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# TOTAL TAX: A SUGGESTED METHOD FOR CALCULATING ALCOHOL BEVERAGE TAXES

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## Introduction

Measuring the taxes levied on alcoholic beverages is an important component of alcohol policy research because alcohol beverage prices (sometimes called economic availability) are a well-established determinant of consumption and related problems (Babor et al., 2010).<sup>3</sup> Although alcohol taxes are an imperfect index of alcohol prices, tax rates are relatively easy to measure and are frequently used as a proxy for economic availability (Wagenaar et al., 2010).<sup>4</sup>

There are three types of taxes that may be levied on alcoholic beverages sold at retail:

1. *Federal and state specific excise taxes* (sometimes called excise taxes)
2. *State on- and/or off-premises ad valorem excise taxes*
3. *State and local alcohol sales taxes* (which may be waived when ad valorem excise taxes are levied)

In a previous paper (Klitzner 2012),<sup>5</sup> we suggested that a measure of “total tax,” including all retail taxes levied by states and the Federal Government, may provide a more precise representation of state alcohol taxes than the more commonly used measure that includes specific excise tax only. Our main motivations for preparing this paper are:

1. To offer total tax as an alternative measure of economic availability of alcohol.
2. To increase awareness that most of the data needed to calculate total tax are available on the Alcohol Policy Information System (APIS) website (2003 to 2015 as of this writing).
3. To encourage alcohol policy researchers to include total tax in their economic availability studies in order to build a corpus of data on total tax.

In the sections that follow, we will further develop the total tax measure and compare its performance to the more common measure of specific excise tax only. Before doing so, we briefly discuss the various cost components that make up retail alcohol prices to place total tax in context.

## Retail Alcohol Prices

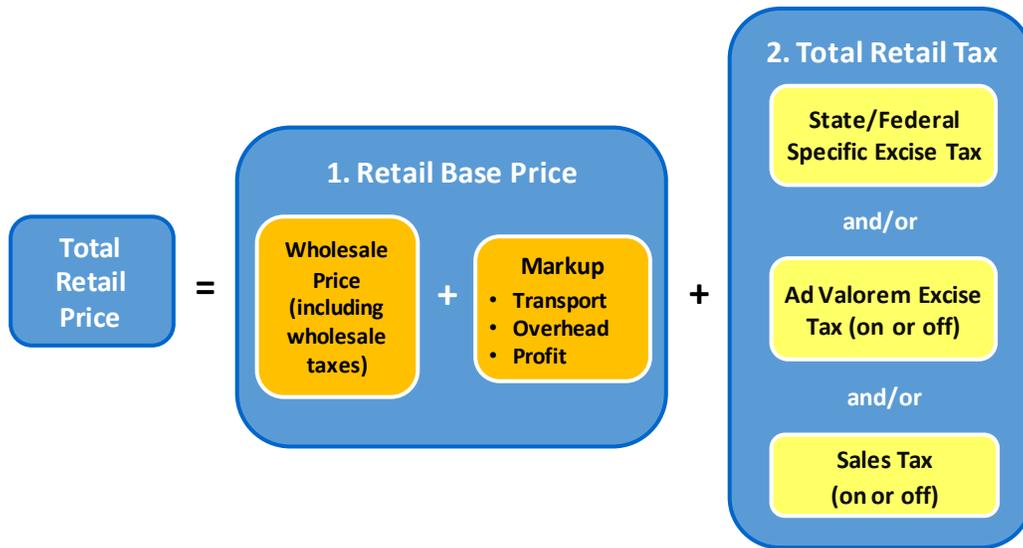
The total retail price paid by consumers for alcoholic beverages is composed of two components (Figure 1).

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<sup>3</sup> Babor T, Caetano R, Casswell S, Edwards G, Geisbrecht N, Graham K, Grube J, Hill L, Holder H, Homel R, Livingston M, Österberg E, Rehm J, Room R, and Rossow I. (2010). *Alcohol: No Ordinary Commodity: Research and Public Policy, Second Edition*. New York: Oxford University Press.

<sup>4</sup> Wagenaar A, Tobler A, and Komro K. (2010). Effects of Alcohol Tax and Price Policies on Morbidity and Mortality: A Systematic Review. *American Journal of Public Health*, 100: 2270-2278.

<sup>5</sup> Klitzner, Michael. *Improving the Measurement of State Alcohol Taxes*. (2012) (available on the APIS website: [http://alcoholpolicy.niaaa.nih.gov/uploads/improving\\_the\\_measurement\\_of\\_state\\_alcohol\\_taxes.pdf](http://alcoholpolicy.niaaa.nih.gov/uploads/improving_the_measurement_of_state_alcohol_taxes.pdf)).

**Figure 1: Two Components of Total Retail Alcohol Prices**

As shown in the figure, the two components of total retail price of alcohol are:

1. *Retail base price*, which includes the wholesale price, wholesale taxes, and mark-up (transport, overhead, profit).
2. *Total retail tax* (hereafter, *total tax*), comprising one or more of the three types of taxes levied at retail.

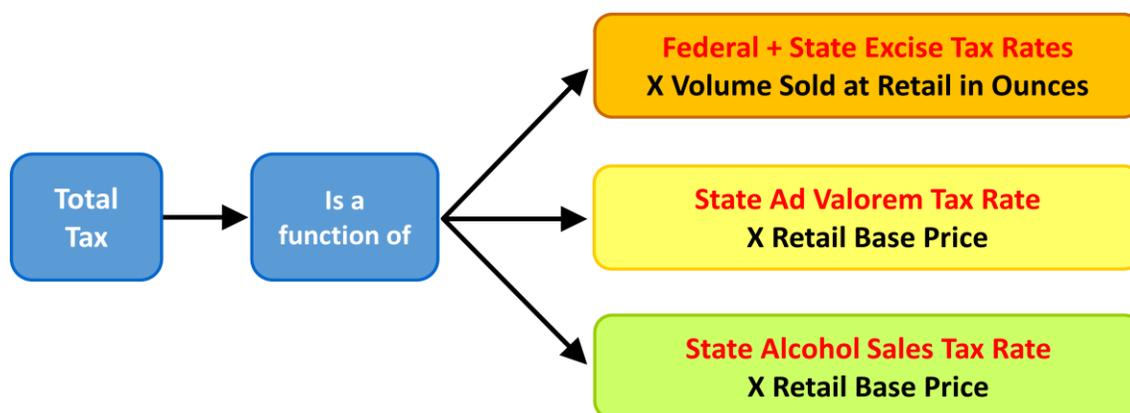
It is important to note that Figure 1 is only meaningful in states with a license retail system (where the state licenses private vendors to operate a retail system of distribution for beer, wine, and/or spirits). In contrast, where the state is the retailer for beer, wine, and/or spirits (through a control system) the two components of total retail alcohol price (Figure 1) become blurred. In states with a control system, the state sets a price for each alcohol product that is some combination of cost, markup, and taxes, and it is not possible to determine the value assigned to each of these components. We, therefore, do not believe that “tax” is a meaningful construct in states with control systems.

Notice that the three tax categories in total tax are connected by “and/or.” As of this writing, there is a Federal specific excise tax (e.g., \$10.80/ gallon for 80 proof spirits) and all license states impose a specific excise tax. There is huge variability among the states in terms of the ad valorem excise tax and retail sales tax on alcohol.

### **Total Tax**

Figure 2 provides additional details of total tax. Specifically, it presents the base upon which various alcohol taxes are calculated.

Figure 2: Total Tax



State and Federal specific excise taxes are *volume-based*—calculated based on the *amount* of alcohol sold (e.g. a fifth of wine, a 12-ounce bottle of beer, a mixed drink with 1.5 ounces of spirits). Although it is conventional to express specific excise taxes as dollars per gallon, we prefer to use dollars per ounce for calculating total tax, as almost all retail sales are of fractions of gallons. Using ounces keeps most fractions out of the equations.

Ad valorem excise taxes and state alcohol sales taxes are calculated based on the retail base price.<sup>6</sup> Retail prices for beer, wine, and spirits for on-premise and off-premise sales are available from Impact Databank. Relied on by alcohol industry members and public health researchers, Impact Databank is a definitive source for alcohol marketing data. Another commonly used source for alcohol prices is the *American Chamber of Commerce Research Association (ACCRA) Cost of Living Index* produced by the Council for Community and Economic Research. However, the *Cost of Living Index* appears to provide data for off-premise sales only. In some states, off-premise prices can be gathered from prices listed by online liquor or wine stores. There are some complexities in selecting retail base prices. We will return to this topic later.

Total tax can be calculated as a simple additive function of the three tax components. However, it is possible that some states use formulas in which taxes compound.<sup>7</sup> As noted in Klitzner (2012), the various possible ways of calculating total tax yield very similar results. We, therefore, recommend that the simple additive model be adopted for research purposes.

## Data Sources

State-level data on specific excise taxes, ad valorem excise taxes, and some sales tax data are available from the APIS tax data tables:

<sup>6</sup> Note that in some states, the alcohol sales tax is the same as the general sales tax. In other states, the rate for alcohol is different than the rate for most other products and may be different for on- and off-premise sales, or may not be levied on alcohol at all.

<sup>7</sup> E.g., Alcohol Sales Tax = Alcohol Sales Tax rate x (Retail Base Price + Specific Excise Tax + Ad Valorem Excise Tax).

*Beer:* [http://alcoholpolicy.niaaa.nih.gov/Taxes\\_Beer.html](http://alcoholpolicy.niaaa.nih.gov/Taxes_Beer.html)

*Wine:* [http://alcoholpolicy.niaaa.nih.gov/Taxes\\_Wine.html](http://alcoholpolicy.niaaa.nih.gov/Taxes_Wine.html)

*Spirits:* [http://alcoholpolicy.niaaa.nih.gov/Taxes\\_Spirits.html](http://alcoholpolicy.niaaa.nih.gov/Taxes_Spirits.html)

One readily available source for sales tax data is the *Federation of Tax Administrators (FTA) State Sales Taxes*. FTA provides one tax rate for each state, although there can be substantial local variations in sales tax within each state. Moreover, there are likely to be differences in on- and off-premise sales taxes that are not reflected in FTA data.

### Examples

Assume one wishes to calculate the total tax on a fifth of spirits (25.6 ounces) purchased off-premises in Arkansas. Relevant data are provided in Table 1.

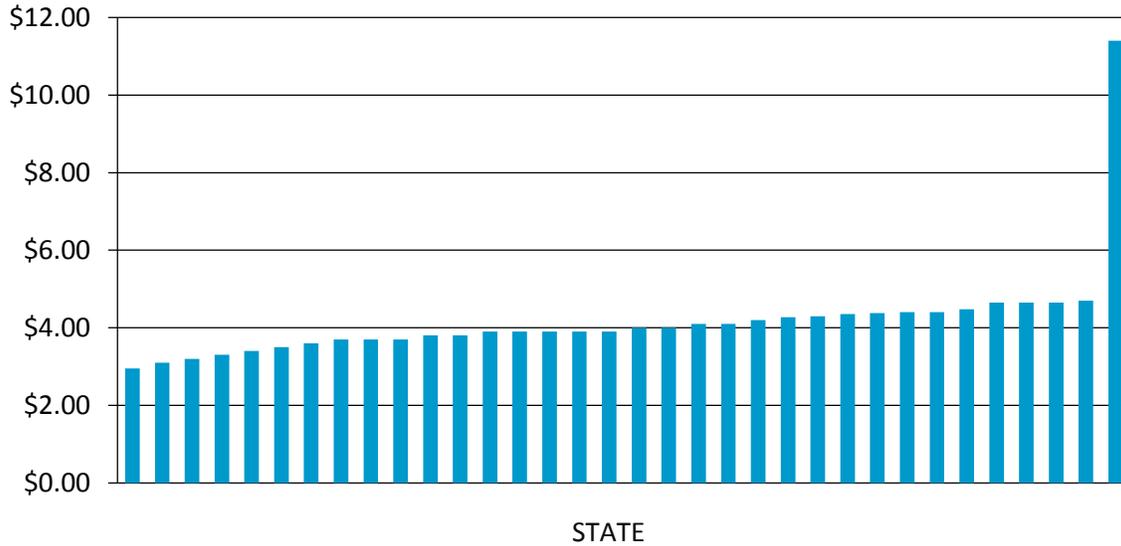
<b>Table 1: Data for Calculating Total Tax on a Fifth of 80 Proof Spirits in Arkansas Data as of 1/1/2014</b>	
<b>Volume Sold</b>	25.6 ounces
<b>Hypothetical Retail Base Price</b>	\$15.00
<b>Federal Specific Excise Tax</b>	\$0.084/ounce
<b>State Specific Excise Tax</b>	\$0.019/ounce
<b>Off-Premises Ad Valorem Excise Tax Rate</b>	3.00% of Retail Base Price
<b>Alcohol Sales Tax Rate</b>	6.50% of Retail Base Price

Following Figure 2, total tax is calculated as:

$$(25.6 \text{ oz.} \times (\$.084/\text{oz.} + \$.019/\text{oz.})) + (\$15 \times 3\%) + (\$15 \times 6.5\%) = \$4.06$$

Repeating this calculation for the other 33 license states yields the distribution of total tax for a fifth of 80 proof spirits shown in Figure 3.

**Figure 3: Total Tax on a Fifth of Spirits (25.6 Ounces) Purchased Off Premises in 34 License States**



As shown in Figure 3, total tax in the license states ranges from under \$3.00 to almost \$12.00.

**Is the Total Tax Measure Useful for Research?**

To assess the utility of the total tax measure, January 1, 2009 off- and on-premise total tax<sup>8</sup> for beer, wine, and spirits was correlated with adult binge drinking rates from the Behavioral Risk Factor Surveillance System (BRFSS) covering the years 2005-2011. For comparison, BRFSS binge drinking data were also correlated with state specific excise tax rates for beer, wine, and spirits, which are the same for on- and off-premise sales. (As noted earlier, the specific excise tax is a commonly used measure in alcohol tax studies.)

Table 2 presents the correlations between adult binge drinking, total tax measures for beer, wine, and spirits, and specific excise tax for beer, wine, and spirits.

<b>Table 2: Correlation of Total Tax Measures and Specific Excise Tax only with Adult Binge Drinking, One-tailed Tests of Significance*</b>			
	<b>Total Tax On-Premise</b>	<b>Total Tax Off-Premise</b>	<b>Specific Excise Tax Only</b>
<b>Beer</b>	-0.02, NS	-0.17, NS	-0.18, NS
<b>Wine</b>	-0.30, P<.025	-0.020. NS	0.020. NS
<b>Spirits</b>	-0.49, p <.005	0.02, NS	0.10, NS

\*NS denotes non-significant relationships.

<sup>8</sup> This analysis used the retail base prices from Klitzner (2012) (available on the APIS website: [http://alcoholpolicy.niaaa.nih.gov/uploads/improving\\_the\\_measurement\\_of\\_state\\_alcohol\\_taxes.pdf](http://alcoholpolicy.niaaa.nih.gov/uploads/improving_the_measurement_of_state_alcohol_taxes.pdf)).

### *Specific Excise Tax Only*

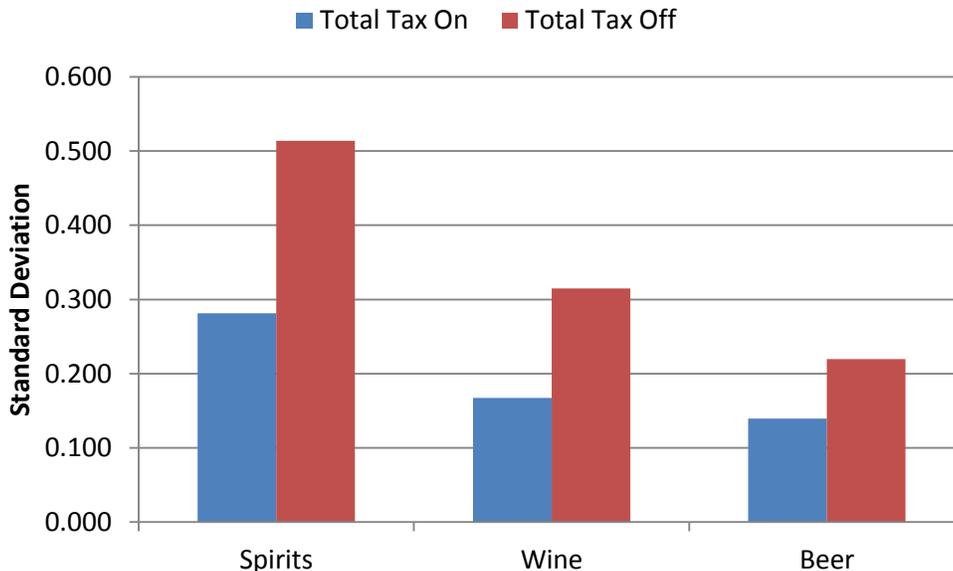
Results suggest no specific excise tax only effect on binge drinking for any beverage. This finding may support our suggestion (Klitzner 2012) that the specific excise tax may not be the most useful measure of state alcohol taxes.

### *Total Tax*

Results for the total tax measures are mixed. There is a strong, significant, negative correlation between on-premise total tax and adult binging for wine and spirits. As on-premise total tax for wine and spirits increases, adult binging decreases—an apparent effect on binging of economic availability as indexed by total tax. However, this effect is not seen for beer or off-premise spirits and wine sales.

*Total Tax for Beer*—The lack of any effects for beer total tax is somewhat puzzling, but may simply reflect smaller variance across states in this measure when compared to total tax for spirits and wine (Figure 4).

**Figure 4: Standard Deviations for Total Tax for Beer, Wine, and Spirits On- and Off- Premises**



*Total Tax for Wine and Spirits*—We offer two possible explanations for the differences in results for on- and off-premise total tax for wine and spirits.<sup>9</sup> One explanation is that price sensitivity for alcohol purchased off-premises has an effect at the time of purchase but less of an effect at

<sup>9</sup> There is very little information on where adult binge drinkers purchase alcohol (on- vs. off-premise). A study by Naimi, et al. (Naimi TS, Nelson DE, and Brewer RD. Driving after binge drinking. *American Journal of Preventive Medicine*, 37 (4): 314–320, 2009) suggested that driving after binging was more common for on-premise drinking than for drinking at home, but this study probably tells us more about the transportation needs of on-premise drinkers than it does about settings for binge drinking.

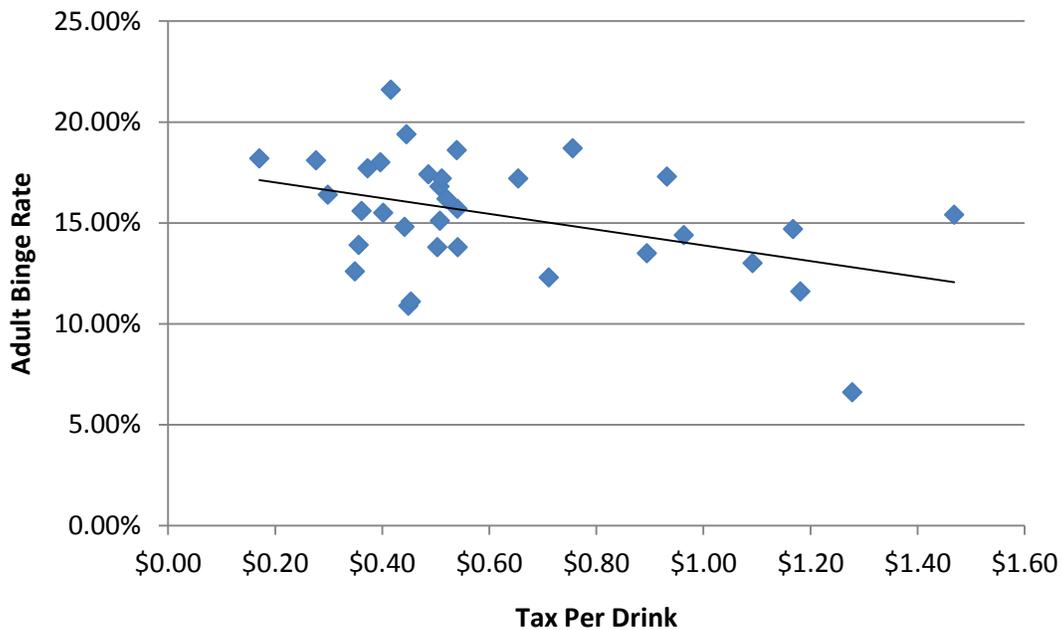
some future time of consumption, i.e., the price is “hidden” from the drinker to some degree when the bottle is opened and its contents consumed. However, our data do not address this speculation.

A second possible explanation arises if we consider the total tax *per drink* for wine and spirits purchased on- and off-premises. The on-premises total tax is already calculated on a per drink basis. The off-premises total tax per drink is simply the off-premises total tax divided by 17.07 for spirits (the number of 1.5 ounce servings in a fifth of spirits) and 6.4 for wine (the number of 4 ounce servings in a fifth of wine).

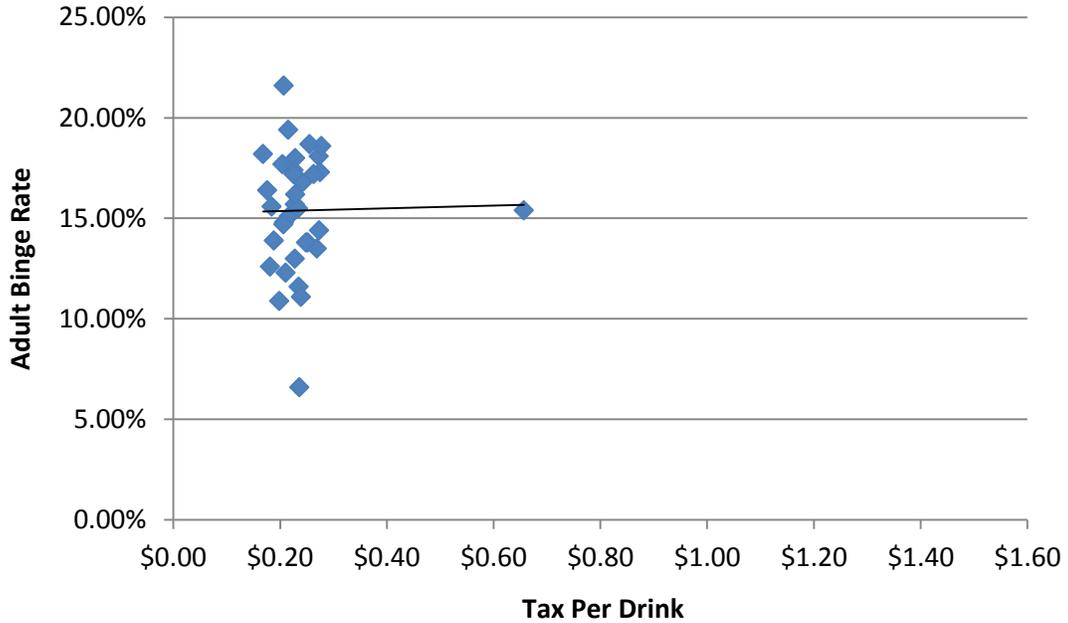
The average on- and off-premises total tax per drink is \$0.62 and \$0.38 respectively for spirits and \$.37 and \$.25 for wine. Thus, a spirits drinker who purchases alcohol on-premises pays about \$3.00 in tax for a five-drink binge while a spirits drinker who purchases off-premises pays about \$1.90. The on-premises tax for a five-drink wine binge is \$1.85 as compared to \$1.25 off premises. Based on total tax alone, on-premise wine or spirits binging is about 1.5 times more expensive than binging off-premises.

Further insight is gained through examination of Figures 5a-5d, which provide scatter plots of on- and off-premises total tax per drink for wine and spirits and adult binging.

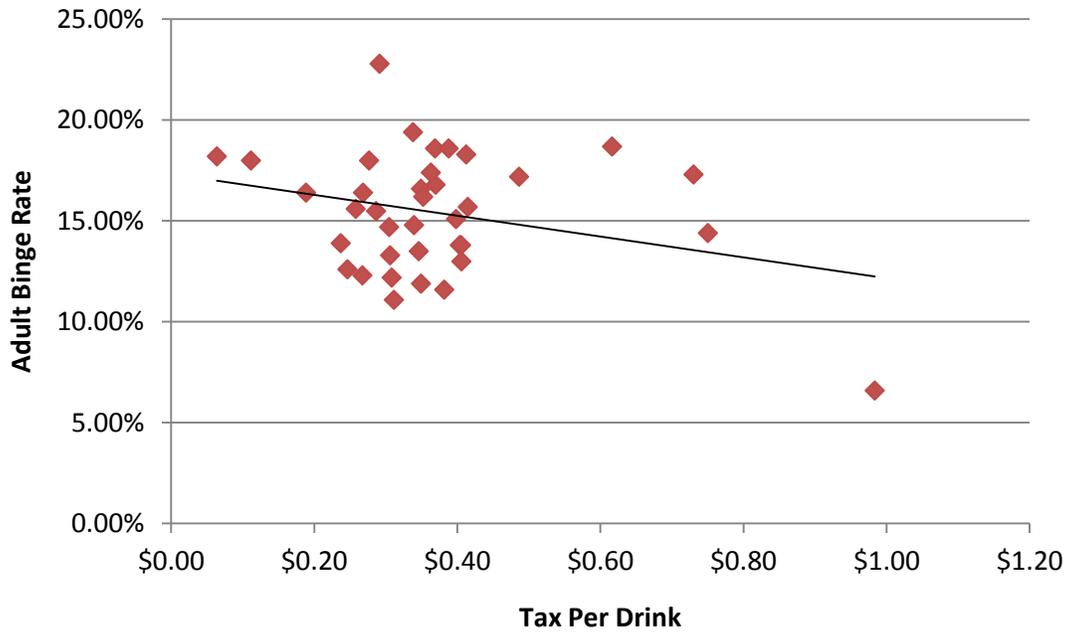
**Figure 5a: On-Premises Total Tax Per Drink of Spirits and Adult Binging**

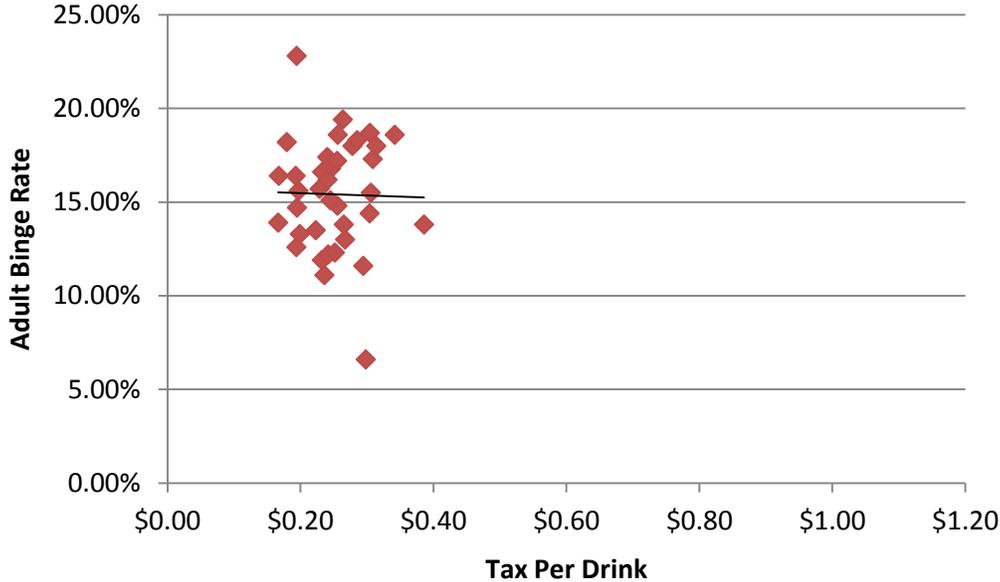


**Figure 5b: Off-Premises Total Tax Per Drink of Spirits and Adult Binging**



**Figure 5c: On-Premises Total Tax Per Drink of Wine and Adult Binging**



**Figure 5d: Off-Premises Total Tax Per Drink of Wine and Adult Binging**

These figures (Figures 5a through 5d) reveal a much smaller variance for off-premises total tax per drink (standard deviation for spirits = \$0.08; \$0.05 for wine) than for on-premises total tax per drink (standard deviation for spirits = \$0.32; \$0.17 for wine). It appears that there is simply not enough variation in off-premises total tax per drink for this variable to have an impact on adult binging.<sup>10</sup>

### Retail Base Price

The total tax measure requires the establishment of a retail base price for the beverage or beverage type for which total tax is to be calculated. Several sources for retail base prices were suggested in the paragraphs above. Whatever the source, it is possible that the retail base price we select already contains one or more retail taxes—i.e., the price may reflect the true retail base price plus specific excise taxes, ad valorem excise taxes, and/or alcohol sales tax.

It may be difficult to determine whether taxes are included in the retail base price from the documentation that accompanies many of the sources from which retail base prices are obtained. However, researchers may safely ignore the issue of taxes in the retail base price unless *absolute* differences in total tax among beverage types or across jurisdictions are of interest. In most policy studies (e.g., cross-jurisdictional comparisons with tax as an independent variable), estimates of total tax that are accurate in a *relative* sense will be sufficient. We have modeled total tax under different assumptions about the taxes included in the retail base price. The correlations between total tax under these differing assumptions range from .98 to .99. For more information on this issue, see Appendix A.

<sup>10</sup> The reader will note a large outlier in the off-premises total tax per drink data. Removing this outlier does not significantly change the correlation with adult binging.

## Conclusion

We have introduced a new index of retail alcohol taxes called total tax. Total tax includes all retail alcohol taxes levied by the states and the Federal Government. Previously, we suggested that total tax may provide a more precise representation of state alcohol taxes than the more commonly used measure that includes specific excise tax only. In this paper, we have presented data that, at least for adult bingeing on-site, support this claim. Appendix A provides guidance for fine-tuning retail alcohol base prices by subtracting retail taxes that are known or believed to be included in available retail base prices.

We are currently in the planning stages of studies assessing the relationship of total tax over time to a variety of alcohol-related health outcomes. It is our hope that interested readers will join us in further development of the total tax measure by including this measure in future alcohol policy studies.

## APPENDIX A

As noted earlier, the total tax measure requires the establishment of a retail base price for the beverage or beverage type for which total tax is to be calculated. We have discussed the possibility that the retail base price selected from available sources may contain one or more retail taxes.

To assess the extent to which the presence of retail taxes in the retail base price affects total tax, we have calculated the total tax measure under the assumption that the retail base price: 1) contains no taxes, 2) contains specific excise and ad valorem excise taxes, and 3) contains specific excise, ad valorem, and alcohol sales tax. In cases 2 and 3, the taxes were “backed out” (or subtracted) from the retail base price before total tax was calculated (see formulas below). Table A-1 presents correlations among the total tax measures under the various assumptions concerning taxes included in the retail base price.

<b>Table A-1: Correlations Among Total Tax Measures under Various Assumptions Concerning Taxes Included in the Retail Base Price</b>				
	<b>SET=Specific Excise Taxes</b>	<b>AET=Ad Valorem Excise Taxes</b>	<b>AST=Alcohol Sales Tax</b>	
	<b>BEER ON-PREMISES</b>		<b>BEER OFF-PREMISES</b>	
	<b>Assumes SET &amp; AET must be backed out of retail base price</b>	<b>Assumes SET, AET &amp; AST must be backed out of retail base price</b>	<b>Assumes SET &amp; AET must be backed out of retail base price</b>	<b>Assumes SET, AET &amp; AST must be backed out of retail base price</b>
<b>Assumes no taxes in the retail base price</b>	.99*	>.99*	>.99*	>.99*
<b>Assumes SET and AET must be backed out of retail base price</b>		>.99*		>.99*

	WINE ON-PREMISES		WINE OFF-PREMISES	
	Assumes SET & AET must be backed out of retail base price	Assumes SET, AET & AST must be backed out of retail base price	Assumes SET & AET must be backed out of retail base price	Assumes SET, AET & AST must be backed out of retail base price
Assumes no taxes in the retail base price	>.99*	>.99*	>.99*	>.99*
Assumes SET and AET must be backed out of retail base price		>.99*		>.99*
	SPIRITS ON-PREMISES		SPIRITS OFF-PREMISES	
	Assumes SET & AET must be backed out of retail base price	Assumes SET, AET & AST must be backed out of retail base price	Assumes SET & AET must be backed out of retail base price	Assumes SET, AET & AST must be backed out of retail base price
Assumes no taxes in the retail base price	>.99*	>.99*	.99*	.98*
Assumes SET and AET must be backed out of retail base price		>.99*		>.99*
P, two tailed >.005				

The correlations in Table A-1 all approach unity. These results strongly support our contention that researchers may safely ignore the issue of taxes in the retail base price unless absolute differences in total tax among beverage types or across jurisdictions are of interest.

However, if retail taxes are known or suspected to be included in the retail base price, these taxes can be “backed out” (as was done for the calculations in Table A-1). These calculations assume a simple additive function for the retail taxes (see text and Footnote 7).<sup>11</sup> Formulas are easily adjusted under the assumption that the retail taxes compound in some fashion or for other combinations of retail taxes.

If it is assumed that the “raw” retail price (i.e., the retail price obtained from one of the sources discussed in the text) includes specific excise and ad valorem taxes (but not sales tax), a corrected or actual retail base price can be calculated that removes these taxes before the total tax is calculated.

<sup>11</sup>The simple additive model underlying the formulas that follow is:

$$\text{Raw Retail Price Base} = \text{Corrected (Actual) Retail Price} + ((\text{Federal Specific Excise Tax} + \text{State Specific Excise Tax}) \times (\text{Ounces Sold}/128)) + (\text{Corrected (Actual) Retail Base Price} \times \text{On- or Off Ad Valorem Excise Tax}) + (\text{Corrected (Actual) Retail Base Price} \times \text{Sales Tax on or Off})$$

Let:

RRP = Raw Retail Price

CRP = Corrected Retail Price

E = (Federal Specific Excise Tax + State Specific Excise Tax) x (Ounces Sold/128)

AV = On- or Off-Premises Ad Valorem Excise Tax

Sales = Sales Tax

Then:

$$CRP = (RRP - E)/(1+AV) \text{ (EQUATION 1)}$$

If it is assumed that Sales Tax is included in the Raw Retail Base Price the formula for Corrected Retail Price becomes:

$$CRP = (RRP - E)/(1+AV+ Sales) \text{ (EQUATION 2)}$$