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ABSTRACT

In this paper, we present estimates of the effect of alcohol taxes on employment, hours of work per week, and wages. These are reduced form estimates derived from a structural model linking alcohol use to labor market outcomes. The reduced form estimates are meaningful in two ways: first, they provide estimates of the effect of an important public policy tool, alcohol taxes, on labor market outcomes, and second, they can be used to evaluate hypotheses about the structural effects of alcohol use on labor market outcomes. The results of the analysis suggest that alcohol taxes are unrelated to employment, hours of work, and wages. Estimates of the effect of alcohol taxes on labor market outcomes were large and imprecise, and characterized by significant variation in sign and magnitude across samples and types of alcohol taxes. This suggests that there is a weak and indeterminate relationship between alcohol taxes and labor market outcomes. This finding implies that alcohol use does not adversely affect labor market outcomes and is inconsistent with findings from previous studies.

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Introduction

Alcohol consumption has the potential to reduce a person's physical and psychological well being, and may cause a variety of individual and social problems. The deleterious effects of alcohol consumption have engendered a public interest in measuring the extent of alcohol-related problems, particularly in light of the government's influence over the distribution and use of alcohol products. The public concern with alcohol consumption also stems from the negative external effects of alcohol consumption—such as drunk driving fatalities—which extend beyond the individual consumer of alcohol to other members of society.

In the case of drunk driving, the causal influence of alcohol is indisputable, and public policies aimed at reducing alcohol consumption can be partially justified on this basis. For other social problems, the causal effect of alcohol consumption is not as clear. For example, the effect of alcohol consumption on employment and income has received considerable attention from researchers, which is not surprising given the critical role that the labor market plays in determining economic prosperity. Several studies have attempted to measure the effect of alcohol use on employment and income.[1] Most have found that problem or heavy drinking is associated with less employment and lower earnings, although this finding is not uniform.[2] The more significant issue of whether or not this relationship is causal remains unknown. In this case, causality is difficult to establish because alcohol use may be correlated with unmeasured personal factors such as motivation that influence labor market outcomes (i.e., statistical endogeneity), and because some labor market outcomes, such as wage income, influence alcohol consumption (i.e., structural endogeneity).

Researchers studying the relationship between alcohol use and labor market outcomes have responded to these empirical problems in a variety of ways. Some simply ignore the problems, and as a result, provide only descriptive evidence about the relationship between alcohol use and labor market outcomes.[3] Other researchers have addressed the statistical problems caused by the endogeneity of alcohol consumption by using instrumental variables (Kenkel and Ribar 1994; Mullahy and Sindelar 1996, Heien 1996, Hamilton and Hamilton 1997). The efficacy of the instrumental variables (IV) procedure depends critically on the quality of the instruments, which can be evaluated in several ways. Of first order importance is the validity of the exclusion restrictions. In this case,

[1] Mullahy (1993) provides a summary of research as of 1993. More recent studies include Kenkel and Ribar (1994), French and Zarkin (1995), Mullahy and Sindelar (1996), Heien (1996), Hamilton and Hamilton (1997) and Zarkin et al. (1998).
[2] Mullahy and Sindelar (1993, 1996), Kenkel and Ribar (1994), French and Zarkin (1995) and Hamilton and Hamilton (1997) find a negative effect of heavy alcohol use on earnings, whereas Zarkin et al (1998) find a positive effect.

alcohol taxes or prices are considered to be ideal instruments for alcohol use and the validity of these instruments is generally accepted.[4] Indeed, all of the researchers using IV have included either prices or taxes among the variables used as instruments. However, the use of alcohol taxes or prices as instruments places other demands on the data that have not been explicitly noted in these studies. Specifically, because the demand for alcohol—particularly among heavy drinkers who are expected to have the most problems—is relatively inelastic, a large number of observations are necessary to obtain credible IV estimates.[5] We return to this point later, but the intuition is straightforward. Variation in alcohol prices or taxes may cause only slight differences in alcohol consumption that will result in small differences in labor market outcomes. In order to detect reliably such small differences many observations are required.

An alternative approach to the problem is to estimate the reduced form model that relates labor market outcomes to alcohol taxes. This approach has been used to examine the relationship among a variety of alcohol control policies (e.g., taxes and minimum drinking age laws) and other adverse consequences associated with alcohol consumption such as cirrhosis rates (Cook 1981, Cook and Tauchen 1982), low educational attainment (Cook and Moore 1993, Dee and Evans 1997), traffic fatalities (Saffer and Grossman 1987, Ruhm 1996, Dee 1999) and violence (Markowitz and Grossman 1998). Surprisingly, the reduced form model has not been used to examine the effect of alcohol taxes or prices on labor market outcomes.

The reduced form approach has several advantages. First, from a policy stance, the reduced form effect of alcohol taxes on labor market outcomes may be of more interest than the structural effect of alcohol consumption on labor market outcomes. Policymakers influence alcohol consumption, and the social consequences of such use, indirectly through changes in alcohol control policies such as alcohol taxes. Ultimately it is the effect of these policies on the social consequences of alcohol use that are relevant to government officials. The public concern is whether or not adverse labor market outcomes associated with alcohol consumption can be improved by

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[3] See for example, French and Zarkin (1995), Zarkin et al. (1998).

[4] Another criterion used to evaluate the adequacy of instruments is the partial correlation between the instruments and the endogenous variable. In this case, there is a relatively large literature demonstrating that alcohol prices and alcohol taxes are significantly related to alcohol consumption, although perhaps less so for heavy drinkers. See for example, Kubik and Moran (2001), Manning et al. (1995), Manning and Mullahy (1998) and Leung and Phelps (1993).

[5] Manning et al. (1995) and Manning and Mullahy (1998) report price elasticities by level of alcohol consumption. They found that heavy drinkers are less price responsive than light and moderate drinkers and that demand is virtually unresponsive to price among the heaviest drinkers. Manning et al. (1995) report a total price elasticity of demand of -0.80 and Manning and Mullahy (1998) report an overall price elasticity of -0.87. Kenkel (1993), however, reports a larger price elasticity for heavy

government policies limiting the consumption of alcohol (Cook 1994, Peltzman 1994). The reduced form estimate provides an answer to this question with regard to alcohol taxes, which is perhaps the most accessible policy instrument. Second, the reduced form estimate provides information about the structural relationship between alcohol use and labor market outcomes. Indeed, the reduced form estimate of the effect of alcohol taxes on labor market outcomes equals the structural effect of alcohol consumption on labor market outcomes times the effect of alcohol taxes on alcohol consumption.[6] Since we know from prior studies that the reduced form estimate of the effect of alcohol taxes on alcohol consumption is negative, we can obtain the sign of the structural effect of alcohol consumption on labor market outcomes from the reduced form estimate of the effect of alcohol taxes on labor market outcomes. For example, a reduced form estimate of the effect of taxes on labor market outcomes that is positive implies a negative structural effect of alcohol consumption on labor market outcomes. Similarly, prior studies' estimates of the magnitude of the effect of alcohol taxes on alcohol consumption can be used to estimate the size of the structural effect of alcohol consumption on labor market outcomes.

Yet another advantage of reduced form estimates is that they are not affected by the serious measurement error associated with self-reported alcohol consumption that plagues estimates of the structural effect of alcohol consumption on labor market outcomes. Finally, although reduced form estimates also require large sample sizes, there exist appropriate data sets that can be used to estimate the reduced form. In contrast, as far as we know, there are no data sets currently available that can produce reliable IV estimates of the structural effect of alcohol consumption on labor market outcomes that use taxes or prices as an instrument.

In this paper, we obtain reduced form estimates of the effect of beer wine and liquor taxes on wages, employment and hours of work for a nationally representative sample of adult males and females drawn from the outgoing rotation files of the Current Population Survey. The critical aspect of these data is their large sample sizes, which are required to obtain credible estimates. And as we have noted, these reduced form estimates are relevant to policymakers, and they provide information about the causal relationship between alcohol consumption and labor market outcomes. In addition, they can also be used to evaluate the credibility of prior studies' IV estimates of the structural effect of alcohol consumption on labor market outcomes.

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drinking than does Manning et al. (1995). Rational addiction models also imply a larger price elasticity among heavy users (Becker and Murphy 1988).

[6] This is true if the model is exactly identified.

Empirical Model

Our empirical models are based on the human capital model of wages and a static labor supply model. We specify the following structural relationships between labor market outcomes and alcohol consumption:

$$(1)\ \ln WAGE_{ijt} = \alpha_i + \beta_H\ HALC_{ijt} + X_{ijt}\Gamma + \varepsilon_{ijt}$$

$$(2)\ LFP(HOURS)_{ijt} = \delta_i + \gamma_W \ln WAGE_{ijt} + \gamma_H\ HALC_{ijt} + Z_{ijt}\Lambda + u_{ijt}$$

In equation (1), the log wage (ln WAGE) of person i in state j and year t depends on heavy alcohol use (HALC) and other personal characteristics (X) such as age and education. Alcohol use is included in equation (1) because it may reduce physical and mental capabilities, and thus lower productivity and the wage.[7] Equation (2) is a labor supply model in which employment (LFP) or hours of work depend on the (log) wage, heavy alcohol use, and personal characteristics (Z). Theoretically, it is the price of alcohol rather than the quantity that enters the labor supply function. Including the quantity of alcohol, however, is theoretically justifiable, although the interpretation of equation (2) changes slightly. Equation (2) is a conditional demand for leisure or a conditional labor supply function; hours of work are chosen conditionally on the quantity of alcohol. In addition, the empirical models we estimate include controls for state and year effects, but these have been suppressed in equations (1) and (2) in order to save on notation.

The primary econometric problems associated with equations (1) and (2) are the presence of the individual-specific effects (α_i and δ_i), which may be correlated with alcohol use, and the possibility that causality runs in both directions; for example, wages may cause alcohol use. To address these problems, previous researchers have used

[7] Equations (1) and (2) assume that moderate alcohol use has no effect on labor market outcomes. This assumption, while reasonable, is at odds with results of previous studies, which found that moderate alcohol use had a significant and positive effect on wages (see Berger and Leigh 1988; French and Zarkin 1995; Hamilton and Hamilton 1997; and Zarkin et al. 1998). This counter intuitive finding is frequently rationalized by reference to the medical literature documenting health benefits of moderate alcohol use—i.e., the vaunted U-shaped relationship between alcohol consumption and mortality (Shaper et al. 1988, Doll et al. 1994, Gronbaek et al. 1995, Fuchs et al. 1995, Thun et al. 1997). This rationale, however, is misplaced when applied to the labor market. The primary health benefit of moderate alcohol use is a decrease in coronary heart disease. Other evidence suggests that moderate alcohol use has negative long-term health effects; for example, moderate alcohol use is associated with greater levels of breast and colorectal cancers (NIAAA 2000). The U-shaped relationship between alcohol use and mortality is due solely to the dominance of coronary heart disease in causing mortality. To argue, based on the link between moderate alcohol use, heart disease and mortality, that moderate alcohol use improves employee health and thus employee productivity seems imprudent. Given the empirical difficulties associated with estimating structural effects of alcohol consumption, an equally likely explanation of this counterintuitive finding is that prior estimates of this effect were biased.

an instrumental variables approach.[8] The key aspect of this approach is the use of alcohol taxes (prices) as instruments. Previous research has shown that alcohol taxes are correlated with alcohol consumption, including heavy alcohol use, and alcohol taxes are not expected to be correlated with individual-specific effects and other determinants of labor market outcomes. Thus, alcohol taxes are "good" instruments.

The relationship between heavy alcohol use and alcohol taxes is specified as follows:

$$(3)\ HALC_{ijt} = \tau_i + \rho TAX_{jt} + v_{ijt}$$

Note that state and year effects have been suppressed in equation (3) for convenience. If we substitute equation (3) into equations (1) and (2), we obtain the following reduced form models:

$$(4)\ \ln WAGE_{ijt} = (\alpha_i + \beta_H \tau_i) + \beta_H \rho\, TAX_{jt} + X_{ijt}\Gamma + (\beta v_{ijt} + \varepsilon_{ijt})$$

$$(5)\ LFP(HOURS)_{ijt} = (\delta_i + \gamma_H \tau_i) + \gamma_W \ln Wage_{ijt} + \gamma_H \rho\, TAX_{jt} + Z_{ijt}\Lambda + (\gamma_H v_{ijt} + u_{ijt})$$

Equation (5) is not truly a reduced form model since the wage depends on heavy alcohol use. Therefore, we can obtain the final reduced form by substituting equation (4) into (5):

$$(6)\ LFP(HOURS)_{ijt} = \lambda_i + (\gamma_W \beta_H \rho + \gamma_H \rho) TAX_{jt} + X\Gamma' + Z_{ijt}\Lambda' + \omega_{ijt}$$

The coefficient on taxes in equation (6) is the sum of the indirect effect of alcohol taxes on employment and hours that works through changes in the wage ($\gamma_W \beta_H \rho$) resulting from alcohol consumption, and the direct effect of alcohol taxes on employment and hours that works through changes in alcohol consumption ($\gamma_H \rho$). The reduced form models given by equations (4) through (6) are the focus of our empirical analysis.

As equations (4) through (6) illustrate, the reduced form estimates depend on the structural effects of alcohol consumption on labor market outcomes and the effect of alcohol taxes on alcohol consumption. Therefore, if we knew the sign of the latter effect, we would also know the sign of the former effect—i.e., the structural effect of alcohol consumption on labor market outcomes. We assume that alcohol taxes have a negative effect on alcohol consumption (i.e., $\rho < 0$). Therefore, a positive reduced form estimate of the effect of taxes in equation (4) implies a negative structural effect of alcohol consumption on wages. Similarly, a positive reduced form estimate

[8] An alternative approach is the fixed-effects methodology such as that used in Kenkel and Ribar (1994). However, this approach requires panel data, which are not often available. In addition, the fixed-effect methodology may exacerbate measurement error problems, which may be severe in the case of self-reported alcohol use.

of the effect of taxes in equation (5) implies a negative structural effect of alcohol consumption on hours of work. For equation (6), the reduced form estimate depends on three structural parameters. The alternative hypothesis is that both β_H and γ_H are negative—i.e., heavy alcohol use adversely affects labor market outcomes. We assume that ρ is negative. If the wage has a positive effect on employment and hours, the reduced form coefficient is expected to be positive under the alternative hypothesis. In the case of employment, the static labor supply model suggests that the wage will be positively related to employment ($\gamma_W > 0$). Therefore, a test of whether the reduced form coefficient of equation (6) is positive is a test of the alternative hypothesis that the heavy alcohol use has an adverse effect on employment.

We believe it is reasonable to assume that alcohol taxes have a negative effect on alcohol consumption. First, economic theory suggests that higher alcohol taxes will reduce alcohol consumption. Second, there is a considerable amount of empirical evidence that the price elasticity of demand for alcohol, including heavy alcohol use, is negative (see Leung and Phelps 1993, Manning et al. 1995, Kenkel 1993, Grossman et al. 1998, Kubik and Moran 2001). Thus, it is reasonable to assume that ρ is negative, although it may be small. If ρ is small, as some evidence suggests, then the reduced form effect may also be quite small, and it will require a large sample size to detect a significant effect. We return to this point later, but note that our sample sizes are substantial and sufficient to detect small effects.

Ideally, we would also like to obtain estimates of the magnitude of the structural effect of alcohol consumption on labor market outcomes. In fact, IV estimates of the structural effect of alcohol consumption on labor market outcomes (e.g., β_H) are equivalent to the ratio of the reduced form estimates from equation (3) to the reduced form estimates from equations (4) through (6). For example, dividing the coefficient of the tax variable in equation (4) by the coefficient of the tax variable in equation (3) yields an estimate of the effect of heavy alcohol use on wages (i.e., β_H). Similarly, dividing the coefficient of the tax variable in equation (5) by the coefficient of the tax variable in equation (3) yields an estimate of the effect of heavy alcohol use on say hours of work (γ_H). Finally, dividing the coefficient of the tax variable of equation (6) by the coefficient of the tax variable of equation (3) yields an estimate of the direct (γ_H) plus indirect ($\gamma_W \beta_H$) effect of alcohol consumption on labor supply. Data constraints prevent such estimation because there are no data sets that contain information on alcohol

consumption and labor market outcomes, and that have the requisite number of observations to obtain reliable IV estimates. However, we can use previously published estimates of the effect of alcohol taxes on alcohol consumption to form "simulated" IV estimates, and in this way obtain estimates of the magnitude of the structural effect of alcohol use on labor market outcomes.

In summary, the reduced form estimates of the effect of alcohol taxes on labor market outcomes are meaningful in two ways. First, they are policy relevant, providing evidence of the effect of an important policy lever, alcohol taxes, on labor market outcomes. Second, the sign of the reduced form estimates provides evidence of the sign of the structural effect of heavy alcohol use on wages and labor supply. A positive reduced form effect is consistent with the hypothesis that alcohol consumption causes adverse labor market outcomes. In contrast, negative or zero reduced form effect is evidence that is inconsistent with the hypothesis that heavy alcohol use adversely affects labor market outcomes.

Data Requirements for Reduced Form and Instrumental Variables Estimation

As noted in the introduction, the use of alcohol taxes as part of an instrumental variables procedure requires a large number of observations to obtain reliable estimates of the causal effect of alcohol on labor market outcomes. The same is true for the reduced form model. The validity of this statement can be established with reference to the following thought experiment pertaining to the determinants of employment.[9] Assume that there are two geographical areas and that in area A alcohol prices are low due to a low tax rate, and that in area B alcohol prices are high due to a high tax rate.

The reduced form estimate of the effect of an indicator of heavy alcohol use, for example, being clinically dependent on alcohol, on employment is simply the difference in mean employment between persons in area A and persons in area B. In terms of equation (5), the reduced form estimate, which we now refer to as π, is

(6) $\pi = \overline{LFP}_A - \overline{LFP}_B = \Delta \text{Tax}\,(\gamma_H)(\rho)$.

The variance of the reduced form effect is simply the variance of the difference in mean employment between area A and area B:

(7) $Var(\pi) = 2\sigma^2 / N$.

[9] For a similar illustration of the problem see Evans and Ringle (1997) and Klerman (1998).

In equation (7), σ^2 is the variance of the binomial outcome of employment, which we assume is equal to 0.16 (implying mean employment of 0.80). Equation (7) also assumes that there are an equal number of observations in area A and B and that the variance of employment is equal in each area. To detect a significant reduced form effect, the reduced form estimate has to be 1.96 times larger than its standard error, or

$$\pi / \sqrt{Var(\pi)} > 1.96$$

$$(8)\quad \pi / \sqrt{2\sigma^2 / N} > 1.96$$

$$N > 2(1.96)^2 \sigma^2 / \pi^2 = 2(1.96)^2 (0.16 / \pi^2)$$

The necessary sample size depends on the magnitude of the true reduced form effect. For illustrative purposes, we obtain an estimate of the reduced form effect using estimates of γ_H, ρ and ΔTax. Mullahy and Sindelar (1996) report (in Table 4, p.427) an OLS estimate of γ_H, the effect of an indicator of heavy alcohol use—being an alcohol abuser or dependent on alcohol—on employment of –0.021. For ΔTax, we use $1.14, which is a one standard deviation in the average liquor tax per gallon during the period of our study. There is little information on the magnitude of ρ, the effect of $1 per gallon change in liquor tax on an indicator of heavy alcohol use. We know, however, that ρ is between 0 and –1.00 because for this example, we are using a measure of heavy alcohol use that is a dichotomous indicator of whether or not a person is an alcohol abuser or dependent on alcohol. Given these assumptions, the reduced form estimate is necessarily between 0 and 0.024 [1.14*(-0.016)].

Table 1

True Reduced Form Effect ($\pi = \Delta Tax(\beta_H)(\rho_H)$)	Required Sample Size (2 *N from Equation 8)
0.001	1,229,312
0.002	614,656
0.003	273,180
0.005	98,345
0.010	24,586
0.020	6,147

Table 1 presents the sample size required for different assumptions about the size of the true reduced form effect. The figures in Table 1 clearly show that relatively large samples sizes are required to detect reliably reduced form effects of the expected size. Most data sets used by researchers studying the relationship between alcohol use and labor market outcomes and which use instrumental variables, and therefore implicitly the reduced form

estimate, contain relatively small samples. For example, Kenkel and Ribar (1994) used a sample with approximately 3,000 observations, and Mullahy and Sindelar (1996) used a sample with approximately 10,000 observations. These sample sizes are sufficient to detect reliably only the largest effect shown in Table 1.

The calculations in Table 1 are more illustrative than definitive. For example, these calculations ignore type II errors, possible non-independence of the samples, and are relevant only for binary outcomes. But they clearly demonstrate that large samples sizes are required to obtain reliable estimates of the effect of heavy alcohol use on labor market outcomes using the reduced form or instrumental variables. Thus, it is not likely that analyses using data with relatively small samples will obtain reliable IV or reduced form estimates.[10] To address this issue, we use the outgoing rotation files of the Current Population Survey (CPS) to estimate the reduced form model of alcohol taxes on labor market outcomes. The sample sizes associated with these data are quite large.

Data

The CPS interviews approximately 60,000 households per month. Each household is interviewed for eight months divided into two four-month periods separated by an eight-month break. In interview months four and eight, the CPS collects information about the hourly and weekly wages of all, non-self employed persons who work for pay. The outgoing rotation files consist of those households receiving their fourth or eighth interview. These households represent about one-quarter of the total CPS sample in each month and all 12 months are combined into yearly files. We use the outgoing rotation files from 1979 to 1995.[11]

For this study, we limit the analysis to persons between the ages of 24 and 54. We omit young and old persons because, as noted by Mullahy and Sindelar (1996), their drinking behavior is qualitatively different from that of persons in their prime working age years. We examine the effect of alcohol taxes on labor market outcomes separately by gender, and for two different age groups: 24-34 and 35-54. Depending on the outcome and demographic group, sample sizes are between approximately 300,000 and 1,000,000. For the analyses of wages

[10] Given the small sample sizes used by Kenkel and Ribar (1994), Mullahy and Sindelar (1996) and others, it is surprising that they obtain statistically significant IV estimates of the effect of alcohol consumption (or dependence) on labor market outcomes. However, the magnitude of the IV estimates and their standard errors increase dramatically, often by a factor of between five to ten, as compared to the OLS estimates. This raises a question about their reliability and whether small sample bias is particularly severe. IV estimates in most of the cited papers are obtained using instruments besides taxes or prices. These variables are not as theoretically valid.

[11] Information on alcohol taxes comes from the Distilled Spirits Council of the United States (DISCUS), which has not published information past 1995. Therefore, the last year of our analysis is 1995.

and hours of work per week, we limit the sample to those who worked for pay in the previous week. However, because the CPS collected wage information only for the non-self employed, sample sizes for these analyses are smaller than that implied by the size of the labor force. Self-employed persons, however, are included in the analysis of employment.

Labor Market Outcomes

In the outgoing rotation files, labor market outcomes are somewhat limited. For example, annual income and annual weeks worked per year are not available. The files, however, do contain information about employment in the week before the survey, hourly and/or weekly wages on the respondent's primary job, and usual hours worked per week on the primary job. The wage information is of high quality because it refers to only one job and is a better measure of current price of labor than wages calculated using annual earnings divided by annual hours of work.

In this study, we focus on the determinants of the real hourly wage, which is deflated using the CPI, employment and hours worked per week.[12] Assuming the existence of a competitive labor market, the hourly wage should be a relatively sound measure of an employee's productivity, and alcohol related differences in productivity should be identifiable. One drawback associated with using the wage as a measure of productivity, however, is that it ignores other components of the compensation package. Mullahy (1993) and Kenkel and Wang (1998) raise the possibility that drinkers may have systematically different preferences than non-drinkers with regard to fringe benefits such as sick leave and health insurance. Under these circumstances the wage will be a noisy measure of productivity differences. Similarly, employment in the week prior to the survey is a limited measure of labor supply as compared to say annual hours of work. It may be the case that drinkers are more likely to work part-time than non-drinkers, but to be just as likely to be working as non-drinkers. To address this possibility, we examine the hours of work during the survey week.

Alcohol Taxes

The key independent variables in this study are the state excise tax on a gallon of beer, wine and liquor. These data come from a publication of the Distilled Spirits Council of the United States (DISCUS) entitled "History of Beverage Alcohol Tax Changes" and are merged to the CPS data by month and year. Matching by month and

year reduces the measurement error that typically affects other analyses that use the average tax for the year. Note that the data refer to real (CPI adjusted) state taxes. Yearly dummy variables are used to control for changes in federal taxes. Finally, we drop from the analysis states with monopoly control over the sales of spirits. Monopoly states effectively control the distribution and sale of some or all alcohol products in the state and state-specific excise taxes are not defined for the controlled products.[13]

Other Independent Variables

Besides taxes, several other independent variables were used in the model (i.e., X and Z in equations (3 and (4)). These variables include age, education, race, ethnicity, and veteran status. The model also includes a complete set of state dummy variables, dummy variables for each year. An appendix table lists the means for variables used in the empirical analysis.

Results

Employment

Table 2 presents the estimates of the effect of beer, wine, and liquor taxes on employment. Estimates were obtained using ordinary least squares.[14] Each cell in Table 2 shows an estimate from a separate regression. We used four different samples defined by gender (male/female) and age (25-34/35-54). In addition, we chose to estimate separate models for each tax because alcohol taxes tend to be highly correlated; including them all in the regression model would make it difficult to identify the effect of the individual taxes.

The left panel of Table 2 presents estimates associated with the sample of adult males. These estimates indicate that alcohol taxes have a negative or zero effect on the employment of adult males. For the sample of young males, estimates of the effect of alcohol taxes are not statistically significant. Estimates associated with older males, however, are negative and two out of three of them are statistically significant. When we combine the two age groups into one sample, estimates indicate that beer and wine taxes have no statistically significant effect on employment, but that liquor taxes are negatively related to employment. In terms of policy, these estimates show that increases in alcohol taxes will have little positive effect on employment rates of adult males. If anything,

[12] For workers who are not paid by the hour, we calculate the hourly wage using information about earnings per week and usual hours worked per week.
[13] Monopoly states have a markup (%) over price to raise revenue, not a specific excise tax.

higher alcohol taxes will decrease employment. In addition, these estimates are inconsistent with a negative structural effect of heavy alcohol use on employment. Increases in alcohol taxes should presumably decrease the incidence of heavy alcohol use, and if a reduction in heavy alcohol use raises wages (indirect effect) and increases employment (direct effect), as some previous studies contend, employment rates should rise in response to a tax increase. We do not find this to be the case, as few of the reduced form estimates have the necessary positive sign that would reflect such a causal effect.

The right panel of Table 2 presents the estimates of the effect of alcohol taxes on female employment. All of these estimates are negative, and many are statistically significant. Estimates tend to be larger and more significant for younger females. Overall, these estimates are consistent with the estimates related to males, and indicate that increases in alcohol taxes will if anything, reduce employment.

The magnitudes of the estimates in Table 2, however, merit comment. For example, the estimate of the effect of beer taxes on the employment rate of males is –0.009, which implies that a $1 per gallon increase in the state beer tax is associated with a 0.9 percentage point reduction in the employment rate of males. A $1 per gallon increase in the beer tax is a large increase given that the mean of the real state beer tax is approximately $0.15 (CPI 1982-1984) per gallon, and one standard deviation in the beer tax is $0.14. The last increase in the federal beer tax, for example, was $0.29 per gallon. A change in state beer taxes of, say $0.10, which is a more commonly observed magnitude of change, is associated with a 0.09 (0.0009 estimate) percentage point decrease in employment of adult males. This is a large effect, and to illustrate this point, we can construct the "simulated" IV estimates of the structural effect. To do this requires an estimate of the effect of alcohol (e.g., beer) taxes on heavy alcohol consumption. We obtain this estimate as follows. A $0.10 increase in the beer tax that was fully passed through to the consumer would increase the price of beer by approximately 2.2 percent assuming that the price of a gallon of beer is $4.50 (CPI 1982-1984).[15] If we assume a price elasticity of demand of –0.50, which is the estimate reported in Manning et al. (1995) for heavy alcohol users, this increase in the price of beer will reduce heavy alcohol consumption by 1.1 percent. Or put another way, since approximately 15 percent of the adult male population is considered to be heavy alcohol users—i.e., dependent on alcohol—a 1.1 percent reduction will decrease the

[14] We adjusted the standard errors for potential clustering and non-independence of observations in the same state in a particular year (Huber 1967).

[15] Alcohol price data comes from the *Inter-City Cost of Living Index* published quarterly by the American Chamber of Commerce Researchers Association (ACCRA).

percentage of the population categorized as such by approximately 0.002, or by 0.2 percentage points. If we use this as an estimate of the effect of beer taxes on heavy alcohol consumption, we can form "simulated" IV estimates of the effect of heavy alcohol consumption on employment by dividing the reduced form estimate of 0.0009 by this figure. This yields a "simulated" IV estimate of the effect of being a heavy alcohol user on employment of 0.45; in other words, being an alcohol abuser or dependent on alcohol *increases* employment by 45 percentage points. Other estimates in Table 2 imply even larger structural effects, particularly the estimates pertaining to the female sample. Thus, it is surprising that many of these reduced form estimates are not statistically significant.

How do we interpret these large estimates? First, the frequent lack of statistical significance associated with such large estimates is not because the analysis lacks statistical power. The large sample sizes used in the analysis are sufficient to detect reliably much smaller effects than many of those observed in Table 2. In this case, the large standard errors associated are likely the result of the instability or indeterminacy of the relationship between alcohol taxes and employment. This instability is also evident if we compare estimates related to different alcohol taxes. For example, among females, beer taxes have much larger (absolute and relative) effects on employment than do wine or liquor taxes. Similar variation can be found among the estimates associated with the male sample; beer taxes have a large positive effect on the employment of younger males, but a large negative effect on the employment of older males. It is difficult to reconcile the observed variation in the sign and magnitude of the estimates of the effect of alcohol taxes with causal mechanisms related to alcohol consumption. In sum, the instability of the estimates and their lack of statistical significance suggests that alcohol taxes, and thus alcohol consumption, have no systematic relationship with employment. If anything, estimates indicate that increases in alcohol taxes would decrease employment. Moreover, these estimates are inconsistent with the hypothesis that alcohol consumption adversely affects employment, and raise questions about the credibility of previous studies' IV estimates of the effect of alcohol consumption on employment.

However, the large reduced form estimates indicate that the partial correlations, regardless of their sign, between alcohol taxes and employment are larger than what is plausibly possible given the known correlation between alcohol taxes and alcohol consumption. Alcohol taxes must be measuring the effect of factors on employment other than those caused by changes in alcohol consumption resulting from changes in taxes. This explains the suspiciously large "simulated" IV estimates. These implausibly large correlations between alcohol

taxes and employment imply that our reduced form model is mis-specified. To investigate this possibility, we obtained reduced form estimates from several different specifications:

- a model that included controls for state-specific trends;
- a model that included state macroeconomic variables (e.g., per capita income);
- a model that used an average of the previous three years alcohol taxes;
- and models that combined some of the three previous specifications.

None of these alternative specifications of the reduced form model yielded qualitatively different estimates than those presented in Table 2. In each case, estimates remained large; were often statistically insignificant; and had alternating signs. One disadvantage associated with each of these alternative models is that they reduce the independent variation in alcohol taxes that is used to identify estimates.[16]

The implausibly large magnitudes of the estimated reduced form effects imply that our estimates are biased by specification error. This necessarily prevents drawing any strong conclusions about the effect of alcohol taxes on employment, and certainly qualifies our earlier statement that alcohol taxes have a zero or negative effect on employment. But it is important to note that any specification error affecting our estimates is likely to have confounded earlier studies that use alcohol taxes as instruments to estimate the structural effect of alcohol consumption on employment. This suggests that the IV estimates from these studies be viewed with ample skepticism.

Hours

Alcohol consumption may also affect hours worked per week. In Table 3, we present the estimates of equation (5) and the effect of state alcohol taxes on usual hours worked per week. Only those subjects who have worked in the prior week are included in the analysis. The presentation of Table 3 is similar to Table 2.

Estimates in the left panel of Table 3 indicate that alcohol taxes are negatively correlated with hours worked per week among males. A $0.10 per gallon increase in beer taxes is associated with a decrease in hours worked per week of between 0.05 and 0.07. A $0.50 per gallon (slightly more than one standard deviation) increase in wine taxes is associated with a decrease in hours worked per week of between 0.24 and 0.35. Finally, a

[16] To address this issue, we limited the analysis to the years 1979-1990, a period characterized by significant variation in beer, wine, and liquor taxes. For example, during this period there was 45 changes in nominal state beer taxes. Results form these analyses were not qualitatively different than those reported.

$1 (slightly less than one standard deviation) per gallon increase in liquor taxes is associated with a decrease in hours worked per week of between 0.15 and 0.18. Two out of the three estimates associated with younger males are not statistically significant. Estimates of the effect of alcohol taxes on female hours of work are presented in the right panel of Table 3. They indicate that alcohol taxes tend to be negatively related to hours of work per week by females, particularly for older women. The magnitudes of the estimates are similar to that for males; for example, a $1 per gallon increase in liquor taxes is associated with a 0.14 decrease in hours worked per week by females. As was the case for the employment outcome, these estimates are inconsistent with the hypothesis that alcohol consumption adversely affects hours of work. If anything, they suggest that alcohol consumption is associated with a greater number of hours of work.

It is also the case, however, that these estimates are large. For example, a $1 per gallon increase in liquor taxes decreases male employment by 0.17 hours. A $1 increase in the liquor tax that was fully passed through to the consumer would increase the price of liquor by approximately three percent assuming that the price of a gallon of liquor is $38.00 (CPI 1982-1984). If we assume a price elasticity of demand of –0.50 for heavy alcohol use, this increase in the price of liquor will reduce heavy alcohol consumption by 1.5 percent; the price increase will reduce the percentage of the population considered to be dependent on alcohol by 0.0023. The "simulated" IV estimates of the effect of heavy alcohol consumption on employment are obtained by dividing the reduced form estimate by this figure, which yields a "simulated" IV estimates of 76; heavy alcohol use is associated with a 76 hour *increase* in hours of work per week. Clearly, this is an implausibly large effect, as are most of the other estimates in Table 3.

Again, it is surprising that given their large size, several of the reduced form estimates are not statistically significant. We believe that this fact, as well as the variation in the sign and magnitudes of the estimates, reflects an instability or indeterminacy in the relationship between alcohol taxes and hours of work per week. However, there is also evidence that our estimates are biased by specification error, which makes it necessary to qualify our conclusions about the effect of alcohol taxes, and thus alcohol consumption, on hours of work per week. Nevertheless, we believe that our analysis casts serious doubt on previous studies' IV estimates of the structural effect of alcohol consumption on labor supply since these studies rely on the same identification strategy.

Wages

Table 4 presents the estimates of equation (4) and the effect of alcohol taxes on the natural logarithm of real wages. The presentation mirrors that of previous tables. Only those subjects who have worked in the prior week are included in the analysis. Estimates related to the male sample (left panel of Table 4) are almost all positive, but only those associated with liquor taxes are statistically significant. Estimates obtained using the female sample (right panel of Table 4) are all positive and statistically significant; increases in alcohol taxes are associated with an increase in female wages. It is obvious, however, that some of the estimates in Table 4 (e.g., 0.179) are implausibly large, but even the smaller estimates are too large to be credible. For example, a $1 per gallon increase in the liquor tax increase is associated with an approximately 1.5 percent increase in both male and female wages. Using the same figures as above to construct a "simulated" IV estimate of the structural effect of heavy alcohol consumption on wages yields an estimate of -6.6, which is not reasonable.

At first glance, estimates in Table 4 suggest that alcohol taxes are positively related to wages, particularly for females. But closer scrutiny of the estimates raises questions about the credibility of such evidence. The relatively large standard errors associated with many estimates, particularly those associated with males, and the significant variation in the magnitude of the estimates suggest a weak and unstable relationship between alcohol taxes and wages. Moreover, there is little reason to believe that alcohol taxes should have an effect on female wages, but not male wages. Increases in alcohol taxes should decrease the consumption of both males and females, and as a result, increase the wages of both males and females. While the magnitude of the effect of alcohol taxes on wages may differ by gender, there is little reason to expect differences by gender in the sign of the estimates, or differences in say the ratio of male to female estimates by type of alcohol product. Finally, estimates in Table 4 of the effect of alcohol taxes on wages are implausibly large and inconsistent with those related to employment and hours of work. Given these caveats, we believe a more prudent conclusion is that alcohol taxes are not systematically related to wages.

Conclusions

Researchers have spent considerable efforts trying to determine whether or not alcohol consumption causes adverse labor market outcomes. To date there is no definitive answer to this question because of the statistical

issues underlying the study of this problem. Most research has attempted to measure directly the effect of alcohol consumption or abuse on labor market outcomes. The best of these studies acknowledge the endogeneity of alcohol consumption and address the problems caused by it using a variety of methods. Theoretically, instrumental variables has the potential to be the most effective, particularly because alcohol taxes are instruments with much theoretical appeal. However, the instrumental variables solution requires relatively large samples that are usually unavailable in data sets containing information on both alcohol consumption and labor market outcomes. Thus, previous studies' estimates of the effect of alcohol use or abuse on labor market outcomes are often imprecisely measured and unreliable.

In this paper, we have chosen an alternative, although related, approach. We chose to estimate the reduced form model that relates alcohol taxes to labor market outcomes. Reduced form estimates provide policy relevant information about the relationship between an important policy tool—alcohol taxes—and outcomes of particular social importance—namely employment and wages. Reduced form estimates also provide information about the structural estimates of the effect of heavy alcohol consumption on labor market outcomes. Under the assumption that there is a negative price elasticity of demand for alcohol, the reduced form estimates provide information about the sign of the causal effect of alcohol use on employment, hours of work, and wages. The advantage of using the reduced form is that it does not require data on alcohol consumption. Therefore, surveys of labor market outcomes such as the CPS, which have large sample sizes, can be used. Moreover, reduced form estimates are not affected by problems related to measurement error in self-reported alcohol use.

The results of the analysis suggest that alcohol taxes tend to be negatively related to employment and hours of work, and positively related to wages. However, several pieces of evidence suggest a different conclusion—namely that alcohol taxes are unrelated to employment, hours of work, and wages. First, the pattern of results noted above is unexpected since it was hypothesized that alcohol taxes would have similarly signed effects on labor supply and wages. Previous studies have shown that alcohol taxes are negatively related to alcohol consumption, which is hypothesized to be negatively related to labor supply and wages. Thus, alcohol taxes are expected to be positively related to both labor market outcomes. The absence of such a finding suggests that either or both sets of estimates may be misleading.

In fact, additional scrutiny of the estimates supports this conclusion. Estimates of the effect of alcohol taxes on employment were large and imprecise, and characterized by significant variation in sign and magnitude across samples and types of alcohol taxes. This suggests that there is a weak and indeterminate relationship between alcohol taxes and employment. Similarly, estimates of the effect of alcohol taxes on hours of work were large and imprecise, and also characterized by significant variation in magnitude across samples and types of alcohol taxes. Again, we believe this reflects an instability or indeterminacy in the relationship between alcohol taxes and hours of work per week. Finally, estimates of the effect of alcohol taxes on wages were also large and imprecise. Moreover, there were significant differences in the magnitude and significance of estimates by gender that could not be easily reconciled with causal mechanisms underlying the relationship between alcohol taxes and wages. Thus, believe that for this outcome too, there is little systematic evidence suggesting a causal effect of alcohol taxes. One important caveat to these conclusions relates to the specification error that was apparent from the implausibly large "simulated" IV estimates of the effect of alcohol taxes on labor market outcomes. The bias caused by this problem may have obscured the true effects of alcohol taxes on labor market outcomes.

Our conclusions about the effect of alcohol taxes also imply that there is no causal effect of alcohol consumption on labor supply and wages. This conclusion is inconsistent with findings from previous studies that examined directly the effect of alcohol consumption on labor supply and wages, and which in general, find adverse effects. However, as we have stressed throughout this paper, the most credible estimates of the effect of alcohol consumption were obtained using an instrumental variables procedure that is closely related to the reduced form used in this paper. The imprecision and instability of the estimates in this paper raise questions about the reliability of these previous studies' estimates. The fundamental identification strategy used in these papers relies to a large extent on the relationship between alcohol taxes and labor market outcomes. Our estimates of this relationship clearly show that it is relatively weak and unstable. Therefore, it is unlikely that previous studies that use instrumental variables estimates have produced credible estimates of the effect of alcohol use on labor market outcomes. Moreover, these studies have used samples that were too small to obtain reliable estimates. Finally, the specification error that may have biased our estimates is also likely to have biased previous studies' instrumental variables estimates.

References

Berger, M. C. and J. P. Leigh, 1988, The Effect of Alcohol Use on Wages, *Applied Economics* 20, 1343-1351.

Cook, P. J., 1981, The Effect of Liquor Taxes on Drinking, Cirrhosis and Auto Fatalities, In: Moore, M and Gerstein, D., eds., *Alcohol and Public Policy: Beyond the Shadow of Prohibition*. Washington DC: National Academy of Sciences, pp. 255-285.

Cook, P. J., 1994, Alcohol Consumption and Young Adults' Socioeconomic Status: Comment, *Brookings Papers on Economic Activity: Microeconomics* 162-166.

Cook, P. J. and M. J. Moore, 1993, Dinking and Schooling, *Journal of Health Economics* 12, 411-429.

Cook, P. J. and G. Tauchen, 1982, The Effect of Liquor Taxes on Heavy Drinking, *Bell Journal of Economics* 13(2): 379-390.

Dee, T. S.,1999, Taxes, Alcohol Use and Traffic Fatalities, unpublished manuscript, Department of Economics, Swarthmore College

Dee, T. S. and W. N. Evans, 1997, Teen Drinking and Educational Attainment: Evidence from Two Sample Instrumental Variables (TSIV) Estimates, *National Bureau of Economic Research Working Paper #6082*, Cambridge, MA: National Bureau of Economic Research.

Doll, R., Peto, R., Hall, E., Wheatley, K. and R. Gray, 1994, Mortality in Relationship to Consumption of Alcohol: 13 Years' Observations on Male British Doctors, *British Medical Journal* 309, 911-918.

Evans, W.N. and J. Ringle, 1997, Can Higher Cigarette Taxes Improve Birth Outcomes? *NBER Working Paper #5998*, Cambridge MA: NBER.

French, M. T. and G. A. Zarkin, 1995, Is Moderate Alcohol Use Related to Wages? Evidence from Four Worksites, *Journal of Health Economics* 14, 319-344.

Fuchs, C. S., Stampfer, M. J., Colditz, G. A., Giovannucci, E. L., Manson, J. E., Kawachi, I., Hunter, D. J., Hankinson, S. E., Hennekens, C. H., Rosner, B., Speizer, F. E. aand W. C. Willett, 1995, Alcohol Consumption and Mortality Among Women, *New England Journal of Medicine* 332, 1245-1250.

Gronbaek, M., Deis, A., Sorensen, T. I. A., Becker U., Schnohr, P. and G. Jensen, 1995, Mortality Associated with Moderate Intakes of Wine, Beer and Spirits, *British Medical Journal* 310, 1165-1169.

Grossman, M., F.J. Chaloupka and I. Sirtilan, An Empirical Analysis of Alcohol Addiction: Results from Monitoring the Future Panels, *Economic Inquiry* 36, 39-48.

Hamilton V. and B. H. Hamilton, 1997, Alcohol and Earnings: Does Drinking Yield a Wage Premium?, *Canadian Journal of Economics* 30, 135-151.

Heien, D. M., 1996, Do Drinkers Earn Less?, *Southern Economic Journal* 63, 60-68.

Huber, P. 1967, "The Behavior of Maximum Likelihood Estimators Under Nonstandard Conditions." In *Proceedings of the Fifth Berkeley Symposium in Mathematical Statistics* Vol. 1. Berkeley: University of California Press.

Kenkel, D.S. and D.C. Ribar, 1994, Alcohol Consumption and Young Adults' Socioeconomic Status, *Brookings Papers on Economic Activity: Microeconomics* 119-175.

Kenkel, D.S. and P. Wang, 1998, Are Alcoholics in Bad Jobs?, *NBER Working Paper #640*, Cambridge, MA: Ntional Bureau of Economic Research.

Kenkel, D.S., 1993, Drinking, Driving and Deterrence, *Journal of Law and Economics* 36, 877-913.

Klerman, J. A., 1998, Welfare Reform and Abortion, in R. Moffitt, ed., *Welfare, The Family, and Reproductive Behavior*, Washington, DC: National Academy Press.

Leung, S. F. and C.E. Phelps, 1993, "My Kingdom for a Drink…?": A Review of the Price Sensitivty of Demand for Alcoholic Beverages, in M. Hilton and G. Bloss, eds., *Economics and the Prevention of Alcohol-Related Problems*, Washington: National Institute on Alcohol Abuse and Alcoholism, NIH Publication No. 93-3513.

Manning, W.G., L. Blumberg and L.H. Moulton, 1995, The Demand for Alcohol: The Differential Response to Price, *Journal of Health Economics* 14, 123-148.

Manning, W.G., and J. Mullahy, 1998, The Effect of Price on Patterns of alcohol Consumption, unpublished manuscript, Department of Health Studies, University of Chicago.

Markowitz, S. and M. Grossman, 1998, Alcohol Regulation and Domestic Violence Towards Children, *Contemporary Economic Policy* 16:309-320.

Mullahy, J., 1993, Alcohol and the Labor Market, in M. Hilton and G. Bloss, eds., *Economics and the Prevention of Alcohol-Related Problems*, Washington: National Institute on Alcohol Abuse and Alcoholism, NIH Publication No. 93-3513.

Mullay J. and J.L. Sindelar, 1993, Alcoholism, Work, and Income, *Journal of Labor Economics* 11, 494-520.

Mullay J. and J.L. Sindelar, 1996, Employment, Unemployment, and Problem Drinking, *Journal of Health Economics* 15, 409-434.

(NIAAA) National Institute on Alcohol Addiction and Abuse, 2000, 10th Special Report to Congress on Alcohol and Health, NIH Publication No. 00-1583.

Peltzman, S., 1994, Alcohol Consumption and Young Adults' Socioeconomic Status: Comment, *Brookings Papers on Economic Activity: Microeconomics* 167-168.

Ruhm, C. J., 1996, Alcohol Policies and Highway Vehicle Fatalities, *Journal of Health Economics* 15, 435-454.

Saffer, H. and M. Grossman, 1987, Beer Taxes, the Legal Drinking Age, and Youth Motor Vehicle Fatalities, *Journal of Legal Studies* 16:351-374.

Shaper A. G., 1990, Alcohol and Mortality: A Review of Prospective Studies, *British Journal of Addiction* 85, 837-847.

Thun M. J., Peto R., Lopez, A. D., Monaco, J. H., Henley, S. J., Heath, C. W. and R. Doll, 1997, Alcohol Consumption and Mortality Among Middle Aged and Elderly U.S. Adults, *New England Journal of Medicine* 337, 705-714.

White, H., 1980, A Heteroscedasticity-Consistent Covariance Matrix and a Direct Test of Heteroscedasticity, *Econometrica* 48, 149-170.

Zarkin, G. A. and M. T. French, 1998, Alcohol Use and Wages: New Results from the National Household Survey on Drug Abuse, *Journal of Health Economics* 17, 53-68.

Table 2
Effects of Beer, Wine and Liquor Taxes on Employment

	Males			Females		
	Age 24-34	Age 35-54	Age 24-54	Age 24-34	Age 35-54	Age 24-54
Beer Tax	0.028	-0.038**	-0.009	-0.058*	-0.041	-0.048*
	(0.022)	(0.012)	(0.013)	(0.027)	(0.022)	(0.021)
Wine Tax	0.007	-0.009	-0.002	-0.026**	-0.014	-0.020*
	(0.007)	(0.005)	(0.005)	(0.010)	(0.008)	(0.008)
Liquor Tax	-0.003	-0.006**	-0.005**	-0.011**	-0.006**	-0.008**
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	439,478	587,004	1,026,482	479,450	634,420	1,113,870
Mean of Dep. Var.	0.84	0.84	0.84	0.63	0.64	0.63

Notes: Each cell shows an estimate from a separate regression. All regression models include: year (dummy variables for each year), state (dummy variables for each state), age (dummy variables for five-year groups), education (HS, Some College, BA plus), race/ethnicity (Black, Hispanic), and veteran status. Standard errors are in parentheses and have been corrected for clustering at the state-year level.
* $.01 < p < .05$, ** $p < .01$

Table 3
Effects of Beer, Wine and Liquor Taxes on Hours of Work per Week

	Males			Females		
	Age 24-34	Age 35-54	Age 24-54	Age 24-34	Age 35-54	Age 24-54
Beer Tax	-0.503	-0.665	-0.586	0.401	-0.618	-0.288
	(0.600)	(0.554)	(0.474)	(0.547)	(0.467)	(0.360)
Wine Tax	-0.486	-0.706**	-0.610**	-0.321	-0.613**	-0.515**
	(0.271)	(0.198)	(0.194)	(0.219)	(0.206)	(0.168)
Liquor Tax	-0.146*	-0.183**	-0.170**	-0.137*	-0.137**	-0.142**
	(0.074)	(0.057)	(0.054)	(0.060)	(0.048)	(0.040)
Log Wage [1]	0.877**	-0.491**	0.113	3.555**	3.576**	3.556**
	(0.080)	(0.078)	(0.067)	(0.072)	(0.069)	(0.058)
Observations	326,300	394,897	721,197	280,771	357,190	637,961
Mean of Dep. Var.	42.810	43.363	43.113	36.812	36.565	36.674

Notes: Each cell shows an estimate from a separate regression. All regression models include: year (dummy variables for each year), state (dummy variables for each state), age (dummy variables for five-year groups), education (HS, Some College, BA plus), race/ethnicity (Black, Hispanic), and veteran status. Standard errors are in parentheses and have been corrected for clustering at the state-year level. $.05 < p < .10$, ** $.01 < p < .05$, *** $p < .01$

[1] The coefficient and standard error on log wage correspond to the regression on beer tax. They are virtually identical for the regressions on wine and liquor tax.

Table 4
Effects of Beer, Wine and Liquor Taxes on Log Wages

	Males			Females		
	Age 24-34	Age 35-54	Age 24-54	Age 24-34	Age 35-54	Age 24-54
Beer Tax	0.066	0.071	0.075	0.170**	0.179**	0.178**
	(0.052)	(0.040)	(0.044)	(0.032)	(0.035)	(0.031)
Wine Tax	-0.007	0.009	0.004	0.036**	0.041**	0.039**
	(0.016)	(0.014)	(0.014)	(0.013)	(0.015)	(0.013)
Liquor Tax	0.014**	0.016**	0.015**	0.013**	0.017**	0.016**
	(0.006)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Observations	326,300	394,897	721,197	280,771	357,190	637,961
Mean of Dep. Var.	2.061	2.291	2.187	1.839	1.903	1.874

Notes: Each cell shows an estimate from a separate regression. All regression models include: year (dummy variables for each year), state (dummy variables for each state), age (dummy variables for five-year groups), education (HS, Some College, BA plus), race/ethnicity (Black, Hispanic), and veteran status. Standard errors are in parentheses and have been corrected for clustering at the state-year level.
* $.05 < p < .10$, ** $.01 < p < .05$, *** $p < .01$