Improving the Measurement of State Alcohol Taxes

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Background

This monograph compares various indices of State alcohol taxes to determine whether there is a method for making cross-State comparisons of economic availability that is more precise than the *specific excise tax* (sometimes called *the excise tax*)—the variable used to index economic availability in most alcohol policy studies. Such studies relate alcohol prices to a variety of alcohol-related consequences, including crime, traffic crashes, violence, and other problems on college campuses.[1] 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.[2]

In addition to the specific excise tax, State alcohol taxes may also include:

1. On- and/or off-premises ad valorem excise taxes (similar to sales taxes, but imposed specifically on alcoholic beverages).
2. General sales tax.[3]

The total tax levied on alcohol can include specific excise taxes, ad valorem excise taxes, and sales taxes. Sales taxes do not always apply to alcoholic beverages. They may be waived when ad valorem excise taxes are levied or waived for all alcoholic beverages.

The question addressed here is whether the specific excise tax is an adequate index of economic availability or whether it is necessary to also take into account ad valorem excise and general sales taxes. About 20 percent of the States levy on- and/or off-premises ad valorem (value-based) excise taxes, and most levy general sales taxes on alcohol. If these taxes significantly alter total costs to consumers—and hence, economic availability—ignoring them may introduce error into alcohol tax analyses.

The interaction of ad valorem and general sales taxes varies across States. In some States, ad valorem taxes are additional to general sales taxes, whereas in others, they substitute for general sales taxes. In the latter case, the ad valorem excise tax must be adjusted by subtracting the general sales tax to maintain comparability across States. Here, this adjusted tax is referred to as the "sales tax adjusted ad valorem excise tax."

The general recommendation of this analysis is that ad valorem excise taxes and sales taxes should be taken into account when measuring alcohol taxation (see Analysis 3 below).

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[1] 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.

[2] 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.

[3] Many experts consider excise taxes as key because they differentiate relative prices of alcoholic beverages from those of other products. Sales taxes are considered less relevant for economic analysis due to the fact that they apply to a wide range of consumer goods and services and therefore do not change relative prices in the same way that excise taxes do. On the other hand, sales taxes vary among States, and in some cases are not applied to alcohol. They may, therefore, be relevant in State-to-State comparisons of alcohol economic availability.

Methods

The current analyses are limited to "license" States. When beverages are sold in State-run retail stores or through State-run wholesalers (beer = 3 States; wine = 13 States; spirits = 18 States), the State sets a price that is some combination of cost, mark-up, and taxes. It is not possible to determine the dollar value assigned to each of these components.

The data come from the National Institute on Alcohol Abuse and Alcoholism's (NIAAA's) Alcohol Policy Information System (APIS). Data on taxation rates were collected through examination of codified statutes and regulations in effect as of January 1, 2009.[4] Two additional years of tax data (2010 and 2011) have been added to APIS since the analyses reported in this monograph were conducted. Some minor changes have occurred in State taxation rates since January 1, 2009.[5] These changes should not materially affect the results of the analyses presented here.

For beer, wine, or distilled spirits, a given State may have half a dozen or more tax rates based on alcohol content, container size, or geographic location. To simplify the situation, this analysis constructed a concept called an *index* beverage. This index establishes a standard alcohol content for each beverage and reports the taxes on beverages of that content (5 percent alcohol by volume for beer, 12 percent alcohol by volume for wine, and 40 percent alcohol by volume for spirits). In any State, other taxation rates may apply to beverages of other content strengths, but these account for a small proportion of overall sales and hence can be ignored for the sake of simplification.

Analyses and Results

The analyses begin with the assumption that an index based on a combination of taxes levied by the States has greater *prima facie construct validity* for indexing economic availability than does an analysis of specific excise taxes alone. An index including multiple taxes is a reflection of actual taxation policies and hence of the actual contribution of taxation to retail price.

The question then becomes whether using an index of actual taxes makes any practical difference, or whether the simpler strategy of using specific excise taxes alone provides a reasonable surrogate measure.

To address this question, a series of analyses were performed.

Analysis 1—What is the covariation of ad valorem excise taxes with respect to specific excise tax rates?

Clearly, if there is a covariation between ad valorem taxes and specific excise taxes (so that the higher ad valorem taxes compensate for the lower specific excise taxes) then the importance of including both taxes in indexing economic availability across States increases.

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[4] Beer Tax Data - http://www.alcoholpolicy.niaaa.nih.gov/Taxes_Beer.html
Wine Tax Data -- http://www.alcoholpolicy.niaaa.nih.gov/Taxes_Wine.html
Spirits Tax Data - http://www.alcoholpolicy.niaaa.nih.gov/Taxes_Spirits.html

[5] Five, six, and four States have made minor changes in specific excise tax or sales tax for beer, wine, and spirits, respectively.

Figures 1a through 1c plot State-specific excise tax rates (in dollars per gallon) against on- and off-premises ad valorem excise tax rates (in percentages) for beer, wine, and spirits. As shown in these figures, few States have ad valorem excise taxes, but the States that have ad valorem excise taxes all have specific excise tax rates that are in the bottom two quartiles of the specific excise tax distribution across States. In other words, States that have ad valorem excise taxes tend to have lower specific excise taxes.

Figure 1a
Ad Valorem Excise Tax as a Function of Specific Excise Tax
Beer

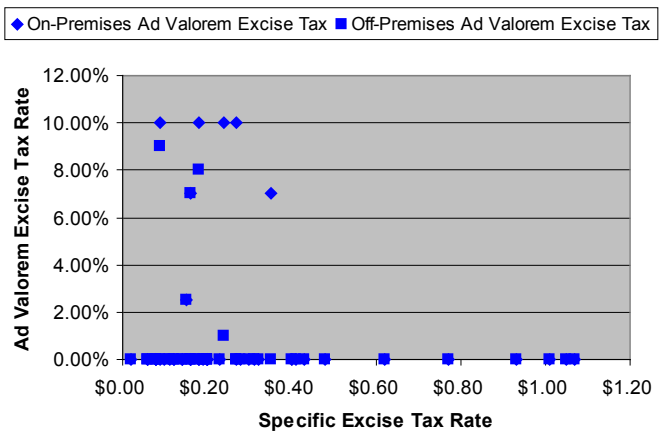


Figure 1b
Ad Valorem Excise Tax as a Function of Specific Excise Tax
Wine

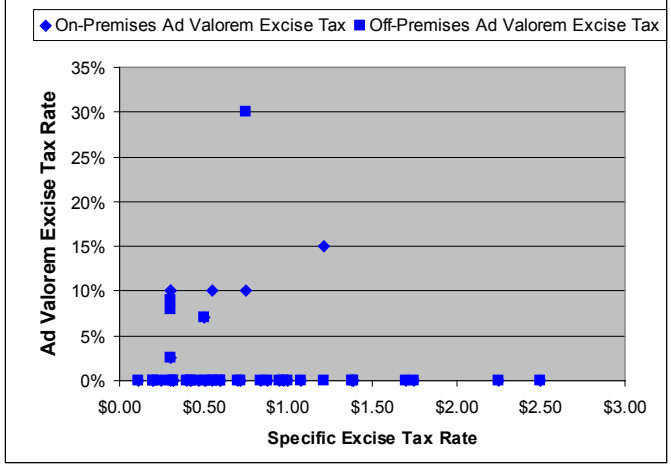
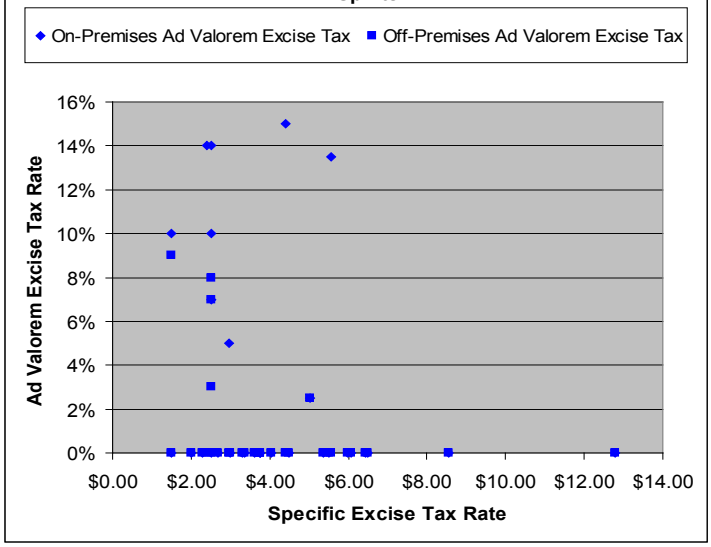


Figure 1c
Ad Valorem Excise Tax as a Function of Specific Excise Tax
Spirits



Analysis 2—To what extent does inclusion of ad valorem excise tax rates disrupt the ranking of States based on specific excise tax alone?

Although ad valorem excise taxes covary with specific excise taxes, it is still possible that they do not have a major effect on the ranking of States' tax rates based only on specific excise taxes. For

example, ad valorem excise taxes may be negligible in terms of their impact on price when compared to the more prevalent specific excise taxes. Were this to be the case, the ad valorem excise taxes could safely be ignored.

To assess the impact of ad valorem excise taxes, the two types of excise taxes (specific and ad valorem) need to be combined and then rankings based on the combined tax rates across States must be compared to rankings based on the specific excise tax alone. (Analysis 3 applies the same logic, but also considers the general sales tax.)

A problem arises because ad valorem excise taxes are in a different metric (dollars per price of sale) than specific excise taxes (dollars per gallon). The raw specific excise and ad valorem excise tax rates are apples and oranges and therefore cannot be directly combined.

To address this issue, a *reference retail price* was selected for on- and off-premises purchases from *Impact Databank*.[6] *Impact Databank* is a definitive source for alcohol marketing data relied upon by both alcohol industry members and public health researchers. However, the *Impact Databank* appears to include taxes in the prices it provides, leading to double counting. Based on the *Brewers' Almanac* data for beer,[7] the *Impact Databank* prices have been discounted by 28 percent to arrive at an approximate *net-of-tax* (before tax) price for each beverage.[8] This strategy provides a conservative test in all calculations that use the price data (Analyses 2, 3, and 4), given that lower price points will dilute the impact of value-based taxes relative to the unit-based specific excise tax.

The price points used in the analyses are as follows:

- *Beer*: Net-of-tax price of a 12 oz. bottle on-premises = $1.89; Net-of-tax price of a six-pack off-premises = $3.14
- *Wine*: Net-of-tax price of a 4 oz. glass of wine on-premises = $2.51; Net-of-tax price of a fifth of wine off-premises = $4.36
- *Spirits*: Net-of-tax price of a 1.5 oz. drink on-premises = $2.51; Net-of-tax price of a fifth (25.6 oz.) of spirits off-premises = $9.04

The retail ad valorem excise taxes were modeled (converted to tax/gallon) for each State based on these prices. The appropriate ad valorem excise tax for these analyses is the *sales tax adjusted retail ad valorem excise tax*, because sales taxes on alcohol are *not* included in the analysis.[9] For States in which sales taxes on alcohol *are not collected*, the sales tax adjusted retail ad valorem excise tax equals the retail ad valorem excise tax minus the unlevied sales tax. For States where sales taxes *are*

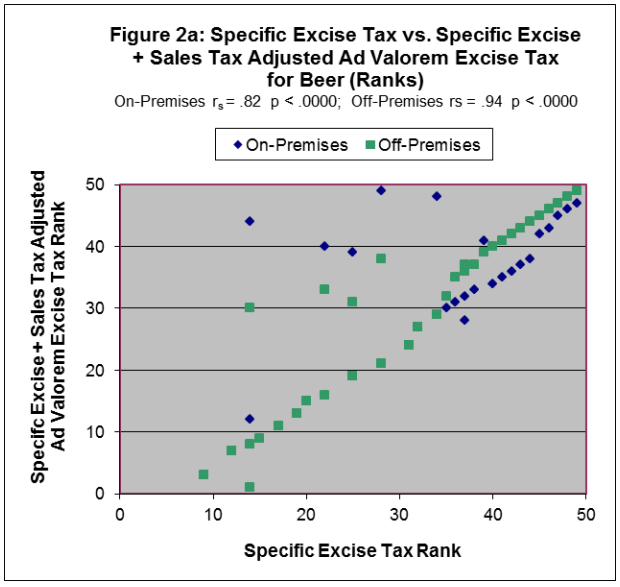
[6] *IMPACT Databank Review and Forecast: The U.S. Spirits, Wine and Beer Markets* (three volume set). (2009). New York: M. Shanken Communications.
[7] *Brewers Almanac* (2008). The Beer Institute. Available at http://beer2.kma.net/index.asp?bid=200.
[8] The 2009 *Brewers' Almanac* shows an average 6-pack price to be $4.66 and the average tax to be about $1.52, yielding a net-of-tax price of roughly $3.14. This represents a 28 percent discount. Absent similar data for wine and spirits, the 28 percent discount has been adopted for all beverage net-of-tax calculations in these analyses.
[9] States in which ad valorem excise taxes are levied only at the wholesale level are not included because there is no readily available source for wholesale price information.

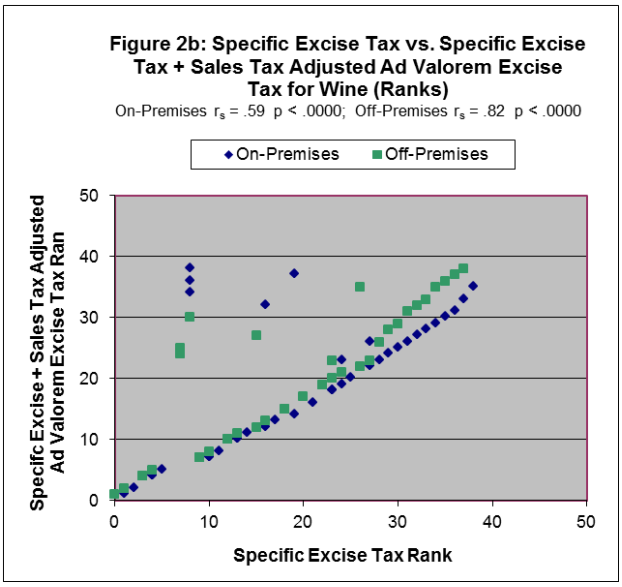
collected on alcohol, the sales tax adjusted retail ad valorem excise tax simply equals the retail ad valorem excise tax.[10]

Figures 2a through 2c are scatter plots of State-specific excise tax versus specific excise tax plus on- and off-premises sales tax adjusted retail ad valorem excise taxes for beer, wine, and spirits. The data are expressed as ranks (1=lowest rank), because the raw tax data are abnormal. Each plot presents Spearman rank–order correlations for the relationships. Again, the question here is whether ad valorem excise taxes have a major effect on the ranking of States' taxes compared to rankings based only on specific excise taxes.

Most points for beer, wine, and spirits on- and off-premises fall on the diagonal, because the specific excise tax + sales tax adjusted retail ad valorem excise tax equals the specific excise tax for the majority of States (i.e., the sales tax adjusted retail ad valorem tax is zero and these points simply plot specific excise tax against specific excise tax). However, many States with retail ad valorem excise taxes moved up substantially in rank, as evidenced by their vertical displacement from the diagonal. At the same time, all of the correlations between specific excise tax alone and specific excise tax + sales tax adjusted retail ad valorem excise tax are statistically significant.

Table 1 shows the percent variance accounted for (r^2) by the six correlations between specific excise tax alone and specific excise tax + ad valorem tax.



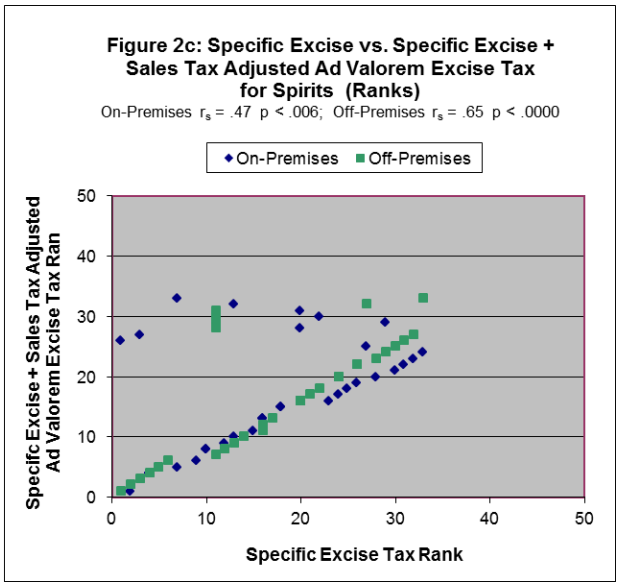


[10] A potential confounding issue concerns whether the sales tax adjusted retail ad valorem excise tax is based on the retail price including or excluding the specific excise tax. Two formulas for calculating the sales tax adjusted retail ad valorem excise taxes are therefore possible:

Formula 1: Sales tax adjusted retail ad valorem excise tax/gallon = Sales tax adjusted retail ad valorem rate x net-of-tax price/gallon

Formula 2: Sales tax adjusted retail ad valorem excise tax/gallon = Sales tax adjusted retail ad valorem rate x (specific excise tax/gallon + net-of-tax price/gallon)

It is likely that some States vary regarding which formula is used and further legal research would be needed to determine the right formula for each State. However, rank order correlations of ad valorem excise taxes using the two formulas exceeded .99 for on- and off-premises ad valorem taxes. Thus, the simpler Formula 1 is used for all calculations.



The correlations shown in Figures 2a through 2c suggest that specific excise tax appears to be a usable surrogate for specific excise tax + sales tax adjusted retail ad valorem excise tax in a cross-State analysis. However, as seen in Table 1, there can be a moderate to substantial loss of precision (variance accounted for) when ad valorem excise taxes are not included.

Table 1: Percent Variance Accounted for (r^2) by the Six Correlations Between Specific Excise Tax Alone and Specific Excise Tax + Sales Tax Adjusted Retail Ad Valorem Excise Tax

Beverage	On-Premises % Variance Accounted for (r^2)	Off-Premises % Variance Accounted for (r^2)
Beer	67%	88%
Wine	35%	67%
Spirits	22%	42%

It is important to note that the number of States with 2009 retail ad valorem taxes is small (six to nine States for on-premises beer, wine, or spirits and five States each for off-premises beer, wine, or spirits). Table 2 presents the rank order correlations between specific excise tax alone and specific excise tax + sales tax adjusted retail ad valorem excise tax when only those States with retail ad valorem excise taxes are considered.

Table 2: Rank Order Correlation Between Specific Excise and Specific Excise + Sales Tax Adjusted Retail Ad Valorem Tax - Ad Valorem States Only

	Beer	Wine	Spirits
On-Premises	-0.17 ns	-.45 ns	-.04 ns
Off-Premises	-0.70 ns	-.11 ns	.71 ns

All six correlations are nonsignificant (ns) as would be expected given the small sample sizes. However, five of these correlations are negative, suggesting that the inclusion of sales tax adjusted ad valorem excise tax may alter State rankings in studies where the proportion of States with ad valorem taxes is large.

Analysis 3—To what extent does inclusion of both ad valorem excise tax and general sales tax rates disrupt the ranking of States based on specific excise tax alone?

Analysis 2 examined the impact of ad valorem taxes on the ranking of State alcohol taxes. As noted in the introduction, general sales taxes constitute a third element of State taxes on alcohol.

Analysis 3 examines the impact of including this third type of tax on State rankings. To do so, a three-component tax was calculated which will be referred to as "total taxes."[11] In this analysis, ad valorem excise taxes that are not adjusted for sales taxes were used, because the analysis includes the sales tax levied on alcohol.

General sales tax rates were obtained from the Federation of Tax Administrators (FTA), a readily available source.[12] The FTA sales tax data have a number of limitations for the current application. Primary among these is that the different sales tax rates for restaurants (and presumably bars) levied in some States are not reflected in the FTA data. Consequently, the on-premises sales tax calculations presented below must be viewed with some skepticism.

Figures 3a through 3c are scatter plots of specific excise tax in license States verses on- and off-premises "total taxes" for beer, wine, and spirits. The data are expressed as ranks (1= lowest rank) because the original data are not normally distributed.

The pattern of correlations between rankings by specific excise taxes and ranking by "total taxes" are similar to those found in Analysis 2, although the correlations in Analysis 3 are generally smaller.

Table 2 displays the percent variance accounted for (r^2) by the six correlations between specific excise tax alone and total taxes. Table 2 shows that there can be a moderate to substantial loss of precision (variance accounted for) when total taxes are not included. In some cases, the loss of precision (as reflected in the variance accounted for) is so pronounced that serious questions may be raised about the appropriateness of using specific excise tax alone as an indicator of economic availability. This is especially the case for on-site total taxes.

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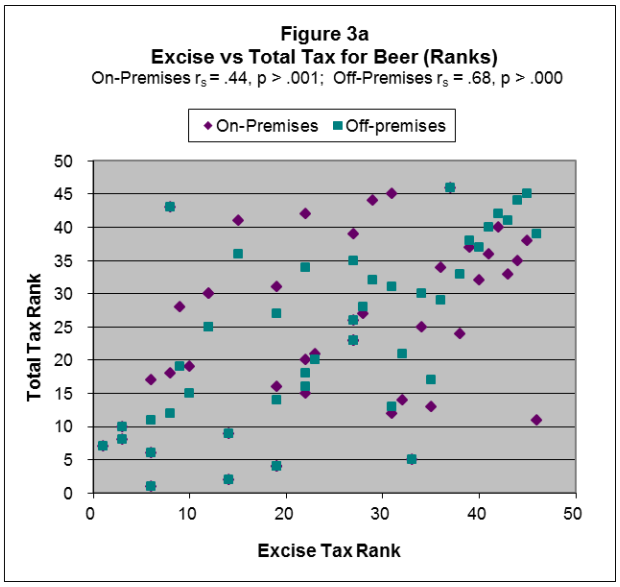
[11] Ad valorem excise taxes were calculated using Formula 1 (see note 10). General sales taxes might be calculated in at least two ways:

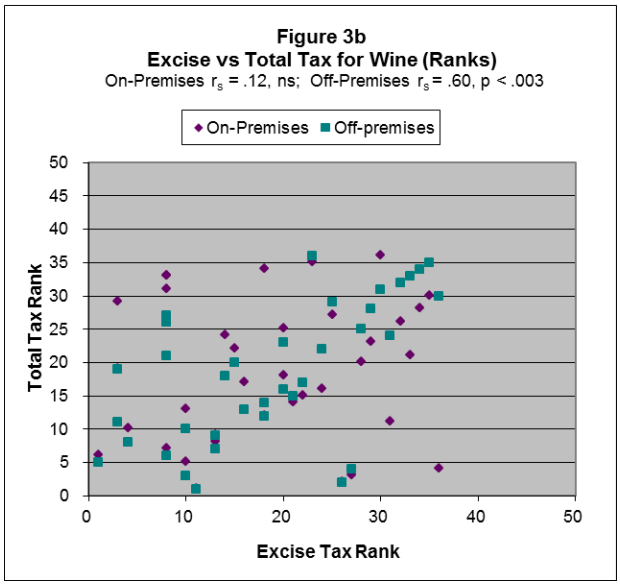
Formula 3: General sales tax/gallon = General sales tax rate x net-of-tax price/gallon

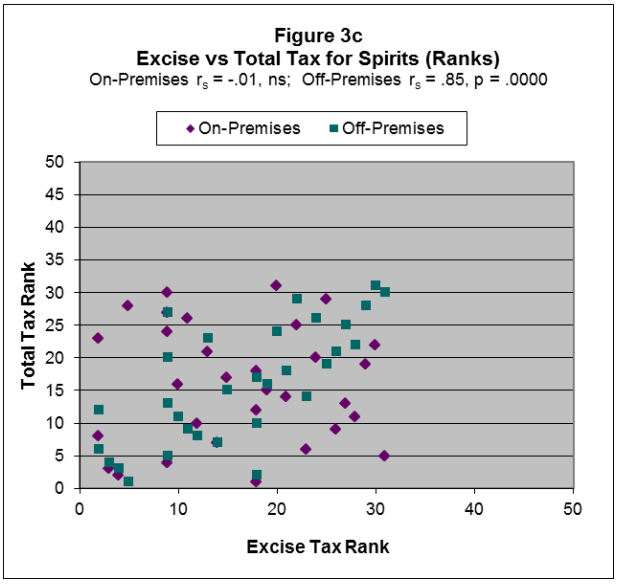
Formula 4: General sales tax/gallon = General sales tax rate x (specific excise tax/gallon + ad valorem excise tax/gallon + net-of-tax price/gallon)

As was the case with ad valorem excise taxes, it is possible that States use both of these formulas (and perhaps others as well). Again, further legal research would be needed to identify which States use which formula. However, rank order correlations of general sales taxes using the two formulas exceeded .98. Thus, the simpler Formula 3 was selected for all calculations.

[12] Federation of Tax Administrators, *State Sales Taxes*. Available at: http://www.taxadmin.org/fta/rate/tax_stru.html. It should be emphasized that the FTA general sales tax data were not derived from analyses of statutes and regulations. Thus, these data differ in source from the other tax data included in the analyses.







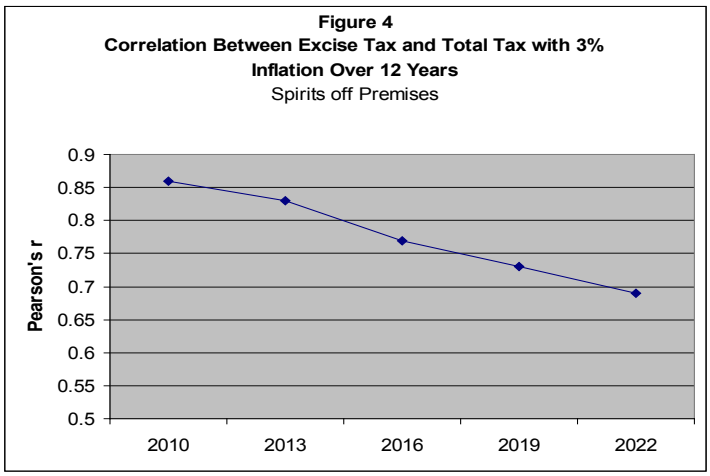
Comparison of the r^2 calculations from Table 2 with those from Table 1 suggests that addition of general sales tax further disrupts the rankings of States based on specific excise tax alone. The exception is spirits off-premises, for which adding sales tax increased the variance accounted for (i.e., 42 percent of the variance was accounted for when only specific excise tax and sales tax adjusted retail ad valorem excise tax were included [Table 1], whereas 72 percent of the variance was accounted for when the total tax index was used). This anomalous result begs an explanation, but none is immediately obvious.

Table 2: Percent Variance Accounted for (r^2) by the Six Correlations Between Specific Excise Tax Alone and Total Taxes		
Beverage	**On-Premises % Variance Accounted for (r^2)**	**Off-Premises % Variance Accounted for (r^2)**
Beer	19%	46%
Wine	1%	36%
Spirits	<1%	72%

Analysis 4—What is the effect of inflation on the above relationships?

In time series analyses, the effects of inflation are of concern. Because the ad valorem excise taxes and general sales tax co-vary with net-of-tax prices, they will increase with inflation. By contrast, the specific excise tax is fixed unless changed by statute or regulation. Figure 4 models the decrease in correlation (Pearson's r[13]) between specific excise tax and total taxes for off-premises spirits when specific excise tax remains constant while off-premises spirits net-of-tax prices rise by 3 percent per year over 12 years (starting with the 2009 price used elsewhere in these analyses). As shown in Figure 4, the correlations decrease by about 20 percent over the 12-year period.

General Discussion



The analyses presented above call into question the appropriateness of using specific excise taxes to index differences among States in economic availability of alcohol. They suggest that either the specific excise tax + ad valorem excise tax or the total taxes measure may be a more appropriate index of economic availability than specific excise taxes alone, with the total taxes measure providing the most precision among the three possible indices. It is also argued that these measures have greater construct validity for indexing economic availability than do specific excise taxes alone, because they reflect the actual tax structure used by the States.

The addition of ad valorem excise taxes to specific excise taxes disrupts State rankings based on specific excise taxes alone with a moderate to substantial loss of precision for some beverage types. Considering only those States with ad valorem excise taxes, five of the six correlations considered become negative. Overall, it would appear that the case for including ad valorem excise taxes in addition to specific excise taxes in indexing economic availability is strong.

However, there seems to be limited justification for including ad valorem taxes without also considering general sales tax, because these two taxes trade off in some States. When general sales

[13] Pearson's r is used in this example, because the rank order correlation will be expected to remain stable.

taxes are considered along with ad valorem excise taxes, correlations with specific excise tax alone are further reduced in all cases except spirits off-premises.

Finally, Analysis 4 demonstrates that correlations between total taxes and specific excise tax will erode in longitudinal studies when inflation affects retail price, because the total taxes measure tracks inflation but the specific excise tax does not.

Four limitations of the analyses presented here should be taken into consideration by researchers using these tax data. First, the indices require the selection of on- and off-premises price points for the beverage(s) for which they are constructed. For the applications above, a single on- and off-premises price point for beer, wine, and spirits was selected using *Impact Databank* and corrected to approximate net-of-tax price. However, researchers may use whatever price points they desire. Moreover, the indices do not require that the same price information be used for each State. Researchers may wish to vary the price information by State, region, or other factors. For some types of studies, a range of price points could be used and the results compared.

Second, the FTA data on general sales tax were used for the total taxes index. FTA provides point estimates, although there can be substantial variations in sales tax within the States. Moreover, there are likely to be differences in on- and off-premises sales taxes that are not reflected in the FTA data. The extent to which the single FTA reported tax is an adequate surrogate for State general sales tax is currently unknown.

A third important issue is the base used for each tax—that is, whether or not the base for the ad valorem excise tax includes or excludes the specific excise tax and whether or not the base for the sales tax includes or excludes the excise taxes. It was assumed, for simplicity, that all taxes are additive and based solely on the net-of-tax price. Our analyses suggest that this simple model correlates well with a model that includes excise taxes in the base. However, further exploration of this issue is needed.

Fourth, the current analyses do not include States that apply ad valorem taxes at the wholesale level. Application of the total taxes model to these States would require access to wholesale price information that is not readily available.