Published in final edited form as:

Public Finance Rev. 2016 May ; 44(3): 291–310. doi:10.1177/1091142115605375.

New Evidence on the Price Effects of Cigarette Tax Competition

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Abstract

Multiple studies have shown that cigarette taxes are more than fully passed through to cigarette prices and that access to a nearby state with a lower cigarette tax also reduces local cigarette prices. We study two other sources of tax competition: nearby Native American reservations and online sales. Using quarterly data on local cigarette prices from 1976–2003, we show that the opening of a Native American casino within 25 miles of a city center is associated with a \$0.016–\$0.027 lower per-pack price, while a 50 percentage point increase in internet penetration is associated with a \$0.22–\$0.25 per-pack price reduction. These effects are not observed for other local prices for which there is no potential tax savings. Our results further our understanding of how tax competition affects local cigarette prices and provide context to studies linking Native American reservations and internet penetration to cigarette smuggling.

Keywords

cigarette tax competition; cigarette prices; internet penetration; Native American casinos

I. Introduction

A large literature in public finance has studied the price effects of various sales and excise taxes (e.g., Besley and Rosen 1999, Poterba 1996). Cigarettes have received perhaps the most attention of any individual commodity, in part due to the very high excise tax burden on cigarettes that has grown even higher since the 1998 Master Settlement Agreement.¹ For example, while the real average value of state plus federal excise taxes on beer declined by \$0.84 from 1976 to 2003 and average state sales tax rates increased from 3.5 percent to 4.7 percent, the associated real value of state plus federal excise taxes on cigarettes increased by \$0.42 over the same period. Previous research has documented the effects of excise taxes on cigarettes on cigarette prices (e.g., Keeler et al. 1996), and several papers also relate the

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

¹Numerous studies have linked cigarette excise taxes to youth and adult smoking and related outcomes. See, for example, Carpenter and Cook (2008), Hansen et al. (2013), and others.

presence of a nearby lower tax border to cigarette prices (Hanson and Sullivan 2009, Harding et al. 2012). Sullivan and Dutkowsky (2012), for example, show both that cigarette taxes are more than fully passed through to prices and that the presence of a nearby state border with a lower cigarette tax also puts downward pressure on local cigarette prices.

In this paper we provide the literature's first evidence on the local price effects of two other sources of competition from low-tax and tax-free cigarettes: (1) online purchases (which enabled tax-free sales over our time period) and (2) purchases on Native American reservations (where cigarettes can typically be purchased tax-free).² We use state internet penetration rates to proxy for online availability, and we use Native American casino openings to proxy for availability on reservations. Prior work has studied tax-free online sales with respect to cigarette consumption and the elasticity of taxable sales (Goolsbee et al. 2010), but we are not aware of any research that has directly linked internet penetration to local cigarette prices. Similarly, prior work has studied cigarette purchasing behavior on Native American reservations (DeCicca et al. 2015), but we are not aware of any research directly linking Native American casino openings to local cigarette prices.

To preview, we use quarterly data on local cigarette prices for 703 cities from 1976–2003 and two-way fixed effects methods to replicate the main results of prior work that taxes are more than fully shifted to prices and that a nearby state with a lower cigarette tax also reduces cigarette prices. We then provide the literature's first evidence that internet penetration rates and Native American casinos also significantly reduce local cigarette prices. For online sales, we estimate that a fifty percentage point increase in the state internet penetration rate (roughly the increase observed over our sample period) is associated with a significantly lower per-pack cigarette price of about \$0.22 to \$0.26. For Native American reservations, we estimate that the opening of a Native American casino within 25 miles of the city center (of which there are 68 over our study period) is associated with a significantly lower per-pack cigarette price of \$0.016 to \$0.027. Consistent with an interpretation of tax competition, we also demonstrate that the casino effect on prices is unique to Native American casinos: there is no price effect for openings of nearby non-Native American casinos (which may be expected to provide similar economic shocks but without the differential cigarette tax treatment). Finally, we document that these price effects of cigarette tax competition are not observed for prices of other services (e.g., a haircut) for which there should be no differential tax competition. Overall, our findings provide the first evidence on the price effects of two previously unstudied sources of cigarette tax competition.

The paper proceeds as follows: section II briefly describes the previous literature. Section III outlines the data and empirical approach. Section IV presents the results, and Section V concludes.

²Strictly speaking cigarettes are not completely tax-free on all Native American reservations, though in practice there are very large price differentials driven mainly by tax exemptions to tribes who are sovereign entities in the eyes of the government. For details, see Lovenheim (2008) and DeCicca et al. (2015). Over our time period (1976–2003) cigarettes could be obtained tax-free from the internet, though this policy has recently changed. For simplicity we refer here to 'tax-exempt' or 'tax-free' cigarette sales in each of these contexts.

II. Previous Literature

Most empirical research on cigarette taxes and prices has estimated rates of tax pass-through; interested readers can find papers in the literature finding no effects of cigarette taxes on prices (Ashenfelter and Sullivan 1987), positive effects of cigarette taxes on prices that do not reflect full shifting (Delipalla and O'Donnell 2001, Chiou and Muehlegger 2010, Harding et al. 2012, DeCicca et al. 2013), and positive effects of cigarette taxes on prices that reflect more than full shifting (Barzel 1976, Keeler et al. 1996, Hanson and Sullivan 2009, Sullivan and Dutkowsky 2012).³ We restrict our brief review here to the handful of recent studies that are most relevant to our work.

Our study is most closely related to Sullivan and Dutkowsky (2012), as we use the same local cigarette price data and two-way fixed effects empirical specifications. They use ACCRA/C2ER and other data to demonstrate that state excise taxes are more than fully shifted to prices and that the presence of a nearby state border with a lower cigarette tax was negatively related to local cigarette prices. Specifically, they estimate that a \$1 tax increases local cigarette prices by approximately \$1.10. They also find that cities within one mile of a lower tax state have cigarette prices that are nearly \$0.08 cheaper, consistent with a price effect of tax competition. Our paper builds on their work by replicating their basic pass-through and nearby low-tax state results using a longer time series (back to 1976) and adding new controls to capture tax competition from online sales and sales at Native American reservations.

Other studies have also examined how cigarette tax pass-through estimates vary with distance to a state with a lower tax border. Hanson and Sullivan (2009) study a cigarette tax hike in Wisconsin and use variation in cigarette prices across stores in the state that are differentially located near borders with Minnesota (which had a lower cigarette tax than Wisconsin following the reform) and Illinois (which had a higher cigarette tax than Wisconsin following the reform). They find that the cigarette tax was more than fully passed through to cigarette prices overall but that this effect was smaller for stores near the Minnesota border. They interpret this as evidence that Wisconsin retailers near the Minnesota border faced stiffer tax competition which reduced their ability to pass on the state tax hike to consumers. Harding, Leibtag, and Lovenheim (2012) use a similar strategy but examine national scanner data from a large grocery store chain from 2005 and 2006. They observe millions of cigarette price observations and find that tax hikes over this period are less than fully passed through to prices. They also find that pass-through rates are lower for stores located near a lower tax border state, again consistent with a role for tax competition in reducing retailers' ability to pass cigarette excise taxes on to consumers. Results from these studies on border-state tax competition are broadly consistent with other papers in health economics that examine the effects of cross-state tax and price differentials on smuggling and tax avoidance behaviors (see, for example, Stehr 2005 and Merriman 2010).

³See Dutkowsky and Sullivan 2014 for an excellent review of this literature.

We are not aware of any prior studies that have studied the effects of availability of tax-free and low-cost cigarettes from online sales or Native American reservations on prices, but a few studies have examined the effects of competition from online sales and Native American reservations on relevant cigarette outcomes other than prices. For example, Goolsbee et al. (2010) consider the impact of tax-free online cigarette sales on the elasticity of taxable cigarette sales. They use the CPS computer use supplements to measure the rate of internet penetration by state from 1989–2003 as a proxy for online sales. In a two-way fixed effects model with controls for neighboring state cigarette tax and population, state income, and wholesale prices of cigarettes, they find that an increase of internet penetration from 0–50 percent nearly doubles the elasticity of taxable cigarette sales, making individuals more sensitive to price changes in their home state's cigarette prices.

Lovenheim (2008) incorporates tax-free cigarette sales on Native American reservations into the more commonly used cross-state tax differentials as incentives for cross-border cigarette smuggling. While not the central focus of his paper, Lovenheim's results using the Tobacco Use Supplements to the Current Population Survey demonstrate the importance of accounting for tax-free sales on Native American reservations in estimating the effects of tax differentials on casual cigarette smuggling. DeCicca et al. (2015) investigate the impact of Native American reservations on cigarette smuggling in New York. Specifically, they examine whether tax-free cigarette savings are fully passed on to the consumer. Using data from the New York State Tobacco survey from 2003–2009, they find that individuals who purchased cigarettes from reservations received a reduction in price nearly equal to the difference in taxation. An important exception occurs for one particular Native American tribe in New York State that faces no tribal competition in cigarette sales; on that reservation, they estimate the tribal monopoly captures about half of the tax differential. Finally, Chernick and Merriman (2013) examine littered cigarette packs in New York City before and after its large city excise tax and find that the share of littered packs with no tax stamp increased substantially following the tax increase and that rates of avoidance were higher for areas of NYC that are closer to the nearest Native American reservation where state and local cigarette excise taxes can be avoided.

III. Data and Empirical Approach

Our primary source for local prices is ACCRA/C2ER. ACCRA data were originally designed to provide cost of living estimates for urban professionals and have been collected quarterly since 1976. Typically volunteers from local Chambers of Commerce would collect information on prices of several local goods in multiple locations, and ACCRA/C2ER compiled these into a city-specific index. These data have been used extensively in the existing literature on tax pass-through in part because of the large number of participating cities. From 1976–2003 we observe the price for a carton of Winston Kings cigarettes in each of several hundred cities.⁴ This price includes any cigarette taxes but excludes sales taxes that are added on at the cash register. We measure all prices in real 2012 U.S. dollars

⁴We note that the sampling of the ACCRA data results in some limitations: we do not observe prices in rural markets, nor do we observe prices of generic cigarettes over our sample period. Moreover, it is a limitation that we only observe prices for one type of cigarette brand (Winston Kings), as it is possible our results would be different for different brands, either premium or generic. For a small number of observations that were listed as a county instead of a city, the largest urban city was matched to the corresponding

and divide each carton price by 10 to arrive at a local real per-pack price. We compile information on state excise taxes on cigarettes from various years of The Tax Burden on Tobacco (Orzechowski and Walker). Our Native American casino data include all 'Class III' Las Vegas style gaming casinos from 1976–2003. We use Native American casinos as a proxy for the ability to purchase cigarette tax-free on reservation land. Although it is possible that individuals may have been able to purchase tax-free cigarettes on some reservations prior to casino openings, we argue that the casino opening provides a shock that drives economic activity to the reservation which may lead to an information transfer to store owners in nearby cities and consumers that cigarettes may be purchased tax-free. Our data on state internet penetration rates come from various years of the Computer Use Supplements to the Current Population Surveys from 1987–2003.⁵

To estimate the price effects of tax competition from Native American casinos and online sales, we follow previous research and estimate two-way fixed effects models controlling for city and time fixed effects and linear city-specific trends. These models take the following form:

$$Y_{cst} = \beta_0 + \beta_1 (CIGARETTE\ EXCISE\ TAX)_{st} + \beta_2 (LOWER\ TAX\ BORDER\ WITHIN\ 25\ MILES)_{st} + \beta_3 (NATIVE\ AMERICAN\ CASINO\ WITHIN\ 25\ MILES)_{ct} + \beta_4 (NON-NATIVE\ AMERICAN\ CASINO\ WITHIN\ 25\ MILES)_{ct} + \beta_5 (STATE\ INTERNET\ PENETRATION\ RATE)_{st} + \beta_6 COST\ CONTROLS_{ct} + \beta_7 CITY_c + \beta_8 TIME_t + \beta_9 CITY\ TREND_{ct} + \varepsilon_{cst} \quad (1)$$

where Y_{cst} is the real cigarette price in city c in state s at time t . CIGARETTE EXCISE TAX is the state excise tax on a pack of cigarettes.⁶ LOWER TAX BORDER WITHIN 25 MILES is an indicator variable equal to one if the ACCRA/C2ER city center is within 25 miles of a state with a lower cigarette tax. NATIVE AMERICAN CASINO WITHIN 25 MILES is an indicator variable equal to one if the ACCRA/C2ER city center is within 25 miles of a Native American casino. In robustness analyses we vary the relevant radii for the lower tax border and casino variables to be 50, 10, and 5 miles. NON-NATIVE AMERICAN CASINO WITHIN 25 MILES is an indicator variable equal to one if the ACCRA/C2ER city center is within 25 miles of a non-Native American casino. This variable is meant to test whether any observed casino-cigarette price relationship is unique to Native American casinos, which should be true if our hypothesis is correct since there is no differential tax treatment for casinos opening on non-tribal lands. STATE INTERNET PENETRATION RATE is the fraction of respondents to the Computer Use Supplements of the CPS who report that they are connected to the internet. COST CONTROLS is a vector of input costs measured in the ACCRA data and include: (1) gasoline, (2) apartment rent, and (3) repair cost (a

city listed in ArcGIS. The population centroid of that city was calculated and the associated observations were used in the data. For example, observations for Miami-Dade County were geocoded to Miami, FL.

⁵Data on casinos were provided by Bobbi Wolfe, Bob Evans, and Brad Humphreys. Mike Lovenheim provided internet penetration rates. These rates for each state were linearly interpolated in the non-survey years.

⁶For the small number of ACCRA cities spanning multiple states, we assign the relevant tax for the state in which the majority of the city is located. Excluding such cities altogether returns similar results. Note that because our price data are quarterly and we do not know when during the quarter the price was collected, we cannot account for mid-quarter tax changes. We therefore assume prices from the first quarter were collected January 1, prices from the second quarter were collected April 1, and so forth, and we assign tax changes to a quarter if the entire quarter is covered by the tax change.

combination of television repair from 1976 to 1979 and washing machine repair from the second quarter of 1979 to 2003 due to data coverage).⁷ CITY and TIME are a full set of city and year-quarter dummies, respectively. CITY TREND is a vector of linear city-specific time trends constructed by taking each city fixed effect and interacting it with a variable TREND that equals 1 in the first quarter of our data, 2 in the second quarter of our data, and so forth. We report standard errors clustered at either the state or city level throughout (Bertrand, Duflo, and Mullainathan 2004).

IV. Results

Figure 1 shows trends in the inflation adjusted price of a pack of cigarettes and in state excise taxes on cigarettes. Cigarette prices have steadily increased since 1976. The graph indicates sharp spikes in both cigarette prices and taxes following the Master Settlement Agreement, resulting in an increase from \$2.50 a pack to almost \$5.00 a pack in just 5 years. Figure 2 shows trends in Native American casinos and state internet penetration rates over our sample period. Native American casinos increased sharply following the 1988 Indian Gaming Regulatory Act which created the conditions for Las Vegas style casino gaming by Native American tribes. The total number of casinos increased from a handful in 1980 to nearly 200 by 2003. Internet penetration steadily increased over our sample period from a very low base. In the empirical work we set all pre-1989 internet observations equal to zero, which Figure 1 shows is a reasonable approximation: in 1989 less than 10 percent of CPS respondents report home internet use. By the end of our sample period, this had increased to well over half of all households.

We present descriptive statistics of key variables in Table 1. Table 1 shows that the mean price for a pack of Winston Kings in the ACCRA/C2ER data over our period was \$2.54, adjusted for inflation. This average reflects considerable variation, as in some cities toward the early part of our sample period a pack of cigarettes cost less than \$0.25 while in one city (New York City) toward the end of our sample a pack of cigarettes cost over \$10. Average inflation adjusted excise taxes on a pack of cigarettes were \$0.56 over the entire period but ranged from \$0.02 (North Carolina) to \$3.46 (Rhode Island). Internet penetration rates averaged 16 percent. Table 1 also shows sample means for the other prices used in our analyses: (1) monthly apartment rent, (2) gasoline, and (3) appliance repair costs (used for local cost shifters); (4) a month subscription to a local newspaper, (5) a movie ticket, (6) dry cleaning for a 2 piece suit, and (7) a man's haircut (used for placebo/falsification tests).

Table 2 presents the key results on cigarette tax pass-through and cigarette tax competition. Columns 1 and 2 present the results on the key variables from equation (1) for the sample that uses any ACCRA/C2ER observation in the data, even if the city was only intermittently participating. We show results for the period 1990–2003 in column 1 in the spirit of replicating prior work by Sullivan and Dutkowsky (2012), and we show results from the full 1976–2003 period in column 2. In the subsequent columns, we present results from similarly specified models on the full 1976–2003 period but where we impose increasingly stronger

⁷These variables were chosen to most closely match the controls used in prior work and because they were consistently measured in the largest number of quarters of the ACCRA data.

requirements about the number of year-quarter observations for which we require the city to have participated in the ACCRA/C2ER data collection (i.e., 25 percent, 50 percent, and 75 percent of year-quarter observations in Columns 2, 3, and 4, respectively). Doing so allows us to be more confident that the city fixed-effects and linear city trends are appropriately controlling for unobserved sources of city-specific bias in the relationship between our tax-free sources of competition and local cigarette prices.⁸ Additionally, it demonstrates the robustness of our results to different samples based on the percentage of data that are missing.⁹ For each sample we show the coefficient estimates on the cigarette tax, the presence of a lower tax border within 25 miles, the presence of a Native American casino within 25 miles, the presence of a non-Native American casino within 25 miles, and the state internet penetration rate.

The results in Table 2 replicate the well-documented finding that cigarette taxes are more than fully passed through to prices. Specifically, we estimate that a \$1 increase in cigarette taxes increases local cigarette prices by between \$1.08 and \$1.11, and this result is statistically significant at the one percent level in every sample. Moreover, the sample period that most closely matches previously published work (column 1, which restricts attention to 1990–2003) returns a pass-through estimate of \$1.11, which is very similar to the \$1.13 estimate from a model with slightly different controls reported in Sullivan and Dutkowsky (2012).¹⁰ We also replicate the literature's previous finding that cities nearby states with lower cigarette taxes – whose variation is driven by cigarette tax changes in the fixed-effects models – have lower cigarette prices, consistent with greater cigarette tax competition reducing prices. These border state effects are statistically significant at the ten percent level or better in all models with clustering at the city level and in two of the four models when we cluster at the state level.

We next turn to the two sources of tax competition that have not been previously studied in the literature on local cigarette prices: Native American casinos and internet penetration rates. We find that the presence of a Native American casino within 25 miles of an ACCRA/C2ER city – whose variation in the fixed-effects models is generated by numerous casino openings over our sample period – is associated with lower local cigarette prices. These estimates are generally sizable and statistically significant at the ten percent level or better in models with state level clustering. Notably, the coefficients on the non-Native American casino indicator variable are smaller in magnitude and are statistically insignificant in all

⁸The city and year-quarter fixed effects and city trends explain the vast majority of variation in local cigarette prices, as evidenced by the high R-squareds for these models, which are standard in this literature (see, for example, Goolsbee et al. 2010 and Sullivan and Dutkowsky 2012).

⁹We also estimated models that used state and year quarter fixed effects with state linear time trends (instead of city fixed effects and trends). These models returned quantitatively similar estimates of the relationship between internet penetration and local cigarette prices. One might also be concerned – particularly for the internet penetration variable which was interpolated in between survey years – about multicollinearity between the area-specific linear trends and internet penetration. Excluding area-specific time trends (but retaining area-specific fixed effects) reduced the magnitude of the internet penetration coefficient and rendered it statistically insignificant though it retained a negative sign. In contrast, the nearby Native American casino estimate was not as sensitive to exclusion of the trends and remained statistically significant in the sample of cities observed in at least 75 percent of year-quarters over the sample period.

¹⁰Specifically, Sullivan and Dutkowsky (2012) include controls for local excise taxes (which we do not observe) and exclude the controls for casinos and internet penetration. Their baseline models also do not include linear city trends; excluding the trends from our specification returns a statistically significant state excise tax pass through estimate of \$1.18, again very close to their published estimate of \$1.13 (column 3 of Table 6 of their paper).

models, consistent with our interpretation that the increased tax competition due to the Native American casino is driving the downward pressure on local prices. Moreover, the point estimates on the Native American casino indicator are broadly similar to those for the variable indicating the presence of a nearby lower tax border. Turning to internet penetration rates, we find that higher internet penetration is associated with substantially lower local cigarette prices. We estimate that a fifty percentage point increase in state internet penetration is associated with a reduction in local cigarette prices by \$0.22 to \$0.25, and these estimates are statistically significant.¹¹ Taken together, the results in Table 2 confirm previously published findings and provide new evidence on the importance of two previously unstudied sources of cigarette tax competition.

In Table 3 we present the robustness of the main findings in Table 2 to alternative choices about what constitute ‘nearby’ lower tax borders and Native American casinos. For all models in Table 3 we restrict attention to cities observed in 75 percent of all year-quarter observations (i.e., the sample from column 4 of Table 2). Column 2 of Table 3 reprints the estimates using a radius of 25 miles, and we present results from other choices in Columns 1 (50 miles), 3 (10 miles), and 4 (5 miles). If our hypotheses about lower tax borders and Native American casinos reflecting cigarette tax competition are correct, we might expect a plausible monotonicity in the relationship between relatively closer tax-free sources compared to relatively farther tax-free sources. Of course, a challenge with this exercise is that the number of cities with nearby sources of tax-free competition gets smaller at smaller radii, so precision is an issue. Despite this challenge, the results in Table 3 are consistent with both lower tax borders and Native American casinos reflecting real effects of tax competition on local prices. At either 50 or 25 mile radii around the ACCRA/C2ER city center, we estimate significant effects of nearby lower tax borders and casinos on prices, and while the coefficients are not statistically significant at 10 or 5 miles, the point estimates are either similar in magnitude or plausibly larger than those from the model based on 50 and 25 mile rules. In all specifications the cigarette tax pass-through estimates and the internet penetration estimates remain unchanged, as expected.¹²

Finally, in Table 4 we demonstrate that the tax competition effects we identify are unique to cigarette prices. We present the coefficient estimates on the ‘placebo’ outcomes from estimation of equation (1) for the full sample for each of other services whose prices were tracked over the same period as cigarettes: (1) a month subscription to a local newspaper, (2) a movie ticket, (3) dry cleaning for a man’s 2-piece suit, and (4) a man’s haircut.¹³ For each of these items we find no consistently significant relationship between either the cigarette

¹¹It could be that purchasers of individual packs of cigarettes might respond differently (probably less) to these tax incentives than more addicted smokers who are more likely buying cigarettes by the carton, which is the only price measure we observe in the ACCRA data.

¹²We also estimated models where we interacted the cigarette tax with the other variables reflecting tax competition to see if pass-through varies systematically with these lower-tax sources as suggested by prior work (Hanson and Sullivan 2009, Harding et al. 2012). The results from these models were uninformative due to insufficient precision. We also examined whether the relationships differed before or after the Master Settlement Agreement (November 1998) using separate city time trends. These results showed that state excise tax pass-through was greater in the pre-MSA period, though the coefficients on the other key tax competition variables did not differ significantly before and after the MSA.

¹³The ACCRA data also tracks prices of a number of other commodities (e.g., tennis balls, man’s shirt), but it is plausible that some of those goods could have had prices affected by ability to buy the items online so we focus on services which are not easily purchased online as our placebo outcomes.

tax or any of the sources of lower-tax competition and the prices of the other goods.¹⁴ These null findings lend further support to our evidence uniquely linking Native American casinos and internet penetration to local cigarette prices.

V. Conclusion

The results presented above provide new evidence on the local price effects of two previously unstudied sources of tax competition: online sales (as proxied by state internet penetration rates) and Native American reservations (as proxied by Native American casino openings). In each case, we find that greater tax competition puts significant downward pressure on local cigarette prices. Notably, we find no significant relationship between non-Native American casinos and local cigarette prices, suggesting that the differential tax treatment at Native American casinos is driving the price effect. These results come from models that replicate the literature's basic findings on tax pass-through and access to lower tax borders, suggesting that our models are generally well specified. Moreover, the effects we observe are not observed for local prices of other commodities that do not share similar tax competition dynamics as do cigarettes.

Our study has implications for interpreting series of studies that have looked at the effects of tax competition on local cigarette sales and consumption. Lovenheim (2008) find that distance to a lower tax border (measured by neighboring state or Native American reservation) significantly increases the home-tax-elasticity of sales, suggesting smuggling behavior. Stehr (2005) finds that cigarette sales respond both to own-tax as well as neighboring tax, consistent with widespread smuggling. Goolsbee et al. (2010) find that the tax elasticity of taxable sales is higher when there is more internet penetration, suggesting that people reduce purchases of home state cigarettes when taxes increase because tax-free sources such as online sales become increasingly attractive in the presence of tax hikes. Our new findings on local prices uncover important mechanisms underlying these effects on sales and consumption.

Acknowledgments

We are grateful to Bill Evans and Bobbi Wolfe for sharing data on Native American casinos, Brad Humphreys for sharing data on non-Native American casinos, and Mike Lovenheim for sharing data on state internet penetration rates. We thank Padmaja Ayyagari, Mark Stehr, Ryan Sullivan, Kip Viscusi, seminar participants at the 2014 APPAM Research Conference, the Editor, and two anonymous referees for very helpful comments on earlier drafts. Boris Rubbani provided excellent research assistance. All errors are our own.

Funding

This research was generously supported by NIH grant #5R21AA019990-02.

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¹⁴The same was true when we restricted the sample to cities observed in 75 percent of year-quarter observations.

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Figure 1.
Cigarette Tax and ACCRA/C2ER Price 1976.1 to 2003.4

Figure 2.
Internet Coverage and Casino Openings 1976.1–2003.4

Table 1

Descriptive Statistics, ACCRA/C2ER

Variable	All ACCRA/C2ER cities	Cities with a lower tax border within 25 miles	Cities with a Native American casino within 25 miles
Cigarette price	\$2.54 (0.96)	\$2.56 (1.02)	\$3.30 (1.11)
Cigarette tax	\$0.42 (0.26)	\$0.49 (0.31)	\$0.59 (0.35)
Internet penetration	0.16 (0.20)	0.14 (0.19)	0.29 (0.22)
Monthly apartment rent	\$800.11 (249.13)	\$799.30 (345.83)	\$886.18 (261.81)
Gasoline price (One Gallon Unleaded)	\$2.05 (0.56)	\$2.09 (0.56)	\$1.85 (0.39)
Appliance repair cost	\$52.83 (19.14)	\$52.35 (9.24)	\$54.42 (9.12)
Monthly newspaper subscription price	\$17.43 (4.28)	\$17.85 (5.16)	\$17.15 (3.48)
Movie ticket price	\$8.73 (1.39)	\$8.75 (1.25)	\$9.07 (1.05)
Dry cleaning price – man's 2 piece suit	\$9.95 (1.50)	\$9.67 (1.30)	\$10.49 (1.49)
Man's haircut price	\$12.71 (2.50)	\$12.43 (2.76)	\$12.80 (2.31)
Number of unique cities in this group	703	68	187

Notes: ACCRA/C2ER means (standard deviations).

Table 2

Tax Competition and Local Cigarette Prices ACCRA 1976–2003

	(1)	(2)	(3)	(4)	(5)
	Sullivan & Dutkowsky (2012) period: 1990–2003	Full sample: 1976–2003	Cities observed in at least 25% of possible year-quarters, 1976– 2003	Cities observed in at least 50% of possible year-quarters, 1976– 2003	Cities observed in at least 75% of possible year-quarters, 1976– 2003
State cigarette excise tax	1.11 (.049) *** [.031] ***	1.08 (.038) *** [.028] ***	1.08 (.038) *** [.028] ***	1.09 (.038) *** [.030] ***	1.11 (.040) *** [.038] ***
Lower tax border within 25 miles	–0.012 (.023) [.022]	–0.020 (.013) [.011] *	–0.020 (.014) [.012] *	–0.026 (.015) * [.013] **	–0.032 (.015) ** [.014] **
Native American casino within 25 miles	0.010 (.019) [.018]	–0.016 (.009) * [.015]	–0.017 (.009) * [.015]	–0.015 (.010) [.016]	–0.027 (.009) *** [.019]
Non-Native American casino within 25 miles	–0.022 (.019) [.016]	–0.008 (.016) [.015]	–0.010 (.016) [.015]	–0.013 (.015) [.015]	–0.014 (.015) [.016]
State internet penetration rate	–0.377 (.312) [.178] **	–0.440 (.265) [.154] ***	–0.436 (.264) [.154] ***	–0.482 (.277) * [.161] ***	–0.508 (.281) * [.187] ***
R-Squared	.98	.99	.99	.99	.99
N	15,407	27,168	24,950	21,545	15,995

Notes: ACCRA/C2ER data from 1976–2003. All models also include controls for city-specific cost controls, city fixed effects, year-quarter fixed effects, and linear city-specific trends. Standard errors clustered at the state level are in parentheses; standard errors clustered at the city level are in brackets.

* significant at 10%;

** significant at 5%;

*** significant at 1%.

Table 3

Robustness to Choice of Distance ACCRA 1976–2003

	(1)	(2)	(3)	(4)
	Cities observed in at least 75% of possible year-quarters	Cities observed in at least 75% of possible year-quarters	Cities observed in at least 75% of possible year-quarters	Cities observed in at least 75% of possible year-quarters
Distance measure used (in miles):	50	25	10	5
State cigarette excise tax	1.11 (.039) *** [.037] ***	1.11 (.040) *** [.037] ***	1.11 (.040) *** [.037] ***	1.11 (.041) *** [.038] ***
Lower tax border within X miles	−0.037 (.015) ** [.015] **	−0.032 (.015) ** [.014] **	−0.031 (.026) [.023]	−0.039 (.036) [.033]
Native American casino within X miles	−0.024 (.012) ** [.015]	−0.027 (.009) *** [.019]	−0.043 (.045) [.041]	−0.089 (.088) [.088]
Non-Native American casino within X miles	0.000 (.014) [.013]	−0.014 (.015) [.016]	0.014 (.017) [.022]	0.024 (.018) [.027]
State internet penetration rate	−0.505 (.280) * [.186] ***	−0.508 (.281) * [.187] ***	−0.497 (.273) * [.184] ***	−0.509 (.273) * [.184] ***
R-Squared	.99	.99	.99	.99
N	15,995	15,995	15,995	15,995

Notes: ACCRA/C2ER data from 1976–2003. All models also include controls for city-specific cost controls, city fixed effects, year-quarter fixed effects, and linear city-specific trends. Standard errors clustered at the state level are in parentheses; standard errors clustered at the city level are in brackets.

* significant at 10%;

** significant at 5%;

*** significant at 1%.

Table 4

Tax Competition and Other Local Prices ACCRA 1976–2003

	(1)	(2)	(3)	(4)
	Monthly newspaper subscription	Movie ticket	Dry Cleaning (2-Piece Suit)	Man's haircut
State cigarette excise tax	0.295 (0.451) [0.458]	−0.263 (0.115) ** [0.078] ***	−0.061 (0.121) [0.108]	0.106 (0.195) [0.235]
Lower tax border within 25 miles	−0.153 (0.240) [0.256]	0.000 (0.040) [0.041]	0.046 (0.074) [0.072]	0.056 (0.143) [0.141]
Native American casino within 25 miles	−0.154 (0.313) [0.373]	−0.071 (0.139) [0.137]	0.127 (0.093) [0.126]	0.240 (0.250) [0.263]
Non-Native American casino within 25 miles	0.668 (0.342) * [0.295] **	−0.012 (0.117) [0.140]	−0.071 (0.076) [0.089]	0.473 (0.151) *** [0.171] ***
State internet penetration rate	−2.254 (2.717) [2.394]	1.057 (0.926) [0.675]	1.392 (1.270) [1.002]	3.251 (2.092) [1.737] *
R-Squared	.829	.615	.722	.698
N	22,843	27,375	27,378	19,923

Notes: ACCRA/C2ER data from 1976–2003. All models also include controls for city-specific cost controls, city fixed effects, year-quarter fixed effects, and linear city-specific trends. Standard errors clustered at the state level are in parentheses; standard errors clustered at the city level are in brackets.

* significant at 10% ;

** significant at 5% ;

*** significant at 1% .