How Excise Tax Differentials Affect Interstate Smuggling and Cross-Border Sales of Cigarettes in the United States

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OCTOBER 1998

BACKGROUND PAPER

NO. 26

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Executive Summary

The cigarette excise tax has been many politicians' favorite revenue raiser for years. However, proposals to raise cigarette excise taxes rarely emphasize the higher prices that low-income smokers will pay. Instead, they claim that raising the price of cigarettes with higher excise taxes will deter smoking. It is important for legislators and the public to understand how the cigarette market reacts to high and low excise taxes.

This study explores the many different avenues that smokers use to buy tax-free or low-tax cigarettes, especially in areas where the excise tax is substantially higher than in neighboring jurisdictions. By using a sophisticated economic model of the cigarette market, we can look back as far as 1960 and follow the trends in taxation up to 1997, all the while examining the ways that excise taxes in each state changed smokers' purchasing habits.

Almost all the methods smokers have used over the years to avoid highly taxed cigarettes involve crossing borders of some sort, either state borders, international borders, or the "borders" of such low-tax jurisdictions as military bases and Native American tribal reservations. Of course, not all cross-border activity is innocent bargain shopping. The extensive organized smuggling of cigarettes that occurs between high- and low-tax jurisdictions is a major focus of this study, and the results should be of interest to federal and state law enforcement officials as well as policy makers.

Tax Avoidance State by State

The variety of cigarette excise tax levels in the nation provide many opportunities for consumers to shop for bargains across borders and for smugglers to make substantial profits. High-tax states like Massachusetts, Michigan, New York and Washington charge as much as $10.00 per carton in taxes. On the other hand, Kentucky, North Carolina, and Virginia go as low as 25 cents.

The table below details the cross-border activity of those jurisdictions losing the most taxable sales. Without exception, these are places where the cigarette excise tax is high and low-tax cigarettes are available nearby. That low-tax refuge can be a neighboring state, a neighboring country, or spe-

States Losing the Most Taxable Sales To Cross-Border Activity by Type

FY 1997

Percentage of Total Taxable Sales Lost

District of Columbia	38.2%
Hawaii	38.0%
New York	35.6%
Washington	33.8%
Michigan	30.3%

Percentage of Total Taxable Sales Lost to Smuggling

Hawaii	26.7%
Michigan	22.7%
Washington	22.5%
District of Columbia	16.4%
New York	15.7%

Percentage of Total Taxable Sales Lost to Cross-Border Sales

District of Columbia	19.3%
New York	18.4%
Massachusetts	17.9%
Maryland	13.2%
Illinois	10.5%

Percentage of Total Taxable Sales Lost to Military Bases

Hawaii	11.3%
Washington	3.2%
District of Columbia	2.5%
Nevada	2.2%
Texas	1.8%

Percentage of Total Taxable Sales Lost to Native American Tribal Reservations

New Mexico	9.1%
Washington	5.4%
South Dakota	5.2%
Alaska	5.1%
Oklahoma	4.8%

Source: Tax Foundation.

cial jurisdictions within a high-tax state such as military bases and Native American tribal reservations. Or in the case of a state with one of the nation's highest cigarette excises, the tax refuge can be far removed, as smugglers buy low-tax cigarettes by the thousands of cartons and truck them to high-tax jurisdictions.

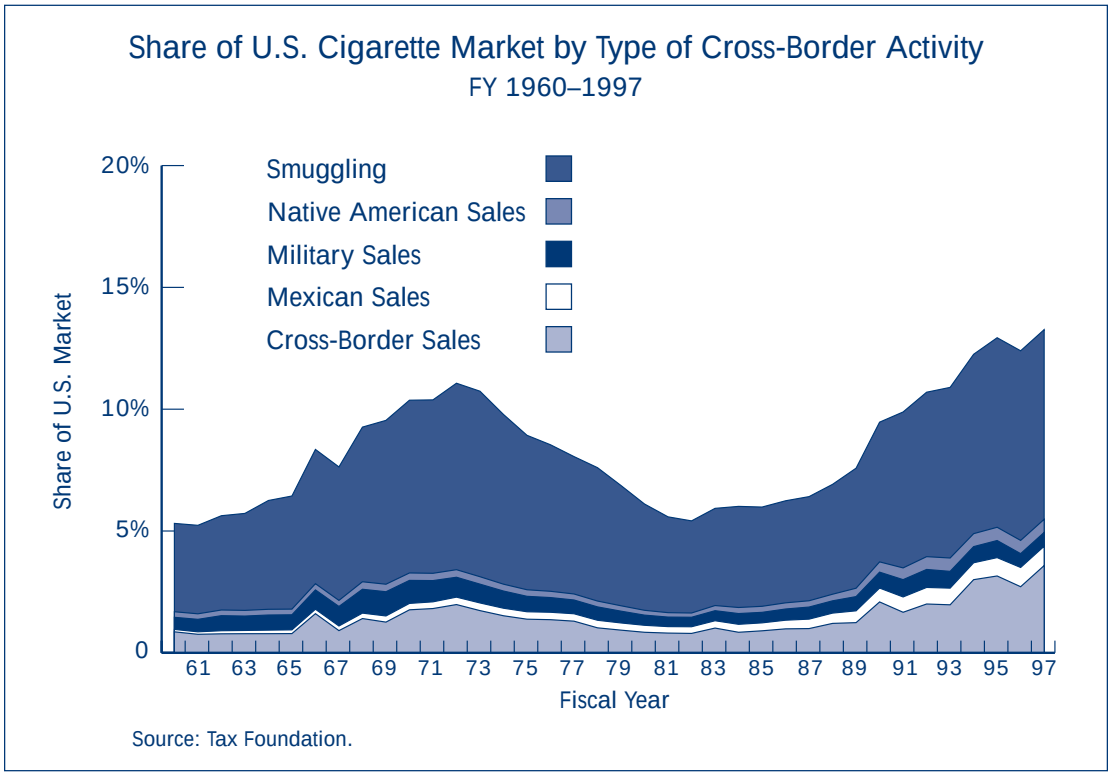
When a state reports lower taxable cigarette sales, that does not always mean that fewer cigarettes were smoked. Often smokers have not been discouraged as much as they have been encouraged to shop elsewhere, and the state-by-state data on cross-border activity can be striking. Washington, D.C., for example, which levies a $6.50 per carton cigarette excise tax, shares a border with Virginia where the tax is just 25 cents. As a result, per capita cigarette purchases in D.C. are only half of Virginia's.

In Michigan, for example, taxable cigarette sales fell 26.7 percent after the state raised its cigarette tax from $2.50 to $7.50 per carton. Meanwhile, sales in Indiana and other border states skyrocketed. Similarly, New Hampshire, with its relatively low excise, sells more than twice as many taxable cigarettes as its neighbor Massachusetts despite higher smoking rates in Massachusetts.

Tax Avoidance in Cigarette Purchases Since 1960

The figure below illustrates trends in cross-border activity in the cigarette market. State and local cigarette taxes in fiscal year 1962 averaged 26.4 cents per pack (FY 1997 dollars), and approximately 5.6 percent of all cigarettes were procured through some type of cross-border activity.

This moderate level of taxation and tax avoidance gave way after the 1964 Surgeon General's report on smoking and health. Politicians turned to cigarette excise taxes, and by 1972 average state and local cigarette taxes had climbed to 47.7 cents per pack (FY 1997 dollars). Cross-border activity kept pace, as the share of all cigarettes smoked in the U.S. acquired this way reached 11.1 percent. Cross-border shopping more doubled from 0.8 percent of total cigarette purchases in 1965 to 2.0 percent in 1972.



Source: Tax Foundation.

Cigarettes are compact, lightweight, and easily transported, an ideal product for both casual cross-border purchases and large-scale interstate smuggling. The rewards can be substantial, ranging from a $10.00 per carton savings for cost-conscious consumers to profits of $100,000 or more per truckload for interstate bootleggers. In 1965, 4.6 percent of all cigarettes smoked in the United States had been smuggled, but by 1972 this figure reached 7.7 percent, drawing the attention of federal, state, and local officials.

In 1977 the Advisory Commission on Intergovernmental Relations (ACIR) published *Cigarette Bootlegging: A State and Federal Responsibility*. It concluded that cigarette tax evasion, which cost the high-tax states $391 million ($944 million in 1998 dollars) in lost revenue each year, was primarily due to state tax differentials and was a serious problem in 14 states and a moderate problem in another eight states.

"Judging from the experience of the past 38 years, jurisdictions with high cigarette excise taxes can depend on losing a substantial fraction of taxable sales, especially if neighboring jurisdictions have significantly lower excises."

Congress's reaction was to enact P.L. 95-575 in October of 1978. That legislation prohibits the transport, receipt, shipment, possession, distribution or purchase of more than 60,000 cigarettes not bearing the tax stamp of the state where the cigarettes are found. Possible punishments include prison, large fines and vehicle seizure.

The state governments' reaction to the ACIR report was mixed. They did not harmonize their excise tax rates, but most states refrained from raising them dramatically, and the high inflation of the late 1970s reduced the per pack weighted-average cigarette excise tax to pre-1960 levels. As a result, the share of total U.S. consumption that was supplied by cross-border activity fell by more than half, from 11.1 percent in 1972 to 5.4 percent in 1982.

This lesson was eventually forgotten. A new round of state and local cigarette excise tax increases began in 1983 and continues to this day. This study estimates that the market share of cross-border activity reached 13.3 percent in 1997, exceeding the watershed levels of the early 1970s.

Conclusion

Trends in cross-border activity are shown to be directly related to trends in excise tax levels. Judging from the experience of the past 38 years, jurisdictions with high cigarette excise taxes can depend on losing a substantial fraction of taxable sales, especially if neighboring jurisdictions have significantly lower excises. Similarly, jurisdictions with excise taxes high enough to attract smugglers must face the certainty of turning cigarette retailing into a law enforcement challenge, with all the human and financial costs that entails.

Introduction

Each year in the United States a substantial number of cigarettes are moved across borders so that purchasers can avoid high excise taxes. Some of these cigarettes are smuggled by organized groups. Others are casually purchased by shoppers crossing state and national borders. Still others are procured in low-tax jurisdictions such as military bases and Native American tribal reservations. While it impossible to know exactly how many cigarettes move across borders each year, it is possible to create a model that can estimate the demand for cigarettes by state, and then estimate how much each available source of cigarettes supplies that market. The model can then be used to estimate changes in cross-border activity over time and by state.

Building on previous work, the Tax Foundation has created such a model. The estimates the model generates are presented in Sections I and II, while the model itself is detailed in Section III.

Section I defines cross-border activities and presents the model's estimates of those activities during the 12-month period from July 1, 1996 to June 30, 1997, the 1997 fiscal year in most states. The evidence shows a consistent correlation between high state-level cigarette excise taxes and a high incidence of lost taxable sales due to cross-border activity.

Section II examines cross-border activities over time, using data from 1960 to 1997 to test the hypothesis that cross-border activity has increased when states increase the excise tax differential between them.

Section III explains the development of the model. Every assumption and variable is examined, and the improved accuracy of the estimates over previous models is explained.

I. The Cross-Border Effects of High Cigarette Excises

In a market economy, competition will tend to drive down and eliminate any price differentials that exist among sellers. If the sellers are located in governmental jurisdictions that levy different excise taxes on a product, however, this effect can be stymied and price differentials can persist. In such cases, with the price mechanism effectively blocked, the market will respond quantitatively as individuals shift some of their purchases to the low-price location.

The sale of cigarettes within the United States is an interesting case study of this phenomenon. Cigarettes are a compact, lightweight product that can easily be transported from one jurisdiction to another. Furthermore, the price of cigarettes varies widely across the country. In FY 1997, for example, the weighted-average price of cigarettes ranged from a high of $2.65 per pack in Washington state to a low of $1.45 in Kentucky.

Most of this variation in price among states was attributable to differences in state and local cigarette excise taxes. In addition, areas with high cigarette prices often share a border with low-tax jurisdictions. Washington, D.C., which levies a $6.50 excise tax on each carton of cigarettes, for example, shares a border with Virginia, which levies a comparable tax of just 25 cents. These factors have led to the growth of three types of activity aimed at avoiding high cigarette excise taxes: crossing state and international borders to shop for bargains, smuggling large quantities of cigarettes across state and international borders for criminal profit, and shopping at special jurisdictions where state and local cigarette excise taxes do not apply (nontaxable sales).

Cross-Border Shopping

Cross-border shopping occurs when an

individual living in close proximity to a low-price jurisdiction simply crosses the border to make cigarette purchases. While the majority of these sales involve interstate travel, customers do cross international borders for cigarettes, and the data show considerable cross-border shopping at the Mexican and Canadian borders.

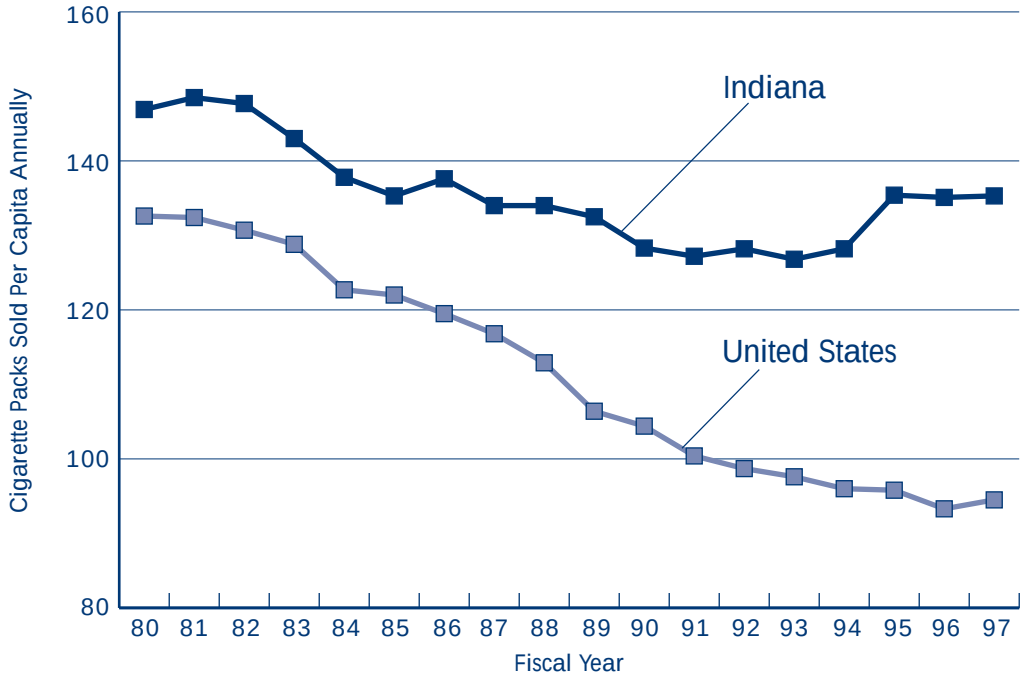
Interstate Shopping

Bargain-hunting smokers frequently cross borders to buy cigarettes, and the majority of cross-border shopping is between states. The recent experience of Indiana and Michigan shows just how strong this incentive can be.

Following the general trend in the rest of the country, cigarette sales per capita had been falling in Indiana since the mid-1970s (see Figure 1). Then, beginning in FY 1993, those states bordering Indiana with higher cigarette prices increased the price differential by raising their cigarette excise taxes. Meanwhile, Indiana kept its tax constant at 15.5 cents per pack. The most dramatic of these excise tax hikes occurred in Michigan, where on May 1, 1994, the state raised its cigarette tax from 25 cents per pack to the nation's second highest rate, 75 cents per pack.

Not surprisingly, sales in areas bordering Michigan soared. By crossing into Indiana, Michigan consumers could save as much as $5.95 in taxes on each carton of cigarettes. According to a survey conducted by Price Waterhouse, many Indiana merchants in the border region saw their cigarette sales rise by 40 percent or more while those located on the Michigan side of the border saw a corresponding decline.[1] One Michigan convenience store located approximately four miles from the Indiana border lost 98 percent of its cigarette carton sales and half of its pack sales in the

Figure 1
Cigarette Sales in Indiana Compared to Nationwide Sales
FY 1980–1997



Source: Tax Foundation.

wake of the tax increase.[2]

During the next fiscal year, per capita taxable cigarette sales fell 26.7 percent in Michigan. At the same time, in spite of a slight decline in national per capita cigarette sales, Indiana experienced a 5.6 percent increase in per capita cigarette sales. Other states bordering Michigan also experienced increases in per capita sales in the wake of the tax increase. Per capita sales rose 2.9 percent in Ohio while those in Wisconsin rose 1.8 percent. Even states beyond Michigan's immediate neighbors saw per capita sales rise. Sales in Tennessee and Kentucky rose 5.6 and 3.0 percent respectively while Missouri's rose 3.9 percent.

Crossing International Borders

Cross-border purchases within the United States are not the only option for some price-conscious consumers. Inexpensive cigarettes in Mexico have drawn U.S. consumers across the border. Likewise, high cigarette taxes in Canada have sent Canadian shoppers south into the U.S.

Smuggling

The tax differentials among states also create an arbitrage opportunity whereby individuals willing to break the law can buy cigarettes in a low-tax jurisdiction, transport them to a high-tax jurisdiction, and resell them. By doing so, the smugglers are able to expropriate much of the tax differential that exists between the two states on every pack smuggled.

Traditionally, smugglers have purchased large quantities of cigarettes in Virginia, Kentucky, and North Carolina, the three states with cigarette excise taxes that are markedly lower than those found in the rest of the country. The cigarette excise taxes in these states were 2.5, 3.0, and 5.0 cents per pack respectively during FY 1997. Smugglers have also acquired cigarettes on Native American tribal reservations and from stocks that were intended for export. The cigarettes allegedly bound for foreign destinations are particularly attractive to smugglers since such cigarettes are subject to neither federal, state, nor local cigarette excise taxes.

The lightweight, compact nature of cigarettes makes it possible to smuggle large quantities. A large semi-trailer, for example, can hold more than 200 cases of cigarettes (a case contains 600 packs). The financial gain from smuggling such quantities of cigarettes can be substantial. Again, the recent experience of Michigan provides a pointed example.

During FY 1997 the weighted-average cost of cigarettes in Michigan was $2.34 per pack. This compares to a price of $1.52 per pack in North Carolina. Most of this difference in price was due to the 70-cent disparity in the cigarette excise. The remainder is attributable to other factors such as differences in other taxes and transportation costs. A smuggler is therefore able to "earn" as much as $100,000 in evaded cigarette excise taxes on every semi-trailer load of cigarettes brought into Michigan from North Carolina. Large-scale smugglers have also smuggled cigarettes into the state from Kentucky, Virginia, and from Native American tribal reservations in New York. Smaller scale smugglers driving RVs and vans have also brought cigarettes into Michigan from Indiana and Tennessee.[3]

The prospect of earning such large sums has apparently lured many individuals into the business of smuggling cigarettes. According to Lt. Robert Manes, head of the Michigan State Police Treasury Enforcement Division, the agency charged with enforcing the state's cigarette tax, "[W]ith the amount of money that can be made now, everybody who has an avenue is getting into it."[4] One Detroit area man was caught after he earned more than $500,000 smuggling cigarettes. According to a report in the *Detroit Free Press,* police admit that there is little that they can do to stem the flow of illegal cigarettes.[5]

Another indication of smuggling's pervasiveness is the infrastructure that has arisen to service it. Retail outlets have opened in Virginia, Kentucky, and North Carolina to supply smugglers with large

quantities of cigarettes. Because federal law prohibits individuals from buying 300 or more cartons of cigarettes per day, and because it requires that retailers report cash transactions in excess of $10,000 to the Internal Revenue Service, smugglers typically travel to several of these outlets until they have filled their vehicles. The cigarettes are then transported to states with relatively high cigarette excises and resold.

Nontaxable Sales

Sometimes it is unnecessary to cross state lines to avoid state cigarette excise taxes. Cigarettes that are not subject to state and local excise taxes are available on Native American tribal reservations and at commissaries on military bases. Individuals with access to them may either consume or resell them. Either way, they replace taxable sales within a state. As was the case with smugglers, individuals reselling untaxed cigarettes are able to expropriate much or all of the tax differential.

Consider the case of Alaska. According to the latest study by the Centers for Disease Control, approximately 27.8 percent of Alaskans smoke.[6] This compares to a nationwide average of 22.9 percent. However, per capita sales of taxable cigarettes in the state during FY 1997 were lower than the national average, 81.7 packs as compared to 94.5 packs nationwide. What accounts for this apparent discrepancy in taxable sales? Studies have shown that a significant number of cigarettes sold on military bases each year find their way inside the civilian market.[7] Sales of cigarettes at military bases in Michigan have reportedly soared in the wake of increase in the state's cigarette excise tax.[8]

The State of Washington faces a similar problem with cigarettes procured on Native American tribal reservations in the state. According to the state's Department of Revenue, approximately 14 percent of all cigarettes consumed in the state during FY 1995, or about 46.1 million packs, had been illegally diverted into the statewide market from stocks intended for sale on Native American tribal reservations.[9]

Cigarettes intended for export are another source of untaxed cigarettes. Each year millions of packs of such cigarettes make their way into the domestic market. Once again, individuals reselling these cigarettes are able to expropriate much or all of the federal, state, and local cigarette excises. Schemes to divert cigarettes intended for export have been uncovered in Washington, California, Texas, New York, and New Jersey.[10]

Variation in Per Capita Cigarette Sales by State

These three activities—cross-border shopping, smuggling, and buying in tax-free jurisdictions—combine with demographic factors and other variables to cause taxable cigarette sales to vary widely from state to state. This variation is illustrated in Figure 2, which ranks states by their per capita sale of taxable cigarettes as compared to the national average for the 1997 fiscal year. Table 1 lists taxable sales and price data by state for FY 1997. Note the wide disparity in per capita taxable sales among states and how much of it is related to price.

Nationally, 94.5 packs of taxable cigarettes were sold per capita during this period at a weighted-average price of $1.85 per pack. The state with the highest per capita sales during this year was Kentucky which sold 186.8 packs of taxable cigarettes per capita, 92.3 packs per capita more than the national average. In FY 1997, Kentucky had the lowest weighted-average price of cigarettes in the country at $1.46 per pack. At the other end of the spectrum was Hawaii, which sold just 49.1 packs of taxable cigarettes per capita, 45.4 fewer than the national average. Hawaii had the third highest priced cigarettes in the country during this period with a weighted-average price of $2.43.

States with relatively low-priced cigarettes serve as supply sources for organized smugglers and act as a magnet to price-conscious consumers. Kentucky's lowest-in-the-nation cigarette prices have made it one of

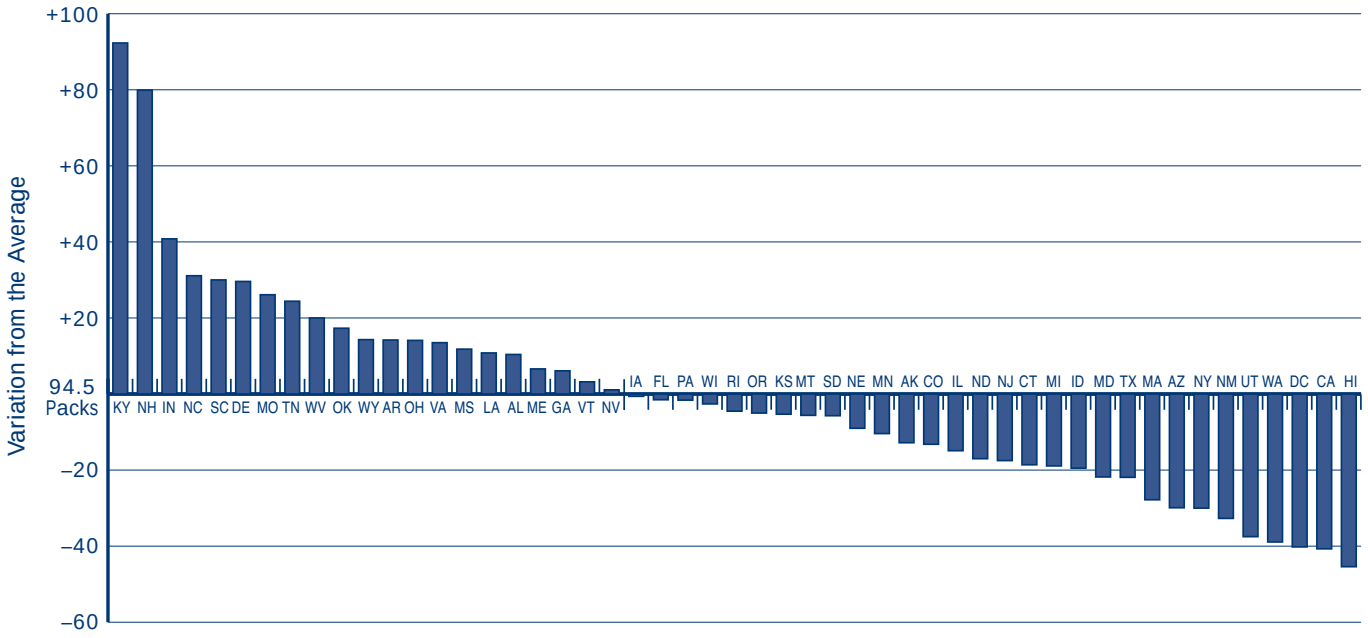
the three primary states providing cigarette smugglers with cigarettes. The state which had the second highest per capita sales during FY 1997 was New Hampshire, which sold 174.4 packs per capita. Note that New Hampshire had the lowest priced cigarettes of any state in New England during that year. This was in large part due to the state's relatively low cigarette excise taxes. The state's low sales and excise taxes, coupled with the short driving distances, have drawn price-conscious consumers from other states and Canada. It's interesting to note that New Hampshire sells more than twice as many cigarettes per capita than does its neighbor Massachusetts where, according to the Centers for Disease Control, the rate of cigarette smoking is slightly higher, 22.3 versus 22.0 percent.[11]

Other states with high per capita cigarette sales include North Carolina and Delaware. As is the case with Kentucky, North Carolina has been identified as a major source of smuggled cigarettes. Meanwhile, relatively low cigarette prices in Delaware have drawn cross-border shoppers from Pennsylvania and Maryland.

At the other end of the spectrum are states with relatively low per capita taxable cigarette sales. The state with the lowest per capita taxable sales during FY 1997 was Hawaii, which had per capita sales of 49.1 packs. According to the latest Centers for Disease Control report comparing smoking rates among the states, Hawaii ranks slightly below the national average in the percentage of its adult population that smokes, 19.5 percent as compared with 22.9 percent for the nation as a whole. Why then are per capita taxable sales in the state less than half the national average? A 1985 federal study of cigarette tax evasion found that the availability of untaxed cigarettes on military bases is a significant factor affecting taxable sales in the state.[12]

California and Washington are also ju-

Figure 2
Variation Among the States in Per Capita Cigarette Pack Sales
FY 1997



Source: Tax Foundation.

risdictions with low per capita sales. In both, taxable cigarette sales are lowered by smuggling and cross-border shopping. In California, this activity includes a substantial international component, as inexpensive cigarettes from Mexico are either smuggled in or bought in Mexico by Californians. In Washington state the availability of low-priced cigarettes on Native American tribal reservations and military bases plays a significant role in reducing taxable sales.

The fact that some states experience low per capita sales may also be attributable to non-tax, demographic factors. Per capita sales are low in Utah, for example, because a large fraction of the population belongs to the Church of Jesus Christ of Latter-Day Saints (Mormons) which strongly discourages smoking by its adherents.

Another way of comparing states is to examine sales in the high-tax versus low-tax blocks of states. Since 1989 there have been more than 57 cigarette excise tax increases. As a result, the following high-tax block of states, California, Massachusetts, Michigan, and New York—with an average tax of 61 cents per pack—sell fewer cigarettes than the following block of low-tax states; Indiana, Kentucky, Missouri, New Hampshire, North Carolina, Tennessee, and Virginia—with an average tax of 12 cents per pack. Yet the four high-tax states have a population (65.8 million) that is nearly double that of the low-tax states (35.8 million).[13]

Table 2 presents the results of a FY 1997 state-by-state analysis of cross-border activity using the model.[14] The first six columns of the table break down state cigarette consumption by supply source. The final column lists the weighted-average sum of state and local cigarette excise taxes per pack encountered by smokers in the states.

The first column shows the percentage of each state's consumption that is supplied by taxable sales. Not surprisingly, the analysis shows that in states with low cigarette taxes, much of the demand for cigarettes is supplied by taxable sales. Kentucky, North Carolina, South Carolina, and Virginia all have cigarette excise taxes lower than 7.5

Table 1
Variation in Per Capita Cigarette Pack Sales Among the States
FY 1997

	Number of Packs Sold Per Capita	Variance from National Average	Average Price (per pack)
United States	94.5	—	$1.85
Kentucky	186.8	92.3	1.46
New Hampshire	174.4	79.9	1.77
Indiana	135.3	40.8	1.56
North Carolina	125.6	31.1	1.52
South Carolina	124.5	30.0	1.54
Delaware	124.1	29.6	1.72
Missouri	120.6	26.1	1.63
Tennessee	118.9	24.4	1.61
West Virginia	114.5	20.0	1.61
Oklahoma	111.8	17.3	1.72
Wyoming	108.8	14.3	1.64
Arkansas	108.7	14.2	1.81
Ohio	108.6	14.1	1.67
Virginia	108.0	13.5	1.60
Mississippi	106.3	11.8	1.69
Louisiana	105.3	10.8	1.67
Alabama	104.9	10.4	1.67
Maine	101.1	6.6	1.90
Georgia	100.6	6.1	1.59
Vermont	97.7	3.2	2.02
Nevada	95.6	1.1	1.99
Iowa	93.9	–0.6	1.89
Florida	93.0	–1.5	1.83
Pennsylvania	92.9	–1.6	1.77
Wisconsin	91.9	–2.6	2.01
Rhode Island	90.0	–4.5	2.17
Oregon	89.5	–5.0	1.98
Kansas	89.2	–5.3	1.71
Montana	88.9	–5.6	1.65
South Dakota	88.8	–5.7	1.82
Nebraska	85.5	–9.0	1.85
Minnesota	84.1	–10.4	2.17
Alaska	81.7	–12.8	2.14
Colorado	81.3	–13.2	1.74
Illinois	79.6	–14.9	1.99
North Dakota	77.5	–17.0	1.94
New Jersey	77.0	–17.5	1.95
Connecticut	75.9	–18.6	2.09
Michigan	75.6	–18.9	2.34
Idaho	75.0	–19.5	1.84
Maryland	72.7	–21.8	1.91
Texas	72.6	–21.9	1.90
Massachusetts	66.7	–27.8	2.45
Arizona	64.6	–29.9	2.22
New York	64.5	–30.0	2.23
New Mexico	61.8	–32.7	1.76
Utah	57.0	–37.5	1.86
Washington	55.6	–38.9	2.65
District of Columbia	54.3	–40.2	2.30
California	53.8	–40.7	2.00
Hawaii	49.1	–45.4	2.43

Source: Tax Foundation.

cents per pack. Consequently, the analysis shows that more than 98 percent of the cigarettes consumed in these states result from taxable sales. Conversely, the analysis shows that in states with high cigarette excise taxes, much of the demand for cigarettes is supplied by some type of cross-border activity. The District of Columbia, Hawaii, New York, Washington and Michigan all have cigarette taxes in excess of 55 cents per pack. Note that taxable sales supply less than 70 percent of the market in each of these jurisdictions.

The second column of Table 2 shows the percentage of smuggled cigarettes consumed in a state. The analysis estimates that more than 15 percent of the cigarette market in Hawaii, Michigan, Washington, the District of Columbia and New York was supplied by smugglers. Note that cigarette excise taxes in each of these states are 55 cents or more per pack. On the other hand, in the low-tax states of Kentucky, North Carolina, South Carolina, and Virginia less than one percent of the cigarettes supplied to the market were procured via smuggling.

The role that interstate cross-border sales play in meeting the demand for cigarettes within a state is demonstrated in the third column of Table 2. These figures are the percentages of each year's cigarette consumption in a state that resulted from cross-border purchases made by that state's residents. The District of Columbia, New York, Massachusetts, Maryland and Illinois all import more than 10 percent of the cigarettes consumed within their borders from neighboring states.

Cross-border shopping by residents of states living along the U.S.-Mexican border is shown by the sixth column of Table 2 to be a significant factor affecting taxable cigarette sales in all the border states. It is estimated that 2.7 percent of the cigarettes consumed in both California and New Mexico were procured across the border in Mexico. Similarly, 2.6 and 2.4 percent of the cigarettes consumed in Texas and Arizona respectively were the product of cross-border purchases in Mexico.

The fourth and fifth columns of Table 2 show the percentage of each state's cigarette consumption supplied by sales on military bases and Native American tribal reservations. The analysis shows that high state and local sales and cigarette excise taxes encourage individuals with access to these tax-free zones to buy cigarettes there. Jurisdictions where cigarette sales on military bases are a significant share of the market include Hawaii, Washington, the District of Columbia and Nevada. States where Native American tribal reservations supply a significant share of the market include New Mexico, Washington, South Dakota, Alaska and Oklahoma.

International Precedents

Cross border effects are not a new phenomena. Smugglers have made their living for thousands of years avoiding taxes and tariffs. In fact, eighteenth century England faced a problem very similar to that faced by states imposing high cigarette excise taxes today. Throughout the eighteenth century, England continually raised its tariff on tobacco. Then, as now, this had the effect of encouraging smuggling. By the early part of the eighteenth century the situation had reached a point where, even though tobacco consumption in England was on the rise, tobacco tariff revenue was falling. Then in 1826, a drafting error inadvertently caused the tobacco tariff rate to be cut by 25 percent. This had the effect of decreasing smuggling to such an extent that revenue from the tobacco tax actually increased.[15]

Astute observers at the time recognized the link between excise taxes and smuggling as well as the possibility that excise taxes could be raised to such levels that they became counterproductive from a revenue standpoint. Adam Smith, the father of modern economics, commented in his book *The Wealth of Nations*:

> The high duties which have been imposed upon the importation of many different sorts of foreign

Table 2
State Cigarette Consumption by Supply Source
FY 1997

		Cross-Border Activity					Memo
	Taxable Sales	Smuggling	Cross–border Sales	Military Sales	Native American Sales	Mexican Sales	Weighted Per Pack State & Local Cigarette Tax (cents per pack in FY 97 $)
United States	86.7%	7.8%	3.6%	0.6%	0.8%	0.5%	34.9¢
Alabama	94.8	4.8	*	0.0	0.5	0.0	21.9
Alaska	91.5	2.6	0.0	0.8	5.1	0.0	40.6
Arizona	88.7	3.8	0.4	1.7	3.0	2.4	58.0
Arkansas	84.8	8.2	6.8	0.2	0.0	0.0	31.5
California	86.1	9.3	0.0	0.8	1.1	2.7	37.0
Colorado	95.2	4.0	0.0	0.3	0.5	0.0	20.0
Connecticut	87.2	11.7	*	0.7	0.4	0.0	50.0
Delaware	94.9	4.8	*	0.3	0.0	0.0	24.0
Florida	88.9	8.5	1.4	0.8	0.4	0.0	33.9
Georgia	97.6	1.7	*	0.5	0.1	0.0	12.0
Hawaii	62.0	26.7	0.0	11.3	0.0	0.0	60.0
Idaho	89.1	8.6	*	0.0	2.3	0.0	28.0
Illinois	83.2	6.2	10.5	0.0	0.0	0.0	50.0
Indiana	97.2	2.8	*	0.0	0.0	0.0	15.5
Iowa	90.2	9.4	*	0.0	0.4	0.0	36.0
Kansas	91.8	5.3	1.5	0.4	0.9	0.0	24.0
Kentucky	99.9	0.0	*	0.1	0.0	0.0	3.0
Louisiana	95.3	4.2	*	0.1	0.4	0.0	20.0
Maine	86.5	9.7	2.4	0.5	0.9	0.0	37.0
Maryland	78.0	8.1	13.2	0.6	0.0	0.0	36.0
Massachusetts	71.3	10.2	17.9	0.3	0.3	0.0	69.7
Michigan	69.7	22.7	5.4	0.1	2.1	0.0	75.0
Minnesota	95.7	2.6	1.0	0.1	0.5	0.0	48.0
Mississippi	95.0	3.9	0.3	0.4	0.4	0.0	18.0
Missouri	95.8	4.1	*	0.1	0.0	0.0	20.1
Montana	92.2	3.9	*	0.0	4.0	0.0	18.0
Nebraska	88.0	8.5	1.1	1.2	1.3	0.0	34.0
Nevada	86.5	8.9	*	2.2	2.4	0.0	35.0
New Hampshire	94.4	5.2	*	0.4	0.0	0.0	25.0
New Jersey	90.5	9.0	*	0.2	0.3	0.0	40.0
New Mexico	82.8	4.8	*	0.6	9.1	2.7	21.0
New York	64.4	15.7	18.4	0.6	0.9	0.0	58.9
North Carolina	99.0	0.1	*	0.5	0.4	0.0	5.0
North Dakota	95.0	2.5	*	0.6	1.9	0.0	44.0
Ohio	93.4	5.2	1.4	0.0	0.0	0.0	24.5
Oklahoma	89.0	5.3	*	0.9	4.8	0.0	23.0
Oregon	82.9	14.1	*	0.5	2.5	0.0	50.3
Pennsylvania	92.9	7.1	*	0.0	0.0	0.0	31.0
Rhode Island	95.8	3.6	*	0.4	0.2	0.0	61.0
South Carolina	99.0	0.6	*	0.3	0.1	0.0	7.0
South Dakota	90.5	4.2	*	0.1	5.2	0.0	33.0
Tennessee	96.9	2.1	0.9	0.1	0.0	0.0	13.0
Texas	83.0	10.3	1.6	1.8	0.7	2.6	41.0
Utah	81.8	13.4	*	1.2	3.5	0.0	26.5
Vermont	88.2	11.8	*	0.0	0.0	0.0	44.0
Virginia	98.4	0.6	*	0.8	0.1	0.0	7.3
Washington	66.2	22.5	2.7	3.2	5.4	0.0	82.5
West Virginia	96.5	3.5	*	0.0	0.0	0.0	17.0
Wisconsin	86.7	11.7	*	0.0	1.6	0.0	44.0
Wyoming	97.0	2.1	*	0.0	0.9	0.0	12.0
Dist. of Columbia	61.8	16.4	19.3	2.5	0.0	0.0	65.0

* Net Exporter of cigarettes purchased by cross-border shoppers.

Source: Tax Foundation.

> goods, in order to discourage their consumption in Great Britain, have in many cases served only to encourage smuggling; and in all cases have reduced the revenue of the customs below what more moderate duties would have afforded.[16]

In America, while discussing methods of financing the operations of the federal government, the Founding Fathers also recognized the problems associated with high excise taxes. In *Federalist* No. 31 Alexander Hamilton wrote:

> Exorbitant duties on imported articles would beget a general spirit of smuggling; which is always prejudicial to the fair trader, and eventually to revenue itself.[17]

As in the United States, cigarette excise taxes, and consequently prices, vary widely around the world. Predictably, this has resulted in a great deal of international cross-border activity and ancillary problems associated with it.

Canada

During the late 1980s and early 1990s, governments in Canada raised their cigarette taxes to the point where cigarettes cost approximately $4.50 per pack, as compared to a range of $1.50 to $2.00 per pack in the U.S. border states. This tax gap created a situation where it was possible to earn as much as $350,000 on every semi-trailer load of cigarettes smuggled into Canada.

Not surprisingly, the prospect of earning such profits caused cigarette smuggling into Canada to soar. Trucks, vans, cars, boats, and even kayaks and snowmobiles were soon employed smuggling cigarettes across the border. In addition, the country experienced significant diversion of tax-exempt cigarettes into its ordinary consumer market. By 1994 it was estimated that one third of the cigarettes sold in the providence of Ontario and two-thirds of the cigarettes sold in Quebec were contraband.[18]

Lost tax revenue was not the only problem associated with the smuggling. Organized crime soon became involved in the illegal cigarette trade and violence erupted in cities and towns across Canada. Small shops were robbed and burglarized because they suddenly held a very valuable commodity—cigarettes. In addition, there was widespread flouting of the law by ordinary Canadian citizens who sometimes lined up for blocks in the presence of police to knowingly buy contraband cigarettes.

The rise of the illegal cigarette market and the problems associated with it caused considerable concern at the highest levels of Canadian government. Prime Minister Jean Chrétien stated, "[S]muggling is threatening the safety of our communities and the livelihood of law-abiding merchants." He went on, "[Cigarette smuggling] is a threat to the very fabric of Canadian society."[19] Solicitor General Herb Gray added:

> Organized crime has become a major player in the contraband cigarette market. What we are seeing is a frightening growth in criminal activity. We are seeing a breakdown in respect for Canadian law. Canadian society is the victim.[20]

After trying various methods of combating this problem, the Canadian government sharply cut its cigarette taxes in February 1994 and encouraged the provinces to follow suit. These measures significantly reduced smuggling and the attendant problems in Canada.

Europe

Europe has a thriving black market in cigarettes driven by cigarette excises that are typically high enough to account for 70 percent or more of the price of cigarettes. A report published by the European Parliament estimates that approximately 10 percent of the cigarette market on the continent is contraband.[21] Others argue that contraband is more prevalent, with up to

50 percent of the market in some countries.[22] The Tobacco Manufacturers Association in the United Kingdom estimates that at least one million consumers purchase black market tobacco products at a cost to the British government of $1.7 billion annually.[23]

Like Canada, Europe has also experienced many of the ancillary problems associated with illegal markets. Germany has experienced a rash of cigarette-related murders and disappearances over the past several years. "We have never seen any thing as brutal as this," says Detlef Schade, a police detective in Berlin, who notes, "People are being executed in cold blood in their apartments and in broad daylight on the streets, on subway platforms, in front of hundreds of witnesses." According to news reports, the illegal cigarette trade has made the streets of Germany's capital more dangerous than at any time since World War II.[24]

Asia

In Asia, rising affluence and changing tastes have increased the demand for American and European cigarettes. In this, the world's largest market for cigarettes, the illegal cigarette trade has been driven by two factors.

In many of the region's nations, the illegal cigarette trade is driven by high cigarette excise taxes, the same factor that drives smuggling in North America and Europe. Asian nations have also been visited by some of the law enforcement problems associated with the illegal cigarette trade. Several years ago, for example, the badly beaten body of a man was fished out of a Singapore harbor after he had threatened to expose a major smuggling operation. As a message to other potential informants, his mouth had been taped shut and a padlocked chain was wrapped around his neck.[25]

In some countries, most notably China, state monopolies still control much of the tobacco market. In these countries, where legal sales of Western brands is relatively small and heavily taxed or sometimes nonexistent, the demand has been filled by smuggled cigarettes. China estimates that 99 percent of the foreign cigarettes sold in the country are the product of smuggling.[26] Such smuggling is estimated to cost the government more than $1.8 billion in lost revenue annually.[27] Since 1994 the Hong Kong Customs and Excise Department has had to deploy a special "Anti-Cigarette-Smuggling Task Force" to combat cigarette smuggling in the territory.[28] In China, gangs are estimated to have paid millions of dollars in bribes to Chinese officials who assist them in their bootlegging operations.[29]

II. Cross-Border Activity in the United States, 1960–1997

High excise tax differentials clearly had a high correlation with increased cross-border activity in fiscal year 1997. This observation can be further validated by an examination of excise tax differentials and cross-border activity over time.

During FY 1960 there was a moderate level of cross-border activity in the United States. Real state and local cigarette taxes averaged 24.8 cents per pack.

During that year approximately 5.3 percent of the cigarettes consumed in the United States were procured via some type of cross-border activity. Table 3 shows that smuggled cigarettes accounted for 3.6 percent of the U.S. market while interstate cross-border purchases, sales on military bases and Native American tribal reservations, and cross-border purchases in Mexico accounted for 0.9, 0.5, 0.1, and 0.2 percent of total consumption, respectively.

This situation began to change during the early 1960s as various state and local governments raised their cigarette taxes. By FY 1965 real state and local cigarette taxes averaged 30.4 cents per pack. This led to a steady rise in the level of cross-border activity. By FY 1965 approximately 6.4 percent of the cigarettes consumed in the United States resulted from cross-border activity. Figure 3 shows that increases in cigarette smuggling accounted for most of this rise. In FY 1965 bootleg cigarettes accounted for 4.6 percent of the U.S. market, up a percentage point from 1960. The share resulting from other types of cross-border activity grew only slightly, from 1.7 percent in FY 1960 to 1.8 percent in 1965.

During the late 1960s and early 1970, politicians across the country cited the 1964 Surgeon General's report on smoking and health as they pushed for higher state and local cigarette excise taxes. By 1972 real state and local cigarette taxes had risen to 47.7 cents per pack, with rates varying widely across the country. Figure 3 shows that these tax rate differentials led to a rapid rise in cross-border activity, particularly smuggling. By 1972, 11.1 percent of the cigarettes consumed in the United States were the product of some type of cross-border activity, up from 6.4 percent in 1965.

This increase in cross-border activity was felt virtually across the board. The share of the cigarette market comprised of interstate cross-border purchases more than doubled from 0.8 percent in 1965 to 2.0 percent in 1972 (see Figure 3). Over this same 7-year time period, the share of the U.S. market that was purchased on military bases grew from 0.6 to 0.8 percent, and the share that was purchased on Native American tribal reservations grew from 0.2 percent to 0.3 percent. Similarly, the share of U.S. consumption that was supplied by purchases in Mexico grew from 0.2 percent in 1965 to 0.3 percent in 1972.

Of greater concern to federal, state, and local officials, however, was cigarette bootlegging, which by this time had become a major problem throughout much of the nation. In 1965, 4.6 percent of the cigarettes consumed in the United States had been smuggled. By 1972 this figure is estimated to have soared to 7.7 percent.

By the middle of the 1970s there was sufficient public awareness of the problems associated with cross-border activity that the federal government began to examine ways of dealing with it. In 1977 the Advisory Commission on Intergovernmental Relations (ACIR) issued a report titled *Cigarette Bootlegging: A State and Federal Responsibility*. This report concluded:

> Tax evasion activities, which cost the high-tax states $391 million ($944 million in 1998 dollars) in revenue losses each year, are primarily due to state tax differentials and are a serious problem in 14 states and a moderate problem in another eight states.[30]

Table 3
Total U.S. Cigarette Consumption by Supply Source
FY 1960 - 1997

Year	Taxable Sales	Cross-Border Activity					Memo: Weighted Per Pack State & Local Cigarette Tax (cents per pack in FY 97 $)
		Smuggling	Cross-border Sales	Military Sales	Native American Sales	Mexican Sales	
1960	94.7%	3.6%	0.9%	0.5%	0.1%	0.2%	24.8¢
1961	94.8	3.6	0.8	0.5	0.1	0.2	25.1¢
1962	94.4	3.9	0.8	0.6	0.1	0.2	26.4¢
1963	94.3	4.0	0.8	0.6	0.1	0.2	26.8¢
1964	93.8	4.5	0.8	0.6	0.1	0.2	29.1¢
1965	93.6	4.6	0.8	0.6	0.2	0.2	30.4¢
1966	91.7	5.5	1.6	0.8	0.2	0.3	35.0¢
1967	92.4	5.5	0.9	0.8	0.2	0.2	35.0¢
1968	90.7	6.3	1.4	1.0	0.2	0.3	39.3¢
1969	90.5	6.7	1.3	1.0	0.3	0.3	40.9¢
1970	89.6	7.1	1.8	0.9	0.3	0.3	44.6¢
1971	89.6	7.1	1.8	0.9	0.3	0.3	45.0¢
1972	88.9	7.7	2.0	0.8	0.3	0.3	47.7¢
1973	89.3	7.6	1.7	0.8	0.3	0.3	47.5¢
1974	90.2	7.0	1.5	0.7	0.3	0.3	43.9¢
1975	91.1	6.3	1.4	0.6	0.3	0.3	39.9¢
1976	91.5	6.0	1.4	0.6	0.3	0.3	37.9¢
1977	92.0	5.6	1.3	0.6	0.3	0.2	35.9¢
1978	92.4	5.5	1.0	0.5	0.3	0.2	34.4¢
1979	93.1	4.9	0.9	0.5	0.3	0.2	31.4¢
1980	93.9	4.4	0.8	0.4	0.3	0.2	28.1¢
1981	94.4	3.9	0.8	0.4	0.3	0.2	25.6¢
1982	94.6	3.8	0.8	0.4	0.3	0.2	24.3¢
1983	94.1	4.0	1.0	0.4	0.3	0.2	24.7¢
1984	94.0	4.1	0.8	0.4	0.3	0.2	25.1¢
1985	94.0	4.1	0.9	0.4	0.3	0.2	24.5¢
1986	93.8	4.2	1.0	0.5	0.4	0.3	25.0¢
1987	93.6	4.3	1.0	0.5	0.4	0.3	25.2¢
1988	93.1	4.5	1.2	0.5	0.4	0.3	25.8¢
1989	92.4	4.9	1.2	0.6	0.5	0.3	27.3¢
1990	90.5	5.7	2.1	0.7	0.6	0.4	29.8¢
1991	90.1	6.4	1.7	0.7	0.6	0.5	31.2¢
1992	89.3	6.7	2.0	0.7	0.7	0.5	31.3¢
1993	89.1	7.0	2.0	0.7	0.7	0.5	31.8¢
1994	87.8	7.4	3.0	0.7	0.7	0.5	34.4¢
1995	87.1	7.8	3.1	0.7	0.8	0.5	35.5¢
1996	87.6	7.8	2.7	0.6	0.8	0.5	35.3¢
1997	86.7	7.8	3.6	0.6	0.8	0.5	34.9¢

Source: Tax Foundation.

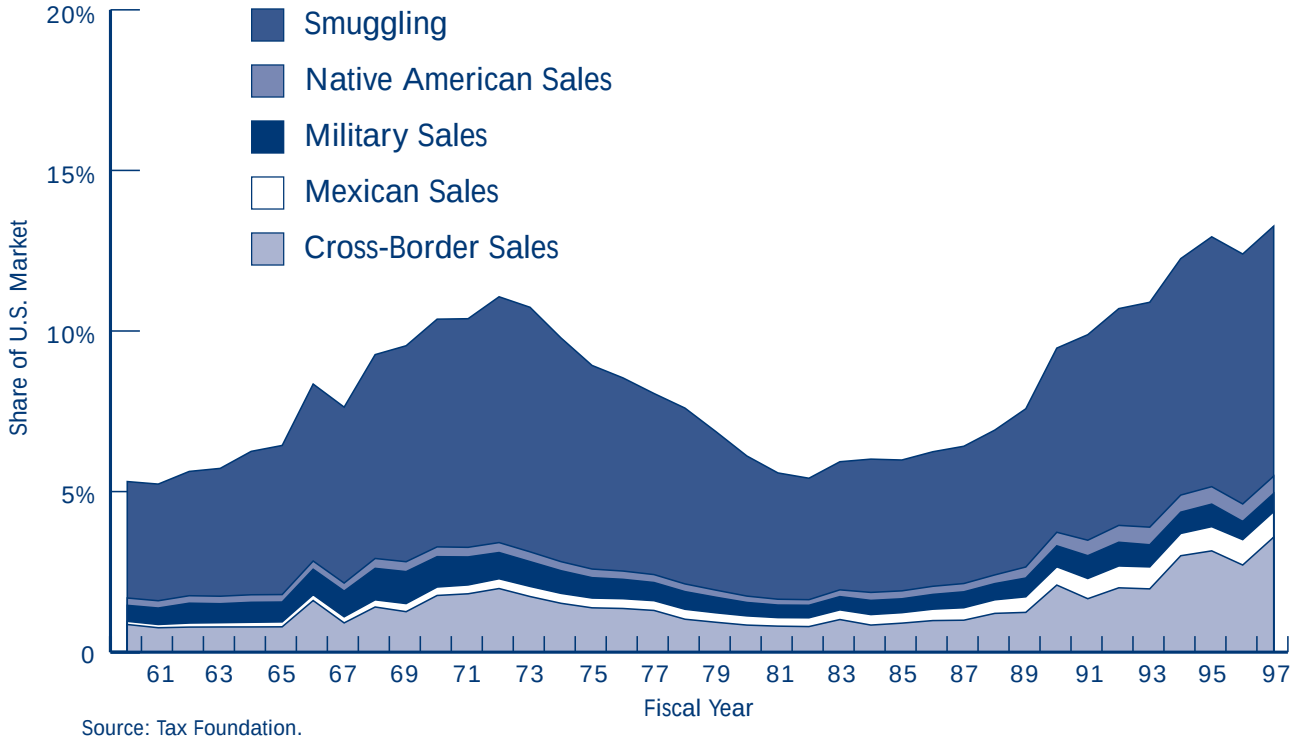
The report contained a number of recommendations for dealing with this problem. At the federal level, the commission suggested that Congress create a federal law prohibiting individuals from transporting large quantities of cigarettes with the intent of avoiding state and local excise taxes. It also recommended that state governments take steps to minimize the variation in their cigarette excise tax rates.

In October of 1978, Congress enacted P.L. 95-575 which prohibits the transport, receipt, shipment, possession, distribution or purchase of more than 60,000 cigarettes not bearing the tax stamp of the state in which the cigarettes are located. Violation of this statute is punishable by up to 5 years in prison and a $100,000 fine. Vehicles used in smuggling activities are also subject to seizure.

The state governments' reaction to the ACIR report was mixed. While they did not collectively take steps to lessen variation in cigarette excise taxes, most refrained from raising them dramatically and the high inflation of the late 1970s reduced the per pack weighted-average cigarette excise tax to pre-1960s levels. As a result, the share of total U.S. consumption that was supplied via some type of cross-border activity fell by more than half, from 11.1 percent in 1972 to 5.4 percent in 1982.

Figure 3 illustrates that these effects were felt across-the-board. In 1972, smuggled cigarettes constituted 7.7 percent of the U.S. market. By 1982 this figure had fallen to 3.8 percent. Similarly, interstate cross-border purchases accounted for 2.0 percent of the total cigarette market in 1972, but by 1982 this figure had fallen to 0.8 percent. Cross-border purchases in Mexico fell from 0.3 percent of the market in 1972 to 0.2 percent in 1982. Likewise, sales on military bases which comprised 0.8 percent of

Figure 3
Share of U.S. Cigarette Market by Type of Cross-Border Activity
FY 1960–1997



Source: Tax Foundation.

the U.S. market in 1972 had fallen to 0.4 percent in 1982. Throughout this period cigarette sales on Native American tribal reservations remained flat at approximately 0.3 percent of the total cigarette market.

The lessons learned during the 1960s and 1970s and detailed in the 1977 ACIR report were soon forgotten. A new round of state and local cigarette excise tax increases began in 1983 and continues to this day. This has caused the levels of cross-border activity to exceed even the watershed levels of the early 1970s. In 1997, 13.3 percent of the cigarettes supplied to U.S. consumers were procured via some type of cross-border activity, up from 5.4 percent in 1982.

Figure 3 shows that the share of the market supplied by all types of cross-border activity rose markedly during this period, particularly smuggling and cross-border shopping. In 1982, 3.8 percent of the U.S. market was supplied by bootleg cigarettes. By 1997 this figure is estimated to have more than doubled to 7.8 percent.

Similarly, in 1982, 0.8 percent of the cigarettes sold in the U.S. market were purchased by cross-border shoppers, but 15 years later in 1997, this figure had more than quadrupled to 3.6 percent. The fraction of the market comprised of cross-border purchases by U.S. consumers shopping in Mexico, which was 0.2 percent in 1982, is estimated to have risen to 0.5 percent in 1997.

Cigarette sales on military bases, which accounted for 0.4 percent of total U.S. cigarette consumption in 1982, rose to 0.6 percent in 1997. Cigarette sales on Native American tribal reservations rose more rapidly, supplying 0.8 percent of the U.S. market in 1997, up from 0.3 percent in 1982.

III. A Model of Cigarette Demand And 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. A 1996 Tax Foundation analysis further developed the methodology used in the 1993 study.

The model developed here represents a significant extension and refinement of previous Tax Foundation analyses. Most significantly, the current model was developed using a much larger data set than those employed in past Tax Foundation analyses. The 1993 report examined cross-border activity using three years of data (FY 1988–1990). The 1996 report used 15 years of data (FY 1980–1994). The model employed here uses 38 years of data (FY 1960–1997). In addition, the current model more comprehensively controls for demographic factors affecting cigarette consumption and more carefully measures international cross-border activity.

Developing the Model

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

Equation 1

$$c_i = a + by_i - pp_i - ss_i(\ln d_i) - mm_i - oo_i - rr_i$$

Consumption of cigarettes by residents of a state is given by c_i in Equation 1. The income level of state residents is given by y_i. Since cigarettes are assumed to be a normal good whose consumption rises with income, the sign of the coefficient b is expected to be positive. The price of cigarettes is given by p_i. Since consumption of cigarettes can be expected to fall as their price rises, the sign of the coefficient p is expected to be negative.

The tastes of consumers vary widely. To some extent, however, they can be captured by looking at the demographic characteristics of consumers in different states. For instance, individuals living in the country's tobacco growing region have always smoked more cigarettes than other Americans. To capture this effect, the variable s_i ($\ln d_i$) was created. It measures the distance of a state from the heart of tobacco country, Raleigh, North Carolina. Since the cigarette consumption is expected to fall as a state's distance from this region increases, the sign of the coefficient s is expected to be negative.

Just as cigarette smoking is less popular in some regions of the country than others, some demographic groups have been less inclined to smoke than the population as a whole. Such groups include Mormons and individuals 65 years of age and over. The percentage of a state's population who is Mormon is given by m_i. The percentage of a state's population who is 65 years of age and older is given by o_i. Since cigarette consumption should be lower in states where these groups make up relatively large shares of the population, the signs of both m and o are expected to be negative.

Consumers' tastes also vary over time. Since the early 1960s the percentage of the American population that smokes has declined. To capture this effect a time variable r_i is also included in Equation 1. Since cigarette consumption has declined over the last 38 years, the sign of the coefficient of this variable, r, is expected to be negative.

Consumption of cigarettes by residents of each state is the sum of taxable and nontaxable sales within the state less net exports to other areas. This relationship is given by Equation 2.

Equation 2

$$c_i = s(t)_i + s(nt)_i - NX_i$$

Taxable and nontaxable sales are given by $s(t)_i$ and $s(nt)_i$ respectively. There are four potential sources of net exports NX_i: (1) sales which result from out-of-state residents purchasing cigarettes while visiting the state as tourists; (2) sales which result from out-of-state residents living in close proximity of state borders crossing the border to purchase cigarettes; (3) sales which result from the organized, interstate smuggling of cigarettes within the United States; and (4) sales across international borders. The components of net exports are listed in Equation 3.

Equation 3

$$NX_i = c_i^* - g[(p_i - p_j)w_{ij}] + df[(p_i - p_j)w_{ij}] + t(tx_i - tx_i^*) + \sum k_i p_p w_{ik} - \sum z_i t_i w_{im}$$

Sales which result from tourism are given by c_i^*. Price 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 $[(p_i - p_j)w_{ij}]$. The direction and magnitude of this incentive is given by the price differential $(p_i - p_j)$ where p_i is the average price of cigarettes in state i and p_j is the average price of cigarettes in a bordering state. The number of individuals with the ability to avail themselves of this opportunity 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

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

if i exports to j.

By summing the variable $(p_i - p_j)w_{ij}$ 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 cigarette sales as a result of cross-border shopping.

The counties in the western states are markedly larger than their eastern counterparts. Longer average travel distances are assumed to impose significant costs on potential cross-border shoppers in these areas. In order to control for this difference the variable $f\mathrm{S}[(p_i - p_j)w_{ij}]$ was created. The first component of this variable, f, is a binary variable indicating a western state. The second part is identical to the aforementioned variable.

There is ample evidence that a considerable amount of cigarette smuggling occurs within the United States. In order to gauge the effect of smuggling on per capita taxable cigarette sales within a state, a tax differential variable $(tx_i - tx_i^*)$ was created where tx_i is the cigarette excise tax in the state into which cigarettes are smuggled and tx_i^* is the tax in the nearest low tax state.

A state's sales are also likely to be affected if it shares a border with Canada or Mexico. Historically, cigarette 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, resulted in large scale cross-border shopping. In order to capture this effect the variable $k_i\, p_p w_{ik}$ was created. The first component of this variable, k_i, is a binary variable which assigns a 1 to all states which are located on the U.S.-Canadian border. The second component, p_p, measures the weighted average real price of cigarettes in Canadian provinces bordering U.S. states. The final component, w_{ik}, is similar to the w_{ij} variable described above.

Equation 5

$$w_{ik} = \frac{\textit{population of k on ik border}}{\textit{population of i}}$$

It measures the effect that Canadians living within 50 miles of the U.S.-Canadian border will have on cigarette sales in border states.

The availability of low-priced cigarettes in Mexico has encouraged cross-border shopping by U.S. consumers living in border states. In order to capture this effect the variable $z_i t_i w_{im}$ was created. The first component of this variable, z_i, is a binary variable which assigns a 1 to all states located on the U.S.-Mexican border. The second component, t_i, attempts to capture the incentive to cross-border shop by measuring total federal, state, and local sales and cigarette excise taxes in each border state over time. The final component, w_{im}, is similar to the w_{ij} and w_{ik} variables described above.

Equation 6

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

It measures the number of individuals living in border states with the ability to cross-border shop.

Substituting Equation 3 into Equation 2 yields:

Equation 7

$$c_i = s(t)_i + s(nt)_i - c_i^* + g\mathrm{S}[(p_i - p_j)w_{ij}] - df\mathrm{S}[(p_i - p_j)w_{ij}] - \mathrm{t}(tx_i - tx_i^*) + kk_i\, p_p\, w_{ik} - zz_i t_i w_{im}$$

Substituting Equation 7 into Equation 1 and rearranging terms so that taxable sales, $s(t)_i$, is alone on the left hand side of the equation yields:

Equation 8

$$s(t)_i = a + by_i - \mathrm{p}\, p_i - ss_i(\ln d_i) - mm_i - oo_i - rr_i - s(nt)_i + c_i^* - g\mathrm{S}[(p_i - p_j)w_{ij}] + df\mathrm{S}[(p_i - p_j)w_{ij}] - \mathrm{t}(tx_i - tx_i^*) + kk_i\, p_p\, w_{ik} - zz_i t_i w_{im}$$

Accurate data on nontaxable cigarette sales by state does not exist. However, two primary sources of such cigarettes are Native American tribal reservations and military bases. In order to capture the effect that the availability of such cigarettes has on states' per capita cigarette sales, the variables $g_i i_i z_i$ and $h_i n_i z_i$ were created. The first component of each of these variables, g_i and h_i, is a binary variable indicating the presence of tribal lands or military bases within a given state. The next component measures the percentage of a state's population that is either Native American, i_i, or active duty military personnel, n_i. The intent of creating these components was to determine whether nontaxable cigarettes were available within a state from these sources and to measure the percentage of a state's population with access to such cigarettes. The final component of these variables, z_i, measures the total effect that state and local excise and sales taxes have on the price of a pack of cigarettes in a state. The intent of creating this component was to capture the incentive created by these taxes for individuals with access to them to buy nontaxable cigarettes.

As was the case with nontaxable cigarette sales, accurate data on cigarette purchases by out-of-state tourists does not exist. The fraction of a state's economy that was comprised of hotel, amusement, and recreational services was used as a proxy for this variable. Since neither Alaska nor Hawaii borders any state, binary variables were included to capture the anticipated changes in the intercept for these states. These changes yield Equation 9.

Equation 9

$$\begin{aligned} s(t)_i = {} & a + by_i - \mathrm{p}\, p_i - ss_i(\ln d_i) - mm_i - \\ & o_i - rr_i - ig_i i_i z_i - uh_i n_i z_i + qt_i - \\ & g\mathrm{S}[(p_i - p_j)w_{ij}] + df\mathrm{S}[(p_i - p_j)w_{ij}] \\ & - \\ & \mathrm{t}(tx_i - tx_i^*) + kk_i p_p w_{ik} - zz_i t_i w_{im} \end{aligned}$$

The signs of the coefficients of the first six variables of Equation 9 were discussed above. Since nontaxable cigarettes are a substitute for taxable ones, the signs of the coefficients i and u are expected to be negative. The sign of the coefficient q, on the other hand, is expected to be positive since taxable cigarette sales within a state should increase with influxes of out-of-state tourists. Recall that if the cross-border variable, $\mathrm{S}[(p_i - p_j)w_{ij}]$, is positive, the state is a net importer of cigarettes from surrounding states. Since consumers substitute cigarettes purchased across state borders for taxable purchases within a state, an increase in the number of imported cigarettes will cause taxable sales to decline within a state. As a result, the sign of the coefficient g is expected to be negative.

The variable $f_i\mathrm{S}[(p_i - p_j)w_{ij}]$ was constructed to control for the significantly larger counties in the western states. It was hypothesized that longer travel distances would make the average resident of these counties less inclined to cross-border shop than their eastern counterparts. As a result, the sign of the coefficient of this variable, d, is expected to be positive, but smaller in terms of absolute magnitude than the ordinary cross-border shopping variable. This would show that while the distances involved would make the residents of western counties less likely to cross-border shop than the residents of eastern counties, they nevertheless have a strong incentive to engage in this type of activity.

Cigarettes that are smuggled into a state replace taxable sales. Therefore, the sign of coefficient t is expected to be negative.

Until recently, the combination of Canadian sales and excise taxes created a price differential as high as $3.50 per pack between Canadian and U.S. cigarettes. This resulted in widespread cross-border shopping in U.S. border states by Canadian citizens. As a result, all else being equal, taxable cigarette sales should be higher in U.S.-Canadian border states than non-border states. As a result, the sign of the coefficient k is expected to be positive.

On the other hand, the availability of low-priced cigarettes in Mexico has encouraged cross-border shopping by residents of

U.S. border states. As a result, the sign of the coefficient *z* is expected to be negative.

Estimation

Equation 7 was estimated using pooled time series/cross section regression analysis. This type of analysis is very powerful in that it allows each of the factors affecting a so-called dependent variable to be identified. The effects that each of these so-called independent variables have on the dependent variable can then be examined while holding the effects of the other independent variables constant. In Equation 9, adult per capita taxable cigarette sales (measured in 20 unit packs) 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 38 year period from FY 1960 though FY 1997.

Results

Table 4 presents the results of the regression analysis. The first column of the table lists the independent variables used 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. 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, Equation 7 explains more than 71 percent of the variation in per capita cigarette sales among states.

It was hypothesized above that cigarettes are a "normal" good whose consumption would rise with personal income. The sign of the estimated income coefficient, *b*, supports this notion. For every $1.00 rise in personal income, annual adult per capita cigarette pack sales can be expected to rise 0.0036 packs, or roughly 3.6 packs for every $1,000 rise in personal income. Similarly, it was hypothesized above that a rise in the

Table 4
Regression Results
Dependent Variable: Adult Per Capita Sales of Taxable Cigarettes
Measured in 20-Unit Packs

Variable	Coefficient	t-statistic
Constant	293.6	
Alaska	21.3	2.75
Hawaii	–65.1	–9.50
Income and Price		
Income (b)	0.0036	9.19
Real Price (p)	–0.64	–10.39
Demographic and Time		
Distance (s)	–1.72	–4.91
Mormon (m)	–0.93	–14.28
Over 65 (o)	–204.55	–6.54
Time (r)	–2.70	–22.58
Nontaxable Sales		
Native American Reservations (i)	–5.55	–3.07
Military Bases (u)	–10.79	–3.11
Tourism		
Tourism (*q*)	353.85	13.96
Cross-border Sales		
Cross-border Sales (g)	–1.84	–31.88
Western State Adjustment (d)	1.40	6.62
Canada (k)	0.28	2.23
Mexico (z)	–0.22	–3.27
Smuggling		
Tax Differential (t)	–0.53	–7.43
R^2	71.1	

Source: Tax Foundation.

price of cigarettes would lead to a decline in per capita cigarette sales. The sign of the estimated real price coefficient, p, supports this hypothesis. According to the model, a $1.00 rise (measured in 1997 dollars) would lead to a 0.64 pack decline in adult per capita consumption of cigarettes.

Earlier it was hypothesized that cigarette smoking, and consequently the demand for cigarettes, was much more prevalent in the southeastern region of the country, particularly the tobacco producing states. The sign of the estimated coefficient of the distance variable, s, supports this notion. It shows that demand for cigarettes drops off fairly rapidly as one travels out of the tobacco producing states and into bordering states. As one moves further and further from this region, demand for cigarettes continues to decline, but at a less rapid rate.

It was pointed out above that some groups, including Mormons and individuals 65 years of age and older, have traditionally been much less inclined to smoke than the population as a whole. It was then asserted that per capita cigarette sales would be lower in states in which these groups comprised a relatively large percentage of the population, all else being equal. The negative signs of the estimated coefficients, m and o, support this notion. The higher the percentage of a state's population that is comprised of these groups, the lower per capita cigarette sales will be.

In order to control for the gradual decline in the number of Americans who smoke, a time variable was added to the regression equation. As expected, the sign of the estimated coefficient of the time variable, r, is negative. It shows that adult per capita cigarette sales decline approximately 2.7 packs per year as a result of the secular decline in smoking that has occurred in the United States since the mid-1960s.

Recall that nontaxable cigarettes are a low cost alternative to taxable ones. The variables $i_i z_i$ and $n_i z_i$ were included in Equation 9 to capture nontaxable sales on native American reservations and military bases. It was hypothesized that the greater the proportion of a state's population that was made up of either of these two groups and/or the larger the tax differential, the lower per capita sales would be within that state. The negative signs of both estimated coefficients, i, and, u, support this notion.

It was also hypothesized above that states which entertained large numbers of out-of-state tourists would have relatively high per capita cigarette sales, all else being equal. The positive sign of the estimated coefficient of the tourist variable, q, supports this notion.

Several variables were included in the model to capture the effects of both interstate and international cross-border cigarette sales. The first of these, $[(p_i - p_j)w_{ij}]$, was included to capture the effect of interstate cross-border shopping. It was hypothesized that states with relatively high priced cigarettes as compared with neighbors would lose cigarette sales to them. The negative sign of the estimated coefficient of the cross-border shopping variable, g, supports this notion.

It was also hypothesized that the much larger counties of the western states would mean that the typical resident of these areas would be less inclined to cross-border shop than their eastern counterpart. The positive sign and magnitude of the coefficient of this variable, d, coupled with that of the aforementioned variable, supports the notion that while the average resident of western border counties may be less inclined to cross-border shop than his eastern counterpart, there is nevertheless a strong incentive to engage in this type of activity.

The model also included variables to estimate the extent of international cross-border shopping. The positive sign of the k supports the notion that high cigarette taxes in Canada has encouraged cross-border shopping by Canadians in the United States. Likewise the negative sign of z is consistent with the notion that the availability of low-priced cigarettes in Mexico has resulted in cross-border shopping by U.S. residents of border states.

The tax differential variable ($tx_i - tx_i^*$) was included in the model to account for the interstate smuggling of cigarettes within the United States. It was hypothesized that the larger the tax differential between a state and the nearest low tax state, the greater the incentive to smuggle cigarettes. Consequently, states with relatively high cigarette excise taxes should have relatively low adult per capita taxable cigarette sales. The negative sign of the estimated coefficient of the tax differential variable, t, supports this notion. It shows that per capita cigarette sales can be expected to fall approximately half a pack for every one cent tax differential that exists between a state and the nearest low tax state.

IV. Conclusion

The per capita sale of taxable cigarettes varies greatly among states. It is widely suspected that these differences are due to cross-border effects. Building on earlier work in this area, this study sought to explain differences in per capita cigarette sales among the states. A model of cigarette demand and its supply by source was constructed. This model was created in a manner that allowed it to capture the effects of several types of cross-border activity on adult per capita cigarette sales within each state. Nontaxable cigarette sales on native American reservations and military commissaries, interstate and international cross-border shopping, and the interstate smuggling of cigarettes are all measured by the model.

The model was then tested empirically using data from FY 1960–1997. All of these cross-border effects were found to have significant effects on cigarette sales among states. In particular, the study indicates that approximately 13.3 percent of the cigarettes consumed in the United States during FY 1997 were procured via some type cross-border activity. The study clearly shows that high interstate excise tax differentials lead to significant increases in cross-border sales and interstate cigarette smuggling.

Endnotes

1. Cited in Dwight Lee, *The Economic Impact of Michigan's 50 Cent Per Pack Cigarette Tax Increase,* Unpublished Manuscript.

2. Chris Christoff, "Smugglers Win," *Detroit Free Press,* February 17, 1995.

3. See Christoff (note 2).

4. See Christoff (note 2).

5. See Christoff (note 2).

6. Centers for Disease Control and Prevention, *State Tobacco Control Highlights,* (Atlanta: Centers for Disease Control and Prevention, 1993).

7. Barents Group LLC of KPMG Peat Marwick LLP, *The Estimated Revenue Effects of a Proposed $1 Per Pack Increase in the Cigarette Tax Rate in Alaska* (Washington, DC: Peat Marwick, December 1995), p. 15.

8. See Christoff (note 2).

9. Donald Gutmann, *The Cigarette Tax Gap* (Draft), Research Division, Washington State Department of Revenue, August 17, 1993.

10. Lindquist Avey Macdonald Baskerville, Forensic Financial Investigations, *Cigarette Smuggling in the State of Michigan,* August 15, 1994.

11. Centers for Disease Control and Prevention, *State Tobacco Control Highlights,* pp. 52 -53, 68-69.

12. Advisory Commission on Intergovernmental Relations. *Cigarette Tax Evasion: A Second Look.* Washington, D.C.: US Government Printing Office, 1985.

13. See Tobacco Institute, *The Tax Burden on Tobacco: Historical Compilations* 31 (1996) Washington D.C.: Tobacco Institute).

14. Most of these estimates were made using the nationwide coefficients presented in Table 4. In some cases, however, the model clearly overestimated the amount of cross-border activity. It is suspected that interaction between variables caused double counting. In Arizona, for example, cigarettes procured in Mexico probably replace, to some extent, cigarettes smuggled from low-tax states. In such cases a scale factor was used to adjust the estimates so that they were in line with known consumption-taxable sales gaps. Such a procedure was used to produce the estimates for Alaska, Arizona, Hawaii, Illinois, Massachusetts, Minnesota, North Dakota, Oklahoma, Rhode Island, South Dakota, Washington, and the District of Columbia.

15. Bruce Bartlett, *Cigarette Taxes, Smuggling, and Revenues,* Arlington, VA: Alexis de Tocqueville Institution, 1994. p. 2.

16. Adam Smith, *The Wealth of Nations,* New York: Modern Library, 1937. p. 832.

17. Alexander Hamilton, "The Federalist No. 35," in Alexander Hamilton, James Madison, and John Jay, *The Federalist Papers,* New York: Bantam Books. p. 164.

18. Jacob Sullum, *For Your Own Good,* New York: The Free Press, 1998. p. 136.

19. Sullum, p. 137.

20. Sullum, p. 137.

21. Committee of Inquiry Into the Community Transit System, European Parliament, February 19, 1997.

22. Bruce Bartlett, "Hiking Cigarette Taxes Is Good for (Illegal) Business," *Wall Street Journal,* May 12, 1998, p. A22.

23. Tobacco Manufacturers Association, "Further Surge in Smuggling Expected Following Cigarette Tax Increase," Press Release, March 17, 1998.

24. For a discussion of European cigarette smuggling, see Bruce Bartlett, "When the Clouds of Smoke Settle," *Washington Times,* August 28, 1997; Paul Geitner, "Smuggling Hard to Snuff Out," *USA Today,* June 13, 1996; Erik Kirschbaum, "Vietnamese Crime Syndicates Smoke with German Smuggling," *Washington Times,* February 3, 1996.

25. See Anthony Flint, "Cigarette Firms Condemn Smuggling and Gain From It." *Boston Globe,* June 10, 1996.

26. See Bartlett (note 20).

27. Antonio Tambunan, "China: Tax Cuts to Curb Cigarette Smuggling," *Pacific Rim Review,* May 11, 1997.

28. Hong Kong Customs and Revenue Department, internet Web site.

29. See Bartlett (note 20).

30. Advisory Commission on Intergovernmental Relations, *Cigarette Bootlegging: A State and Federal Responsibility,* Washington, DC: U.S. Government Printing Office, 1977.

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