J Labor Res (2009) 30:219–244
DOI 10.1007/s12122-009-9064-7

In Vino Pecunia? The Association Between Beverage-Specific Drinking Behavior and Wages

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Published online: 13 February 2009

Abstract The positive association between moderate alcohol consumption and wages is well documented in the economic literature. Positive health effects as well as networking mechanisms serve as explanations for the "alcohol–income puzzle." Using individual-based microdata from the SOEP for 2006, we confirm that this relationship exists for Germany as well. More importantly, we shed light on the alcohol–income puzzle by analyzing, for the first time, the association between beverage-specific drinking behavior and wages. In our analysis, we disentangle the general wage effect of drinking into diverse effects for different types of drinkers. Mincerian estimates reveal significant and positive relationships between wine drinkers and wages as well as between multiple beverage drinkers and wages. When splitting the sample into age groups, the "drinking gain" disappears for employees under the age of 35 and increases in size and significance for higher age groups. We also find a "beer gain" for the oldest age group and male residents of rural areas as well as a "cocktail gain" for residents of urban areas. Several explanations for our empirical results are discussed in view of the likelihood that the alcohol–income puzzle is a multicausal phenomenon.

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Keywords Alcohol–income puzzle · Beverage-specific drinking behavior · Wages · Wine · Socio-Economic Panel Study (SOEP)

JEL Classification I10 · I12 · J30 · J31

Introduction

According to the World Health Organization (WHO), about 2 billion people consume alcoholic beverages worldwide (World Health Organization 2004). An extensive body of medical, economic and sociological literature has documented tremendous negative effects of alcohol abuse: not only harmful health consequences, but also high social and economic costs that impose a major burden on society.

On the other hand, economists have identified a distinct positive relationship between moderate alcohol consumption and earnings (Peters and Stringham 2006; Van Ours 2004; MacDonald and Shields 2001). The exact mechanisms of this "alcohol–income puzzle" still remain subject to speculation. An often-cited explanation refers to the positive health effects of moderate alcohol intake. Another argument involves the potential networking and social effects induced by drinking.

Despite a substantial body of the literature that deals with alcohol consumption and labor market outcomes, there has been no analysis to date of the association between beverage-specific drinking behavior and labor market outcomes. Our work extends the current literature in various ways. First, the existence of a positive wage differential for moderate drinkers has never before been shown for Germany. Moreover, we use a representative sample and recent data for our analysis. Third and most importantly, this is the first attempt to model a relationship between beverage-specific drinking behavior and wages. We present different model specifications and consider cohort-specific as well as regional effects.

The paper is organized as follows. The section "Background and Previous Studies" summarizes previous studies and the background. The third chapter, "Econometric Methods and Statistical Testing" deals with the econometric model employed and several statistical testing procedures. The "Data" section outlines the dataset and the variables used. In the section "Results", we present our empirical results. "Pathways from Alcohol Consumption to Wages" discusses the findings and limitations of the paper and the last chapter concludes.

Background and Previous Studies

Since the early work of Becker (1964) and others, human capital is considered to be one of the major income determinants. Following Grossman (1972), a tremendous amount of empirical work has been conducted on human capital formation. In recent years, substance use and abuse and their impact on health and labor market outcomes has received at great deal of attention. We can formulate:

$$\ln(\omega) = \beta_0 + \beta_1\mathrm{D} + \beta_2\mathrm{J} + \beta_3\mathrm{H} + \beta_4\mathrm{A} + \varepsilon \quad (1)$$

This Mincerian earnings equation models the wage (ω) as a function of observable demographic characteristics (D), job characteristics (J), the stock of human capital (H), and alcohol consumption (A). We add an error term (ε) that captures unobservable characteristics.

Alcohol may affect the stock of human capital through at least two channels. Alcohol consumption may influence an individual's productivity and thus wages through his or her health status. Additionally, social and network effects could be induced through drinking habits. It is also imaginable that factors like passion or life satisfaction that determine work productivity are driven by alcohol consumption.

Numerous empirical studies have been conducted in the last twenty years investigating these relationships. The publications differ with respect to the datasets used (most of them are US, Canadian, or British datasets), the target sample (in most cases the working population aged 25 to 55) and the exact research question. The latter can be categorized as follows.

One group of studies focus on how the volume of alcohol consumed affects wages. Among the first to analyze the relationship between drinkers, non-drinkers, and their hourly wages were Berger and Leigh (1988). Taking data from the US Quality and Employment Survey, they found that drinkers earn significantly more than nondrinkers. In the subsequent years, several papers revealed that the relationship between units of alcohol consumed and wages follows an inverse U-function (French and Zarkin 1995; Heien 1996; Hamilton and Hamilton 1997; Zarkin et al. 1998; MacDonald and Shields 2001).

A second group of articles concentrates on the effects of problem drinking or alcohol dependency. Mullahy and Sindelar (1991, 1993, 1996) came to the conclusion that what lowers an alcoholic's income is the negative impact on the decision to work rather than pressure on wages. Terza (2002) replicated Mullahy and Sindelar's (1996) study and came to the same conclusion. One of the few studies that found no significant effect of problem drinking on labor market participation was the one of Feng et al. (2001). The three most recent studies congruently found negative labor market effects induced by alcohol dependency. MacDonald and Shields (2004) estimated various specifications of bivariate probit models with different sets of instruments and found significant and negative employment effects. Jones and Richmond (2006) took advantage of the propensity score matching method as an alternative to instrumental variable estimation and detected, in addition to substantial gender and life-cycle effects, productivity losses due to alcoholism. Johansson et al. (2007) reasoned that alcohol dependency substantially lowers the probability of being employed in the Finnish labor market.

Besides a growing body of the literature that examines the impact of cigarette use, drug abuse, and obesity on labor market outcomes (Morris 2006), there is a third group of papers that models and simultaneously estimates the wage effect of drinking together with a second endogenous variable which affects both alcohol consumption and wages. Van Ours (2004) employed a proportional hazard model to estimate the starting rates of alcohol and tobacco consumption in order to model unobserved heterogeneity. He concluded that the positive wage effect of moderate drinking was of the same size as the negative effect of smoking. Wage losses due to smoking are reported by Auld (2005), who estimated a system of equations and found wage gains for drinkers. The work of Bray (2005) is the first that explicitly models the mechanism through which drinking affects wages, namely through the formation of human capital. The empirical application of his theoretically derived model suggests that moderate alcohol consumption exerts positive effects on the returns to education and experience, whereas heavy drinking has a negative impact.

To our knowledge, this is the first study that tries to link beverage-specific drinking behavior to wages. By decomposing the wage gains of moderate drinkers into diverse effects for different types of drinkers, we contribute to the existing literature and shed light on the alcohol–income puzzle. Estimates reveal a highly significant positive association between being a wine drinker and being a higher earner, as well as between multiple beverage drinking and wages. By means of conventional testing procedures, we are unable to uncover a distinct endogenous relationship between drinking and income. Splitting the sample into three age groups results in age-increasing wage differentials for wine and multiple beverage drinkers. Surprisingly, the drinking gain vanishes for the youngest cohort. A beer gain appears for male people living in rural areas whereas in urban areas, cocktail drinkers have higher wages. The evidence suggests that the alcohol income puzzle is a multicausal phenomenon, making it very difficult to identify a single distinct causal relationship.

Econometric Methods and Statistical Testing

OLS Regression

Consider the following simple framework:

$$y = \boldsymbol{X}\beta + \varepsilon$$

where y stands for the logarithm of hourly gross wages and $\boldsymbol{X}$ is a $n \times K$ matrix of regressors, with n as the number of observations. The set of regressors can be partitioned into $[\boldsymbol{X}_1, \boldsymbol{X}_2]$, where $\boldsymbol{X}_1$ includes observable individual characteristics and $\boldsymbol{X}_2$ incorporates variables of alcohol consumption. As usual, ε is an unobservable error term.

OLS estimates for β are unbiased, given that the regressors are exogenous, e.g., uncorrelated with the error term. For at least two reasons, the drinking variables $\boldsymbol{X_2}$ are potentially endogenous. If unobserved factors exist that jointly determine alcohol consumption and wages, we face an omitted variable bias. Moreover, the problem of reverse causality occurs if drinking behavior depends on income.

IV Regression

The standard econometric method to overcome the problem of an estimation bias due to endogeneity is instrumental variable (IV) estimation. The IV method requires the use of a set of instruments ($\boldsymbol{Z}$). Consider $\boldsymbol{Z}$ to be $n \times L$. Again, we separate the matrix into $[\boldsymbol{Z_1}, \boldsymbol{Z_2}]$ and call $\boldsymbol{Z_1} = \boldsymbol{X_1}$ included instruments and $\boldsymbol{Z_2}$ excluded identifying instruments.

Instruments need to fulfill three conditions. First, there must be at least as many instruments as regressors, e.g., $L = K$, so that the equation is identified. For $L = K$, the equation is called exactly identified and for $L > K$ overidentified. Second, the instruments need to be correlated with the endogenous regressors (relevance). Third, the instruments should be exogenous to the error process (validity), e.g. $E(\boldsymbol{Z}\varepsilon) = 0$ (Wooldridge 2002).

The IV estimator is often referred to as the two-stage least squares (2SLS) estimator since it is possible to compute it by two successive regressions. In the first-stage regression, the full set of instruments $\boldsymbol{Z}$ is regressed on the endogenous variables ($\boldsymbol{X_2}$) by OLS. The fitted values are then regressed on y, producing an unbiased estimator.

It is crucial for IV estimation that these conditions hold. The practical problem is to find relevant and valid instruments. In a first step, researchers need to choose instruments by economic insight. Then, statistical tests should be employed.

Testing the Relevance of Instruments

Bound et al. (1995) have shown that weak correlation between the instruments and the endogenous variables can lead to large inconsistencies of the IV estimates, even if there is only a weak correlation between the instrument and the error process (weak instrument problem). To test the explanatory power of the excluded identifying instruments, it is convenient to rely on the R^2 of the first-stage regression with the included instruments partialled out (partial R^2). A further development is Shea's partial R^2 which takes the intercorrelations between the instruments into account (Shea 1997). Additionally, an F-test on the joint significance of $\boldsymbol{Z_2}$ in the first-stage regression can be computed (Bound et al. 1995). Unfortunately, the weak instrument problem may be present even if the instruments are significant in the first stage and with large n. A rule of thumb suggests that the F-statistic should well exceed 10 (Staiger and Stock 1997). Another proposal is to keep the number of excluded identifying instruments as small as possible, as the IV bias increases with the number of instruments (Hahn and Hausman 2002).

Testing the Validity of Instruments

Testing the orthogonality condition is somewhat more difficult since it requires the overidentified case, and a direct test is not possible. Tests of overidentifying restrictions should be routinely reported under the joint null of orthogonality and correct exclusion of the instruments (Davidson and MacKinnon 1993). A rejection calls the validity of the instruments into question. For the 2SLS estimation, the test statistic is Sargan's (1958); for efficient GMM in case of heteroskedasticity, Hansen's (1982) J-statistic needs to be employed.

Testing the Endogeneity of Regressors

IV estimation yields a consistent output no matter whether the regressors $\boldsymbol{X_2}$ are endogenous or not. The price to pay in case of exogenous regressors is a loss of efficiency in comparison to OLS. It is therefore worth testing whether a suspicious regressor is indeed correlated with the error term. For this purpose, a C-test can be performed by conducting two regressions. One regression assumes the variables to be tested as exogenous and the other as endogenous. This test resembles the more popular Durbin-Wu-Hausman test but is robust to the presence of heteroskedasticity (Baum et al. 2007).

Data

Dataset

The empirical part of this paper is based on wave W (2006) of the German Socio-Economic Panel Study (SOEP). In 2006, questions about drinking habits were asked for the first time. The SOEP is a representative longitudinal household based panel study for Germany (Wagner et al. 2007). It started in 1984 and in 2006 sampled data on 11,000 households with more than 20,000 individuals over 17 years. In the following, we focus on the working population aged 18 to 65; the resulting sample size consists of 5026 males and 4484 females.

Definition of Variables

The whole set of variables, their definitions, means and standard deviations are presented in Appendix 2.

Dependent Variable

Our variable of interest is the logarithm of hourly gross wages. We calculated this measure of labor market success by adding all bonuses, such as Christmas bonuses and profit shares, to the monthly gross wage. Then we divided by the actual working time per month. Missing values were imputed and an imputation dummy added to each regression. We dropped nonsense data with an hourly wage of less than three euros.

Exogenous Variables

The set of exogenous variables (X_1) can be classified as follows. The first group is labeled as "demographics" and involves the dummy variables *female*, *immigrant*, *eastgerman*, *married*, and *kids*. The second category lists educational regressors. Potential labor market experience (*experience*) serves as an indicator for general skills, whereas the number of years with the current employer (*work for company since*) stands for firm-specific capital formation. The third category deals with job-specific characteristics, such as whether the employee holds a blue or a white-collar job and the number of employees in the company. The whole set of explanatory variables can be found in Appendix 2.

Variables of Drinking Behavior

From the four questions presented in Appendix 1, we constructed two groups of variables on alcohol consumption. The first group solely tries to measure the volume of alcohol consumed. *Abstainers* are persons who never drink any alcohol. The dummy *seldom drinkers* takes on the value one if the respondent stated never drinking alcohol "regularly" or "occasionally" but at least one sort of alcohol "seldom." *Moderate drinkers* consume at least one type of alcohol occasionally but deny regular alcohol consumption. The last dummy *regular drinkers* assigns one to a person who drinks at least one alcoholic beverage regularly. The drawback of these indicators is their rather vague character, as no information about the exact quantity of alcohol consumption is collected.

The second group classifies individuals into drinkers of wine, beer, spirits, and cocktails, and multiple beverage drinkers. For the sake of having a consistent reference category and mutually exclusive variables that sum up to 100%, we keep the dummies abstainers and seldom drinkers in this group. We categorize people as *beer drinkers* if they drink beer regularly or occasionally but no other beverage regular or occasionally. The same goes for drinkers of wine, spirits, and cocktails. *Multiple beverage drinkers* consume at least two kinds of alcohol occasionally or regularly. The sample distribution can be found in Table 1.

Instruments

Relevant and valid instruments need to be sufficiently correlated with the endogenous variable but uncorrelated with unobservable characteristics. Most of the previous studies took religious affiliation, long-term non-acute illnesses such as asthma or diabetes, alcohol prices or taxes, and structural indicators of the region (e.g. unemployment rate) as instruments for drinking behavior. To instrument beverage-specific alcohol consumption, these instruments appear to be weak with the known consequences.

Table 1 Descriptive statistic of alcohol consumption variables by gender

Covariate	Male			Female		
	Freq. d=1	Percent	Mean wage	Freq. d=1	Percent	Mean wage
Abstainer	292	5.81	2.633	444	9.90	2.389
Seldom drinker	1,059	21.07	2.739	1,632	36.40	2.463
Moderate drinker	2,345	46.66	2.779	1,968	43.89	2.528
Regular drinker	1,330	26.46	2.864	440	9.81	2.699
Abstainer	292	5.81	2.633	444	9.90	2.389
Rare drinker	1,059	21.07	2.739	1,632	36.40	2.463
Beer drinker	1,329	26.44	2.704	239	5.33	2.504
Wine drinker	372	7.40	3.049	1,158	25.83	2.578
Spirit drinker	58	1.15	2.629	24	0.54	2.506
Cocktail drinker	40	0.80	2.569	63	1.40	2.341
Multiple beverage drinker	1,876	37.33	2.849	924	20.61	2.566

Source: German Socio Economic Panel Study (SOEP)

Taking advantage of the household character of the rich SOEP dataset, we generated three main classes of instruments. Analogously to the drinking variables presented above, we modeled the drinking behavior of the partner, the father, and the mother. For example, we constructed dummy variables for the partner being an abstainer, a seldom, moderate, or regular drinker. Because of data limitations, we were unable to construct instruments for drinkers of spirits or cocktails.

The behavior of parents is claimed to be a good instrument because children adopt their parent's behavior due to education and genes. On the other hand, this may also be true for unobservable characteristics, in which case the validity condition of the instruments would be violated.

In the social sciences, the phenomenon of positive assortative mating, e.g., the tendency to marry within one's social group, has been discussed in a large body of literature. Most of the empirical studies on this topic focus on marriages and define social groups by observables like education, occupation, religion, or race. In industrialized countries, we are currently observing a decline in marriages and a tendency towards noncommittal partnerships. Moreover, race, social background, and religion have become less important factors in the partner selection process, and consequently, recent studies have found only small assortative patterns but preference heterogeneity between gender with respect to education, religion and race (Fisman et al. 2006; Hitsch and Hortacsu 2005; Kurzban and Weeden 2005).

Results

Descriptive Statistics

The sample distribution of the two groups of drinking variables is in Table 1 separately by gender. Females abstain from drinking more often than males

(10% vs. 6%). Around 10% consume alcohol regularly in comparison to 26% of the males.

Looking at the second group of drinking variables, gender-specific drinking behavior becomes evident, which is in accordance with the literature (Mäkelä et al. 2006; Holmila and Raitasalo 2005). Twenty-six percent of the women can be classified as wine drinkers, but only 5% are beer drinkers. Men report the opposite (7% vs. 26%). The majority of males are multiple beverage drinkers (37%) but only 21% of the females. Note the low percentage of respondents who primarily drink spirits or cocktails.

Table 1 also presents first data on the mean wage. It seems as if wages would rise with the amount of alcohol consumed. The highest income group is that of wine drinkers, followed by multiple beverage drinkers. Due to the descriptive nature of the data, we cannot establish a causal relationship on that basis. Econometric methods, which control for socioeconomic status, are required.

To make our estimates comparable to the existing literature, we follow the usual convention and use abstainers as the reference category in all our specifications.[1]

OLS Results

Table 2 shows OLS estimation results by gender for the two models.[2] In both models and for both genders, the non-drinking covariates are about the same size and do not differ widely in significance. Moreover, they all take on reasonable values.

Model 1 measures the impact of alcohol consumption on wages by volume. For both females and males, we can state a positive and significant association between alcohol consumption and wages. For males, moderate drinkers seem to earn about 5% more than abstainers; the effect is even more pronounced for regular drinkers (8.9%). As for females, we find a positive and significant correlation between regular drinkers and higher wages of about 7.5%. These results are in line with the rest of the literature (MacDonald and Shields 2001; Zarkin et al. 1998; Hamilton and Hamilton 1997; Heien 1996; French and Zarkin 1995).

Model 2 gives us the relationship between beverage-specific drinking behavior and wages. Consider females first. The regression output reveals a significant 5.7% wage gain for multiple beverage drinkers. The other drinking

[1]However, it might be argued that seldom drinkers would be more appropriate as reference group since abstainers may be a negative selection with respect to labor market outcomes. The proportion of ex-alcoholics or people with severe illnesses is certainly higher in this subsample. In sensitivity analyses, we checked whether the choice of the reference group makes a substantial difference in our results which is not the case.

[2]We conducted a battery of standard tests on the presence of heteroskedasticity and found evidence for the presence of arbitrary heteroskedasticity. Consequently, in the following, we use robust standard errors in all empirical specifications.

Table 2 OLS estimation results

Covariate	Coefficient (*Robust standard errors*)			
	Males		Females	
	Model 1	Model 2	Model 1	Model 2
Intercept	1.756***(0.048)	1.776***(0.048)	1.816***(0.047)	1.820***(0.045)
Demographics				
Immigrant	−0.027(0.018)	−0.036(0.018)	−0.037(0.023)	−0.038(0.023)
Eastgerman	−0.235***(0.028)	−0.233***(0.028)	−0.193***(0.040)	−0.193***(0.040)
Married	0.064***(0.015)	0.064***(0.015)	−0.006(0.015)	−0.006(0.015)
Kids	0.043***(0.014)	0.045***(0.014)	0.003(0.016)	0.003(0.016)
Education				
Apprenticeship	0.001(0.016)	0.002(0.015)	−0.029(0.017)	−0.029(0.017)
College degree	0.249***(0.019)	0.242***(0.019)	0.200***(0.021)	0.200***(0.021)
Experience	0.024***(0.003)	0.025***(0.003)	0.025***(0.003)	0.025***(0.003)
$(\text{Experience}^2)/100$	−0.041***(0.005)	−0.042***(0.005)	−0.046***(0.006)	−0.000***(0.000)
Work for company since	0.008***(0.001)	0.008***(0.001)	0.009***(0.001)	0.009***(0.001)
Unemployed last year	−0.168***(0.029)	−0.165***(0.029)	−0.165***(0.029)	−0.165***(0.029)
Job Characteristics				
Part time work	−0.214***(0.035)	−0.217***(0.035)	−0.103***(0.014)	−0.103***(0.014)
Blue collar worker	0.129***(0.021)	0.130***(0.020)	−0.149***(0.030)	−0.149***(0.030)
Self-employed	0.203***(0.033)	0.198***(0.033)	0.024(0.046)	0.024(0.046)
White collar	0.259***(0.017)	0.255***(0.017)	0.071***(0.024)	0.071***(0.024)
Job in East Germany	−0.109***(0.029)	−0.109***(0.029)	−0.063(0.040)	−0.063(0.040)
Work in job studied for	0.046***(0.012)	0.045***(0.012)	0.122***(0.016)	0.122***(0.016)
High autonomy	0.265***(0.017)	0.262***(0.017)	0.224***(0.021)	0.224***(0.021)
Size of company	0.032***(0.003)	0.031***(0.003)	0.032***(0.002)	0.032***(0.002)
Feel work pressure	−0.030***(0.011)	−0.030***(0.011)	−0.001(0.013)	−0.001(0.013)
Drinking Behavior				
Seldom drinker	0.017(0.026)		0.004(0.023)	
Moderate drinker	0.050**(0.025)		0.041(0.023)	
Regular drinker	0.089***(0.026)		0.075***(0.030)	
Seldom drinker		−0.016(0.026)		0.003(0.023)
Beer drinker		0.025(0.025)		0.039(0.034)
Wine drinker		0.154***(0.033)		0.037(0.025)
Spirit drinker		0.002(0.059)		0.084(0.069)
Cocktail drinker		0.039(0.067)		0.067(0.063)
Multiple beverage drinker		0.078***(0.025)		0.057**(0.025)
Observations	5026	5026	4484	4484
Adjusted R^2	0.48	0.48	0.38	0.38
F-test	213.67	190.01	135.68	120.19

[a] **Significant at the 0.05 level; ***Significant at the 0.01 level

[b] Omitted categories are *Drop-outs* and *Abstainer*

[c] Also included but not reported is a dummy that is 1 if the wage was imputed

variables are not significant. In the case of men, the results for multiple beverage drinkers are similar (7.8%) but we also find a significant and strong association between wine drinkers and wages of around 15.4%.

Since the results in the basic specification do not vary widely by gender, in order to save space we do not present any further estimates by gender.[3] This also ensures that the sample sizes in every drinking category remain sufficiently large for more refined specifications.

Testing Relevance, Validity, and Endogeneity

In the following, we conduct statistical tests to see whether our instruments fulfill the two conditions of relevance and validity (Table 3). Afterwards we use the most appropriate set of instruments to test whether the drinking variables are endogenous or not (Table 4).

The first column of Table 3 gives us the variables for which instruments are available for. Columns 2 to 7 display the tests on the relevance of the instruments, whereas the test statistics for testing the validity are shown in column 8.

Tests on the Relevance of Instruments

To evaluate whether an instrument is weak or not, we rely on Shea's partial R^2 and the F-statistic of the excluded identifying instruments in the first stage regression. We can easily see that for our partner instruments, the F-statistics range from 33 to 158, hence clearly exceed the minimum value of 10, and are always highly significant. The father's drinking behavior is correlated with the drinking behavior of his children, but the F-statistic is higher than 10 only in one case. Turning to the mother IVs, none of the variables has enough power to serve as an instrument.

In addition to the tests presented in Table 3, we performed some tests of under- and weak identification. Among them were Anderson's (1950) canonical correlations test and the Cragg and Donald (1993) F-statistic. All these statistics confirmed that the drinking behavior of the mate is a highly relevant instrument.

Tests on the Validity of Instruments

Testing the validity of instruments, e.g. their potential correlation with the error process, is only feasible in the overidentified case. Thus, we use the parent's and partner's drinking habits at the same time as instruments to test the validity of the partner instruments. Column 8 and 9 of Table 3 present the Hansen J-test which jointly evaluates the entire set of overidentifying restrictions. For all tested instruments, we are unable to reject the null hypothesis of validity.

Remember that we probably face a weak instrument problem for most of the parent IVs and that the validity tests are only of indirect manner. To

[3] However, the estimates are available upon request from the authors.

Table 3 Overview of tests on relevance, validity, and endogeneity

(1)	Testing relevance						Testing validity	
	Partner IVs		Father IVs		Mother IVs		Hansen J-statistic	
	Shea's partial R^2	F-test	Shea's partial R^2	F-test	Shea's partial R^2	F-test	(8)	p-value
	(2)	(3)	(4)	(5)	(6)	(7)		
Seldom drinker	0.021	105.96***	0.009	3.71***	0.003	2.98**	4.411	0.110
Moderate drinker	0.044	65.03***	0.012	2.75**	0.031	4.88***	2.562	0.278
Regular drinker	0.038	158.29***	0.021	10.84***	0.013	9.65***	0.478	0.788
Beer drinker	0.013	33.38***	0.017	2.95**	0.001	0.59*	3.000	0.223
Wine drinker	0.012	44.90***	0.007	1.88*	0.010	4.83***	2.273	0.321
Multiple beverage drinker	0.027	133.48***	0.011	7.46***	0.009	4.57***	1.268	0.531

Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females

*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

Table 4 Testing the endogeneity of the drinking variables

	C-statistic	*p*-value
Seldom drinker	0.059	0.808
Moderate drinker	1.624	0.203
Regular drinker	0.041	0.839
Beer drinker	0.499	0.480
Wine drinker	2.024	0.155
Multiple beverage drinker	1.510	0.219

be precise, to be absolutely sure that an instrument to be tested is valid, we would need one instrument that is definitely relevant and valid apart from the instrument to be tested. But if we had a proper instrument, we would not need to find an additional instrument. This resembles the problem with the hen and the egg and illustrates the practical difficulties with IV estimation. All in all, it seems as if the validity of the mate instruments is given, but nevertheless, we should be cautious when interpreting the IV estimates. In the remainder of this paper, we discard the weak parent IVs and rely exclusively on the partner instruments.

Tests on the Endogeneity of Drinking Behavior

The C-test as described in the subsection "IV Regression" serves us as a test on endogeneity. As can be seen in Table 4, the null of exogeneity is never rejected. In other words, we do not find evidence for an endogenous relationship between drinking and earnings, which suggests that, given that our instruments are valid, OLS estimates should be used.

IV Results

Table 5 shows IV regression results for both models. Every model represents a just-identified case, since we only use the drinking behavior of the partner as excluded identifying instruments. For example, in Model 1, the three variables of the amount of alcohol consumed are instrumented with the included instruments and three excluded instruments, namely *partner abstainer*, *partner moderate drinker*, and *partner regular drinker*.

In Model 1, drinking is highly significant and associated with a wage gain of 15 and 19% for moderate and regular drinkers, respectively. In our second model, wine drinking, cocktail drinking, and multiple beverage drinking are marginally significant. Note that we employed a less efficient estimation method in comparison to OLS. Increasing coefficients suggests an underestimation of the effects in the OLS case.[4] Since we cannot rule out the possibility

[4] As the IV estimates rely on people in a partnership who might represent a positive selection with respect to labor market outcomes, we repeated our OLS estimates with that subsample. The drinking coefficients increased but remained smaller than in the IV case.

Table 5 IV estimation results

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	0.019(0.135)	
Moderate drinker	0.147*(0.087)	
Regular drinker	0.192*(0.107)	
Seldom drinker		0.015(0.156)
Beer drinker		0.104(0.205)
Wine drinker		0.387*(0.205)
Spirit drinker		0.172(0.105)
Cocktail drinker		0.218*(0.123)
Multiple beverage drinker		0.245*(0.126)
Observations	6867	6867
Adjusted R^2	0.46	0.44
F-test	267.31	230.55

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. *Spirit drinker* and *Cocktail drinker* are not instrumented due to data limitations. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*. Sample size deviates from the one in Tables 1 and 2 as IV estimation is only feasible for respondents with a partner
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

that our instruments violate the validity assumption despite having passed all standard test procedures, and since some of the coefficient estimates are of implausibly large magnitude, we should interpret the results with caution.

Cohort Effects

In the following, we split our sample into three age groups as well as into rural and urban areas. Lifecycle effects are likely to play a role for the alcohol–income puzzle and it is known that drinking behavior varies by cohort (Kerr et al. 2004). The same may be true for rural areas in comparison to urban areas, especially if network effects matter.

Table 6 shows OLS estimation results for respondents under the age of 35. Interestingly enough, the positive associations between alcohol consumption and wages vanish entirely. Note that the coefficient for wine drinkers turns out to be negative, although insignificant.

Consider now respondents between 35 and 50 years (Table 7). What we see are significant and positive wage differentials for moderate (4.8%) and regular drinkers (7.2%) as well as for wine (7.1%) and multiple beverage drinkers (6.3%).

The results for people over the age of 50 can be looked up in Table 8. Again, we find the same drinking variables as in Table 7 to be significant but the coefficients increase substantially in size. We also find a marginally significant and positive association between beer drinkers and wages (7%). To sum up,

Table 6 OLS estimation results for respondents under the age of 35

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	−0.012(0.029)	
Moderate drinker	0.003(0.027)	
Regular drinker	0.044(0.032)	
Abstainer		−0.012(0.029)
Beer drinker		0.005(0.031)
Wine drinker		−0.016(0.034)
Spirit drinker		−0.051(0.072)
Cocktail drinker		−0.012(0.066)
Multiple beverage drinker		0.031(0.029)
Observations	2167	2167
Adjusted R^2	0.43	0.43
F-test	73.17	65.00

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

the positive association between alcohol consumption and wages increases in size and significance by age group and we do not find any significant association for people under 35.

Table 7 OLS estimation results for respondents aged between 35 and 50

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	0.009(0.026)	
Moderate drinker	0.048*(0.026)	
Regular drinker	0.072***(0.028)	
Seldom drinker		0.009(0.026)
Beer drinker		0.013(0.028)
Wine drinker		0.071**(0.029)
Spirit drinker		0.065(0.068)
Cocktail drinker		0.115(0.082)
Multiple beverage drinker		0.063**(0.027)
Observations	4704	4704
Adjusted R^2	0.43	0.43
F-test	159.64	142.89

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

Table 8 OLS estimation results for respondents over the age of 50

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	0.055(0.037)	
Moderate drinker	0.109***(0.036)	
Regular drinker	0.150***(0.039)	
Seldom drinker		0.056(0.037)
Beer drinker		0.070*(0.039)
Wine drinker		0.156***(0.040)
Spirit drinker		−0.004(0.109)
Cocktail drinker		0.008(0.137)
Multiple beverage drinker		0.124***(0.038)
Observations	2639	2639
Adjusted R^2	0.46	0.46
F-test	104.32	92.94

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

In Tables 9 and 10 we find the estimation output by type of region. We call areas with less than 5,000 inhabitants[5] rural and those with more than 100,000 residents urban. As for rural regions and with respect to Model 1 (Table 9), we observe no major differences from the general results. Surprisingly, the decomposition of the general drinking gain results in a marginally significant gain only for multiple beverage drinkers (8.3%). Separate regressions by gender reveal that the effects stem solely from significant drinking gains for males, i.e., we do not find any effects for females. As for males, it is worth mentioning that there are strong and significant effects for male wine drinkers (20.6%) as well as for male multiple beverage drinkers (16.9%) and that a strong “beer gain” (14.7%, *p*-value: 0.04) plays a role.

In urban areas, the usual association between volume of alcohol intake and wages can be found (Table 10). In addition to the wine and multiple beverage drinking gain, we find that cocktail drinking is strongly linked to wages.

Robustness Checks

To exclude the possibility of outliers or selection effects, we restricted the sample to respondents aged 25 to 55 but could not find any distorting effects. The same variables as in the main specification show significant correlations with the wage. For women, we find that regular drinking is associated with a

[5] In East Germany: up to 20,000 inhabitants.

Table 9 OLS estimation results for rural areas

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	0.015(0.049)	
Moderate drinker	0.067(0.049)	
Regular drinker	0.102**(0.051)	
Seldom drinker		0.015(0.049)
Beer drinker		0.066(0.051)
Wine drinker		0.074(0.053)
Spirit drinker		0.062(0.076)
Cocktail drinker		0.039(0.104)
Multiple beverage drinker		0.083*(0.050)
Observations	2032	2032
Adjusted R^2	0.45	0.45
F-test	80.35	71.60

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

5.8% higher wage, as is wine drinking (8.4%) and multiple beverage drinking (5.8%). For men, we find significant and positive correlations for moderate (6.2%) and regular (9.9%) drinking, which are driven by positive correlations for wine (6.6%) and multiple beverage drinkers (7.4%). Additionally, we experimented with the inclusion of other controls but our results remained stable. By restricting our sample to the working population, we condition the results and conclusions to that subsample of the population. In order to test whether self-selection into the labor market matters in our setting, we conducted a battery of standard Heckman selection regressions (Heckman 1979) and found that it is of minor importance.[6]

Pathways from Alcohol Consumption to Wages

There are several potential explanations for our findings. The first refers to the argument that moderate alcohol consumption is beneficial to health and thus increases a person's productivity and wages. Medical studies have consistently found a J-shaped inverse relationship between alcohol consumption and cardiovascular (heart and blood vessel) diseases, cerebrovascular (brain artery) diseases, peripheral arterial diseases, as well as morbidity, implying positive

[6]For the sake of saving space, we do not report the results here. These can be provided by the authors upon request.

Table 10 OLS estimation results for urban areas

Covariate	Model 1	Model 2
Other covariates	Controlled for but not reported	
Drinking behavior		
Seldom drinker	0.036(0.031)	
Moderate drinker	0.077***(0.030)	
Regular drinker	0.058*(0.033)	
Seldom drinker		0.037(0.031)
Beer drinker		0.001(0.033)
Wine drinker		0.081**(0.034)
Spirit drinker		0.049(0.086)
Cocktail drinker		0.232***(0.084)
Multiple beverage drinker		0.096***(0.032)
Observations	2755	2755
Adjusted R^2	0.45	0.46
F-test	100.12	90.61

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Due to sample size and space restrictions, no differentiation by gender is made, i.e., all estimates are obtained by including males and females. Omitted category is *Abstainer*
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

health effects of moderate drinking (Rehm et al. 2001). It has been found that especially men over 40 benefit from moderate alcohol consumption as they have the highest risk of contracting these diseases. These health benefits stem from the positive effects of ethanol, and there is also evidence that red wine provides further benefits for health (Szmitoko and Subodh 2005). Moreover, some researchers argue that health benefits are specific to red wine (Grønbæk et al. 2000; Renault et al. 1998). The health-productivity explanation is in line with our findings, especially as the drinking effects increase by cohort (see subsection "Cohort Effects"). However, it is not plausible that health effects play a dominant role.

A second explanation would be that moderate drinkers are more productive than abstainers because of a higher degree of life satisfaction, passion, or vitality; one could argue that alcohol belongs to the amenities of life like chocolate or music. Wine in particular is widely believed to have these effects, and it fits into the picture that wine drinkers report not only better physical but also better mental health than abstainers, heavy drinkers, and particularly drinkers of spirits (Stranges et al. 2006). The question of causality remains. Is it the wine that endows wine drinkers with a higher life satisfaction or do more passionate people tend to drink wine rather than beer?

Third, we may just be capturing selection effects here, and the whole story behind the alcohol–income puzzle might actually go back to endogeneity issues. It is imaginable that people with certain characteristics self-select themselves into different drinking habits. According to this explanation, highly intelligent, diligent, or ambitious people would prefer wine.

Although we are unable to identify endogeneity problems on the basis of statistical tests, we have to admit that our instruments might not meet the preconditions of validity for these tests. This study illustrates the limitations of IV regression and the practical issues confronting applied researchers. While the consequences of a weak correlation between instrument and endogenous variable are well understood and distinct available tests are available, the exogeneity assumption of the instrument is not directly testable, rendering the rest of the analyses mostly a matter of belief.

Concerning the correlation patterns for wine drinkers, it is obvious that reverse causality is likely to play an important role. This aspect might be a crucial piece in the alcohol–income puzzle and was not put forward in any of the previous studies since it was masked by the aggregate information about the volume of alcohol intake. The beverage-specific analysis reveals that a good deal of the alcohol–income correlation is driven by wine-income correlations; a relationship that is likely to work from income to wine: the more people earn, the more wine they drink since (good) wine is still a relatively expensive beverage. However, mass production has led to decreasing wine prices in recent decades, and today, good wine is available in supermarkets at decent prices. Today, at least in Germany, wine is not only a consumption good for the wealthy; it is also a common beverage among young people. For older generations, however, good wine might still have a luxury good character. This explanation fits perfectly with our observations and might be one key to the alcohol–income puzzle.

However, since we also find positive wage correlations for multiple beverage drinkers, the appearance of a beer gain in rural areas, and a cocktail gain in urban areas, reverse causality is probably not the only explanation for the alcohol–income puzzle. Moreover, tracing the whole story back to spurious regression results would call the entire previous literature on this subject into question.

A final, and maybe a very relevant argument, is the one of social and networking effects. Several studies have demonstrated that moderate drinkers are more social than abstainers and possess the strongest social networks (Buonanno and Vanin 2007; Peters and Stringham 2006; Leifman et al. 1995). As moderate drinking is a social norm in Western culture, it may enhance social skills and lead to a greater efficiency in the production of human capital. Social skills and the ability for networking are important factors in the labor market and determine wages to a high degree (Ioannides and Loury 2004; Montgomery 1991). This is in line with our results as it can be assumed that "networking returns" cumulate over the lifecycle and pay off more the older a person is. It is also plausible that beer is a more popular networking beverage in rural areas whereas the same holds true for cocktails in urban areas.

A quick and crude test of the relevance of our hypotheses is to rerun our basic regression specification with additional covariates that proxy our explanations. We see from column 2 and 3 of Table 11 that the relevant coefficients decrease slightly when a health status dummy and a life satisfaction

Table 11 Basic model and alternative specifications with additional covariates

	Basic specification (1)	(1) + health status (2)	(1) + life satisfaction (3)	(1) + social contacts (4)	(2) + (3) + (4) (5)	Decrease of coefficients in (5) relative to (1) (in percent)
Other covariates	Controlled for but not reported					
Model 1						
Seldom drinker	0.011(0.019)	0.012(0.019)	0.013(0.019)	0.005(0.019)	0.009(0.020)	
Moderate Drinker	0.045***(0.018)	0.045***(0.018)	0.044***(0.018)	0.035**(0.019)	0.036***(0.019))	20.0
Regular Drinker	0.073***(0.019)	0.073***(0.019)	0.071***(0.020)	0.060***(0.021)	0.059***(0.021)	19.2
Model 2						
Seldom drinker	0.011(0.019)	0.012(0.019)	0.014(0.019)	0.005(0.020)	0.008(0.020)	
Beer drinker	0.016(0.019)	0.016(0.020)	0.018(0.020)	0.013(0.021)	0.016(0.021)	
Wine drinker	0.067***(0.021)	0.066***(0.021)	0.064***(0.021)	0.052**(0.022)	0.050**(0.015)	25.4
Spirit drinker	0.007(0.049)	0.007(0.049)	0.012(0.049)	0.010(0.051)	0.013(0.051)	
Cocktail drinker	0.058(0.051)	0.060(0.051)	0.065(0.051)	0.050(0.052)	0.060(0.052)	
Multiple beverage drinker	0.063***(0.019)	0.063***(0.019)	0.061***(0.019)	0.050***(0.019)	0.050***(0.020)	20.6

Notes: Also included but not reported are the same covariates as in Table 2 and an imputation dummy. Omitted category is *Abstainer*. Specification (2) includes the dummy *health status very good* which takes on the value 1 for respondents who reported a very good health status on a scale from 0 to 5. Specification (3) includes the dummy *high life satisfaction* which takes on the value 1 if the respondent indicated a life satisfaction above 8 on a scale from 0 to 10 (with 10 being the highest score). Specification (4) includes one dummy *socializing* which takes on the value 1 for respondents who attend cultural events at least once a month and meet friends every week. The second dummy included specifies whether the respondent's persons of trust are relatives or not. All specifications include 8479 observations and are obtained by including males and females. As there are no appropriate questions about social networks in the 2006 questionnaire, we took the information of 2005, balanced the sample and assumed that the answers wouldn't change within a single year

*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level

dummy are included. Variables that crudely captures the social networks of a person lead to a stronger decrease (column 4). If we add all variables at the same time, the coefficients are reduced about 20% in comparison to the basic specification. We take this as a hint for our explanations being at least partly true.

The limitations of this study should be kept in mind. Due to the cross-sectional character of the data, it is not possible to capture individual heterogeneity or to take a potential endogeneity issue into account through appropriate modeling. Moreover, we are unable to identify alcoholics and binge drinkers, a problem that is rooted in the design of the questions.

Conclusion

Despite a large body of economic literature on the association between alcohol consumption and labor market outcomes, no study has been conducted to date analyzing the role of beverage-specific drinking behavior. This paper sheds light on the alcohol–income puzzle by decomposing the positive wage differential of moderate drinkers into wage effects for beverage-specific drinkers.

The main findings can be summarized as follows: First, the existence of positive wage differentials for moderate drinkers can be confirmed for Germany. Second, we find a strong and positive association between wine drinking and wages. Moreover, people who drink more than one type of alcohol, e.g., multiple beverage drinkers, seem to earn significantly more than abstainers. Third, the alcohol-wage relationship disappears for respondents under the age 35 and increases in size and significance by cohort. Fourth, we find a significant link between beer drinkers and higher wages for males in rural areas as well as between cocktail drinkers and higher wages in urban areas. Finally, we offer several explanations for our findings and present indications for their relevance. As the wage-alcohol correlations are largely driven by wage-wine correlations, reverse causality is likely to play a role along with other probable pathways such as network effects. Multicausal explanations seem to be the key to the alcohol–income puzzle, making it very difficult to identify a single and distinct causal relationship explaining the strong and stable association between alcohol consumption and higher wages.

All in all, this paper sheds light on the alcohol–income puzzle by decomposing the positive wage effects of moderate drinkers into diverse effects for different types of drinkers. We have shown that beverage-specific drinking behavior plays a crucial role in explaining the alcohol–income puzzle. Further research will need to be conducted as exact measures of drinking patterns and panel data become available since the exact mechanisms of how drinking is related to wages remain obscure.

Acknowledgements We would like to thank the editor, an anonymous referee, Eva M. Berger, Eberhard Feess, Joachim R. Frick, Daniela Glocker, John P. Haisken-DeNew, Peter Haan, Martin Karlsson, Michael Kvasnicka, Cathérine Müller, Tom Siedler, Victor Steiner, Marc Vothknecht, Gert G. Wagner as well as the seminar participants at the 23rd Annual Congres of the European Economic Association, the 22nd Annual Conference of the European Society for Population Economics, the SOEP Brown Bag, and the Berlin Network of Labour Market Researchers (BeNA) for their helpful comments and discussions. A special thank goes to Deborah Bowen who helped us with the title and did the proofreading. Financial aid from the *Stiftung der Deutschen Wirtschaft* (sdw, Foundation of German Business) is gratefully acknowledged. All remaining errors are our own.

Appendices

Appendix 1

The GSOEP group asked the following questions in 2006 for the first time.
How often do you drink the following alcoholic beverages?

1. Beer
   - (a) Regularly
   - (b) Occasionally
   - (c) Seldom
   - (d) Never
2. Wine, Champagne
   - (a) Regularly
   - (b) Occasionally
   - (c) Seldom
   - (d) Never
3. Spirits (hard liquor, brandy etc.)
   - (a) Regularly
   - (b) Occasionally
   - (c) Seldom
   - (d) Never
4. Mixed drinks (cocktails, alcopops etc.)
   - (a) Regularly
   - (b) Occasionally
   - (c) Seldom
   - (d) Never

Appendix 2

Table 12 Definition of variables and summary statistic

Variable	Definition	Mean	SD	Obs.	Min.	Max.
Log gross wage per hour	Logarithm of gross wage per hour	2.654	0.554	9510	1.099	6.14
Demographics						
Female	1 if female, 0 else	0.472	0.499	9510	0	1
Immigrant	1 if immigrant, 0 else	0.099	0.299	9510	0	1
Eastgerman	1 if East German, 0 else	0.216	0.412	9510	0	1
Married	1 if married, 0 else	0.683	0.465	9510	0	1
Kids	1 if kids, 0 else	0.388	0.487	9510	0	1
Education						
Apprenticeship	1 if apprenticeship degree, 0 else	0.713	0.453	9510	0	1
College degree	1 if college degree, 0 else	0.273	0.446	9510	0	1
Experience	Age minus years in education minus 6	24.8	10.4	9510	0	51
($Experience^2$)*100	$Experience^2$*100	722.4	522.1	9510	0	2601
Work for company since	Years with current employer	11.779	10.012	9510	0	49.08
Unemployed last year	1 if unemployed last year, 0 else	0.054	0.226	9510	0	1
Job characteristics						
Part time worker	1 if part time worker, 0 else	0.256	0.437	9510	0	1
Blue collar worker	1 if blue collar worker, 0 else	0.268	0.443	9510	0	1
Self-employed	1 if self-employed, 0 else	0.098	0.297	9510	0	1
White collar worker	1 if white collar worker, 0 else	0.548	0.498	9510	0	1
Job in East Germany	1 if job in East Germany, 0 else	0.208	0.406	9510	0	1
Work in job studied for	1 if working in occupation trained for, 0 else	0.621	0.485	9510	0	1
High autonomy	1 if job with high autonomy, 0 else	0.298	0.457	9510	0	1
Size of company	Size of company (increasing scale: 0 to 10)	6.911	2.969	9510	1	11
Feel work pressure	1 if work pressure, 0 else	0.469	0.499	9510	0	1

Table 12 (continued)

Variable	Definition	Mean	SD	Obs.	Min.	Max.
Drinking behavior						
Abstainer	1 if abstainer, 0 else	0.077	0.267	9510	0	1
Seldom drinker	1 if seldom drinker, 0 else	0.283	0.450	9510	0	1
Moderate drinker	1 if moderate drinker, 0 else	0.454	0.498	9510	0	1
Regular drinker	1 if regular drinker, 0 else	0.186	0.389	9510	0	1
Beer drinker	1 if beer drinker, 0 else	0.165	0.371	9510	0	1
Wine drinker	1 if wine drinker, 0 else	0.161	0.367	9510	0	1
Spirit drinker	1 if spirit drinker, 0 else	0.009	0.092	9510	0	1
Cocktail drinker	1 if cocktail drinker, 0 else	0.011	0.104	9510	0	1
Non-specific drinker	1 if non-specific drinker, 0 else	0.294	0.456	9510	0	1
Instruments						
Partner abstainer	1 if partner abstainer, 0 else	0.098	0.298	6867	0	1
Partner seldom drinker	1 if partner seldom drinker, 0 else	0.293	0.455	6867	0	1
Partner moderate Drinker	1 if partner moderate drinker, 0 else	0.427	0.495	6867	0	1
Partner regular Drinker	1 if partner regular drinker, 0 else	0.181	0.385	6867	0	1
Partner beer drinker	1 if partner beer drinker, 0 else	0.146	0.353	6867	0	1
Partner wine drinker	1 if partner wine drinker, 0 else	0.174	0.379	6867	0	1
Partner spirit drinker	1 if partner spirit drinker, 0 else	0.008	0.089	6867	0	1
Partner cocktail drinker	1 if partner cocktail drinker, 0 else	0.007	0.082	6867	0	1
Partner multiple beverage drinker	1 if partner multiple beverage drinker, 0 else	0.273	0.445	6867	0	1

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