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EASING THE PAIN OF AN ECONOMIC DOWNTURN: MACROECONOMIC CONDITIONS AND EXCESSIVE ALCOHOL CONSUMPTION

MARÍA E. DÁVALOS, PhD[a], **HAI FANG, PhD**[b], and **MICHAEL T. FRENCH, PhD**[c,*]

[a]Health Economics Research Group, Sociology Research Center, University of Miami, 5665 Ponce de Leon Blvd., Flipse Building, Room 107, Coral Gables, FL 33124-0719, USA

[b]Department of Health Systems, Management, and Policy, Colorado School of Public Health, University of Colorado Denver, 13001 E. 17th Place, Room E3312, Campus Box B119, Aurora, CO 80045, USA

[c]Health Economics Research Group, Department of Sociology, Department of Economics, and Department of Epidemiology and Public Health, University of Miami, Coral Gables, FL 33124, USA

SUMMARY

Individuals can react to financial stress in a variety of ways, such as reducing discretionary spending or engaging in risky behaviors. This paper investigates the effect of changing macroeconomic conditions (measured by the unemployment rate in the state of residence) on one type of risky behavior: excessive alcohol consumption. Using unique and recent panel data from Waves 1 and 2 of the National Epidemiological Survey of Alcohol and Related Conditions (NESARC) and estimating fixed-effects models, we find that changes in the unemployment rate are positively related to changes in binge drinking, alcohol-involved driving, and alcohol abuse and/or dependence. Some differences are present among demographic groups, primarily in the magnitude of the estimated effects. These results contradict previous studies and suggest that problematic drinking may be an indirect and unfortunate consequence of an economic downturn.

Keywords

alcohol consumption; economic downturn; unemployment rate; fixed-effects estimation

1. INTRODUCTION

The recent worldwide economic recession has contributed to many unfortunate yet expected macroeconomic consequences, such as tightened credit markets and increased rates of unemployment, foreclosures, and bankruptcies. Financial stress can lead individuals to make ill-advised decisions regarding their long-term health and welfare. For example, research shows that some individuals forego annual medical exams and screening tests (Ruhm, 2000) and/or visit their physicians less often (Ruhm, 2003) when economic conditions deteriorate. Evidence on caloric intake, nutrition, and exercise is ambiguous. While some studies find that diet improves and individuals exercise more during economic downturns (Ruhm, 2000;

*Correspondence to: Michael T. French, Professor of Health Economics, University of Miami, Department of Sociology, 5202 University Drive, Merrick Building, Room 121F, P.O. Box 248162, Coral Gables, FL 33124-2030, USA; Telephone: 1-305-284-6039; Fax: 1-305-284-5310; mfrench@miami.edu..
maria.davalos@gmail.com, hai.fang@ucdenver.edu

2005), others argue that when personal incomes decline, many households actually exercise less and increase total caloric intake by eating lower quality and often unhealthy foods (Charles and DeCicca, 2008; Stoddard, 2009).

A related area that has received some attention from economists is the effect of macroeconomic conditions on alcohol consumption (Arkes, 2007; Charles and DeCicca, 2008; Dee, 2001; Ettner, 1997; Freeman, 1999; Jiménez-Martín *et al.*, 2006; Ruhm, 1995; Ruhm and Black, 2002). Alcohol is an interesting case study because, although it is a normal good for most individuals, it nevertheless possesses mood-altering, medicinal, and addictive properties.

Changes in macroeconomic conditions can affect alcohol consumption through a number of different mechanisms, some acting in opposite directions. The first is a pure income-effect, whereby reductions in income cause drinkers to cut back on their consumption of alcohol (as well as other normal goods) or even stop drinking completely. Indeed, several earlier studies have found that alcohol use is pro-cyclical, with changes in consumption that are opposite in direction to changes in the unemployment rate (Ettner, 1997; Freeman, 1999; Ruhm, 1995; Ruhm and Black, 2002). The magnitude of an income effect depends on the type of alcoholic beverage, the pattern of consumption, and the strength of the relationship. For instance, since drinking behavior and the associated effects are not necessarily linear (French and Zarkin, 1995; Heien, 1996; Manning *et al.*, 1995), light and moderate drinkers may initiate a greater proportional change in their consumption relative to heavy drinkers. Given the addictive properties of alcohol for certain individuals, abusive or dependent drinkers may experience little or no change in their consumption.

The second mechanism involves an allocation of leisure time among utility-enhancing activities (Arkes, 2007; Dee, 2001; Ettner, 1997). During economic downturns, many individuals will experience an increase in leisure time due to reduced work hours, furloughs, and layoffs. Because alcohol consumption is a desirable leisure-time activity for some individuals, often occurring during activities such as sporting events, social gatherings, parties, and television viewing (French *et al.*, 2009), drinking will increase accordingly. In sum, as leisure time increases with rising unemployment, alcohol consumption will also increase if these behavioral patterns endure (Dee, 2001).

Grounded in medical and clinical research rather than economic theory per se, the third mechanism reflects that alcohol is a legal psychoactive drug that is often used for self-medication purposes (Harris and Edlund, 2005; Kushner *et al.*, 1990). Indeed, several studies have demonstrated that certain individuals turn to alcohol to ease the pain of medical challenges, employment problems, emotional distress and anxiety, and financial hardship (Hill and Angel, 2005; Pierce *et al.*, 1994). Economic downturns have also been associated with reductions in mental health (Charles and DeCicca, 2008; Ruhm, 2003) and increases in suicides (Ruhm, 2000). Overall, the extent of this public health problem will likely increase with the severity of the economic downturn.

A fourth mechanism is also possible, whereby the workplace serves as a conduit for alcohol-related events (e.g., happy hours, softball leagues, holiday parties). In this context, unemployed individuals might drink less due to fewer opportunities for social coordination.

Before discussing whether public health interventions or government policy is warranted in this area, it is helpful to determine which of these mechanisms dominates. If the income-effect and social coordination mechanism override the leisure-time and self-medicating mechanisms, then an economic downturn may actually improve health and reduce externalities by lowering the prevalence and frequency of excessive drinking.[1] If the reverse

is true, however, then an economic downturn may create significant personal and societal consequences associated with an increase in excessive drinking.

Whether alcohol consumption is pro-cyclical or counter-cyclical is an empirical question that should be carefully addressed with quality data and a careful analysis. In fact, it is possible that all four of the mechanisms noted above are operational for different groups of individuals. While it would be difficult to determine the specific importance of each pathway with survey data alone, we can nevertheless draw some conclusions about relative strength and dominance.

The main objective of this paper is to further explore these four mechanisms with a unique and more recent panel data set containing a rich collection of measures for individual alcohol consumption and related behaviors. The remainder of the paper is organized as follows. Section 2 summarizes the previous literature on the relationships between macroeconomic conditions and alcohol consumption. Section 3 describes the NESARC data and key variables. We present our empirical approach in Section 4 and the estimation results in Section 5. In Section 6, we discuss research limitations and policy implications. We conclude the paper with a brief summary and offer recommendations for future research in Section 7.

2. BACKGROUND

Research on the effects of macroeconomic conditions on alcohol consumption is scant. Although a few studies have found alcohol consumption to be pro-cyclical (i.e., increasing during periods of economic growth), the exact direction and magnitude of the effects remain ambiguous.

Ruhm (1995) used state-level data collected between 1975 and 1988 from 48 states in the U.S. to study the relationship between unemployment indicators and alcohol consumption. Considering state-level measures of alcohol consumption and highway fatalities, he found alcohol consumption and motor vehicle deaths to be pro-cyclical. A follow-up study by Freeman (1999) found similar results by employing logarithmic differences in alcohol consumption and state economic conditions used by Ruhm (1995).

A key limitation of aggregate state-level data is that it does not incorporate individual-specific characteristics that may have important implications for the analysis. To address this issue, Ettner (1997) used cross-sectional data from the 1988 National Health Interview Survey and employed an instrumental variables technique to study the effect of employment status (instrumented with the state unemployment rate) on alcohol consumption and dependence. In addition to using individual-level data, this is the first study to include a measure for alcohol dependence.[2] Results show a negative and significant effect of not working (i.e., unemployed or not in the labor force) on alcohol consumption and dependence. Alcohol consumption, however, increases while alcohol dependence symptoms diminish when an individual is unemployed. Dee (2001) also used individual-level data by pooling independent cross sections from the 1984-1995 Behavioral Risk Factor Surveillance System (BRFSS) surveys. He ran a model with state fixed effects and found that while alcohol consumption decreases during economic downturns, binge drinking prevalence during the past month increases by approximately 1.5 percent in response to a 1 percentage-point increase in the unemployment rate.

[1]Of course, a full welfare analysis should also consider the potential utility loss for those who drink responsibly and reduce their consumption of alcohol when their incomes decline.

[2]The author constructs a summary scale based on the frequency of 41 alcohol-dependence symptoms in the last 12 months.

Ruhm and Black (2002) made an important contribution to the literature with a comprehensive analysis of BRFSS surveys from 1987 to 1999. Controlling for state and month-of-interview fixed effects, the authors find that alcohol consumption is pro-cyclical and changes in alcohol consumption during economic downturns are mostly driven by heavy drinkers. Specifically, Ruhm and Black estimated that a one percentage point increase in the unemployment rate leads to a 10 percent drop in the prevalence of heavy drinking (i.e., 100 or more drinks per month). Moreover, alcohol-involved driving decreases by 3.3 percent, drinking participation by 0.3 percent, and total number of drinks by 3.1 percent.

Arkes (2007) studied the effects of macroeconomic conditions on teenage substance use, including the consumption of alcohol, marijuana, and cocaine/hard drugs. Using data collected between 1996 and 2004 for the National Longitudinal Survey of Youth, he found that substance use among teenagers is counter-cyclical in that a one percentage-point increase in the unemployment rate raises the prevalence of marijuana use by 15 percent, the prevalence of hard-drug use by 17 percent, and the number of days of alcohol consumption by approximately 7 percent. Arkes claimed that these findings are not necessarily unexpected vis-à-vis earlier published studies because adolescents can react to macroeconomic conditions differently from adults.

Using pooled cross-sectional data from the National Health Interview Surveys for 1997-2001, Charles and DeCicca (2008) examined the effect of local labor market conditions (measured by MSA-level unemployment rates) on binge drinking and several health measures. Most of the estimated effects of labor market fluctuations on the prevalence and frequency of binge drinking were not statistically significant.

Jiménez-Martín and colleagues (2006) constructed a pseudo-panel of the BRFSS from 1987 to 2003. Controlling for cohort-specific fixed-effects and estimating similar specifications to those in Dee (2001) and Ruhm and Black (2002), the authors found that the unemployment rate was not significantly related to various measures of alcohol consumption.

The present paper makes several unique and important contributions to this body of research. First, we analyze data from a more recent period (2001-2005) relative to the existing studies. Second, while previous studies were able to use state fixed-effects in their models by pooling cross sectional data, panel data allow us to estimate a more fully specified model by controlling for unobserved and time-invariant state and individual characteristics. Third, our data include a rich set of measures on alcohol consumption that were not collectively available to earlier studies. We are now able to analyze indicators of alcohol abuse and dependence that were derived from standardized diagnostic criteria. Such conditions represent less common yet critically important potential consequences of economic downturns. Fourth, our alcohol-use measures pertain to the previous 12 months, providing more consistent and stable patterns of alcohol consumption. Finally, we have a large number of time-varying individual and state-level variables, which enables us to control for important predictors of alcohol consumption and reduce the possibility of omitted variables bias.

3. DATA

3.1. National Epidemiological Survey on Alcohol and Related Conditions (NESARC)

To examine the impact of macroeconomic conditions on alcohol consumption, we analyze data from Waves 1 and 2 of the NESARC. The NESARC was specifically designed to collect information on alcohol consumption, alcohol use disorders, and related consequences. Wave 1 was administered in 2001-2002 and Wave 2 in 2004-2005.

Fieldwork for the first wave of the NESARC was conducted by the U.S. Bureau of the Census on behalf of the National Institute on Alcoholism and Alcohol Abuse (NIAAA). Survey administrators recruited a representative sample of the U.S. population, surveying a total of 43,093 Wave 1 respondents face-to-face through computer-assisted personal interviewing. The target population of the NESARC was the civilian non-institutionalized population aged 18 and older residing in the U.S. and the District of Columbia, including Alaska and Hawaii. The sample includes individuals living in households; military personnel living off base; and individuals residing in boarding or rooming houses, non-transient hotels and motels, shelters, facilities for housing workers, college dormitories, and group homes. The overall survey response rate was 81 percent, which is comparable to other national co-morbidity surveys (Division of Health Interview Statistics, National Center for Health Statistics, 2004). In Wave 2, the NESARC located and re-interviewed 34,653 of the respondents who participated in Wave 1.[3]

The core specifications in our analysis are conditional fixed-effects models using longitudinal data, so only those individuals who were surveyed in both waves are included. After dropping those respondents who did not provide valid responses for all of the key variables in each wave, the final sample includes 34,120 individuals (14,291 men and 19,829 women) surveyed in both waves. With considerable loss to follow-up at Wave 2, our sensitivity analysis section includes a test to determine the extent of possible bias in our core models from non-random attrition.

3.2. Measures

The primary alcohol variables pertain to consumption in the year prior to the interview. To examine a range of patterns and relationships, we selected four alcohol consumption measures: (1) a dichotomous indicator of any binge drinking (i.e., five or more drinks per episode for men and four or more drinks per episode for women);[4] (2) the number of binge drinking days; (3) a dichotomous indicator of driving after having too much to drink; and (4) a dichotomous indicator of alcohol abuse and/or dependence diagnosis. Alcohol abuse and dependence diagnoses follow the criteria specified in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) of the American Psychiatric Association (APA, 1994).

State-specific economic conditions can be represented by a number of different macroeconomic variables (e.g., unemployment rate, inflation rate, per capita income). For direct comparison with other studies in the literature, we selected the average monthly statewide unemployment rate obtained from the Bureau of Labor Statistics, Local Area Unemployment Statistics (LAUS) Database. To preserve time consistency with our annual alcohol-use measures, we calculated the average unemployment rate in the state of residence for the 12 months prior to the interview and assigned these values to each individual accordingly. The analyses include numerous time-varying individual-specific and state-specific variables (e.g., health status, employment status, state-specific beer tax, state-specific per capita alcohol consumption) to control for other factors that could influence individual alcohol consumption.

An important data limitation of our analysis is the absence of state identifiers in Wave 2 of the NESARC. As a result, we were forced to assume that individuals did not change their

[3]Additional information on the sampling frame, instrumentation, and key findings of the NESARC can be found in Dawson *et al.* (2007), Grant *et al.* (2003; 2009), and Ruan *et al.* (2008).

[4]Previous research sometimes defines binge drinking as consuming five or more drinks per episode, regardless of gender. Given well-established differences in drinking patterns and outcomes between men and women, however, we follow the more common, gender-specific definitions of binge drinking.

state of residence between Waves 1 and 2. This assumption is supported by a recent study (Theodos, 2006) reporting that interstate movers during the 2000-2003 period represented only 2.8 percent of the total population in the U.S., with intra-county and intra-state moves at 8.3 and 2.8 percent, respectively. Moreover, among the relatively small group of interstate moves in 2005, approximately 38 percent were employment-related, 28 percent were family-related, 20 percent were housing-related, and 15 percent were for other reasons. Other research shows that individuals moving to another state for job-related reasons usually enter a state with a lower unemployment rate.[5] Although the majority of interstate moves were for employment reasons (e.g., job transfers), the likely effect on our findings (if any) is uncertain a priori.[6]

3.3. Descriptive statistics

Table 1 presents mean values for the main variables used in the analysis by waves of the NESARC for the full sample. Approximately 22 percent of all respondents in Wave 1 and 25 percent in Wave 2 had at least one day of binge drinking in the past year. 2.7 percent of the full sample in Wave 1 and 3.7 percent in Wave 2 reported driving after having too much to drink. For alcohol abuse and/or dependence, about 8 percent of the full sample in Wave 1 and 9 percent in Wave 2 were diagnosed with one or both of these conditions.

Compared to the double-digit unemployment rates in 2010, the state unemployment rates during our study period were relatively low. Specifically, the average rate (previous 12 months) across all states rose from 4.5 percent in 2001/2002 to 5.6 percent in 2004/2005. All but the states of Hawaii, Nevada and Montana, experienced an increase in their unemployment rate from Wave 1 to Wave 2.

4. METHODS

To examine the effects of the unemployment rate on alcohol consumption, we estimate state and individual fixed-effects models. To set up the models, we assume that there are individual unobservable variables and state unobservable variables that may be correlated with the state unemployment rate. We measure alcohol consumption (A_{ist}) several ways, but each empirical model begins with the same basic specification:

$$A_{ist}=F\left(\beta_0+\beta_U U_{st}+X_{ist}\beta_X+\beta_\gamma\gamma_m+C_i+C_s+\varepsilon_{ist}\right) \quad (1)$$

in which i indexes individuals, s indexes the state of residence, t indexes time, U_{st} is the unemployment rate, X_{ist} is a vector of all other observable state- and individual-specific explanatory variables, γ_m is the interview month, C_i represents the unobservable individual variables, C_s represents the unobservable state variables, and ε_{ist} is the true disturbance term. β_0, β_U, β_X, and β_γ are the coefficients to be estimated, with β_U serving as the main coefficient of interest. Variables in X_{ist} include socioeconomic and demographic measures for each individual, such as age, household size, number of children in the household, education, general health status, mental health status, living in a metropolitan statistical area (MSA), being born outside the U.S., marital status, and race/ethnicity.

[5]Davies *et al.* (2001), for example, find that an increase in the destination-to-origin unemployment rate ratio reduces the probability of interstate migration.

[6]As mentioned earlier, the potential bias from assuming no state migration is indeterminate a priori. If individuals move to a state with a lower unemployment rate without changes in their drinking behavior, the bias would be most likely towards zero. If, on the contrary, the move to a lower unemployment state is accompanied with an increase (decrease) in problematic drinking the bias would be upward (downward).

When the dependent variable (A_{ist}) is a dichotomous measure, we assume that F follows a logistic distribution, and when A_{ist} is a count measure, we assume that F follows a negative binomial distribution. Because the conditional mean of A_{ist} is greater than its standard deviation, negative binomial regression is a better fit than Poisson regression (Greene, 2007). To control for other economic factors associated with alcohol consumption, we include personal income for each individual, the state-specific beer tax in cents per 12 oz. drink (The Beer Institute, Brewer's Almanac, 2007), the proportion of employed individuals that are represented by unions in each state (U.S. Bureau of Labor Statistics, 2009), and the per capita (population 14 or older) state alcohol (ethanol) consumption in gallons. We convert the first two measures to 2001 dollars using the national Consumer Price Index (CPI) corresponding to the interview year.

Equation (1) will be consistently estimated only if the explanatory variables are exogenous (i.e., uncorrelated with the disturbance term). Intuitively, however, there are reasons to believe that important explanatory variables, such as individual-specific risk preferences and attitudes towards alcohol consumption (C_i) as well as state alcohol policies and political preferences (C_s), are missing from the alcohol-use equations because they are unobservable or unavailable. Although unobservable individual-specific variables are unlikely to be significantly correlated with the state unemployment rate, this is not true for unobservable state-specific variables. If an endogeneity problem is present, then the estimated coefficient for the unemployment rate in Equation (1) will be inconsistent. Stated differently, single-equation estimation of Equation (1) will produce a consistent estimate of β_U only if the unobservable variables contained in C_i and C_s are uncorrelated with the state unemployment rate, U_{st} (Greene, 2007).

Although it is possible to control for omitted variable bias by using exogenous instrumental variables (IV) for the unemployment rate, it is often difficult to find valid and reliable instruments (French and Popovici, 2011; Murray, 2006). Because of the inherent challenges associated with a credible IV analysis, and given the fact that the NESARC recently became a panel dataset, we implemented a full fixed-effects approach. This is an efficient means of controlling for unobserved time-invariant omitted variables (e.g., genetic factors, personality traits, individual preferences, state policies and positions) because they drop out of the estimating equation. In other words, fixed-effects transformations eliminate the unobserved individual and state heterogeneity, C_I and C_s, that was previously included in the disturbance term of Equation (1) and produces a consistent estimate of the effect of the unemployment rate on alcohol consumption (Wooldridge, 2001):

$$A_i = F\left(\beta_0 + \beta_U U + X_i\beta_X + \beta_\gamma\gamma_m + \varepsilon_i\right) \quad (2)$$

Despite this convenient technique for removing time-invariant factors, any time-varying omitted variables, if present, would continue to function as a source of potential bias in the fixed-effects models. In addition, the fixed-effects technique cannot address reverse causality. Nevertheless, it is unlikely that individual alcohol consumption affects macroeconomic conditions such as the unemployment rate, so reverse causality is not an important concern in our models.

If the dependent variable is continuous and $t = 2$, fixed-effects estimation is equivalent to simple first-difference estimation. Subtracting all variables in $t = 2$ by the same variables in $t = 1$ will remove the time-invariant omitted variables, C_i and C_s, as they are constant over time. Our dependent variables, however, are binary and count measures, so first differencing is not appropriate. Instead, we employ the conditional fixed-effects logit technique for the binary measures of drinking and the conditional fixed-effects negative binomial for the

count measure. Neither of the likelihood functions for these two fixed-effects estimations depend on the unobserved factors, C_i and C_S (Greene, 2007; Wooldridge, 2001). For example, β_U can be estimated by standard conditional maximum likelihood estimation using the multinomial log likelihood for the count dependent variable. Because raw coefficient estimates from logit and negative binomial are difficult to interpret, we transform the conditional logit estimates into odds ratios (ORs)[7] and the conditional negative binomial estimates into incidence rate ratios (IRRs).[8]

5. RESULTS

To organize the presentation of findings, we first report descriptive information on changes in our key variables from Wave 1 to Wave 2. Next, we present estimation results for the conditional fixed-effects models, followed by a discussion of results for population subgroups to better understand the strength of the relationships. Finally, we conduct numerous sensitivity tests and robustness checks, and discuss these findings.

5.1. Identification

Identification in individual fixed-effects models hinges on changers or converters across waves. In other words, fixed-effects estimation of alcohol consumption is less informative or stable if few individuals change their drinking behaviors over time. To explore this issue with our data, we calculated counts and proportions of changers between Waves 1 and 2 for the four alcohol consumption variables. These simple descriptive statistics demonstrate that the alcohol consumption variables have sufficient variation across the two waves to allow identification of the effect of the unemployment rate on alcohol consumption in a fixed-effects framework. Specifically, 16 percent of the full sample began or stopped binge drinking between the two waves, 28 percent altered the days (frequency) of binge drinking, almost five percent changed their drinking and driving behavior, and there was a change of around 10 percent in the abuse and/or dependence diagnosis between Waves 1 and 2. A closer look at the characteristics of changers versus non-changers shows that those who change their drinking behavior between waves tend to be younger and male.

5.2. Full fixed-effects results

As explained in the previous section, the conditional fixed-effects models (logit and negative binomial) control for both state and individual time-invariant characteristics.[9] Although state fixed-effects are more likely than individual fixed-effects to be correlated with the state unemployment rate, a fully specified model should consider both potential sources of bias. Because panel datasets are not common, most of the existing literature only includes state fixed-effects.

Tables 2-5 present estimation results for the fixed-effects models. Each table reports the results from six stacked specifications. The first specification includes the state-specific unemployment rate with no other controls. New sets of control variables (i.e., individual and

[7]ORs are most commonly estimated when both the dependent and key explanatory variables are binary. In this case, the OR is the ratio of the odds of an event occurring in one group (e.g., men) to the odds of it occurring in another group (e.g., women). An OR of one indicates that the condition or event under study is equally likely to occur in both groups. An odds ratio greater than one indicates that the condition or event is more likely to occur in the first group; and an odds ratio less than one indicates that the condition or event is less likely to occur in the first group.

[8]IRRs are the exponentiated coefficients and represent the difference in the rate of binge drinking days predicted by the model when the unemployment rate is increased by one unit above its mean value while all other variables are kept constant at their means (see Table 1 for the means and units of measure for all variables used in the analysis). A value greater than one indicates a positive relationship between the rate of binge drinking days and the unemployment rate, and a value less than one indicates the opposite.

[9]It is important to note that in our model of individual fixed-effects under the assumption of no individuals moving across state lines, state fixed-effects are already implicitly accounted for.

demographic characteristics, individual health status, individual economic and employment characteristics, state characteristics, month-of-interview effects) are then sequentially added to the model, with the final specification representing the fully-specified model. The most important finding to note from these tables is that the unemployment rate coefficients (transformed to odds ratios or incidence rate ratios) are always positive and statistically significant ($p<0.01$), regardless of alcohol use measure and specification.

Turning to the quantitative findings, a one percentage point increase in the unemployment rate will lead to an estimated increase of approximately one binge-drinking day per year (0.080×12.8) based on the fully-specified model (Column vi in Table 3). The direction of the binge-drinking result is consistent with Dee (2001), who found that a one percentage point increase in the unemployment rate (past month) led to a 1.5 percent higher monthly prevalence of binge drinking.

Other estimates reveal statistically strong and quantitatively large effects of the unemployment rate on problematic drinking. For example, a one-percentage point increase in the unemployment rate led to 1.350 greater odds of alcohol-involved driving (Column vi in Table 4). Driving after having too much to drink could lead to significant social costs and is consistent with the related effects on alcohol abuse and/or dependence. Specifically, a one-percentage point increase in the unemployment rate led to 1.167 greater odds of alcohol abuse and/or dependence (Column vi in Table 5).

Focusing on Column vi in Tables 2-5, interesting findings emerge for some of the control variables. Number of children in the household and being married are negatively related to binge drinking and alcohol abuse and/or dependence. Binge drinking is more common among higher educated individuals and those with greater personal income. Individuals who are employed have more binge drinking days and are more likely to drive after having too much to drink. The SF-12 mental health scale is negatively related to all four of our alcohol use measures, indicating that declining mental health status is associated with problematic drinking. From a policy perspective, it is interesting to observe that the beer tax is negatively and significantly related to the likelihood and intensity of binge drinking, but the effect is not statistically significant for alcohol-related driving or alcohol abuse and/or dependence.

Our fully specified model of Column vi of Tables 2-5 already controls for some of the mechanisms through which changes in unemployment rate can potentially affect drinking behavior. Specifically, we include an income variable linked to the income hypothesis and a measure of mental health that relates to the financial distress hypothesis. Moreover, the employment status measure is associated with the hypotheses of increased leisure time from unemployment (for those unemployed) or increased drinking from social activities at the workplace (for those employed). Even controlling for these factors, our large and significant results indicate that macroeconomic conditions influence drinking. It could be the case, however, that additional sources of income (e.g., investment income, other employment benefits, income from other household members) are also affecting changes in alcohol consumption. Similarly, the mental health variable included in our model could be missing some aspects of financial-related distress that are outside of the scope of the SF-12 index. These additional mechanisms should be further explored in future research.

5.3. Subgroup analyses

The main results in Tables 2-5 led us to investigate whether differences are present for various demographic groups (segmented by race/ethnicity, age, and employment status). Table 6 presents the unemployment rate estimates pertaining to the fully specified models described earlier. The first row of Table 6 reproduces the estimates for the full sample to facilitate easy comparisons with the subgroup estimates.

As with the full sample, the effect of the unemployment rate on any binge drinking and number of binge drinking days is positive and statistically significant for all of the population subgroups, with Blacks and those between ages 18 and 24 displaying the largest effects sizes. The direction of the effect for the younger population is consistent with the findings in Arkes (2007).[10] Interestingly, the unemployment rate has the strongest effects on alcohol-involved driving for White and middle-aged (25-59) adults. These subgroup effects are also present when alcohol abuse and/or dependence is the dependent variable.

Focusing on the employed population, the estimated effects are all statistically significant, but slightly smaller in magnitude compared to the full sample. These results lend support to the self-medication hypothesis, as employed individuals may be consuming greater amounts of alcohol to cope with the financial strains of an economic downturn even though they have not become unemployed personally (Dee, 2001).

Differences by gender could also be important, as previous research has found significant gender differences in patterns of alcohol consumption (Hupkens *et al.*, 1993; Robbins and Martin, 1993; Wilsnack *et al.*, 2000). Our results (available upon request) reveal estimates that are similar in magnitude, direction, and statistical significance for men and women.

5.4. Sensitivity analysis

The NESARC contains an extensive set of alcohol-use and other individual-level variables. We supplemented the person-specific information with state-level data on the unemployment rate, beer tax, per-capita alcohol consumption, and union representation. Results of the core analyses indicated strong effects for the full sample, yet the estimates vary somewhat by race/ethnicity, age, and employment status.

All the specifications control for personal income, so an imbedded or unobserved income effect is not a likely explanation for our findings. Nevertheless, to account for other possible income mechanisms, we added a new control variable for other income.[11] The coefficients for the unemployment rate remain significant, same-signed, and of similar magnitude to previous results. In addition, excluding controls for individual income and employment status from our main specifications yields similar results, with slightly larger coefficients in some cases.

Because our counter-cyclical findings are at odds with the pro-cyclical results found in many earlier studies, it is possible that period-specific effects influence these relationships (e.g., the relationships between alcohol consumption and economic factors are changing over time). To explore this possibility, we acquired data from the BRFSS (used by most previous studies) spanning the years 2001 to 2005 that our NESARC data covered. We then coded all of the analysis variables to coincide as closely as possible with those used by Ruhm and Black (2002). Finally, we estimated various specifications using BRFSS and NESARC data to determine whether the results are sensitive to analysis variables and analysis period (see Table 7).

Applying OLS to 2001-2005 BRFSS data along with alcohol consumption variables that come as close to Ruhm and Black (2002) as possible (e.g., alcohol involved driving is not available in most years), we find that the monthly state unemployment rate is positively correlated with drinking participation and binge drinking (see Column i of Table 7). These findings are consistent with our core results using NESARC data, but opposite to those in Ruhm and Black (2002) using earlier years from the BRFSS. Using only 2001 and 2005

[10]Arkes (2007) analyzes data on youth between the ages of 16 and 18.
[11]Other income is calculated as the natural log of the difference between household income and personal income in 2001 dollars.

BRFSS data, none of the estimated effects of the monthly state unemployment rate on the drinking measures are statistically significant (see Column ii of Table 7).

To better understand our results in the context of previous studies, we employ OLS (without individual fixed effects) to the NESARC data, but with the same drinking measures as in Ruhm and Black (2002). We then repeat this exercise but exclude respondents not observed in both waves (as in our core models). We find that the state unemployment rate is positively and significantly correlated with all three drinking measures (see Column iii of Table 7). These results confirm the robustness of our core findings. We then re-estimate these same models with the standard fixed-effects estimator and find that the coefficient estimate for drinking participation (one of the variables used in Ruhm and Black, 2002) is not statistically significant, while the coefficient estimates for conditional number of drinks and binge drinking are positive and significant at the 10 percent and 1 percent levels, respectively (see Column iv of Table 7).

Our choice estimators (conditional fixed-effects logit and negative binomial) are also tested. Using the set of alcohol consumption and explanatory variables in our core models, we find that the standard fixed-effects estimator generates results (reported in Column v of Table 7) that are identical in sign and significance relative to our core maximum-likelihood models reported earlier (and summarized in Column vi of Table 7).[12] In terms of effect sizes, although standard fixed-effects regression coefficients are not directly comparable to odds ratios and/or incidence rate ratios, rough comparisons (e.g., probability change for a binary measure and marginal effect for a count measure) are possible. In general, the standard fixed-effects estimates are between 1/2 and 3/4 the size of those from our core results, but both sets of estimates are much larger in magnitude vis-à-vis the existing literature. Given that our alcohol consumption variables are binary and count, we decided to retain the conditional fixed-effects logit and negative binomial models for the core results.

To further test the robustness of our results, we restricted the sample to (i) those employed full-time, (ii) drinkers in both waves, and then to (iii) those in the labor force. Again, the results were almost identical in all respects to our core findings. In addition, to address the possible differential effects of long-term unemployment, we calculated a 3-year average unemployment rate starting from the month and year of the interview and moving backwards. We then replaced the 1-year average unemployment rate with the 3-year average unemployment rate in all specifications. The new results are very similar to the core estimates in sign, significance, and magnitude. All results from these sensitivity analyses are available from the authors upon request.

One final sensitivity test replaces our current month-of-interview dummies with one set of month indicators for the first wave and another for the second wave. Results are presented in Column vii of Table 7 and show that all coefficients are still positive, and those for any binge drinking and drinking and driving remain significant. The loss of significance for the other two measures is probably due to an over-specification of time effects.

As mentioned earlier, given the absence of state identifiers in Wave 2 of the NESARC, we assume that individuals did not change their state of residence between Waves 1 and 2. The small magnitude of interstate migration flows suggests that this assumption should not significantly alter our results. Despite these assurances, we decided to further test robustness by re-running our full-sample fixed-effects models using the actual state-specific

[12]An exception to this general finding is the result for binge drinking days (continuous variable), which is not significant in the standard fixed-effects models. However, it becomes significant and with similar sign as in our main specifications once the variable is transformed into its natural logarithm.

unemployment rate in Wave 1 and then setting the Wave 2 rate equal to the average unemployment rate for the Wave 1 residence state and all contiguous states. The reasoning here is that if individuals moved to another state after Wave 1, then they were most likely to move to a neighboring state. After this adjustment to the Wave 2 unemployment rate measure, the new results (available upon request) are identical in direction, very similar in magnitude, and the same in significance (except for one estimate) to the core results presented in Tables 2-5.

To further refine this sensitivity test, we make use of a question in the NESARC: "did you move or anyone new [*sic*] come live with you in past year?" Although this question does not refer exclusively to moves, does not differentiate between inter- and intra-state moves, and only accounts for past-year living arrangements, it does offer some supplementary information. We then assigned the unemployment rates for the Wave 1 residence state to all respondents who answered "no" to this question. For those who answered "yes," we substituted the imputed Wave 2 unemployment rate based on the Wave 1 residence state and all contiguous states (see above). Again, the results (available upon request) are almost identical in all respects to the core findings.

Finally, given that not all households in Wave 1 were re-interviewed in Wave 2, non-random attrition could be a source of concern in our study. To test for this, we first created a state-specific unemployment rate change variable by calculating the yearly average of our core unemployment variable (average unemployment rate in the previous 12 months) for 2001 and 2005, and then subtracted these unemployment rates. Second, using the Wave 1 sample, we created a binary attrition measure equal to one if the Wave 1 respondent attrited in Wave 2. Third, we estimated a probit model with the attrition binary measure as the dependent variable, the unemployment rate change variable, all of the other control variables that were included in our core fixed-effects analyses, and state fixed-effects. The coefficient estimate for the unemployment rate change variable is not significantly different from zero, thereby supporting the internal and external validity of our core findings. The full results from this attrition analysis are available upon request.

6. DISCUSSION

Based on the analyses of recent panel data, this study presents new findings on the effects of macroeconomic conditions (represented by the unemployment rate) on alcohol consumption. Our results show that four types of problematic alcohol consumption increase as the economy declines. These findings suggest that a combination of self-medication associated with economic distress and increased drinking during newfound leisure time dominate the income effect and social coordination effect. Although the direction and significance of the coefficient estimates were similar across demographic subgroups (gender, age, race/ethnicity), the effect sizes were variable. Numerous sensitivity analyses and robustness checks supported the core findings.

The use of relatively recent individual-level panel data is a distinctive feature of our study. We are also fortunate to have access to nationally representative data with a much wider range of alcohol-related variables compared to earlier studies, including clinical diagnoses for alcohol abuse and/or dependence. However, the NESARC data also has a few pertinent limitations. Due to its short existence, only two waves of data collection covering a five-year period have been completed. It would be advantageous to have more waves of data, particularly those extending into the severe worldwide recession of the present era. Second, for confidentiality reasons, state identifiers were not provided in Wave 2, compelling us to use Wave 1 state identifiers for both waves. Although this may seem like a strong assumption, census data indicate that less than 3 percent of the population completed inter-

state moves during this period (Theodos, 2006) and that most relocations are to border states (Davies *et al.*, 2001). Furthermore, using an alternative measure for the unemployment rate in Wave 2 (i.e., average of the residence state and all contiguous states) had little effect on the main findings. Finally, some important time-varying factors at the individual (e.g., career goals, family formation, time preferences) and state (e.g., labor laws and policies, compensation structures, economic indicators) levels were not available in the NESARC or elsewhere. Thus, potential bias due to unobserved time-varying heterogeneity in these areas remains a concern.

In general, our results contradict some of those in the existing literature on employment and alcohol consumption. Ruhm and Black (2002) find that alcohol use is pro-cyclical (i.e., decreases when the economy declines). Analyzing state-level data, Ruhm (1995) and Freeman (1999) also conclude that alcohol use is pro-cyclical. Ettner (1997) reported mixed results. She found that although alcohol consumption decreases with a decline in employment, it increases with a rise in involuntary unemployment.[13] Other studies found no statistically significant relationships between macroeconomic conditions and alcohol consumption (Charles and DeCicca, 2008; Jiménez-Martín *et al.*, 2006). Our findings, however, are consistent with those reported by Arkes (2007) for a young cohort and by Dee (2001), who found that binge drinking increases as the unemployment rate rises, which he explained as stress-induced alcohol consumption.

The differences in our findings relative to the previous literature could originate from various factors. First, our data are more recent, covering the period from 2001 to 2005. The majority of previous papers used data from the 1980s and 1990s, with some covering a period of 10 years or longer (e.g., Dee, 2001; Ruhm and Black, 2002).[14] Second, our analysis includes some variables that have not appeared in previous studies (e.g., alcohol abuse and dependence diagnoses). Third, our alcohol consumption variables capture drinking behavior during the past year, as opposed to alcohol consumption during the past month (Arkes, 2007; Dee, 2001; Jiménez-Martín and colleagues, 2006; Ruhm and Black, 2002) or past week (Ettner, 1997). While a shorter period may enhance recall and diminish reporting mistakes, a longer period offers a more stable profile of drinking patterns. Lastly, we employ logit and negative binomial estimation techniques for binary and count dependent variables. Most of the existing studies estimate standard OLS and linear probability models even though the dependent variables are usually not linear. For comparison purposes, we re-estimated all our models with fixed-effects linear regression and found that the qualitative findings rarely changed from our core results.

7. CONCLUSION

The end of the first decade of the 21st century has ushered in a severe worldwide economic recession, the worst in nearly a century. Job loss remains a source of concern in the U.S.A., and many economists forecast an unemployment rate well above the pre-crisis levels for several years (International Monetary Fund, 2011). Based on economic research analyzing data primarily from the final decades of the 20th century, analysts report that economic downturns may actually be health enhancing, leading to reductions in alcohol consumption (Ettner, 1997; Freeman, 1999; Ruhm 1995; Ruhm and Black, 2002), better nutrition (Ruhm, 2000), increased exercise (Ruhm, 2000; 2005), and improvements in other health indicators (Gerdtham and Ruhm, 2006; Miller *et al.*, 2009; Ruhm, 2000; 2004; 2005; 2007; 2008).

[13]The author distinguishes between not working (unemployment plus non-participation in the labor force) and unemployment alone.
[14]As noted earlier, we find some evidence of period-specific effects when analyzing BRFSS data from 2001-2005.

Earlier studies showing alcohol consumption to be pro-cyclical are somewhat surprising, given that many drinkers self-medicate with alcohol to cope with challenging life events, behavior that sometimes advances to addiction. The common explanation offered in the literature is that the income effect associated with poor economic conditions dominates the emotional distress or self-medicating effect. No previous study, however, has estimated the relationship between alcohol use and the unemployment rate using individual panel data and full fixed-effects models. Using the first two waves of the NESARC and controlling for time-invariant individual and state heterogeneity, we find alcohol consumption, and particularly problematic drinking, to be counter-cyclical.

The policy implications of our research are both timely and alarming. If heavy drinking, alcohol abuse, and alcohol dependence rise during a period of economic decline, then these public health consequences are an indirect and unfortunate outcome of business cycles. It remains unknown whether the extent of the public health problem will vary directly with the severity and length of a recession, although such an outcome is certainly plausible. If our core findings are accurate, then alcohol abuse treatment programs, 12-step self-help groups, and other related service providers should prepare for increased demand during economic downturns. Indeed, it would be interesting in future research to examine whether participation rates at these agencies spiked during the recent worldwide economic recession.

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Table 1

Summary Statistics at Waves 1 and 2 of the NESARC

	Wave 1		Wave 2			Wave 1		Wave 2	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Variable**	**Mean**	**SD**	**Mean**	**SD**
Alcohol consumption (past year)									
Any binge drinking (%)	21.8		24.9		Native American (%)	1.7			
Days of binge drinking[1]	12.8	48.4	12.7	47.2	Asian (%)	2.8			
Driving after too much to drink[2] (%)	2.7		3.7		Hispanic (%)	18.4			
Abuse and/or dependence (%)	7.7		9		Born outside U.S. (%)	15.4			
Individual and Demographic Characteristics					**Individual Health Status**				
Number of people in household	2.5	1.5	2.7	1.5	SF-12 general health scale[3]	50.1	12.2	48.9	12.2
Number of children in household	0.7	1.1	0.6	1.1	SF-12 mental health scale[3]	51.9	10.5	51.5	10.6
Years of schooling	13.2	3.3	13.3	3.4					
Living in an MSA (%)	80.9		83.9		**Individual Economic and Employment Characteristics**				
Married (%)	53.4		51.5		Employed (full-time or part-time) (%)	64.7		63.2	
Widowed, separated, or divorced (%)	24.7		29.5		Personal income (in 1,000s of US$2001)	29.7	30.1	30.5	30.0
Never married (%)	21.9		19						
Age	46.0	17.3	49.0	17.3	**State Characteristics**				
Age first alcohol use (non-abstainers)	20.1				Unemployment rate (%)[4]	4.5	0.7	5.6	0.8
White (%)	58.3				Beer tax per 12 oz drink (cents in US$2001)	2.4	1.9	2.2	1.8
Black (%)	18.9				Union representation (% of employed)[5]	14.5	6.1	13.7	6.3
					Alcohol consumption (gals. per capita)[6]	2.18	0.3	2.25	0.3

[1] Days of 5+ (4+) drinks per episode for men (women).

[2] More than once in the past year.

[3] Scores derived from the SF-12 health survey, version 2, and apply to the general health and mental health norm-based (standardized to a mean of 50 and standard deviation of 10) subscales. A higher score reflects better health status.

[4] Average of previous 12 months from interview date.

[5] Average of interview year.

[6] Wave 1 data are from 2001. Wave 2 data are from 2005. Gallons per capita are calculated for the population 14 years of age or older.

Table 2

Conditional Fixed-Effects Logit Estimation of Any Binge Drinking (Odds Ratios)

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
State unemployment rate	1.325*** (0.028)	1 275*** (0.029)	1 273*** (0.029)	1.269*** (0.029)	1.258*** (0.035)	1.268*** (0.037)
Individual and Demographic Characteristics						
Number of household members		1.050* (0.028)	1.050* (0.028)	1.051* (0.028)	1.050* (0.028)	1.050* (0.028)
Number of children in the household (*under 18*)		0.855*** (0.033)	0.857*** (0.034)	0.859*** (0.034)	0.863*** (0.034)	0.863*** (0.034)
Years of schooling		1 167*** (0.047)	1 167*** (0.047)	1.158*** (0.046)	1.153*** (0.046)	1.162*** (0.047)
Living in MSA		1.026 (0.055)	1.028 (0.055)	1.033 (0.056)	1.039 (0.056)	1.040 (0.057)
Married		0.771** (0.095)	0.774** (0.096)	0.771** (0.096)	0.768** (0.095)	0.772** (0.096)
Widowed, separated, or divorced		1.052 (0.147)	1.052 (0.148)	1.039 (0.146)	1.029 (0.145)	1.030 (0.146)
Individual Health Status						
SF-12 general health scale			1.001 (0.003)	1.001 (0.003)	1.001 (0.003)	1.001 (0.003)
SF-12 mental health scale			0.988*** (0.002)	0.988*** (0.002)	0.988*** (0.002)	0.988*** (0.002)
Individual Economic and Employment Characteristics						
Personal income (*in US$2001, natural log*)				1.043*** (0.014)	1.043*** (0.014)	1.043*** (0.014)
Employed (*full-time orpart-time*)				1.081 (0.074)	1.073 (0.074)	1.089 (0.075)
State Characteristics						
Beer tax per 12 oz drink (*cents of US$2001*)					0.875* (0.063)	0.837*** (0.063)
Union representation (*% of employed*)					1.031 (0.023)	1.022 (0.023)
Alcohol consumption (*gals. per capita*)					1.800** (0.532)	1.860** (0.555)
Month of Interview Effects	no	no	no	no	no	yes

Notes: Reported estimates are odds ratios and standard errors are presented in parentheses.

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 3

Conditional Fixed-Effects Negative Binomial Estimation of Binge Drinking Days (Incidence Rate Ratios)

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
State unemployment rate	1.096*** (0.011)	1.087*** (0.011)	1.088*** (0.011)	1.086*** (0.011)	1.076*** (0.011)	1.080*** (0.012)
Individual and Demographic Characteristics						
Number of household members		1.020* (0.012)	1.020* (0.012)	1.021* (0.012)	1.018 (0.012)	1.019 (0.012)
Number of children in the household (*under 18*)		0.944*** (0.016)	0.943*** (0.016)	0.940*** (0.016)	0.942*** (0.016)	0.942*** (0.016)
Years of schooling		1.056*** (0.006)	1.054*** (0.006)	1.045*** (0.006)	1.045*** (0.006)	1.045*** (0.006)
Living in MSA		0.970 (0.025)	0.971 (0.025)	0.974 (0.025)	0.963 (0.025)	0.969 (0.025)
Married		0.903*** (0.030)	0.910*** (0.031)	0.898*** (0.030)	0.900*** (0.030)	0.893*** (0.030)
Widowed, separated, or divorced		0.928* (0.036)	0.934* (0.037)	0.915** (0.036)	0.918** (0.036)	0.914** (0.036)
Individual Health Status						
SF-12 general health scale			1.004*** (0.001)	1.002* (0.001)	1.002 (0.001)	1.002 (0.001)
SF-12 mental health scale			0.994*** (0.001)	0.994*** (0.001)	0.994*** (0.001)	0.994*** (0.001)
Individual Economic and Employment Characteristics						
Personal income (*in US$2001, natural log*)				1.032*** (0.007)	1.030*** (0.007)	1.031*** (0.007)
Employed (*full-time orpart-time*)				1.244*** (0.039)	1.246*** (0.039)	1.256*** (0.039)
State Characteristics						
Beer tax per 12 oz drink (*cents of US$2001*)					0.923*** (0.010)	0.922*** (0.010)
Union representation (*% of employed*)					0.995** (0.003)	0.994* (0.003)
Alcohol consumption (*gals. per capita*)					1.132*** (0.053)	1.114** (0.053)
Month of Interview Effects	no	no	no	no	no	yes

Notes: Reported estimates are incident rate ratios and standard errors are presented in parentheses.

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 4

Conditional Fixed-Effects Logit Estimation of Driving After Having Too Much to Drink (Odds Ratios)

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
State unemployment rate	1.366*** (0.055)	1.316*** (0.057)	1.305*** (0.057)	1.309*** (0.057)	1 312*** (0.069)	1.350*** (0.074)
Individual and Demographic Characteristics						
Number of household members		0.972 (0.047)	0.970 (0.048)	0.965 (0.048)	0.966 (0.048)	0.970 (0.048)
Number of children in the household (*under 18*)		0.936 (0.070)	0.935 (0.070)	0.938 (0.071)	0.935 (0.071)	0.936 (0.072)
Years of schooling		1.132* (0.085)	1.138 (0.085)	1.117 (0.083)	1.116 (0.084)	1.113 (0.085)
Living in MSA		0.904 (0.090)	0.922 (0.092)	0.923 (0.093)	0.929 (0.094)	0.920 (0.094)
Married		0.731 (0.165)	0.719 (0.163)	0.723 (0.164)	0.720 (0.164)	0.704 (0.161)
Widowed, separated, or divorced		1.452 (0.368)	1.414 (0.361)	1.394 (0.357)	1.401 (0.360)	1.391 (0.359)
Individual Health Status						
SF-12 general health scale			0.998 (0.006)	0.998 (0.006)	0.998 (0.006)	0.997 (0.006)
SF-12 mental health scale			0.983*** (0.005)	0.983*** (0.005)	0.983*** (0.005)	0.983*** (0.005)
Individual Economic and Employment Characteristics						
Personal income (*in US$2001, natural log*)				1.017 (0.029)	1.017 (0.029)	1.015 (0.029)
Employed (*full-time orpart-time*)				1.353** (0.185)	1.344** (0.184)	1.373** (0.190)
State Characteristics						
Beer tax per 12 oz drink (*cents of US$2001*)					0.859 (0.129)	0.796 (0.123)
Union representation (*% of employed*)					1.026 (0.045)	1.026 (0.045)
Alcohol consumption (*gals. per capita*)					1.016 (0.563)	1.081 (0.609)
Month of Interview Effects	no	no	no	no	no	yes

Notes: Reported estimates are odds ratios and standard errors are presented in parentheses.

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 5

Conditional Fixed-Effects Logit Estimation of Alcohol Abuse and/or Dependence Diagnosis (Odds Ratios)

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
State unemployment rate	1.181***	1.157***	1.142***	1.138***	1.155***	1.167***
	(0.032)	(0.034)	(0.034)	(0.034)	(0.041)	(0.043)
Individual and Demographic Characteristics						
Number of household members		0.996	0.995	0.996	0.998	0.997
		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Number of children in the household (*under 18*)		0.907**	0.911*	0.909*	0.908*	0.911*
		(0.045)	(0.046)	(0.046)	(0.046)	(0.046)
Years of schooling		0.966	0.982	0.974	0.974	0.980
		(0.044)	(0.045)	(0.045)	(0.045)	(0.046)
Living in MSA		0.880*	0.880*	0.879*	0.887*	0.889*
		(0.061)	(0.062)	(0.062)	(0.063)	(0.063)
Married		0.707**	0.706**	0.705**	0.708**	0.707**
		(0.108)	(0.109)	(0.109)	(0.110)	(0.110)
Widowed, separated, or divorced		1.223	1.226	1.218	1.237	1.243
		(0.209)	(0.213)	(0.211)	(0.215)	(0.218)
Individual Health Status						
SF-12 general health scale			0.994*	0.994*	0.994*	0.994*
			(0.004)	(0.004)	(0.004)	(0.004)
SF-12 mental health scale			0.973***	0.973***	0.973***	0.974***
			(0.003)	(0.003)	(0.003)	(0.003)
Individual Economic and Employment Characteristics						
Personal income (*in US$2001, natural log*)				1.028	1.028	1.031
				(0.020)	(0.020)	(0.020)
Employed (*full-time orpart-time*)				1.046	1.041	1.067
				(0.090)	(0.090)	(0.093)
State Characteristics						
Beer tax per 12 oz drink (*cents of US$2001*)					0.918	0.878
					(0.084)	(0.083)
Union representation (*% of employed*)					1.039	1.026
					(0.030)	(0.030)
Alcohol consumption (*gals. per capita*)					0.990	1.021
					(0.375)	(0.391)
Month of Interview Effects	no	no	no	no	no	yes

Notes: Reported estimates are odds ratios and standard errors are presented in parentheses.

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 6

Conditional Fixed-Effects Estimation (Logit and Negative Binomial): Group-Specific Results for the State Unemployment Rate

Group	Any binge drinking[1]	Days of binge drinking[2,3]	Driving after too much to drink[1]	Alcohol abuse and/or dependence[1]	N[4]
Full sample	1.268*** (0.037)	1.080*** (0.012)	1.350*** (0.074)	1.167*** (0.043)	34,120
Race/ethnicity					
White	1.282*** (0.049)	1.073*** (0.014)	1.374*** (0.093)	1.168*** (0.055)	19,885
Black	1.232*** (0.102)	1.159*** (0.042)	1.394 (0.296)	1.067 (0.113)	6,459
Hispanic	1.223*** (0.081)	1.111*** (0.032)	1.333* (0.206)	1.151 (0.106)	6,264
Age (*in Wave 1*)					
18-24	1.521*** (0.121)	1.122*** (0.028)	1.290** (0.167)	1.121 (0.092)	3,897
25-59	1.253*** (0.042)	1.068*** (0.014)	1.372*** (0.088)	1.220*** (0.054)	22,347
Employment status					
Employed (both waves)	1.252*** (0.045)	1.062*** (0.014)	1.277*** (0.083)	1.166*** (0.053)	19,031

Notes: Time-varying control variables include month-of-the-interview fixed-effects, beer taxes in cents per 12 oz. drink (US$2001), percentage of employed individuals represented by unions in each state, personal income (natural log, US$2001), number of people in household, number of children under 18 in household, SF-12 general health and mental health scales, marital status, schooling, currently employed, and residing in an MSA. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. Standard errors are presented in parenthesis.

[1] Estimated with conditional fixed-effect logit. Coefficient estimates were transformed into odds ratios.

[2] Estimated with conditional fixed-effect negative binomial. Coefficient estimates were transformed into incidence rate ratios.

[3] Days of drinking 5+ (4+) drinks per episode for men (women).

[4] Sample sizes reported here are those prior to the specific estimations. With conditional fixed-effects estimation, sample sizes become smaller as these techniques only include those individuals who changed their drinking behavior from Wave 1 to Wave 2.

Table 7

Estimated Odds Ratios and Incidence Rate Ratios for the Effect of the State Unemployment Rate on Alcohol Consumption Measures: Sensitivity Analyses

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Drinking participation	0.009*** (0.001)	−0.001 (0.003)	0.007* (0.004)	−0.004 (0.003)	..	..	..
Conditional number of drinks	0.081 (0.195)	−0.205 (0.344)	6.672* (3.652)	9.120* (5.104)	..	..	..
Any binge drinking	0.006*** (0.001)	−0.002 (0.002)	0.037*** (0.003)	0.010*** (0.003)	0.018*** (0.002)	1.268*** (0.037)	1 115*** (0.052)
Days of binge drinking	..	..	..	..	−0.012 (0.283)	1.080*** (0.012)	1.010 0.017
Driving after too much to drink	..	..	..	..	0.006*** (0.001)	1.350*** (0.074)	1.196** (0.107)
Alcohol abuse and/or dependence	..	..	..	..	0.007*** (0.002)	1.167*** (0.043)	1.009 (0.061)
Period for alcohol variables	Month	Month	Year	Year	Year	Year	Year
Period for unemployment rate variable:	Month	Month	Avg. past year	Avg. past year	Avg. past year	Avg. past year	Avg. past year
Dataset	BRFSS	BRFSS	NESARC	NESARC	NESARC	NESARC	NESARC
Years	2001- 2005	2001 & 2005	2001/2002 & 2004/2005	2001/2002 & 2004/2005	2001/2002 & 2004/2005	2001/2002 & 2004/2005	2001/2002 & 2004/2005
Model	OLS	OLS	OLS	FE	FE	Conditional FE logit and negative binomial (Core model)	Conditional FE logit and negative binomial

Notes: Specifications (i) through (iv): control variables follow those of Ruhm and Black (2002) and include age, age squared, gender, education, race, marital status, interaction of gender and age, interaction of gender and race, interaction of age and race, state dummies, and month dummies. Specifications (v) and (vi) employ the controls used in our core models, specifically month-of-the-interview fixed-effects, beer taxes in cents per 12 oz. drink (US$2001), percentage of employed individuals represented by unions in each state, personal income (natural log, US$2001), number of people in household, number of children under 18 in household, SF-12 general health and mental health scales, marital status, schooling, currently employed, and residing in an MSA. Finally, column (vii) replaces our month of interview dummies in (vi) with wave-specific month of interview dummies. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. For (i) through (iii), robust standard errors clustered at the state-month level are presented. For (iv), robust standard errors clustered at the state level are presented. For (v), robust standard errors clustered at the state-wave level are presented (the significance of the results remains if errors are clustered only at the state level). For conditional fixed effects logit and negative biomial specifications, standard errors are presented in parenthesis.