How Excise Tax Differentials Affect Cross-Border Sales Of Beer in the United States

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About the Tax Foundation

In 1937, civic-minded businessmen envisioned an independent group of researchers who, by gathering data and publishing information on the public sector in an objective, unbiased fashion, could counsel government, industry and the citizenry on public finance.

Six decades later, in a radically different public arena, the Tax Foundation continues to fulfill the mission set out by its founders. Through newspapers, radio, television, and mass distribution of its own publications, the Foundation supplies objective fiscal information and analysis to policymakers, business leaders, and the general public.

The Tax Foundation's research record has made it an oft-quoted source in Washington and state capitals, not as the voice of left or right, not as the voice of an industry or even of business in general, but as an advocate of a principled approach to tax policy, based on years of professional research.

Today, farsighted individuals, businesses, and charitable foundations still understand the need for sound information on fiscal policy. As a nonprofit, tax exempt 501(c)(3) organization, the Tax Foundation relies solely on their voluntary contributions for its support.

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Executive Summary

Tax competition is the bane of governments worldwide that seek higher levels of tax receipts. On the other hand, tax competition is an effective force protecting taxpayers from higher taxes.

State and local governments must compete for private sector investment in much the same way that companies compete for customers. A generally low-tax state will lure private investment away from states that impose higher tax burdens. For example, if a state levies a low sales tax, it will lure customers from neighboring states to its retailers. Similarly, if a state imposes a beer excise that is lower than in surrounding states, the low-tax state will sell more beer to the residents of surrounding states who live near the border.

In effect, the demonstration in this paper of cross-border beer sales is an example of tax competition among the states generally and a microcosm of tax competition among nations.

From the perspective of sellers and purchasers of any product, the market competition that drives down price differentials among sellers is stymied when sellers are located in different governmental jurisdictions with different tax laws. Higher taxes must be reflected in higher prices, so when sellers in low- and high-tax jurisdictions serve overlapping markets, cross-border shopping is the result. (See maps below showing the flow of beer across borders from low-tax to high-tax states.) The greater

Effective Tax Rates on Packaged Beer and the Resulting Cross–Border Purchases: Delaware and Neighboring States

Thousands of Cases of Beer

1997
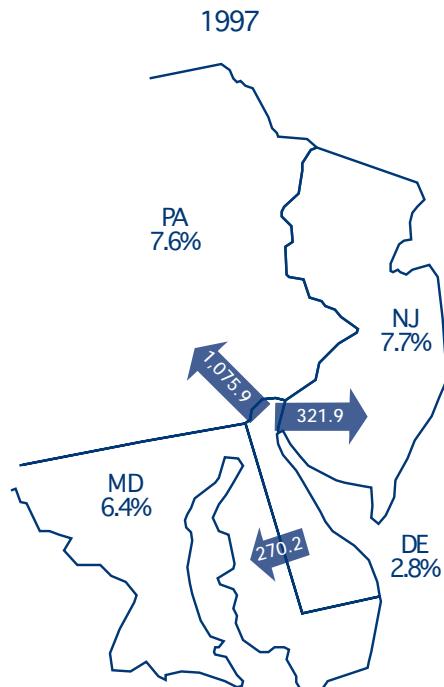
Source: Tax Foundation.

Effective Tax Rates on Packaged Beer and the Resulting Cross–Border Purchases: Alabama and Neighboring States

Thousands of Cases of Beer

1997
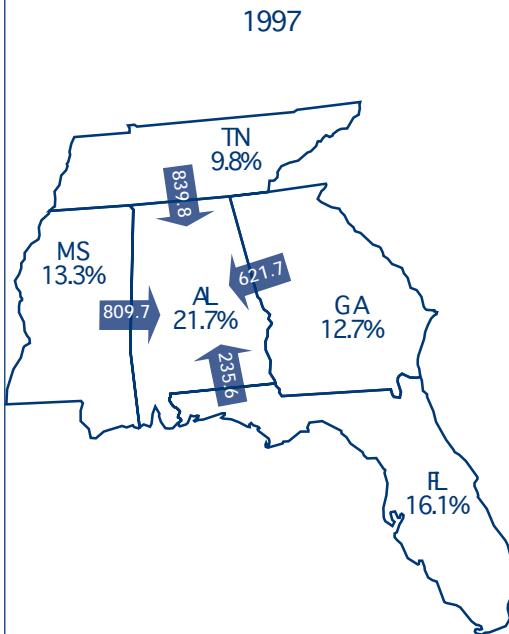
Source: Tax Foundation.

the price differential, the more likely it is that individuals living in border areas of high-tax jurisdictions will cross the border to shop in the low-tax jurisdiction.

The sale of beer in the United States is an interesting case study of this cross-border shopping phenomenon. By constructing a

While cross-border shopping obviously affects sales and product-specific excise tax collections, ... it also affects income and property tax collections, license fees, and a host of other sources of government revenue.

sophisticated econometric model that calculates demand for beer by state and then examines its supply by source, we can examine the patterns of cross-border activity.

Briefly, the model estimates the demand for packaged beer by residents of different states by controlling for factors such as abstinence rates, differences in consumption, and purchases by nonresidents. It then uses sales data to estimate the degree to which this demand is met by cross-border purchases. While the model accurately estimates shifts in

government revenue collected from state and local sales taxes and state excise taxes, it does not include other effects of cross-border shopping, such as its effects on revenue from income taxes, property taxes, and license fees. These unmeasured effects can match or even exceed the revenue changes measured by the model, so even though the results of this study are significant in themselves, government policymakers should be aware that the effects of cross-border shopping are even more extensive.

The extent of the cross-border shopping that occurs in these circumstances can have important fiscal effects on state and local governments. While this migration of economic activity across jurisdictional lines obviously affects sales and product-specific excise tax collections, the story does not end there. Cross-border shopping affects income and property tax collections, license fees, and a host of other sources of government revenue.

Policymakers are frequently surprised by the magnitude of the revenue effects caused by cross-border shopping. Such surprises can be particularly unnerving when the government in question is required to maintain a balanced budget. This study alerts policymakers to the extent of cross-border shopping and its revenue effects.

Introduction

In a market economy, competition will tend to drive down and eliminate any price differentials that exist among sellers. However, this price-leveling effect is stymied when sellers are located in different governmental jurisdictions with different tax laws. When sellers in low- and high-tax jurisdictions serve overlapping markets, cross-border shopping is the result. The greater the price differential, the more likely it is that individuals living in border areas of high-tax jurisdictions will cross the border to shop in a low-tax jurisdiction.

The sale of beer in the United States is an interesting case study of this phenomenon. The price of beer varies widely across the country. In 1997, for example, the weighted-average price of packaged beer ranged from a high of $20.23 per case in Alabama to a low of $16.89 in Oregon.[1] Most of this variation is attributable to differences in state and local sales taxes and beer excise taxes. More economically significant than an Alabama-Oregon comparison are the instances where high- and low-tax jurisdictions border one another. Washington, for example, which levies a statewide 6.5 percent sales tax, additional local sales taxes and a $7.172 per barrel beer excise tax, shares a border with Oregon, which levies no state or local sales taxes and has a state beer excise of just $2.60 per barrel.

The extent of the cross-border shopping that occurs in these circumstances can have important fiscal effects on state and local governments. While this migration of economic activity across jurisdictional lines obviously affects sales and product-specific excise tax collections, the story does not end there. Cross-border shopping affects income and property tax collections, license fees, and a host of other sources of government revenue.

The magnitude of cross-border shopping's revenue effects often surprises policymakers. Such surprises can be particularly unnerving when the government in question is required to maintain a balanced budget. This study attempts to alert policymakers about the extent of cross-border shopping and its revenue effects.

The prospect of significant, tax-driven cross-border sales is one dimension of a larger issue—tax competition among governments. In general, state and local gov-

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ernments must compete for private sector investment in much the same way that companies compete for customers. If a state levies a low tax burden, then it will lure private investment away from states that impose higher tax burdens. For example, if a state levies a low sales tax, it will lure customers from neighboring states to its retailers. Similarly, if a state imposes a beer excise that is lower than in surrounding states, the low-tax state will sell more beer to the residents of surrounding states who live near the border.

Tax competition is the bane of governments worldwide seeking higher levels of tax receipts. On the other hand, tax competition is an effective force protecting taxpayers from higher taxes. In effect, the demonstration in this paper of cross-border beer sales is a microcosm of the consequences of tax competition among the states generally, and among nations.

Packaged Beer Sales By State

The amount of beer sold within the geographic confines of a state is the sum of sales to residents and nonresidents. Sales to residents is a function of the number of individuals in a state who drink beer, their consumption levels, and their ability to take advantage of lower-priced beer in neighboring jurisdictions. Nonresident sales are a function of the number of individuals who intentionally travel into the state to take advantage of low-priced beer plus sales to nonresidents who incidentally purchase beer while traveling in the state for business or pleasure.

Looking at the variation in packaged beer sales by state gives an indication of the effect these factors have on packaged beer sales in a state.[2] This variation is illustrated in Figure 1, which ranks states by their per capita packaged beer sales as compared to the national average for 1997, the latest year for which data is available. The state with the highest per capita packaged beer sales was New Hampshire, which sold 29.4 gallons per capita, 9.6 gallons more than the national average of 19.8 gallons. While the latest data from the U.S. Department of Health and Human Services shows that the rate of alcohol use is relatively high in New Hampshire, cross-border shopping also plays a role.

New Hampshire's lack of state or local sales taxes has long drawn shoppers from surrounding states and Canada. Table 1 shows that the state enjoys a price advantage over all of its neighbors, Maine, Vermont and Massachusetts. Canada's prices are also higher. Packaged beer sales were also high in Nevada, Texas, New Mexico, and Louisiana. In each of these cases the states enjoy price advantages on most or all of their borders.

Figure 1
Variation Among the States in Per Capita Sales of Packaged Beer
1997
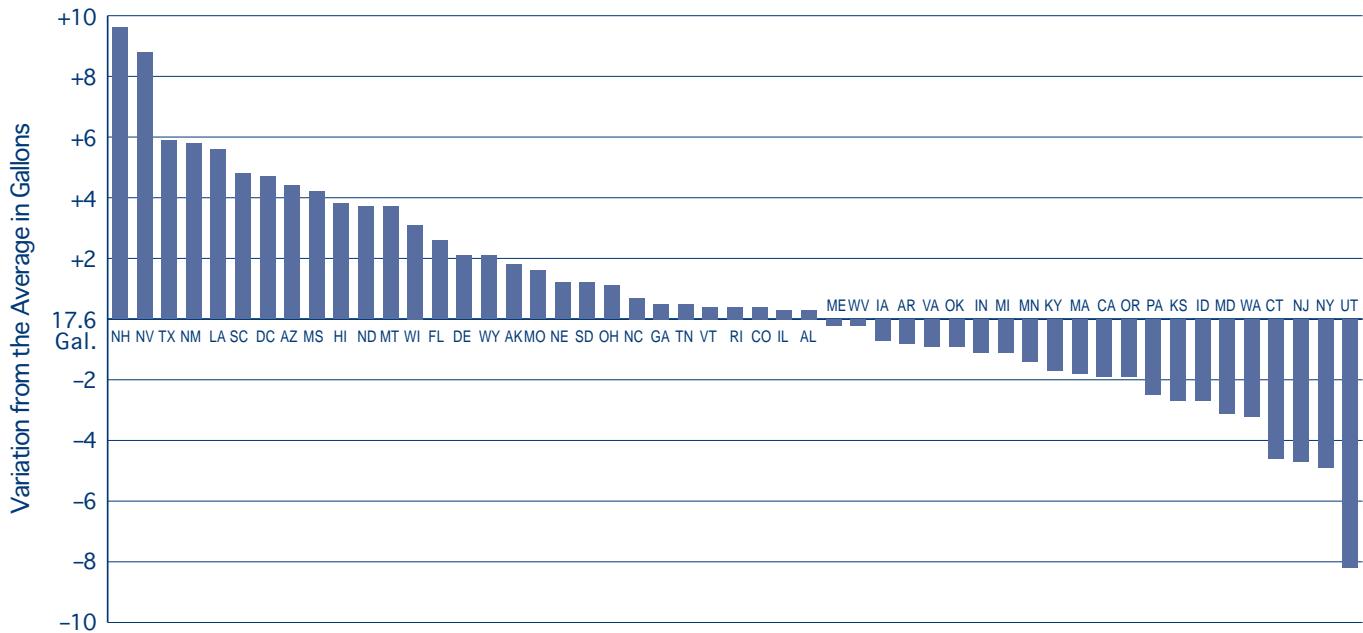
Source: Tax Foundation.

At the other end of the spectrum was Utah, which sold just 11.5 gallons of beer per capita, 8.2 gallons less per capita than the national average. Table 1 shows that Utah's beer prices are higher than in any of the neighboring states except New Mexico. While this price differential undoubtedly accounts for part of the state's low beer sales, alcohol sales are generally low in Utah due to the large fraction of the population who belong to the Church of Jesus Christ of Latter-Day Saints (Mormons), which strongly discourages drinking by its adherents.

New York has the second lowest rate of beer sales despite being a popular tourist destination. Tourism invariably means higher consumption, but in 1997 the sales New York lost to border states Pennsylvania, Massachusetts and New Jersey outweighed the extra sales to tourists, driving per capita beer sales down to 14.8 gallons, or 4.9 gallons less than the national average.

Table 1
Variation Among the States in Per Capita Packaged Beer Sales
1997

	Per Capita Packaged Beer Sales (gallons)	Variance from National Average (gallons)	Average Price ($ Per Case)
United States	19.8	0.0	$18.20
New Hampshire	29.4	9.6	17.45
Nevada	28.6	8.8	17.95
Texas	25.7	5.9	18.15
New Mexico	25.6	5.8	18.58
Louisiana	25.4	5.6	18.62
South Carolina	24.6	4.8	19.44
District of Columbia	24.5	4.7	17.78
Arizona	24.2	4.4	17.89
Mississippi	24.0	4.2	18.84
Hawaii	23.6	3.8	19.64
North Dakota	23.5	3.7	17.85
Montana	23.5	3.7	17.03
Wisconsin	22.9	3.1	17.65
Florida	22.4	2.6	19.29
Delaware	21.9	2.1	17.08
Wyoming	21.9	2.1	17.50
Alaska	21.6	1.8	17.58
Missouri	21.3	1.6	17.63
Nebraska	21.0	1.2	18.03
South Dakota	21.0	1.2	17.99
Ohio	20.9	1.1	18.03
North Carolina	20.5	0.7	18.96
Georgia	20.3	0.5	18.73
Tennessee	20.3	0.5	18.25
Vermont	20.2	0.4	18.12
Rhode Island	20.1	0.4	17.99
Colorado	20.1	0.4	17.43
Illinois	20.1	0.3	17.86
Alabama	20.1	0.3	20.23
Maine	19.6	–0.2	18.49
West Virginia	19.5	–0.2	18.05
Iowa	19.1	–0.7	17.99
Arkansas	19.0	–0.8	18.16
Virginia	18.9	–0.9	18.09
Oklahoma	18.9	–0.9	18.34
Indiana	18.7	–1.1	17.73
Michigan	18.7	–1.1	18.11
Minnesota	18.4	–1.4	17.90
Kentucky	18.1	–1.7	17.80
Massachusetts	18.0	–1.8	17.71
California	17.9	–1.9	18.29
Oregon	17.9	–1.9	16.89
Pennsylvania	17.3	–2.5	17.88
Kansas	17.1	–2.7	18.00
Idaho	17.1	–2.7	17.82
Maryland	16.7	–3.1	17.67
Washington	16.6	–3.2	18.49
Connecticut	15.2	–4.6	18.10
New Jersey	15.0	–4.7	17.89
New York	14.8	–4.9	18.02
Utah	11.5	–8.2	18.48

Source: Tax Foundation

A Model of Beer Sales by State

While a cursory examination of aggregate sales data gives some indication of the various factors affecting state beer sales, the information such an analysis can yield is limited. Much more information can be gleaned by constructing a sophisticated econometric model that calculates demand for beer by state and then examines its supply by source. The Tax Foundation has developed such a model, and it is described in detail starting on page 13.

Briefly, the model estimates the demand for packaged beer by residents of different states by controlling for factors such as abstinence rates, differences in consumption, and purchases by nonresidents. It then uses sales data to estimate the degree to which this demand is met by cross-border purchases. While the model accurately estimates shifts in government revenue collected from state and local sales taxes and state excise taxes, it does not include other effects of cross-border shopping, such as its

Figure 2
Effective Tax Rates on Packaged Beer by State
(State & Local Sales Taxes and Beer Excise Taxes)
1997

WA 11.3%
MT 2.5%
ND 7.4%
MN 7.7%
VT 9.0%
NH 5.0%
ME 11.2%
OR 1.6%
ID 7.2%
WY 5.3%
SD 8.2%
WI 6.2%
MI 9.0%
NY 8.4%
MA 6.6%
RI 8.2%
CT 8.9%
NV 8.0%
UT 11.2%
CO 4.9%
NE 8.5%
IA 8.2%
IL 7.5%
IN 6.7%
OH 8.4%
PA 7.6%
NJ 7.7%
DE 2.8%
MD 6.3%
CA 10.1%
KS 8.3%
MO 6.1%
WV 8.6%
VA 8.8%
DC 7.0%
AZ 7.6%
NM 11.8%
OK 10.4%
AR 9.3%
KY 7.1%
TN 9.8%
NC 14.1%
SC 17.0
TX 9.2%
LA 12.0%
MS 13.3%
AL 21.7%
GA 12.7%
FL 16.1%

- under 6.0%
- 6.0% to 7.0%
- 7.0% to 8.0%
- 8.0% to 9.0%
- 9.0% to 10.0%
- 10.0% to 14.0%
- over 14.0%
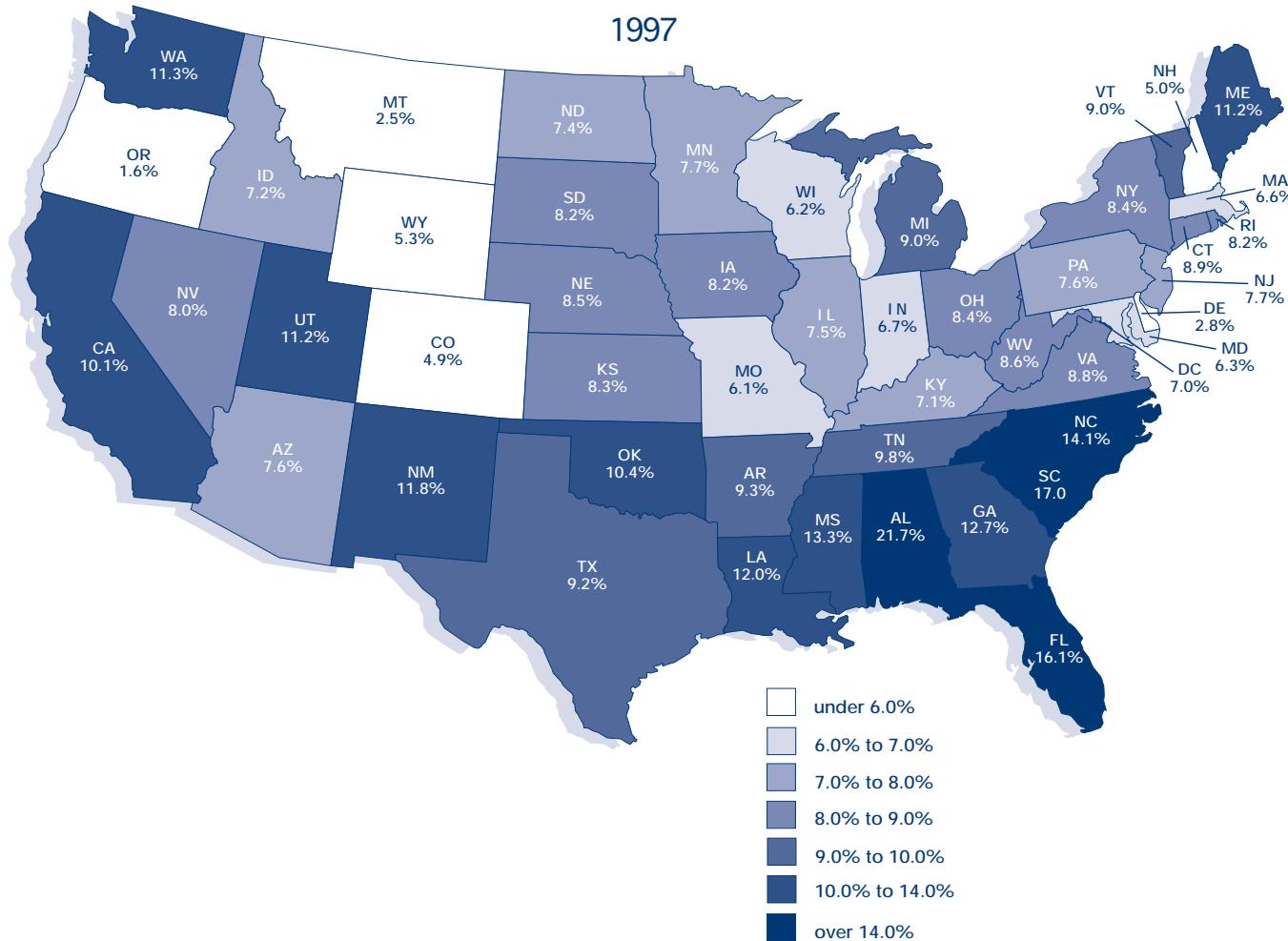
Source: Tax Foundation.

effects on revenue from income taxes, property taxes, and license fees. These unmeasured effects can match or even exceed the revenue changes measured by the model, so even though the results of this study are significant in themselves, government policymakers should be aware that the effects of cross-border shopping are even more extensive.

Figures 2 and 3 show how a disparity in effective beer tax rates on two sides of a border results in cross-border purchases. This correspondence is clear even though the effective tax rates shown in the maps

are partial; that is, they only include beer excises and state and local sales taxes.

Table 2 presents data on sales taxes and state beer excise taxes across the nation, and the results of an econometric analysis of the 1997 packaged beer market is presented in Table 3. The table is divided into three sections. Data in the first column of the first section shows interstate cross-border imports as a percent of packaged beer sales in a state. The data in the second and third columns of the table shows the number of cases of beer imported into the state by cross-border shoppers and the effect

Figure 3
Net Interstate Cross-Border Sales As a Percentage of Total
Packaged Beer Sales by State

1997

Legend:
- over +4.0%
- +2.0% to +4.0%
- +1.0% to +2.0%
- −1.0% to +1.0%
- −2.0% to −1.0%
- −4.0% to −2.0%
- under −4%

WA −4.9%
OR +9.1%
MT +2.4%
ID +1.2%
WY +2.1%
ND −0.3%
MN 0.8%
WI +2.0%
MI −0.3%
NY −0.3%
VT −2.5%
NH +16.8%
ME −2.6%
MA −0.3%
RI −3.0%
CT −3.0%
NJ −1.1%
DE +22.3%
MD +2.7%
DC −0.3%
NV +1.8%
UT −1.8%
CO +1.6%
SD −1.3%
NE −0.5%
IA −1.3%
IL −1.6%
IN +3.6%
OH −0.7%
PA −0.8%
WV −0.6%
VA −0.4%
CA −1.0%
AZ +3.7%
NM −3.6%
KS −1.3%
MO +1.8%
KY +1.0%
TN +1.3%
NC 0%
SC −2.2
OK −0.7%
AR +0.4%
MS +1.7%
AL −6.0%
GA +1.4%
TX +0.3%
LA −1.1%
FL 0%

Source: Tax Foundation.
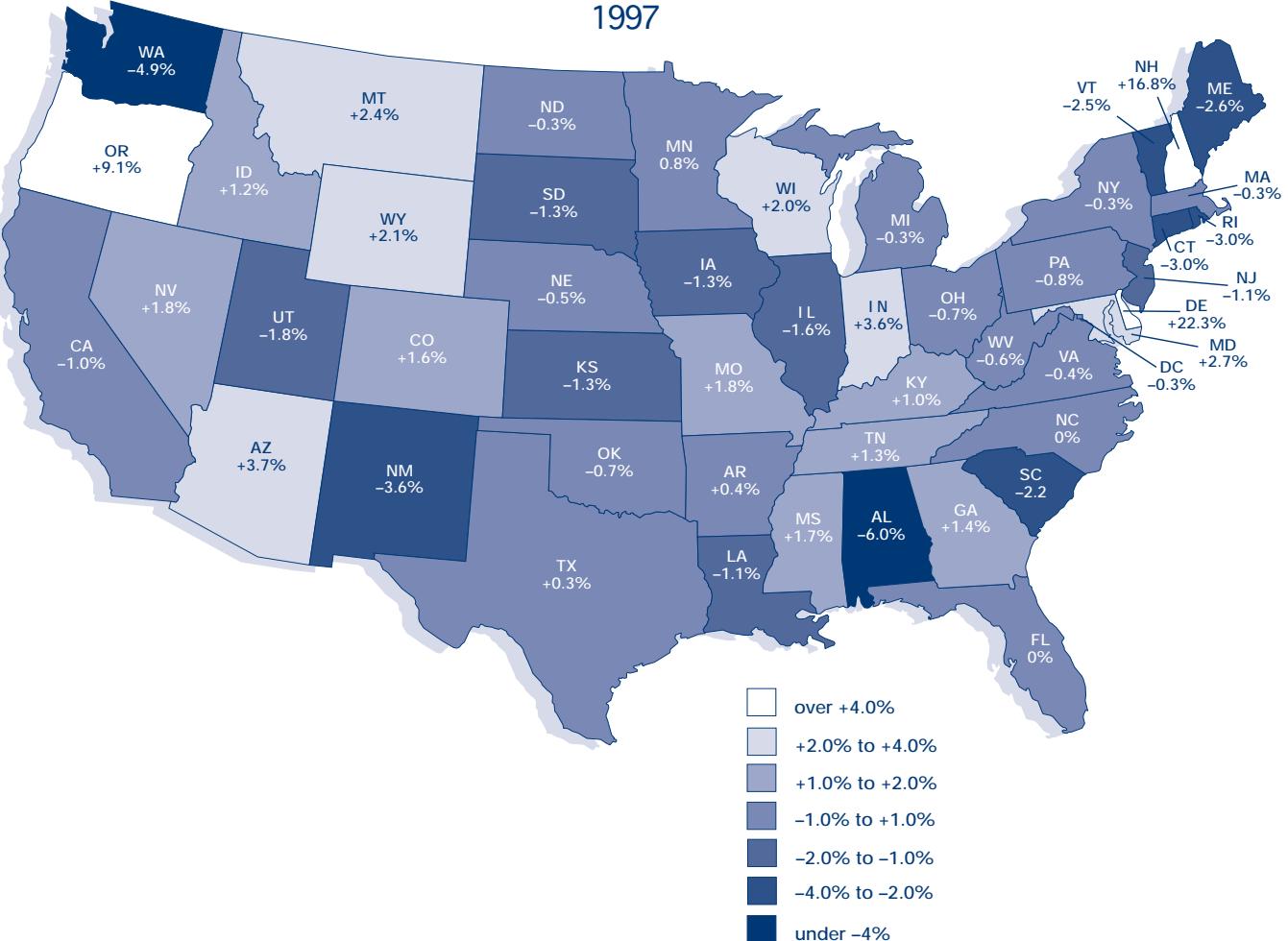
Table 2
Sales and State Beer Excise Taxes by State
1997

	Taxes		State
	State Sales (Percent)	Local Sales Authorized	Beer Excise ($ Per Barrel)
Alabama	4%	yes	$ 32.65
Alaska	-	-	10.85
Arizona	5	yes	4.96
Arkansas	4.625	yes	7.508
California	6	yes	6.20
Colorado	3	yes	2.48
Connecticut	6	no	6.20
Delaware	-	-	4.85
Florida	6	yes	19.84
Georgia	4	yes	14.88
Hawaii	4	no	28.21
Idaho	5	yes	4.65
Illinois	6.25	yes	2.17
Indiana	5	no	3.565
Iowa	5	yes	5.89
Kansas	4.9	yes	5.58
Kentucky	6	no	2.50
Louisiana	4	yes	10.00
Maine	6	no	10.85
Maryland	5	no	2.79
Massachusetts	5	no	3.30
Michigan	6	no	6.30
Minnesota	6.5	no	2.40
Mississippi	7	no	13.23
Missouri	4.225	yes	1.86
Montana	-	-	4.30
Nebraska	5	yes	7.13
Nevada	6.5	yes	2.79
New Hampshire	-	-	9.30
New Jersey	6	no	3.72
New Mexico	5	yes	12.71
New York	4	yes	4.96
North Carolina	4	yes	16.53
North Dakota	5	yes	4.96
Ohio	5	yes	5.5552
Oklahoma	4.5	yes	11.25
Oregon	-	-	2.60
Pennsylvania	6	yes	3.31
Rhode Island	7	no	3.00
South Carolina	5	yes	23.808
South Dakota	4	yes	8.50
Tennessee	6	yes	3.90
Texas	6.25	yes	6.00
Utah	4.875	yes	11.00
Vermont	5	no	8.215
Virginia	3.5	yes	8.76
Washington	6.5	yes	7.172
West Virginia	6	no	5.50
Wisconsin	5	yes	2.00
Wyoming	4	yes	0.62
District of Columbia	5.75	n.a.	2.79

Source: Tax Foundation.

that this type of activity had on government revenue generated by the combination of state and local sales taxes and state beer excises.

Data in the other two sections of the table provide similar data for net interstate exporting states and for states which export beer to Canada.

Net Interstate Importing States

The first section of Table 3 shows that slightly more than half of the states were net importers of packaged beer during 1997. Ranging from 6.7 percent in Alabama to a trivial 0.02 percent in Florida. Interstate cross-border purchases averaged 1.2 percent of packaged beer sales in the importing states. As a result of this in-bound cross-border traffic, net importing states lost approximately $34.7 million in sales and

Policymakers should be aware that the effects of cross-border shopping on income taxes, property taxes, and license fees can match or even exceed the revenue changes in state and local sales and excise taxes measured by the model.

beer excise tax revenue during 1997. Importantly, the data presented in this column is net imports. It is common for states to lose sales on some borders while picking them up on others; so a total import figure would be deceptive. Maryland, for example, loses sales to Delaware but picks them up on each of its other borders.

The state that lost the most sales to its neighbors in 1997 was Alabama (see Figure 4). During that year interstate cross-border

Table 3
Cross-border Activity by State

	Net Interstate Imports (Imports/Sales)	Net Imports (cases)	Lost Sales & Excise Tax Revenue	Net Interstate Exports (Exports/Sales)	Net Exports (cases)	Gained Sales & Excise Tax Revenue	Canadian Exports (Exports/Sales)	Total Exports (cases)	Gained Sales & Excise Tax Revenue
United States	1.2%	18,148,201	$34,711,318	2.0%	18,148,201	$18,752,943	2.7%	10,884,966	$14,620,473
Alabama	6.7%	2,506,751	9,038,975	**	**	**	***	***	***
Alaska	*	*	*	**	**	**	3.0%	176,369	168,377
Arizona	*	*	*	3.8%	1,847,281	2,344,391	***	***	***
Arkansas	*	*	*	0.4%	84,140	129,382	***	***	***
California	1.0%	3,139,317	5,248,466	**	**	**	***	***	***
Colorado	*	*	*	1.7%	562,416	453,566	***	***	***
Connecticut	3.3%	859,168	1,273,244	**	**	**	***	***	***
Delaware	*	*	*	22.1%	1,668,020	765,405	***	***	***
Florida	0.02%	22,800	60,917	**	**	**	***	***	***
Georgia	*	*	*	1.5%	1,080,145	2,280,090	***	***	***
Hawaii	*	*	*	**	**	**	***	***	***
Idaho	*	*	*	1.4%	129,389	155,518	2.3%	217,771	261,749
Illinois	1.5%	1,617,226	2,002,627	**	**	**	***	***	***
Indiana	*	*	*	3.6%	1,935,264	2,152,560	***	***	***
Iowa	1.4%	324,412	442,787	**	**	**	***	***	***
Kansas	1.3%	280,765	387,697	**	**	**	***	***	***
Kentucky	*	*	*	1.1%	393,789	463,173	***	***	***
Louisiana	1.1%	498,286	996,523	**	**	**	***	***	***
Maine	2.9%	312,970	584,068	**	**	**	11.7%	1,245,746	2,324,822
Maryland	*	*	*	3.0%	1,259,841	1,320,614	***	***	***
Massachusetts	*	*	*	0.3%	136,925	149,301	***	***	***
Michigan	0.3%	269,631	401,807	**	**	**	3.3%	3,040,756	4,531,374
Minnesota	0.8%	324,765	416,424	**	**	**	3.0%	1,259,649	1,615,163
Mississippi	*	*	*	1.9%	515,371	1,141,444	***	***	***
Missouri	*	*	*	1.9%	1,037,759	1,046,577	***	***	***
Montana	*	*	*	2.7%	236,308	97,694	17.5%	1,557,456	643,884
Nebraska	0.5%	73,190	102,969	**	**	**	***	***	***
Nevada	*	*	*	2.4%	554,176	738,290	***	***	***
New Hampshire	*	*	*	15.6%	1,877,437	1,551,894	1.8%	219,214	181,202
New Jersey	1.1%	717,099	913,064	**	**	**	***	***	***
New Mexico	4.0%	729,770	1,426,586	**	**	**	***	***	***
New York	0.3%	532,102	741,681	**	**	**	0.6%	941,083	1,311,747
North Carolina	*	*	*	0.05%	33,189	77,515	***	***	***
North Dakota	0.3%	18,980	23,299	**	**	**	6.9%	460,914	565,800
Ohio	0.8%	733,894	1,030,714	**	**	**	***	***	***
Oklahoma	0.8%	222,005	382,036	**	**	**	***	***	***
Oregon	*	*	*	9.3%	2,389,970	652,314	***	***	***
Pennsylvania	0.8%	721,090	908,080	**	**	**	***	***	***
Rhode Island	2.8%	258,628	354,174	**	**	**	***	***	***
South Carolina	2.5%	896,378	2,526,972	**	**	**	***	***	***
South Dakota	1.8%	118,627	162,302	**	**	**	***	***	***
Tennessee	*	*	*	1.6%	733,006	1,195,567	***	***	***
Texas	*	*	*	0.3%	657,871	1,005,261	***	***	***
Utah	1.9%	247,602	460,445	**	**	**	***	***	***
Vermont	3.1%	173,097	259,047	**	**	**	14.0%	769,334	1,151,340
Virginia	0.6%	400,347	586,757	**	**	**	***	***	***
Washington	5.2%	2,059,599	3,853,998	**	**	**	2.5%	996,674	1,865,014
West Virginia	0.5%	81,758	116,432	**	**	**	***	***	***
Wisconsin	*	*	*	2.0%	906,859	936,991	***	***	***
Wyoming	*	*	*	2.8%	109,045	95,394	***	***	***
District of Columbia	0.2%	7,942	9,230	**	**	**	***	***	***

* Net Exporter of Beer
** Net Importer of Beer
*** Not Applicable

purchases were equal to 6.7 percent of packaged beer sales in the state. This cross-border shopping was driven by the state government's 4.0 percent sales tax, additional sales taxes levied by local governments, and its highest-in-the-nation $32.65 per barrel beer excise tax. This combination of tax rates resulted in Alabama's losing sales to all of the surrounding states. While most lost sales were the result of cross-border shopping in Tennessee (33.5 percent) and Mississippi (32.3 percent), significant amounts were also lost along its borders with Georgia (24.8 percent) and Florida (9.4 percent). In total, Alabama lost a whopping $9.0 million in sales tax collections and state beer excises as a result of this cross-border traffic.
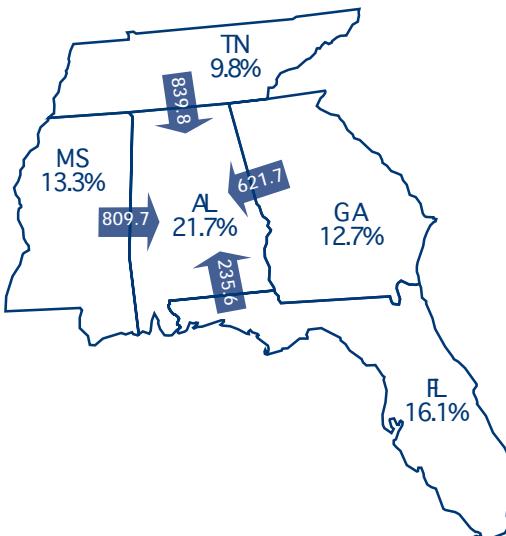
Washington also lost a significant amount of packaged beer sales to neighboring states in 1997. During that year an amount equal to 5.2 percent of packaged beer sales in the state was purchased in states along its borders. That's more than 2.0 million cases of beer that came across borders into Washington due to the state's 6.5 percent sales tax, additional sales taxes levied by local governments, and $7.172 per barrel state beer excise. More than three quarters of the $3.9 million that Washington lost in sales tax and beer excise revenue can be attributed to cross-border shopping in Oregon. Table 3 shows that Oregon has no state or local sales taxes and a modest $2.60 per barrel state beer excise.

The state with the third highest percentage of lost package sales during 1997 was New Mexico where out-of-state vendors supplied an amount equal to 4.0 percent of New Mexico's packaged beer sales to cross-border shoppers. The motivating factors were New Mexico's 5.0 percent state sales tax, additional sales taxes levied at the local level, and the $12.71 per barrel state beer excise. As was the case with both Alabama and Washington, these relatively high tax rates resulted in New Mexico's losing sales to all neighboring states. While most of these lost sales occurred along the state's border with Colorado (36.1 percent), large shares of the total were also lost along its borders with Arizona (32.9 percent) and Texas (29.0 percent). Even along the state's short border with Oklahoma the state lost sales. In total, New Mexico's general sales and beer tax collections were more than $1.4 million lower in 1997 due to cross-border shopping.

Net Interstate Exporting States

The second section of Table 3 presents data on the share of each state's packaged beer sales that was purchased by cross-border shoppers from other states in 1997. Slightly less than half of states were net exporters, and in-bound customers accounted for an average of 2.0 percent of total sales in those states. As a result of the incoming

Figure 4
Effective Tax Rates on Packaged Beer and the Resulting Cross-Border Purchases: Alabama and Neighboring States

Thousands of Cases of Beer

1997

TN
9.8%

839.8

MS
13.3%

621.7

809.7

AL
21.7%

GA
12.7%

235.6

FL
16.1%

Source: Tax Foundation.

business, the beer exporting states collected $18.8 million in sales taxes and beer excises from the citizens of neighboring states, in effect "exporting" their tax burdens. As stated earlier, sales and excise taxes are the only types of state and local revenue measured by this study. For beer exporting states, the migration of business activity across state lines into their states also leads to higher revenue from income and property taxes, license fees, and other business related revenue sources.

The highest rate of net beer export was 22.1 percent of sales in Delaware (see Figure 2), where vendors situated along the borders effectively marketed the state's lack of state or local sales taxes and its moderate $4.85 per barrel state beer excise. During

Figure 5
Effective Tax Rates on Packaged Beer and the Resulting Cross-Border Purchases: Delaware and Neighboring States

Thousands of Cases of Beer

1997

PA
7.6%

NJ
7.7%

1,075.9

321.9

MD
6.4%

270.2

DE
2.8%

Source: Tax Foundation.

1997 cross-border shoppers bought approximately 1.7 million cases of beer in Delaware. Pennsylvanians accounted for 64.5 percent of these sales while residents of New Jersey and Maryland accounted for 19.3 and 16.2 percent.

Residents of New Hampshire's neighboring states crossed into the state and constituted a very significant fraction of its packaged beer sales during 1997. Approximately 15.6 percent of the packaged beer sold in New Hampshire, or approximately 1.9 million cases, was purchased by cross-border shoppers from Massachusetts, Maine and Vermont. As with Delaware, New Hampshire's lack of state or local sales taxes coupled with a moderate beer excise, $9.30 per barrel, provided the attraction to cross-border shoppers. Residents of Massachusetts bought 69.0 percent of New Hampshire's interstate beer exports, and cross-border sales to residents of Maine and Vermont accounted for 21.3 and 9.7 percent. As a result, New Hampshire collected $1.6 million in state beer excise taxes from neighboring states.

The state with the third highest percentage of net beer exports was Oregon, which managed to sell 9.3 percent of its packaged beer to cross-border shoppers. Like Delaware and New Hampshire, Oregon has no state or local sales taxes. Combining this incentive with a low $2.60 per barrel beer excise, Oregon was able to lure cross-border shoppers who bought 2.4 million cases of beer. Most of it (60.8 percent) was sold to residents of Washington. Nevadans accounted for 20.6 percent, and the balance was purchased by residents of Idaho (11.7 percent) and California (6.9 percent). As a result, more than half a million dollars in beer excise taxes came into Oregon government coffers from outside the state.

Canadian Cross-Border Traffic

The third section of Table 3 presents data on international cross-border shopping along the U.S.–Canadian border. The analysis shows that all of the states along the border were net beer exporters to Canada.
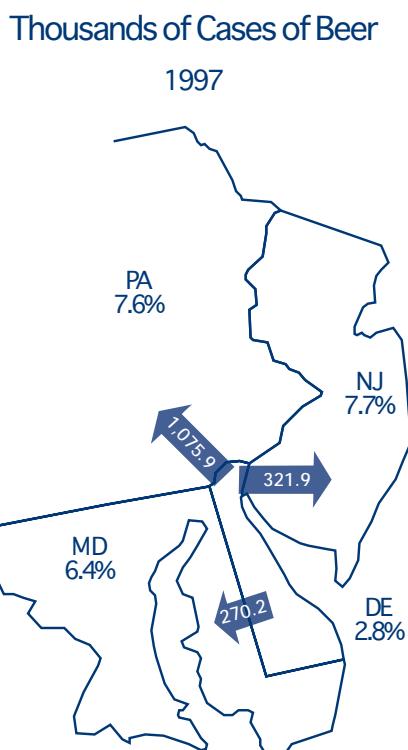
Rates of net export ranged from 17.5 percent of packaged beer sales in Montana to 0.6 percent of sales in New York. On average, Canadian cross-border purchases averaged 2.7 percent of sales in states along the border. The border states sold 10.9 million

tana sold more than 20 percent of its packaged beer to cross-border shoppers in 1997.

Vermont also exported a significant amount of beer to Canada in 1997. During that year the state sold 769,334 cases of beer, or 14.0 percent of total sales, to cross-border shoppers from Canada, collecting $1.2 million in sales taxes and beer excise taxes from them.

The state that exported the third highest percentage of its packaged beer sales to Canada in 1997 was Maine. Approximately 11.7 percent of its sales were to Canadian shoppers who paid more than $2.3 million into Maine's government coffers in state and local sales and state beer excise taxes.

Some states with high effective tax rates on beer were able to make up for the sales they lost to neighboring states by exporting large quantities of beer to Canada. Figure 5 illustrates this shifting of tax burdens from jurisdiction to jurisdiction by showing the flow of beer into and out of Washington.

Figure 6
Effective Tax Rates on Packaged Beer and Resulting Cross-Border Activity: Washington and Neighboring Jurisdictions

Millions of Cases of Beer

1997

1.4

WA
11.3%

7.2

0.2

OR
1.6%

ID
7.2%
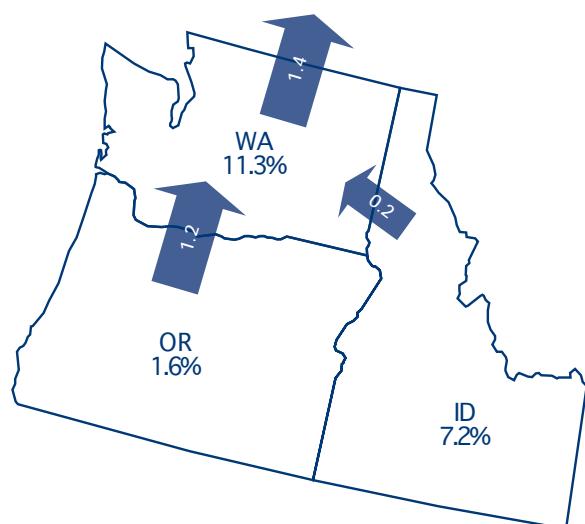
Source: Tax Foundation.

cases of beer to Canadian shoppers in 1997, collecting $14.6 million in sales taxes and beer excise taxes as a result.

Among the states, Montana exported the highest percentage of its packaged beer sales to Canada in 1997—approximately 17.5 percent, netting the state more than half a million dollars in beer excise tax collections. Adding together its exports to Canada and to its neighboring states, Mon-

A Model of Demand for Packaged Beer And Its Supply by Source

The econometric model developed in this section builds on several previous studies of cross-border activity. The most significant of these are the 1977 and 1985 Advisory Commission on Intergovernmental Relations (ACIR) studies of cross-border activity. A 1993 Tax Foundation analysis conducted by the Economic Policy Group of KPMG Peat Marwick built on these two studies. Additional Tax Foundation analyses conducted in 1996 and 1998 further developed the methodology used in the 1993 study.

All prior Tax Foundation analyses of cross-border activity have dealt exclusively with cigarettes. This research generated a great deal of interest on the part of policymakers, the media, and the public. In response, the Tax Foundation has decided to conduct additional analyses by applying the methodology that it has developed to other goods which are subject to sales and product-specific excise taxes.

Developing the Model

Economic theory suggests that the demand for a good is a function of its price, consumers' income levels, and their tastes. Equation 1 is an algebraic representation of the demand for beer by residents of different states.

Equation 1

$$c_i = a - pp_i + iy_i + [tastes]$$

Beer consumption by residents of a state is given by c_i. The price of beer is given by p_r. The income level of state residents is given by y_r. The effect of consumer tastes is temporarily represented by [tastes].

The beer consumed in a state is supplied by sales in that state plus any imports from other areas. This relationship is given by Equation 2.

Equation 2

$$c_i = s_i + NX_i$$

Domestic sales are given by s_i. There are three potential sources of net exports NX_i: (1) sales that result when out-of-state residents living close to a state border intentionally cross the border to purchase beer; (2) sales that result when residents of Canada intentionally cross the border to purchase beer in border states; and (3) incidental package beer purchases by nonresidents when in a state on personal or business travel. The components of net exports are listed in Equation 3:

Equation 3

$$NX_i = gS[(t_i - t_j)w_{ij}] + kk_iS[(t_i - t_k)w_{ik}] + [incidental\ nonresident\ purchases]$$

Tax differentials between states provide individuals living near state borders with the incentive to shop across the border. Sales which result from cross-border shopping are measured by $S[(t_i - t_j)w_{ij}]$. The direction and magnitude of this incentive is given by the tax differential $(t_i - t_j)$ where t_i is the weighted average effective tax rate on packaged beer along the border created by state and local sales and state beer excises in state i and t_j is the weighted effective tax rate created by these taxes along the border in the neighboring state j. The number of individuals with the ability to avail themselves of the opportunity to cross-border shop and their effect on sales in a particular state is given by w_{ij}, where:

Equation 4

$$w_{ij} = \frac{population\ of\ i\ on\ ij\ border}{population\ of\ i}$$

if i imports from j, or

$$w_{ij} = \frac{population\ of\ j\ on\ ij\ border}{population\ of\ i}$$

if i exports to j.

By summing the variable $(t_i - t_j)w_{ij}$ for all of the states which surround a state, it is possible to determine whether the state will experience a net increase or decrease in packaged beer sales as a result of cross-border shopping.

A state's sales are also likely to be affected if it shares a border with Canada. Historically, beer prices have been much higher in Canada than in the United States. This price differential, due in large part to high Canadian sales and excise taxes, has resulted in large scale cross-border shopping. In order to capture this effect the variable $k_i S[(t_i - t_k)w_{ik}]$ was created. The first component of this variable, k_i, is a binary variable which assigns a 1 to all states located on the U.S.-Canadian border and a 0 to those that are not. The second component, $(t_i - t_k)$, measures the direction and magnitude of the incentive to cross-border shop. It is similar to the $(t_i - t_j)$ component described above. The final component, w_{ik}, is similar to the w_{ij} variable also described above. It measures the effect that Canadians living within 50 miles of the U.S.-Canadian border will have on beer sales in border states. Sales that result from incidental purchases by nonresidents are temporarily given by [*incidental nonresident purchases*].

Substituting Equation 3 into Equation 2 yields:

Equation 5

$$c_i = \quad s_i - gS[(t_i - t_j)w_{ij}] - \\ k\,k_i S[(t_i - t_k)w_{ik}] + \\ [incidental\ nonresident\ purchases]$$

Substituting Equation 7 into Equation 1 and rearranging terms so that taxable sales, s_i, is alone on the left hand side of the equation yields:

Equation 6

$$s_i = \quad a - pp_i + iy_i + [tastes] - \\ gS[(t_i - t_j)w_{ij}] - k\,k_i S[(t_i - t_k)w_{ik}] + \\ [incidental\ nonresident\ purchases]$$

Before Equation 6 can be estimated using empirical data it requires several modifications. First, federal data shows that both the fraction of the population who consume alcohol and average consumption levels vary widely by state. In order to control for these factors the following modifications were made to the model. First, the dependent variable was created by dividing total domestic packaged sales in a state by the number of individuals who consume alcohol. Then several independent variables were added to control for differences in tastes among consumers.

The most significant of these was an average consumption variable. The U.S. Department of Agriculture tracks average beer consumption by age and region. The Census Bureau produces an annual series detailing the composition of state population by age. By using these two series it was possible to compute average consumption levels by state. However, since the data provided by the USDA is by region and not state it can be augmented somewhat. Data from the U.S. Department of Health and Human Services shows that alcohol consumption is positively correlated with education level. In order to control this factor an education variable e_i was added to Equation 6. It measures the percentage of the states' populations who have a bachelors or higher degree. Similarly, data from the HHS shows that alcohol consumption is higher among males than females and that it is more prevalent among the young. In order to control for these factors the variable m_i was created. It measures the percent of a state's population that is comprised of males between 21 and 40 years of age.

Finally, alcohol consumption varies by region. In order to control for these differences, binary intercept variables were added to the model. The country was divided up

into four regions. The first included the states in the New England, Mideast, and Great Lakes regions of the country as defined by the U.S. Bureau of Economic Analysis. The second region includes states in the Plains, Rocky Mountain, and Far West regions. States in the Southwest region comprised the third region while those in the Southwest made up the forth region. Alaska and Hawaii were not included in the second region and were assigned their own individual binary variables.

Draught beer is a substitute for packaged beer. In order to control for differences in draught beer consumption by state the variable d_i was added to the model. It measures draught beer sales as a percentage of total beer sales by state.

Data on incidental nonresident package beer purchases does not exist. However, the U.S. Bureau of Economic Analysis produces data on the composition of gross state product by state. The fraction of a state's economy that was comprised of hotel, amusement, and recreational services, *ni, was* used as a proxy for this variable. Equation 7 therefore represents an estimable form of Equation 6.

Equation 7

$$
\begin{aligned}
s_i = \quad & a + a_{R2} + a_{R3} + a_{R4} + a_{AK} + a_{HI} - p\, p_i \\
& + i y_i + c c_i + h e_i + m m_i - \mathrm{d} d_i - \\
& g \mathrm{S}[(t_i - t_j) w_{ij}] - \\
& k k_i \mathrm{S}[(t_i - t_k) w_{ik}] + n n_i
\end{aligned}
$$

The signs of the coefficients of the variables in Equation 7 represent ex ante expectations as to the effect that each will have on packaged beer sales in a state. There is assumed to be an inverse relationship between the price of a good and the quantity demanded by consumers. As a result, the sign of the coefficient p is expected to be negative. Similarly, since packaged beer is assumed to be a normal good whose consumption rises with income, the sign of i is expected to be positive.

As discussed earlier, the variables c_i, e_i and m_i were included in Equation 7 to represent differences in the tastes of consumers in the states. Federal data suggests that all should be positively correlated with beer consumption in a state. Therefore, the coefficients of all of these variables are expected to have a positive sign.

Draught beer is a substitute for packaged beer. Therefore, the coefficient, d, is expected to be negative.

If the effective tax rate on beer in state i is higher than it is in neighboring jurisdictions it will encourage cross-border shopping. Since beer purchased in neighboring jurisdictions replaces packaged sales in that state the signs of g and k are expected to be negative.

The variable n_i was included in Equation 7 as a proxy for incidental nonresident packaged beer consumption. Since packaged beer sales in a state should rise with influxes of nonresidents the sign of n is expected to be positive.

Estimation

Equation 7 was estimated using ordinary least squares regression analysis. This type of analysis is very powerful in that it allows a researcher to identify various factors (formally called independent variables) that affect a so-called dependent variable and then estimate the effects that each has on that variable while holding the effects of the other variables constant. In Equation 7, per drinker domestic packaged beer sales (measured in gallons) is the dependent variable. All of the variables listed on the right hand side of the equation are independent variables. The data used to estimate this equation was collected for all fifty states and the District of Columbia for the eight year period from 1990 though 1997.

Results

Table 4 presents the results of the regression analysis. The first column of the table lists the independent variables used

Table 4
Regression Results
Dependent Variable: Per Drinker Packaged Beer Sales

Measured in Gallons

Variable	Coefficient	t-statistic
Intercepts		
Intercept (a)	−11.1	−1.4
Region 2 (a_{R2})	2.4	3.1
Region 3 (a_{R3})	6.3	5.9
Region 4 (a_{R4})	11.3	10.3
Alaska (a_{AK})	6.7	3.5
Hawaii (a_{HI})	8.6	4.6
Price and Income		
Price (p)	−0.01010	−0.5
Income (i)	0.00003	0.3
Demographic		
Consume (c)	0.2	19.3
Education (e)	69.1	8.2
Male2140 (m)	55.9	2.1
Draught (h)	−25.8	−3.5
Cross-Border Shopping		
Interstate (g)	−88.3	−7.4
Canada (k)	−119.0	−5.4
Other		
Incidental Nonresident Consumption	111.2	12.0
R^2	86.0	

Source: Tax Foundation.

in the regression. These have been segregated by the types of effects they were intended to capture. The second column lists the estimated coefficients of these variables. The coefficients measure the direction and magnitude of change in the dependent variable for each one unit change in an independent variable while holding the effects of the other independent variables constant. The t-statistics, listed in column 3, measure the degree of confidence in each estimated coefficient. If the t-statistic is greater than

1.96 in absolute value, it indicates a high level of confidence in the estimated coefficient. All of the variables estimated in this analysis were statistically significant except those for the price and income variables. However, both the magnitudes and signs of these coefficients were as expected. The R^2 statistic at the bottom of Table 4 measures the amount of variation in the dependent variable that is explained by the overall model. In this particular case, the model explains 86.0 percent of the variation in per drinker packaged beer sales among states.

It was hypothesized above that a rise in the price of beer would lead to a decline in sales. The sign of the estimated price coefficient p supports this notion. Similarly, it was hypothesized that beer was a normal good whose consumption rose with income. The sign of the estimated income coefficient i supports this notion.

The variables c_i, e_i and m_i were included in the model to control for differences in tastes among consumers in the states. It was hypothesized that all of these variables would be positively correlated with packaged beer sales. The positive signs of each of the estimated coefficients of these variables supports this notion.

It was hypothesized that draught sales replace packaged beer sales in states. The sign of the coefficient d supports this notion.

Two variables were included in the model to capture the effects of interstate and Canadian cross-border shopping. The first of these, $S[(t_i - t_j)w_{ij}]$, was included to capture the effect of interstate cross-border shopping. It was hypothesized that states with relatively high effective tax rates on packaged beer would lose sales to them. The negative sign of the estimated coefficient of the cross-border shopping variable g supports this notion.

The model also included variable $k_iS[(t_i - t_j)w_{ik}]$ to estimate the extent of Canadian cross-border shopping in border states. The positive sign of the k supports the notion that high effective tax rates on beer in Canada has encouraged cross-border shopping by Canadians in the United States.

It was also hypothesized above that states which entertained large numbers of nonresidents would have relatively high packaged beer sales, all else being equal. The positive sign of the estimated coefficient of the tourist variable, q, supports this notion.

Conclusion

The per capita sale of packaged beer varies widely by state. It has long been suspected that these differences are due in part to cross-border shopping. Building on earlier work in this area, this study sought to explain differences in packaged beer sales among the states. A model of demand for beer and its supply by source was constructed. This model was created in a manner that allowed it to capture the effects of both interstate and Canadian cross-border shopping on beer sales in the states.

The model was then tested empirically using data from 1990–1997. Cross-border shopping was found to have significant effects on packaged beer sales in the states. In particular, the study found that in 1997, 18.1 million cases of beer, on net, moved from low- to high-tax states. Such exports accounted for approximately 2.0 percent of sales in net exporting states and allowed them to export $18.8 million in sales and beer excise taxes to their high-tax neighbors. In addition, states along the U.S.-Canadian border were able to export 10.9 million cases of beer and $14.6 million in sales and beer excise taxes to Canada. The study clearly shows that high sales and excise tax differentials lead to significant increases in cross-border beer sales.

Notes

1. Figures given are weighted average prices of all packaged sales.

2. The term 'packaged beer' is sometimes used to describe beer sold for off-premises consumption. Here it refers to all container, or non-draught, beer.

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