

PLAYING WITH FIRE: CIGARETTES, TAXES AND COMPETITION FROM THE INTERNET

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Draft: January, 2004

Abstract

This paper documents the rise of the Internet as a source of cigarette tax competition for states in the U.S. Using data on the cigarette tax rates, taxable sales and individual smoking by state from 1990 to 2001 merged to data on the rise of Internet use, the paper documents the paper first documents that in recent years there has been a substantial increase in the sensitivity of the sales of cigarettes in a state to changes in the state's cigarette tax. It then shows that that this increase in sensitivity is directly correlated with the rise of Internet usage across states. But, while the increase of the Internet appears to have almost doubled the tax sensitivity of within-state cigarette sales, data on cigarette useage does not indicate that Internet growth has made smoking any more sensitive to tax rates. If anything, rising internet usage has made smoking *less* sensitive to tax rates as smokers now have another way to avoid high taxes. Overall, with the tax sensitivity of taxable cigarette sales having almost doubled, this has lessened the revenue generating potential of recent cigarette tax increases by 25 percent or more. Given the continuing growth of the Internet and of Internet cigarette merchants, the results imply serious problems for state revenue authorities.

We wish to thank Jonathan Gruber, James Poterba, Raj Chetty and members of the NBER Public Economics workshop for helpful comments and Jane Dokko, Pablo Pena and Svetla Tzenova for research assistance, and the American Tax Policy Institute for financial support.

Introduction

Cigarette taxes have always given policy makers a benign tradeoff regarding taxes. On one hand, demand for cigarettes is thought to be inelastic so raising taxes can generate a lot of revenue. On the other, since cigarettes are one of the leading causes of health problems in the country, if the taxes fail to raise revenue (i.e., when they get people to consumer fewer cigarettes), they save lives.

The rise of the Internet, however, has begun to seriously threaten that happy tradeoff. By purchasing cigarettes online, consumers have been able to evade state cigarette taxes. The Internet has the potential to wreak havoc on both sides of the equation. When people can buy online, raising taxes may generate little revenue while at the same time doing nothing to improve health. Instead, people simply become more sensitive in where they choose to buy their cigarettes.

This has become an issue of first order importance in the last several years as many states have significantly raised their cigarette taxes to help close their budget deficits. Since January, 2002, some 30 states and the District of Columbia have increased their cigarette tax rates, expecting to raise significant revenues based on the view that demand for cigarettes is relatively inelastic.¹ This paper will examine whether the rise of the Internet has made cigarette purchases more responsive to tax rates.

¹ There is an extensive literature on the demand for cigarettes including Becker and Murphy (*others), Gruber and Koszegi (2001). Evans et al (1999) and Chaloupka and Warner (1999) survey the literature. There is, of course, a tension in policy toward smoking since at the same time policy makers want to get revenue from smokers, they would like to reduce the amount of smoking for health reasons. Evans et al. (1999), Hu et al. (1995), examine the impact of various non-tax public policies to reduce smoking.

Cigarettes are a natural place to look for the impact of tax evasion because state excise tax rates on cigarettes are particularly high relative to other consumption taxes and because avoidance and evasion, both informal and organized, is rampant.²

Internet cigarette merchants located on Native American reservations (where state sales tax laws are difficult to enforce) and in states with very low cigarette taxes have dramatically increased. Although Internet sales are technically subject to cigarette taxes in the states where the cigarettes are consumed, it is apparent that little tax is actually paid on these online sales. Indeed, the state of New York has recently attempted to ban Internet cigarette merchants completely and has argued that it alone loses some \$500 to \$600 million per year of revenue from Internet, 800 number and Indian reservation sales (REA, 2002).

In this paper we make use of survey data on Internet use by state and across time and state data on taxed cigarette sales and on actual smoking to investigate how the growth of the Internet has affected the level and elasticity of taxed cigarette sales and of smoking. The results document that the rise of online shopping has dramatically increased the sensitivity of in-state purchases to tax rates. The mean price elasticity of cigarette demand has risen most in those places where the Internet has grown the fastest (holding other things equal) and in magnitude, may have almost doubled the sensitivity of taxable cigarette sales to state tax rates. The data on cigarette usage, however, shows the opposite. Growth of the Internet has made smoking *less* sensitive to taxation than it was before people were able to evade local taxation. The overall impact of Internet growth on

² Becker, Grossman, and Murphy (1993), Coats (1995), Thursby and Thursby (2000), Yurekli and Zhang (2000), Farrelly, et al. (2001), and Gruber et al (2003) all document ways that smuggling and proximity to low-tax neighbors make cigarette sales more sensitive to tax rate changes. Slemrod (2003) shows how changing the enforcement regime affected the tax responsiveness of sales in Michigan.

tax revenue thus far appears to be modest but the impact on the ability of tax increase to generate revenue has been sizable. We predict that the tax increases of 2001-2003 would have generated about 25 percent more revenue had the Internet merchants not existed. In some states this is as high as 40 percent.

The paper proceeds in five sections. Section II discusses the cigarette retail industry and the role of the new Internet sites. Section III presents the methodology of our paper and describes the data we use. Section IV presents the basic results on cigarette sales. Section V shows tests of robustness. Section VI documents the major differences when looking at usage versus taxable sales and clarifies the importance of smuggling. Section VII concludes.

II. THE CIGARETTE INDUSTRY

With the growth of the Internet, many websites offering cigarettes for sale online have arisen. A GAO report identified the name and address of some 147 such sites in 2002 and said that there might be 400 or more such sites in existence (GAO, 2002). With names like www.taxfreecigarettes.com, www.notaxsmokes.com and www.0taxcigs.com, it is clear that vendors are aware of the opportunities the Internet provides for tax smuggling. Virtually all of the merchants are physically located either on American Indian reservations (who do not remit state excise taxes) or in states like North Carolina, Kentucky or Virginia, where the state cigarette excise tax is very low.

While these sites facilitate avoiding the payment of state excise taxes (which are usually paid by the wholesaler and included in the final retail price), they do not eliminate the legal obligation to do so. By state law, an individual is supposed to pay the excise tax

on any cigarettes they consume in their state of residence, even if the cigarettes were purchased elsewhere and brought into the state, or received by mail. Given the variation in tax rates on cigarettes around the country, it isn't surprising that cross-border shipments would proliferate or that there would be laws designed to contain it. The Jenkins Act, a federal law, requires anyone that sells cigarettes for a profit to a customer across state lines (other than to a licensed distributor) to report the brand and quantity of the sale as well as the name and address of the customer to the buyer's state's tobacco tax authority. If online merchants did that, of course, it would be much easier for states to enforce taxes on Internet sales.

Violating the Jenkins Act, however, is only a misdemeanor and the penalty cannot exceed a \$1000 fine (or 6 months in prison). Further, enforcement of the act is left to the Department of Justice and the FBI, who have not actively pursued such cases. Indeed, many of the online sellers of cigarettes specifically claim on their websites that (illegally) they do not comply with the Jenkins Act or that (falsely) the Jenkins Act does not apply to them as Indian tribes. The GAO reported that of the websites they examined, almost 80 percent either claimed the Jenkins Act did not apply, or that they refused to comply and would keep all customer information secret. Another law, the Contraband Cigarette Trafficking Act of 1978, makes it a federal crime to transport more than 60,000 cigarettes (i.e., 300 cartons) across state lines without proof that state taxes have been paid but most of the online sites specifically limit purchases to less than 300 cartons for this reason. Again, enforcement is difficult and the key matter for the online merchants.

Because the states do not have enforcement authority regarding the federal Jenkins Act, there is little they can do, as described in the existing GAO reports (G.A.O.,

2002; 2003). New York has tried banning the delivery of cigarettes ordered online and began enforcing that ban in 2003 by threatening fines for delivery companies and by threatening to close down merchants within the state (many sites are operated on the Seneca Indian lands in upstate New York) (Business Review, 2003). California has tried to notify Internet merchants and California residents directly. From May, 1999 to September, 2001 they notified 167 Internet vendors and 23,500 residents, but collected only \$1.4 million in taxes, penalties, and interest (GAO, 2002). The federal government is also concerned about the issue. Recent legislation proposed in Congress would strengthen reporting requirements, raise violations of the Jenkins Act to a felony and reduce the number of cigarettes required to qualify as contraband to 10,000 (Glasner, 2003).

There is little information, however, on the most basic of issues such as the volume of online sales of cigarettes. Forrester Research (2001) predicts that online sales will top more than \$5 billion by 2005, equal to about 14 percent of total sales, with some \$1.4 billion in lost tax revenue. Everyone agrees that the sales online have been growing very rapidly in the last several years. Moreover, even if people do not actually buy their cigarettes online, the fact that they could buy them online and may be comparing prices online can make their demand much more price sensitive and put a major check on the ability of states to raise cigarette taxes.

Are the tax savings passed on to consumers, or captured by online merchants through higher pre-tax prices? To check this, we gathered data on in-store retail prices from several merchants in Ann Arbor, Michigan and compared them to the prices available at the top five domestic cigarette sites listed at Google for the search phrase "tax

free cigarettes."³ We did this for the top ten cigarette brands, as identified by Advertising Age (2001).⁴ Weighting the ten brands by their national sales volume, we found that prices online were \$27.33 a carton and pre-tax prices in the stores were \$25.83. Michigan taxes on such a carton amount to \$14.80 (including the sales tax), so the average online site is passing about 90 percent of the tax savings through to the consumer. This is likely to be a lower bound on the cost savings, because with even a minor amount of search online one can find lower prices for any particular brand one (using the minimum price among the online sites yielded prices lower than the pre-tax prices in the retail stores), and because most cigarettes are actually purchased one pack at a time where prices are higher than when bought in cartons. So it seems clear that online sites are, indeed, a way customers might save money when buying cigarettes and may very well increase the price sensitivity of demand.

II. Methodology and Data

1. Methodology

We seek to investigate whether the level and tax responsiveness of a state's taxed cigarette sales are related to the extent of Internet use in that state in a given year. We regress the logarithm of per-capita taxed cigarette packs against the log of the real tax-inclusive price of cigarettes in the state and a measure of neighboring states' tax-inclusive prices. Then, we add the state's log tax-inclusive price interacted with a measure of Internet usage, and the level of Internet usage by itself. The basic specification is, then,

³ The retail merchants were Walgreens, Meijer's, K-Mart, Campus Corner, and Kroger. The online sites were taxfreecigarettes.com, travelingsmoke.com, dutyfreetaxfree.com, tobaccobymail.com and 4cheapcigs.com. All of these sites are located on Indian reservation land in New York State. A similar analysis using merchants in Chicago showed a similar pattern as the one reported in the paper.

⁴ These were Marlboro, Newport, Doral, Camel, Basic, Winston, GPC, Kool, Salem, and Virginia Slims.

$$\ln(q_{st}) = a_s + a_t + a_2 \ln(P_{st} + \text{tax}_{st}) + a_3(I_{st}) + a_4(I_{st}) + a_5(\text{Neighbors}' \\ P_{st} + \text{tax}_{st}) + a_6 \ln(Y_{st}) + \varepsilon_{st} \quad (1)$$

where q is the quantity of taxed cigarette packs sold per capita in a given state and year, I is a measure of Internet usage in the state discussed below and Y is real personal income per capita in the state. Because we do not expect to be able to explain all of the cross-state and cross-time variation in taxed sales due to non-tax factors, we also include dummy variables for each state and each year. With both state and year dummy variables included, we are seeking to explain the year-to-year changes in a state's per capita taxed sales relative to the average year-to-year changes, as a function of the state's year-to-year changes in the real excise tax. In particular we seek evidence as to whether the tax sensitivity increases most in places where Internet usage grows fastest.⁵

2. Data

Although we do not have any direct measures of how much people use the Internet to buy or research cigarettes online, we do have large cross-sectional micro survey data on overall use of the Internet that we will use as a proxy, implicitly assuming that use of Internet cigarette sites is proportional to other measures of Internet use. Our main source of Internet data is the survey conducted by Forrester Research, Inc. as part of the Technographics 2002 program. The survey asked some 80,000 people about their

⁵ We implicitly ignore the possibility that the extent of Internet use is itself affected by the level of cigarette taxes in a state, and therefore the potential tax savings from using the Internet to avoid or evade taxes. Goolsbee (2000) showed this to be true for the case of retail sales taxes, and cigarette taxes are even less likely to motivate people to go online (since the amount of money at stake is typically smaller).

demographics (including whether they smoke) along with questions about whether they use the Internet at all, whether they have ever bought something online, and their past history of Internet usage. The data is meant to be nationally representative; more details can be found in Yonish et al. (2001) or Goolsbee (2000). Using the data on how long each person has been online, we are able to create a measure of the share of each state's population that was online in a given year from 1995 to the present following the method of Brown and Goolsbee (2002). For years before 1995, we set all the measures to zero.

While we will primarily use the share of the state that had online access in the year as our measure, the survey data also provide alternative measures we can use. In addition to knowing whether the respondent used the Internet, we also know (at the time of the survey) whether they were smokers and whether they had bought anything online. We will, therefore, also look at measures of the share of people in the state have bought online, the share that smoke and have Internet access, the share that smoke and have bought online, and the share of smokers in the state that are online. Varying the measure of Internet access makes little difference to the results.

We will also use data from the computer supplements to the Current Population Survey that ask about computer usage in 1994, 1997, 1998, 2000 and 2001. The survey question used is whether the respondent uses the Internet. Unfortunately, the CPS wording changes from year to year. The 2001 estimates, for example, report Internet use from ANY location, whereas in the 2000 and 1998, they report Internet use at home and outside the home and in 1997 home, work and school. For the latter ones we define an individual as an internet user if they respond yes to any of these questions. The 1994 version of the survey does not contain any questions related to the Internet, but did ask

whether they had a computer with a modem. This was repeated in 1997 so we multiply the share of modem users in 1994 by the share of modem users in 1997 that had Internet access (58%).⁶

The data on taxed cigarette sales, excise taxes, and the retail prices of cigarettes are taken from *The Tax Burden on Tobacco*, published by The Tobacco Institute until 1998 and updated by Orzechowski and Walker (**). The tax rate is the weighted average over the year. Since the price is only reported at a point in time (November 1 of the year) we impute an estimate for the weighted average price in the year, though our results were very similar just using the point in time measure instead.⁷ We will also look at the actual consumption of cigarettes in the states in response to tax changes. For this, we will use data from the Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS). These data provide information on the number of cigarettes smoked per day for people that report being smokers. The BRFSS is a very large dataset and is meant to provide a comprehensive look at the risky behaviors of individuals in the United States. The data are collected from a random sample of adults (age 18 and over) annually. More details on the BRFSS can be found in CDC (2003).

Summary statistics for the variables used in our analysis from all the sources are presented in Table 1. There is a large increase between 1990 and 2001 in the taxes and prices of cigarettes as well as a huge increase in the share of people using the Internet. It is important to note that there is both annual and cross-sectional variation in the cigarette

⁶ We tried more sophisticated approaches to predicting Internet usage from the modem usage data such as various county-level regression and individual level probit specifications, but because they did not lead to any significant change in the results we report only the results based on the simpler approach.

⁷ To do this imputation, we assume constant linear growth from November to November of each year. Given this assumption and prices from the previous and following years, the formula for the weighted average price in the year is $P = 25/72 (P_{Nov,t-1}) + 46/72 (P_{Nov,t}) + 1/72 (P_{Nov,t+1})$. In the final year of our sample we have no data on $P_{Nov,t+1}$ so we set it equal to $(P_{Nov,t})$. Given the low weighting on this value, this is irrelevant to the results.

tax. Across time, the standard deviation in the real tax rate for the mean state is 5.06 cents. Across states, the standard deviation for the mean year is 13.91 cents.

2. Basic Results and Robustness Checks

We begin with the baseline specification of log sales per capita regressed on the log real price (including taxes) as well as the real price interacted with the share of people in the state-year with Internet access as measured in the Forrester data, instrumenting for the price terms using the log of the real tax term and the level of the real tax term.⁸ We present the results from this regression in column (1) of Table 2. The estimated elasticity of taxable sales before the Internet is $-.57$, very much in line with the previous literature's findings. The elasticity of taxable sales with respect to the mean tax-inclusive price of neighboring states is positive, as expected, and significant, suggesting that if neighbors raise their rates, this increases taxable sales in the state. Most importantly, though, the interaction of the state tax rate with the share of the state that uses the Internet is negative and very significant. The point estimates indicate that the growth of the Internet in the sample from zero to its average value in 2001 raised the elasticity of taxable sales from $-.57$ to $-.99$.⁹

The next several columns check the robustness of the results to the measure of Internet usage. Column (2) repeats the same regression using the CPS computer supplement measures of Internet usage rather than the Forrester measures. Again the results show a large and significant increase in the elasticity of taxable sales in states as

⁸ We instrument the interaction of the share online with the log (tax inclusive) price using the log of taxes interacted with the share online and the level of real taxes interacted with the share online. We tried using just the log of taxes, just the level of taxes, as well as combinations of higher order terms and interactions and the results were all quite similar.

⁹ The $-.99$ is equal to $-.53 + (-.94 * .699)$, where $.699$ is the 2001 state average of Internet usage.

the usage of the Internet rises. The magnitudes are almost identical: the growth of Internet use has almost doubled the elasticity of cigarette sales to changes in taxes, from -.53 to -1.02. Columns (3) to (7) show the results using the share of the state that has bought online, the share that smokes and is online, the share that smokes and has bought online, and the share of smokers in the state that are online or have bought online. In every case the interaction term with Internet usage is negative and significant, and the magnitudes are all very similar. The average estimated elasticities across the specifications in the period before the Internet existed range from -.58 to -.68, while the elasticities at the end of the sample (when all the measures of the Internet are at their maximums) range from -1.05 to -1.17. Because the key results are not sensitive to which measure of Internet use we choose, in all the results that follow we will use the Forrester measure of total online usage.¹⁰

Our next checks of robustness look at the instruments and the sample. In column (1) of Table 3, we first repeat, as a basis for comparison, the baseline specification that used the level and log of taxes as instruments for the log of the tax-inclusive price. Column (2) then first differences the data. Again, there is a negative and significant coefficient on the tax term, although the estimates are somewhat compared to the level regressions. The estimated magnitudes are, however, similar: the rise of the Internet raises the elasticity of taxed cigarette sales from -.54 to -.83.

In columns (3) and (4) we deal with the issue that some of our data is imputed. In column (3), we use the Forrester data but restrict the sample to include only the 1996-2001 period when we have data; in other words, we exclude the years for which in the baseline specification we assume that Internet use was negligible. The coefficient on the

¹⁰ We found that the qualitative conclusions below were robust to the choice of Internet measures.

Internet tax term is slightly smaller than before but still shows the same significant, negative effect. In column (4), we return to the CPS data and use only the years for which there was an actual CPS survey (1994, 1997, 1998, 2000, and 2001); that is, we exclude the years for which in the baseline specification we have linearly interpolated the CPS data. Here the results are almost identical to the previous CPS results.

Next, in column (5) we report the results of the baseline specification estimated using only data through 1998. We do this to be sure that our results are not unduly influenced by the sharp break in wholesale cigarette prices that occurred in November 1998 in the wake of the tobacco settlement.¹¹ The results are almost exactly the same.

No matter how we measure the use of the Internet or the instruments or sample we use, the results consistently show that the Internet has substantially increased the sensitivity of taxable cigarette sales in a state to changes in tax rates.

3. The Role of Demographics and Unobserved Factors

It is important for this analysis to verify that the changes occurring in the tax sensitivity over time that we are attributing to the rise of the Internet are not, in fact, attributable to, say, demographic factors differing across states that are correlated with Internet usage but are themselves determinants of price sensitivity. For example, if there has been a rise in teen smoking, and teens are both relatively price-sensitive (as documented in Gruber, 2000) and tend to live in states where the Internet grew fastest, this could cause us to spuriously conclude that rising Internet use makes taxed cigarette sales more tax-sensitive.

¹¹ We observe that, in regressions using data for all the years, the estimated coefficients on the year dummy variables often have a sharp upward spike in 2000 and 2001, though it does not matter for the coefficients on the covariates.

To test this hypothesis, we first add interactions of the price term with various demographic factors in the state as of 2000 from the Census: the share of the state that is 18 and under, the share of the state that is black, the share of the state that has attended college, and the real income level.¹² Column (6) of Table 4 shows that some of these factors are significant determinants of the state's price sensitivity—having higher real income, for example, makes the state more price-sensitive, holding other things equal. But, none of these factors reduces the estimated impact of the Internet on tax sensitivity by much. The interaction term is still negative and significant with almost the same coefficient as before.

Column (7) takes this robustness check to the extreme by allowing the underlying price sensitivity to be different in each state.¹³ The specification also includes the Internet interaction term to see if higher Internet use makes states more price-sensitive than they would otherwise have been; this generically accounts for any state-level differences in price sensitivity. The results show that the impact of the Internet on tax sensitivity is even greater than in the baseline specification: the increase of the Internet adds $-.56$ to the elasticity (versus $-.42$ in the baseline specification).

4. Taxes, Smoking and Smuggling

Given the results that the growth of the Internet appears to make the demand for taxable cigarettes significantly more price-sensitive, it is worth noting that the implications should be very different if measured on cigarette usage, or consumption, than on taxed cigarette purchases. Consumption should be less sensitive than taxed

¹² We do not enter these variables independently because they are included in the state dummies.

¹³ These coefficients are not reported individually in order to save space.

purchases to the home state tax rate because people can avoid it by buying cigarettes in neighboring states or on the Internet (see). In addition, greater Internet access probably does not make consumption more sensitive to changes in tax rates. Indeed, it is possible that rising Internet usage could make smoking *less* sensitive to changes in the tax rate because it provides a new way to get around state taxes.¹⁴

We convert the BRFSS cigarette consumption per day measure into an annual packs-per- person figure (so that it is comparable to our taxable sales data) and regress the log of cigarettes packs smoked per day per person for each state year on the same variables as we did before. In column (1) of Table 4 we do this for the baseline specification. In column (2) we allow the baseline price sensitivity to vary by state to allow for the most comprehensive set of controls, as in the previous table. In both cases we see that, as predicted, the price sensitivity of smoking in a state is much less than the price sensitivity of taxed cigarette sales. The baseline sensitivity is between -.07 to -.14 and not significantly different from zero.

In neither specification do we find a significant impact of the Internet on the price sensitivity of cigarette usage. In the regression with the full controls shown in column (2), the Internet interaction term's point estimate is actually positive, although this estimate is not significantly different from zero.

¹⁴ Gruber ** makes a similar argument regarding cigarette sales versus consumption among Canadians along the U.S. border. Assuming that smokers either buy taxed cigarettes or over the Internet, the relationship between the price elasticity of taxed sales and usage is as follows: $e_U = e_T(1-i) + Ite_i$, where e_U is the price elasticity of usage, e_T is the price elasticity of taxed sales among those who buy taxed cigarettes, I is the fraction of total usage that is purchased on the Internet, I is the average amount of cigarettes purchased by those who buy over the Internet, t is the cigarette tax rate as a fraction of the total retail price, and e_i is the price elasticity of the fraction of the population that buy cigarettes over the Internet. As long as higher cigarette taxes induce some people to buy cigarettes over the Internet (so that $e_i > 0$), $e_U > e_T$, implying that usage is less sensitive to price than taxed sales. [LET'S CHECK THIS.]

Comparing the usage data to the sales data, we can get a sense of the amount of nontaxable cigarette purchases occurring in a state (or, in the case of low-tax states, the amount of exporting occurring). We explore this in two ways. First, we create a dummy variable equal to one if the data suggest the state is a net smuggler (that is, if usage per person is greater than taxable sales per person), and we regress this on the same variables as before. We examine this using a linear probability model so that we can continue to use the instrumental-variables framework. The results in the baseline specification in column (3) shows that the probability of smuggling rises strongly with the state's tax rate and this effect increases when the Internet starts growing faster. In the specification including the full controls, shown in column (4), the Internet interaction term again has a positive estimated coefficient.

The second thing we look at is an indicator of the amount of smuggling or exporting going on in a state. This is defined as the difference between the log of cigarette usage in the state minus and the log of taxed cigarette sales in the state, which is equal to the log of the ratio of cigarette usage to taxed cigarette sales. In column (5) we use the baseline specification. In column (6) we allow the baseline price sensitivity to vary by state. Again, in both cases we find a strong positive relationship between the amount of smuggled cigarette activity and the state's tax rate and that the relationship gets stronger as the Internet grows. We also find that the income elasticity of the smuggling indicator is negative: holding the price incentives constant, higher income reduces the prevalence of smuggling.

So the usage data is fully consistent with the view that the Internet has raised the tax sensitivity of cigarette purchases.

7. Revenue

Given the apparent significance of Internet use on tax sensitivity, it is clear that there will be major revenue implications for the states. We present two types of calculations. The first is to estimate the overall impact of Internet growth on the volume of taxable cigarette purchases in the state. This combines the coefficients on the internet alone with the coefficient on the interaction term of prices with the Internet. Using the average log of the real price in 2001, reducing Internet usage from its average in that year (about .5) to zero indicates that the growth of the Internet has reduced overall sales by a little less than 4 percent, though not significant.¹⁵

While the overall impact of the Internet has been modest, the impact on revenue coming from tax increases has most certainly not been. Here, we need to look at the impact of changing the tax rate for a given level of Internet use and this is a large number. To point out the magnitude, we gathered data on the cigarette tax increases that occurred between the end of our sample and September 2003. This included 30 states. As table 5 shows, among those 30 states, average real taxes *doubled* in the intervening two years. For each state, we compute the change in log revenue that would occur using the elasticity with Internet usage at zero. This is computed according to

$$\begin{aligned}\ln(\text{Re } v_1) - \ln(\text{Re } v_0) &= \ln(t_1) - \ln(t_0) + \ln(q_1) - \ln(q_0)\eta[\ln(p + t_1) - \ln(p + t_0)] \\ &= \ln(t_1) - \ln(t_0) + \eta[(p + t_1) - \ln(p + t_0)]\end{aligned}$$

¹⁵ We also tried doing this computation for specifications using the various measures in the Forrester data. They were a bit noisy. They ranged from +9 percent in the case of share of the city who smoke and also buy things online to -25 percent for the share of the city who are online. None of them were significantly different from one another or from zero, however.

from our empirical model (where η is the elasticity) holding all the other covariates constant.

As the lower panel of table 5 shows, the predicted change in revenue from the tax increase in these thirty states would average about * percent at the price sensitivity given Internet usage of zero. At the actual Internet usage in 2001, however, the predicted revenue growth from the tax increases is almost 25 percent less. In the extreme case of Connecticut, where they increased the cigarette tax from 50 cents per pack to 151 cents per pack (and where Internet usage is higher than the national average), the revenue growth is some 40 percent lower than would be predicted without the Internet.

While it is true that the cigarette tax increases of the last two years have been especially large and that may have contributed to the revenue discrepancies being so large, it is still clear that there is a major shift underway in the ability of states to raise money.

Conclusions

Using information on the purchases of cigarettes and the use of the Internet across states and time since 1990, this paper has presented evidence suggesting that the rise of the Internet and the ability for individuals to shop across districts has significantly increased the tax sensitivity of consumers. The elasticity of demand (at 2001 prices) increased by about 25 percent because of the growth of the Internet. This increase was smaller in places where neighboring state cigarette tax rates were already low (so people could already drive to a nearby state and buy cigarettes at lower tax rates). The analyses do not yield a precise estimate of the loss in revenue at current average levels of state

taxes and Internet use, but do suggest that for high-tax, high-Internet-use states, this revenue loss is likely to be large and to grow as the online cigarette merchants expand. The implications of Internet created tax competition are particularly important in the area of physical goods like cigarettes and may extend to the international area, as well.

TABLE 1: SUMMARY STATS

	Mean (Standard Deviation) 1990	Mean (Standard Deviation) 2001
Ln (Sales/capita)	4.622 (.202)	4.351 (.314)
State Tax (in 2001 cents)	29.16 (12.58)	38.83 (24.17)
Full Price (in 2001 cents)	203.47 (19.94)	328.20 (34.25)
Ln (income/capita)	2.914 (.159)	3.063 (.157)
CPS Internet %	0 (0)	.524 (.053)
Online %	0 (0)	.699 (.054)
Buy Online %	0 (0)	.429 (.059)
Online & Smoke %	0 (0)	.167 (.025)
Online & Buy %	0 (0)	.095 (.016)
%Smokers Online	0 (0)	.619 (.068)
%Smokers Buy	0 (0)	.355 (.060)

Source: Authors' calculations

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