Preliminary and incomplete—comments most welcome

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

by

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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 that 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 usage 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. The impact of the internet appears to be concentrated entirely in the amount of smuggled cigarettes. 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.

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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 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 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

[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.

that the tax increases of 2001-2003 would have generates 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

[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.

$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,

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

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 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

[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).

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.[6] 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. The1994 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%).[7]

The data on taxed cigarette sales, excise taxes, and the retail prices of cigarettes are

[6] The surveys take place late in the year so they apply to the following fiscal year in the cigarette data.
[7] 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.

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.[8] 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 an 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. The biggest part of the increase in prices came about from the tobacco settlement which put in place regulatory charges that are essentially like per pack taxes but are counted in the price of the cigarettes. It is also worth noting that there is cross-sectional variation in the tax rate as well as across time variation. Across time, the standard deviation in the real tax rate for the mean state is 5.1 cents. Across states, the standard deviation for the mean year is 13.9 cents. For the internet,

[8] 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.

however, most of the variation comes across time. Across states within a year, as seen in the table, the variation in internet usage is much tighter.

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.[9] We present the results from this regression in column (1) of Table 2. The estimated elasticity of taxable sales even before the rise of the Internet is, at around -.9, already at the high end of elasticities found in the previous literature. 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, taxable sales in the state increase. Most relevant for our purposes, though, the interaction of the state tax rate with the share of the state that uses the Internet is negative and very significant. Clearly the data indicate that the sensitivity of purchases to prices has increased substantially. The point estimates suggest that growth of the Internet in the sample from zero in 1990 to its average value in 2001 corresponds with a doubling of the elasticity to -1.82.[10]

As a check on the robustness of the result using the CPS measure of Internet usage, the next several columns try alternatives. Column (2) uses the alternative, Forrester measure of Internet usage in the state. Again the results show a large and significant increase in the

[9] 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.

[10] The -1.77 is equal to -.92 + (-1.72*.52), where .52 is the 2001 state average of Internet usage in the CPS.

elasticity of taxable sales in states as the usage of the Internet rises. The magnitudes are close. Here the elasticity rises from -1.0 to -1.78 with the growth of the internet in the sample. Column (3) first differences the data. The results again show the rising price sensitivity of cigarette purchases in places where the Internet is growing fastest (controlling for state and year dummies), though the overall magnitude is somewhat smaller. Here the growth of the internet corresponds with a change in the elasticity from -1.1 to -1.66. Columns (4) and (5) deal with the issue of imputed values. Column (4) restricts the sample to only those years where internet usage is positive (i.e., no imputed zeros) by looking only at the years post 1995. Column (5) uses only years in which the CPS actually has observations (i.e., no imputed internet usage between survey years). In both cases, this yields virtually identical results.

Finally, in column (6), we include lags and leads of the tax rates to determine if the results are simply the result of short-run shifting of purchases along the lines of **. Basically, the lagged and leading tax variables have no impact. All that matters are the contemporaneous values. Short-run timing shifts are, on average, relatively small (perhaps because the tax changes are not anticipated well) and the baseline effects are almost the same as before.

These baseline specifications, then, suggests that controlling as the internet grew in states, the sensitivity of taxable internet sales in those states grew. We next consider whether this evidence is consistent with alternative explanations or is likely to be tied to a rise in cigarette smuggling due to the Internet.

3. Alternative Explanations

The first thing we show, in column (1) of table 3, is that the results are not simply the spurious correlation of high internet usage late in the sample with the large rise in prices due to the tobacco settlement. We do this by restricting the sample to only the years before fiscal year 1999 (when the settlement raised pre-tax prices substantially in our data).[11] The results are almost exactly the same, indeed, even slightly more pronounced for the role of the internet.

Second, in column (2), we exclude the four states with the lowest cigarette taxes (VA, KY, NC, SC) since they are frequently the source of the internet cigarettes so their taxable sales may respond quite differently to changes in internet usage. They are only a small segment of the sample but the point estimates do show slightly more sensitivity when they are excluded, as would be expected (and doing the regression on those four states alone shows no impact of the internet on sensitivity). Column (3) weights each observation by population in case the results are being driven by a few outlying observations in small states. If anything, the results are again stronger.

In column (4) we consider the role of Native American reservations as an alternative source of smuggling. As detailed in Evans, et al. (2002), a loosening of the rules regarding gambling on reservation land in 1989 has caused a dramatic increase in the number of Indian casinos in the United States in the last 15 years. To the extent that more people are going to such casinos and are, then, able to pick up cigarettes tax free when they are there, this will make the price sensitivity of sales in a state more sensitive to tax rates but will be only spuriously correlated with the growth of the Internet over the same time period.

[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.

We have no direct measures of the number of Indian gaming visits by state across time but using the data from the BIA, we have been able to count the change in the number of Indian casinos by state from 1989 to 2004 and we interact that with the Internet term as well as including it as a control, to determine if the rise of Indian casinos seems to reduce the estimated impact of the internet on tax sensitivity. We are able to do this because while there are many states that have had extensive expansion of casinos (like Minnesota or Arizona), there are many states that continue to have no Indian casinos at all (like Kentucky). The results do not indicate that states with extensive growth of casinos have any smaller estimated impacts of the Internet than places with no Indian casinos.

Finally, in columns (5)-(7) we deal with the issues of changing demographics or other potential explanations. If there has been a rise in teen smoking, for example, 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. Any measure of the actual change of demographic characteristics in a state will almost certainly not give an explanation as to why the tax sensitivity of cigarette sales have doubled in such a short time frame. The changes and the differences in elasticities across groups are simply too small. We will, then add interactions of the price term with the level of 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 (5) shows that some of these factors are significant determinants of the state's price sensitivity but, none of these factors reduces the estimated impact of the Internet on tax

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

sensitivity by much. The interaction term is still negative and significant with almost the same coefficient as before.

Column (6) then takes this robustness check to an extreme by allowing the baseline price sensitivity to be different in each state (on top of the existing state and year dummies accounting for differing levels of consumption).[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 and 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 average t statistic on the state level price elasticities is around 6 so there is still enough variation to estimate these separately. Finally, in column (7), we take the robustness check to the full extreme—allowing every state and every year to have a separate baseline elasticity and identify the impact of the internet on price sensitivity relative to these. Here the results break down. The point estimate of the interaction term is not significant and of the wrong sign. Further, none of the state or year price elasticities are individually significant, either (average t statistics of only around 0.2). The data are simply unable to estimate all of these effects separately.

4. Taxes, Smoking and Smuggling

The results, then, show rather clearly that the elasticity of sales have grown. That growth appears to be correlated with the rise of the Internet in different states. The implications of something that changes the ease of smuggling, however, are quite different for smoking than they are for cigarette purchases. Consumption should be less sensitive than taxed purchases to the home state tax rate because people can avoid it by buying cigarettes in

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

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 turn to the BRFSS for cigarette consumption per day and convert it into a state level measure of annual packs-per-person (so that it is comparable to our taxable sales data) and regress the log of cigarettes packs smoked per day per person and do this for each state year. In columns (1)-(3) of table 4, we then repeat the same regressions as we did previously but for smoking rather than purchases. 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 and in column (3) allow the baseline to vary by state and by year. The baseline price sensitivity of smoking is clearly much smaller than the elasticity of taxable purchases. Further, the internet shows no significant influence on that elasticity. In column (1) the point estimate is negative, though small and insignificant. In columns (2) and (3) it is positive (implying that rising internet usage has made consumption less sensitive to tax changes), though again not significant.

This is consistent with a change in the technology of smuggling. Purchases have become dramatically more elastic while smoking has remained the same or perhaps gotten less elastic. In columns (4)-(6) we create a measure of the amount of smuggled cigarettes by

[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 $e_I>0$), $e_U>e_I$, implying that usage is less sensitive to price than taxed sales. [LET'S CHECK THIS.]

taking the log difference of the amount of cigarettes people say they smoked in the year and the amount they purchased in-state.

In every case we find coefficients of the predicted signs. In the baseline, column (4), higher taxes lead to more smuggling and the amount of additional smuggling has grown significantly with the rise of the Internet. Allowing every state to have a separate baseline elasticity still shows a significant impact of Internet growth on tax induced smuggling, here more than twice as big as the baseline. Allowing every state and every year to have separate baseline elasticities again reduces the coefficient to insignificance, as in previous tables, though the sign is consistent.

The magnitude in the baseline specification says that the amount of smuggling arising from a change in a state's tax rate has more than doubled due to the rise of the Internet in this sample.

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]

[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

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

$$\ln(\mathrm{Re}\, v_1) - \ln(\mathrm{Re}\, v_0) = \ln(t_1) - \ln(t_0) + \ln(q_1) - \ln(q_0)\eta[\ln(p + t_1) - \ln(p + t_0)]$$

$$= \ln(t_1) - \ln(t_0) + \eta[(p + t_1) - \ln(p + t_0)]$$

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. Interestingly, in New York, where the tax went from 56 cents to 150 cents, the New York Convenience Store Association has claimed that the revenues from this tax increase were some 50 percent smaller than forecast at the time of the tax hike.

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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.

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 through tobacco taxes.

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 sales may have doubled due to the growth of cigarette sellers online. The evidence also suggests that this is due to smuggling, not any greater sensitivity of cigarette consumption and that the increasing sensitivity is unlikely to be due to changing demographics of smokers or other spuriously correlated factors. The large estimates imply major reductions in the ability of states to raise revenue from increases in the cigarette tax and are particularly relevant given the experience during the current downturn.

TABLE 1: SUMMARY STATISTICS

	Mean (Std Dev) 1990	Mean (Std Dev) 1997	Mean (Std Dev) 2001
Ln (Sales/capita)	4.62 (.20)	4.48 (.28)	4.35 (.31)
State Tax (in 2001 cents)	29.2 (12.6)	36.2 (20.8)	38.8 (24.2)
Full Price (in 2001 cents)	203.5 (19.9)	214.3 (28.8)	328.2 (34.3)
Ln (income/capita)	2.91 (.16)	2.98 (.15)	3.06 (.16)
CPS Internet %	0 (0)	.181 (.037)	.524 (.053)
Forrester Online %	0 (0)	.223 (.041)	.699 (.054)

Source: Authors' calculations

TABLE 2: THE IMPACT OF TAXES ON CIGARETTE SALES

Dep Var: ln(sales/pop)	(1)	(2)	(3)	(4)	(5)	(6)
	CPS	Forrester	1st Diff	>1995	CPS yrs	Timing
ln(p+t) - year (t-1)						-0.047
						(0.146)
ln(p+t)	-0.922	-1.006	-1.107	-0.766	-0.716	-1.110
	(0.075)	(0.073)	(0.103)	(0.101)	(0.130)	(0.201)
ln(p+t) - year (t+1)						0.205
						(0.142)
ln(p+t)* intern% -yr (t-1)						-0.078
						(0.052)
ln(p+t)* intern%	-1.720	-1.110	-1.069	-1.249	-1.421	-1.253
	(0.167)	(0.120)	(0.318)	(0.190)	(0.218)	(0.236)
ln(p+t)* intern% - yr (t+1)						0.073
						(0.045)
ln(p+t) of neighbor states	0.214	0.328	0.193	0.152	0.153	0.248
	(0.127)	(0.124)	(0.148)	(0.177)	(0.235)	(0.132)
internet %	9.621	6.034	5.756	7.243		6.804
	(0.965)	(0.714)	(1.791)	(1.109)		(1.259)
ln(real income/cap)	0.634	0.407	0.393	0.179	0.064	0.389
	(0.156)	(0.159)	(0.177)	(0.224)	(0.273)	(0.179)
Dummies	Year	Year	Year	Year	Year	Year
	State	State	State	State	State	State
Observations	576	528	528	288	192	480
R-squared	0.96	0.96	0.15	0.98	0.98	0.96

Standard errors in parentheses

TABLE 3: ROBUSTNESS AND CONTROLS

Dep Var: ln(sales/pop)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	pre-settlement	no havens	pop wts	casinos	controls	controls	controls
ln(p+t)	-0.880	-0.894	-0.743	-0.940	1.030		
	(0.091)	(0.078)	(0.067)	(0.076)	(0.769)		
ln(p+t)* int%	-1.931	-1.847	-2.215	-1.692	-1.059	-2.697	1.048
	(0.379)	(0.187)	(0.139)	(0.213)	(0.409)	(0.627)	(1.363)
Neighbors' ln(p+t)	0.221	0.214	-0.446	0.240	0.159		
	(0.118)	(0.130)	(0.115)	(0.127)	(0.340)		
internet%	10.069	10.372	12.798	9.489	6.193	14.469	-5.799
	(2.073)	(1.070)	(0.806)	(1.235)	(2.254)	(3.454)	(7.350)
ln(real income/cap)	0.865	0.643	1.040	0.664	1.404	1.090	0.758
	(0.178)	(0.160)	(0.145)	(0.157)	(0.629)	(0.218)	(0.215)
ln(p+t)* int%*(Δ#casinos)				-0.040			
				(0.292)			
Δ in number of Indian casinos				0.146			
				(1.664)			
ln(p+t)*(%under 18)					-1.405		
					(2.896)		
ln(p+t)* (%black)					-0.723		
					(0.373)		
ln(p+t)* (% college)					-2.646		
					(1.355)		
ln(p+t)* (real income/cap)					-0.006		
					(0.004)		
Controls						48 ST η	48 ST η 12 YR η
Dummies	Year State	Year State	Year State	Year State	Year State	Year State	Year State
Observations	432	528	576	576	576	576	576
R-squared	0.96	0.95	0.97	0.96	0.96	0.96	0.97

Standard errors in parentheses

TABLE 4: THE IMPACT OF TAXES ON USAGE AND SMUGGLING

	(1)	(2)		(3)	(4)	(5)
	ln(use/pop)	ln(use/pop)	ln(use/pop)	l(use)-ln(sales)	l(use)-ln(sales)	l(use)-ln(sales)
ln(p+t)	-0.039	-0.056	0.041	0.946		
	(0.057)	(0.142)	(0.238)	(0.095)		
ln(p+t)* internet%	-0.200	0.266	0.686	1.238	2.716	0.301
	(0.142)	(0.455)	(1.275)	(0.236)	(0.737)	(1.822)
Neighbors' ln(p+t)	-0.228	-0.315	-0.392	-0.511	-0.339	-0.478
	(0.091)	(0.116)	(0.125)	(0.151)	(0.187)	(0.179)
internet%	1.182	-1.421	-3.728	-6.620	-14.271	-1.353
	(0.818)	(2.504)	(6.853)	(1.361)	(4.051)	(9.797)
ln(real income/cap)	0.079	0.148	0.256	-0.508	-0.929	-0.664
	(0.116)	(0.179)	(0.200)	(0.194)	(0.290)	(0.286)
% smoke	4.794	4.936	4.661	4.766	5.682	4.916
	(0.148)	(0.185)	(0.416)	(0.247)	(0.649)	(0.594)
Controls		48 ST η	48 ST η		48 ST η	48 ST η
			12 YR η			12 YR η
Dummies	Year	Year	Year	Year	Year	Year
	State	State	State	State	State	State
Observations	515	515	515	515	515	515
R-squared	0.96	0.95	0.95	0.85	0.85	0.88

Standard errors in parentheses

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