The Lasting Effects of Leaving School in an Economic Downturn on Alcohol Use

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This study tests whether leaving school in an economic downturn persistently affects alcohol use. The author models alcohol use in middle age as a function of the state unemployment rate at school-leaving in the National Longitudinal Survey of Youth 1979 Cohort. The results suggest that men, but not women, who leave school in an economic downturn consume more drinks and are more likely to report heavy and binge drinking than otherwise similar men. Findings are robust to addressing the endogeniety of the time and location of school-leaving, and contribute to the literature on the lasting consequences of leaving school in an economic downturn.

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Disclaimer: This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

In this study I examine the lasting impact of leaving school in an economic downturn on alcohol use, both measures of social use and excessive use. Alcohol use, particularly excessive use, is conceptually and empirically linked with negative externalities to society. Because of market imperfections excessive drinkers do not fully internalize the cost of their actions and instead impose costs on others through motor vehicle accidents, increased use of publically provided health care and addiction treatment services, child and partner abuse, violence, crime, and reduced productivity in the labor market (Carpenter, 2007, Markowitz, 2000, Chatterji *et al.*, 2004, Markowitz, 2005, Mullahy and Sindelar, 1996, Mullahy and Sindelar, 2008, Balsa *et al.*, 2009, Corman and Mocan, 2013, Cook and Moore, 2002, Lovenheim and Slemrod, 2010, Lovenheim and Steefel, 2011, MacDonald and Shields, 2004, Manning, 1991, Terza, 2002, Markowitz and Grossman, 2000, Levit *et al.*, 2008, Balsa and French, 2010).

The direct medical, crime, and labor market costs of alcohol in the U.S. are estimated to be $259 billion per year (Bouchery *et al.*, 2011). The true burden of alcohol use is likely larger as its negative consequences impact the friends, family members, and co-workers of excessive drinkers. For example, Balsa (2008) finds that parental excessive drinking leads to worse labor market outcomes for children. Taken together these statistics suggest that the costs to society of alcohol use are high, and understanding and mitigating determinants of alcohol use (particularly excessive use) could lead to substantial welfare gains.

I obtain data from the National Longitudinal Survey of Youth 1979 Cohort (NLSY79) and model four measures of past 30 day alcohol use (number of drinks, heavy drinking, weekly binge drinking, drinking more than the 99th percentile drinker) in middle age as a function of the state unemployment rate at school-leaving. I address the potential endogeneity of the time and location of school-leaving with instrumental variables; explore heterogeneity by race, ethnicity, and skill level; and study potential mechanisms for the net relationship. In extensions, I assess

whether other risky behaviors are impacted by leaving school in an economic downturn.

My measures of alcohol use, particularly heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker, plausibly capture the patterns of alcohol use that lead to negative externalities. Indeed, the Centers for Disease Control and Prevention classifies these consumption patterns as excessive drinking based on their associated costs (Centers for Disease Control and Prevention, 2013). Alternatively, the number of drinks measure may capture social use of alcohol that need not impose social costs. Comparing across alcohol use measures will allow me to assess whether my findings represent a public health concern.

This study makes two contributions to the economics literature. First, it extends the growing body of work examining the lasting impact of leaving school in an economic downturn as it examines a previously unconsidered and policy relevant health behavior: alcohol use. Second, my findings add to the broader line of research which examines the link between economic fluctuations and alcohol use. Unlike previous work which examines the short run effects of contemporaneous shocks in the general population, I study the lasting impact of experiencing an economic shock among young adults as they transition from school to work. Moreover, the neuroscience literature shows that this period of the life course corresponds to an important stage for development of persistent alcohol use patterns.

Theory and Background Literature

Leaving school in an economic downturn *per se* is unlikely to influence alcohol use. Instead, leaving school in a downturn may persistently alter labor and marriage market outcomes, which may in turn influence alcohol use patterns. I next review potential channels.

First, leaving school in an economic downturn can persistently impact alcohol use through an income effect. A series of studies documents that workers who leave school in an economic downturn have persistently lower wages and earnings than otherwise similar workers (Oyer,

2006, Oyer, 2008, Genda *et al.*, 2010, Oreopoulos *et al.*, 2012, Kahn, 2010, Hershbein, 2012, Kondo, 2007, Kwon *et al.*, 2010). For example, Kahn (2010) finds that a 1 percentage point increase in the state unemployment rate at school-leaving leads to an annual wage loss of 2.5 to 9% 15 years later among white male college graduates.

As shown by Kondo (2007), Genda *et al.* (2010), and Hershbein (2012) there are differences in the both magnitude and persistence of earnings effects by worker characteristics, however. Kondo (2007) finds that African American men who leave school in an economic downturn initially face larger wage penalties than white men, but wage effects are more persistent among white men. Genda *et al.* (2010) show more persistent earnings effects for college educated men than high school graduates in the U.S. Women's labor market outcomes may be relatively inelastic to leaving school in a downturn (Hershbein, 2012, Kondo, 2007). These studies suggest that, if leaving school in an economic downturn impacts alcohol use through an income effect, we might expect differences in the alcohol use effects by these characteristics.

The economic literature on alcohol and income using individual measures of income implies that social alcohol use increases with income, but excessive use may be unrelated to income (Kim and Ruhm, 2012, Apouey and Clark, 2010, Ettner, 1996). These studies suggest that leaving school in an economic downturn will reduce social use of alcohol, but perhaps excessive use will be unaffected. Alternatively psychological research links financial strain with increased excessive use of alcohol (Shaw *et al.*, 2011). If leaving school in an economic downturn leads to financial strain, not simply lowering incomes, we might expect those who left school in an economic downturn to have persistently higher excessive use of alcohol.

Importantly for this study an active line of research has addressed this question using changes in the contemporaneous economic environment to proxy individual income changes.[1]

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[1] Income changes are only one mechanism through which contemporaneous economic fluctuations may impact alcohol use. As noted by Ruhm and others, they may also alter time costs and psychological strain.

Early studies suggest a pro-cyclical relationship: alcohol use (both social use and excessive use) decreases in economic downturns (Ruhm, 2000, Ruhm, 2003, Ruhm, 2005, Ruhm and Black, 2002, Ettner, 1997, Freeman, 1999). Ruhm and Black (2002), for example, document that a 1 percentage point increase in the state unemployment rate leads to 0.3% decline in the probability of any alcohol use, 3.1% fewer drinks, and a 9.7% reduction in the probability of binge drinking.

Subsequent work calls to question the direction of this relationship, however. Charles and DeCicca (2008) find no relationship between economic conditions and binge drinking and Freeman (2001) shows that beer consumption does not vary across the business cycle. On the other hand Dee (2001), Davalos *et al.* (2012), and Cotti *et al.* (2013) find that heavy and binge drinking, and drinking while driving increase in economic downturns.[2] Of particular relevance to this study, Arkes (2007) shows that youth (16 to 18 years of age) alcohol use increases in downturns.[3] While mixed, on net more recent studies examining the impact of contemporaneous economic downturns and alcohol use suggest that leaving school in an economic downturn will persistently increase alcohol use and in particular excessive use.

Second, reduced wages may lower an individual's time cost. Moreover, marriage outcomes may be influenced by leaving school in an economic downturn and further alter the opportunity costs to drinking through changes in household production responsibilities. An individual who leaves school in an economic downturn and obtains a low paying job may have poor marriage market opportunities, and he may decide to forego marriage. Standard economic models of the family predict that labor market success is particularly important for men's marriage market opportunities (Becker, 1973, Becker, 1981).

Kondo (2011) shows that a higher state unemployment rate at marriage market entrance

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[2] Dee (2001) shows that both drinking participation and number of drinks decline during economic downturns, while binge drinking increases. Thus, the pattern of drinking may matter.
[3] Arkes (2007) shows that number of days consuming increases in economic downturns among youth. Although this pattern of use might be considered social use among adults, it is an illegal behavior among youth and the Centers for Disease Control and Prevention views any alcohol use among youth as a major public health concern.

(18 to 20 years) lowers the median age at which a woman marries, but does not impact marriage outcomes by age 30. However, Maclean *et al.* (2013) isolate the school-leaving period and show that men (not women) who leave school in an economic downturn are persistently less likely to marry and have children than otherwise similar men. Thus, leaving school in an economic downturn may increase alcohol use for men.

Third, poor outcomes in the labor market may lead to psychosocial strain. Research on health and economic downturns supports this concept: mental health declines during downturns (Ruhm, 2000, Charles and DeCicca, 2008, Davalos and French, 2011, Tefft, 2011, McInerney and Mellor, 2012, Deaton, 2012). Of particular relevance for this study, Maclean (2013a) documents that men, but not women, who leave school in an economic downturn have worse mental functioning and self-reported health, and more depressive symptoms in middle age than otherwise similar men. These findings suggest that individuals, and in particular men, who leave school in an economic downturn are more likely to consume alcohol in middle age in attempts to self-medicate psychological strain (Kushner *et al.*, 1990).

Fourth, leaving school in an economic downturn may influence alcohol use by changing the composition of coworkers. Kahn (2010) finds that, in addition to lower wages, men who leave school in an economic downturn work in less prestigious jobs. If movement down the occupational prestige scale is correlated with heavier drinking coworkers then leaving school in an economic downturn could increase in the school-leaver's alcohol use through peer effects (Kremer and Levy, 2008). Indeed, excessive alcohol use is most common among blue collar workers (Substance Abuse and Mental Health Services Administration, 1996).

Fifth, employment may act as a conduit for drinking opportunities (e.g., holiday parties, softball games, happy hours). In this light, unemployment may offer fewer opportunities to consume alcohol. This channel suggests that individuals who leave school in an economic

downturn may consume less alcohol than otherwise similar individuals by limiting occasions that promote excessive consumption of alcohol.

Thus there are multiple potential channels through which leaving school in an economic downturn may persistently impact alcohol use, and these channels are not mutually exclusive. On net the literature seems to suggest that leaving school in an economic downturn will lead to persistently increased alcohol use, specifically excessive use, and the relationship will be particularly strong for men and individuals highly attached to the labor market.

Neuroscience research lends credence to persistent alcohol use effects. Excessive alcohol use is associated with what neuroscientists refer to as psychological deregulation: "a deficiency in the ability to regulate attention, emotions and behavior in response to environmental challenges" (Clark *et al.*, 2008). The prefrontal cortex region of the brain controls many functions that are related to psychological deregulation, and the typical school-leaving age (late teens to mid-20s) is an important period for development of this area of the brain (Dahl, 2004, Zhang *et al.*, 2005, Schmithorst *et al.*, 2002, Spear, 2000, Klingberg *et al.*, 1999, Clark and Winters, 2002, Clark *et al.*, 2008). Moreover, Kaestner and Yarnoff (2011) demonstrate using the minimum legal drinking age the importance of this developmental period for long-run excessive alcohol use: youth would had legal access to alcohol use before age 21 were more likely to use alcohol, and to use it excessively, in middle age. Thus, experiencing an economic shock during the school-leaving period may alter brain development and yield persistent alcohol use, particularly excessive alcohol use, effects.

Data

I obtain data from the National Longitudinal Survey of Youth 1979 Cohort (NLSY79). The original sample consists of 12,686 youth ages 14 to 22 in 1979. The survey was fielded annually by the Bureau of Labor Statistics (BLS) between 1979 and 1993, and bi-annually

between 1994 and 2010. I exclude subsamples dropped by the NLSY79 for financial reasons (1,079 members of the military sample were dropped in 1985 and 1,643 members of the supplemental subsample were dropped after 1990, leaving 9,964 eligible respondents for the 1991 interview). I delete respondents who left school before 1976 as state-level unemployment data from the BLS are available from 1976 onwards (*n*=740) and for whom I cannot determine the year (*n*=622) or state (*n*=294) of school-leaving (detailed in a later section). I exclude those respondents who left school before age 16 (*n*=273). After excluding observations with missing alcohol use in middle age and instrumental variable information (detailed in a later section) and no years of completed education, my analysis sample includes 3,328 men and 3,498 women. Thus, my analysis sample size is in line with studies that utilize the NLSY79 to test the persistent career effects of leaving school in an economic downturn (Kondo, 2007, Kahn, 2010, Hershbein, 2012) and represents 90% of the available sample in 2010 (Bureau of Labor Statistics, 2013b).

Alcohol Use in Middle Age

My primary interest is in the persistent impact of leaving school in an economic downturn and I examine measures of alcohol use collected in middle age. NLSY79 respondents are asked about alcohol use in the 1982, 1983, 1984, 1985, 1988, 1989, 1992, 1994, 2002, 2008, and 2010 rounds. I consider four measures of past 30 day alcohol use: total number of drinks consumed,[4] and indicators for heavy drinking (≥ 60 drinks for men and ≥ 30 drinks for women), weekly binge drinking (≥ 6 drinks per drinking session[5]), and drinking more than the 99th percentile drinker.[6] I use alcohol information from the 2010 round. If a respondent did not provide valid alcohol use information in 2010, I sequentially use the 2008 and 2002 values to preserve sample size. Reasons for missing alcohol use information include attrition and selective item non-response.

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[4] Using the logarithm of the number of drinks produces consistent results.
[5] Although binge drinking is typically defined as consuming 5 or more drinks per drinking session, the NLSY79 respondents are queried about consuming 6 or more drinks per drinking session.
[6] This measure is defined separately for men and women. The male drinker at the 99th percentile of the empirical distribution consumed 180 drinks in the past 30 days, for women the comparable drinker consumed 90 drinks.

Respondents are roughly 49 years of age when these variables are measured.

Economic Conditions at School-leaving

The key explanatory variable in this analysis is the economic conditions at school-leaving. I focus on the first period of school-leaving and, by definition, this event occurs once per observation. I include school-leaving from all types of educational institutions (e.g., high school, community college, four year college, graduate or professional school) with or without a diploma or degree, thus I include both graduates and drop outs. I use responses to education history questions fielded between 1979 and 1998 to identify the year the respondent left school. My sample left school between 1976 and 1998 and I exclude those who left school after 1998 (when respondents are roughly 33 to 41 years of age). I require that respondents report being out of school for a period of two years after school-leaving to avoid classifying short departures from educational attainment as true school-leaving (e.g., leaving school for a year to travel abroad).

Next, I determine the state of residence in the school-leaving period using the NLSY79 geocodes. Respondents who left school between 1976 and 1978 are assigned the 1979 interview state in the year of school-leaving. This imputation assumes that individuals do not move across state lines between school-leaving and 1979. The interview state is assigned to respondents who left school in 1979 and onwards.

In my core regressions I proxy economic conditions with the seasonally adjusted annual state unemployment rate from the BLS, although results are consistent if I use the employment-to-population ratio or past year employment growth rate. I utilize an alternative measure of economic conditions to test whether there are symmetric effects from leaving school in an economic upturn and an economic downturn: positive deviations from the long-run (1976 to 1998) trend in the school-leaving state unemployment rate. To construct this measure I subtract the state-specific mean from the school-leaving state unemployment rate and divide by the state-

specific standard deviation for the 1976 to 1998 period, and I set negative values to zero.

Figure 1 reports the quasi-experiment I exploit to estimate lasting alcohol use effects: the average state unemployment rate between 1976 and 1998 is plotted. During this time period the U.S. experienced three recessions (January 1980 to July 1980, July 1981 to November 1982, July 1990 to March 1991) and growth periods in the mid- to late-1980s and 1990s (National Bureau of Economic Research, 2010).

[Figure 1 about here]

Other Control Variables

In all regressions I include the age at school-leaving, years of education at school-leaving, age in 2010, race/ethnicity indicators (African American and Hispanic, with white as the omitted group), an indicator for birth outside the U.S., a proxy for ability (age-standardized Armed Forces Qualification Test [AFQT][7]), and parental education (mother's and father's years of education). To preserve sample size, I include indicators for missing information and assign missing observations the sample mean (continuous) or mode (binary). Results are robust to excluding these observations. I include the tax for a gallon of packaged beer at the time of school-leaving in 2010 dollars (The Beer Institute, 2012) as a proxy for the monetary price of alcohol.

Empirical Model

I model alcohol use in middle age as a function of the school-leaving state unemployment rate and other covariates as outlined in Equation (1):

(1) $\qquad A_{ist} = \alpha_0 + \alpha_1 U_{st} + \alpha_2' X_{ist} + \alpha_3 B_{st} + \alpha_4' S_S + \alpha_5' D_t + \varepsilon_{ist}$

A_{ist} is a measure of past 30 day alcohol use for individual i in school-leaving state s and school-leaving year t. U_{st} is the state unemployment rate (or positive deviations from long-run trend) in school-leaving state s and school-leaving year t, and X_{ist} is a vector of personal

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[7] Respondents were administered the AFQT in 1980 at 15 to 23 years. I follow Kahn (2010) and age-standardize the AFQT score for individual i in age group g (15 to 23 years): $(AFQT_{ig} - \overline{AFQT_g})/Standard\ Deviation_g$.

characteristics. B_{st} is the beer tax in school-leaving state s and school-leaving year t. S_s and D_t are vectors of school-leaving state and year fixed effects. Inclusion of the school-leaving state fixed effects implies that I use within school-leaving state variation in unemployment rates to identify persistent alcohol use effects. Including these fixed effects allows me to control for time invariant unobservable between school-leaving state differences. Lastly, ε_{ist} is the error term.

I estimate least squares when the outcome variable is the number of drinks, and a linear probability model when the outcome variable is heavy drinking, weekly binge drinking, or drinking more than the 99th percentile drinker.[8] Equations are estimated separately by sex given the different alcohol use and labor market participation patterns of men and women (Blau and Kahn, 2007, Naimi *et al.*, 2003, Brady *et al.*, 1993, Brady and Randall, 1999, Kondo, 2007). I apply NLSY79 sample weights that account for survey design and attrition in all analyses, and I cluster standard errors around the school-leaving state. Unweighted results are consistent, as are standard error estimates clustered at the school-leaving year or school-leaving year/state level.

The key identifying assumption of Equation (1) is presented in Equation (2):

(2) $$Cov(U_{st}, \varepsilon_{ist} | X_{ist}, B_{st}, S_s, D_t) = 0$$

In words, the state unemployment rate at school-leaving is uncorrelated with the error term in the alcohol use equation after conditioning on personal characteristics and various fixed effects. An obvious concern is that the time or location of school-leaving is endogenous to the state unemployment rate. School-leavers may engage in endogenous timing (enrolling in additional schooling, dropping out) or migration (moving to a stronger labor market) to avoid leaving school in an economic downturn (Kahn, 2010). I refer to these activities as endogenous sorting.

The intuition for the sign of the potential bias from endogenous sorting is difficult to

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[8] As a sensitivity check I estimate probit models when the outcome variable is binary and the results are consistent. A substantial number of observations in the female regressions are perfected predicted in the probit model and I encounter a large drop in the sample size. I choose to estimate the linear probability model, and a two-stage linear probability model in instrumental variable analysis, and note this data problem as a limitation of the study.

determine *ex ante*. Individuals who avoid leaving school in an economic downturn may have characteristics (e.g., financial resources) likely not included in survey data but predict alcohol use. Myopic individuals or those with hyperbolic discounting may leave school before graduation to take advantage of an economic upturn, which may persistently impede labor market outcomes, and have higher alcohol consumption. Alternatively, it may be that only the most capable and hard-working individuals are willing to leave school in a downturn as their abilities will allow them to secure desirable jobs regardless of the economic conditions. Such characteristics are arguably negatively correlated with excessive alcohol use, but may be positively correlated with more moderate alcohol use. An additional concern is measurement error in the school-leaving variables which are based on self-reports and subject to recall bias. Random measurement error can reduce precision and attenuate estimates, while non-random attrition can bias estimates in either direction (Bound *et al.*, 2001, Wooldridge, 2010).

To circumvent these empirical concerns I estimate instrumental variable models. Following Kahn (2010), I instrument the school-leaving state unemployment rate with the "on time" state unemployment rate. I create on time state unemployment rates using birth date, state of residence at age 14 (respondents who resided outside the U.S. at age 14 are excluded, n=40), and education at school-leaving. I use minimum school-starting ages from Acemoglu *et al.* (2001). Respondents are assigned the state unemployment rate they would face if they left school on time. For example, I assign a college graduate the unemployment rate in the year she turned 22 (modal school-leaving age for college graduates in my sample) in the state of residence at age 14. State of residence at age 14 is used as it is arguably exogenous to the school-leaver while the school-leaving state is more suspect. I make similar assignments for all educational levels. This instrument utilizes variation in school-leaving economic conditions that is determined by year of birth and state of residence at age 14.

I use a second IV (Maclean, 2013a): the "respondent expected" school-leaving state unemployment rate. I construct respondent expected state unemployment rates using birth date and school start dates detailed above, reported educational expectations in 1979, and state of residence at age 14. In 1979 respondents were asked "What level of education do you expect to attain?"[9] The respondent expected state unemployment rate is the state unemployment rate the respondent would have faced had he left school at his expected time. For example, I assign a respondent who reported that he expected to complete high school the unemployment rate in the year he turns 18 in state of residence at age 14. I make similar assignments for all levels of expected education. This second instrument allows only *ex ante* expectations of educational attainment to dictate the school-leaving period.[10]

I replace the school-leaving state and year fixed effects with age 14 state of residence fixed effects, and on time and respondent expected year fixed effects. I cluster the standard errors in instrumental variable models by the age 14 state of residence; standard error estimates are robust if I cluster at the expected or respondent expected school-leaving year.

Results

Sample Characteristics

Summary statistics are reported in Table 1. Among men, the mean number of drinks consumed is 19.2, and 9.3%, 12.0%, and 0.7% of men report heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker. Consistent with the public health literature, women consume less alcohol than men (Brady and Randall, 1999, Naimi *et al.*, 2003, Kanny *et al.*, 2012). In the female sample the mean number of alcohol drinks consumed is 8.8, and 8.8%, 3.2%, and 0.5% of women report heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker.

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[9] NLSY79 respondents were also asked this question in 1981 and 1982. If a respondent did not provide a valid answer to this question in 1979, I sequentially use the 1981 and 1982 values.

[10] I would like to thank David Card for suggesting this instrument.

The average annual state unemployment rate at school-leaving for men and women is 7.5%. The average school-leaver left school in 1980, just ahead of the 1981 to 1982 recession. In 2010 members of my sample are roughly 49 years of age. Respondents left school with 13 years of education at age 19. Men have slightly higher AFQT scores than women: 50.7 vs. 49.4. Other personal characteristics are consistent with the U.S. population.

[Table 1 about here]

Regression Results

Table 2 reports selected estimates of the effect of leaving school in an economic downturn on alcohol use in middle age for men and women. The top panel reports results for men, and the bottom panel pertains to women. I report regressions that proxy economic conditions at school-leaving with both the school-leaving state unemployment rate and positive deviations from long-run trend in this rate. These models do not address the potential endogeneity of the time or location of school-leaving, or measurement error in the school-leaving variables. To distinguish these models from instrumental variable models presented later I refer to them as "naïve" models.

[Table 2 about here]

Men who leave school in an economic downturn consume more drinks and are more likely to report heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker. Only the number of drinks and weekly binge drinking parameter estimates are statistically different from zero, however. A 1 percentage point increase in the school-leaving state unemployment rate is associated with 1.5 additional drinks, and a 0.9, 1.4, and 0.2 percentage point increase in the probability of heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker. These parameter estimates translate into a 7.7% increase in the number of drinks, and a 10.0%, 11.3%, and 20.0% increase in the risk of heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker among men.

Leaving school in an economic downturn is not a strong predictor of women's alcohol use in middle age: in all regressions the parameter estimates are small and statistically indistinguishable from zero. The estimates do carry a negative sign, however, suggesting that women who leave school in an economic downturn may be less likely to consume alcohol in middle age.

Results utilizing the positive deviations from long-run trend in the school-leaving state unemployment rate to proxy economic conditions produce consistent results: leaving school when the state unemployment rate is above it long-run trend increases alcohol use in middle age.

Instrumental Variable Regression Results

The key empirical challenge in this study is bias from endogenous sorting and measurement error in the school-leaving variables. To address these potential sources of bias, I estimate instrumental variables models. In the number of drinks regressions I estimate two-stage least squares, and in the heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker regressions I estimate two-stage linear probability models. I instrument the school-leaving state unemployment rate with the on time and respondent expected school-leaving state unemployment rates.

Instrumental variable models estimate a local average treatment for those individuals who comply with the instrument. Understanding what type of individual complies with my selected instruments is important for establishing whether or not these individuals represent an informative group to study and the generalizability of my findings to the broader population.

Conceptually, individuals who comply with my selected instruments do not alter their education profile in response to economic conditions at the time of school-leaving as determined by date and location of birth or planned educational attainment. Compliers may not change their educational plans because they have strong preferences towards obtaining a specific level of education (e.g., college degree). Alternatively these individuals may be particularly able and

hardworking, and these abilities will secure them a good job regardless of the economic conditions under which they leave school. Compliers may lack the resources to optimally respond to poor economic conditions at school-leaving. For example, these individuals may not have the financial resources to pursue an additional degree if they complete college in a downturn or they may not understand how economic conditions will impact their careers.

Moreover, my selected instruments should exclude individuals who decide to continue studying when faced with an economic downturn (perhaps because of the lower opportunity cost of education) or who migrant to another labor market when faced with an economic downturn at school-leaving. Such individuals may be more advantaged. Lastly, the selected instruments should exclude myopic individuals, or those with hyperbolic discounting, who decide to drop out of school before completing their planned education in response to economic upturns. Thus, the compliers likely include both advantaged and dis-advantaged workers.

I next compare personal characteristics of compliers and non-compliers. I refer to those individuals whose on time school-leaving year matches their actual school-leaving year, and their state of residence at age 14 matches their state of residence at actual school-leaving, as compliers to the on time instrument. I define compliers to the respondent expected instrument analogously. Table 3 presents personal characteristics for each of these groups, the top panel pertains to the on time instrument and the bottom panel pertains to the respondent expected instrument.

On average, the compliers to both instruments are less advantaged than the non-compliers. The compliers to the on time instrument left school at an earlier age with fewer years of education, are more likely to be a racial or ethnic minority, have lower age-adjusted AFQT scores, and have less educated parents than the non-compliers. Moreover, these differences are often statistically different from zero. Differences are consistent, yet smaller in magnitude and less likely to be statistically different from zero, for the respondent expected instrument. Thus,

these statistics suggest that the compliers represent a relatively vulnerable group of individuals.

Because the labor literature shows that more advantaged groups (e.g., high skill workers, non-minorities) experience the most persistent career effects from leaving school in an economic downturn, we might expect that the effect I estimate with my selected IVs is smaller than the effect for the broader population. Identifying an instrumental variable that will estimate a LATE for more advantaged groups is an important area of study that I defer to future work.

[Table 3 about here].

IVs must predict the endogenous regressor to consistently estimate a local average treatment effect for the compliers. Table 4 presents selected results from first stage regressions: the school-leaving state unemployment rate is regressed on the IVs and all other covariates included in Equation (1) using least squares. The IVs are strong predictors of the school-leaving state unemployment rate for both men and women: the F-statistics range from 105 among men to 196 among women, well above the minimum recommended value of 10 (Stock *et al.*, 2002). A 1 percentage point increase in the on time (respondent expected) state unemployment rate is associated with a 0.6 (0.1) percentage point increase in the school-leaving state unemployment rate among men ($p \leq 0.01$), and results are similar in size among women although the respondent-expected school-leaving state unemployment rate is slightly less precisely estimated ($p \leq 0.05$).

[Table 4 about here]

Instrumental variables must pass the monotonicity assumption: the IV must operate in the same direction for all respondents. To shed light on whether my selected IVs satisfy this assumption, I stratify the sample on race/ethnicity (white, African American, and Hispanic) and skill level at school-leaving (college degree and less then college) and re-estimate the first-stage regressions. Results are reported in Appendix Table A and suggest that my selected IVs satisfy this assumption. Specifically, the coefficients on the IVs are positive in all regressions and the

parameters are statistically significant ($p < 0.10$) for 16 of 20 coefficients. One exception is the

coefficient on the respondent-expected school-leaving state unemployment rate among high skill

women: the coefficient is negative but the 95% confidence interval includes positive values and

thus I cannot definitively rule out a positive correlation in this sample.

A third assumption in an instrumental variables model is that the selected IVs are valid,

that is they are correctly excluded from the structural equation (Equation (1) in this study).

Unfortunately, the researcher cannot definitively prove that the IVs are valid. In an attempt to

provide suggestive evidence on the validity of my IVs, in separate models I regress each IV on all

other variables included in Equation (1) and test the joint significance of personal characteristics.

If the IVs are not strongly correlated with observable personal characteristics perhaps they are

uncorrelated with the error term of Equation (1) and thus correctly excluded. Selected results

from this analysis are reported in Table 5. The personal characteristics included in Equation (1)

are generally not strong predictors of the IVs, and the *F*-statistics of the personal characteristics

joint significance range from 0.56 to 3.19.

[Table 5 about here]

Tables 6 reports selected results from the instrumental variables models of alcohol use in

middle age. The top panel presents estimates for men and the bottom panel applies to women.

Among men, the IV parameter estimates are consistent in terms of sign, although all coefficients

estimates are now statistically different from zero in regressions that proxy economic conditions

at school-leaving with the state unemployment rate.[11] A 1 percentage point increase in the

school-leaving state unemployment rate leads to 1.9 additional drinks, and a 1.2, 1.0, and 0.3

percentage point increase in the probability of heavy drinking, weekly binge drinking, and

drinking more than the 99th percentile drinker. As in the naïve models, leaving school in an

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[11] I calculated the difference between the naïve and IV estimates and could not reject the null hypotheses that the estimates were the same. Standard errors were calculated using non-parametric bootstraps with 500 repetitions.

economic downturn does not appear to substantially impact women's alcohol use in middle age: the estimates carry a negative sign but are small and statistically indistinguishable from zero.

Results are consistent in terms of sign when I proxy economic conditions at school-leaving with positive deviations from long-run trend in the school-leaving state unemployment rate, although the coefficient on heavy drinking is no longer statistically significant among men. For brevity, I report results generated in the IV models utilizing the state unemployment rate in the remainder of the paper. Full results are consistent and are available on request, however.

[Table 6 about here]

The results are consistent if I estimate just-identified models (i.e., instrumenting with either the on time or respondent expected school-leaving state unemployment rate) and are presented in Appendix Table B. The coefficients are generally more precise when I utilize the on time rather than the respondent expected school-leaving state unemployment rate; this difference in estimate precision is perhaps not entirely surprising as first stage regressions reveal that the on time state unemployment rate is a stronger predictor (i.e., the associations are four to six times larger) of the school-leaving state unemployment rate than the respondent-expected rate.

Equation (1) controls for school-leaving state fixed effects. To ensure that I do not spuriously attribute the effects if a subsequent economic downturn to the school-leaving state unemployment rate, I re-estimate Equation (1) augmented with the state of residence in 2010 fixed effects. Results are reported in Appendix Table C and are highly consistent in terms of direction and magnitude, although the standard errors increase slightly for the heavy drinker and drinking more than the 99th percentile drinker and the estimates are no longer precisely estimated.

The models presented thus far address two sources of bias: 1) difficult-to-observe time invariant school-leaving state characteristics that influence both leaving school in an economic downturn and alcohol use in middle age and 2) bias from endogenous sorting on the part of

school-leavers. However, these models to not address important difficult-to-observe time varying

school-leaving state characteristics. My sample left school between 1976 and 1998, and we

might expect that time-varying characteristics may have changed substantially (e.g., attitudes

toward alcohol use and labor market attachment). To address this source of bias I re-estimate

models that include school-leaving state-specific linear time trends.[12] Results are reported in

Appendix Table D and are consistent with the core findings for men. Among women the

coefficients are small and statistically indistinguishable from zero, and they do change signs

across regressions: coefficients are positive (negative) in the number of drinks and heavy

drinking (weekly binge drinking and drinking more than the 99th percentile drinker) regressions.

Heterogeneity in the Alcohol Use Effects

In this section I investigate heterogeneity in the alcohol use effects. As outlined in an

earlier section of the paper, the career effects of leaving school in an economic downturn are not

experienced equally by all workers. Thus, we might expect that different groups experience

different alcohol use effects as well. I re-estimate the models by 1) race/ethnicity (whites,

African Americans, Hispanics) and 2) skill level at school-leaving (high skill is defined as a

college education and low skill is as defined as by less than college).

Results by race and ethnicity are reported in Table 7. A caveat to this analysis is that

stratifying by race and ethnicity substantially reduces my sample size for particular groups. For

example, I examine just 569 and 586 Hispanic men and women.

Among men, the effects of leaving school in an economic downturn are strongest for

white men and are consistent with the full sample: leaving school when the state unemployment

rate is high leads to higher alcohol use (social use and excessive use). A 1 percentage point

increases in the school-leaving state unemployment rate leads to 2.2 more drinks, and a 1.5, 1.1,

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[12] I replace the school-leaving year fixed effects with a linear trend in the years since school-leaving to limit the number of interactions in a small data set such as the NLSY79.

and 0.3 percentage point increase in the probability of heavy drinking, weekly binge drinking, and drinking more than the 99th percentile drinker (the weekly binge drinking coefficient is statistically indistinguishable from zero, however). The coefficients estimated in the minority samples change signs across alcohol use measure (negative for number of drinks and heavy alcohol use, positive for weekly binge drinking and drinking more than the 99th percentile drinker) and are not statistically different from zero.

Kondo (2007) shows that the wage effects of leaving school in an economic downturn are more persistent for white men than for African American men. Perhaps this extends to alcohol use as well, that is the alcohol use effects for minorities may dissipate over time. Alternatively, alcohol use patterns vary across racial and ethnic groups (Substance Abuse and Mental Health Services Administration, 2012). For example, whites are more likely than African Americans and Hispanics to use any alcohol and to report heavy drinking. It is thus plausible that the responsiveness to economic conditions at school-leaving varies across these groups as well as clinical work suggests heterogeneity in price responsiveness by these characteristics (An and Sturm, 2011). Alternatively, it may be that the small sample sizes for minorities (particularly Hispanics) prevent me from precisely estimating effects. Future work, utilizing a larger data set, could explore these racial and ethnic disparities more rigorously.

Among women, the coefficients are rarely statistically significant in any of the racial or ethnic groups I examine. Although imprecise, white women who leave school in an economic downturn may be less likely to consume alcohol in middle age. The pattern of results is less clear for minority women: the coefficient in the weekly binge drinking is negative while the coefficients in other regressions change sign in a difficult to interpret manner. Indeed the coefficient in the weekly binge drinking regression in the African American women sample is statistically different from zero: a one percentage point increase in the school-leaving state

unemployment rate leads to a one percentage point decrease in the risk of weekly binge drinking.

[Table 7 about here]

Table 8 reports heterogeneity by skill level as measured by years of education at school-leaving. Stratifying the sample in this manner may lead to sample selection bias if school-leavers alter the level of education they obtain in response to contemporaneous economic conditions, and thus readers should interpret these findings with some caution. In addition, I am unable to estimate the model of drinking more than the 99th percentile drinker in the high skill men sample as there are no high skill men in my sample that display this pattern of drinking.

I find few statistically significant effects in either the high skill or low skill men samples, although the sign on the estimated coefficients suggests that leaving school in an economic downturn increases alcohol use in middle age among men of all skill levels. Perhaps the persistence of the alcohol use effects is more equally distributed across skill levels than are career effects (Genda *et al.*, 2010). Alternatively, I have four to five times more low skill men than high skill men, and the small size of the NLSY79 may prevent me from estimating these relationships. Findings in the high and low skill female samples offer little robust evidence that leaving school in an economic downturn persistently impacts alcohol use among women: the coefficients are not statistically different from zero, the magnitude of the effects is small, and the direction of the relationship changes across the alcohol use measures.

[Table 8 about here]

Mechanisms

In my core models I examine the net effect of leaving school in an economic downturn on alcohol use in middle age. I next explore potential mechanisms for these relationships. As described earlier in this manuscript it is unlikely that leaving school in an economic downturn *per se* affects alcohol use in middle age, rather it impacts outcomes that in turn influence alcohol use.

Additionally, analysis of potential mechanisms may shed light on the heterogeneous effects by race and ethnicity, and (to a lesser extent) skill level.

I examine six potential mechanisms measured in the NLSY79. While not comprehensive, these variables potentially capture use of alcohol for self-medication purposes, time costs to using alcohol, income, and coworker peer effects. I construct measures of self-esteem (measured by the Rosenberg (1965) score, the score ranges from 0 to 100 and higher scores indicate higher levels of self-esteem, I convert this measure to a proportion and take a logit transformation to account for the fact that it is bounded by 0 and 100); probability of employment; logarithm of annual earnings (in 2010 dollars); probability of working in a blue collar occupation;[13] the probability of being somewhat or very dis-satisfied with one's job (this variable may capture job strain); and the probability of being married.[14]

I chose to measure these variables in 2006 as the employment and self-esteem variables are only collected sporadically in the later years of the NLSY79, but are collected in 2006, and thus 2006 offers the best time match to the alcohol use measures (which are measured in 2010, 2008, or 2002). I replicate the regressions outlined in Equation (1) and results are reported in Tables 9 (full sample), 10 (sample stratified by race and ethnicity), and 11 (sample stratified by skill level at school-leaving).

The findings for the full sample of men suggest that those men who leave school in an economic downturn have lower levels of self-esteem, are less likely to be employed, have lower annual earnings, and are less likely to be married in middle age than otherwise similar men. However, leaving school in an economic downturn is not a statistically significant predictor of the probability of working in a blue collar job (my proxy for coworker peer effects) or being dis-

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[13] Blue collar workers are defined using 2000 Census 4-digit occupation codes in 2006. Respondents reporting occupations in food preparation and serving; cleaning and building service; construction trade and extraction workers; installation, maintenance and repairs workers; production and operating workers; food preparation; setters, operators and tenders; and transportation and material moving workers.
[14] Occupation and job satisfaction measures pertain to the first job listed in the employment section.

satisfied with one's job (my proxy for a poor job match or job strain). However, these proxies are likely crude and may not capture these concepts particularly well among men.

Among women, I find that leaving school in an economic downturn does not substantially impact the majority of potential mechanism I study, although it may decrease the probability of job dis-satisfaction and increase the probability of marriage in middle age. It is possible among women that the alcohol enhancing aspects of job strain are offset by the alcohol reducing concepts of marriage.

[Table 9 about here]

Turning to racial and ethnic groups (Table 10), I find (consistent with the full sample) that white men who leave school in an economic downturn have lower levels of self-esteem, are less likely to be employed, have lower annual earnings, and are less likely to be married in middle age than otherwise similar white men. I find comparable patterns for African American and Hispanic men, although the coefficients are less likely to be statistically significant. The coefficients suggest that leaving school in an economic downturn is particularly detrimental to marriage among African American men: a 1 percentage point increase in the school-leaving state unemployment rate leads to an 8.3 percentage point decrease in the probability of marriage for such men. Among Hispanic men, leaving school in an economic downturn has large and negative effects on the probability of employment and being dis-satisfied with one's job.

Findings for white women are consistent with the full sample: leaving school in an economic downturn may decrease (increase) the probability that a white woman is dis-satisfied with her job (married) in middle age. The school-leaving state unemployment rate is not a statistically significant predictor of any other mechanisms I study. Among African American women, leaving school in an economic downturn reduces self-esteem and the probability of employment in middle age, but increases the probability of working in a blue collar job. Perhaps

for this group of women, lower access to employment-based alcohol promoting activities protects against excessive alcohol use as leaving school in an economic downturn increases weekly binge drinking among African American women (Table 7). None of the relationships between leaving school in an economic downturn and alcohol use are statistically significant among Hispanic women but sample sizes are particularly small (n=383 to 519).

[Table 10 about here]

Table 11 reports analysis of mechanisms by skill level at school leaving (high skill defined as a college degree vs. less than college). I find similar results in both the high and low skill male samples, and these are consistent with the full sample of men. However, the coefficients are more often statistically significant among low skill men than among high skill men (an exception is the earnings regression, the effects on earnings are only precisely estimated among high skill men and this finding is consistent with previous work (Genda *et al.*, 2010)). As noted earlier, differences in precision may be attributable to differences in sample size: I have four to five times as many low skill men as high skill men in my analysis sample. Moreover, my sample of low skill men includes both middle skill (high school graduates and some college) and low skill men. The results broadly suggest that self-mediation and time costs, but perhaps not peer effects from coworkers (as measured by blue collar jobs), are important mechanisms for men of all skill levels. Among both high and low skill women, I find little evidence that the potential mechanisms I consider are substantially influenced by leaving school in an economic downturn. Indeed, not one of the twelve coefficients is statistically different from zero.

[Table 11 about here]

Self-medication with alcohol and lower time costs from reduced earnings and probability of marriage appear to be important mechanisms, particularly for men. To further examine the importance of these mechanisms, I examine alcohol use patterns by employment status, marital

status, and mental functioning in the NLSY79. I compare my four drinking variables by contemporaneous employment status (employed vs. not employed), marital status (married vs. non-married), and mental functioning (I utilize the SF-12 Mental Components (MCS) score (Ware *et al.*, 2002) that was collected as part of the Age 40 Health Supplement between 1998 and 2006, and the I code respondents below the gender-specific sample mean MCS score as low mental functioning). Results are reported in Appendix Table E.

The findings provide suggestive evidence in support of time cost and self-medication mechanisms among men: drinking patterns are higher among the non-employed and non-married, and men with low mental functioning. The differences are largest, and most likely to be statistically significant, between the married and non-married men. Interestingly, among women the differences in drinking patterns are often reversed: employed and married women tend to have higher drinking patterns (at least in terms of number of drinks and heavy drinking) than non-employed and non-married women. Consistent with men, women with low mental functioning drink more than women with high mental functioning. Differences in the female sample are generally not statistically different from zero, however.

Dynamics of the relationship

In my main analyses I focus on the persistent effect of leaving school in an economic downturn on alcohol use. Understanding the dynamics of this relationship is important, however. For example, does the relationship broaden (perhaps as workers spend more time in a low wage, or otherwise undesirable, job and remain single they become more dis-satisfied with their lives and increasingly turn to alcohol as a form of self-medication) or narrow (workers may initially increase their alcohol use but as they adapt to their lowered labor market performance and failure to enter marriage they may rely less on self-medication through alcohol use) over time?

To understand the dynamics of the relationship, I utilize alcohol use from all available

rounds: 1982, 1983, 1984, 1985, 1988, 1989, 1992, 1994, 2002, 2008, and 2010 (binge drinking information is not available in the 1992 round). I pool the available rounds, and re-estimate Equation (1). I re-define the indicator for drinking more than the 99th percentile drinker based on the pooled sample.[15] I include the years since school-leaving (defined as the year the alcohol use variable is measured minus the school-leaving year) and interact the years since school-leaving with the school-leaving state unemployment rate. Because the time and location of school-leaving are potentially endogenous, so are the years since school-leaving and the interaction between this variable and the school-leaving state unemployment rate. I instrument the years since school-leaving with two variables: the difference between 2010 and the 1) on time year of school-leaving and 2) respondent expected year of school-leaving. I instrument the interaction term between the school-leaving state unemployment rate and the time since school-leaving with analogous interaction terms using the instruments. Results are reported in Table 12.

Among men, the coefficient estimates on the school-leaving state unemployment rates are consistent with the core results in terms of sign, although they are slightly smaller in magnitude and less precisely estimated. The interaction terms are small and statistically indistinguishable from zero in all regressions. One interpretation of these findings is that the relationship between leaving school in an economic downturn and alcohol use is reasonably consistent over time. However, collinearity between the school-leaving variables and instrumenting for three variables may prevent me from precisely estimating these relationships. The results for women are consistent with the core results: coefficient estimates are small in magnitude, never distinguishable from zero, and change signs across alcohol use.

[Table 12 about here].

What about other risky behaviors?

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[15] Among men in the pooled sample the drinker at the 99th percentile consumed 217 drinks in the past 30 days, the comparable women consumed 96 drinks in the past 30 days.

The findings suggest that leaving school in an economic downturn leads to increased alcohol use among men. An obvious question is whether the use of other substances is impacted. In this section I assess whether leaving school in an economic downturn impacts past 30 day smoking and past year illicit drug use (as measured by marijuana/hashish and cocaine).

Smoking is the leading cause of preventable death in the U.S., and is a contributing factor to 440,000 preventable deaths each year (Centers for Disease and Prevention, 2008). In 2011, marijuana and cocaine were the 1st and 3rd most commonly used illicit drugs in the U.S. and thus capture a substantial portion of illicit drug use (National Institute on Drug Abuse, 2012).

Cigarette smoking information is collected in the 1984, 1992, 1994, 1998, 2008, and 2010 rounds. To focus on the persistent smoking effects, I use past 30 day smoking information from 2010 (if the 2010 information is not available, I utilize information from 2008). I code respondents as 1 if they indicate that they smoked cigarettes daily or occasionally in the 30 days prior to the survey, and 0 otherwise. Information on past year marijuana (for brevity I refer to marijuana or hashish use as marijuana use henceforth) is collected in 1980, 1984, 1988, 1992, 1994, and 1998, while information on past year cocaine use is collected in 1984, 1988, 1992, 1994, and 1998. For each illicit drug I construct an indicator variable coded 1 if the respondent reports past year use and 0 otherwise. I use information from the most recent round in which marijuana and cocaine use information was collected (1998) to assess persistent effects.

In separate regressions, I model the probability of any 30 day cigarette smoking, any past year marijuana use, and past year cocaine use as a function of leaving school in an economic downturn using Equation (1). Results are reported in Table 13. The top panel pertains to men and the bottom panel pertains to women. I find no evidence that cigarette smoking is impacted by leaving school in an economic downturn: the coefficients are small and statistically indistinguishable from zero. However, turning to marijuana and cocaine use I find that leaving

school in an economic downturn may reduce use of these substances among men. A 1 percentage point increase in the school-leaving state unemployment rate leads to a 1.4 and 0.3 percentage point reduction in the probability of any past year marijuana and cocaine use. Moreover, the coefficient in the marijuana use regression is precisely estimated ($p < 0.05$). Among women, the school-leaving state unemployment rate is positively correlated with these substances, but the 95% confidence intervals contain negative values and thus I cannot rule out negative effects.

[Table 13 about here]

The heterogeneous findings across substances is worthy of some discussion. In terms of smoking 88% of smokers initiate into smoking before age 18 (United States Department of Health and Human Services, 2010) and the average age of smoking initiation in the NLSY79 sample is 13 years while the mean school-leaving age is 19 years. Historical data from the Monitoring the Future Survey shows that in 1976 (the first year members of my sample left school) the modal grade high students initiate into daily smoking is grade nine (Johnston *et al.*, 1977). Thus, for most smokers initiation predates school-leaving by several years. Moreover, smoking is a highly addictive habit that is difficult to quit: more than 75% of current American smokers wish to quit (Centers for Disease Control and Prevention, 2009), yet only 2 to 3% of smokers attain prolonged abstinence annually (Hughes, 2003). In this light it is less surprising that smoking patterns in middle age are not impacted by leaving school in an economic downturn: school-leaving simply occurs too late in the life course to substantially impact smoking outcomes. Turning next to the marijuana and cocaine findings among men, although the literature is mixed, there is some evidence that alcohol and illicit drugs such as marijuana and cocaine are economic substitutes (DiNardo and Lemieux, 2001, Cameron and Williams, 2001, Michael Conlin *et al.*, 2005, Petry, 2001). Thus, men who leave school in an economic downturn may substitute alcohol for other substances. Perhaps they fear further impeding their success in

the labor and marriage market by entering into illegal activities and taking on the associated risks. I find no evidence that women's use of illicit drugs is influenced by leaving school in an economic downturn. There is limited evidence to suggest that women are substantially affected by leaving school in an economic downturn (both the evidence presented here and in previous studies) and that may translate to use of illicit drugs.

Another risky behavior that is potentially of interest to policy makers is obesity, which is generally attributable to overconsumption of calories and sedentary lifestyles. Obesity is a major public health concern in the U.S. with over one third of adults meeting clinical definitions for this condition (Flegal *et al.*, 2012). Moreover, obesity leads to substantial increase in health care costs. Cawley and Meyerhoefer (2012) show that obesity raises health care costs by $2,741 annually per obese adult, or $190.2 billion per year. Maclean (2013b) shows that men (but not women) who leave school in an economic downturn turn have persistently lower body weight than otherwise similar men, and this relationship may operate through a subset of the channels outlined for alcohol use: lower opportunity costs of time (i.e., it is less costly to invest in exercise) or income (e.g., reduced income lowers the quantity demanded of high calorie foods). Moreover, excessive alcohol use and exercise are positively correlated (French *et al.*, 2009).

Conclusion

This study provides new evidence on the lasting consequences of leaving school in an economic downturn. I find that men, but not women, who leave school in an economic downturn consume higher quantities of alcohol and are more likely to report heavy drinking, weekly binge drinking, and drinking more than the 99th percentile of drinkers in middle age than otherwise similar men. Because I find that leaving school in an economic downturn increases excessive alcohol use, not exclusively social use, these findings may represent a public health concern: cohorts of men with persistently higher patterns of alcohol use that are linked with social costs.

A potential silver lining is that these men may be persistently less likely to use illicit drugs such as marijuana and cocaine perhaps through substitution between substances. The results are robust to various sensitivity checks and I find that the alcohol use effects are largest for white men, a group that experiences substantial career consequences after leaving school in an economic downturn (Kondo, 2007). The adverse labor and marriage market outcomes experienced by these men may place them at higher risk for excessive alcohol use in middle age by reducing the cost of using alcohol and increasing use of alcohol for self-medication purposes. The later mechanisms is supported by Maclean (2013a), who finds that men who leave school in an economic downturn have persistently worse mental functioning, lower self-reported health, and more depressive symptoms than otherwise similar men.

My findings are concentrated among men, but I examine an older sample of Americans (NLSY79 respondents were born between 1957 and 1964). Labor market participation rates for women have increased substantially between the NLSY79 cohort and the current cohort of school-leavers: in 1979, the first year members of my analysis sample left school, the adult female labor market participation was 42.9% (Bureau of the Census, 1976) and by 2013 adult women's participation rate was 58.7% (Bureau of Labor Statistics, 2013a). The current cohort of school-leaving women, including those who left school during the 2007 to 2009 recession, may have labor market attachment and experiences closer to NLSY79 men than women. If this is the case, then both men and women who left school during the 2007 to 2009 recession may persistently consume more alcohol and be at higher risk for excessive drinking than their counterparts who left school under more favorable economic conditions.

This study has several limitations that must be considered when interpreting the results. The most notable is the NLSY79 small sample size: I examine just 3,326 men and 3,496 women, and many of my findings are only marginally statistically significant. There is no clear solution

to this data limitation. The NLSY79 offers essential information for testing the persistent alcohol use consequences of leaving school in an economic downturn (e.g., the ability to accurately locate the school-leaving time and location, track respondents into middle age, and explore a rich set of potential mechanisms), but like many longitudinal surveys it does not offer a large sample size. The NLSY79 lacks clinical diagnoses of alcohol abuse and dependence, and these measures may best capture the patterns of alcohol use that lead to social costs. Moreover, the measures of alcohol use are self-reported and are therefore subject to miss-reporting. However, previous work suggests that self-reported substance use, particularly when the recall period is short such as the past 30 day measures I study in my core analysis, are valid for statistical analysis (Del Boca and Darkes, 2003, Midanik, 1982). Finally, the NLSY79 contains only one cohort of Americans and how well findings generalize to the broader U.S. population is unclear.

It may be useful to situate my findings within the broader literature on alcohol and economic downturns. An important distinction between my work and previous studies is that I focus on experiencing an economic downturn during the school-to-work transition while much of the existing work examines the impact of contemporaneous economic fluctuations. Early work by Ruhm (Ruhm, 1995, Ruhm and Black, 2002) suggests that alcohol use, both social and excessive use, declines during recessions. However, more recent work calls to question whether alcohol use follows a counter-cyclical pattern (Davalos *et al.*, 2012, Cotti *et al.*, 2013, Dee, 2001, Arkes, 2007). While reconciling these diverging findings is beyond the scope of this paper, it may be that different economic contractions and expansions are utilized to identify findings across these studies. For example, Ruhm and Black (2002) utilize data from the period between 1987 and 1999, while I examine school-leaving between 1976 and 1998. Thus, I capture the large and widespread 1981 to 1982 while Ruhm and Black (2002) do not. A recent review by Pacula (2011) suggests that different downturns will have different impacts on alcohol use.

Moreover, it is plausible that individuals respond differently in terms of their alcohol use to permanent and transitory changes in employment, income, marriage, etc. Lastly, I focus on experiencing a negative labor market shock during a stage of brain development identified by neuroscience research as important for self-regulation development and excessive alcohol use (Dahl, 2004, Clark *et al.*, 2008, Kaestner and Yarnoff, 2011).

In this study I attempt to shed some light on the potential mechanisms through which leaving school in an economic downturn could impact alcohol use in middle age. Specifically I examine self-esteem, labor supply, earnings, coworkers, dis-satisfying jobs, and marriage. These variables potentially capture different channels: self-medication, time costs, income, and peers. I find among men that leaving school in an economic downturn worsens self-esteem, decreases the probability of employment and lowers wage earnings, and a lowers probability of marriage. Because previous economic work suggests that alcohol is a normal good (Ettner, 1996) (excessive use may be unrelated to income, however), it seems unlikely that income is the dominate channel in my sample rather self-medication and reduced time costs may better explain the relationships I observe for most school-leavers. This interpretation is consistent with studies that examine exogenous job loss: losing one's job has been shown to reduce income and to increase alcohol use (Jacobson *et al.*, 1993, Deb *et al.*, 2011). Because I find no effects on job strain, the self-medication may relate to more so to poor marriage market rather than labor market performance. Alternatively, my proxy for job strain (probability of being somewhat or very dis-satisfied with a job) may be too crude to capture this concept.

My findings are timely as the U.S. is recovering from the 2007 to 2009 recession. The national unemployment rate was 7.6% in April 2013, this number translates into 11.7 million unemployed Americans (Bureau of Labor Statistics, 2013a). The rate of unemployment is particularly high among new labor market entrants: 13.3% among those aged 20 to 24 years

(Bureau of Labor Statistics, 2013a). This study, and other related studies noted above, suggest that this temporary, market-level shock may lead to persistent cross-cohort differences in career, social, and health outcomes. Policy makers tasked with responding to the career effects of the 2007 to 2009 may wish to incorporate these potential downstream health effects into any interventions aimed at mitigating the consequences of this recession. Mitigating the impact of leaving school in an economic downturn on outcomes, such as alcohol use, that potentially impose negative externalities on the broader population may be particularly worthwhile given that the costs extend beyond the directly impacted individuals.

Table 1. Summary statistics: NLSY79 men and women

	Men		Women	
	Mean/ proportion	**N**	**Mean/ proportion**	**N**
Past 30 day alcohol use in middle age				
Number of drinks	19.21	3326	8.82	3496
Heavy drinker[1]	0.093	3326	0.088	3496
Weekly binger[2]	0.12	3328	0.032	3498
Drink > 99th percentile drinker[3]	0.0066	3326	0.0045	3496
School-leaving variables				
School-leaving state UE rate	7.53	3328	7.52	3498
School-leaving year	1980.7	3328	1980.5	3498
Beer tax (dollars per gallon)	0.50	3328	0.52	3498
School-leaving age	19.3	3328	19.1	3498
Education at school-leaving (years)	13.0	3328	13.1	3498
Personal characteristics				
Age in 2010	48.7	3328	48.6	3498
White	0.81	3328	0.81	3498
African American	0.13	3328	0.14	3498
Hispanic	0.057	3328	0.052	3498
Born outside U.S.	0.030	3328	0.032	3498
AFQT score	50.7	3328	49.4	3498
Age-adjusted AFQT score	0.37	3328	0.33	3498
Age-adjusted AFQT score missing	0.060	3328	0.043	3498
Mother's years of education	11.8	3328	11.7	3498
Mother's years of education missing	0.046	3328	0.039	3498
Father's years of education	12.1	3328	11.9	3498
Father's years of education missing	7.53	3328	7.52	3498

Notes: NLSY79 sample weights applied.
[1]Heavy drinking is defined as ≥ 60 drinks in the past 30 day among men and ≥ 30 drinks in the past 30 day among women.
[2]Weekly binge drinking is defined as ≥ 6 drinks per drinking session on a weekly basis.
[3]The drinker at the 99th percentile consumes180 drinks among men and 90 drinks among women.

Table 2. Effect of leaving school in an economic downturn on past 30 day alcohol use in middle age: Naïve models

	Number of drinks	Heavy drinker	Weekly binger	Drink > 99th percentile drinker
Men				
Mean/proportion	19.21	0.09	0.12	0.01
School-leaving state UE rate	1.4878*	0.0090	0.0136***	0.0020
	(0.7421)	(0.0060)	(0.0048)	(0.0016)
Positive dev. from LR trend in	3.7573*	0.0170	0.0229*	0.0026
school-leaving state UE rate	(1.9159)	(0.0174)	(0.0122)	(0.0042)
N	3326	3326	3328	3326
Women				
Mean/proportion	8.82	0.09	0.03	0.005
School-leaving state UE rate	-0.1907	-0.0024	-0.0021	-0.0011
	(0.1934)	(0.0026)	(0.0023)	(0.0014)
Positive dev. from LR trend in	-0.6210	-0.0054	-0.0060	-0.0027
school-leaving state UE rate	(0.5486)	(0.0118)	(0.0064)	(0.0036)
N	3496	3496	3498	3496

Notes: Number of drinks in the past 30 day equation is estimated with least squares, and past 30 day heavy drinking weekly binge drinking, and drink more than 99th percentile drinker equations are estimated with a linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving state and year fixed effects, school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, and indicators for missing information. Standard errors are clustered by school-leaving state and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 3. Characteristics of compliers and non-compliers to the instrumental variables

	Complier*	Non-complier*	Difference (*p*-value)
On time school-leaving state unemployment rate			
Age at school-leaving	18.8	19.4	0.0000
Education at school-leaving (years)	12.8	13.2	0.0000
Male	0.52	0.50	0.0880
Female	0.48	0.50	0.1725
Age in 2010	48.7	48.6	0.1725
White	0.80	0.81	0.1359
African American	0.14	0.13	0.0437
Hispanic	0.054	0.055	0.6223
Born outside U.S.	0.028	0.032	0.6100
Age-adjusted AFQT score	0.20	0.41	0.0000
Age-adjusted AFQT score missing	0.049	0.053	0.0912
Mother's years of education	11.5	11.9	0.0000
Mother's years of education missing	0.047	0.041	0.8466
Father's years of education	11.6	12.2	0.0000
Father's years of education missing	0.099	0.087	0.0155
N	1789	5037	
Respondent-expected school-leaving state unemployment rate			
Age at school-leaving	19.1	19.2	0.0517
Education at school-leaving (years)	12.9	13.1	0.0219
Male	0.53	0.50	0.0588
Female	0.47	0.50	0.0588
Age in 2010	48.8	48.6	0.0504
White	0.82	0.81	0.6110
African American	0.13	0.14	0.5795
Hispanic	0.048	0.056	0.1743
Born outside U.S.	0.024	0.032	0.1363
Age-adjusted AFQT score	0.16	0.39	0.0000
Age-adjusted AFQT score missing	0.052	0.052	0.1037
Mother's years of education	11.3	11.9	0.0000
Mother's years of education missing	0.049	0.041	0.9199
Father's years of education	11.3	12.2	0.0000
Father's years of education missing	0.10	0.088	0.1022
N	1096	5730	

*A complier to the on time school-leaving state unemployment rate is defined as a respondent whose actual year and state of school leaving is equal to year and state of school-leaving predicted by the on time state unemployment rate. A complier to the respondent-expected school-leaving state unemployment rate is defined analogously.

Table 4. First stage regressions: Correlates of school-leaving state unemployment rates

	Men	Women
Mean	7.53	7.52
On time school-leaving UE rate	0.6350***	0.6759***
	(0.0440)	(0.0366)
Respondent-expected school-leaving UE rate	0.1275***	0.1073**
	(0.0399)	(0.0435)
F-statistic of instrument joint significance	105.49	196.49
(*p*-value)	(*p*<0.0000)	(*p*<0.0000)
Beer tax	-0.0639	0.0182
	(0.1737)	(0.1433)
School-leaving age	-0.0729***	-0.1273***
	(0.0259)	(0.0365)
Education at school-leaving	0.0756	0.1144
	(0.0914)	(0.0715)
Age in 2010	-0.0213	0.0154
	(0.0843)	(0.0785)
African American	-0.0316	0.0262
	(0.0702)	(0.0807)
Hispanic	-0.1193	0.0468
	(0.0820)	(0.0849)
Born outside U.S.	0.1367	0.0984
	(0.2291)	(0.2281)
Age-adjusted AFQT score	-0.0484	-0.0567
	(0.0376)	(0.0449)
Age-adjusted AFQT score missing	0.0144	0.0730
	(0.1085)	(0.1313)
Mother's years of education	-0.0053	0.0027
	(0.0099)	(0.0154)
Mother's years of education missing	0.3937**	0.0194
	(0.1557)	(0.1287)
Father's years of education	-0.0089	-0.0115
	(0.0119)	(0.0138)
Father's years of education missing	-0.0136	-0.0494
	(0.0946)	(0.0979)
N	3328	3498

Notes: All models estimated with least squares. All models apply NLSY79 sample weights and adjust for state of residence at age 14, on time year fixed effects, and respondent-expected school-leaving year fixed effects. Standard errors are clustered by state of residence at age 14 and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 5. Instrument excludability: Correlates of selected instrumental variables

	Men		Women	
	On time	**Respondent expected**	**On time**	**Respondent expected**
Mean	7.58	7.68	7.67	7.82
Beer tax	-0.1663	-0.1897	-0.1841	-0.1699*
	(0.1839)	(0.1190)	(0.1179)	(0.1003)
School-leaving age	-0.0063	-0.0237***	0.0066	0.0030
	(0.0152)	(0.0086)	(0.0111)	(0.0095)
Education at school-leaving	0.0146	0.0211	0.0560	0.0125
	(0.0488)	(0.0356)	(0.0447)	(0.0289)
Age in 2010	-0.0147	-0.0077	-0.0245	0.0020
	(0.0433)	(0.0387)	(0.0326)	(0.0269)
African American	0.0121	-0.1007	-0.0787	-0.1399**
	(0.0476)	(0.0794)	(0.0626)	(0.0684)
Hispanic	0.0948	-0.0424	-0.0595	-0.0399
	(0.1233)	(0.1171)	(0.0627)	(0.0754)
Born outside U.S.	-0.0052	-0.0346	0.1610**	0.1503*
	(0.1666)	(0.1308)	(0.0648)	(0.0825)
Age-adjusted AFQT score	-0.0037	-0.0402	-0.0225	-0.0212
	(0.0297)	(0.0368)	(0.0388)	(0.0248)
Age-adjusted AFQT score missing	0.0281	0.0648	0.2468**	0.1299
	(0.0911)	(0.0789)	(0.1055)	(0.1013)
Mother's years of education	0.0018	-0.0030	-0.0123	0.0020
	(0.0092)	(0.0101)	(0.0104)	(0.0074)
Mother's years of education missing	0.0378	-0.0729	0.0825	0.1108
	(0.1003)	(0.0780)	(0.0948)	(0.0893)
Father's years of education	-0.0085	-0.0081	-0.0120*	-0.0052
	(0.0071)	(0.0067)	(0.0071)	(0.0103)
Father's years of education missing	-0.0609	-0.0361	0.0491	0.0067
	(0.0672)	(0.0902)	(0.0932)	(0.0729)
F-test of personal characteristics joint significance	0.56 (p=0.8695)	3.19 (p=0.0017)	1.90 (p=0.0546)	1.48 (p=0.1595)
N	3328	3328	3498	3498

Notes: All models estimated with least squares. All models apply NLSY79 sample weights and adjust for state of residence at age 14, on time year fixed effects, and respondent-expected school-leaving year fixed effects. Standard errors are clustered by state of residence at age 14 and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 6. Effect of leaving school in an economic downturn on past 30 day alcohol use in middle age: Instrumental variables models

	Number of drinks	Heavy drinker	Weekly binger	Drink > 99th percentile drinker
	Men			
Mean/proportion	19.20	0.09	0.12	0.01
School-leaving state UE rate	1.8730**	0.0121*	0.0101**	0.0025**
	(0.7558)	(0.0072)	(0.0051)	(0.0012)
Positive dev. from LR trend in school-leaving state UE rate	5.5855**	0.0363	0.0303*	0.0073**
	(2.5051)	(0.0240)	(0.0167)	(0.0033)
N	3326	3326	3328	3326
	Women			
Mean/proportion	8.82	0.09	0.03	0.005
School-leaving state UE rate	-0.1873	-0.0017	-0.0043	-0.0018
	(0.3994)	(0.0054)	(0.0043)	(0.0015)
Positive dev. from LR trend in school-leaving state UE rate	-0.5516	-0.0071	-0.0132	-0.0052
	(1.1734)	(0.0166)	(0.0125)	(0.0043)
N	3496	3496	3498	3496

Notes: Number of drinks in the past 30 day equation estimated with an instrumental variables model, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 7. Heterogeneity in the effect of leaving school in an economic downturn on past 30 day alcohol use in middle age by race and ethnicity: Instrumental variable models

	Number of drinks	Heavy drinker	Weekly binger	Drink > 99th percentile drinker
White men				
Mean/proportion	20.32	0.10	0.12	0.01
School-leaving	2.2369***	0.0154*	0.0106	0.0032**
state UE rate	(0.8489)	(0.0084)	(0.0065)	(0.0014)
N	1745	1745	1746	1745
African American men				
Mean/proportion	13.50	0.07	0.08	0.001
School-leaving	-0.5041	-0.0074	0.0101	0.0009
state UE rate	(1.5536)	(0.0178)	(0.0114)	(0.0015)
N	1012	1012	1013	1012
Hispanic men				
Mean/proportion	16.94	0.08	0.12	0.003
School-leaving	-0.2127	-0.0105	0.0133	0.0016
state UE rate	(3.6549)	(0.0337)	(0.0320)	(0.0027)
N	569	569	569	569
White women				
Mean/proportion	9.70	0.10	0.03	0.01
School-leaving	-0.2445	-0.0033	-0.0042	-0.0022
state UE rate	(0.4925)	(0.0072)	(0.0053)	(0.0017)
N	1835	1835	1837	1835
African American women				
Mean/proportion	4.78	0.05	0.03	0.002
School-leaving	0.3125	0.0071	-0.0077***	-0.0005
state UE rate	(0.3020)	(0.0056)	(0.0027)	(0.0005)
N	1075	1075	1075	1075
Hispanic women				
Mean/proportion	5.81	0.04	0.03	0.001
School-leaving	0.3086	0.0181	-0.0130	0.0007
state UE rate	(1.1862)	(0.0152)	(0.0133)	(0.0016)
N	586	586	586	586

Notes: Number of drinks in the past 30 day equation estimated with an instrumental variables model, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 8. Heterogeneity in the effect of leaving school in an economic downturn on past 30 day alcohol use in middle age by education at school-leaving: Instrumental variable models

	Number of drinks	Heavy drinker	Weekly binger	Drink > 99th percentile drinker
High skill men (college degree or more at school-leaving)				
Mean/proportion	16.50	0.06	0.07	0
School-leaving state UE rate	0.5147 (1.1318)	0.0222 (0.0142)	0.0085 (0.0205)	--
N	556	556	556	556
Low skill men (less than college at school-leaving)				
Mean/proportion	19.96	0.10	0.13	0.01
School-leaving state UE rate	1.9861** (0.7844)	0.0109 (0.0077)	0.0089 (0.0075)	0.0024 (0.0016)
N	2770	2770	2772	2770
High skill women (college degree or more at school-leaving)				
Mean/proportion	10.13	0.09	0.01	0.002
School-leaving state UE rate	-0.3693 (0.8096)	0.0004 (0.0150)	-0.0013 (0.0027)	0.0006 (0.0012)
N	594	594	596	594
Low skill men (less than college at school-leaving)				
Mean/proportion	8.49	0.09	0.04	0.01
School-leaving state UE rate	0.0451 (0.4728)	0.0020 (0.0066)	-0.0055 (0.0057)	-0.0026 (0.0018)
N	2902	2902	2902	2902

Notes: Number of drinks in the past 30 day equation estimated with two-stage least squares, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 9. Effect of leaving school in an economic downturn on potential mechanisms measured in middle age: Instrumental variables models

	Self-esteem	Employed	Log (earnings)	Blue collar job	Dis-satisfied with job	Married
Men						
Mean/proportion	0.53	0.88	63903	0.43	0.07	0.66
School-leaving state UE rate	-0.1858***	-0.0200**	-0.0465**	-0.0048	0.0008	-0.0298***
	(0.0640)	(0.0102)	(0.0221)	(0.0115)	(0.0088)	(0.0104)
N	2971	2972	2441	2686	2755	2972
Women						
Mean/proportion	0.50	0.79	33303	0.14	0.08	0.65
School-leaving state UE rate	-0.0828	0.0045	0.0293	0.0012	-0.0099*	0.0148*
	(0.0522)	(0.0088)	(0.0267)	(0.0085)	(0.0056)	(0.0085)
N	3182	3184	2402	2654	2710	3184

Notes: Self-esteem score and log(earnings) equations are estimated with two-stage least squares, and the employed, blue collar, and married equations are estimated with a two-stage linear probability model. A logit transformation is performed on the self-esteem variable. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 10. Heterogeneity in the effect of leaving school in an economic downturn on potential mechanisms measured in middle age by years of education at school-leaving: Instrumental variable models

	Self-esteem	Employed	Log (earnings)	Blue collar job	Dis-satisfied with job	Married
White men						
Mean/proportion	0.53	0.90	68539	0.39	0.07	0.70
School-leaving	-0.2194***	-0.0235**	-0.0533**	-0.0036	0.0024	-0.0252*
state UE rate	(0.0798)	(0.0106)	(0.0265)	(0.0139)	(0.0103)	(0.0129)
N	1543	1544	1341	1454	1476	1544
African American men						
Mean/proportion	0.52	0.78	39991	0.58	0.09	0.43
School-leaving	-0.1179*	-0.0041	-0.0244	-0.0083	-0.0187	-0.0831***
state UE rate	(0.0630)	(0.0272)	(0.0553)	(0.0211)	(0.0168)	(0.0272)
N	909	909	686	775	808	909
Hispanic men						
Mean/proportion	0.50	0.84	53631	0.51	0.05	0.58
School-leaving	-0.0781	-0.0606**	-0.1004	-0.0064	0.0431**	-0.0123
state UE rate	(0.0760)	(0.0262)	(0.1412)	(0.0356)	(0.0216)	(0.0521)
N	519	519	414	457	471	519
White women						
Mean/proportion	0.49	0.80	34382	0.13	0.08	0.71
School-leaving	-0.0932	0.0113	0.0195	-0.0050	-0.0122*	0.0184*
state UE rate	(0.0598)	(0.0087)	(0.0271)	(0.0096)	(0.0064)	(0.0107)
N	1676	1677	1304	1411	1439	1677
African American women						
Mean/proportion	0.53	0.76	27432	0.20	0.09	0.36
School-leaving	-0.1060**	-0.0297*	0.0692	0.0370***	0.0068	0.0147
state UE rate	(0.0459)	(0.0157)	(0.0573)	(0.0102)	(0.0126)	(0.0180)
N	987	988	715	820	838	988
Hispanic women						
Mean/proportion	0.49	0.77	31315	0.10	0.07	0.59
School-leaving	-0.0371	-0.0321	0.0652	-0.0001	0.0163	-0.0337
state UE rate	(0.0956)	(0.0471)	(0.1102)	(0.0484)	(0.0234)	(0.0548)
N	519	519	383	423	433	519

Notes: Self-esteem and log(earnings) equations are estimated with two-stage least squares, and the employed, blue collar, and married equations are estimated with a two-stage linear probability model. A logit transformation is performed on the self-esteem variable. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 11. Heterogeneity in the effect of leaving school in an economic downturn on potential mechanisms measured in middle age by years of education at school-leaving: Instrumental variable models

	Self-esteem	Employed	Log (earnings)	Blue collar job	Dis-satisfied with job	Married
High skill men (college degree or more at school-leaving)						
Mean/proportion	0.61	0.96	111883	0.07	0.06	0.79
School-leaving	0.1201	-0.0198	-0.1117**	0.0253	-0.0019	-0.0142
state UE rate	(0.2373)	(0.0147)	(0.0535)	(0.0230)	(0.0206)	(0.0260)
N	505	505	465	484	497	505
Low skill men (less than college at school-leaving)						
Mean/proportion	0.50	0.85	50085	0.53	0.08	0.62
School-leaving	-0.1270*	-0.0204*	-0.0220	-0.0040	-0.0010	-0.0301***
state UE rate	(0.0707)	(0.0107)	(0.0208)	(0.0138)	(0.0087)	(0.0108)
N	2466	2467	1976	2202	2258	2467
High skill women (college degree or more at school-leaving)						
Mean/proportion	0.54	0.83	53656	0.02	0.07	0.78
School-leaving	-0.0855	-0.0002	-0.0713	0.0021	-0.0042	0.0262
state UE rate	(0.1189)	(0.0187)	(0.0863)	(0.0124)	(0.0153)	(0.0255)
N	552	554	441	485	494	554
Low skill women (less than college at school-leaving)						
Mean/proportion	0.49	0.78	27828	0.17	0.08	0.62
School-leaving	-0.0767	-0.0004	0.0428	0.0041	-0.0065	0.0137
state UE rate	(0.0661)	(0.0119)	(0.0308)	(0.0108)	(0.0048)	(0.0089)
N	2630	2630	1961	2169	2216	2630

Notes: Self-esteem and log(earnings) equations are estimated with two-stage least squares, and the employed, blue collar, and married equations are estimated with a two-stage linear probability model. A logit transformation is performed on the self-esteem variable. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 12. Effect of leaving school in an economic downturn on past 30 day alcohol use across the life course: Instrumental models

	Number of drinks	Heavy drinker	Weekly binging	Drink > 99th percentile drinker
Men				
Mean/proportion	26.33	0.14	0.29	0.01
School-leaving state	1.4287	0.0127**	0.0070	0.0018
UE rate	(0.9856)	(0.0062)	(0.0087)	(0.0014)
Interaction with years	-0.0018	-0.0000	0.0003	-0.0000
since school-leaving	(0.0280)	(0.0002)	(0.0003)	(0.0000)
N	42924	42924	39035	42924
Women				
Mean/proportion	10.29	0.10	0.11	0.01
School-leaving state	-0.0684	-0.0026	0.0009	-0.0006
UE rate	(0.3660)	(0.0041)	(0.0042)	(0.0010)
Interaction with years	-0.0007	-0.0001	-0.0001	-0.0000
since school-leaving	(0.0112)	(0.0001)	(0.0001)	(0.0000)
N	44932	44932	41111	44932

Notes: Number of drinks in the past 30 day equation estimated with two-stage least squares, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Table 13. Effect of leaving school in an economic downturn on past 30 day cigarette smoking and past year illicit drug use in middle age: Instrumental models

	Smoke cigarettes	Marijuana	Cocaine
Proportion	0.25	0.13	0.02
School-leaving state UE rate	0.0078	-0.0136**	-0.0027
	(0.0091)	(0.0069)	(0.0030)
N	3116	3245	3254
Proportion	0.23	0.07	0.01
School-leaving state UE rate	-0.0005	0.0066	0.0024
	(0.0108)	(0.0053)	(0.0022)
N	3322	3479	3479

Notes: All equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table A. Selected first stage regressions by sub-group: Correlates of school-leaving state unemployment rate

	Men	**Women**
White		
Mean	7.58	7.57
On time school-leaving UE rate	0.6479***	0.6845***
	(0.0570)	(0.0386)
Respondent-expected school-	0.1319***	0.1050*
leaving UE rate	(0.0399)	(0.0547)
N	1746	1837
African American		
Mean	7.45	7.40
On time school-leaving UE rate	0.5146***	0.6979***
	(0.0729)	(0.0567)
Respondent-expected school-	0.1145	0.0989***
leaving UE rate	(0.0885)	(0.0345)
N	1013	1075
Hispanic		
Mean	7.08	7.15
On time school-leaving UE rate	0.7102***	0.3210***
	(0.1116)	(0.1003)
Respondent-expected school-	0.0076	0.1272*
leaving UE rate	(0.1139)	(0.0719)
N	569	586
High skill (college degree at school-leaving)		
Mean	7.62	7.87
On time school-leaving UE rate	0.5520***	0.8429***
	(0.0929)	(0.1663)
Respondent-expected school-	0.1781	-0.0532
leaving UE rate	(0.1196)	(0.1264)
N	556	596
Low skill (less than college degree at school-leaving)		
Mean	7.50	7.43
On time school-leaving UE rate	0.6915***	0.6614***
	(0.0610)	(0.0543)
Respondent-expected school-	0.1273***	0.1438***
leaving UE rate	(0.0406)	(0.0503)
N	2772	2902

Notes: All models estimated with least squares. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by state of residence at age 14 and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table B. Effect of leaving school in an economic downturn on past 30 day alcohol use in middle age: Alternative instrumental variable models using the state unemployment rate as a proxy for economic conditions

	Number of drinks	Heavy drinker	Weekly binging	Drink > 99th percentile drinker
Men	19.2	0.09	0.12	0.01
Overidentified model	1.8730**	0.0121*	0.0101**	0.0025**
	(0.7558)	(0.0072)	(0.0051)	(0.0012)
On time state UE rate	1.8301**	0.0124*	0.0107**	0.0018*
	(0.7284)	(0.0073)	(0.0047)	(0.0010)
Respondent-expected state UE rate	2.1860	0.0099	0.0058	0.0074**
	(1.5386)	(0.0104)	(0.0103)	(0.0037)
N	3326	3326	3328	3326
Women	8.8	0.09	0.03	0.005
Overidentified model	-0.1873	-0.0017	-0.0043	-0.0018
	(0.3994)	(0.0054)	(0.0043)	(0.0015)
On time state UE rate	-0.1971	-0.0007	-0.0042	-0.0019
	(0.4106)	(0.0053)	(0.0042)	(0.0015)
Respondent-expected state UE rate	-0.0933	-0.0111	-0.0048	-0.0006
	(0.6559)	(0.0082)	(0.0060)	(0.0023)
N	3496	3496	3498	3496

Notes: All models estimated two-stage least squares. Number of drinks in the past 30 day equations estimated with two-stage least squares, and past 30 day heavy, weekly binge drinking, and drink more than the 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, and indicators for missing information. Models that instrument the school-leaving state unemployment rate with the on time state unemployment rate include on time school-leaving year fixed effects. Models that instrument the school-leaving state unemployment rate with the respondent-expected school-leaving state unemployment rate include respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.

***; **; * = statistically different from zero at the 1%; 5%; 10% level.

Appendix Table C. Effect of leaving school in an economic downturn on past 30 day alcohol use in middle age: Instrumental variables models with current state of residence fixed effects

	Number of drinks	Heavy drinker	Weekly binging	Drink > 99th percentile drinker
Men				
Mean/proportion	19.2	0.093	0.12	0.0066
School-leaving state UE rate	1.7849**	0.0108	0.0103**	0.0021
	(0.7611)	(0.0074)	(0.0051)	(0.0014)
N	3326	3326	3328	3326
Women				
Mean/proportion	8.82	0.088	0.032	0.0045
School-leaving state UE rate	-0.3184	-0.0033	-0.0048	-0.0023
	(0.4521)	(0.0058)	(0.0043)	(0.0016)
N	3496	3496	3498	3496

Notes: Number of drinks in the past 30 day equation estimated with an instrumental variables model, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table D. Effect of leaving school in an economic downturn on past 30 day alcohol use in middle age: Instrumental variable models with controls for school-leaving state-specific time trends

	Number of drinks	Heavy drinker	Weekly binging	Drink > 99th percentile drinker
	Men			
Mean/proportion	19.2	0.09	0.12	0.01
School-leaving state UE rate	2.2254**	0.0167*	0.0124	0.0032*
	(0.8641)	(0.0089)	(0.0087)	(0.0017)
N	3326	3326	3328	3326
	Women			
Mean/proportion	8.8	0.09	0.03	0.005
School-leaving state UE rate	0.0893	0.0129	-0.0043	-0.0030
	(0.6020)	(0.0093)	(0.0074)	(0.0023)
N	3496	3496	3498	3496

Notes: Number of drinks in the past 30 day equation estimated with two-stage least squares, and past 30 day heavy drinking, weekly binge drinking, and drink more than 99th percentile drinker equations estimated with a two-stage linear probability model. All models apply NLSY79 sample weights and adjust for school-leaving beer tax, age at school-leaving, education at school-leaving, age in 2010, race/ethnicity, birth outside the U.S., age-standardized AFQT score, mother's education, father's education, indicators for missing information, age 14 state of residence fixed effects, and on time and respondent expected school-leaving year fixed effects. Standard errors are clustered by age 14 state of residence and reported in parentheses.
***; **; * = statistically significant at the 1%; 5%; 10% level.

Appendix Table E. Comparison of drinking patterns in middle age by marital, employment, and mental functioning status

	Number of drinks	Heavy drinker	Weekly binging	Drink > 99th percentile drinker
Men				
Employed	19.27	0.09	0.11	0.004
Not employed	22.99	0.11	0.15	0.02
Difference (*p*-value)	0.2753	0.1343	0.2265	0.0718
Married	17.87	0.08	0.10	0.006
Not married	23.26	0.14	0.16	0.009
Difference (*p*-value)	0.0008	0.0000	0.0000	0.1969
High mental functioning	18.28	0.08	0.11	0.008
Low mental functioning	20.22	0.10	0.12	0.006
Difference (*p*-value)	0.0671	0.0687	0.0687	0.4633
Women				
Employed	9.00	0.09	0.03	0.004
Not employed	7.45	0.08	0.03	0.002
Difference (*p*-value)	0.0260	0.4859	0.6153	0.3552
Married	9.03	0.09	0.03	0.004
Not married	8.00	0.08	0.04	0.004
Difference (*p*-value)	0.0432	0.2515	0.2375	0.9232
High mental functioning	8.52	0.08	0.03	0.003
Low mental functioning	9.21	0.10	0.04	0.006
Difference (*p*-value)	0.4519	0.6198	0.6198	0.5404

Notes: Employment and marital status information is measured at the time alcohol use is collected, mental functioning is measured by the SF12 Mental Component Score in the Age 40 Health Supplement. *T*-test utilized when outcome is number of drinks in the past 30 days, and difference in proportions test utilized when the outcome is heavy drinking, weekly binge drinking, or drinking more than the 99th percentile drinker.

Figure 1. Average state unemployment rates: 1976 to 1998
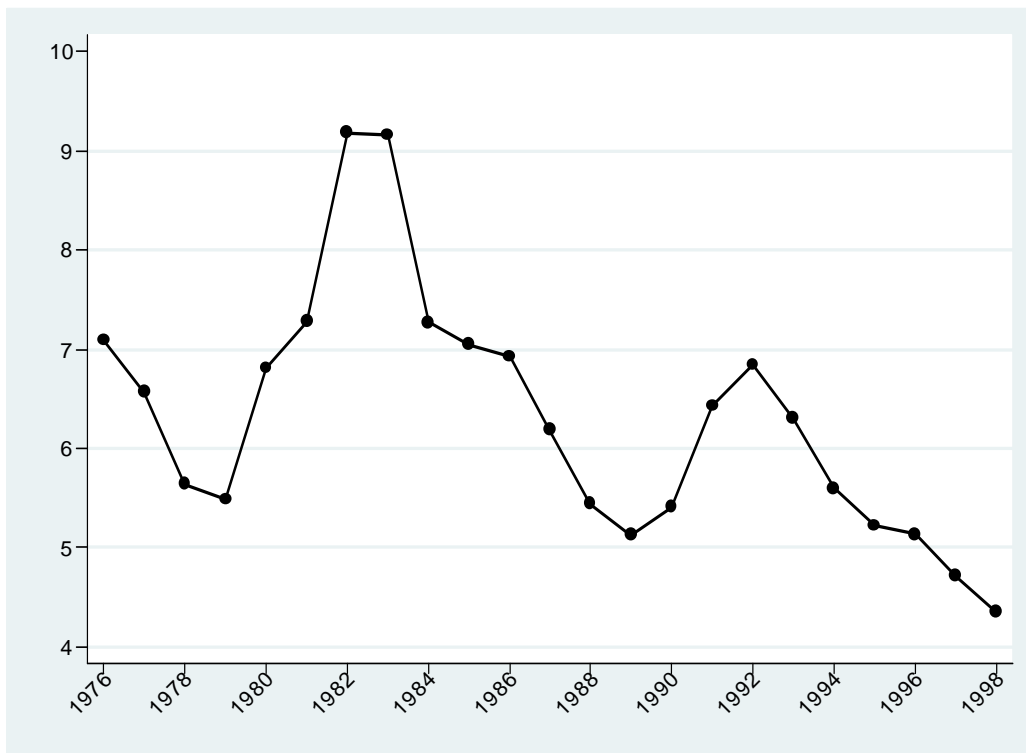
Notes: Data are drawn from the Bureau of Labor Statistics Local Area Unemployment Database.

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