

# The Study of the Impact of Alcohol Consumption on Wage Rate

Yichen Sun<sup>1, \*, †</sup>, Ruiqi Zhang<sup>2, \*, †</sup>

<sup>1</sup>University of California, San Diego, 9500 Gilman Dr, La Jolla, CA 92093, U.S.

<sup>2</sup>University of California, Los Angeles, 315 Portola Plaza, Los Angeles, CA 90095, U.S

\*Corresponding author. Email: y4sun@ucsd.edu; rqzhang21@ucla.edu

†These authors contributed equally.

## ABSTRACT

Driving by the incentive to help policymakers design more appropriate decisions and providing individuals with more accurate direction about consuming alcohol, this study explores the impact of alcohol consumption on people's employment attainment. The wage rate use is a specific measure for employment attainment. Using the data about the labour market outcomes, alcohol consumption, and assorted demographics for individuals comes from the National Longitudinal Survey of Youth (NLSY) 1989 and 1994, OLS regressions and Instrumental regressions are applied as approaches due to the endogenous nature of alcohol consumption. This study finds out that there is a significant and positive return of alcohol consumption on the wage rate. Specifically, there is an inverse U-shaped relationship between individuals' drinking habits and their wage rate. In addition, the study explores the inverse U-shaped relationship separately for men and women and conclude the slight differences in the extreme points for different genders. The innovative points of our study are to overcome the endogenous nature of alcohol consumption measures and the differences in the relationship between drinking and wage rates for males and females.

**Keywords:** Alcohol consumption, Employment, Wage rate, Instrumental variables

## 1. INTRODUCTION

### 1.1. Research Background

It is not difficult to observe that, in daily life, one's drinking habits can have certain ambiguous impacts on a person's occupation. An alcoholic may perform poorly on the task in his work and thereby experience a lower possibility of obtaining promotion and a higher likelihood of being quitted. On the contrary, moderate drinking levels can also promote socialization and interactions between employees, which can bring positive effects to the workers and increase the likelihood of obtaining promotions. Therefore, it is essential to find out the impact of alcohol consumption on the public's employment status for helping policymakers design more appropriate decisions and providing individuals with more accurate direction about consuming alcohol.

This paper aims to use the OLS and instrumental regressions to find out the relationship between alcohol consumption and employment attainment results. Specifically, wage rate is constructed using data from the

National Longitudinal Survey of Youth (NLSY) 1989 and 1994 as a particular indicator of employment results.

### 1.2. Research Gap

In our literature review, many existing studies and related research papers have strongly presented and proved the endogenous nature of alcohol consumption. In the paper "The causal effect of alcohol consumption on employment status", the author Sangchai points out that the endogeneity problem of the measure of alcohol consumption mainly arises from the issue of omitted variables, measurement errors and simultaneity problems [1]. To be detailed, the reports about individuals' alcohol consumption are highly likely to be underreported or over-reported based on individuals' incentive to tell the truth in different circumstances [1]. Also, unobserved variables determining one's employment condition can contribute to the endogeneity of the alcohol consumption [1].

The endogenous nature of the measure of alcohol consumption can be regarded as the major research gap

in the related studies. Similarly, the biased effects resulting from endogeneity existing the alcohol consumption will be expected to appear in the OLS regression results. As an alternative to overcome the problem, instrumental regression is applied to eliminate the bias, which will be discussed in further detail in later sections.

The other part of the research gaps in the differences in alcohol consumption and its separate impact on employment toward females and males. Compared with males, females generally have a lower upper limit in drinking due to the different body nature, sizes [2], and the influences from differences in social constraints and preferences. Although there is generally an inverse u-shaped relationship between alcohol consumption and earnings for both genders [3], these distinctions cause the relationship to appear different characteristics. This study will also explore the differences further in the instrumental regression via running the regressions separately for different genders.

## 2. MODEL & DATA

### 2.1. Variable Selection

#### 2.1.1. Dependent Variable

The dependent variable is the logarithm of the hourly wage rate (Table 1). Hourly wage rate is calculated using the total wage measured in U.S. dollars in the past calendar year divided by the hours worked in the past calendar year. Many studies have shown that excessive drinking can correlate with employers' absence from work or reduced working time [2]. Meanwhile, severe drinking abuse can also lead to unemployment [2]. The hourly wage rate allows us to examine the individual's explicit employment outcome with control of employed status and working hours, helping us away from the potential selection bias.

#### 2.1.2. Independent Variables and Control Variables

**Table 1.** Description of variables

Dependent Variables	Description
Wage rate	Hourly wage rate
Independent Variable	Description
Alcohol consumption	Drinking frequency
Control Variables	Description
Sex	Biological gender of the individuals, including men and women
Race	Racial groups including Hispanic, Black and others
Age	Age of the individuals in years
Education/Higrad	The number of years of education the individual has completed
Marital Status/Marst	Individual's marital status including never married, married with a spouse present and others
Region	The region that the individuals live in includes Northeast, North Central, South, West
Family Size/Famsz	The number of people in the individual's family

Different drinking levels can have exactly distinctive impacts on employment outcomes, thus making our proper measure about alcohol consumption fairly essential [1]. Our independent variable measures the individual's monthly alcohol consumption, which is constructed via the multiplication of the number of days that one has had a drink in the last month with the average number of drinks consumed in the last month.

More importantly, individuals' wage rates can also be indirectly determined by some exogenous factors, thereby indirectly bias the relationship between alcohol consumption and wage rate. According to the theory of accumulation of human capital, education, age, marital status, and various exogenous factors can indirectly affect one's employment outcome and thereby wage rate [1]. To acquire accurate results, it is necessary to include these exogenous factors within the model. In this way, the model includes seven common variables, sex, race, age,

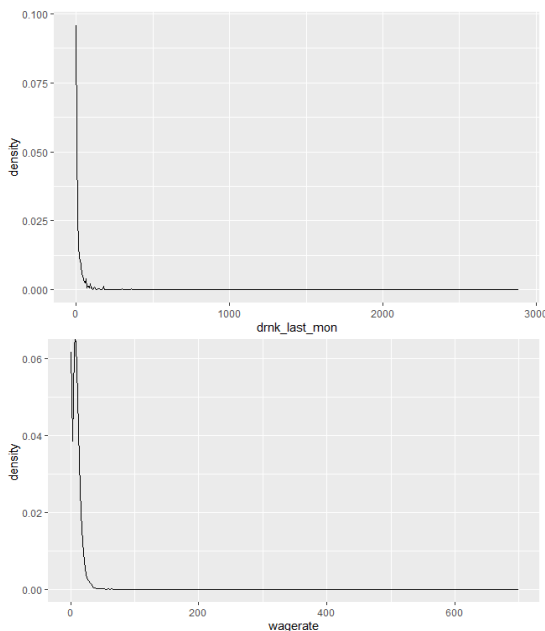
education, marital status, region, and family size, as the control variables.

## 2.2. Data Description

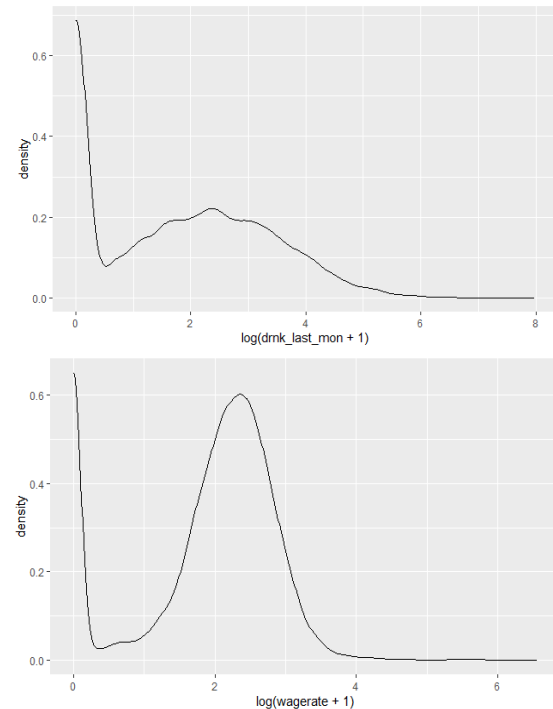
The data set comes from the National Longitudinal Survey of Youth (NLSY). It includes information on labor market outcomes, alcohol consumption, and assorted demographics for individuals in each of 2 years – 1989 and 1994. The data is a panel data set containing observations toward the same individuals across a five-year period, providing us with the convenience to track an individual's long term drinking habits to more accurately determine one's alcohol consumption in later instrumental regressions. Additionally, it recorded individuals aged 24 and 32 in 1989, which can be regarded as ages with high productivity in the labor market and enable our results and analysis to represent labor supply.

In our data cleaning stage, values of the continuous variable present to be N.A. are filled in with average values. For dummy variables, if NA is more than 10%, majority group values are filled in. To the largest extent, the filling-in avoids the results from our later OLS and instrumental regressions being negatively influenced by the blank values and makes sure our consequent regression is more accurate.

## 2.3. Methodology



**Figure 1.** Distribution for Independent and Dependent Variables



**Figure 2.** Distribution for Independent and Dependent Variables with Natural Logarithm

Figures 1 and 2 describes the distributions of dependent and independent variables before and after taking the log. In our model, both independent and dependent variables are taken with natural logarithms in running the regressions. The reason for adding the logarithms is due to the highly right-skewed distributions of both dependent and independent variables. The right-skewed distribution (Figure 1) prevents our results from following the assumptions for the OLS model as violating the normality assumption, which could be problematic in our later analysis. Both variables are added with natural logarithms to solve the potential problem within to produce the asymptotically normal distribution. The addition of natural logarithms can readjust the value of our data to the scales greater than the median value (Figure 2).

In the first OLS estimation, the model in the following is used in the regression:

$$\begin{aligned} \text{Wagerate} = & \beta_0 + \beta_1 \text{Alcohol consumption} \\ & + \beta_3 X_i + \varepsilon \end{aligned} \quad (1)$$

Where  $X_i$  represents the matrix of all controls.

Also, as proven by many studies, there is an inverse U-shaped relationship between alcohol consumption and earnings. In the work of MacDonald et al., the authors utilize a continuous variable of the drinking amount combined with a square term of the variable to capture this relationship [3]. The results from the models by MacDonald et al. generally present significant and negative returns of the square term of the alcohol consumption variable in the model [3]. The square term

of alcohol consumption helps us better identify the negative effect of over drinking. Then the model with the quadratic term is used:

$$\text{Wagerate} = \beta_0 + \beta_1 \text{Alcohol consumption} + \beta_2 \text{Alcohol consumption}^2 + \beta_3 X_i + \varepsilon$$

(2)

**Table 2.** OLS result

Wage rate	(1)	(2)
Intercept	0.017(0.079)	0.039(0.079)
Alcohol consumption	0.041(0.005)***	0.175(0.014)***
Alcohol consumption^2		-0.034(0.003)***
Race		
black	-0.158(0.023)***	-0.152(0.023)***
Otherwise	-0.011(0.021)	-0.009(0.021)
Age	0.026(0.002)***	0.026(0.002)***
Sex		
Female	-0.446(0.015)***	-0.455(0.015)***
Education	0.115(0.003)***	0.110(0.003)***
Region		
North Central	-0.157(0.022)***	-0.155(0.022)***
South	-0.116(0.020)***	-0.109(0.021)***
West	-0.123(0.023)***	-0.122(0.023)***
Family Size	-0.086(0.004)***	-0.085(0.004)***
Marital status		
Married with a spouse present	0.291(0.018)***	0.282(0.018)***
Other	0.093(0.022)***	0.094(0.022)***
Observations	16000	16000
Multiple R-Squared:	0.2076	0.2131
Adjusted R-squared:	0.207	0.2125
F-statistic	349.1	333

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

The OLS result is shown in Table 2. Column (1) is the regression result of equation (1) and column (2) is the result of equation (2). Our result is contrary to the intuition that over drinking can negatively affect careers, and the result of Lancet [4] indicated drinking had no positive effect on health. The study finds a significant and positive impact of alcohol consumption on the wage rate, which is in accordance with previous studies of Michael T. French, Gary A. Zarkin [5]. The study found the wage rate would rise 4.1% as monthly drinking increases by 1%. Moderate drinking does have a positive impact on wages. There are several assumptions for the positive wage effect. In the study of Ukrainian business people, alcohol use is connected to showing respect to colleagues on business occasions [6]. People who drink from time to time could also benefit from increased networking

Where the square of *Alcohol consumption* is added in the function.

### 3. OLS RESULTS AND DISCUSSION

#### 3.1 OLS Results

opportunities and get a more implicit working outcome. Even though drinking only harms people's physical health, people could release pressure at work while drinking, leading to a positive effect on their mental health, reflected in their career attainment and wage.

However, severe alcohol abuse does have a negative impact both on health and on career attainment, as many studies showed. This study also looks into the adverse impact of over drinking. The study found an inverse U-shape relationship between alcohol consumption and wage rate. Heavy drinkers experience a drop in wage compared with moderate drinkers. When over a certain threshold, approximately 12 times a month in this study, the negative impact of drinking starts to dominate. Too frequent drinking in front of colleagues or seniors would

leave an impression of being an alcoholic. Also, alcohol abuse could have a negative impact on health and increase the possibility of death. Even though drinking a suitable amount of alcohol could help release pressure, there is evidence that alcohol is a causal factor for depression. In some European countries, up to 10% of male depression [7]. Therefore, over drinking will also have a negative impact on mental health. The additive effect of the aspects above caused the decline in average wage after a certain threshold. This finding corresponds to our general intuition as well as previous study shows.

## 4. INSTRUMENTAL REGRESSION

### 4.1. Instrumental Variable Selection

However, due to the endogeneity of the key variable alcohol consumption, the OLS results turn out to be biased. Therefore, the second stage lease square (2SLS) method is used in our next step. Self-assessment for the amount of drinking 5 years ago is used as an instrument to predict alcohol consumption in 1994 and estimate the impact of drinking on the wage rate. Intuitively, drinking habits are not likely to change over the years. However, the drinking habit 5 years ago is not likely to be related to human capital features and career attainment now.

**Table 3.** 1<sup>st</sup> stage regression in 2SLS

log(drnk_last_mon_94 + 1)					
intercept	gtint_891	gtint_892	gtint_893	gtint_894	gtint_895
0.952(0.032)***	1.827(0.060)***	1.578(0.065)***	1.277(0.062)***	1.005(0.055)***	0.895(0.047)***
Multiple R-squared: 0.1767					
Adjusted R-squared: 0.1761					
F-statistic:261.9 on 5 and 6099 DF, p-value: < 10102.2e-16					

Table 3 displays the relationship between the instrument and our key variable. From table 3 above, there is a significant and explicit relationship between self-assessment of drinking 5 years ago and alcohol consumption now. The Hausman test result is 25.063, indicating the key variable is endogenous. The weak instrument test result is 70.32, indicating that at least one instrument is strong. From the result above, self-

assessment for the amount of drinking 5 years ago (gtint\_89 in the model) can be a suitable instrument for our estimation.

### 4.2 Instrumental Regression Results and Data Analysis

**Table 4.** 2<sup>nd</sup> stage regression in 2SLS

	All	Male	Female
Intercept	0.444(0.201)**	0.511(0.256)**	0.062(0.308)
Alcohol consumption	0.659(0.102)***	0.540(0.134)***	0.840(0.048)***
Alcohol consumption^2	-0.141(0.022)***	-0.105(0.027)***	-0.210(0.048)***
Race			
black	-0.203(0.039)***	-0.213(0.049)***	-0.187(0.061)**
Otherwise	-0.035(0.036)	0.07(0.045)	-0.099(0.054).
Age	0.008(0.005)	0.005(0.006)	0.011(0.008).
Sex			
Female	-0.408(0.026)***		
Education	0.104(0.006)***	0.088(0.007)***	0.115(0.009)***
Region			
North Central	-0.179(0.038)***	-0.177(0.048)***	-0.188(0.059)**
South	-0.109(0.036)**	-0.151(0.045)***	-0.074(0.056)

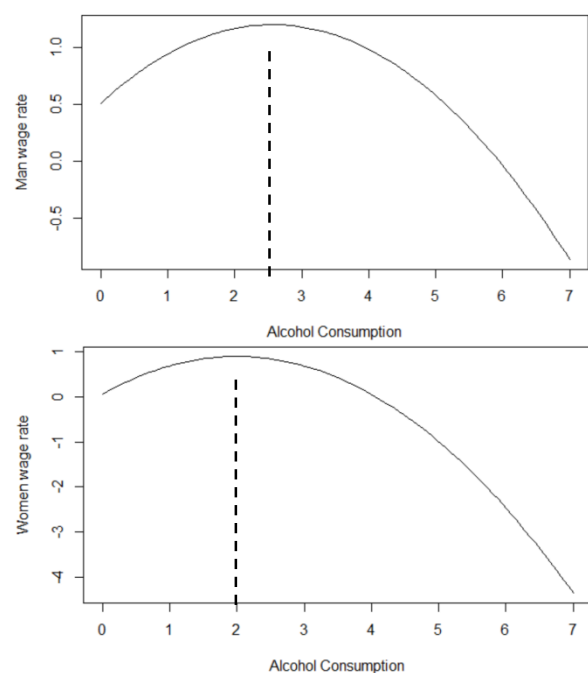
West	-0.137(0.041)***	-0.171(0.051)***	-0.121(0.064).
Family Size	-0.089(0.008)***	-0.040(0.011)***	-0.139(0.013)***
Marital status			
Married with a spouse	0.351(0.034)***	0.451(0.043)***	0.208(0.053)***
Other	0.148(0.037)***	0.180(0.047)***	0.072(0.057)
Observations	6105	2983	3122
Multiple R-Squared:	0.157	0.1817	0.09056
Wald test	117.1 on 13 and 6091 DF	62.92 on 12 and 2970 DF	49.88 on 12 and 3109 DF

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

The IV regression result is shown in Table 4. First, there is still an inverse U-shaped relationship between alcohol consumption and wage rate, indicating this relationship is still robust and in accordance with related studies. Compared with the OLS result, the adverse impact from the IV result is greater (OLS: -0.034, IV: -0.141), indicating that the negative effect of drinking may be covered from the endogenous effect of wage itself or other controls such as education, as multiple studies show. Yet, the true negative effect is stronger as the IV estimation yields. On the other hand, the threshold when the negative impact of drinking dominates comes earlier in IV results than OLS. In IV estimates, the turning point for all samples is 9.35 times per month, almost 25% less compared with that in the OLS result. Still, the negative social impact of heavy drinking is concealed by human capital controls [8].

Moreover, a comparison is made between men and women. The regressions are run through only male subsamples and female subsamples separately. From columns 2 and 3 in table 4, there is an explicit inverse U-shape relationship for both men and women. Compared with men, no-drinking women have an initial wage disadvantage. However, moderate has a stronger positive impact on women's wages, indicating women are more likely to strengthen their social network through occasions involving drinkings, such as banquets or feasts. This result is in accordance with Yin and Gan [9], while contradictory to the result of Zhang [10]. While benefiting from a higher income impact of drinking, there is also a higher adverse effect of over drinking for women. As Figure 3 shows, the negative slope when the wage rate decreases with the amount of drinking is steeper for women than men. As World Health Organization (WHO) showed, women would face more severe health effects of alcohol abuse than men, as World Health Organization (WHO) showed [11]. Deteriorated health from overdrinking will cause a decrease in wages, especially for women.

Moreover, the turning point where negative effects on wage dominate for women appear earlier than men. As Figure 3 shows, the turning point on the figure means the natural log of the amount of drinking per month. On the graph, the turning point for men is about 2.00 while the turning point for women is about 2.57. This means the critical amount of drinking for women is approximately 6.39 times per month while that of men is 12.06 times per month. The results indicated that women are more vulnerable to alcohol and are more likely to suffer from the negative impact of drinking.



**Figure 3.** Comparison between men and women on turning point on the wage of drinking

## 5. CONCLUSION

Our study finds out that, as presented by the inverse U-shaped relationship between alcohol consumption and wage rate, a moderate level of drinking can positively and

significantly impact the wage rate, promoting an individual's employment development. The relationship can be both applied for females and males with slight differences in the extreme point for the inverse U-shaped curve. More significantly, our OLS and instrumental regression results are consistent with our initial hypothesis and intuition. However, our study limits to dig into the deep surface of the social and psychological factors driven behind. Also, the relationship between health outcomes and alcohol consumption is urgent to be explored in future studies. In the future, possible cooperative studies with sociology, psychology, and medical fields can promote our study to a higher level and help the government department design proper policy and institutions that provide more appropriate health direction regarding alcohol consumption in both daily consumption surface and employment fields.

## REFERENCES

- [1] Sangchai, Chanvuth, "The causal effect of alcohol consumption on employment status" (2006). Graduate Theses and Dissertations. <http://scholarcommons.usf.edu/etd/2693>
- [2] Jenny Lye & Joe Hirschberg, 2004. "Alcohol consumption, smoking and wages," *Applied Economics*, Taylor & Francis Journals, vol. 36(16), pages 1807-1817.
- [3] MacDonald, Ziggy; Shields, Michael A. (2000) : The Impact of Alcohol Consumption on Occupational Attainment in England, IZA Discussion Papers, No. 166, Institute for the Study of Labor (IZA), Bonn
- [4] Griswold, Max G., et al. "Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016." *The Lancet* 392.10152 (2018): 1015-1035.
- [5] Michael T. French, Gary A. Zarkin, Is moderate alcohol use related to wages? Evidence from four worksites, *Journal of Health Economics*, Volume 14, Issue 3, 1995, Pages 319-344, ISSN 0167-6296
- [6] Todosiienko, Volodymyr, and Mr Volodymyr Sidenko. "The Ukrainian Way of Doing Business: the Impact of Alcohol Consumption on Wage."
- [7] JANE-LLOPIS, E. and MATYTSINA, I. (2006), Mental health and alcohol, drugs and tobacco: a review of the comorbidity between mental disorders and the use of alcohol, tobacco and illicit drugs. *Drug and Alcohol Review*, 25: 515-536.
- [8] Hamilton, Vivian, and Barton H. Hamilton. "Alcohol and Earnings: Does Drinking Yield a Wage Premium?" *The Canadian Journal of Economics / Revue Canadienne D'Economique*, vol. 30, no. 1, 1997, pp. 135–151. JSTOR, [www.jstor.org/stable/136363](http://www.jstor.org/stable/136363). Accessed 21 Aug. 2021.
- [9] Zhichao, Gan Li. Cigarette, wine and income[J]. *Economic Research*, 2010, 45(10): 90-100+160.
- [10] Zhang Xibei. The impact of smoking and drinking on the income of residents and their spouses[D]. Southwestern University of Finance and Economics, 2014
- [11] Gender, Health and Alcohol Use. Geneva: World Health Organization; September 2005.
- [12] Tekin, Erdal (2002) : Employment, Wages, and Alcohol Consumption in Russia: Evidence from Panel Data, IZA Discussion Papers, No. 432, Institute for the Study of Labor (IZA), Bonn
- [13] Feng, W., Zhou, W., Butler, J., Booth, B.M. and French, M.T. (2001), The impact of problem drinking on employment. *Health Econ.*, 10: 509-521.
- [14] Murakami, K., Hashimoto, H. Associations of education and income with heavy drinking and problem drinking among men: evidence from a population-based study in Japan. *BMC Public Health* 19, 420 (2019).
- [15] Rosoff, D.B., Clarke, TK., Adams, M.J. et al. Educational attainment impacts drinking behaviors and risk for alcohol dependence: results from a two-sample Mendelian randomization study with ~780,000 participants. *Mol Psychiatry* 26, 1119–1132 (2021).