-sectional and over-sample cases.

Table 3: *Ex Ante* Moral Hazard | OLS regressions

$$\textit{total number of injuries or illnesses}_{it} = \beta_0 + \beta_1 \textit{ insurance status}_{it} + \beta_2 X_{it}$$

Variables	**2002 Total injuries/illnesses**	**2003 Total injuries/illnesses**	**2004 Total injuries/illnesses**
Insurance	0.482**	0.112	0.384**
	(0.211)	(0.182)	(0.185)
Male	-0.597***	-0.838***	-0.830***
	(0.122)	(0.115)	(0.124)
Black	-0.574***	-0.692***	-0.826***
	(0.156)	(0.147)	(0.164)
Hispanic	-0.226	-0.322	-0.292
	(0.201)	(0.181)	(0.187)
Non-Hispanic mixed-race	-0.161	-0.743	0.538
	(0.593)	(0.616)	(0.594)
Dad is high school dropout	0.506	-0.126	-0.693**
	(0.298)	(0.291)	(0.315)
Dad is college dropout	0.124	0.0407	-0.127
	(0.133)	(0.124)	(0.135)
Mom is high school dropout	-0.281	-0.136	-0.0969
	(0.272)	(0.268)	(0.290)
Mom is college dropout	-0.137	0.0470	-0.208
	(0.133)	(0.124)	(0.134)
Excellent health	-0.533***	-0.387***	-0.667***
	(0.135)	(0.129)	(0.138)
Good health	0.424**	0.317**	0.00566
	(0.165)	(0.154)	(0.170)
Fair health	0.522	0.803**	1.453***
	(0.409)	(0.326)	(0.380)
Poor health	2.620**	2.579	3.190
	(1.134)	(1.384)	(1.945)
Log household income per person	0.0583	0.0670	0.0612
	(0.0614)	(0.0500)	(0.0420)
Private college	0.198	0.197	-0.0864
	(0.134)	(0.130)	(0.146)
Constant	1.403**	1.802***	2.059***
	(0.601)	(0.505)	(0.431)
Observations	1,078	1,216	1,027
R-squared	0.087	0.097	0.127

Standard errors in parentheses

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

Table 4: Price Effect | Logit regressions

(treated injuries or illnesses) / (total number of injuries or illnesses) $_{it}$= β_0 + β_1 *insurance status*$_{it}$ + β_2 X_{it}

Variables	2002 Ratio	2003 Ratio	2004 Ratio
Insurance	0.603**	0.526**	0.564**
	(0.303)	(0.248)	(0.259)
Male	-0.582***	-0.362**	-0.398**
	(0.176)	(0.157)	(0.174)
Black	-0.458**	-0.279	0.200
	(0.223)	(0.208)	(0.261)
Hispanic	-0.283	-0.430	-0.0771
	(0.281)	(0.235)	(0.256)
Non-Hispanic mixed-race	0.832	-0.0210	-1.283
	(0.464)	(0.885)	(0.770)
Dad is high school dropout	0.433**	-0.359	-0.687
	(0.191)	(0.388)	(0.417)
Dad is college dropout	-0.301	-0.114	0.0504
	(0.405)	(0.166)	(0.192)
Mom is high school dropout	-0.464**	-0.269	-0.373
	(0.191)	(0.350)	(0.378)
Mom is college dropout	-0.165	-0.0340	0.0117
	(0.198)	(0.168)	(0.189)
Excellent health	-0.0996	-0.130	-0.325
	(0.228)	(0.174)	(0.197)
Good health	0.832	0.364	-0.0307
	(0.773)	(0.208)	(0.233)
Fair health	-0.00271	0.0280	0.520
	(1.249)	(0.0697)	(0.536)
Poor health	0.128	0.0813	0.0220
	(0.0845)	(0.179)	(0.0582)
Log household income per person	0.0455	0.293	-0.284
	(0.193)	(0.708)	(0.204)
Private college	0.0455	0.0813	-0.284
	(0.193)	(0.179)	(0.204)
Constant	-0.369	0.268	0.518
	(0.820)	(0.674)	(0.596)
Observations	721	822	688

Standard errors in parentheses

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

Table 5:
Ex Ante Moral Hazard | Stacked OLS regression
Price Effect | Stacked Logit Regression

Variables	Total injuries/illnesses *Ex ante moral hazard*	Ratio *Price effect*
Insurance	0.313***	0.528***
	(0.110)	(0.151)
Male	-0.747***	-0.436***
	(0.0691)	(0.0959)
Black	-0.690***	-0.224
	(0.0892)	(0.129)
Hispanic	-0.282***	-0.288**
	(0.109)	(0.144)
Non-Hispanic mixed-race	-0.0593	-0.0188
	(0.346)	-0.474
Dad is high school dropout	-0.0774	-0.0845
	(0.173)	(0.230)
Dad is college dropout	0.0178	0.103
	(0.0752)	(0.104)
Mom is high school dropout	-0.217	-0.374
	(0.158)	(0.211)
Mom is college dropout	-0.0924	-0.160
	(0.0746)	(0.104)
Excellent health	-0.544***	-0.185
	(0.0769)	(0.107)
Good health	0.258***	0.115
	(0.0936)	(0.127)
Fair health	0.908***	1.525***
	(0.211)	(0.410)
Poor health	2.649***	0.765
	(0.795)	(1.105)
Log household income per person	0.0514	0.0565
	(0.0282)	(0.0389)
Private college	0.116	-0.0251
	(0.0785)	(0.109)
Year 2002	-0.0911	0.0687
	(0.0852)	(0.120)
Year 2003	-0.00946	-0.0804
	(0.0823)	(0.113)
Constant	1.895***	0.205
	(0.286)	(0.391)
Observations	3,321	2,231
R-squared	0.095	

Standard errors in parentheses
*** p<0.01, ** p<0.05