经济萧条时的饮酒变化

二元选择模型的应用

讲课人：何濯羽（国际教育学院）

参考论文：Ruhm & Black (2002)

CONTENTS

01

心理学 VS 经济学

经济萧条会导致民众饮酒行为的增加还是减少?

心理学理论 VS 经济学理论

Psychologist

经济萧条

↓

人民生活压力增大

↓

饮酒更为频繁

Economist

经济萧条

↓

工作薪水降低

↓

减少饮酒

酒是“正常商品”（normal good）！

前人的研究

有许多人研究过税率、最低合法饮酒年龄、酒驾法规等政策对个人饮酒行为的影响，但是很少人研究过宏观经济对饮酒行为的影响。

为什么？

宏观经济学家通常使用**“聚合数据”（aggregate data）**，然而使用聚合数据来研究该问题有诸多缺陷：

- Ecological inference problem（区群推断问题）。举例：经济萧条时，重度酗酒者增加饮酒，而轻度饮酒者减少饮酒，人数较多的轻度饮酒者会使得我们在聚合数据中观测到经济萧条时饮酒减少的现象——这掩盖了重度酗酒者增加饮酒的事实。
- 聚合数据使得我们无法识别不同人群（不同性别、种族、年龄）在经济萧条时的饮酒行为。
- 聚合数据中可用的控制变量较少。

02 研究数据

Behavioral Risk Factor Surveillance System (BRFSS)

行为风险因子监测系统（BRFSS）

系统官网：https://www.cdc.gov/brfss/index.html

BRFSS 由美国疾病控制与预防中心（Centers for Disease Control and Prevention）管理，是一项针对成年人口的年度电话调查，旨在收集有关预防性健康行为和危害行为（包括酗酒）的统一州际数据。该调查的目标之一是让公共卫生专业人员能够监测美国各州在实现“2010年健康人民：国家健康促进和疾病预防目标”（Healthy People 2010）方面取得的进展。

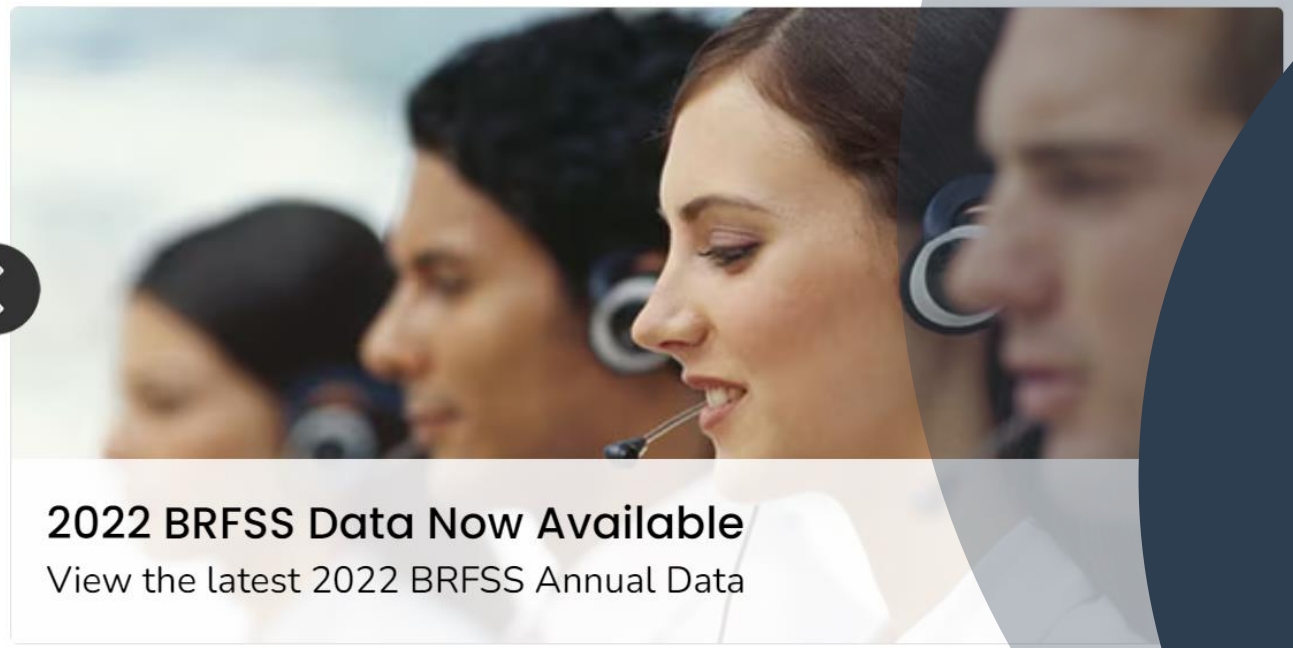
第一年（1984年）只有15个州参与 BRFSS，但到1987年已有34个州参加，而在90年代每年都有45个或更多州参加。该系统数据的样本量很大，每年的样本量都超过500,000个，并且随着时间的推移而增加。Ruhm & Black (2002) 使用了1987-1999年（共13年）的数据，包含了100多万个观察值。除1994年、1996年和1998年外，所有受访者均提供了有关个人饮酒的信息。

An official website of the United States government Here's how you know

Behavioral Risk Factor Surveillance System

Search

Print

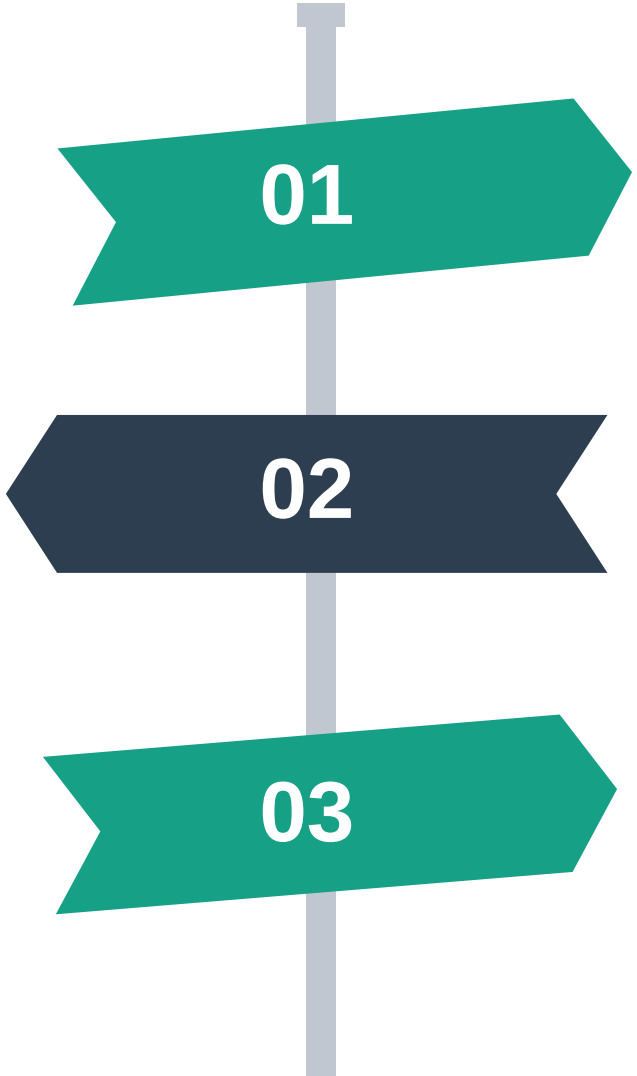


截至2024年8月，

该系统数据已更新至2022年。

可免费下载！

BRFSS 数据的局限性



由于数据是通过对居民家庭的电话调查获得的，因此不包括没有电话或住宅（例如大学宿舍、公寓）的人员。

数据不包含18岁以下青少年的信息。

自我报告的数据中，饮酒情况可能被刻意或无意低估。然而，我们可以相信：随着时间的推移，自我报告的误差是近乎一致的。

Dee (2001) 研究的漏洞

在 Ruhm & Black (2002) 之前，斯坦福大学的 Thomas S. Dee 教授在2001年已经使用 BRFSS 数据和固定效应模型（fixed-effect model）研究了经济萧条对饮酒行为的影响，但是他的研究有以下漏洞：

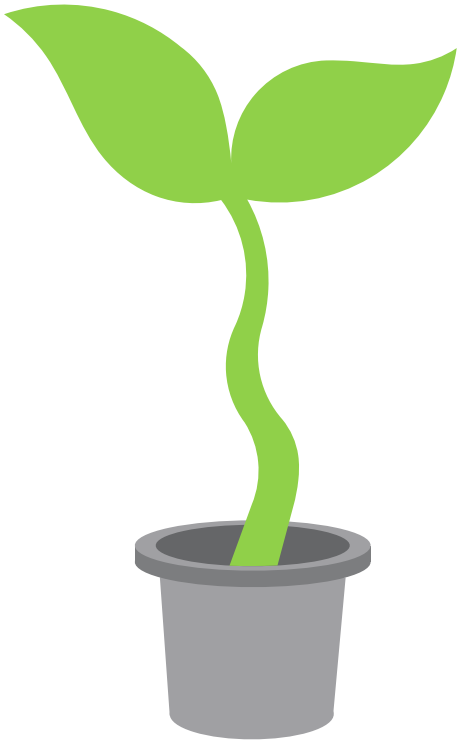
1. Dee (2001) 只使用了1984-1995年的数据，早年的数据中只包含了少数几个州的数据。

2. Dee (2001) 使用了一般最小二乘法（OLS）估计参数，忽略了 BRFSS 数据在加权之后才具有全国代表性（不同群体的饮酒行为存在巨大差异）。

3. Dee (2001) 的模型中包含的控制变量较少，比如：他忽略了酒税、居民教育水平、居民婚姻状况等变量。

Ruhm & Black (2002) 的改善

Ruhm & Black (2002) 在 Dee (2001) 的基础上，对数据和研究方法进行了改善：



1. Ruhm & Black (2002) 使用的数据覆盖了更长且更近的时间。

2. Ruhm & Black (2002) 构建了更多的结果变量，用于区分休闲饮酒者（recreational drinker）和重度饮酒者（heavy drinker）。

3. Ruhm & Black (2002) 使用了**加权最小二乘法（WLS）**估计参数，消除OLS带来的偏误。

03 二元选择模型

线性概率模型与 Probit 模型

线性概率模型（Linear Probability Model, LPM）

$$Y_{ijmt} = \alpha_j + \mathbf{X}_{ijmt}\beta + E_{mjt}\gamma + \delta_m + \alpha_j T_{mt}\lambda + \varepsilon_{ijmt}$$

二元结果变量（binary outcome variable）

1) Drinking participation（是否参与饮酒）
2) Alcohol-involved driving（是否在饮酒后开车）
3) Binge drinking（是否放纵饮酒，即一次性饮酒5杯或以上）

是 = 1

否 = 0

线性概率模型（Linear Probability Model, LPM）

$$Y_{ijmt} = \alpha_j + \mathbf{X}_{ijmt}\beta + E_{mjt}\gamma + \delta_m + \alpha_j T_{mt}\lambda + \varepsilon_{ijmt}$$

解释变量：失业率和人均收入

特定州的线性趋势

将特定州的线性趋势放入模型，主要用于控制那些特定州随时间变化的因子。

Probit 模型

$$Y_{ijmt} = \Phi\left(\alpha_j + \mathbf{X}_{ijmt}\beta + E_{mjt}\gamma + \delta_m + \alpha_j T_{mt}\lambda\right) + \varepsilon_{ijmt}$$

标准正态分布的累积分布函数

误差项服从 $N(0,1)$

没有实际原因，只是因为标准正态分布可以简化运算。

注：Probit 模型的参数估计值（即上式中的 γ）没有解释意义！

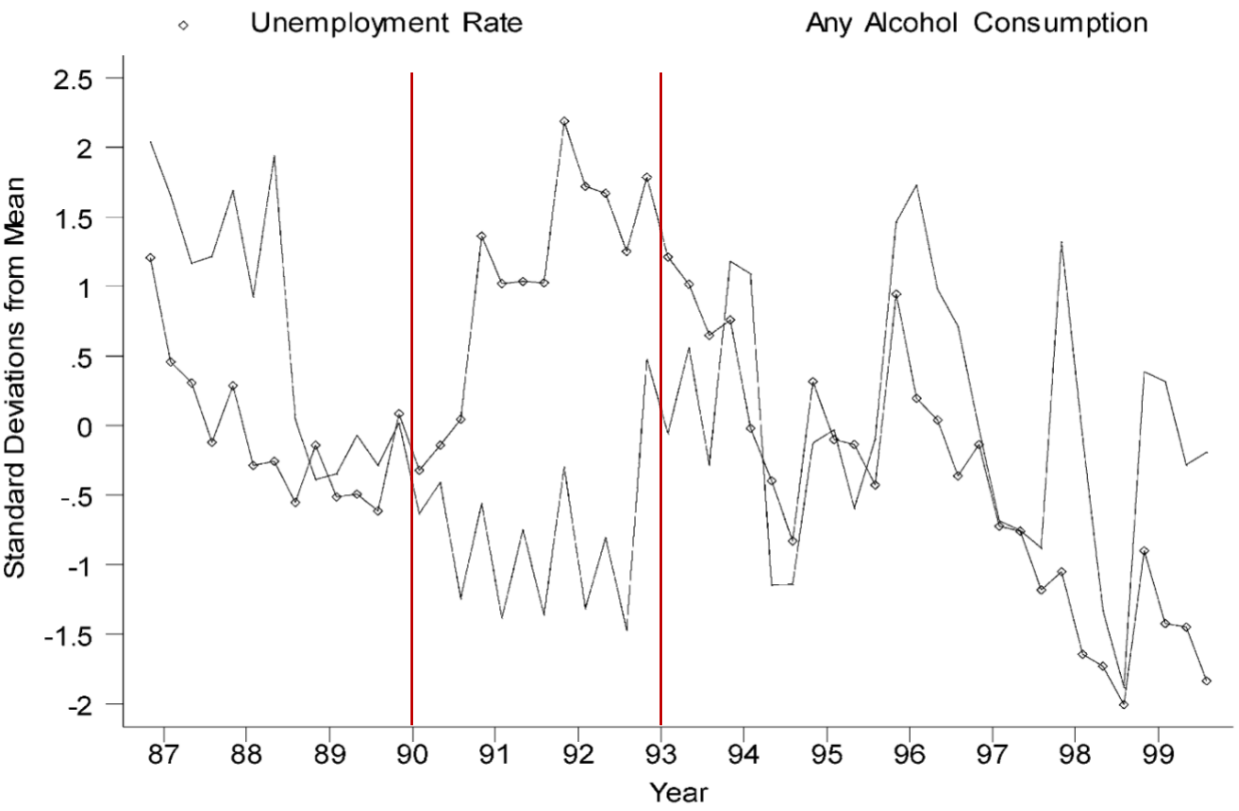
但是，我们可以对上式关于 E_{mjt} 求导，然后计算得到**边际效应（marginal effects）**。

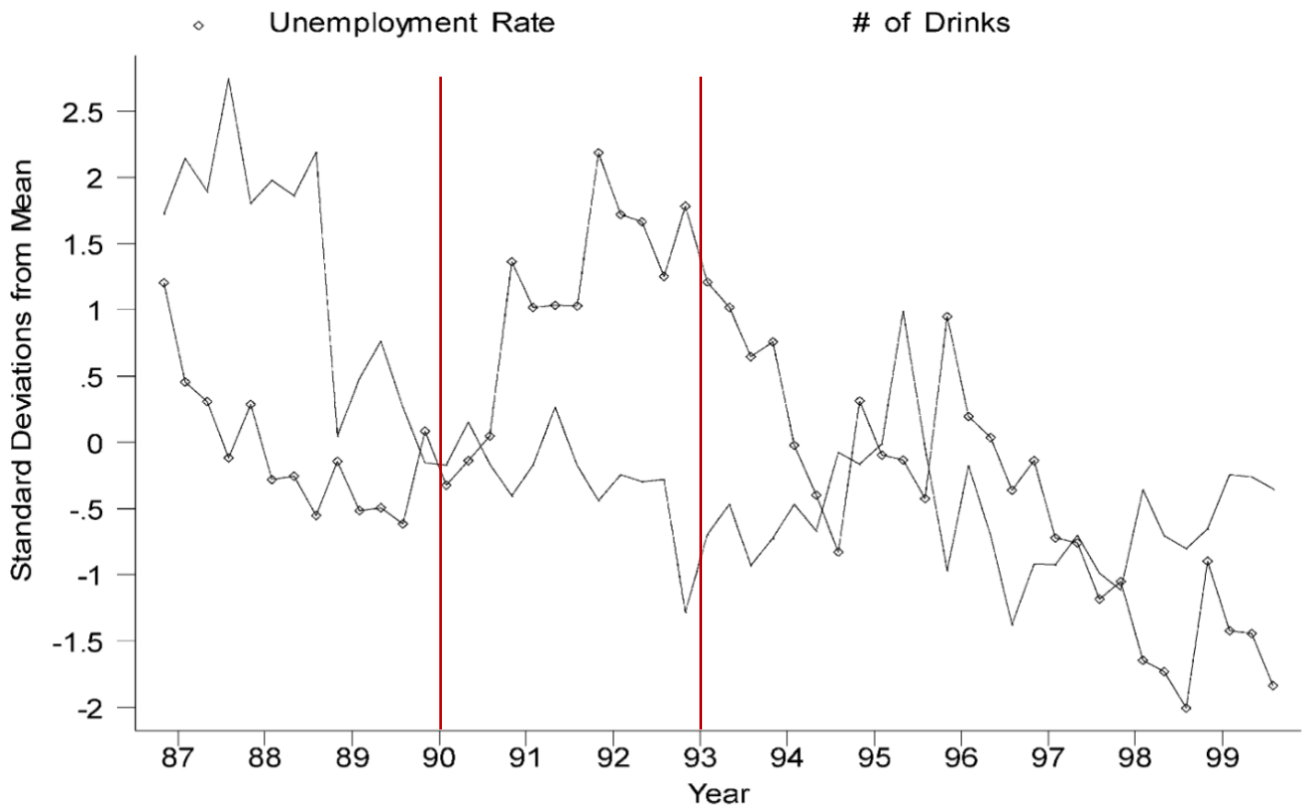
04 研究发现

经济萧条时，饮酒行为减少！

研究发现：Drinking is procyclical.

顺周期变量（procyclical variable）：与经济周期波动（如国内生产总值、就业率等）呈正相关的变量。





上方两张图初步展示了饮酒是顺周期的：失业率高的时期（90年代初期），酒类产品消费降低，居民饮酒量降低。

研究发现：Drinking is procyclical.

Predicted effect of a one percentage point increase in the state unemployment rate on alcohol use and problems

Outcome	(a)	(b)	(c)	(d)	(e)	(f)
Drinker	−4.5E−4 (7.8E−4)	−6.1E−4 (8.2E−4)	−0.0018 (0.0013)	−0.0019 (0.0013)	−0.0021 (0.0014)	−3.3E−4 (0.0031)
Log of number of drinks	−0.0151 (0.0024)	−0.0184 (0.0027)	−0.0313 (0.0048)	−0.0099 (0.0045)		−0.0408 (0.0141)
Alcohol-involved driving	−4.1E−4 (1.8E−4)	−1.8E−4 (2.0E−4)	−8.9E−4 (3.4E−4)	−4.8E−4 (3.7E−4)	−5.1E−4 (2.0E−4)	−6.7E−4 (4.7E−4)
Type of data	Individual	Individual	Individual	Individual	Individual	Aggregate
State-specific time-trends	No	Yes	Yes	Yes	Yes	Yes
Year effects	No	No	No	Yes	No	No
Sampling weights	No	No	Yes	Yes	Yes	Yes
Estimation technique	OLS	OLS	WLS	WLS	Probit	WLS

Note: the table displays predicted effects of a one percentage point increase in the state unemployment rate, using data from 1987 to 1999 BRFSS. The first five columns show results using individual-level data. Robust S.E., calculated assuming that observations are independent across months and states but not within-states in a given month, are reported in parenthesis. These specifications include month and state dummy variables and control for beer taxes, age, sex, race/ethnicity, education, marital status, and interactions between age, sex, and race/ethnicity. Columns (b–e) also contain state-specific linear time trends and specification (d) includes year dummy variables. "Drinking" refers to a dichotomous variable indicating whether the respondent had at least one drink in the last month. The "number of drinks" refers to alcoholic beverages imbibed in the last month for those with some consumption. Alcohol-involved driving is a binary variable set to one if the respondent reported driving at least once during the last month when he/she "had perhaps to much too drink". Sample sizes are 1,032,965, 490,653, and 1,030,174 for the three outcomes. Predicted effects are equal to the unemployment rate coefficients for the OLS and WLS estimates. For the probit models they are calculated as marginal effects with the independent variables, other than the unemployment rate, evaluated at the sample means. Column (f) shows the results of models estimated by regressing state level aggregates on the state unemployment rate, beer tax, state dummy variables, and state-specific time trends. These data are obtained by taking (weighted) averages for each state–year cell in the BRFSS sample, with observations weighted by the square root of the adult state population (aged 18 years and over).

(c) 列显示：伴随着 1 ppt 的失业率增长，居民参与饮酒的概率降低 0.0018，饮酒杯数降低 3.08%，酒驾概率降低 0.00089。

研究发现：Drinking is procyclical.

Additional estimates of the effects of changes in macroeconomic conditions on alcohol use and drinking problems

Regressor	(a) 来自Table 2(c)	(b)	(c)
	Drinker		
State unemployment rate	−0.0018 (0.0013)	0.0021 (0.0013)	−0.0021 (0.0013)
National unemployment rate		−0.0163 (0.0025)	
Per capita personal income (US$ 1000)			−0.0012 (0.0023)
	Log of number of drinks		
State unemployment rate	−0.0313 (0.0048)	−0.0131 (0.0050)	−0.0231 (0.0052)
National unemployment rate		−0.0664 (0.0095)	
Per capita personal income (US$ 1000)			0.0537 (0.0080)
	Alcohol-involved driving		
State unemployment rate	−8.9E−4 (3.4E−4)	−5.2E−4 (3.7E−4)	−6.7E−4 (3.6E−4)
National unemployment rate		−0.0015 (6.6E−4)	
Per capita personal income (US$ 1000)			0.0012 (5.8E−4)

Note: see note on Table 2. The regressions also control for personal characteristics, beer taxes, month and state dummy variables, and state-specific linear time trends. They are estimated by weighted least squares, using BRFSS final sampling weights. Robust S.E. are reported in the parentheses.

1) 相比于州级的经济萧条，国家级的经济萧条带来了更多的减少饮酒行为。

2) 个人收入每降低1000美元，模型估计参与饮酒的概率降低0.0012，饮酒杯数降低5.5%，酒驾概率降低0.0012。

研究发现：A strong procyclical variation in heavy use.

Econometric estimates of categorical amounts of drinking for persons consuming some alcohol during the last month

Regressor	Number of drinks in last month					
	1–10 **Light**	1–20	21–59 **Moderate**	≥60 **Chronic**	≥100 **Heavy**	≥5 drinks on one occasion **Binge**
Sample mean	0.518	0.694	0.225	0.081	0.029	0.286
State unemployment rate	0.0102 (0.0017)	0.0092 (0.0017)	−0.0029 (0.0013)	−0.0063 (0.0012)	−0.0028 (6.6E−4)	−6.9E−4 (0.0013)
State unemployment rate	0.0077 (0.0018)	0.0070 (0.0018)	−0.0013 (0.0014)	−0.0057 (0.0012)	−0.0027 (7.2E−4)	0.0013 (0.0014)
Per capita personal income (US$ 1000)	−0.0167 (0.0028)	−0.0145 (0.0027)	0.0107 (0.0022)	0.0038 (0.0018)	4.5E−4 (0.0011)	0.0134 (0.0023)

Note: see note on Table 2. The dependent variables are dichotomous outcomes indicating whether respondents consumed the specified amounts of alcohol. The sample is restricted to persons with some drinking during the last month. The first row of the table shows the weighted mean for each dependant variable. The second row presents regression results for the models which control for personal characteristics and beer taxes, month and state dummy variables, state-specific linear time trends, and the state unemployment rate. The third and forth row display results for a model which is identical except that it also holds per capita incomes constant. The regressions are estimated by weighted least squares, using BRFSS final sampling weights. Robust S.E. are reported in the parentheses.

第二和第三行显示：在经济萧条时，饮酒行为减少主要是由于长期饮酒者（chronic drinkers）和中毒酗酒者（heavy drinkers）减少了饮酒行为，轻度饮酒者（light drinkers）几乎没有改变饮酒行为。

研究发现：No evidence of large permanent effects.

Predicted effect of a sustained one percentage point increase in the state unemployment rate on alcohol use and drinking problems

Months since rise in unemployment	Drinker	Log of number of drinks	Alcohol-involved driving	Heavy drinking (≥100 drinks)
0	−0.0133 (0.0043)	−0.0348 (0.0159)	−0.0020 (0.0011)	−0.0041 (0.0019)
3	−0.0134 (0.0040)	−0.0375 (0.0156)	−0.0038 (0.0012)	−0.0037 (0.0021)
6	−0.0093 (0.0031)	−0.0270 (0.0129)	−0.0011 (8.7E−4)	−0.0051 (0.0019)
9	−0.0047 (0.0030)	−0.0616 (0.0127)	−0.0012 (9.0E−4)	−0.0063 (0.0017)
12	0.0048 (0.0042)	−0.0286 (0.0160)	−0.0007 (0.0011)	−0.0020 (0.0018)
15	0.0031 (0.0041)	−0.0514 (0.0157)	0.0014 (0.0011)	−0.0041 (0.0021)
18	0.0059 (0.0015)	−0.0180 (0.0053)	−0.0007 (4.2E−4)	−4.7E−4 (7.3E−4)

Note: see notes on Tables 2 and 4. This table shows the predicted effect of a one percentage point increase in the state unemployment rate that is sustained for the number of months shown in the first column. These predictions are made using models that correspond to column (c) of Table 2, except that they also include lagged unemployment rates for the first through eighteenth month prior to the survey date. The effect of a rise in the unemployment rate lasting for k months is calculated as $\sum_{n=0}^{k}\hat{\beta}_{t-n}$, for $\hat{\beta}_{t-n}$ the regression coefficient on the n months lag of the unemployment rate. Robust S.E. are shown in the parentheses.

研究发现：Big differences across population groups.

Predicted effect of a one percentage point increase in the state unemployment rate on alcohol use and drinking problems

Group	Drinker	Log of number of drinks	Alcohol-involved driving	Heavy drinking
All respondents	−0.0018 (0.0013)	−0.0313 (0.0048)	−8.9E−4 (3.4E−4)	−0.0028 (6.6E−4)
Sex				
Male	−0.0020 (0.0017)	−0.0342 (0.0062)	−0.0017 (6.5E−4)	−0.0042 (0.0011)
Female	−0.0018 (0.0015)	−0.0277 (0.0055)	−1.2E−4 (2.8E−4)	−0.0011 (4.5E−4)
Race/ethnicity				
White (not Hispanic)	−0.0012 (0.0013)	−0.0302 (0.0048)	−4.8E−4 (3.8E−4)	−0.0028 (6.5E−4)
Black (not Hispanic)	−0.0086 (0.0037)	−0.0089 (0.0159)	−0.0012 (0.0010)	−0.0027 (0.0026)
Other race (not Hispanic)	−0.0158 (0.0059)	−0.0596 (0.0247)	−6.8E−4 (0.0015)	6.9E−4 (0.0031)
Hispanic	2.8E−4 (0.0046)	−0.0684 (0.0216)	−0.0047 (0.0018)	−0.0054 (0.0027)
Age (years)				
18–24	−0.0029 (0.0034)	−0.0276 (0.0112)	−0.0032 (0.0015)	−0.0027 (0.0020)
25–64	−7.5E−4 (0.0014)	−0.0333 (0.0049)	−5.6E−4 (4.0E−4)	−0.0030 (6.7E−4)
≥65	−0.0050 (0.0023)	−0.0209 (0.0120)	−2.0E−4 (2.4E−4)	−0.0017 (0.0013)

Note: see notes on Tables 2, 4 and 5. The regressions control for personal characteristics, beer taxes, month and state dummy variables, and state-specific linear time trends. They are estimated by WLS using BRFSS final sampling weights. Robust S.E. are reported in the parentheses. Heavy drinking refers to the consumption of 100 or more drinks in the last month, for persons with some alcohol use.

西班牙裔居民的饮酒行为展现出巨大的顺周期变化！

这可以通过其特定的就业模式和文化背景得到解释：西班牙裔通常在美国从事辛苦的农业工作，而且西班牙裔通常将饮酒作为辛勤工作的个人奖励。

研究发现的总结

01

Intensive Margin

几乎所有顺周期的饮酒行为变化都是由现有饮酒者饮酒行为的变化造成的。

02

Heavy Drinkers

经济萧条时期的饮酒量减少主要集中在重度饮酒者而不是休闲饮酒者。

03

Hispanics

不同群体饮酒行为的宏观经济反应基本相似，但西班牙裔的顺周期变化相对较大。

经济萧条时的饮酒变化

二元选择模型的应用

感谢聆听