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Fiscal Impacts and Cross-Border Effects of a Change in State Liquor Policy

Philip Watson,[aΦ] Jason Winfree,[b] and Daniel Toro-González[c]

[a]*Associate Professor, Agricultural Economics and Rural Sociology,*
University of Idaho,
Moscow, Idaho 8344, United States

[b]*Associate Professor, Agricultural Economics and Rural Sociology,*
University of Idaho,
Moscow, Idaho 8344, United States

[c]*Professor, Economics and Business,*
Universidad Tecnológica de Bolívar,
Cartagena de Indias, Columbia

Abstract

This paper analyzes the economic effects of the 2012 change in liquor policy (Initiative 1183) in Washington State in the United States. This policy increased the availability of liquor but also increased taxes on liquor in Washington. This research provides some evidence that the quantity of liquor sold in both Washington and Idaho increased, suggesting that availability/convenience effects can outweigh tax/price effects. Furthermore, the cross-border spillover effects are isolated to the nearest store to the border.

Keywords: fiscal impacts, liquor policy, regulation, spatial spillovers, vertical restraints

ΦCorresponding author: Tel: (208) 962-1312
Email: pwatson@uidaho.edu

Introduction

Liquor policy in the United States has had a contentious history; federal, state, and local governments at various times have all attempted to simultaneously promote temperance while also viewing liquor as an important industry and a valuable source of tax revenue.[1] Due to this dual nature, there are a variety of strategies employed across jurisdictions to regulate liquor sales including "sin taxes," "blue laws," alcohol level limits, point-of-sale restrictions, and full-on state ownership and monopolization of liquor stores. While the federal government has historically (and infamously) exerted influence on liquor regulation and some local jurisdictions have voted to be "dry" and outlaw the sale of liquor outright, the vast majority of liquor controls now reside with individual state governments. Regulatory strategies that individual states employ can also change over time and can vary widely between bordering states. One such example of the differences in liquor laws is between Washington and Idaho, the result of a 2012 policy change in Washington. We analyze liquor (here defined as a beverage sold for human consumption that exceeds 24% alcohol by volume) data from 2010–2014 and quantify the effects of this change in both Washington and Idaho.

U.S. Liquor Policy Background

Liquor policy in the United States has been a central component of the larger domestic food policy for decades (Rorabaugh, 1991; Hogeland, 2010).[2] After the repeal of Prohibition in 1933, domestic liquor policy and regulation were largely left to individual states and even local jurisdictions. Subsequent to the repeal of Prohibition, liquor laws varied widely between bordering states, counties, and even townships, creating significant border effects, which have been well documented in the literature (Asplund, Richard, and Wilander, 2007; Chiou and Muehlegger, 2008). More specifically, there has also been a limited previous literature on border effects and spatial spillovers in liquor demand. Beatty, Larsen, and Sommervoll (2009) find evidence for tax avoidance behavior across international borders in Europe. Stehr (2007) finds significant in-state and cross-state effects of a repeal in Sunday liquor sales policies.

More recently, the U.S. government has attempted to reign in some of the variation in liquor policy across states and regions, most notably in the area of minimum drinking age. Prior to the National Minimum Drinking Age Act of 1984, the legal age to consume alcohol varied greatly from state to state. This created additional border effects, where underage drinkers in one state could drive across the border to consume alcohol in a bordering state, creating drunk driving and public safety concerns. The act used tax incentives and penalties, especially federal disbursements of transportation funding, to ensure that all states abide by the guidelines to keep their minimum drinking age at 21, thus reducing some of the border effect problems.

[1] One of the charges of the Idaho State Liquor Division (the legal regulatory board for the state of Idaho) is to "curtail the intemperate use of alcoholic beverages" (Section 010.11 of Idaho Administrative Code 15.10.01).

[2] Liquor was also responsible for one of the first federal food quality standards in the U.S. food industry. A decade before the more famous Pure Food and Drug Act of 1906, the Bottled in Bond Act of 1897 established food quality standards and liquor taxation regulations for U.S. whiskey production (High and Coppin, 1988).

However, states and local jurisdictions are still granted wide latitude in liquor taxation and regulation. As of early 2020, seven states (Alabama, Idaho, New Hampshire, North Carolina, Pennsylvania, Utah, and Virginia) outright restricted liquor sales to state-owned (and/or state-regulated) liquor stores. Until 2012, the state of Washington was also in this group. An additional ten states (Iowa, Maine, Michigan, Mississippi, Montana, Ohio, Oregon, Vermont, Wyoming, and West Virginia) permit liquor to be sold in private stores, but the state controls the distribution and wholesale of liquor in the state, effectively controlling the minimum price of liquor in the state. Further, three states (Maryland, Minnesota, and South Dakota) currently allow local jurisdictions and municipalities to establish control of their liquor distribution and sales. Due to the heterogeneity of liquor policies across states and local jurisdictions, liquor provides some opportunities to look how policy changes effect behaviors and demand for a food and beverage product. While previous literature on tax differentials between adjacent municipalities have shown little effect on consumer behavior (Burge and Rogers, 2011; Rogers, 2004), this study analyzes not only a change in liquor taxation but also a change in liquor management across a state border. This policy change had a significant effect on the real price of liquor between the states but also introduced increased convenience in liquor purchase in Washington.

Specific Policy Addressed

Voters in the state of Washington passed a liquor privatization law (Initiative 1183) in November 2011; the law took effect on June 1, 2012. Prior to this change in regulation, liquor (technically referred to as "spirits" in Washington State statutes is defined as having over 24% alcohol by volume) in Washington was exclusively sold in state owned and regulated liquor stores. Initiative 1183 dismantled the state-owned system and allowed privately owned stores to acquire a license to sell liquor. Further, the initiative placed few restrictions on who could acquire a liquor license, and many existing convenience stores and grocery stores began selling liquor in addition to newly opened private liquor stores.

For comparison, in 2010, 1 year prior to the law change, there were 226 state-owned or contracted liquor stores in Washington. By 2013, the number of establishments permitted to sell liquor for off premise consumption grew by a factor of 6, to 1,422 licensed vendors of liquor. Conversely, Idaho has maintained a state-run liquor system in which all liquor must be sold through dedicated liquor stores, most of which are owned and operated by Idaho; a small minority of the liquor stores in Idaho are privately owned and operated but still subject to state pricing and operational constraints.

Initiative 1183 had a significant effect on the price of liquor in Washington. After factoring in all applicable taxes and fees—including all liquor taxes—the average retail price per liter of liquor in Washington jumped 15% from January 2012 (before the law took effect) to January 2013 (after the law took effect). The new taxes included a retail license (with both fixed and variable costs), increased penalties for sale violations, and a distributor license fee (Ferraro, 2015). This change in liquor policy in Washington State represents a natural experiment which enables us to formally analyze how liquor policy changes affect neighboring jurisdictions and how those neighboring jurisdictions respond to their neighbors' actions. We are also able to estimate fiscal impacts of the policy change on both Washington and Idaho.

While previous studies have found an impact on demand for liquor in Idaho due to Washington's policy change (Winfree and Watson, 2015; Ye and Kerr, 2016), this study uses more detailed and disaggregated data to calculate exactly where and how the impacts occurred and how liquor sales changed in Washington. Not only did an increase in taxes change the price of liquor in Washington, but it also changed the way liquor was sold. After the initiative, liquor was more available to consumers since it was sold in privately owned stores, including many grocery stores. This changed the market and made liquor more convenient to purchase and therefore changed demand. This study shows that after the policy there was both an increase in demand for liquor in Washington and a price increase. Therefore, we disaggregate the changes in Washington tax revenue due to the shift in demand and the price change. Adding complexity and interest to this analysis, months after the policy change took place in Washington, in response, Idaho built a new liquor store very close to the border. This study more closely estimates how much of the change in revenues in Idaho was due to Washington's policy change and how much was due to Idaho's response in building a new store.

The policy change had an impact on both supply and demand for liquor in Washington State. We assume that given the market structure, the supply of liquor is flat and depends upon the tax structure. We assume that supply of liquor is flat for our region because, as opposed to the demand for liquor which is highly localized and distribution is highly regulated, the supply of liquor is highly competitive and competes in global market, of which our region represents a very small portion. Therefore, the policy change causes supply of liquor to increase from S_1 to S_2, as shown in Figure 1. We also assume that demand for liquor in grocery stores is higher than demand for liquor at state-run liquor stores due to increased convenience, and therefore goes from D_1 to D_2 . This implies that the policy change increased the price of liquor but the directional change in quantity depended on the elasticity of demand.

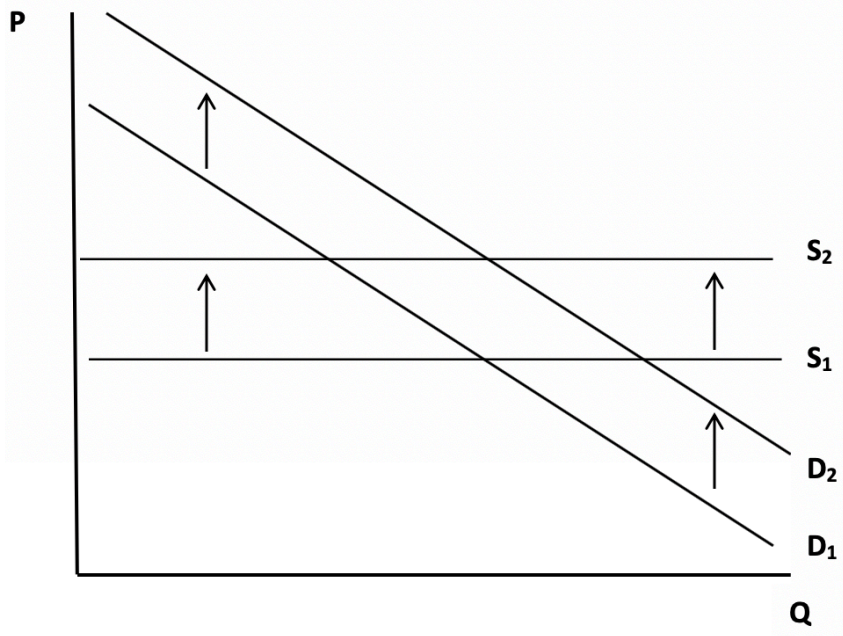

Figure 1. Change in Supply and Demand of Liquor in Washington State from Policy Change

There is a long literature on spatial spillovers resulting from policy changes in adjoining jurisdictions (Anselin, Varga, and Acs, 1997; Ying, 2000; Geys, 2006; Feng and Patton, 2017). These spillover effects are often estimated on proximal (e.g., contiguous or nearest) jurisdictions (e.g., states, counties, regions) using spatial econometric techniques. However, very few analyses have the establishment-level spatial data needed to estimate the geographic extent to which these spatial spillover effects extend. While it is commonly understood that policy changes in one jurisdiction will affect neighboring jurisdictions, these effects are almost always estimated as an aggregate effect across the entire neighboring jurisdiction. In the case of state liquor policies, it may be that spatial spillovers extend across the entire state, may be limited to neighboring counties, or may be limited to specific stores that are closest to the border. The specific dataset employed here allows us to estimate how far the spatial spillover effect of a change in Washington liquor policy extends into Idaho.

The first step in analyzing those effects is to understand the nature of the demand for liquor in both Washington and Idaho. Relative to previous studies of the demand for liquor, the analysis presented here uses much more disaggregated data and allows for a more robust investigation into the determinants of demand for liquor and the fiscal impacts of state policy changes. More specifically, we are able to isolate the effect of the policy change on specific stores in Idaho and determine the spatial extent of the impacts of the policy change on Idaho and evaluate the effectiveness of Idaho's response to Washington's change in liquor policy. After estimating the demand for liquor in both states, we then estimate the fiscal and economic impacts of changes in Washington's liquor laws and investigate the effectiveness of Idaho's response to the policy changes in Washington. The various impacts are important for both researchers and policy makers.

Liquor Demand Background

The demand for liquor has been extensively estimated using a variety of frameworks and estimated across many nations (Selvanathan and Selvanathan, 2005). Demand for liquor has often been estimated in a system of equations with the assumed substitutes of beer and wine (Gallet, 2007). In a meta-analysis of beer, wine, and spirits studies, Fogarty (2010) found that, while there is a significant difference in own-price and income elasticity estimates for liquor, there was no statistically significant difference based on methodology employed by the various studies, including single time frame cross-sectional studies, versus other demand estimates nor between panel data models versus simultaneous equation models.

Fogarty (2010) reported own-price elasticities ranging from −0.3 to −1.7; own-price elasticities and income elasticities were found to be becoming less inelastic over time. Fogarty (2010) also reports that there is little substitution between types of alcoholic beverages and that consumers respond to prices changes by stocking up on preferred liquors. Even within different products in the same category, Toro-González, McCluskey, and Mittelhammer (2014) indicate that beer is a normal good with a demand that is inelastic to changes in prices and almost no substitution across types of beer (mass, craft, and import). A particularly noteworthy study by Baltagi and Griffin (1995) used panel data for aggregate liquor consumption and process across 43 U.S. states and 23

years. Their results found an own-price elasticity of aggregate liquor demand of −0.7 and very small positive income elasticities.

Ruhm et al. (2012) argue that many previous studies of liquor demand are unreliable due to their suspect data source for liquor prices and quantities or because of their dependence on liquor tax data as a proxy for liquor sales volume and prices. They indicate that scanner data is needed to provide an accurate and reliable estimate of liquor demand. Additionally, many previous studies have relied on ACCRA data of quarterly index prices for liquor across approximately 300 metropolitan areas in the United States (Williams, Chaloupka, and Wechsler, 2005; Arcidiacono, Sieg, and Sloan, 2007). However, as many studies have pointed out, these data are subject to numerous limitations and measurement error issues (Young and Bielinska-Kwapisz, 2003).

The income and employment relationship with liquor demand is also a point of controversy in the literature. Some studies have found that alcohol consumption is positively correlated with job losses and losses in income (Mulia et al., 2014; Cotti, Dunn, and Tefft, 2015), while other studies have found alcohol consumption to be a normal good, where demand rises with income and job stability (Ruhm, 2007; Evans and Moore, 2012). The study described in this paper differentiates itself from this literature in the detail of the data, both in geographic resolution and in the specificity of the liquor transactions.

Data and Model

For this study, we use monthly liquor transaction data for both Washington and Idaho. Data from Washington are aggregate monthly data of total state-wide liquor sales across a 10-year period. The data for Washington were provided by the Washington State Liquor and Cannabis Board and consisted of 127 total observations of monthly liquor sales and prices in liters from November 2003 to May 2014.[3] Due to these data limitations, the model for Washington is somewhat simpler, with our unit of observation consisting of the quantity (in liters) of liquor sold in Washington in month *k*, and year *l*. The Washington model is estimated as a reduced linear functional form as follows:

$$(1) \quad \ln\left(Q_{kl}\right) = \propto + \beta \ln\left(P_{kl}^{o}\right) + \gamma \ln\left(I_{kl}\right) + \delta \ln\left(E_{kl}\right) + \vartheta \ln\left(P_{kl}^{s}\right) + \varphi\left(W_{kl}\right) + \psi\left(M_{k}\right) + \omega\left(T_{l}\right) + \mu,$$

where Q_{kl} is the quantity of liquor sold in liters in month *k* and year *l*, P_{kl}^{o} is the own price of liquor, I_{kl} is real per capita personal income, E_{kl} is the unemployment rate, P_{kl}^{s} represent price index vectors for beer and wine included as prices of substitute goods, W_{kl} is an indicator variable equal to 1 if it is after the Washington initiative was enacted and 0 otherwise, M_{k} is a month fixed effect, and T_{l} represents both a linear monthly trend and a quadratic monthly trend variable. μ represents a random error with 0 mean and constant variance.

[3] Data are also available for June and July 2014; however, there seem to be anomalies in the data. Therefore, those two observations were dropped. This does not change the statistical significance of any variable.

The data for Idaho are more detailed and represents every liquor transaction at every liquor store over a 5-year period in Idaho. The Idaho data have many advantages over data used in previous studies of the demand for liquor. As opposed to the scanner data used in Ruhm et al. (2012) and Toro-González, McCluskey, and Mittelhammer (2014), the Idaho data are detailed to the individual bottle (brand, type, and size) and capture all liquor transactions at the store level of detail across the entire state, including both urban and rural areas. Minimum sales prices of liquor in Idaho are set by the Idaho State Liquor Division. Individual stores have the latitude to charge a higher price than the state minimum but not a lower price. In practice, only a very small fraction of stores ever charge a different price for a given bottle than the state minimum.

The Idaho data for this study came from the Idaho State Liquor Division and represent all of the individual liquor store transactions that took place from July 2009 through June 2014. We aggregated these transactions so that our unit of observation is quantity of liquor sold by type (*i*),[4] store (*j*), month (*k*), and year (*l*), which gives us 63,219 observations. Data on unemployment were obtained from the U.S. Bureau of Labor Statistics; per capita income data and consumer price index values for beer and wine were obtained from the U.S. Bureau of Economic Analysis.

The model for Idaho is as follows:

$$(2) \quad \ln\left(Q_{ijkl}\right) = \propto + \beta \ln\left(P^{o}_{ijkl}\right) + \gamma \ln\left(I_{jkl}\right) + \delta \ln\left(E_{jkl}\right) + \vartheta \ln\left(P^{s}_{kl}\right) + \varphi\left(W_{kl}\right) + \rho\left(S_{j}\right) + \psi\left(M_{k}\right) + \omega\left(T_{l}\right) + \lambda\left(L_{i}\right) + \mu,$$

where Q_{ijkl} is the quantity of type *i* liquor sold in liters in store *j* in month *k* and year *l*, P^{o}_{ijkl} is the own price of liquor,[5] I_{jkl} is real per capita personal income in the county where the store is located, E_{jkl} is the unemployment rate in the county where the store is located, P^{s}_{kl} represent price index vectors for beer and wine included as prices of substitute goods, W_{kl} is an indicator variable equal to 1 if it is after the Washington initiative was enacted and 0 otherwise, S_{j} is a store fixed effect, M_{k} is a month fixed effect, T_{l} is a linear and quadratic monthly trend, and *L* is a liquor type fixed effect.[6] For reasons explained later in the text, one store (store #304) was split into three indicator variables. μ represents a random error. Both estimations used robust standard errors.

Results

Summary statistics for the variables used in the Washington and Idaho analysis are presented in Tables 1 and 2, respectively. The results of the demand model for Washington are presented in Table 3, and the results for the demand model in Idaho are presented in Table 4. Table 3 shows an own-price elasticity estimate of −0.978 for Washington liquor, which is quite close to the estimate of −1.008 for Idaho shown on Table 4. Table 3 and Table 4 show income effects are positive and

[4] This includes American whiskey, Irish whiskey, blends, Canadian whisky, Scotch whisky, brandy, rum, gin, vodka, specialties, crème liqueurs, cordials, schnapps, vermouth, fortified wine, and tequila. For the analysis, American whiskey was the omitted variable type.

[5] This price represents an average that is weighted by volume.

[6] County-specific demographic variables such as religious adherence, race, and rurality were initially considered but were replaced with store-level fixed effects to control for the broadest set of geographically specific effects possible.

significant for both states. The effect of unemployment on liquor sales is negative and significant in Idaho but positive and not significant in Washington. Liquor is not a statistically significant substitute for either beer or wine in Washington, but liquor is a statistically significant substitute for wine in Idaho. Both estimations show a dramatic increase in liquor demand in December.

Table 1. Summary Statistics for Variables in the Washington Model (N = 127)

Variable	Mean	Std. Dev.	Min.	Max.
Log of liters sold	14.90	0.15	14.58	15.32
Log of own price per liter	2.77	0.05	2.63	2.91
Log of per capita personal income	10.75	0.03	10.67	10.81
Log of unemployment rate	1.91	0.26	1.53	2.34
Log of consumer price index for beer	5.37	0.02	5.32	5.40
Log of consumer price index for wine	5.22	0.04	5.13	5.28
Policy dummy for months after privatization in WA	0.19	0.39	0	1
Trend	64	36.81	1	127

Table 2. Summary Statistics for Variables in the Idaho Model (N = 63,219)

Variable	Mean	Std. Dev.	Min	Max
Log of liters sold	12.31	1.47	5.93	16.82
Log of own price per liter	2.91	0.36	2.22	3.71
Log of population by county by year	11.47	1.26	8.95	12.96
Log of per capita personal income	10.53	0.17	10.13	11.19
Log of unemployment rate	2.02	0.31	1.31	3.02
Log of consumer price index for beer	5.38	0.01	5.36	5.40
Log of consumer price index for wine	5.18	0.04	5.13	5.26
Dummy for month 36 to 39 for store 304	<0.01	0.03	0	1
Dummy for month 40 to 60 for store 304	0.01	0.07	0	1
Policy dummy for months after privatization in WA	0.11	0.32	0	1
Trend	30.53	17.31	1	60

Policy Impacts on Washington

First we estimate the impacts of the policy on Washington State. The estimates from Table 3 show that there was an increase in demand for liquor after the policy change that is statistically significant at the 5% level but not the 1% level. Presumably this illustrates that demand for liquor stores is higher at grocery stores than compared to stores that only sell liquor, which increased demand by 12.41%.[7] This may be due to the convenience of grocery stores relative to dedicated liquor stores, which have more limited hours and require a separate trip. However, the policy also increased prices, so changes in quantity demanded are less pronounced. Although far less liquor transaction data are available for Washington than for Idaho, the available data allows us to

[7] $e^{0.117} - 1 = 0.1241$.

estimate both the shift and movement along the demand curve from the change in policy. Figure 2 shows that even with increased prices, volume sold increased, is in line with the statistically significant increase in demand. Figure 3 illustrates that there was a change in the average price to consumers (including the liquor specific taxes paid by consumers at the point of sale) immediately after the policy change. Figure 4 shows that there may have also been a slight increase in tax revenue after the policy, but it is important to keep in mind that the policy impacted many types of taxes; these data may not account for all the taxes in the same manner, pre- and post-policy. It is therefore difficult to know the actual changes in tax revenue.

Table 3. Determinants of Demand for Liquor in Washington ($N = 127$)

Washington Model	**Log of Liters Sold**
Log of own price per liter	−0.978**
	(0.292)
Log of per capita personal income	0.729*
	(0.312)
Log of unemployment rate	0.039
	(0.047)
Log of consumer price index for beer	0.527
	(0.456)
Log of consumer price index for wine	0.090
	(0.411)
Policy dummy for months after privatization in Washington	0.117*
	(0.052)
Trend	0.004**
	(0.001)
$Trend^2$	−0.00001
	(0.00001)
	(0.030)
Constant	6.090
	(4.179)
R^2	0.92

Note: Single and double asterisks (*, ** indicate significance at the 5% and 1% level. Month fixed effects are included as controls but the results are not reported.

Before the change in policy, monthly average tax revenues were $19,330,072, and post policy they were $22,821,137 (in 2014 dollars). This represents an increase in tax revenue of 18.1%, or $3,491,065. However, since the price changed via taxes and availability went from liquor stores to grocery stores, the cause of this increase is not clear. In fact, if the tax revenue after the policy is accounted for differently, this may not be a reliable estimate. Therefore, we use the demand estimation to disaggregate the effects.

Given a prepolicy average monthly tax revenue of $19,330,072, an increase in demand of 12.41% is equal to $2,398,862. However, it is crucial to note that besides a shift in demand, prices also increased due to tax increases. The estimates from Table 3 also show the price elasticity of liquor in Washington State to be −0.978. Since the average tax rate before the policy was 42.28%, the

Table 4. Determinates of Demand for Liquor in Idaho (N = 63,219)

Idaho Model	**Log of Liters Sold**
Log of own price per liter	−1.008**
	(0.038)
Log of per capita personal income	0.349**
	(0.111)
Log of unemployment rate	−0.472**
	(0.025)
Log of consumer price index for beer	0.487
	(0.375)
Log of consumer price index for wine	0.767**
	(0.281)
Log of the county population by year	0.503**
	(0.169)
Policy dummy for months after privatization in Washington	0.013
	(0.007)
Dummy for month 36 to 39 for store 304	0.345**
	(0.050)
Dummy for month 40 to 60 for store 304	−0.284**
	(0.030)
Trend	0.003**
	(0.001)
Trend^2	−0.0001**
	(0.00001)
Constant	1.474
	(3.269)
R^2	0.92

Note: Single and double asterisks (*, ** indicate significance at the 5% and 1% level. Store, month, and liquor type fixed effects are included as controls but results are not reported.

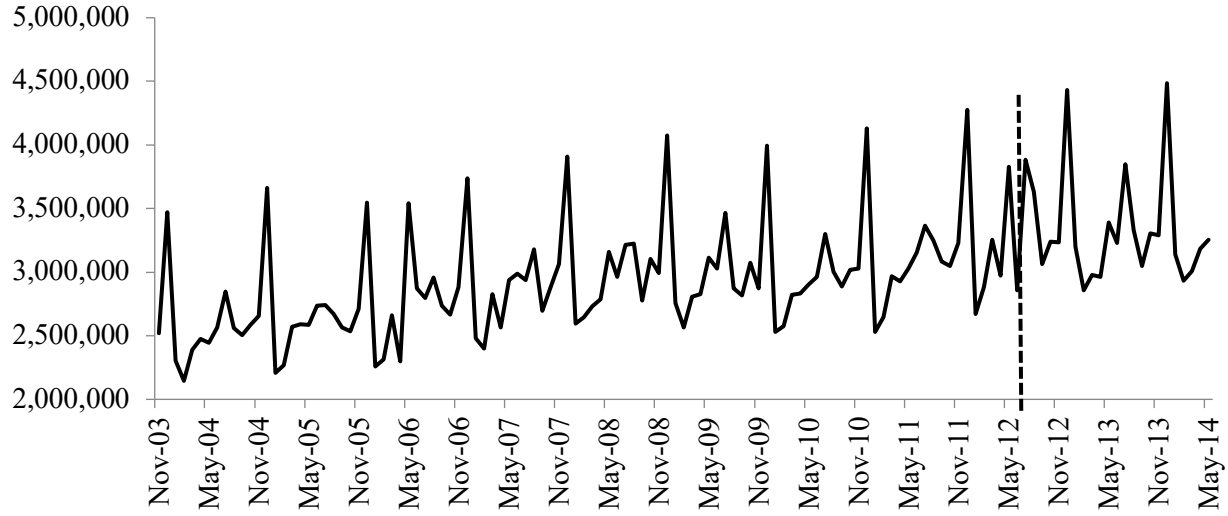

Figure 2. Liters Sold in Washington

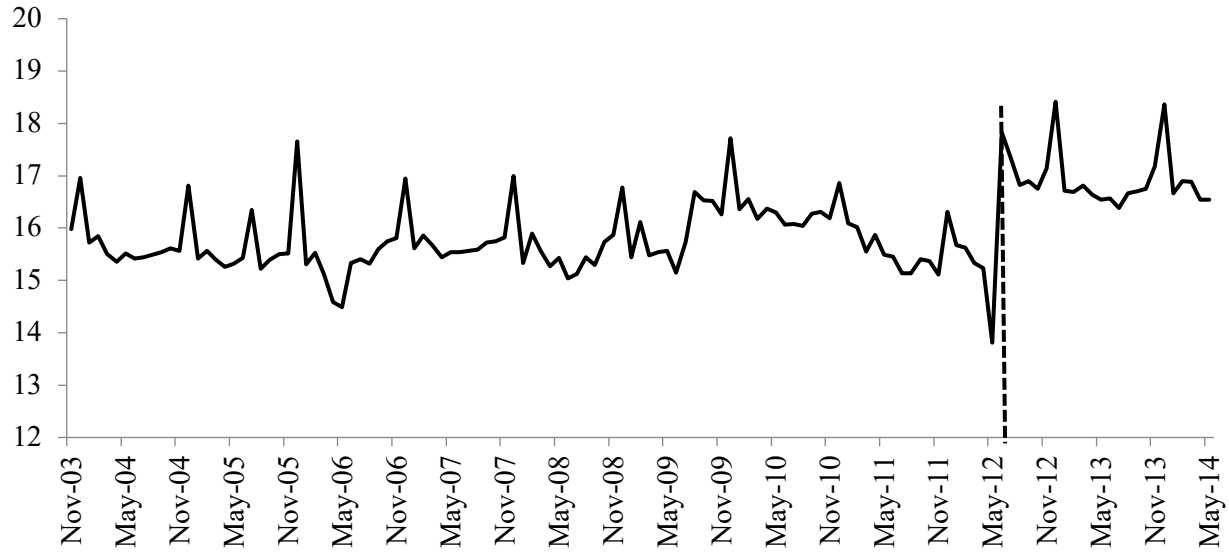

Figure 3. Average Prices in Washington

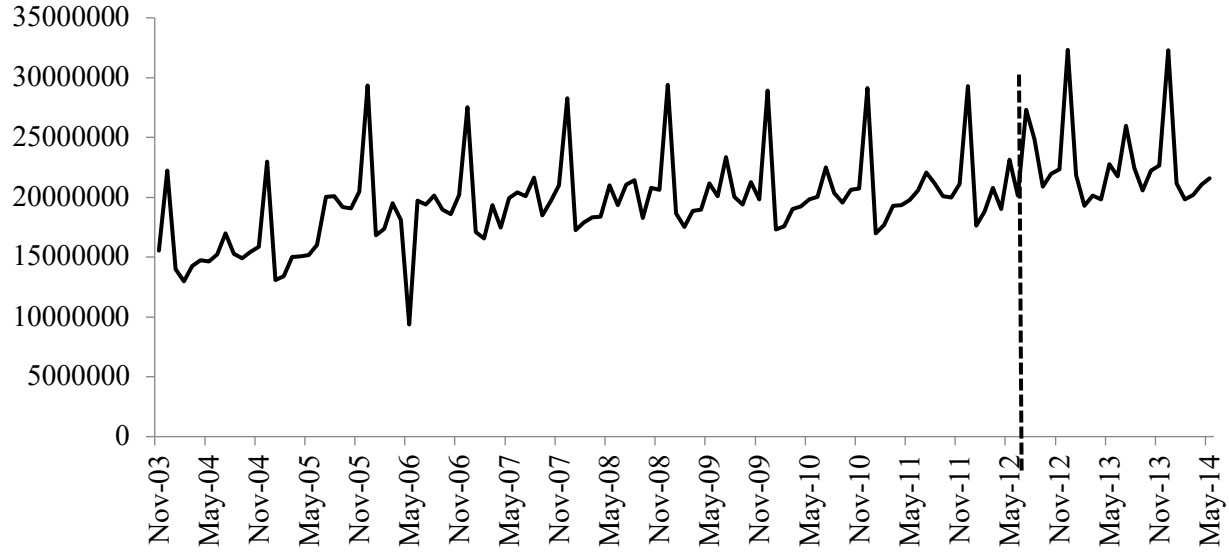

Figure 4. Real Tax Collections in Washington

elasticity with respect to taxes and output is −0.4135. This implies that, *ceteris paribus*, an increase in taxes increases tax revenue. The data show that average price before the policy change was \$15.74 and increased 7.58% to \$16.93. If this increase is all attributed to an increase in taxes, this represents a 17.93% increase in taxes.[8] Using the elasticity estimates, this increase in price should represent a 7.41% decrease in quantity.[9] These numbers estimate that the increase in tax revenue

[8] $0.0758 / 0.4228 = 0.1793$.
[9] $0.0758 \times 0.978 = 0.0741$.

should be 9.19%,[10] or $1,776,702 per month. Therefore, the increase in tax revenue from the policy change was roughly half due to increases in demand and roughly half due to increases in taxes.

Policy Impacts on Idaho

The analysis shows no statistically significant general effect of the Washington policy on Idaho liquor sales; however, this is due to the statistical specification and a deeper examination of specific stores shows that there are effects and they vary widely. In other words, the substitution effect was not widespread and did not result in statistically significant increases. However, much of this is due to the change in the composition of stores after the policy change. More specifically, certain stores are controlled for more closely, eliminating the statistical significance of the other stores.

We first look at Kootenai County, Idaho, which is adjacent to Spokane County, by far the most populous Washington county adjacent to Idaho. What makes this county unique is that a new state-run liquor store (store #307) opened up in October 2012 in State Line, Idaho, approximately 50 feet from the Washington/Idaho border. It was built only 4 months after the Washington policy came into effect and has important implications for the analysis.

Before store #307 was built, the nearest Kootenai County liquor store to Washington was in Post Falls, ID (store #304), approximately 5 miles from the Washington/Idaho border. Therefore, in addition to having dummy variables for both store #307 and #304, we included a dummy variable for store #304 during the 4 months after the policy in the absence of store #307 and a dummy variable for store #304 after store #307 opened up. Table 4 shows that store #304 saw sales increase 34.5% after the policy. However, after store #307 was built, store #304 saw a statistically significant drop in sales to 28.4% below what they had been prior to the change in Washington policy. This implies that the opening of store #307 nearly cut sales of store #304 in half from their peak level.

Figure 5 shows the monthly revenues for store #304, store #307, and the average of the other seven state-run liquor stores in Kootenai County. This graph shows the spike in revenues in December, along with smaller spikes during the summer months. However, the policy change appears to have no impact on sales for stores that are not the closest to the border. The policy change did impact store #304, illustrating the 34.5% increase.

These numbers translate into $205,031 in increased monthly sales for store #304 for the 4 months immediately after the policy change. After store #307 opened, there was a net increase of monthly sales of $268,433 in comparison to prior to the policy change. This accounts for both the sales of store #307 and the loss in sales to store #304. Thus, the opening of store #307 created a net increase of monthly revenues of $63,402, which represents 14.7% of the total revenue for store #307. Conversely, 85.3% of the store's revenues represent lost revenues from store #304. Regardless, these two stores alone account for an increase of over $3.2 million annually, which represents roughly two-thirds of the overall increase to the state (Winfree and Watson, 2015).

[10] $1.1793 \times (1 - 0.0741) - 1 = 0.0919$.

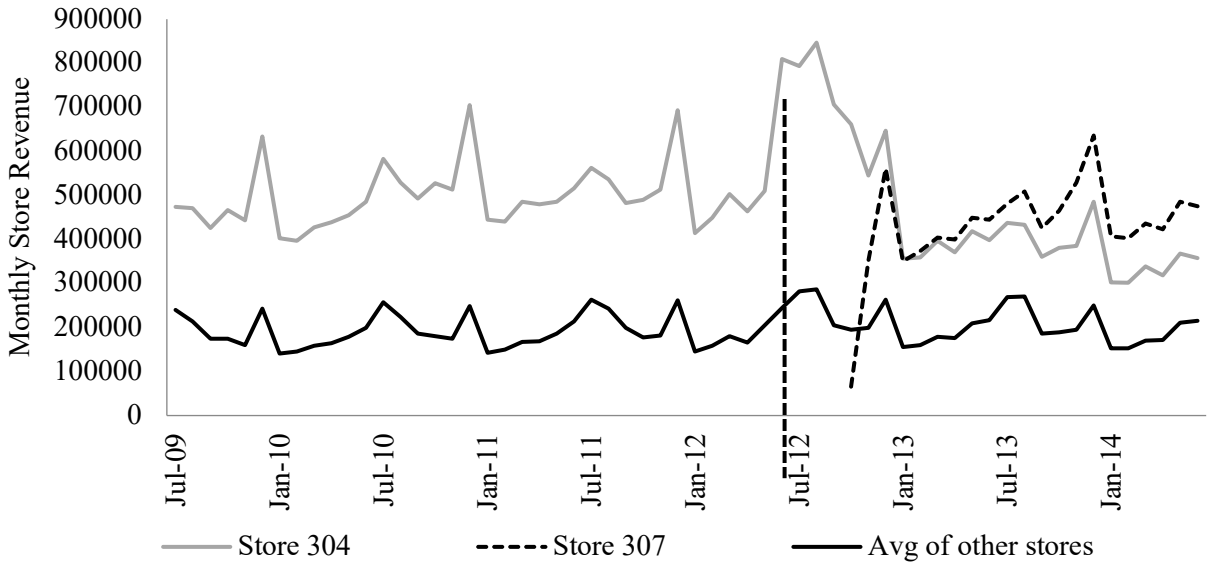

Figure 5. Kootenai County, Idaho, Liquor Sales

Next we analyze Latah County, Idaho. Figure 6 shows monthly revenues for the two state-owned liquor stores in Latah County. Store #303 is closer than store #309 to Washington. First, revenues for these stores decrease during the summer and do not have the same December spike, which is in contrast to the stores in Kootenai County. Presumably this is because Latah County and adjacent Whitman County in Washington both have very large universities and have a large student demographic. Figure 6 does show that store #303 increases over time relative to store #309. However, this change seems somewhat gradual, and there is no obvious shift at the time of the policy. So, while it does seem that the policy likely had an impact, the magnitude could be called into question.

Figure 6. Latah County, Idaho, Liquor Sales

Finally, we analyze Nez Perce County, Idaho (Figure 7). While this county has one state-run liquor store (store #301) right next to the Washington/Idaho border and one liquor store (store #321) farther away, there seems to no discernable difference in revenues for either store due to the Washington policy change. One possible explanation for this is that there is a large Costco Wholesale approximately 1 mile from store #301, but it is across the border in Washington. Before Washington's policy change, they were not allowed to sell liquor. After the policy change, Costco was allowed to sell liquor, albeit with high taxes in addition to the retail margin. Therefore, this increased availability of liquor may have counteracted any substitution effects from price.

These examples illustrate that any effects of the policy are far from uniform. As one might expect, stores very near the border and near population centers saw the biggest effects. Further, there was an apparent supply response from Idaho to capture more customers from out of state. Finally, not all "border stores" saw any impact from the policy change in Washington.

Figure 7. Nez Perce County, Idaho, Liquor Sales

Conclusions

It is unclear whether the liquor privatization policy change in Washington had the intended effect or if voters who approved it were happy with the outcomes (Subbaraman and Kerr, 2016). From this analysis, it is clear that the policy change to privatize liquor sales in Washington led to measurable and statistically significant positive effects on the amount of liquor sold in both Washington and Idaho. This is hypothesized to arise due to increased convenience of purchasing liquor in Washington, despite the average price of liquor actually increasing in the state. The finding that prices actually went up in Washington after privatization is somewhat novel, as previous literature has shown that average liquor prices were typically 6.9% lower after privatization (Siegel et al., 2013). The effect of the policy change in Washington was an increase in the register price (retail price plus taxes) of liquor in Washington which, *ceteris paribus*, would

result in a decrease in the quantity of liquor demanded. However, this increase in price was coupled with an increase in the convenience of buying liquor, which, *ceteris paribus*, would lead to an increase in the quantity of liquor demand.

The fact that an overall increase in the amount of liquor sold was observed presents evidence that the increase in convenience was more valuable to consumers than was the cost increase was damaging. Additionally, by taking advantage of the increased convenience to increase the taxes on liquor sold in the state, Washington was able to increase the tax revenue generated by liquor sales. This has implications for other jurisdictions that are looking for polices to increase tax revenues; increasing the convenience of purchasing a taxed good can allow for more sales and more overall revenue, even in response to an increase in tax rate.

In Idaho, tax avoidance behaviors on the part of Washington consumers led to a cross-border effect that increased sales of liquor in Idaho. However, this effect was limited to the stores most proximal to the Washington border and did not extend into more interior stores. So, while there are spatial spillovers of the economic impact of the policy change, these are more focused on specific locations than a traditional county or regionally specified spatial autocorrelation model would accurately capture.

From a fiscal impact standpoint, the liquor policy change in Washington resulted in a measurable increase in tax revenues in Washington and, through these spatial spillover effects, an increase in tax revenues in Idaho as well. Therefore, while Washington did experience increased tax revenues associated with the policy change, they lost sales to Idaho; Idaho also experienced increased tax revenues associated with Washington's liquor policy change. The overall effect is that the policy change in Washington led to Washington consumers paying more in liquor taxes both inside the state and in the neighboring state of Idaho.

The findings of this study serve to inform researchers and policy makers about far tax avoidance spatial spillovers extend into neighboring jurisdictions. Additionally, Idaho responded to this policy change in Washington by building a new liquor store closer to the border, which in turn increased liquor sales even more. Because this store did not open until a few months after the implementation of the policy change in Washington, the border store was shown to have an additional marginal effect above and beyond the next closest store in the county. This result adds to the literature on spatial spillover effects of policy changes on neighboring jurisdictions and demonstrates that, at least in some cases, neighboring states anticipate some of the price effects and change behaviors to try to maximize the spillover effects.

Future work may examine whether there were heterogeneous substation effects across liquor types. For example, consumers may have substituted expensive liquor more than cheap liquor. This may help explain why substitution effects were larger in some areas. Similarly, this policy change may have had an impact on the composition of liquor sales and consumption.

The results are of use to both researchers and policy makers. When analyzing the effects of tax policies, it is important to analyze any changes in demand, changes in prices, and substitution

effects. In this case, a strong cross-border effect was found; however, that effect is limited to a small number of establishments that are immediately proximal to the border. Future policy changes should incorporate all of these ideas to ensure the impacts align with the goal of the policy.

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