The Effects of Alcohol on the Consumption of Hard Drugs: Regression Discontinuity Evidence from the National Longitudinal Study of Youth, 1997

By

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Abstract

This paper estimates the effect of alcohol use on consumption of hard drugs using the exogenous decrease in the cost of accessing alcohol that occurs when individuals reach the minimum legal drinking age. Using a regression discontinuity design and the National Longitudinal Study of Youth 1997, I find that all measures of alcohol consumption, even alcohol initiation increase discontinuously at age 21. I also find evidence that consumption of hard drugs decreased by 1.5 to 2 percentage points and the probability of initiating the use of hard drugs decreased by 1 percentage point at age 21, while the intensity of use among users remained unchanged. These estimates are robust to a variety of specifications and also remain robust across different subsamples.

JEL: I10, J19

1. INTRODUCTION

Because of the popularity of alcohol among youth, it is crucial for policy makers to understand the effect of alcohol consumption on other risky behaviors. However, establishing causality between alcohol and risky behaviors is problematic, because there may be unobserved heterogeneity driving heavy alcohol consumption and other risky behaviors.

The key to disentangling the causal effect of alcohol consumption on other risky behaviors is to identify a research design that involves an exogenous variation in alcohol consumption. Previous studies have relied on different policies that exogenously change the cost of accessing alcohol to establish causality between alcohol consumption and risky behaviors. The policies that provide exogenous changes in the cost of accessing alcohol can be grouped into five main categories: (1) state-level changes in the minimum legal drinking age, (2) zero-tolerance laws, (3) college campuses that restrict alcohol use on campus, (4) beer price and tax rate, and (5) the current minimum legal drinking age.

State-level change in the minimum legal drinking age occurred in 1983 after the Reagan administration adopted incentives for states to increase the minimum legal drinking age from 18 to 21. The minimum legal drinking age changed from 18 to 21 in different states at different times. By 1988, all states had implemented the new minimum legal drinking age of 21. Previous research exploits the exogenous timing of implementation at the state level to study the complementarity between alcohol and marijuana (Dinardo and Lemieux 2001) and fatalities from motor vehicle accidents (Wagenaar and Toomey 2002) among may other outcomes. A potential limitation of this research design is that the exact date in which states comply with the federal policy is potentially nonrandom (Carpenter and Dobkin, 2009).

A second source of exogenous change in the cost of alcohol accessibility is generated by Zero Tolerance Laws (underage drunk driving laws). The goal of these laws was to deter alcohol consumption among youth by suspending the license of drivers under the age of 21 who have any amount of alcohol in their blood. The widespread variation in the timing of adoption among states provided a clear identification strategy. Carpenter used this identification strategy to conclude that ZT laws decrease the probability of suicide (Carpenter 2004a) and heavy alcohol use (Carpenter 2004b) and to present evidence that heavy alcohol use causes the commission of property and nuisance crimes (Carpenter 2005). Similar to the federal policy to increase the minimum legal drinking age, a potential limitation is that the date on which a state adopts zero tolerance laws is nonrandom.

A third source of exogenous change in the cost of alcohol accessibility is generated by certain university's campus policies that forbid alcohol consumption on campus. Williams et al. (2004) relied on this identification strategy to analyze the relationship between contemporary use of alcohol and marijuana and concluded that alcohol and marijuana are complements.

A fourth source of identification is provided by the state-level variation in price and tax rate for beer. While federal tax provided only limited longitudinal variation, the state-level variation of beer tax and price provides a research design to study the effect of alcohol on alcohol consumption (Carpenter et al 2007), marijuana consumption (Pacula 1998), spousal abuse (Markowitz 2000), and child abuse (Grossman and Markowitz 2000), among other behaviors. While higher prices and tax rates clearly influence the consumption of alcohol, it is unclear whether the cross-state variation reflects local sentiments about alcohol and substance use in general.

Finally, a fifth source of exogenous change in the cost of accessing alcohol occurs at age 21, when individuals can start purchasing alcohol legally. The current minimum legal drinking age does not vary across states, which avoids confounding the effects of the MLDA with state-level sentiments against substance use. Also, the current MLDA of age 21 has been implemented in every state since 1988, which has given every state enough time to comply with this law. While the share of individuals who abstain from using alcohol until age 21 is almost negligible, all measures of alcohol consumption, frequency and intensity of use increase discontinuously at age 21. Exploiting this discontinuity in alcohol consumption, previous research studies the effect of alcohol use on arrests (Carpenter and Dobkin 2010), mortality (Carpenter 2009), and recent marijuana and cigarette consumption (Yoruk and Yoruk 2011)[1].

In this paper, I study the effect of alcohol consumption on the three aspects of consumption of hard drugs at the extensive (consumption vs. no consumption of hard drugs) or intensive margin (frequency of consumption of hard drugs), as well as initiation into hard drugs[2]. While previous literature has focused on studying the effect of alcohol on tobacco and marijuana consumption, raw data shows that it is more common to consume hard drugs with alcohol than it

[1] Recent consumption of a particular drug is defined as consumption in the last month prior to the interview. The NLSY97 only reports the last month's consumption of alcohol, cigarettes and marijuana. Criminal participation and cocaine consumption are reported for the full year prior to the interview.

[2] Self-reported use of hard drugs in the last year answers the question "Excluding marijuana and alcohol, since the date of last interview, have you used any drugs like cocaine or crack or heroin, or any other substance not prescribed by a doctor, in order to get high or to achieve an altered state?"

is to consume them with marijuana[3] (Panel C Table 1), and the probability of consuming hard drugs conditional on consuming alcohol in the same period is higher than the unconditional probability of consuming hard drugs (Panel D Table 1). This makes it an interesting policy question whether alcohol causally affects the consumption of hard drugs. If the relationship between alcohol and hard drugs is causal, then any exogenous shock in alcohol consumption will affect the consumption of hard drugs. On the other hand, if the relationship between alcohol and hard drugs is pure correlation, then an exogenous increase in the availability of alcohol should have no effect on the use of hard drugs.

Identifying the causal effect relies on the exogenous decrease in the cost of accessing alcohol that occurs at age 21. During the first months after turning 21, measures of drug consumption in the last year include such behavior during the person's twentieth year. While the ideal dataset would include the exact dates in which the respondent used hard drugs and the exact birth date, reported outcomes in the year prior to the interview are also valuable. For instance, if respondents who are just older than 21 are much more likely to report having consumed a particular drug in the previous year than individuals who are just younger than 21, some of that discontinuous change in drug consumption must be driven by the exogenous increase in alcohol consumption that occurs at age 21. While more specific data is easily accessible for mortality or arrests, self-reported drug consumption is reported for the past 12 months or the past month only.

[3] Among respondents who consumed only two drugs, the more popular bundle to consume is alcohol and marijuana (15.6% of the sample consumed this bundle at a given year) and the second more popular bundle is alcohol and marijuana (0.9% of the sample consumed this bundle at a given year). Only 0.16% of the sample consumed marijuana and cocaine only (Table 1 Panel C).

For instance, Carpenter (2009) uses exact date of death to study the effect of turning 21 years old on mortality. Due to the lack of granularity of the self-reported measures of drug consumption, the exact date of birth has no added value[4]. Furthermore, the NLSY97 includes information on the month and year of birth as well as the month and year of the interview, which allows me to know the age in months of the respondent at the time the interview took place.

This study finds that the decrease in the cost of accessing alcohol that occurs at age 21 results in the following: First, all measures of alcohol consumption increased discontinuously at age 21. Second, the consumption of hard drugs decreased by 1.6 to 2.6 percentage points at age 21, while the frequency of consumption of hard drugs remained unchanged at age 21. Finally, the probability of initiation into hard drugs decreased by 1 to 1.6 percentage points at age 21. These estimates are robust to the inclusion of time-varying covariates such as enrollment in a 2-year college or 4-year college, employment status, highest degree obtained by the end of the survey[5], and the inclusion of demographics.

The remainder of the paper proceeds as follows. Section 2 describes the National Longitudinal Study of Youth 1997 dataset that I use for this study. Section 3 describes the

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[4] Yoruk and Yoruk (2011) use exact date of birth to study whether self-reported marijuana and tobacco use in the last month increase at age 21. I replicate their results using month and year of birth as opposed to the exact date of birth and I obtain results similar to theirs.

[5] While the regression discontinuity is restricted to respondents between the ages of 19 to 23, the last survey takes place in 2009 when the respondents are between the ages of 24 and 29. The highest degree obtained by the end of the survey is reported in 2009 and corresponds to the highest level of education attained by the last wave in which the respondent was interviewed.

empirical strategy (regression discontinuity research design), and specifications for different models. Section 4 describes the results and robustness checks. Finally, section 5 offers a policy discussion and concludes.

2. DATA

The data used in this analysis is extracted from the National Longitudinal Survey of Youth 1997 (NLSY97). This survey gathers data on 13 waves corresponding to calendar years 1997 to 2009. The sample consists of 8984 individuals who were between the ages of 12 to 16 as of December 1996, and between the ages of 24 and 30 in the last available wave (2009). I restrict my analysis to the periods when adults are between the ages 19 and 23.

While the public version of the NLSY97 does not contain information on the exact date of birth, it includes the month and year of birth as well as the age in months at the time of the interview.[6] The NLSY97 asks respondents questions regarding the consumption and intensity of use of a variety of drugs, including hard drugs, as well as participation in risky behaviors and criminal activity.

The NLSY97 asks participants questions related to alcohol participation in the last year (whether the individual reported having consumed alcohol since the date of the last interview),

[6] Having age in months at the time of the interview allows me to construct the variable age_decimal at the time of the interview (age_decimal=age_month/12). For instance, an individual with PUBID 94 is 232 months old at the time of the 1999 interview. Therefore, individual 94 will be assigned age_decimal 19.33 . The variable age_month is equivalent to the difference in months between date of birth and date of interview. Month and year of birth, as well as date, month and year of interview, are available in the public dataset.

frequency of use in the last month (number of days the respondent had at least one alcoholic drink in the last month, conditional on having consumed alcohol since the last interview), intensity of use in the last month (number of drinks the respondent usually had on the days he or she consumed alcohol in the past month), and binge drinking in the last month (number of days the respondent had 5 or more drinks on one occasion, within a specified number of hours of each other, in the last month).

The NLSY97 also asks participants to report consumption of hard drugs at the extensive and intensity margin (the survey asks respondents the number of times the respondent had used hard drugs since the last interview).[7] The NLSY97 also includes various demographics and measures of education, college enrollment, military service, and employment.

The first wave of the NLSY97 asks respondents whether they have used alcohol, marijuana, tobacco, and hard drugs, and if so, the survey asks respondents to report age of initiation. If the respondent has not used those drugs by the first wave, age of initiation can be inferred using yearly information on drug consumption (whether the respondent used a particular

[7] I will interpret the number of times the respondent consumed cocaine as the number of days of consumption in order to create a variable for the share of days last year when the individual consumed cocaine. The NLSY97 asks respondents to self-report their tobacco and marijuana consumption in the last month. Yoruk and Yoruk (2011) study the effect of the discontinuity in alcohol consumption which occurs at age 21 on marijuana and cigarette use, using the NLSY97. My study only uses measures of tobacco and marijuana use to obtain the age of initiation.

drug[8] in the last year) accompanied by age at first wave, and whether the respondent had used any of these drugs before the first wave.

While a potential problem with self-reported data is measurement error, researchers need to rely on self-reported substance use because biochemical measures of substance use only captures very recent substance use and urinalysis that detects recent marijuana use has significant number of false negatives (Brener et al. 2003). While it is beyond my control to guarantee that respondents report their drug consumption truthfully, the NLSY97 interviews are conducted using a Computer-Assisted Personal Interview (CAPI), while answers to sensitive questions are collected using an Audio Computer-Assisted Self-Interview (ACASI). Self-reported measures of risky behavior produced by ACASI enable the respondent to listen to the questions directly using headphones, allowing greater privacy (Brener et al 2003). A final remark about the NLSY97 is that it is comparable to other popular health related datasets such as the National Survey of Drug Use and Health (NSDUH) and the Monitoring the Future (MTF)[9].

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[8] I analyze initiation age for alcohol, marijuana, cigarettes, and hard drugs.

[9] The 2010 report "Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings" compares measures of lifetime and recent drug use patterns for the NSDUH and the MTF separately for teenagers (12-17 years old) and for young adults (18-25 years old) for years 2002 to 2010. If I compared teenagers from the NSDUH in 2002, I would have to compare them with respondents in 1997 (the year when they were 12-17), and drug patterns could have changed between 1997 and 2002. On the other hand, young adults (18-25) in 2002 in the NSDUH seem a comparable group with young adults (18-23) in the NLSY97 in 2002. The appendix table shows that NLSY97, NSDUH and MTF are comparable in their observables.

3. Methods: Regression Discontinuity Research Design

To estimate the causal effect of alcohol consumption on hard drug consumption, I use a regression discontinuity research design that exploits the discontinuous decrease in the cost of accessing alcohol that occurs at age 21 due to the minimum legal drinking age. I estimate three specifications of a research discontinuity design. Each specification clusters the standard errors at the individual level, and includes year effects.

The first specification uses an OLS model with first (model 1), second (model 2), and third (model 3) age-centered polynomial but does not include covariates.

$$Y_{it} = \delta D_{it} + f^p(\widetilde{a_{it}}) + T_t + \varepsilon_{it} \quad (1)$$

where Y_{it} is the outcome of interest for individual i in year t, and $D_{it} = 1[a \geq 21]$ is an indicator function of individual i being at least 21 years old at the date of interview in year t.

The function $f^p(\widetilde{a_{it}})$ is a p-th order polynomial of an age-centered variable $\widetilde{a_{it}} = (a_{it} - 21)$ interacted with the indicator D_{it} , where

$$f^p(\widetilde{a_{it}}) = \beta_1 \widetilde{a_{it}} + \cdots . + \beta_p \widetilde{a_{it}}^p + \beta_1^D \widetilde{a_{it}} D_{it} + \cdots \ldots \ldots \ldots \beta_p^D \widetilde{a_{it}}^p D_{it} \quad (2)$$

While the first specification provides an intuition for the direction and the size of the discontinuous change of the variable Y_{it}, this discontinuity may be confounded with birthday effects, transitory events such as being unemployed, or with the fact that young adults are more likely to use drugs when they are in a college environment than when they are part of the labor force. To account for these possible problems, the second specification includes an indicator for whether the month of the interview coincided with the birthday month ($birthday_{it}$) which

accounts for birthday celebratory effects. Furthermore, the second specification includes demographics such as gender and race (X_i), and time-varying covariates such as whether the respondent is enrolled in a 2-year college, a 4-year college, or graduate school, or is employed or serving in the military at the time of interview, or has served in the military in the year prior to the interview (X_{it}).

$$Y_{it} = \delta D_{it} + X_{it}\gamma + X_i\beta + \varphi birthday_{it} + f^p(\widetilde{a_{it}}) + T_t + \varepsilon_{it} \quad (3)$$

Finally, a third specification exploits the longitudinal nature of the NLSY97 dataset and includes fixed effects to account for time-invariant unobserved preferences and omitted variables across individuals (equation 4).

$$Y_{it} = \delta D_{it} + X_{it}\gamma + \varphi birthday_{it} + f^p(\widetilde{a_{it}}) + T_t + \alpha_i + \varepsilon_{it} \quad (4)$$

The parameter δ identifies the causal effect of lowering the cost of accessing alcohol at age 21 on the outcome Y_{it}. The age polynomial is a function of normalized age (age centered at 21), which ensures that δ reflects the treatment effect on the outcome Y_{it} that occurs exactly at age 21. I estimate the model using first (model 1), second (model 2), and third (model 3) order age polynomials on individuals between 19 and 23 years old.[10] Finally, ε_{it} represents the time-varying unobserved component.

The identification of the causal effect established by a regression discontinuity design is based on the assumption that other determinants of alcohol consumption and hard drug use will

[10] While my dataset interviews individuals at age 12-16 in December 1996 and ends when individuals are between 24 and 31 years old in the last wave, I focus on individuals when they are within two years of age 21.

transition smoothly before and after age 21. If that assumption holds, then the discontinuous jump in any particular risky behavior will be attributed to the discontinuous increase in alcohol consumption.

Because individuals who are currently attending college may be most vulnerable to a change in the accessibility of alcohol[11], it is important to examine whether the probability of attending a four-year college transitions smoothly through the minimum legal drinking age of 21. Because the labor force does not tolerate the same lifestyle that college allows (some jobs require drug testing as a pre-requisite to being hired), the results may be driven by the drastic change in drug use patterns among recent college graduates even if there is not a discontinuous change in the probability of graduating from college at age 21. When I perform the analysis on the subsample of respondents who never attended a 2-year or a 4-year college, the results remain robust, indicating that the increase in alcohol consumption and the decrease in consumption of hard drugs at age 21 is not driven by the effects of being in college.

I also examine whether there is non-random sorting of certain demographics at the threshold. Figure 1 shows graphical evidence of a smooth transition of demographics and college attendance through the threshold of age 21, which are consistent with the statistically insignificant δ reported in Table 2.

[11] Carpenter and Dobkin (2009) find that the overall increase in the mortality rate occurring at the discontinuity of age 21 is due to large increases in mortality among white males, particularly those currently attending college. Also, Williams et al (2004) report that the share of users of alcohol, marijuana and any illicit drug is higher among college students than among young adults in general.

Another potential threat to this analysis is that individuals may become more likely to report alcohol consumption as soon as they turn 21, even if their alcohol consumption remained unchanged, because the outcome is illegal for individuals under 21. Carpenter and Dobkin (2009) show that there is a large increase in alcohol-related deaths and no change in reported lifetime drinking participation at age 21 (as opposed to recent alcohol consumption), which is compelling evidence that the increase in alcohol consumption that occurs at age 21 is unlikely driven by underreporting of alcohol use by individuals under the age of 21.

Given that demographics and college attendance transition smoothly through the threshold at age 21, I attribute the changes in risky behaviors that occur at age 21 to the exogenous decrease in the cost of alcohol consumption that occurs at age 21.

Finally, I perform falsification tests using as thresholds age 20, 21 and 22, and I find that the results hold only at age 21. This indicates that the effects are not driven by birthday effects or college transition effects, but by the discontinuous decrease in the cost of accessing alcohol.

4. RESULTS AND DISCUSSION

This section examines whether participation in risky behaviors changes in response to the sharp decrease in the cost of accessing alcohol that occurs at age 21. In particular, I examine whether self-reported consumption of hard drugs and the probability of using hard drugs for the first time change discontinuously at age 21. The first subsection documents the drastic increase in alcohol consumption that occurs at age 21.

A. Alcohol

The first stage of the regression discontinuity design evaluates whether there is a discontinuous increase in alcohol consumption in response to the decrease in cost of accessing alcohol that occurs exactly at age 21. I examine five outcomes: (1) alcohol use last year, (2) alcohol use last month, (3) binge use of alcohol in the last month (consumed 5 or more drinks on one occasion at least one day in the past month), (4) share of days on which alcohol was consumed in the last month (number of days in which the respondent used alcohol divided by 30), and (5) share of days on which 5 or more drinks were consumed in one occasion in the last month (number of days on which the respondent binged on alcohol divided by 30).

Each point in panels (A)-(C) of Figure 2 represents the proportion of respondents in each age bin that reports having consumed alcohol in the last year, consumed alcohol in the last month, or engaged in binge drinking in the last month (five or more drinks in one sitting in the same day), correspondingly. Panel (D)-(E) of Figure 2 represents measures of frequency (share of days drinking in the last month) and intensity of alcohol use (share of days binge drinking in the last month), correspondingly. I have eight bins on each side of the threshold of age 21, and they are determined as being eight-tiles, based on the age group.

To quantify the size of the discontinuous increase in alcohol consumption that occurs at age 21, Table 3 presents the coefficient δ for models with different order centered-age polynomials interacted with an indicator that the respondent is older than 21.

In the top panel of Table 3, I present regression estimates of the change in the share of respondents who reported having consumed alcohol since the last interview. The first three columns of table 3 present the regression estimates from specification 1, which includes only the age-centered polynomials and year effects and clusters the standard errors at the individual level.

A first-order age polynomial (model 1) confirms that the increase in self-reported alcohol use in the last year is approximately 6 percentage points (Figure 2, Panel A shows a discontinuous increase from approximately 68% to 75%). This estimate remains robust to a second (model 2) and third order polynomial (model 3) where the estimates change to 5.5 and 6.3 percentage points, respectively. I also present regression estimates after controlling for demographics, birthday effects, college enrollment and employment status (specification 2). A first-order age-centered polynomial confirms an increase of approximately 6 percentage points, which only changes to 4.7 and 5.4 percentage points when I use and second and third-order age polynomial, respectively. Specification two controls for only race and gender as the time-invariant demographics. Specification three estimates a panel fixed effects regression model, which includes a person-specific time-invariant component to control for unobserved heterogeneity. Using specification 3, a first-order age-centered polynomial reports a discontinuity of 5.7 percentage points, which remains robust as I change the order of the age-centered polynomial. All specifications cluster standard errors at the individual level and include year effects.

Similarly, Panel B of Figure 2 indicates that the proportion of people who reported consuming alcohol in the previous month increased by a large magnitude, from 57% to 65% at age 21. The regression estimates reported in Panel B of Table 3 confirm a statistically significant increase of approximately 7 to 8 percentage points, and this remains robust across specifications regardless of the order of the age-centered polynomial.

While drinking in moderate amounts is not necessarily correlated with negative health outcomes, binge drinking is associated with traffic fatalities, suicide, criminal activity, and liver, and kidney disease, among other outcomes. The share of respondents who reported having binged on alcohol at least one day in the last month also increased discontinuously by

approximately 6 percentage points (Table 3 Panel C), and this sharp increase is presented graphically in Panel C of Figure 2.

After establishing that all measures of alcohol participation increased sharply at age 21, I also examine measures of frequency of alcohol use. To measure frequency of alcohol use, Panel D and E of Figure 2 show the percentage of days on which alcohol was consumed in the last month (number of days of alcohol use in the last month, divided by 30) and the percentage of days on which the respondent reported binge drinking in the last month (number of days on which the respondent drank 5 or more drinks in one sitting, divided by 30), respectively. Panel D of Table 3 confirms an increase of approximately 4 percentage points in the share of days on which a respondent consumed alcohol in the last month, which remains robust across specifications, and the order of the age-centered polynomial. Finally, Panel E of Table 3 confirms a 1.5 percentage point increase in the share of days on which the respondent reported binge drinking in the last month.

In summary, all measures of alcohol consumption, frequency, and intensity of use increased by a large magnitude at age 21. All these specifications include year effects and cluster the standard errors at the individual level.

Given that the previous section presented evidence that demographics and college attendance transition smoothly through the age 21 threshold while alcohol consumption increases drastically at age 21, any change in the risky behaviors mentioned below will be attributed to the increase in alcohol consumption.

B. Consumption of Hard Drugs

The NLSY97 asks respondents to report only two measures of consumption of hard drugs: first, whether the respondent consumed hard drugs since the date of the last interview, and second, the number of times the respondent consumed hard drugs in the last year[12].

This paper analyzes whether the consumption of hard drugs changed discontinuously at age 21 at the extensive (share of respondents who consumed hard drugs since the last interview), and at the intensive margin (percentage of days in the last year on which the respondent used hard drugs, conditional on having used them).

Panel A of Figure 3 illustrates a visible discontinuous decrease from approximately 7% to 5.5% in the share of respondents who reported consumption of hard drugs at age 21. Panel A of Table 4 reports a statistically significant decrease of approximately 1.5 to 2 percentage points. This discontinuous decrease remains robust to several specifications, the order of the age-centered polynomial, and the inclusion of birthday celebratory effects, demographics and time-varying covariates.

While the number of respondents who reported consumption of hard drugs decreased, the frequency of consumption of hard drugs among users remains unchanged. Panel C of Figure 3 illustrates a slight increase in the frequency of hard drugs consumption among users (number of days on which hard drugs were consumed last year, divided by 365, conditional on consuming hard drugs in that year), but this increase is statistically insignificant across specifications.

A natural concern is that, even if the probability of being enrolled in college transitions smoothly through the minimum legal drinking age, my results may be driven by a college

[12] I interpret the number of times the respondent consumed cocaine since the last interview as the number of days of use since the last interview, which allows me to compute the percentage of days in the last year on which the individual consumed cocaine

graduation effect if the recent graduates alter their drug use patterns drastically in response to their entrance into the labor market.

To prevent my estimates from being affected by college graduation effects, I perform the same analysis on a subsample of respondents who were never enrolled in a 2-year or a 4-year college. Table 6 reports the estimated parameter δ for first (model 1), second (model 2), and third-order (model 3) age-centered polynomials models that correspond to specification 2 (regression estimates with birthday effects, year effects, demographics, and time-varying covariates such as employment status, military service status and college enrollment indicators when the subsample is not restricted to those who were never enrolled in college).

Alcohol consumption increased drastically at age 21, particularly among those who were never enrolled in college. The share of respondents who consumed alcohol since the last interview increased by 3.5 to 5 percentage points among those who reported having been enrolled in college at any period during the survey (between 1997 and 2009). On the other hand, respondents who were never enrolled in college reported an increase in their alcohol consumption of 6 to 7 percentage points and these estimates are statistically significant regardless of the order of the age-centered polynomial. More interestingly, individuals who eventually obtain at least a bachelor's degree do not adjust their alcohol consumption discontinuously in response to their 21st birthday, which is reflected by an estimated discontinuous change that is statistically indistinguishable from zero (columns 7, 8, and 9 in Table 6). Respondents whose highest level of education by the last wave is at most a high school diploma or GED increase their alcohol consumption by 6 to 7 percentage points at their 21st birthday. Not only does the substantial increase in alcohol use still hold among those who never

attended college, but this effect is also larger in magnitude than among more educated respondents.

Panel C of Table 6 displays how these heterogeneous effects of the 21st birthday on alcohol consumption translate into consumption of hard drugs. Using specification 2, my results confirm a decrease between 1.6 and 4 percentage points in the consumption of hard drugs among those who were never enrolled in college. These results are statistically significant at the 5% level for the first and third order polynomial, and at the 10% level at the second order polynomial. Furthermore, when I analyze the change in consumption of hard drugs among respondents with at most a high school diploma or GED by the last wave of interviews, I estimate a decrease of between 1.4 to 3 percentage points, and these estimates are statistically significant regardless of the order of the age-centered polynomial. While the estimates for the more educated subsample are not statistically significant at the conventional level, they are not zero. The point I want to make is that the increase in alcohol consumption and the decrease in the use of hard drugs also occurred among those who were never enrolled in college, indicating that these results were not driven by college graduation effects.

As a final robustness check, I estimate δ using a second-order age-centered polynomial and a regressions discontinuity research design using as thresholds age 20, 21 and 22. Table 7 reports the parameter δ using the three different specifications that were described in the previous section. There is no change in the share of respondents who report recent consumption of hard drugs at age 20 and 22, and the estimate remains indistinguishable from zero across specifications. On the other hand, the discontinuous decrease in the consumption of hard drugs remains statistically significant and robust across specification when I use age 21 as the threshold. These results illustrate that my findings are not driven by birthday celebratory effects.

C. Initiation into Hard Drugs

After establishing that the use of hard drugs decreases discontinuously at age 21, while the frequency of consumption among users remains unchanged, it is important to see whether the composition of consumers of hard drugs changed.

Because the average starting age for hard drugs is before age 21 (Table 1), respondents who use hard drugs for the first time following their 21st birthday may probably have low preference for hard drugs and hence, conditional on using hard drugs, they will not consume them frequently. If this were the case, these new users may be driving down the average frequency of consumption of hard drugs among users.

To assess whether alcohol is a gateway drug, in the sense that it increases the probability of consuming hard drugs for the first time, I analyze whether first-time consumption of hard drugs[13] changes discontinuously at age 21. The first wave of the NLSY97 asks participants whether they have ever used alcohol, tobacco, marijuana and cocaine, and the age of initiation for each drug, conditional on having already used that drug by the first wave. For those who had not used a drug by the first wave and hence did not report initiation age in 1997, I impute starting age to be equivalent to the age at the time of the interview in which they first reported having consumed that drug.

[13] The probability of drug initiation is the number of first-time drug users in year t divided by the number of respondents who had not consumed that drug as of year t-1. The probability of consuming a particular drug at age 21 is different from the probability of initiating consumption of that drug at age 21.

Assigning drug initiation age is only possible for respondents with non-missing indicators of drug use for every period preceding the period during which the drug was used for the first time. [14]

The average initiation age for alcohol is 15.42 and for hard drugs is 18.27 (Panel B of Table 1). Because most individuals who will ever drink alcohol have already done so by age 21, the probability of alcohol initiation decreases over time (Panel A of Figure 4). Despite the continuous decrease in the probability of alcohol initiation, there is a discontinuous increase in the probability of alcohol initiation that occurs exactly at age 21. Using a specification with no controls (specification 1), the models estimate that the probability of using alcohol for the first time increases by 1.5 to 1.8 percentage points at age 21, and these estimates are statistically significant regardless of the order of the age-centered polynomial. When I incorporate

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[14] For instance, respondent 2 and respondent 32 have the following sequence for alcohol use from years 1997 to 2009

R2=(y97=0, y98=0, y99=1, y00=0, y01=1, y02=1, y03=0, y04=1, y05=0, y06=. , y07=. , y08=1, y09=1)

R32=(y97=0, y98=0, y99=0, y00=. , y01=1, y02=1, y03=1, y04=1, y05=. , y06=. , y07=. , y08=., y09=.)

For periods in which data is missing, I assign zeros as the indicator for whether drug initiation occurred in that period, provided that drug use was already reported in earlier period. The imputed alcohol initiation age for respondent 2 corresponds to the age in year 1999, whereas the imputed alcohol initiation age for respondent 32 is unknown, because we do not know whether the first period of use was 2000 or 2001.

demographics, birthday effects, and time-varying covariates (specification 2), the model estimates a discontinuous increase that is in the range of 1.4 to 1.9 percentage points and is statistically significant. Finally, a panel fixed effects model (specification 3) with birthday effects and time-varying covariates indicates a statistically significant increase of 1.5 percentage points when using a first-order age-centered polynomial. While the magnitude of the discontinuous increase remain robust when using a second and third order age-centered polynomial (1.2 and 1.8 percentage points respectively), these estimates are statistically significant only at the 10% level.

Panel D of Figure 4 illustrates a decrease in the probability of using hard drugs for the first time that occurs exactly at age 21. Panel D of Table 5 reports that the probability of using hard drugs for the first time decreased discontinuously by approximately 1.5 percentage points. This decrease is statistically significant at the conventional levels for first and second order age-centered polynomial, and statistically significant at the 10% significance level for the third order polynomial under the first and second specification.

Although the effect of alcohol on tobacco and marijuana is not analyzed in this paper, I do evaluate whether tobacco and marijuana initiation changed discontinuously at age 21. Panel B and C illustrate a smooth transition in the probability of using tobacco and marijuana for the first time, which are supported by the estimates reported in Panel B and C in Table 5, where the estimates are statistically indistinguishable from zero across specifications.[15]

[15] Yoruk and Yoruk (2011) studied the effects of alcohol on marijuana and tobacco using the NLSY97. This paper focuses on the effects of alcohol on consumption and first-time consumption of hard drugs.

5. CONCLUSIONS

This paper examines the role of an increase in alcohol consumption at age 21, generated by the minimum legal drinking age, on risky behaviors. In particular, I analyze whether consumption and first-time consumption of hard drugs changed discontinuously as a result of the decrease in the cost of accessing alcohol that occurs at age 21.

The legal minimum drinking age of 21 affects all measures of alcohol consumption for individuals just under 21 years of age. The share of individuals consuming alcohol last year and last month, as well as the percentage of respondents who reported binge drinking last month, increased at age 21. Intensity of alcohol of use, measured by the percentage of days of drinking and binge drinking last month, increased by 4 and 1 percentage points respectively. The increase in alcohol consumption and intensity of use that occur at age 21 are statistically significant. While most individuals have already used alcohol before age 21, the probability of alcohol initiation is also 1.5 percentage point higher for those just above age 21 relative to those just below age 21.

The results of this paper can be summarized as follows:

First, the number of users of hard drugs in the last year decreased discontinuously at age 21 by approximately 2 percentage points, and this effect remains robust across different specifications.

Second, this study presents evidence that alcohol consumption at age 21 does not exert gateway effects to hard drugs, defined as alcohol increasing the probability of initiation into other drugs. In fact, the probability of consuming cocaine for the first time decreases at age 21.

I want to emphasize that these findings are specific to the effects of alcohol exactly at age 21, without any intention of generalizing these findings to other age groups. Most respondents who initiate use of hard drugs do so at an earlier age than 21. Hence, respondents who initiate cocaine use between age 21 and 22 are not a representative sample of the population of hard drug users.

While lowering the cost of accessing alcohol may have negative consequences in youth mortality (Carpenter and Dobkin 2009), or increase the probability of recent marijuana consumption among users (Yoruk and Yoruk 2011), this study finds that it lowers the probability of consumption and first-time consumption of hard drugs.

The conclusions of this study are robust to the inclusion of covariates, birthday effects, and to different specifications. I also performed a falsification test, where I estimate the parameter of interest using as a discontinuity age 20, 21, and 22. The only discontinuous changes occur when I use age 21 as the discontinuity, indicating that my results are not driven by the effect of birthday celebrations. To confirm that the findings of this study are not being confounded with potential effect from graduating from college or entering the labor force, I estimate the analysis in the subsample that never attended either a 2-year or 4-year college.

My results show that alcohol and hard drugs are substitutes[16]. The exogenous decrease in the cost of accessing alcohol that occurs at age 21 translates into a discontinuous increase in alcohol consumption and a discontinuous decrease in consumption of hard drugs at the extensive margin only. However, I cannot rule out the possibility that this substitutability is driven by the

[16] These results remained robust when I experimented with different age bandwidths.

fact that turning 21 enables respondents to consume alcohol in public places, where it is more costly to consume hard drugs.

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Figure 1: Smooth Transition of Demographics

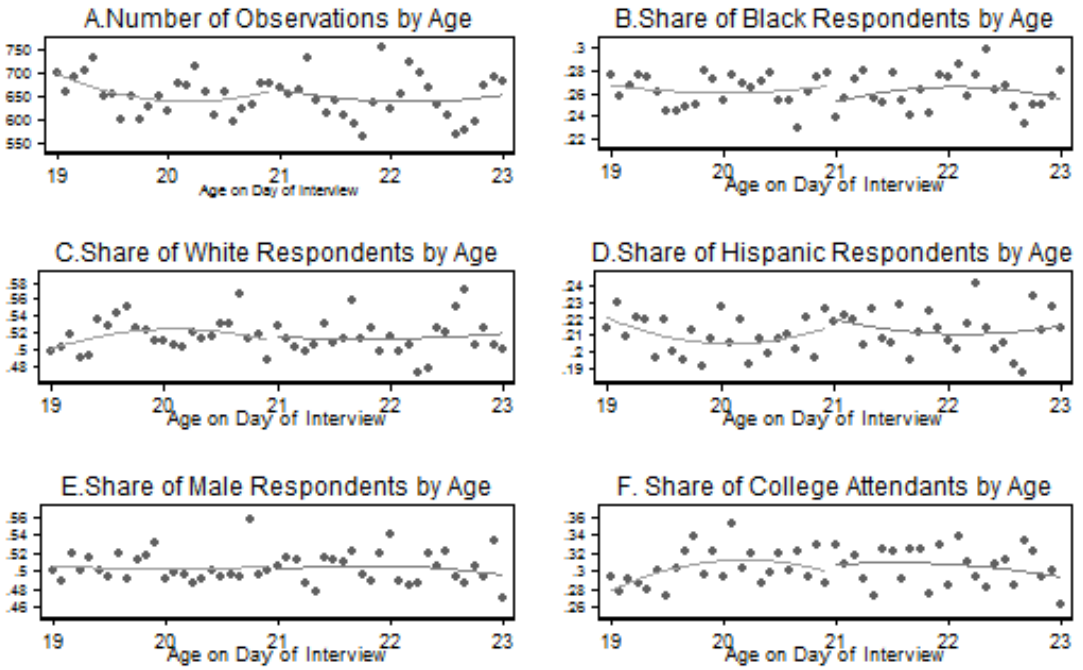

Figure 2: Measures of Alcohol Consumption

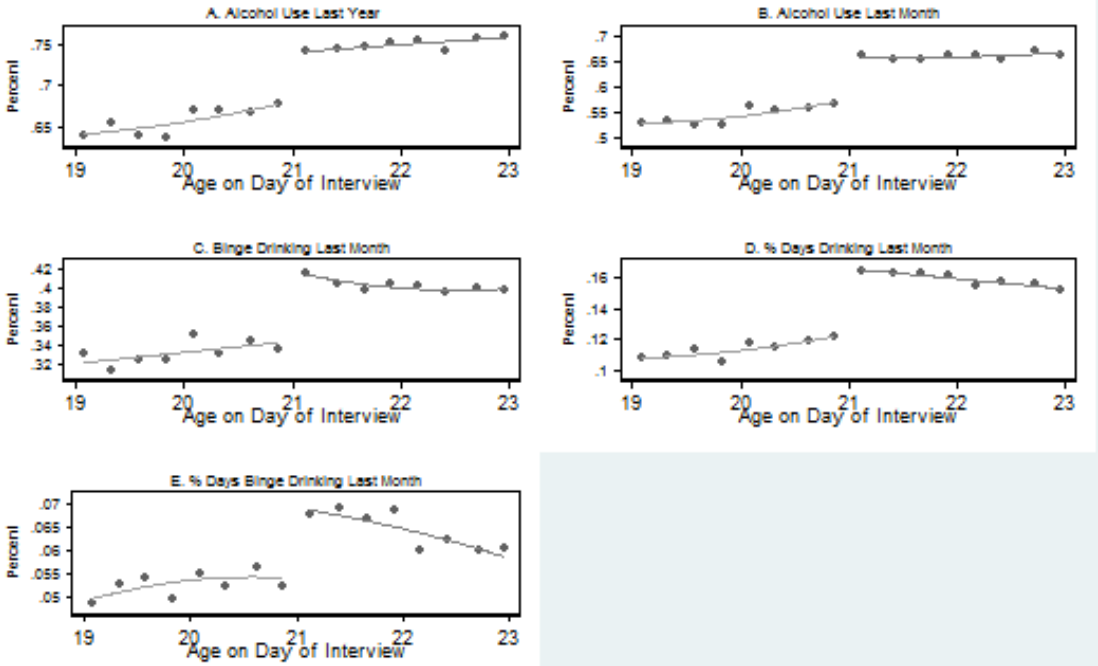

Figure 3: Measures of Hard Drug Consumption

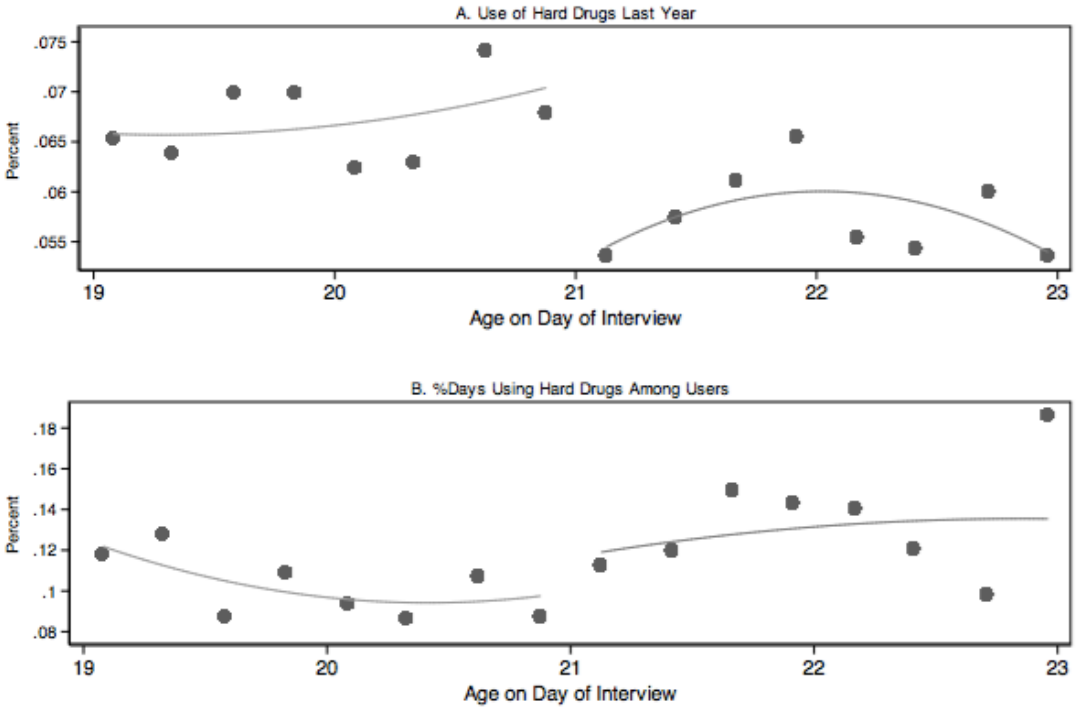

Figure 4: Age Profile of Drug Initiation

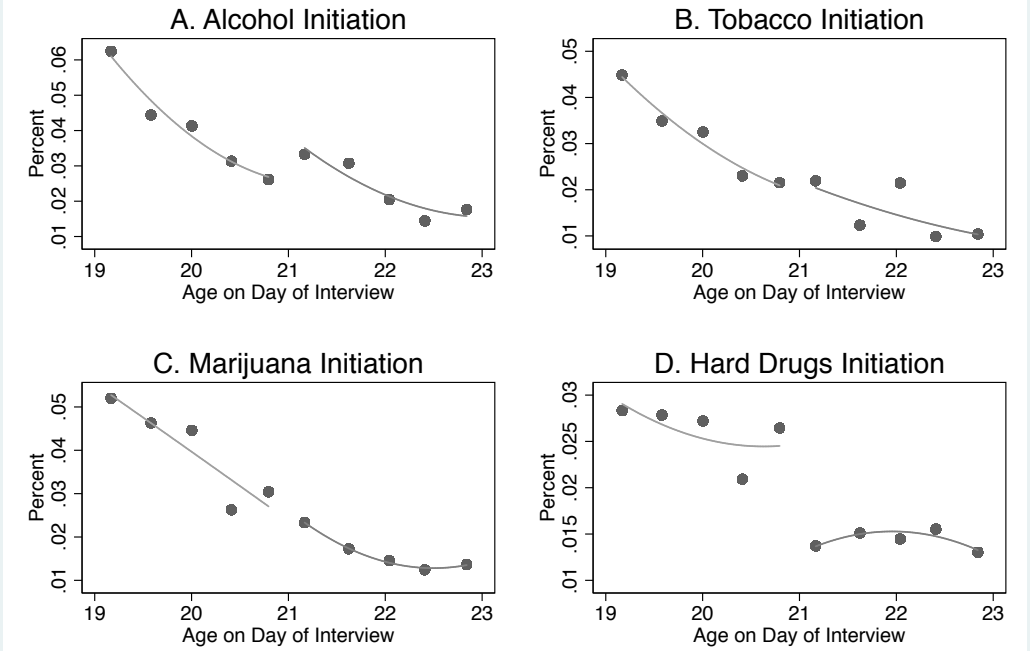

Table 1: Summary Statistics

		Not Lost Due to Attrition				
		Answered Drug Questions (and no attrition)				
	Full sample		Alcohol	Marijuana	Cigarette	Hard Drugs
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Demographics						
Age(1997)	14.35	14.24	14.24	14.24	14.24	14.24
Male	51.19	47.30	46.44	46.00	46.91	46.34
black	25.99	26.67	25.29	25.19	25.90	25.73
hispanic	21.16	20.37	20.59	20.60	20.42	20.44
white	51.93	51.92	53.05	53.13	52.60	52.77
P(ever alcohol)	93.24	95.23	95.37	95.21	95.30	95.30
P(ever marijuana)	58.94	59.68	59.40	58.33	59.46	58.79
P(ever hard drugs)	24.08	25.76	25.61	25.17	25.55	25.09
P(ever cigarette)	73.11	72.63	71.91	71.23	72.02	71.60
Percentage	100.00	59.94				
N	8984	5385				
Panel B: Average Starting Age			Among those who Ever Used			
	All		Alcohol	Tobacco	Mar	Coc
Alcohol Starting Age	15.42	15.45	15.45	14.73	14.41	14.01
Tobacco Starting Age	15.04	15.13	15.11	15.13	14.59	14.01
Marijuana Starting Age	16.61	16.79	16.79	16.52	16.79	15.87
Hard Drugs Starting Age	18.27	18.34	18.35	18.30	18.24	18.34
Panel C:Shareof respondents by Bundles of Consumption (alcohol, marijuana, hard drugs)						
(0,0,0)	30.59					
(1,0,0)	47.05					
(0,1,0)	1.34					
(0,0,1)	0.14					
(1,1,0)	15.61					
(0,1,1)	0.16					
(1,0,1)	0.9					
(1,1,1)	4.2					

Panel D: Conditional Probabilitiy of Substance Use

	Unconditional	Alcohol	No Alcohol
Hard Drugd	5.39	7.77	0.93
Marijuana	21.36	30.14	4.52
Cigarettes	41.29	51.86	20.63

Notes:

Panel A describes the demographics of different subsamples. Column 1 represents the full sample. Column 2 consists of respondents who were not lost due to attrition between 1997 to 1009. Column 3,4,5,6 represents the subsample of respondents who were not lost due to attrition who also did not avoid the questions related to alcohol, marijuana, cigarettes, and hard drugs consumption, respectively.

Panel B describes the average starting age for each drug separately. Column 1 and column 2 are restricted to the same subsample as Panel A. Column 3,4,5,6 are now restricted to respondents who ever used alcohol, tobacco, marijuana, and hard drugs, regardless of whether they were eventually lost due to attrition. Starting age is determin only for those who are not lost due attrition until the period where they report first time use.

Panel C reports the share of respondents who consumed a particular bundle where (drink, mar, hard drugs), and the probabilities were computed for each year independently and then I took the average.

Panel D reports the probability of consuming hard drugs, marijuana, and cigarettes conditional on also drinking alcohol and not drinking alcohol.

Table 2: Age Profile of Demographic Characteristics

	Attending College		Male		Black		Hispanic		White	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Over 21=Di	-0.006	0.008	0.002	-0.002	-0.002	-0.014	0.009	0.004	-0.011	0.005
	(0.008)	(0.013)	(0.009)	(0.014)	(0.008)	(0.012)	(0.007)	(0.011)	(0.009)	(0.014)
Constant	0.224***	0.217***	0.533***	0.533***	0.329***	0.331***	0.182***	0.186***	0.484***	0.478***
	(0.039)	(0.039)	(0.047)	(0.047)	(0.044)	(0.044)	(0.037)	(0.037)	(0.047)	(0.047)
cluster (id)	Yes		Yes		Yes		Yes		Yes	
Year Effects	Yes		Yes		Yes		Yes		Yes	
N clusters	8542									
N	31879									

Note:

Model 1: Model with first order interacted polynomial

Model 2: Model with second-order interacted polynomial .

The reported coefficients are estimated by a OLS model with year effects ,and SE are clustered at the individual level.

Table 3: Measures of Alcohol Participation

	Specification 1			Specification 2			Specification 3		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Panel A: Alcohol Participation in the Last Year									
Over 21=Di	0.061***	0.055***	0.063**	0.059***	0.047***	0.054**	0.057***	0.059***	0.059***
	(0.009)	(0.014)	(0.022)	(0.009)	(0.014)	(0.021)	(0.008)	(0.012)	(0.018)
N clusters					8526				
N					31591				
Panel B: Alcohol Participation in the Last Month									
Over 21=Di	0.085***	0.077***	0.087***	0.082***	0.069***	0.078***	0.079***	0.077***	0.081***
	(0.010)	(0.015)	(0.023)	(0.010)	(0.015)	(0.022)	(0.009)	(0.013)	(0.020)
N clusters					8524				
N					31483				
Panel C: Binge Drinking Last Month									
Over 21=Di	0.067***	0.070***	0.087***	0.063***	0.064***	0.081***	0.059***	0.061***	0.067***
	(0.010)	(0.015)	(0.022)	(0.009)	(0.015)	(0.022)	(0.009)	(0.013)	(0.020)
N clusters					8542				
N					31879				
Panel D: Share of Days in which R Consumed Alcohol in the Last Month									
Over 21=Di	0.043***	0.040***	0.038***	0.042***	0.039***	0.038***	0.039***	0.037***	0.030***
	(0.004)	(0.006)	(0.010)	(0.004)	(0.006)	(0.010)	(0.004)	(0.005)	(0.008)
N clusters					8523				
N					31416				
Panel E: Share of Days in which R Binged on Alcohol in the Last Month									
Over 21=Di	0.014***	0.016***	0.016**	0.014***	0.015***	0.014*	0.012***	0.013***	0.011
	(0.003)	(0.004)	(0.006)	(0.003)	(0.004)	(0.006)	(0.002)	(0.004)	(0.005)
N clusters					8522				
N					31273				
cluster (id)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
birthday	N	N	N	Y	Y	Y	Y	Y	Y
Xi	N	N	N	Y	Y	Y	N	N	N
Xit	N	N	N	Y	Y	Y	Y	Y	Y
fixed effects	N	N	N	N	N	N	Y	Y	Y

Note: Model 1, 2, and 3 correspond to the first, second, and third-order interacted age-polynomial respectively.

* indicates p<=0.05, ** indicates p<=0.01, *** indicates p<=0.001.

Xi corresponds to time-invariant covariates such as indicates for male, black, and hispanic.

Xit corresponds to time-varying covariates such as the dummies for the respondent being enrolled in a 2 yr college, enrolled in a 4 year college, enrolled in graduate school, enlisted in the military, currently employed, and currently employed by the military.

Birthtday is a time-varying indicator for whether the interview in year t took place in the same month as the month of birth, to control for birthday celebrations.

Table 4: Measures of Hard Drug Consumption in the Last Year

	Specification 1			Specification 2			Specification 3		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Panel A: Hard Drug Consumption in the Last Year									
Over 21=Di	-0.014**	-0.017**	-0.021	-0.015**	-0.020**	-0.026*	-0.014**	-0.019**	**-0.020**
	(0.005)	(0.008)	(0.012)	(0.005)	(0.008)	(0.012)	(0.005)	(0.007)	**(0.011)**
N clusters					8475				
N					31345				
Panel B: Instensity of Hard Drug Consumption in the Last Year Among Consumers									
Over 21=Di	0.021	0.014	-0.017	0.016	0.009	-0.035	0.026	0.076	0.076
	(0.021)	(0.030)	(0.041)	(0.021)	(0.029)	(0.039)	(0.024)	(0.038)	(0.059)
N clusters					1185				
N					1952				
cluster (id)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
birthday	N	N	N	Y	Y	Y	Y	Y	Y
Xi	N	N	N	Y	Y	Y	N	N	N
Xit	N	N	N	Y	Y	Y	Y	Y	Y
fixed effects	N	N	N	N	N	N	Y	Y	Y

Note:

Note: Model 1, 2, and 3 correspond to the first, second, and third-order interacted age-polynomial respectively.

* indicates p<=0.05, ** indicates p<=0.01, *** indicates p<=0.001.

Xi corresponds to time-invariant covariates such as indicates for male, black, and hispanic.

Xit corresponds to time-varying covariates such as the dummies for the respondent being enrolled in a 2 yr college, enrolled in a 4 year college, enrolled in graduate school, enlisted in the military, currently employed, and currently employed by the military.

Birthday is a time-varying indicator for whether the interview in year t took place in the same month as the month of birth, to control for birthday celebrations.

Panel A: The outcome variable is an indicator for whether the respondent has consumed hard drugs in the last year

Panel B: The outcome variable is the share of days in the last year in which the respondent consumed hard drugs conditional on consuming hard drugs in the last year.

Table 5: Measures of Drug Initiation

	Specification 1			Specification 2			Specification 3		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Panel A: Alcohol Initiation									
Over 21=Di	.015***	0.014*	0.018*	0.014***	0.014*	0.019*	0.015***	**0.012**	**0.018**
	(0.004)	(0.006)	(0.008)	(0.004)	(0.006)	(0.008)	(0.005)	(0.007)	(0.010)
N clusters					8010				
N					30214				
Panel B: Tobacco Initiation									
Over 21=Di	0.003	0.002	0.003	0.002	0.001	0.001	0.002	0.001	0.002
	(0.003)	(0.005)	(0.007)	(0.003)	(0.005)	(0.007)	(0.004)	(0.006)	(0.009)
N clusters					7938				
N					29961				
Panel C: Marijuana Initiation									
Over 21=Di	-0.002	0.001	-0.005	-0.002	0.001	-0.006	-0.003	0.000	-0.012
	(0.004)	(0.006)	(0.008)	(0.004)	(0.006)	(0.008)	(0.004)	(0.007)	(0.010)
N clusters					7693				
N					29121				
Panel D: Hard Drugs Initiation									
Over 21=Di	-.009**	-.012*	**-0.013**	-0.010**	-0.013*	-0.016*	-0.011**	-0.013*	**-0.016**
	(0.003)	(0.005)	**(0.007)**	(0.003)	(0.005)	(0.007)	(0.004)	(0.006)	**(0.009)**
N clusters					7367				
N					27914				
cluster (id)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
birthday	N	N	N	Y	Y	Y	Y	Y	Y
Xi	N	N	N	Y	Y	Y	N	N	N
Xit	N	N	N	Y	Y	Y	Y	Y	Y
fixed effects	N	N	N	N	N	N	Y	Y	Y

Note: Model 1, 2, and 3 correspond to the first, second, and third-order interacted age-polynomial respectively.

* indicates p<=0.05, ** indicates p<=0.01, *** indicates p<=0.001.

Xi corresponds to time-invariant covariates such as indicates for male, black, and hispanic.

Xit corresponds to time-varying covariates such as the dummies for the respondent being enrolled in a 2 yr college, enrolled in a 4 year college, enrolled in graduate school, enlisted in the military, currently employed, and currently employed by the military.

Birthtday is a time-varying indicator for whether the interview in year t took place in the same month as the month of birth, to control for birthday celebrations.

Table 6: Heterogeneous Discontinuities at Age 21

	Never Enrolled in 2yr or 4yr college			Ever Enrolled in 2yr or 4yr College			Highest Degree BA or more			Highest Degree HS or GED		
	Model1	**Model2**	**Model3**	**Model1**	**Model2**	**Model3**	**Model1**	**Model2**	**Model3**	**Model1**	**Model2**	**Model3**
Panel A: Heterogeneous Effect on Alcohol Consumption in the Last Year												
Over 21=Di	0.074***	0.063**	0.065*	0.049***	.035*	0.039	0.017	-0.001	-0.017	0.070***	0.061***	0.074**
	(0.014)	(0.022)	(0.033)	(0.011)	(0.017)	(0.027)	(0.015)	(0.023)	(0.038)	(0.011)	(0.018)	(0.027)
N clusters		3835			4691			2056			5874	
N		13660			17931			8112			21220	
Panel B: Heterogeneous Effects on Hard Drugs Use												
Over 21=Di	-0.016*	**-0.022**	-0.040*	-0.014*	**-0.018**	-0.015	-0.016	-0.021	-0.018	-0.014*	-0.020*	-0.030*
	(0.008)	**(0.012)**	(0.019)	(0.006)	**(0.010)**	(0.016)	(0.009)	(0.014)	(0.023)	(0.006)	(0.010)	(0.015)
N clusters		3800			4675			2051			5830	
N		13513			17832			8079			21019	
cluster (id)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
birthday	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Xi	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Xit	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note:

Note: Model 1, 2, and 3 correspond to the first, second, and third-order interacted age-polynomial respectively.

* indicates p<=0.05, ** indicates p<=0.01, *** indicates p<=0.001.

Xi corresponds to time-invariant covariates such as indicates for male, black, and hispanic.

Xit corresponds to time-varying covariates such as the dummies for the respondent being enrolled in a 2 yr college, enrolled in a 4 year college, enrolled in graduate school, enlisted in the military, currently employed, and currently employed by the military. Birthtday is a time-varying indicator for whether the interview in year t took place in the same month as the month of birth, to control for birthday celebrations. All reported parameters were estimated using specification 2.

Table 7: Falsification Tests : Age Discontinuity at 20, 21 and 22 in Hard Drugs Consumption (2nd order polynomial)

	Specification 1			Specification 2			Specification 3		
	Age 20	**Age 21**	**Age 22**	**Age 20**	**Age 21**	**Age 22**	**Age 20**	**Age 21**	**Age 22**
Di	0.003	-0.017*	-0.001	0.004	-0.020**	-0.002	0.013	-0.019**	0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
N clusters	8550	8475	8413	8550	8475	8413	8550	8475	8413
N	31542	31345	31063	31542	31345	31063	31542	31345	31063
cluster (id)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
birthday	N	N	N	Y	Y	Y	Y	Y	Y
Xi	N	N	N	Y	Y	Y	N	N	N
Xit	N	N	N	Y	Y	Y	Y	Y	Y
fixed effects	N	N	N	N	N	N	Y	Y	Y

Note:

Note: Model 1, 2, and 3 correspond to the first, second, and third-order interacted age-polynomial respectively. * indicates p<=0.05, ** indicates p<=0.01, *** indicates p<=0.001. Xi corresponds to time-invariant covariates such as indicates for male, black, and hispanic. Xit corresponds to time-varying covariates such as the dummies for the respondent being enrolled in a 2 yr college, enrolled in a 4 year college, enrolled in graduate school, enlisted in the military, currently employed, and currently employed by the military. Birthtday is a time-varying indicator for whether the interview in year t took place in the same month as the month of birth, to control for birthday celebrations. All reported parameters were estimated using specification 2.

Appendix: Comparing the NLSY97 with Other Sources of Data Among Young Adults (18-25) in 2002

	NLSY97(a)	NSDUH (b)	MTF(c)
Min Age in 2002	18	18	19
Max Age in 2002	23	25	24
Lifetime Drug Use			
Lifetime Alcohol	86.23	86.70	88.40
Lifetime Marijuana	52.52	53.80	56.10
Lifetime Cocaine (*)	18.67	15.40	12.90
Past Year Drug Use			
Alcohol	67.65	77.90	83.90
Marijuana	24.51	29.80	34.20
Cocaine (*)	6.03	6.70	6.50
Past Month Drug Use			
Alcohol	56.98	60.50	67.70
Marijuana	18.57	17.30	19.80
Cocaine (*)	-	2.00	2.50
N	7896		

Note: (*) Cocaine in the NLSY97 refers to hard drugs in general.