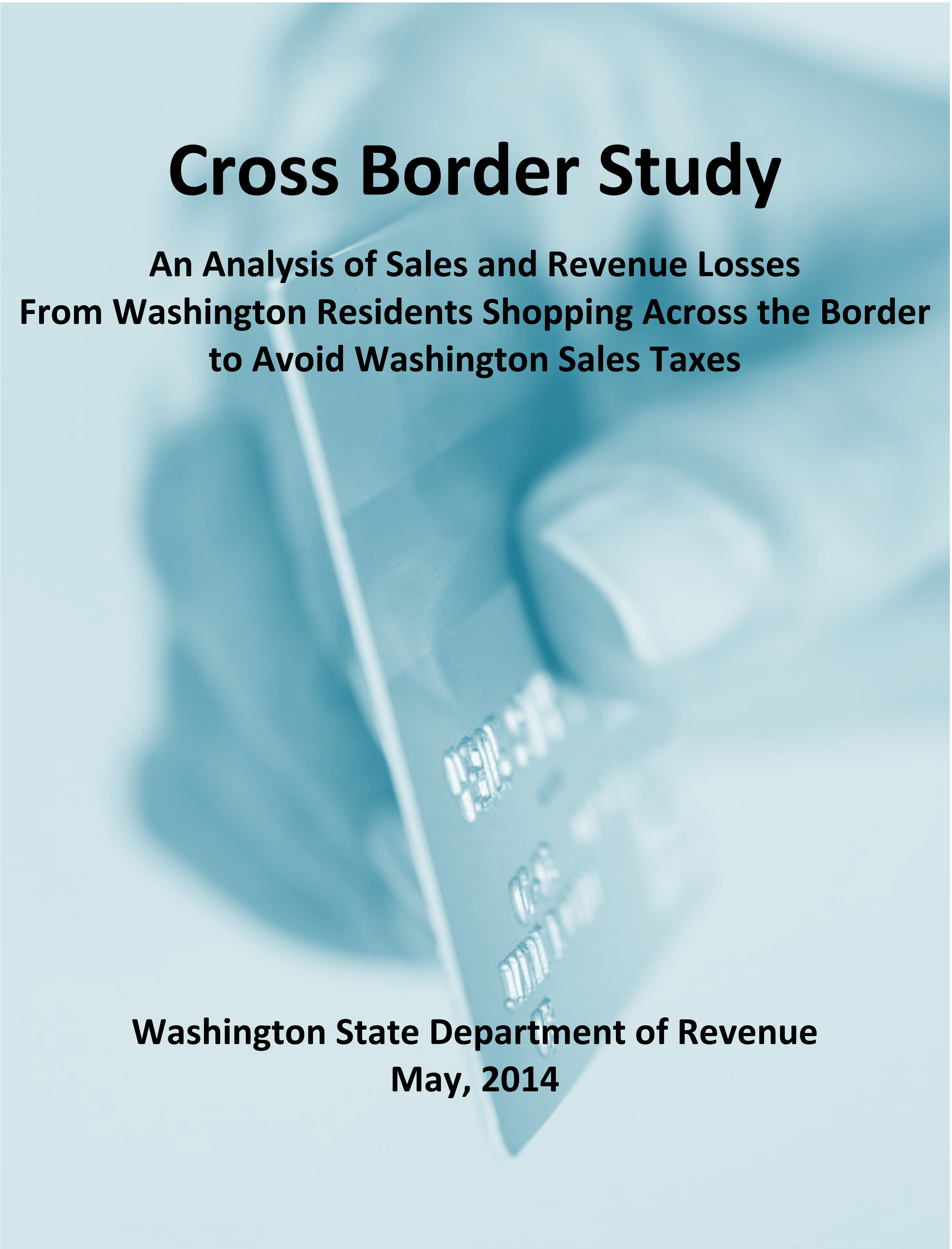


Cross Border Study

An Analysis of Sales and Revenue Losses From Washington Residents Shopping Across the Border to Avoid Washington Sales Taxes

Washington State Department of Revenue

May, 2014

Table of Contents

Executive Summary

Purpose

Data indicate that taxable retail sales and sales tax revenues in Washington border counties suffer due to the proximity of tax free shopping across the border in Oregon and from lower sales tax rates in Idaho. This Department of Revenue (Department) study uses an econometric analysis to provide current estimates of lost taxable retail sales and sales taxes resulting from casual cross-border sales tax evasion.

- This study estimates the loss of taxable retail sales and sales tax revenues from Washington residents shopping across the border to avoid paying the Washington sales tax on purchases.

- This study does not estimate the cost of the nonresident exemption for purchases made to qualified nonresidents of states, possessions, and provinces with a sales tax rate of less than 3 percent.

Result

Washington border counties will lose $3 billion in taxable retail sales to casual cross-border evasion in Fiscal Year 2014. This represents $193 million in state and $54 million in local sales tax revenues lost to evasion, $247 million in total.

If Oregon and Idaho raise sales tax rates one percentage point, Washington border county taxable retail sales would rise by $583 million. State sales tax revenues would increase by $38 million and local sales taxes by $11 million.

Casual Sales Tax Evasion Across Washington's Borders

Casual, Cross-Border Sales Tax Evasion

Sales tax evasion may take many forms such as:

- Internet sales,
- organized crime,
- unreported business equipment purchases, and
- retailer theft or non-collection of taxes.

This study analyzes the sales and revenue losses from casual, cross-border, sales tax evasion. This occurs when residents avoid Washington taxes by shopping in neighboring states for goods they bring back to Washington. The greatest incentive for this type of evasion is along state borders, particularly those with large differences in sales tax rates.

The states of Washington and Oregon are alike in many respects with similar climates, geographies, histories, cultures, demographics and economies. However, the two states probably have the most widely divergent tax structures of any adjacent states in the U.S. Washington has no income tax and depends most heavily on sales taxes, while Oregon has no sales tax and depends heavily on income taxes. The difference between the high sales tax rates on the Washington side of the border and no sales taxes on the Oregon side provide possibly the strongest incentive for casual, cross-border sales tax evasion in the country. There is also a smaller incentive to shop across the border in Idaho.

This report presents the results of a statistical analysis by the Department to estimate the amount of lost taxable retail sales, and the amount of lost state and local sales tax revenues from casual, cross-border sales tax evasion. The analysis does not measure the loss from other types of evasion. Although Internet sales and other forms of e-commerce raise similar issues, such evasion is not analyzed here because those sales do not depend on proximity to an interstate border.

Washington Border and Non-Border Counties Defined

This study is about Washington State border counties and non-border counties. A border county shares a border with Oregon or Idaho. All other counties are considered non-border counties for this study.

Washington Border and Non-Border Counties

Comparative State and Local Sales Tax Rates

Comparative sales tax rates estimated by the Tax Foundation show that, as of January 1, 2013, Washington had the nation's fourth highest combined state and local sales tax rate. The Tax Foundation report shows a Washington combined rate of 8.86 percent, just below third ranked Louisiana's 8.87 percent.

According to the Tax Foundation, Washington has a combined sales tax rate of 8.86%, the fourth highest in the nation.

Combined sales tax rates in the Northwest:

Washington	**8.95%**
Idaho	**6.00%**
Lewiston, Idaho	**6.50%**
Oregon	**None**

Department data indicate a slightly higher statewide average rate in Fiscal Year 2013, 8.95 percent. Most Idaho jurisdictions along the Washington border are subject to the state sales tax of 6 percent. Nez Perce County, where the city of Lewiston lies, levies an additional 0.5 percent county-wide tax. Oregon, on the other hand, is one of only four states with no state or local sales taxes.

Washington's border counties have lower tax rates than the statewide average, presumably because border jurisdictions have stronger incentives to hold down sales tax rates. The Fiscal Year 2013 average combined state and local rate for border counties is:

- 8.2 percent along the Western border where desirable Oregon shopping is readily accessible.
- 8.5 percent for Eastern Washington residents where Idaho has a sales tax and there are far fewer desirable cross-border shopping opportunities in Eastern Oregon.

The Tax Foundation and Department of Revenue tax rate information is shown in Table 1, below.

Table 1
Combined State and Local Sales Tax Rates
Selected States and Washington Border Regions

U.S. Rank & Location	Data Source	Combined State and Local Rate
1. Tennessee	Tax Foundation	9.44%
2. Arizona	"	9.16%
3. Louisiana	"	8.87%
4. Washington State	"	8.86%
- Washington State	Department Data	8.95%
- Eastern Washington Border Counties	"	8.50%
- Western Washington Border Counties	"	8.20%

Note: Washington State tax rates compiled by the Tax Foundation and by the Department are calculated somewhat differently and with time periods that are not exactly the same.

Lost Retail Sales and Sales Tax Revenues Due to Casual Cross-Border Evasion

Observers have long noted that per capita taxable retail sales for Washington border counties are much lower than for non-border counties. Table 2 below shows two measures of per capita taxable retail sales for the state:

1. Total taxable retail sales, and
2. Taxable retail sales net of the construction and accommodations sectors.

The latter is a better measure of resident household purchases and turns out to be more responsive to the level of the tax rate. The two taxable retail sales variables are shown for border versus non-border counties, and for Eastern versus Western border counties.

Table 2
Real, Per Capita, Total Taxable Retail Sales (TRS) and
Real, Per Capita TRS net of the Construction and Accommodations Sectors

	Real Per Capita Taxable Retail Sales (TRS)	
Washington Region	Total TRS	TRS net of Construction and Accommodations
All of Washington State	$ 16,400	$ 13,200
Non-Border Counties Only	17,300	13,800
Border Counties Only	13,100	10,700
Eastern Washington Border Counties	14,700	12,200
Western Washington Border Counties	10,900	8,700
Difference between:		
- Non-Border & Eastern Border Counties	2,600	1,600
- Non-Border & Western Border Counties	6,400	5,100
- Eastern & Western Border Counties	3,800	3,500

Note: Data in Table 2 is inflation adjusted (real) per capita, annual TRS, averaged over the years 2005 through 2011, and stated in terms of 2013 dollars. The seven years of data smoothes out year to year fluctuations.

Evidence shows that easy access to tax free shopping has a large effect on taxable retail sales.

Table 2 shows:

- Both measures of per capita taxable retail sales are lower in border counties than in non-border counties.
- Per capita retail sales are lower in Washington's Western border counties than in the Eastern border counties despite the lower tax rates in the Western regions.
- The difference between Eastern and Western border counties is actually larger than the difference between non-border counties and Eastern border counties.

Casual Sales Tax Evasion Across Washington's Borders

An estimate for lost sales tax revenues can easily be calculated from the per capita taxable retail sales data used for Table 2 if one assumes that border counties should have the same amount of per capita retail sales as non-border counties. However, this method over-estimates lost taxable retail sales and sales taxes because it ignores income variability across counties. Some non-border counties, such as those in the Puget Sound region, have higher than average per capita incomes and consequently higher per capita taxable retail sales.

An easy way to deal with the income variability is to compare taxable retail sales as a percent of personal income. Over the years 2005 through 2011 real taxable retail sales averaged:

- 60.0% of income for border counties, and
- 62.6% for non-border counties.

Despite the fact that the Western border counties of Clark, Skamania, and Wahkiakum were among the counties with the four lowest percentages of taxable retail sales, this 2.6% difference implies small amounts of lost retail sales. The small island county of San Juan had the lowest ratio, but it has relatively low levels of retail activity and is in many ways atypical.

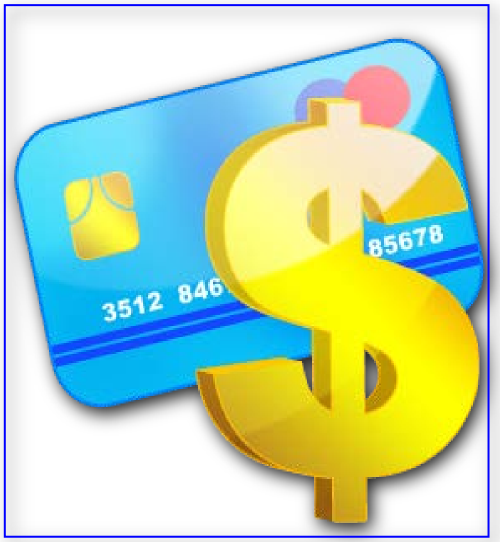
Statistical Measures of Lost Retail Sales and Sales Tax Revenues

Simple ratios like those mentioned above are inadequate to measure taxable retail sales lost to casual, cross-border evasion because shopping behavior is also influenced by demographic and other factors. What's required is a more general approach to incorporate all factors demonstrated to have significant effects on taxable retail sales and sales taxes. The best approach is a regression model.

Regression analysis is a statistical procedure that finds the set of factors (independent variables) and the type of equation that best explain or determine the behavior of the dependent variable. In this case the dependent variable is taxable retail sales.

This Department study found that the following set of independent variables best explained the amount of taxable retail sales in each county:

- Home county population (the home county is where the person lives)
- Real, per capita income in the home county
- Relative sales tax rates in the home county versus the nearest low tax, neighboring jurisdiction (with the influence of tax rates working through prices)
- Travel costs, including miles to the nearest location with low tax shopping, and including real fuel costs
- The home county's unemployment rate
- Percentages of the home county's population below 19 and over 64 years of age
- Number of retailers per thousand residents in the home county



There are two other sets of variables to consider, one for time and one to control for other region specific factors that might influence retail activity; these will be discussed in the Statistical Analysis section.

The factors used in this study are typically among the independent variables found by researchers to best explain the level of retail sales in a wide variety of markets and settings. In this study, the statistical equation, or model, that best explains the amount of each county's taxable retail sales is a fixed-effects, cross-sectional time series model with a log-log specification. The formula is discussed in the Statistical Analysis section.

The Results: Estimated Taxable Retail Sales and Sales Taxes Lost

Casual cross-border tax evasion is estimated to cost border counties $3 billion in lost taxable retail sales in Fiscal Year 2014. This represents $193 million in lost state sales taxes, and $54 million in lost local sales taxes.

The estimate of Fiscal Year 2014 losses is shown in Table 3.

Table 3
Estimated Loss of Border County Taxable Retail Sales, and State and Local Sales Taxes
(FY 2014)

Estimated Losses from Cross-border Sales Tax Evasion	
FY 2014 Taxable Retail Sales (TRS)	$2,970,000,000
FY 2014 State Sales Tax Revenues	193,000,000
FY 2014 Local Sales Tax Revenues	54,000,000
Total State plus Local Sales Tax Revenues	$ 247,000,000

The losses can also be thought of as the maximum potential gains if shoppers in border counties faced a more "normal" sales tax environment, one that provided shopping incentives similar to those of non-border counties. It's not necessary that tax differentials be completely eliminated between Washington and adjacent states, only that rate differences be "normalized."

Table 4 below presents the estimated losses from Table 3 as potential gains, and details the estimates for each border county. Potential gains in taxable retail sales, and state and local sales tax revenues assume that out-of-state sales tax rates increase enough to normalize tax differentials. This is unlikely since Washington has no control over policy decisions of other states.

Table 4
Potential Gains from Border County Tax Rate Normalization
(FY 2014)

Border Counties, FY14 Estimates	Potential Gains if Border Counties Face "Normal" Tax Differences		
	Taxable Retail Sales	State Sales Taxes	Local Sales Taxes
Asotin	$ 7,129,000	$ 463,000	$ 71,000
Benton	681,676,000	44,309,000	12,111,000
Clark	1,177,815,000	76,558,000	21,885,000
Columbia	8,416,000	547,000	118,000
Cowlitz	353,865,000	23,001,000	5,004,000
Garfield	1,074,000	70,000	11,000
Klickitat	41,494,000	2,697,000	290,000
Pacific	43,130,000	2,803,000	561,000
Pend Oreille	6,134,000	399,000	67,000
Skamania	10,867,000	706,000	130,000
Spokane	431,695,000	28,060,000	9,342,000
Wahkiakum	4,974,000	323,000	55,000
Walla Walla	180,593,000	11,739,000	4,007,000
Whitman	21,373,000	1,389,000	278,000
All Border Counties	$ 2,970,235,000	$ 193,064,000	$ 53,930,000

Note: The information provided in this table assumes a sales tax rate increase in Oregon and Idaho to normalize tax differentials.

Table 5 presents a different option; the potential gains resulting from a one percentage point decrease in the border county sales tax differential. It still assumes the changes are made to out of state tax rates. A reduction in Washington border county tax rates will generally yield net sales tax losses because the amount lost from lower rates outweighs increases in taxable retail sales. Only very small border county rate reductions have the potential to increase revenues, and then only in some border counties.

Note: It is not possible to reduce the state sales tax rate solely in border counties. This is due to the State Supreme Court decision Bond v. Burrows, 1994, where the court ruled that the state sales tax rate must be uniform throughout Washington.

Table 5
Potential Gains from a One Percentage Point Decrease
In the Border Tax Differential
(FY 2014)

Potential Gains If the Tax Differential Declined by One Percentage Point (e.g. a one percent increase in out of state tax rates)				
Border Counties	Increase in FY14 Taxable Retail Sales	Sales Tax Gain (FY 2014)		
		State Sales Tax Gain	Local Sales Tax Gain	State & Local Sales Taxes
Asotin	$ 7,129,000	$ 463,000	$ 71,000	$ 534,000
Benton	82,587,000	5,368,000	1,467,000	6,835,000
Clark	144,764,000	9,410,000	2,690,000	12,100,000
Columbia	1,050,000	68,000	15,000	83,000
Cowlitz	43,594,000	2,834,000	616,000	3,450,000
Garfield	1,074,000	70,000	11,000	81,000
Klickitat	5,581,000	363,000	39,000	402,000
Pacific	5,314,000	345,000	69,000	414,000
Pend Oreille	3,812,000	248,000	42,000	290,000
Skamania	1,464,000	95,000	18,000	113,000
Spokane	250,151,000	16,260,000	5,413,000	21,673,000
Wahkiakum	591,000	38,000	6,000	44,000
Walla Walla	21,271,000	1,383,000	472,000	1,855,000
Whitman	14,142,000	919,000	184,000	1,103,000
All Border Counties	$582,524,000	$ 37,864,000	$ 11,113,000	$ 48,977,000

Note: The information provided in this table assumes a sales tax rate increase in Oregon and Idaho to normalize tax differentials.

The effects of reducing Washington border tax differentials by one percentage point are:

- $583 million in additional taxable retail sales
- $ 38 million in additional state sales tax revenues
- $ 11 million in additional local sales tax revenues
- $ 49 million in additional state and local sales tax revenues

The one percentage point change in Table 5 makes it easier to estimate the impact of a change in the tax differential on border county retail activity:

1. A rate reduction of one half the size has about one half the effect
2. A two percentage point reduction in the tax differential has about twice the effect

Note also that the gains in taxable retail sales for Asotin and Garfield Counties are the same in Tables 4 and 5. This is because a one percentage point reduction in the tax rate differential completely eliminates the differential between those two counties and Lewiston in Nez Perce County Idaho.

Conclusion

This analysis estimates that casual cross-border evasion will cost the state $3 billion in taxable retail sales resulting in $247 million in state and local sales tax losses in Fiscal Year 2014.

- $193 million in state sales tax losses
- $54 million in losses to border counties

A one percentage point reduction in Washington border county tax differentials results in a $583 million increase in taxable retail sales. This increase may or may not create additional sales tax revenues. A reduction in Washington border county tax rates will generally create a net sales tax loss because the tax lost from lower rates outweighs the increase in taxable retail sales. However, when the change is due to an out of state tax rate increase, both taxable retail sales and sales tax revenues can be expected to increase.

Statistical Analysis

History of Washington Cross-Border Literature

This analysis of lost sales tax revenues resulting from cross-border traffic follows a long line of related studies employing variety of methodologies.

- Wolman (1958) interviewed border county business people and compared Census Bureau data for retail sales and income in Washington non-border and border counties and in Oregon and Idaho border areas.
- McAllister (1961) surveyed and compared the purchasing behavior of 100 random persons in each of three Washington border cities and three non-border cities.
- Burrows (1982) expands on Wolman's methodology bringing far more data to the analysis and providing the first detailed comparison of per capita retail sales for selected Washington non-border and border counties.
- Brown's (1990) innovative econometric (statistical) analysis of 11 Washington border cities paired with their Oregon and Idaho neighbors derived both short term and long term border price elasticities.
- Beck's (1992) analysis used 39 county data to estimate elasticities for metropolitan areas and elasticities for non-metropolitan areas.
- Wooster and Lehner (2010) incorporated fixed-effects models and an interactive price variable that includes the relative price term and a binary border variable.

A brief discussion of the more pertinent results of these studies is found in the literature review at the end of this study.

Variables used in the Analysis

The factors that potentially influence retail activity are generally similar regardless of whether the issue is the purchases of specific retail items, such as cigarettes in the Department's cigarette study (Smith and Huynh, 2007,) or total retail sales of all taxable items, as in the present cross-border analysis. Though a large number of explanatory factors were investigated, the ones that were found to have significant effects on total retail sales are the very common factors described below.

Population and per capita income:
The most obvious factors that may influence the total amount of retail sales in a county or any region are that region's population (Pop) and per capita income (Inc). More people and greater incomes usually translate into greater sales amounts.

- The Population estimates used are from the Washington State Office of Finance and Management (OFM). Person counts from the Internal Revenue Service (IRS) were also tested and provided results that were almost as good.

Statistical Analysis

- The Income data used is from the IRS. The IRS data is more strongly correlated with the other model variables than alternative data from the U.S. Bureau of Labor Statistics. A number of IRS income related variables were tried in the modeling including, total income, adjusted gross income, and disposable income. The statistical results for these three were very close, but real total income had the best results.

Prices:

Prices (Price) are usually the next factor researchers look to. In this case the relevant prices are the general price level for all goods, as influenced by the differences between sales tax rates in the various counties and states. There's no reason to believe that the retailer cost of the goods on the shelves is noticeably different between Vancouver Washington and Portland Oregon, or between Spokane and Coeur d'Alene Idaho. So we can model the relative pre-sales tax prices of any specific good as $^1/_1$ in Vancouver and Portland and also on the Idaho border.

It can be assumed that the market baskets of items purchased in Washington, Oregon, and Idaho are similar. Hence, we can also model the average, relative pre-tax price of all retail goods as $^1/_1$.

Tax rates are likely the primary reason for price differences across Northwest state borders, particularly sales tax rates. We can model the relative price difference between a home county and a neighboring county that competes for sales revenues as:

$$\text{Relative Price} = P_H(1+t_H)/P_N(1+t_N)$$

Where:

t_H = the tax rate in the Washington State home county,
t_N = the tax rate in neighboring competitor county in Washington, Oregon, or Idaho,
$(1+t_H)$ = the general price level in the Washington State home county, and
$(1+t_N)$ = the general price level in the most likely lower tax neighboring competitor county in one of the 3 states, and
P_H and P_N are price indices for all goods in the home and likely neighbor counties.

Given similar costs of goods and market baskets, P_H/P_N, = $^1/_1$ and the price equation simplifies to:

$$\text{Relative Price} = (1+t_H)/(1+t_N).$$

Travel distance and costs:

Since the subject matter is casual cross-border shopping, traveling distance and related costs are the next likely factors to investigate. The distances between two shopping competitor counties, whether Washington counties or out of state locations, is based on mean center taxable retail sales and mean center Income data; the former is from Department tax data and the latter is from IRS data. Travel costs (Travel) were defined as the miles between locations multiplied by the real gas tax rate; annual regional gas prices were derived from data obtained from the American Automobile Association and the U.S. Energy Information Agency.

As in other studies, the travel costs did not consistently prove significant over the range of models tested; neither did alternative modeling approaches such as road miles or various measures based on the reciprocal of the square root of distance from the mean center of income.

Unemployment:

Unemployment (Unemp) is an economic variable closely related to income and typically important in economic and market studies. The unemployment variable used was county unemployment rates from the Washington State Employment Security Department (ES). Neither the amount of unemployment compensation declared on IRS returns, nor the percentage of such returns, was as reliable as the ES data.

Demographics:

Following population, income, and prices, researchers typically turn to demographic factors. Casual cross-border tax evasion is primarily based on economic incentives with ethnic, cultural, or social factors believed to have less influence on general taxable retail sales. Such factors are not specifically modeled, though they may exert some collective influence through the regional control variables.

The two demographic factors that were found to be significant, at least in some models, were the percentage of the population under the age of 19 (Youth) and the percentage older than 64 (Senior). Data for these two age variables also comes from OFM's population estimates.

Number of retail establishments:

The last factor that proved significant in explaining taxable retail sales was simply the number of retail establishments (Retailers) in each county per thousand persons. This measure is a proxy for the availability of a wide range of shopping choices.

Other variables tested that had less desirable results included the number of retail NAICS and the number of retailers per square mile (of land area).

Dependent variable:

In terms of the dependent variable, the quantity to be explained, a number of measures of real taxable retail sales were employed. The two that are reported here are real total taxable retail sales (Total TRS) and the best variable, in terms of statistical results, real taxable retail sales net of the construction and accommodations sectors (netTRS).

Other taxable retail sales variables tested for comparison purposes include real taxable retail sales for consumer durables, for construction, for accommodations, for food and beverage, for motor vehicles, and for all other types of retailers.

Dollar variables adjusted for inflation:

The dollar variables, taxable retail sales, income, and the gas price component of Travel, are in real terms (adjusted for inflation).

Models and Equations

A wide variety of variables and models were tested. In fact, the initial approach was specifically an attempt to avoid county level models and measure general parameters that applied to intra-county, inter-county, and inter-state markets, with the data disaggregated to 360 local sales tax jurisdictions and out of state locations. However, successive aggregations to deal with specification problems and improve results ultimately led back to a 39 county aggregation.

Model used:

The final model used for the results is a fixed-effects, cross-sectional time series model with a log-log specification.

- The *cross-sectional time series* nature of the model means that the data covers different locations (counties and states) and also spans a number of years. There are 39 Washington counties with seven years of data, 2005 through 2011, so the data would have 39 * 7 = 273 observations, but two have been omitted as outliers, leaving 271 observations.

  Note that two Garfield County observations were dropped for 2010 and 2011. Garfield is a small county and its taxable retail sales were swamped in those years by a large capital investment project. The impact on the results from omitting these is trivial. Garfield County is also assumed to border Idaho since Lewiston is the closest out-of-state shopping.

- The *fixed-effects* aspect of the model results from the remaining two variables, time (Years) and a set of regional indicators (Region) that control for other, unspecified regional specific factors that might influence retail activity (these region specific factors may be education, marital status, Internet use, etc.)

- The *log-log* nature of the model refers to the specific mathematical specification.

Linear equation:
Researchers' first choice in specifying a regression model is a linear equation since linear regression techniques are the most widely understood and have desirable properties. A linear (levels) specification of a model containing the variables above would be:

$$\text{TRS} = \alpha + \beta\text{Pop} + \chi\text{Inc} + \delta\text{Price} + \varepsilon\text{Travel} + \phi\text{Unemp} + \gamma\text{Youth} + \eta\text{Senior} + \iota\text{Retailers}$$

Where TRS is the dependent variable, α is the intercept, the Greek letters represent the parameters (coefficients) to be estimated, and the remaining terms are the independent variables that influence TRS.

Non-linear equation:
The model was converted into a non-linear model because of data non-linearity, and because these models performed much better in two respects:

1. Using non-linear logarithmic models, along with fixed-effects variables, provided greater explanatory power.

2. More of the expected economic variables were statistically significant, with higher confidence levels, and with stable parameters and reasonable signs.

Log-log model:
The linear model above is converted into a log-log, non-linear model by taking the natural log of those variables that are not percents, e.g.:

$$Ln\text{TRS}=\alpha(Ln\text{Pop}^{\beta} * Ln\text{Inc}^{\chi} * Ln\text{Price}^{\delta} * Ln\text{Travel}^{\varepsilon} * Ln\text{Retailers}^{\iota}) + \phi\text{Unemp} + \gamma\text{Youth} + \eta\text{Senior}$$

Where *Ln* represents the natural log of the variable, "$*$" stands for multiplication, and the superscripts are exponents.

The results also contain a similar semi-log specification where the dependent variable, TRS, is not in logarithmic form. In addition, two levels models are also presented for comparison purposes.

Statistical Analysis

Results

Table 6 presents the regression results for six different model specifications. The differences between the models are described below, and the table is on the following page.

Models 1 through 3:

Models 1 through 3 all use the same set of variables, but differ in form.

- Model 1 is a log-log (non-linear) equation and is in many ways the best model; it's the basis for the estimates shown in tables 3 to 5.
- Model 2 uses the same variables, but uses a semi-log equation.
- Model 3 also uses the same variables, but it's specified with a levels (linear) equation.

These first three models show how the movement from a levels model, to a semi-log, then a log-log model improves explanatory power, as evidenced by the increasing R-squares. In addition, more of the variables believed to influence the level of retail sales are significant in the log-log model.

Models 4 through 6:

Models 4 through 6 vary the basic framework further by changing the variables modeled.

- Model 4 uses the same log-log equation as Model 1 but does not include the regional fixed-effects variables and the year variables.
- Model 5 has the same specification as Model 1, except it uses the dependent variable TotalTRS rather than NetTRS.
- Model 6 uses a levels equation like Model 3, but the dependent variable is TotalTRS rather than NetTRS and it does not contain the regional fixed-effects variables and the year variables, as Model 3 does.

The results from these last three models provide further evidence supporting the notion that Model 1 is the best model tested.

T-statistic values:

The results also provide information about each variable tested. T-statistic values (t-values) larger than 1.96 (in absolute value) indicate that the associated variable is statistically significant at the 5 percent confidence level, a commonly used criterion. The level of confidence is indicated immediately to the right of each t-value with:

- 10% implying fairly good,
- 5% indicating a higher level of significance, and
- 1% implying better still.

Table 6
Selected Regression Results
Model 1, with the results used in Tables 3, 4, and 5, and Five other Comparison Models

	Model 1, Results Used in Tables 3 to 6	Model 2	Model 3
Specification	Log -Log	Semi-Log	Levels
Dependent Variable	*Ln* netTRS	netTRS	netTRS
R-square	0.774	0.750	0.701
Adjusted R-square	0.758	0.732	0.680
F value	47.89	41.89	32.82

	Model 1 *Ln* ?	Model 1 Parameter Estimate	Model 1 't' value	Model 1 sig. at	Model 2 *Ln* ?	Model 2 Parameter Estimate	Model 2 't' value	Model 2 sig. at	Model 3 Parameter Estimate	Model 3 't' value	Model 3 sig. at
Intercept		2.732	3.37	1%		-46,896	-6.72	1%	46,071.0	8.61	1%
Population	yes	0.243	11.65	1%	yes	1,615	8.98	1%	0.003	3.82	1%
Income/Capita	yes	0.262	3.94	1%	yes	3,229	5.65	1%	0.3	6.81	1%
Relative Prices	yes	**-4.510**	**-8.08**	1%	yes	**-33,191**	**-6.91**	1%	**-40,161.0**	**-7.67**	1%
Travel Cost	yes	0.001	0.03		yes	137	0.79		-1	-0.40	
Unemp. Rate		-3.027	-2.95	1%		-22,172	-2.51	1%	-10,914.0	-1.11	
Youth Percent		1.103	2.42	1%		6,295	1.60		6,819.2	1.57	
Senior Percent		2.652	4.38	1%		16,637	3.19	1%	205.9	0.04	
Retailers/1,000	yes	0.231	4.94	1%	yes	1,541	3.83	1%	2.2	0.70	
Region Binaries		significant				significant			significant		
Year Binaries		significant				significant			significant		

	Model 4	Model 5	Model 6
Specification	Log -Log	Log -Log	Levels
Dependent Variable	*Ln* netTRS	*Ln* TotalTRS	TotalTRS
R-square	0.614	0.724	0.530
Adjusted R-square	0.602	0.705	0.515
F value	51.97	38.97	36.86

	Model 4 *Ln* ?	Model 4 Parameter Estimate	Model 4 't' value	Model 4 sig. at	Model 5 *Ln* ?	Model 5 Parameter Estimate	Model 5 't' value	Model 5 sig. at	Model 6 Parameter Estimate	Model 6 't' value	Model 6 sig. at
Intercept		2.288	3.53	1%		3.489	4.49	1%	32,339.0	5.10	1%
Population	yes	0.137	6.60	1%	yes	0.166	8.29	1%	-0.001	-1.29	
Income/Capita	yes	0.440	6.61	1%	yes	0.339	5.31	1%	0.5	10.70	1%
Relative Prices	yes	**-2.689**	**-4.86**	1%	yes	**-3.634**	**-6.78**	1%	**-24,908.0**	**-4.26**	1%
Travel Cost	yes	0.013	0.54		yes	0.035	1.78	10%	8.6	2.27	5%
Unemp. Rate		-0.871	-1.30			-2.206	-2.24	5%	-12,427.0	-1.76	10%
Youth Percent		1.783	3.21	1%		-0.335	-0.77		-3,826.4	-0.61	
Senior Percent		1.231	1.74	10%		1.264	2.18	5%	-13,821.0	-1.91	10%
Retailers/1,000	yes	0.105	3.02	1%	yes	0.203	4.52	1%	2.9	0.80	
Region Binaries		not modeled				significant			not modeled		
Year Binaries		not modeled				2009 is significant			not modeled		

Notes:

- All dollar variables are real (the dependent TRS variables, Income, and gas prices in Travel Cost).
- The indicator Ln stands for the natural log of the variable.
- A "yes" in the “Ln?” columns implies that the associated independent variable is the log version.
- The "sig. at" columns show the significance level for variables that are statistically significant.
- The variable netTRS is TRS net of the construction and accommodations sectors.
- Relative price is bolded because it determines the responsive of TRS to the change in tax rates.

Statistical Analysis

Model 1 versus the Other Models:

Model 1 is a log-log model with both the dependent TRS variable and those independent variables that are not percentages specified as the natural log (*Ln*) of the original variable. The dependent TRS variable is therefore *Ln* real TRS net of the construction and accommodations sectors (*Ln* netTRS).

- The R-square and adjusted R-square statistics mean that Model 1 explains 76 to 77 percent of the variation in the TRS variable, the highest R-square obtained with the 2005-11 county data.

- The difference between the R-square and adjusted R-square is trivial, 0.016, implying that important explanatory variables are unlikely to be missing from the equation.

- The high F-value implies a trivial probability, 1 in 10,000, that TRS is unrelated to the other variables.

Travel:

All of the variables in Model 1 except for Travel can be said to be statistically related to TRS. Variables not included in the model were generally not statistically significant. Travel was rarely significant in any model and the sign often switched from plus to minus, results commonly found by other researchers.

Population, Income, and Retailers:

Population, Income, and Retailers have positive parameter estimates (coefficients) in Model 1 and the other models, as expected. They are also statistically significant in the first five Models. Population is not significant in Model 6.

Relative price and unemployment:

The relative price variable and the unemployment rate have the expected negative signs in all models. Price is statistically significant in all models too, but unemployment is not significant in Models 3 or 4.

Age demographic:

Youth and Senior are significant in Model 1, but show more uncertain results in the other models. The Youth variable is positively related with TRS, as expected. Young families with children tend to establish new households and purchase household goods, clothing, etc.

The Senior variable is also positive, and is positive in most models. This is unexpected in that seniors have historically had less than average spending due to fixed incomes and fewer household purchases.

Statistical Analysis

This dataset is dominated by the economic swings of the “great recession” and its aftermath which may have altered spending patterns. The lack of jobs has arguably hit family formation and may have affected spending by families with young. Meanwhile, there are some indications that fixed incomes may have allowed seniors to experience less income variability over this period than other households. In addition, seniors who cannot afford to retire due to expected lower incomes, resulting from reduced interest rates on savings and reduced pension valuations, may find that their incomes as full-time employees provide for greater spending than is typical of retirees.

Regional fixed-effects variables and the year variables:

There is a notable improvement in R-square between Models 4 and 1. The only specification difference between the two is that Model 1 includes the regional fixed-effects variables and the year variables. Just the inclusion of these two sets of variables raises the R-square by 16 points, from 0.614 to 0.774. A similar improvement can be seen between Models 6 and 3, though the dependent variables also differ (tests using the same dependent variables do show similar improvements.) This improvement in model explanatory power is representative of all the models tested that incorporate regional and year variables.

The regional control variables that were statistically significant in nearly all models tested were:

- Region 1 = King, Pierce, and Snohomish
- Region 2 = the Olympic Peninsula
- Region 3 = Benton, Franklin, and Walla Walla
- Region 4 = Ferry, Lincoln, Stevens, and Pend Oreille

Other regions were generally not statistically significant and tended to have parameters that would change signs.

Dependent variable TotalTRS versus NetTRS:

The second interesting comparison concerns the use of TotalTRS as the dependent variable versus the netTRS version (which has the TRS for the construction and the accommodations sectors netted out). The reason for using netTRS in is that construction and accommodations are not typical retail activities and are influenced by different variables or in different ways.

Using netTRS as the dependent variable has a small effect on R-square, raising it from 0.724 in the otherwise identical Model 5, to 0.750 in Model 2. In addition, Model 2 improves the statistical significance of the unemployment and senior variables. Meanwhile, the unstable travel cost variable, which has the wrong sign implying that higher cost induces more travel for shopping purposes, is not significant in Model 2; this is a preferable result. These results are also typical of other models that were tested.

Calculating Impacts from the Model Results

Since the focus of this study is the relationship between sales tax rates and taxable retail sales, the most important variables are the dependent TRS variables and the relative price variable, the latter incorporating relative tax rates. The relative price variable is bolded for all models in Table 6. The TRS and sales tax estimates presented in this study depend entirely on the parameter (coefficient) estimates for Price.

Price:

The Price coefficient is estimated to be -4.5 in Model 1 implying that if the price (tax rate) difference goes up, the TRS variable will decline. In a log-log model such as this the parameter value is the elasticity of the dependent variable with respect to the independent variable; it's an easy-to-use measure of the influence of Price on netTRS per capita. A 1% difference in the relative price implies a 4.5% difference in the opposite direction for netTRS per capita. Note, a 1% change in the relative price should not be confused with a one percentage point change in the tax rate itself because the relative price variable is defined as $(1+t_H)/(1+t_N)$.

To show an example of the results assume that Clark County's population is 415,000, the netTRS per capita is $8,000, and the average tax rate is 8%. Since Oregon's tax rate is zero Clark County's prices can be assumed to be 8% higher. To measure the effect on netTRS we use the estimated parameter of (-)4.5, e.g.:

netTRS per capita = 4.5 * 8% * $8,000 = $2,880 per capita (a loss.)

Multiplying by the population then yields a total loss of $1.2 billion, a figure very close to the one in Table 4 (this example uses approximations for simplicity).

Differences between Model 1 and Model 4:

Model 4 also uses the dependent variable *Ln* netTRS, but unlike Model 1 it has no regional or year variables. The parameter estimate for the relative price variable in Model 4 , however, is only -2.7 which is only 60% of the -4.5 estimated in Model 1. This means that the estimated taxable retail sales at issue are also estimated to be only 60% as large. Model 1, though, is the better estimate since it has a significantly higher R-square.

Differences between Model 1 and Model 5:

Model 5 also uses a log-log specification like Model 1, but its Price coefficient (elasticity) is estimated to be -3.6. Does this imply an estimated TRS only 3.6/4.5, or 80% of Model 1's estimate? No, because the dependent variable is Total TRS where Model 1 uses netTRS (net of construction and accommodations). Total TRS is greater than netTRS by definition and 3.6 times Total TRS yields an estimate for lost TRS that is almost identical to that of Model 1. Note that Model 5 is the one that is most similar to the Wooster and Lehner model, though it lacks their second price variable with the border binary; Model 5's elasticity of -3.6 is similar to their estimated elasticity of -3.11.

Model 1 and Model 3:

Model 3's results, though calculated differently, estimate lost taxable retail sales in border counties as $2.78 billion. This is very close to Model 1's estimate of $2.97 billion which further reinforces the conclusion that the modeling effort is on the right track.

Conclusion

This analysis estimates that casual cross-border evasion will cost the state $3 billion in taxable retail sales and $247 million in state and local sales tax losses in Fiscal Year 2014.

- $193 million in state sales tax losses
- $54 million in losses to border counties

The effects of reducing Washington border tax differentials by one percentage point are:

- $583 million in additional taxable retail sales
- $ 38 million in additional state sales tax revenues
- $ 11 million in additional local sales tax revenues
- $ 49 million in additional state and local sales tax revenues

The results found in this study are robust; the estimated amount of lost TRS is consistent across the range of models tested. The results are also consistent with previous, comparable results of other researchers, as summarized in Table 7.

Table 7
Comparison with Prior Research

Study Results Compared to Prior Research	Current Loss (Potential Gain) in Border County Taxable Retail Sales (Percentage Basis)
This DOR Study (2014)	14.8%
Wooster & Lehner (2010)	12.7%
Beck (1992)	21.8%
Brown (1990)	13.0%

Review of Related Washington Cross-Border Tax Evasion Literature

Wolman (1958)

Wolman, William. "The Impact of Washington's Tax Structure on The State's Border Areas," A Report Submitted to the Tax Advisory Council of the State of Washington, May, 1958.

Wolman described the history of the State's border regions and interviewed business people about the competitive environment. He used Census Bureau data to compare retail sales as a percent of income in Walla Walla, Clark, Whitman, and Asotin counties with similar non-border counties. Retail sales were broken out by ten categories of retailer. Wolman compared the 1948 to 1954 growth in retail sales for these counties with the growth in counties on the other side of the border, except that Clark was compared with the same non-border counties. The conclusion was that Washington border county retail sales as a percent of income were less than in non-border counties and that and the growth of retail sales were less than in adjacent out of state border areas.

McAllister (1961)

McAllister, Harry E. "The Border Tax Problem in Washington," *National Tax Journal*, Vol. XIV, No 4, December, 1931.

McAllister conducted a survey of 100 random persons each from Vancouver, Walla Walla, and Pullman, as well as from a non-border control city for each, to find out where people made their last purchase of various categories of goods. In addition, the survey asked for the reason that residents made the purchases where they did. Was it because of selection, price, or because it was not reasonable to purchase in that location--or was it to avoid sales tax, or some combination of these? McAllister concluded that escaping the sales tax is the dominant position in people's minds when they make purchases in out of state counties. However, McAllister also found that the some purchases were motivated by the selection of goods and convenience.

Burrows (1982)

Burrows, Donald R. "Impact of Washington Taxes on Border Areas," a Department of Revenue Report to the Senate Committee on Ways and Means, in fulfillment of SR 1981-162, March 9, 1982.

Burrows expanded on Wolman's approach, but brought far more description and data to the analysis including those counties with Canadian land borders. In addition to Wolman's four border counties the report categorizes the remaining border counties into other urban and other rural border counties. The Burrows report is also the first to compare per capita taxable retail sales and to look at retail sales by all of the other sectors in the economy. Data is detailed by nine broad industry sectors that encompass everything in the economy but general government, and with the retailing sector divided into eight subsectors. The report contains no estimates for lost taxable retail sales, but is worth the detailed descriptions of the individual areas and the different economic situation faced by each.

Literature Review

Brown (1990)
Brown, Lorrie. "The Effects of Tax Rate Differences on Retail Trade in Washington Border Counties," Washington State Department of Revenue Research Report #90-5 – Revised, June 5, 1990.

Brown's cross-sectional econometric model of 11 Washington border cities paired with their Oregon and Idaho neighbors estimated that equalizing the tax differential would increase short run TRS by $369 million with an additional $92 million effect in the long. Brown also separately estimated lost TRS in the consumer durables sector. The use of a lagged explanatory variable allowed the estimates of a short run elasticity of -1.7 and a long run elasticity of -2.4.

Beck (1992)
Beck, John. "The Border Tax Problem in Metropolitan and Non-metropolitan Areas of Washington," Western Tax Review, Winter 1992.

Beck estimated a range of elasticities for counties in nonmetropolitan areas and a range for those bordering metropolitan areas (Portland Oregon). Elasticities were higher in the latter, as were lost sales taxes.

Wooster and Lehner (2010)
Wooster, Rossitza B., Lehner, Joshua W. "Reexamining the Border Tax Effect: A Case Study of Washington State," *Contemporary Economic Policy*, Vol. 28 Issue 4, October2010.

Wooster and Lehner used fixed-effects models and employed two relative price variables, the standard $(1+t_H)/(1+t_N)$, and an additional price variable that multiplies the standard price component by a binary border term. Wooster and Lehner also employ a spatial lag analysis and determine that their sample has no significant spatial dependence.