

ALCOHOL ABUSE AND ECONOMIC CONDITIONS: EVIDENCE FROM REPEATED CROSS-SECTIONS OF INDIVIDUAL-LEVEL DATA

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SUMMARY

This study presents novel evidence on the relationship between macroeconomic conditions and patterns of alcohol consumption. Prior research has suggested that alcohol abuse varies procyclically, implying that income effects dominate any drinking patterns related to the opportunity cost of time or the psychological stress of recessions. However, those inferences have been based either on aggregate measures of consumption volume or possibly confounded cross-sectional identification strategies. This study examines these issues by evaluating detailed consumption data from the more than 700000 respondents who participated in the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) surveys over the 1984–1995 period. The results provide robust evidence that the prevalence of binge drinking is strongly countercyclical. Furthermore, even among those who remain employed, binge drinking increased substantially during economic downturns. This combination of results suggests that recession-induced increases in the prevalence of binge drinking do not simply reflect an increased availability of leisure and may instead reflect the influence of economic stress. Copyright © 2001 John Wiley & Sons, Ltd.

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INTRODUCTION

There is a wide variety of evidence suggesting that the abuse of alcohol increases in response to stress. The most straightforward evidence is that surveyed individuals routinely report that this is so. In particular, alcohol use is widely viewed as one means of dealing with various crises including economic and job-related stress. Similarly, there is intriguing evidence that alcohol abuse increases dramatically in the wake of stressful natural disasters. The evidence for stress-induced increases in

alcohol use has also been buttressed by a number of controlled animal studies.^a These conventional findings suggest that various economic stresses may be important and largely overlooked determinants of abusive drinking and its associated social costs.^b One clearly compelling approach to identifying the effects of economic stress has been to exploit the region-specific fluctuations in economic conditions associated with macroeconomic cycles. More specifically, macroeconomic variation in unemployment and real income can conceivably provide broad and plausibly exogenous

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variation in economic conditions.^c However, interpreting the relationship between alcohol abuse and economic conditions is not entirely straightforward since there are various theoretical explanations for why these outcomes might be related. For example, recessions may have positive health benefits in this context if the prevalence of abusive drinking falls in response to reductions in purchasing power or increases in time allocated to general health production. Alternatively, abusive drinking might actually increase during recessions because of a stress response or because of reductions in the implicit price of a possible complement, leisure. Recent empirical studies of these relationships have uniformly concluded that alcohol abuse is procyclical. For example, Ettner [11] presents evidence that alcohol consumption and dependence fall in response to increases in state unemployment rates.^d These inferences were based on data from individual-level data from the 1988 National Health Interview Survey (NHIS) and an identification strategy that relied on the cross-state variation in unemployment rates. Similarly, Ruhm [12] found that state-level measures of per capita alcohol consumption varied procyclically and concluded that any stress-induced increases in alcohol use during recessions were more than offset by income effects.

This study presents new evidence on the relationship between patterns of alcohol use and economic conditions by drawing upon detailed individual-level data from roughly 740 000 respondents to the Center for Disease Control and Prevention's (CDC) 1984–1995 Behavioral Risk Factor Surveillance System (BRFSS) surveys. A key motivation for reassessments with the BRFSS data is that their unique attributes facilitate careful examination of two potentially confounding features of prior empirical studies. The first issue involves the diverse nature of patterns of alcohol consumption. Ruhm's [12] study employed state-level measures of per capita alcohol consumption, which may be a poor proxy for the patterns of abusive consumption typically associated with negative social outcomes. In the prior literature on alcohol use, abusive drinking has typically been defined as participation in a high volume of consumption within a relatively narrow time period. These distinctions in consumption behaviour may be particularly relevant in this context. Measures of per capita consumption could conceivably reflect procyclical patterns in relatively

casual, income-related alcohol use, which obscure alternative changes in the prevalence of abusive consumption. The second issue involves the possibly confounding influence of omitted variables. Ettner's [11] study did include a detailed individual-level measure of alcohol dependence. However, the identification strategy in that study relied exclusively on the cross-state variation in state unemployment rates for 1988 NHIS respondents. Given the considerable cross-state heterogeneity in alcohol use, this approach may confound a state's economic environment with its unobserved and state-specific determinants of alcohol use.^e

Empirical models based on pooled BRFSS survey data can provide direct and compelling evidence on the relevance of both of these specification concerns. First, since the BRFSS data contain information on drinking participation, drinking volume (i.e. drinks per month and chronic drinking participation) and binge drinking participation, the estimates presented in this study can evaluate potentially important response heterogeneities with regard to patterns of alcohol consumption.^f Second, because the BRFSS data consist of repeated cross-sectional surveys, the empirical specifications can include fixed effects that unambiguously purge the unobserved and possibly confounding state-specific determinants of alcohol use.^g The results of these evaluations demonstrate that both of the specification concerns raised here are critically important. These results replicate prior evidence that the overall volume of alcohol consumption is highly procyclical. However, this evidence also demonstrates that participation in binge drinking is decidedly countercyclical.^h Furthermore, the increased prevalence of binge drinking during recessions is quite large. For example, between 1983 and 1995, the monthly unemployment rate in the United States varied by roughly 5 percentage points.ⁱ The results presented here suggest that such an increase would raise the probability of binge drinking by 8%. Interestingly, the estimated increases are substantially larger in response to more prolonged periods of unemployment as well as among certain demographic subgroups. However, this unique reduced-form evidence begs a further question. Why is it that the prevalence of binge drinking increases during recessions? The conventional 'psychological' interpretation would be that increases in abusive drinking are a response to the general stress associated with financial downturns

(e.g. Wilson and Walker [6], Peirce *et al.* [17]). However, this pattern could also simply reflect the increased availability of leisure, a commodity that may complement and encourage binge drinking. This study presents unique indirect evidence that attempts to distinguish between these explanations by evaluating the patterns of binge drinking by labour force status. The motivation for this approach is straightforward. To the extent that recession-induced increases in binge drinking simply reflect an increased availability of time, we would expect to find smaller marginal effects among those who have maintained some labour force attachment. If, however, the increases in binge drinking were larger among the group of employed respondents, it would suggest the relative importance of the general stress associated with economic downturns. The results of this exercise demonstrate the recession-induced increases in binge drinking are particularly large among those who remain employed. This striking heterogeneity suggests that the increases in binge drinking during recessions can be understood as a stress response that is manifested broadly in the labour force.

BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM (BRFSS)

The individual-level data employed in this study are drawn from the 1984–1995 survey responses to the CDC's annual BRFSS. The BRFSS is an annual telephone-based survey designed to produce 'uniform and state-specific' estimates of the prevalence of important health behaviours including alcohol abuse.^j The BRFSS respondents are chosen to represent the civilian, non-institutionalized population aged 18 or older. One important and quite novel feature of the BRFSS surveys is that they were explicitly designed to generate estimates of key health behaviours that are representative at the state level.^k Specifically, the BRFSS respondents from each participating state are drawn from a three-stage clustered sample design.^l The primary sampling units are based on randomly selected blocks of 100 phone numbers defined by the area code and first five digits of the telephone number (e.g. 212-555-55xx). The next three stages involve screening the primary sampling unit for residential phones, randomly selecting additional households within the sampling

unit and randomly selecting an individual respondent from a given household. Three completed interviews within a primary sampling unit constitute a cluster. As with any survey data, there are a number of caveats associated with analysis of the available responses. In particular, one important concern is that respondents may misunderstand or provide inaccurate responses to potentially sensitive questions like those related to alcohol use.^m Furthermore, because this survey is based on residential phone numbers, certain populations are unequally represented. These include potential respondents whose abode is classified as non-residential (e.g. those on military bases, college dorms or other institutions) as well as populations less likely to reside in households with phones (e.g. Native Americans, blacks in the rural South).

In its initial year (1984), the BRFSS survey was fielded in only 15 states. However, by 1995, respondents from all 50 states and the District of Columbia were questioned.ⁿ Questions on alcohol use were in the survey 'core' administered to all respondents over this 12-year period except in 1994. In that year, questions on alcohol use were an optional 'module' selected only by 11 states and the District of Columbia. This study focuses on four distinct measures of alcohol use reported by the BRFSS respondents. The first is drinking participation: a binary indicator that equals one for respondents who reported any alcohol use over the past 30 days. The second measure is the natural log of the number of drinks per month reported by such drinkers. This 'two-part' representation (i.e. drinking participation and consumption volume) is frequently employed in this literature (e.g. Cook and Moore [20], Manning *et al.* [21]).^o A third measure of consumption volume is a binary indicator that captures participation in 'chronic' drinking: having 60 or more drinks in the last month. The fourth and final measure of alcohol use employed in this study represents participation in 'binge' drinking. Binge drinking is represented by a binary indicator equal to one for BRFSS respondents who reported at least one occasion in the last month of consuming five or more drinks in a row. Notably, similar definitions are frequently employed in other studies (e.g. Grossman *et al.* [22], Dee [23]) since this question captures a consumption pattern typically presumed to be associated with many of alcohol's negative consequences. More specifically, the

definition of binge drinking identifies the interaction of both quantity and frequency of alcohol consumption.^p

These four measures of alcohol use were defined for an initial sample of 828 868 BRFSS respondents, which was comprised of all individuals for whom basic demographic information (gender, race and ethnicity) and state identifiers were available. However, roughly 80 000 of these respondents were discarded since they were part of the 1994 survey in states that did not field the optional questions on alcohol use. Further modest editing of the data led to a sample of 742 821 respondents for whom drinking participation was defined. The descriptive statistics in Table 1 indicate that nearly half of these respondents reported drinking participation within the past 30 days. Additionally, these drinkers consumed on average nearly 21 drinks per month (Table 1). Only 4% of respondents qualified as chronic drinkers. However, 13% of available respondents identified at least one episode of five or more drinks in a row over the previous month (Table 1).

The empirical models for these four distinct measures of alcohol use condition on basic demographic characteristics of the BRFSS respondents by including age, age squared and binary indicators for gender, race and ethnicity as regressors.^q Some of the models presented here also introduce controls for each respondent's marital and education status. The motivation for presenting results with those controls both included and excluded is that they may be important determinants but they may also be determined endogenously with alcohol use. The key independent variables in these evaluations are two distinct measures of macroeconomic activity: the state unemployment rate and real state personal income per capita (Table 1). BRFSS respondents were matched to information on their state's real personal income per capita by survey year. However, they were also matched to current unemployment rates by state, year and the month of their interview.^r Additionally, the BRFSS respondents were also matched to the state average unemployment rate during the 12 months leading up to their interview. This formulation may prove useful in this context since it captures the presence of more prolonged periods of unemployment (Ruhm [8]). Some readers may find it curious that alcohol taxes are not included in these evaluations given the conventional evidence suggesting that alcohol use is

highly tax and price responsive (e.g. Cook and Moore [24]). However, the direct evidence in support of that view has been based exclusively on cross-sectional identification strategies. Recent studies suggest that these links are not robust to fixed effects that control for the unobserved, state-specific determinants of alcohol use (e.g. Dee [23], Mast *et al.* [25]).^s

SPECIFICATIONS

The empirical models for the three drinking measures employed in this study exploit the 'pseudo-panel' nature of the BRFSS data to examine the potentially confounding biases introduced by unobserved time-series and cross-sectional determinants. More specifically, the basic specification for the empirical results presented here is

$$y_{ismt} = \mathbf{X}_{ismt}\boldsymbol{\beta} + \gamma U_{smt} + \delta M_{st} + w_s + k_m + v_t + \varepsilon_{ismt}$$

where y_{ismt} is the drinking measure for person i in state s who was interviewed in month m and year t . The matrix, \mathbf{X}_{ismt} , includes an intercept and the set of explicit regression controls (Table 1). The term, U_{smt} , represents respectively the unemployment rate matched to the respondents from state s who were interviewed in month m of year t while M_{st} is the real personal income per capita in state s during year t . The terms, w_s , k_m and v_t , represent the unobserved determinants of alcohol use associated respectively with a particular state, interview month and survey year. As in Ettner [11], most prior evaluations of drinking behaviour have relied largely on the cross-state variation in key regressors (e.g. Manning *et al.* [21]; Kenkel [26]; Sloan *et al.* [27]). The empirical relevance of this approach for this study's key inferences is evaluated here by comparing estimates from specifications that do and do not include the state fixed effects, w_s . The sensitivity of this study's key inferences to the presence of state fixed effects also provides more general evidence on the relevance of the unobserved cross-sectional variation in alcohol use. Since BRFSS respondents were interviewed throughout the calendar year, the observed patterns of alcohol consumption could also reflect some seasonality. Therefore, all of these specifications include fixed effects for the interview month.

In equations for drinks per month, y_{ismt} , represents the natural logarithm of the reported

Table 1. Descriptive statistics, 1984–1995 BRFSS

Variable	Mean (S.D.)	Sample size
Drinking participation (Any drink in past month)	0.50 (0.50)	742 821
Drinks per month/drinking participation	20.9 (33.2)	359 069
Chronic drinking participation (60 or more drinks in past month)	0.04 (0.19)	733 069
Binge drinking participation (five or more drinks in a row in past month)	0.13 (0.34)	737 019
State unemployment rate (interview month)	0.06 (0.02)	742 821
State unemployment rate (last 12 months)	0.06 (0.02)	742 821
Real state personal income per capita (000 000)	0.14 (0.02)	742 821
Female	0.58 (0.49)	742 821
Black	0.09 (0.28)	742 821
Hispanic	0.03 (0.18)	742 821
Other race/ethnicity	0.05 (0.21)	742 821
Race/ethnicity missing	0.001 (0.04)	742 821
Age	45.5 (17.9)	742 821
Age missing	0.0001 (0.01)	742 821
High school graduate	0.34 (0.47)	742 821
Some college	0.24 (0.43)	742 821
College graduate	0.26 (0.44)	742 821
Education status missing	0.002 (0.05)	742 821
Married	0.56 (0.50)	742 821
Divorced	0.14 (0.34)	742 821
Widowed	0.11 (0.32)	742 821
Marital status missing	0.002 (0.04)	742 821

monthly consumption. As noted earlier, in modelling drinks per month, a semi-log specification is appropriate and frequently employed because of the skewness in the consumption data (e.g. Cook and Moore [20], Manning *et al.* [21]). For the binary measures of drinking, chronic drinking and

binge drinking participation, the results from least-squares estimations of linear probability models based on this specification are also presented. While this approach does not recognize the binary nature of these dependent variables, it facilitates the tractable estimation of these

models, which are based on a large number of observations and an expansive set of regression controls. Furthermore, this approach does not appear to introduce any important reductions in efficiency or consistency. Specifically, probit and logistic models for these dependent variables return marginal effects that are quite similar in magnitude and precision to those reported here.^t

Another potentially relevant issue is the likely existence of heteroskedasticity in this regression model. A straightforward and unrestrictive approach to addressing the presence of heteroskedasticity is to adopt a White correction. However, given the clustering in the year-specific BRFSS survey designs and the fact that the key unemployment variables only vary at the state level, this correction may also need to allow for heteroskedasticity specific to each state, sampling strata or primary sampling unit in a given year. Evaluations of these varying approaches suggested that allowing the White correction to recognize heteroskedasticity specific to each state and year generated the most conservative inferences (i.e. the largest standard errors). Therefore, that correction is adopted for the standard errors reported here.^u

RESULTS

This section presents the results from least squares estimations of empirical models which relate the measures of macroeconomic variation to the four distinct measures of alcohol use among BRFSS respondents.

Full sample

The key estimation results from models relating the state-level macroeconomic covariates to patterns of alcohol use among the full sample of BRFSS respondents are reported in Tables 2–4. The estimated coefficients on the demographic variables in these models are not reported. However, they uniformly indicate that by all measures, younger, white males are substantially more likely to consume alcohol. In general, higher levels of education are also associated with an increased likelihood of having had a drink in the past month but a lower volume of consumption and a decreased prevalence of binge drinking. Single and divorced respondents were most likely to have reported drinking in the past month. However, single respondents have a higher volume of

Table 2. Drinking participation and economic conditions^a

Independent variables	Without state fixed effects			With state fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
State unemployment rate (interview month)	-1.50 [‡] (0.35)	-1.32 [‡] (0.31)	-0.93 [‡] (0.24)	0.09 (0.17)	0.09 (0.17)	0.06 (0.18)
Real state personal income per capita	–	–	2.68 [‡] (0.22)	–	–	-0.69 (0.75)
R ²	0.0907	0.1180	0.1301	0.1315	0.1528	0.1528
State unemployment rate (last 12 months)	-1.72 [‡] (0.35)	-1.50 [‡] (0.31)	-0.93 [‡] (0.25)	0.37* (0.20)	0.35* (0.20)	0.32 (0.21)
Real state personal income per capita	–	–	2.65 [‡] (0.23)	–	–	-0.55 (0.79)
R ²	0.0912	0.1184	0.1300	0.1315	0.1529	0.1529
Marital and education status included?	No	Yes	Yes	No	Yes	Yes

^a Heteroscedastic-consistent standard errors are reported in parentheses. All models include month and year fixed effects and the individual variables representing age, age squared, race/ethnicity and gender.

* Statistically significant with a p -value < 0.10.

[†] Statistically significant with a p -value < 0.05.

[‡] Statistically significant with a p -value < 0.01.

alcohol consumption and are more likely to report binge drinking.

However, the covariates of interest in this context are the macroeconomic variables. The results presented in Table 2 are based on models of drinking participation. In specifications that omit state fixed effects (columns (1) through (3)), we find strong evidence that drinking participation falls significantly as unemployment increases. However, the results in columns (4) through (6) suggests that this conventional evidence may merely reflect omitted variable biases. In models

that rely on the within-state variation in macroeconomic conditions, there is no evidence that recessions generate significant reductions in drinking participation.^v In fact, the bottom panel of Table 2 presents weakly significant evidence that persistently high levels of unemployment may actually encourage abstainers to consume alcohol. The results in Table 3 present evidence on the estimated effects of these macroeconomic measures on the two measures of drinking volume. In models that omit state fixed effects, these results suggest that increases in real personal income per

Table 3. Drinking volume and economic conditions^a

Independent variables	Without state fixed effects			With state fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Dependent variable: ln(drinks per month)</i>					
State unemployment rate (interview month)	0.44 (0.40)	0.26 (0.38)	0.44 (0.35)	-0.69 [†] (0.31)	-0.66 [†] (0.31)	-0.67 [†] (0.32)
Real state personal income per capita	-	-	1.75 [‡] (0.27)	-	-	0.04 (1.11)
R ²	0.1094	0.1214	0.1222	0.1158	0.1273	0.1273
State unemployment rate (last 12 months)	0.38 (0.42)	0.20 (0.41)	0.51 (0.37)	-0.73 [†] (0.34)	-0.67 [†] (0.34)	-0.68* (0.36)
Real state personal income per capita	-	-	1.76 [‡] (0.27)	-	-	-0.12 (1.13)
R ²	0.1094	0.1214	0.1222	0.1158	0.1273	0.1273
	<i>Dependent variable: Chronic drinking participation</i>					
State unemployment rate (last 12 months)	-0.08* (0.04)	-0.10 [†] (0.04)	-0.05 (0.03)	-0.15 [‡] (0.05)	-0.15 [‡] (0.04)	-0.15 [‡] (0.04)
Real state personal income per capita	-	-	0.24 [‡] (0.03)	-	-	0.01 (0.14)
R ²	0.0325	0.0375	0.0382	0.0355	0.0403	0.0403
State unemployment rate (last 12 months)	-0.08* (0.04)	-0.09 [†] (0.04)	-0.05 (0.03)	-0.15 [‡] (0.05)	-0.15 [‡] (0.05)	-0.15 [‡] (0.05)
Real state personal income per capita	-	-	0.24 [‡] (0.03)	-	-	-0.01 (0.14)
R ²	0.0325	0.0375	0.0382	0.0356	0.0404	0.0404
Marital and education status included?	No	Yes	Yes	No	Yes	Yes

^a Heteroscedastic-consistent standard errors are reported in parentheses. All models include month and year fixed effects and the individual variables representing age, age squared, race/ethnicity and gender.

* Statistically significant with a p -value < 0.10.

[†] Statistically significant with a p -value < 0.05.

[‡] Statistically significant with a p -value < 0.01.

Table 4. Binge drinking participation and economic conditions^a

Independent variables	Without state fixed effects			With state fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
State unemployment rate (interview month)	-0.32 [‡] (0.11)	-0.37 [‡] (0.11)	-0.30 [‡] (0.10)	0.22 [†] (0.10)	0.22 [†] (0.10)	0.20 [†] (0.10)
Real state personal income per capita	-	-	0.45 [‡] (0.08)	-	-	-0.33 (0.26)
R ²	0.1023	0.1140	0.1147	0.1135	0.1248	0.1248
State unemployment rate (last 12 months)	-0.35 [‡] (0.11)	-0.38 [‡] (0.11)	-0.29 [‡] (0.11)	0.32 [‡] (0.12)	0.32 [‡] (0.12)	0.30 [†] (0.12)
Real state personal income per capita	-	-	0.44 [‡] (0.08)	-	-	-0.26 (0.27)
R ²	0.1023	0.1140	0.1147	0.1135	0.1248	0.1249
Marital and education status included?	No	Yes	Yes	No	Yes	Yes

^a Heteroscedastic-consistent standard errors are reported in parentheses. All models include month and year fixed effects and the individual variables representing age, age squared, race/ethnicity and gender.

* Statistically significant with a p -value < 0.10.

† Statistically significant with a p -value < 0.05.

‡ Statistically significant with a p -value < 0.01.

capita are associated with increases in both measures of drinking volume (column (3)). Similarly, there is limited evidence that high unemployment rates reduce chronic drinking participation. However, these estimated effects are substantially larger and more precise in models that include state fixed effects. More specifically, the preferred results in Table 3 suggest that high unemployment generates significant reductions in both measures of drinking volume. For example, this evidence indicates that an increase of 5 percentage points in the unemployment rate would reduce drinks per month by roughly 3.5% (0.05×-0.7). That same increase would reduce chronic drinking participation by roughly 19% of its mean value ($[0.05 \times -0.15]/0.04$). Notably, there is little difference between the estimated effects of the current unemployment rate and the unemployment rate over the last 12 months.

The evidence from Tables 2 and 3 underscores the importance of state fixed effects. However, the essential results reported by Ettner [11] and Ruhm [12] seem quite robust. Cyclical increases in unemployment are associated with significant reductions in alcohol consumption. But Table 4 presents the results of similar evaluations for a particularly distinct and policy-relevant measure

of alcohol consumption: participation in binge drinking. In models that omit state fixed effects, we again see a replication of the conventional results. Recession-induced decreases in employment and earnings appear to generate statistically significant reductions in the prevalence of binge drinking. But these results are not at all robust to the introduction of state fixed effects.^w The within-state variation in real personal income has small and statistically insignificant effects (column (6)). And, the results in columns (4) through (6) suggest that increases in the unemployment rate are actually associated with statistically significant increases in the prevalence of binge drinking. Interestingly, these marginal effects appear substantively larger when the unemployment variable is defined for the previous 12 months. This distinction should not be overdrawn since these estimated marginal effects are within one standard error of each other. Nonetheless, this evidence suggests that persistently high cyclical unemployment generates particularly large increases in the prevalence of binge drinking. The recession-induced increases in binge drinking are also fairly large. A 5 percentage-point increase in the unemployment rate increases the mean prevalence of binge drinking by roughly 8% ($[0.05 \times 0.2]/0.13$).

Binge drinking by race and gender

The results of the previous section provided clear evidence that the conventional links between periods of unemployment and reductions in alcohol use may have been misleading. While the overall volume of alcohol consumption may decrease during recessions, this evidence clearly indicated that periods of high unemployment are associated with significant increases in the prevalence of binge drinking. However, these results which are based on the full sample may obscure heterogeneous responses among particular subsets of BRFSS respondents.^x In particular, patterns of abusive drinking differ sharply by gender and race. For example, the coefficients on the demographic variables in the binge drinking models (Table 4), which were not reported, indicate that whites, males and younger respondents are substantially more likely to engage in binge drinking. These distinctions in the prevalence of binge drinking suggest that there may be unobserved, cultural or economic attributes that make each group's drinking responses to economic contractions and expansions unique. Direct evidence on this question is presented in Table 5, which con-

tains the key estimation results from linear probability models for binge drinking estimated by gender, race and age groups. The specifications chosen for these estimates correspond to column (5) in Table 4. State fixed effects and the controls for education and marital status are included. The unemployment variable in these estimations is the one representing the mean state unemployment rate leading up to the 12 months prior to the BRFSS interview. For ease of reference, the results for the full sample are reported again in the top row of Table 5.

The dependent means reported in the second column of Table 5 indicate how sharply the prevalence of binge drinking differs by gender, race and age. The probability of binge drinking for males is over three times larger than that for females.^y Similarly, the prevalence of binge drinking among white respondents was nearly twice that of black respondents. The prevalence of binge drinking also decreases sharply with age. The estimated marginal effects of the unemployment rate that the responsiveness of binge drinking is fairly heterogeneous as well. More specifically, the evidence in Table 5 indicates that there are significant recession-induced increases in

Table 5. Binge drinking and economic conditions, by respondent traits^a

Sample	Dependent mean	Estimated effect of state unemployment rate (past 12 months)	Sample size
Full	0.13	0.32 [‡] (0.12)	737 019
White	0.14	0.40 [‡] (0.11)	613 862
Black	0.08	0.36 [†] (0.17)	63 872
Male	0.22	0.56 [‡] (0.19)	306 956
Female	0.07	0.15* (0.08)	430 063
Aged 18–24	0.27	0.86 [‡] (0.27)	79 347
Aged 25–55	0.16	0.39 [‡] (0.14)	437 823
Aged 56 or more	0.04	0.03 (0.06)	219 849

^a Heteroscedastic-consistent standard errors are reported in parentheses. All models include state, month and year fixed effects and the individual variables representing age, age squared, race/ethnicity, gender, marital and education status.

* Statistically significant with a p -value < 0.10.

† Statistically significant with a p -value < 0.05.

‡ Statistically significant with a p -value < 0.01.

binge drinking in nearly all of the demographic groups. However, the varying magnitudes of these estimated marginal effects indicate a great deal of response heterogeneity. In particular, recession-induced increases in the prevalence of binge drinking are particularly large among males and younger respondents.^z However, among respondents aged 56 or older, the unemployment rate has no significant effect on the probability of binge drinking. This is a plausible non-response since the financial security of this age group is likely to be less subject to cyclical variation in economic conditions. Among black and white respondents, the recession-induced changes in the prevalence of binge drinking are roughly equivalent. However, since there is substantially less binge drinking among blacks overall, this increase is disproportionately large in percentage terms.

Binge drinking by employment status

The previous results provide clear evidence that economic contractions induce large and statistically significant increases in the prevalence of binge drinking and that these increases are manifested throughout much of the population. However, there is a fundamental theoretical ambiguity associated with interpreting these results. It could be that that increased binge drinking during recessions merely reflects, to an unknown degree, an increased availability of time (i.e. an implicit fall in the price of a possible drinking complement, leisure) rather than the frequently hypothesized role of economic stress. Given the large magnitude of the marginal effects identified here, it seems highly implausible that they reflect only the influence of such cross-price effects. Nonetheless, this section presents more direct evidence on this question by replicating the binge drinking results among specific subsets of the BRFSS respondents. More specifically, a compelling and straightforward approach to addressing this distinction is to estimate the binge drinking equations using data only on those respondents who are employed. A question on employment status was in the 'core' of questions administered to all BRFSS respondents. Over half of BRFSS respondents identified themselves as employed for wages.^{aa} If economic contractions increased binge drinking largely by making more time available for such abusive consumption, the estimated marginal effects associated with the unemployment rate should be

sharply attenuated in models that only include those who remain attached in the labour market. However, to the extent that the countercyclical pattern of binge drinking is robust among employed persons, it would suggest that the stress of economic contractions, broadly defined, is an important determinant of binge drinking.^{bb}

The key results of binge drinking equations estimated separately for BRFSS respondents defined by their employment status are reported in Table 6. The evidence from the first two rows indicates recessions significantly increase the prevalence of binge drinking among the employed as well as those who are not employed. However, these recession-induced increases in binge drinking are largely concentrated among those who remain employed, even when the marginal effects are defined in percentage terms. One limitation of these results is that employment status is likely to be associated with other traits that limit the power of these comparisons. In particular, the marginal effects among those not employed may be smaller simply because that group consists of disproportionately more older respondents for whom cyclical economic conditions are less relevant. To address this concern and make this evidence more crisp, the remaining results in Table 6 focus only on 'prime-age' respondents (i.e. those aged 25–55) for whom cyclical economic conditions should be particularly relevant. Again these results suggest that recession-induced increases in binge drinking are concentrated among those who remain employed.^{cc} Overall, the robustness and relative size of these estimated marginal effects among employed respondents provides important evidence that the countercyclical pattern of binge drinking may reflect a stress response and not simply the increased availability of leisure. Furthermore, this evidence underscores that the pattern of recession-induced increases in binge drinking are prevalent through a broad cross-section of the labour force.

CONCLUSIONS

Varied studies from several disciplines have suggested that stress, including the economic stress associated with recessions, can be an important determinant of an important health behaviour: the abusive consumption of alcohol (National Institute on Alcohol Abuse and Alcoholism (NIAAA) [2]). However, recent econometric studies

Table 6. Binge drinking and economic conditions, by employment status and respondent traits^a

Sample	Dependent mean	Estimated effect of state unemployment rate (past 12 months)	Sample size
		<i>Full sample</i>	
Not employed	0.09	0.19 [†] (0.09)	349 737
Employed	0.17	0.47 [‡] (0.16)	386 193
		<i>Aged 25–55</i>	
Not employed	0.13	0.25 [†] (0.10)	130 775
Employed	0.17	0.45 [‡] (0.16)	302 466
White and Employed	0.18	0.58 [‡] (0.15)	248 882
Black and Employed	0.10	0.62 [†] (0.26)	28 127
Male and Employed	0.26	0.71 [‡] (0.24)	144 271
Female and Employed	0.09	0.19 (0.13)	158 195

^a Heteroscedastic-consistent standard errors are reported in parentheses. All models include state, month and year fixed effects and the individual variables representing age, age squared, race/ethnicity, gender, marital and education status.

* Statistically significant with a p -value < 0.10.

† Statistically significant with a p -value < 0.05.

‡ Statistically significant with a p -value < 0.01.

relating alcohol use to fluctuations in economic conditions have concluded that the prevalence of alcohol abuse actually decreases during economic downturns, implying that income effects dominate any stress-induced increases in drinking behaviour during recessions. This study has suggested that this prior evidence may be misleading for two reasons. One is that some studies ignore the important heterogeneity in patterns of alcohol consumption by modelling measures of consumption volume rather than abusive consumption. The second stated concern is that identification strategies that rely on the cross-state variation in economic conditions may confound their true effects with the unobserved state-specific determinants of alcohol use. The availability of detailed individual-level consumption data from repeated cross-sections of BRFSS respondents allowed this study to investigate the empirical relevance of these two concerns directly.

The results of evaluations based on these BRFSS data demonstrated that both of these concerns are empirically relevant. In particular, these results indicate that participation in binge

drinking is decidedly countercyclical. The estimated increases in the prevalence of binge drinking during recessions are quite large. For example, these results indicate that an increase of 5 percentage points in the unemployment rate induces an 8% increase in the probability of binge drinking. The evidence that economic recessions increase the prevalence of binge drinking is largely persistent in models estimated for samples defined by gender, race and employment status. The robustness of countercyclical patterns of binge drinking among these different groups suggests that this is a pervasive phenomenon that can provide important guidance to the efforts aimed at identifying and treating the broad social consequences of alcohol abuse and dependence. The demonstrated robustness of these results among employed respondents is particularly insightful because it indicates that the increased prevalence of binge drinking during recessions is likely to reflect a stress response and is not merely driven by an increased availability of leisure. The existence of such stress-induced binge drinking among the employed underscores the relevance of the many

workplace initiatives aimed at reducing alcohol abuse. However, these binge-drinking results are also more generally policy-relevant because they suggest that the exogenous variation in economic conditions is an important determinant of a costly health behaviour.

NOTES

- a. Pohorecky [1] and NIAAA [2] provide overviews of the diverse biological and behavioural evidence linking stress and alcohol use. The issues addressed here are also part of a broader literature concerned with the effects of financial status in general and macroeconomic cycles in particular on health behaviours and outcomes (e.g. Chapman and Hariharan [3], Ettner [4], Catalano *et al.* [5], Wilson and Walker [6], Jin *et al.* [7], Ruhm [8]).
- b. The National Institute on Drug Abuse (NIDA) [9] estimates that the annual social costs of alcohol abuse may be as much as \$148 billion in 1992 dollars. While the available cost estimates are based on varied approaches (Sindelar [10]), this figure nonetheless suggests the normative relevance of the abusive consumption of alcohol.
- c. Furthermore, given that economic conditions, broadly defined, can be influenced by a variety of government policies, the influence of exogenous variation in economic conditions on patterns of alcohol use is directly policy-relevant.
- d. More specifically, Ettner [11] uses state unemployment rates as an instrumental variable for how an individual's unemployment influences average consumption and a score for alcohol dependence. However, evidence of the 'reduced-form' procyclicality of average alcohol consumption and alcohol dependence are directly implied by the positive first-stage and negative IV estimates.
- e. For example, prior evidence for the procyclicality of alcohol abuse in cross-sectional data could simply reflect the possibility that states with considerable economic activity have unobserved attributes that also imply higher levels of abusive drinking (e.g. cultural attitudes, state-specific age distributions, more urbanicity, lower levels of religiosity, etc.).
- f. Drinking participation refers to having any drink within the past month. Chronic drinking participation refers to having 60 or more drinks in the past month. This volume measure may not be a particularly strong proxy for abusive consumption since it includes those who have two drinks per day (a consumption pattern often associated with good cardiovascular health). In contrast, the definition of binge drinking (at least one episode in the past month of five or more drinks in a row) combines information on consumption volume in a narrow period of time.
- g. Unlike many surveys, BRFSS also has the virtue of being explicitly designed to generate health surveillance information that is representative at the state and year level.
- h. These results are not necessarily inconsistent with the well-documented procyclicality in traffic fatalities (Evans and Graham [13]) for at least three reasons. One is that the procyclicality in traffic fatalities could simply reflect the crash risks associated with increased road congestion. Second, it could also reflect increased consumption at bars and restaurants to which one typically drives. Third, it could reflect the procyclicality in drinking volume. A diverse set of evidence suggests that traffic fatality risks are sharply increased at the relatively low blood alcohol concentrations that might be associated with changes in average consumption (Dee [14], General Accounting Office (GAO) [15], Zador [16]).
- i. The variation within some states is much larger. For example, in West Virginia, the unemployment rate varied by 14 percentage points during the study period.
- j. The BRFSS is designed and administered with the assistance of state health departments.
- k. Studies in this literature typically evaluate the efficacy of state policies by relying on survey data that were only designed to be representative at much higher levels of aggregation.
- l. This discussion is drawn from CDC [18]. The sampling designs sometimes varied across states and within states over time. For example, in a small number of states and years, the sampling design was also stratified to oversample blocks of phone numbers more likely to be associated with residences.
- m. However, Smith *et al.* [19] report high correlations between state-level measures of self-reported alcohol use from the 1985 BRFSS and state-level consumption data. See CDC [18] for an extensive bibliography of studies that address the overall quality of the BRFSS design and data.
- n. The geographic coverage of BRFSS expanded fairly quickly. In 1988, there were 33 states; in 1990, 45 states.
- o. There are several motivations for this approach. For example, decisions about drinking participation and consumption volume are arguably distinct ones with possibly heterogeneous marginal effects. The two-part approach also facilitates a semi-log specification that corrects the well-known skewness in 'drinks per month' data (Manning *et al.* [21]). The subsequent results underscore the importance of the 'two-part' approach for this study's key inferences. I also examined the possible influence of

- extreme outliers in drinking volume by omitting observations with drinks per month greater than the 99th percentile value (i.e. 112 drinks per month) and found that the results were quite robust.
- p. However, a limitation of this measure is that it applies the same five-drinks standard regardless of the respondent's gender. Some of the subsequent empirical models address this concern by estimating models separately by gender.
 - q. The reference group in these models consists of white non-Hispanic males. Non-white respondents of Hispanic ethnicity are identified with their racial category while white Hispanics are identified separately. Since CDC [18] notes some large interstate differences in protocols for identifying respondents of Hispanic ethnicity, models based on this subgroup should be viewed with some caution.
 - r. The availability of survey data and unemployment rates disaggregated this finely helps to reduce measurement error.
 - s. Regardless, the results presented here are robust to the inclusion of alcohol taxes as a regressor. However, some results are less precise in models that include liquor taxes since the sample sizes are smaller due to the fact that these taxes are only meaningfully defined in the states that do not exercise monopoly control over the wholesale or retail sale of liquor.
 - t. Maddala [28] describes the conditions under which linear probability models are appropriate.
 - u. Even though this approach may overstate the standard errors, there is still sufficient precision in many of the models to provide a commentary on the conventional cross-sectional identification strategies. I also evaluated 'survey' estimators that incorporated the sample weights. That approach replicated this study's key result (i.e. the counter-cyclicality of binge drinking participation).
 - v. It is straightforward to show that the state fixed effects are jointly significant determinants. For example, an F -test can be constructed using the R^2 in columns (1) and (4) (i.e. $F(51, 742719) = [(0.1315 - 0.0912)/51]/[(1 - 0.1315)/742719] = 676$) which implies rejection of the hypothesis that they are jointly insignificant.
 - w. The particular direction of this omitted variable bias indicates that states with high unemployment rates have an unobserved propensity for less binge drinking. This may reflect unobserved determinants like a higher proportion of rural respondents and increased levels of religiosity.
 - x. For example, Mullahy and Sindelar [29] note the gender- and race-specific links between alcohol use and labour market experiences.
 - y. As noted earlier, these gender differences, as well as those presented in Tables 5 and 6, should be interpreted cautiously since the CDC definition of binge drinking applies the five-drink standard to respondents of either gender.
 - z. However, these increases are not necessarily much larger in percentage terms since these groups engage in much more binge drinking overall.
 - aa. Unfortunately, this question did not distinguish the characteristics of employment in much more detail. Instead, respondents merely identified themselves as employed for wages, self-employed, out of work or out of the labour force in some other capacity. Since there was some modest non-response to the question, the sample sizes are also somewhat smaller.
 - bb. Note that this approach is not entirely definitive. Persons who remain employed might feel economic strain through a reduction in hours or the labour market experiences of a spouse which are not evidenced in these data. Nonetheless, if the observed pattern were due largely to the availability of leisure, there would still be some attenuation of the marginal effects among these respondents.
 - cc. The remaining models in Table 6 examine the responsive heterogeneity among prime-age workers by race and gender. As with the results in Table 5, these estimates indicate that these effects are roughly equivalent across white and black respondents but are concentrated among males.

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