Racial Demographics and Cigarette Tax Shifting: Evidence from Scanner Data

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Abstract

This paper examines the association between racial demographics and the shifting of cigarette excise taxes to consumer prices. Using scanner data on cigarette sales from 1,687 stores across 53 American cities, 2009 to 2011, we found that cigarette taxes are shifted significantly less to consumer prices in cities with large minority (black and Hispanic) populations. The potential for price search behavior implies that our estimates understate the magnitude of the true relationship between local racial composition and cigarette tax shifting. Our finding suggests that increasing cigarette taxes may not be an effective means of reducing cigarette consumption in high-minority areas.

JEL Classification: H22, H32, H71, J15, L66

Keywords: tax shifting, cigarette excise tax, tax incidence, racial and ethnic minorities, scanner data

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1 Introduction

This paper documents that racial demographics influence the incidence of cigarette excise taxes. Patterns of tax incidence by racial composition have important implications for health disparities. In general, racial minorities have lower incomes, lower life expectancies, and higher rates of smoking-related diseases than whites (Miller et al. 1996; Olshansky et al. 2012; American Cancer Society 2015). For instance, African Americans have the highest incidence of lung cancer and are also more likely to die from tobacco-related cancers than any other racial group.[1] African American males are outlived by white males at every age and education level (Olshansky et al. 2012). Furthermore, there are substantial racial disparities in healthcare and medical treatment.[2] Thus, if minorities develop smoking-related diseases, their health outcomes are worse.

This article examines whether cigarette taxes affect prices differently according to the demographic composition of the population. Our central finding is that cigarette taxes are shifted less to consumer prices in cities with a large minority (black and Hispanic) population. The difference in cigarette tax pass-through across demographics is the key issue for public health policy. If taxes affect prices less in high-minority areas, then increasing cigarette taxes may not be an effective measure to reduce smoking consumption in diverse places.

To estimate cigarette tax incidence, we use scanner data from Information Resources, Inc. (IRI).[3] Our dataset contains monthly store prices (converted from weekly prices) at the Universal Product Code (UPC) level for 1,687 stores across 53 cities in 28 U.S. states from January 2009 to December 2011. Most previous studies used either aggregate data on prices or a limited sample of micro data. Our dataset is more detailed and comprehensive in terms of product coverage and time frequency. Contrary to previous studies, our study employs store prices, rather than prices paid by sampled consumers.[4] Because the store level data capture sufficient variation in prices across stores, we can identify how store prices respond to tax changes allowing for demographic characteristics of

[1] The death rate from lung cancer among black men is 21 percent higher than white men (American Cancer Society 2015).

[2] 2016 National Healthcare Quality and Disparities Report. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/research/findings/nhqrdr/nhqdr16/index.html.

[3] The IRI is one of two major vendors of supermarket scanner data (along with A.C. Nielsen).

[4] For instance, using Nielsen Homescan data, Harding et al. (2012) concluded that cigarette taxes are passed through less to consumer price if consumers live closer to a lower-tax border. Using data from the Current Population Survey (2003 and 2006-2007), DeCicca et al. (2013) found that price search behaviors—that is, buying cartons instead of packs—significantly reduce the shifting of cigarette excise taxes to consumer prices.

the market. Our data show substantial differences in the responsiveness of cigarette prices to taxes across chains and brands.

Using the scanner data on store prices, we test the extent to which cigarette taxes are shifted differently to consumer prices in cities with different minority populations. The empirical methodology used in this study inspects the pass-through of excise taxes under different racial compositions. This means adding to the standard cigarette price regression interactions between excise tax and racial demographic variables. The empirical results suggest that the shares of black and Hispanic population are negatively associated with the tendency of cigarette excise taxes to increase consumer prices. We estimate that, evaluated at the mean, an increase in the population share of blacks (Hispanics) by one standard deviation would be associated with a decrease in pass-through rate of about 19 cents (15 cents) per $1 tax a pack.

To address the concern of racial segregation within U.S. cities, additional analysis examines the effect of racial demographics within smaller geographic units (i.e., counties). The results of this analysis suggest that the potential for price search behavior biases upward estimates of the (negative) relationship between minority population share and tax pass-through. Consumers tend to travel across geographic boundaries to purchase their cigarettes in an area with lower tax pass-through (which increases the average price of cigarettes in that area).

To illustrate the relationship between racial demographics and tax shifting, Figure 1 compares tax pass-through rates between two cities: Washington D.C. (Panel A) and Eau Claire (WI) (Panel B). These two cities have the highest and lowest average population share of blacks—0.5 for Washington D.C. and 0.01 for Eau Claire—among the 17 cities that increased taxes in our sample.[5] The figure presents the distribution of consumer price changes per $1-a-pack tax increase for all products (pack and carton) sold in the two cities. We measure the price change by the difference in (tax-inclusive) prices averaged over 12 months before and after tax increase (to suppress monthly seasonal effects). It is clear that the pass-through rates are lower in a city with a larger black population. The distribution of pass-through rates is symmetric around the mean of $0.41 in Panel A, whereas the distribution is fairly skewed to the left with the higher mean of $0.96 in Panel B.[6]

[5]State cigarette taxes increased in 17 cities across 9 states (out of 53 cities across 28 states) in our sample. Figure 1 refers to the tax increases of 50 cents per pack (DC) and 75 cents per pack (WI) that took place in 2009.

[6]We have also constructed a similar figure comparing tax pass-through between two cities: Seattle (WA) with the highest median income and Hartford (CT) with the lowest median income (among the 17 cities where tax changed). Compared to Figure 1, the distributions of pass-through rates were both symmetric around means, and the two means

A potential caveat to this simple comparison is that Washington D.C. borders on the state of Virginia where average cigarette prices (and taxes) are lower. Thus, cross-border competition may entirely explain the lower pass-through rates in Panel *A*. In the empirical section, we provide a rigorous test of the relationship between racial demographics and tax shifting, controlling for the cross-border effect and other potential factors.

The rest of the paper is organized as follows. Section 2 presents a brief literature review. Section 3 describes the data, explains our empirical strategy, and reports the results. Section 4 discusses our findings and concludes the paper.

2 Brief Literature Review

Previous literature on cigarette tax incidence has focused on how the economic burden of cigarette taxes is split between consumers and suppliers. Although a number of studies supported that cigarette taxes are more than fully shifted to consumer prices (e.g., Barzel 1976; Johnson 1978; Keeler et al. 1996; Hanson and Sullivan 2009), recent studies found that cigarette taxes are less than fully shifted to consumer prices due to consumer search behavior (Harding et al. 2012; DeCicca et al. 2013; Chiou and Muehlegger 2014).

Some of the latter studies have used scanner data to study cigarette taxes. Harding et al. (2012) employed household level scanner data to estimate tax incidences (with a focus on cross-state tax avoidance). Chiou and Muehlegger (2014) used store level scanner data to examine consumer responses to tax changes such as stockpiling and substitution between products. Contrary to the aggregate data, the scanner data allow one to observe prices at a more detailed UPC level (e.g., Camel 99s hard pack).

Moreover, recent studies reported that cigarette tax shifting varies with demographic characteristics, including income, education, and race/ethnicity. Harding et al. (2012) found that cigarette taxes are shifted less to the prices for lower-income families and high school graduates relative to higher-income families and college graduates, perhaps reflecting different search behavior. DeCicca et al. (2013) showed that blacks and Hispanics are less likely to purchase cigarettes by the carton—searching for volume discounts—rather than by the pack. No studies have examined whether taxes

were relatively similar—$0.80 in Seattle and $0.92 in Hartford (not shown). Thus, the pattern of pass-through shown in Figure 1 is distinctive to racial demographics.

are shifted at different rates in areas with different racial demographics, however.

Racial and ethnic demographics may influence the incidence of cigarette taxes, potentially because cigarette smoking behavior has strong cultural and economic dimensions (Baluja et al. 2003). For instance, African Americans are more likely than whites to compensate for price increases by smoking cigarettes higher in tar and nicotine (Farrelly et al. 2004; Adda and Cornaglia 2006). The racial differences in compensating behavior may be explained by mentholated cigarettes (whose cooling actions facilitate deeper inhalation of smoke) and income levels (because poor smokers will intake more nicotine per cigarette to maintain desired levels of nicotine) (Perez-Stable et al. 1998; McCarthy et al. 1992).[7]

In addition, racial demographics may influence cigarette tax incidence if different racial groups exhibit different search behavior.[8] In a study of littered cigarette packs in Chicago, Merriman (2010) found that neighborhoods with a higher share of non-white households have a lower probability of tax compliance (i.e., a lower probability that a littered pack has a proper local tax stamp). Merriman explained that high-minority neighborhoods have more formal or informal networks that allow circumvention of the cigarette taxes.[9] On the contrary, DeCicca et al. (2013) reported that blacks and Hispanics are less likely to engage in price search (that is, by purchasing cigarettes by the carton relative to by the pack). The evidence is thus inconclusive on whether the share of racial minority will increase or decrease price search behavior.

On the supply side, decisions of stores (sellers) to pass on taxes to consumers depend on demographic characteristics of the market. Retail stores in oligopoly competition set prices strategically—taking into account consumer purchase patterns that vary by demographic characteristics.[10] For instance, supermarket chains in a racially diverse market prefer everyday low pricing (i.e., consistently low prices across the board) to promotional pricing (i.e., deep but temporary discounts) (Ellickson and Misra 2008).[11] A strand of theoretical literature examined tax incidence in differen-

[7]Blacks are more likely to smoke cigarettes that are mentholated and stronger, and extract significantly more nicotine per cigarette than whites (Adda and Cornaglia 2006; Caraballo et al. 1998; Perez-Stable et al. 1998).

[8]We control for the effect of income on the incidence of cigarette taxes in the empirical work.

[9]Maclean et al. (2013) suggested that living in ethnic enclaves may allow more opportunity to obtain untaxed cigarettes. For instance, a large tax increase in New York City led to pervasive illegal cigarette markets in black and Hispanic communities (Coady et al. 2013). Using focus groups study, Shelley et al. (2007) documented large-scale purchasing of untaxed cigarettes in Central Harlem in New York City—a phenomenon known as the "5 dollar man."

[10]For related discussions, see Berry et al. (1995), Nevo (2001), Petrin (2002), Goolsbee and Petrin (2004), Smith (2004), Ellickson and Misra (2008), and Jia (2008).

[11]Note that retail stores have substantial flexibility to alter cigarette prices through deals with tobacco producers (Bloom 2001; Toomey et al. 2009).

tiated product oligopoly markets (Seade 1985; Stern 1987; Anderson et al. 2001), but the effect of demographic characteristics on tax shifting is an empirical matter that has not been much studied.

3 Empirical Evidence

3.1 Data and Variables

We construct a panel data set with 36 time periods (from January 2009 to December 2011) for 1,687 grocery and drug stores across 53 cities in 28 U.S. states.

For cigarette prices (inclusive of taxes), our dependent variable, we use scanner data collected by IRI.[12] The IRI data contain store-level information—sales, pricing, and promotions for a complete set of items sold—collected via scanning devices. The data cover a large number of chain retailers (grocery stores, drug stores, and mass merchandisers) over a broad array of geographic markets (mainly major metropolitan areas such as Chicago, IL).

Our dataset contains information on store-level monthly price and quantity for each product at the Universal Product Code (UPC) level.[13] The UPC distinguishes each cigarette product uniquely by detailed attributes, including brand, size, package, flavor, and nicotine content (e.g., Marlboro menthol 100s soft pack). Most of our 1,687 sample stores belong to 123 different supermarket chains, and carry about 3,231 cigarette products (423 brands). Because our price data cover all products sold in each store, they provide a clear advantage over the aggregate data (e.g., quarterly average prices) or a smaller sample of micro data (e.g., prices paid by survey respondents).[14]

State cigarette excise taxes are collected from *The Tax Burden on Tobacco* (Orzechowski and Walker 2012).[15] Among the 28 states in our data, cigarette excise taxes increased at least once in 9 states between 2009 and 2011. The tax change is 72 cents per pack on average, ranging between 10 cents and $1.60. Although our dataset does not cover all 50 states (due to data availability), the data provide sufficient variations in racial demographics across markets and consumer prices across

[12]Since 2008, IRI has made available to researchers detailed transaction-level data spanning 30 categories of products, including cigarette product. See Bronnenberg, Kruger, and Mela (2008) for further details on the data.

[13]We computed the monthly prices by averaging weekly prices over a month. This does not undermine the virtue of disaggregate level information because relatively little variation in prices is observed within a month.

[14]See Besley and Rosen (1999), Hanson and Sullivan (2009), Sullivan and Dutkowsky (2012), and DeCicca et al. (2013).

[15]In some states, localities impose excise taxes on cigarettes in addition to the state tax. With a few exceptions (e.g., Chicago and Cook County (Illinois) and New York City (New York)), however, the local taxes are relatively small (DeCicca et al. 2013).

stores to identify the parameters of interest.[16] In addition, 28 states in our sample fairly represent all states in terms of geographic regions, cigarette excise taxes, and demographics.[17] Thus, limited coverage of states would not severely restrict the generalization of our findings. Table 1 presents the mean cigarette prices and taxes for each state in our sample.

[Table 1 here]

We use the 2010 American Community Survey (ACS) to collect demographic information of each store. The 1,687 stores in our data are located in 53 cities. For each city nesting the sample stores, we collect the population shares of six minority groups: Blacks, Hispanics, Asians, Native Americans, mixed, and others.

Other demographic variables include population (in natural logs), median household income (in natural logs), percentage of residents with a bachelor's degree, and percentage of the population over age 65. These variables are demand shifters for cigarette markets in equilibrium (Keeler et al. 1996; DeCicca et al. 2013). As robustness check, we also collect demographic information at the county level.

Following previous studies, we control for consumer search behavior by using information on the location of stores—that is, latitude and longitude of the centroid of the zip code in which each store is located. We calculate the shortest geodesic (or crow-flies) distance between each store and lower-tax state borders.[18] Table $A1$ shows the summary statistics for the demographic and other control variables used in this study.

For illustration purpose, Table 2 presents average changes in consumer price after a $1 excise tax increase in the state of Washington (in Ma[illegible]010). We pick the top 50 UPCs (in quantity sales) sold in three major chains, and measure the price change by the difference in prices averaged over 12 months before and after the tax increase.

[16]For confidentiality reasons, IRI does not report the data collected from markets where only a few chains have dominant market shares (because chain names would be easily identified). Out of the available data, we exclude the stores (in Maine, New Hampshire, and Vermont) for which the geographic market is ambiguously defined by IRI. This reduces our sample to 1,687 stores in 28 states.

[17]Summary statistics of key demographic variables are similar between included and excluded states.

[18]Lovenheim (2008) and Harding et al. (2012) computed the distance from each census tract to a road crossing into the lower-tax state. Callison and Kaestner (2014) used Google Maps API to measure the distance to the nearest lower-tax border. In our paper, border locations are measured by a set of geographical coordinates of the line segments that make up the state borders (see Holmes (1998) for further details). The estimates for our distance measure are consistent with the findings of previous literature.

Table 2 shows substantial variations in price changes across brands, chains, and cities. First, while taxes are overshifted to consumer prices for some top-sales UPCs (for instance, Marlboro and Camel), the price changes are less than 50 cents or even negative for other UPCs (for instance, Marlboro Lights and Basic Lights). Second, different chains shift the tax at different rates to consumer prices. In Seattle, for instance, chain C shifts the tax at substantially lower rates (at nearly zero rates) to the prices of Marlboro Lights than chains A and B, but shifts tax at higher rates to the prices of Newports. These variations in price changes indicate that chain pricing strategies affect the pass-through of cigarette taxes. Third, and more importantly, patterns of tax shifting clearly differ across cities. For instance, as the last row of Table 2 shows, a \$1 tax increase leads to about \$1.50 price increase in Spokane, but about \$0.99 price increases in Tacoma. Note that Spokane has a smaller share of black population (2 percent) than Tacoma (11 percent), while the two cities are similar in other demographics (e.g., population and median household income). Thus, black population size appears to be negatively associated with the tax pass-through rate.[19]

[Table 2 here]

3.2 Empirical Model

This paper uses a reduced-form equation of prices to estimate the pass-through of cigarette taxes (Chaloupka et al. 2010; Harding et al. 2012; DeCicca et al. 2013). In particular, we allow the pass-through to vary according to racial composition. The basic estimation equation is

$$\begin{aligned} P_{ijt} = {} & \beta_0 + \beta_1 \tau_{st}^h + \beta_2 \cdot \tau_{st}^h Z_j + \beta_3 (\tau_{st}^h - \tau_{st}^b) + \beta_4 ln(D_{jst}) \\ & + \ \beta_5 (\tau_{st}^h - \tau_{st}^b) ln(D_{jst}) + \Phi \cdot X_j + \delta_i + \theta_j + \mu_s + \lambda_t + \epsilon_{ijt}, \end{aligned} \tag{1}$$

where P_{ijt} is the price per pack for UPC i sold in store j at time t, τ_{st}^h is the per-pack state tax in home state s (where the store is located), Z_j is the vector that includes the shares of minority groups and median income in store j's city, τ_{st}^b is the tax in the nearest lower-tax state, and D_{jst} is the distance between the store and the border to the nearest lower-tax state.

[19] In addition, although Seattle is larger and wealthier than Tacoma (e.g., more than three times larger in population), the pass-through rate in Seattle (\$1.00) is close to the pass-through rate in Tacoma (\$0.99). This is consistent with the fact that the shares of black population in the two cities are relatively similar (i.e., 8 percent in Seattle and 11 percent in Tacoma).

In Equation (1), vector β_2 identifies the difference in tax incidence across different racial demographics and income levels. For instance, if Z_j includes only the black population share (Black), $\beta_2 < 0$ would indicate that taxes are passed through less in areas with a higher share of blacks.

The tax difference $\tau^h - \tau^b$ captures the cross-state tax avoidance opportunity (Harding et al. 2012). The interaction between the tax difference and log distance to the lower-tax border $(\tau^h - \tau^b)ln(D)$ indicates the extent to which a cross-state avoidance opportunity changes as stores are located farther from the border. Thus, $\beta_1 + \beta_2 \cdot Z_j + \beta_3 + \beta_5 ln(D)$ shows the full marginal effect of excise taxes on cigarette prices. For a store on the border with a lower-tax state, the marginal effect becomes $\beta_1 + \beta_2 \cdot Z_j + \beta_3$. We expect that $\beta_3 < 0$ (because the tax difference between home and the nearest lower-tax state leads to cross-state competition), and that $\beta_5 > 0$ (because a larger distance from the border means less opportunity for cross-state avoidance).

X_j is a vector of demographic and socioeconomic characteristics of store j's city (including Z_j). Parameters δ_i, θ_j, μ_s, and λ_t are the set of UPC, chain, state, and time (month) fixed effects, respectively.[20]

We include UPC fixed effects to capture within-UPC changes in prices when taxes increase. The UPC fixed effects control for the possibility that consumers alter their product choices when excise taxes increase (Harding et al. 2012). For instance, consumers may upgrade the quality of cigarettes when excise taxes increase—because per-unit tax increases the price of high quality products by relatively less than low quality products (Barzel 1976; Borcherding and Silberberg 1978; Sobel and Garrett 1997; Evans and Farrelly 1998). In the short term, however, some consumers may switch to cheaper (low-quality) cigarettes to offset the effect of tax increases (Chiou and Muehlegger 2014).

The chain fixed effects capture the pricing behavior of chain stores. One of the key features that distinguish supermarket chains is their pricing strategy (e.g., heavy discounters, Everyday Low Price, and High/Low). Chain fixed effects thus control for unobserved price heterogeneity across chain stores that is correlated with taxes. Furthermore, if price competition occurs at the chain level rather than at the store level, the chain fixed effects can control for the competition effects on

[20] Alternatively, we could include store fixed effects rather than chain fixed effects. In our data, however, price variation across stores within a chain for each UPC (in each city and month) is much smaller than the price variation across chains—suggesting that the chain fixed effects better capture pricing behavior. The average coefficient of variation (ratio of standard deviation to mean) is 7.05% for variation across chains but only 0.29% for variation across stores of the same chain. Using the Nielsen scanner data, Hitsch et al. (2017) also found that retail prices and promotions are relatively homogeneous across stores belonging to the same retail chain.

prices.[21] Our data show substantial variations in prices across products and chain stores.

Finally, the state fixed effects control for the possibility that some states may have higher prices due to some unobservable state characteristics that are correlated with cigarette taxes (Harding et al. 2012). For instance, states with a strong anti-smoking sentiment are likely to have relatively high cigarette excise taxes and may have relatively high consumer prices due to strict regulations (e.g., minimum cigarette price laws).[22] On the contrary, some tobacco producing states with a pro-smoking sentiment may pass lower taxes (Farrelly et al. 2001).[23]

Before proceeding, we have to justify our choice of city as geographical units. A potential problem with using city-level measures of demographics is that many U.S. cities are residentially segregated by race. This is not problematic in our context, however, because our analysis focuses on the differences in pass-through rates across cities, not on the causal associations between demographic differences and pass-through rates. On the contrary, using a finer-level geographic measure (e.g., county or census-tract) poses a problem of price search behavior. For instance, consumers may travel across geographic boundaries to purchase cigarettes in areas with lower tax pass-through. Because we do not know where consumers live, it would be difficult to separate price search behavior from the true relationship between racial composition and cigarette tax pass-through. This distinction is important because we care about how tax pass-through that varies with local racial composition of an area may affect health outcomes in that area. In the next section, we show the results of using smaller geographic units (counties).[24]

Another justification for using city-level demographic measures is that retail chains tend to set a similar price for cigarette products across their stores within the same city (market). Because our empirical model includes state and chain fixed effects, our parameters of interest are identified by within-state, within-chain variations in price, which come mainly from variation across cities. In

[21] We also controlled for the number of stores operating within varied thresholds of the radius as a proxy variable for price competition. The estimates were insignificant, however, and the coefficients of tax shifting barely changed (not reported). This indicates that the chain fixed effects capture most of the competition effects.

[22] Another possibility is that sellers might offset anti-smoking regulations by lowering prices (Keeler et al. 1996).

[23] The baseline assumption underlying our empirical model is that there are time-invariant unobserved effects on cigarette prices (across products, chains, and states) that are correlated with the observed regressors such as demographics, distance to the lower-tax state, and taxes. To deal with the potential endogeneity, we use the fixed effects model. Thus, the key identifying assumption is that only the observed regressors affect the expected value of cigarette prices once the fixed effects are controlled for. Section 3.3 shows that our results are robust to various specifications of the fixed effects model.

[24] We do not consider census tracts—even smaller units with roughly 4,000 residents—because consumers typically travel much farther to shop, and because stores across tracts within a city face more competition from one another than stores across cities.

short, city-level demographics matter for the differences in tax shifting because that is how retail chains set prices.[25]

3.3 Empirical Results

As a benchmark, we first estimate cigarette prices without allowing the impact of cigarette tax to vary across demographics. Table 3 thus shows the results of estimating Equation (1) where $\beta_2 = 0$. Column 1 takes a basic equation that includes only excise tax, and the time and state fixed effects. Columns 2 and 3 show the results of adding successively the chain fixed effects and the UPC fixed effects. Column 4 adds demographics as well as cross-border effects—by including the tax difference, log distance to the lower-tax border, and the interaction between the two.

[Table 3 here]

In columns 1 and 2, the estimate of the tax pass-through rate is about 0.97, which indicates that a one dollar increase in taxes is associated with a 97 cent increase in price per pack. When UPC fixed effects are added in column 3, however, the pass-through rate decreases to 0.91. This result is consistent with Harding et al. (2012) who found that adding UPC fixed effects significantly reduces the estimated pass-through rate because consumers alter their purchasing patterns when taxes increase.[26] Our results show that the pass-through rate is less than one throughout the specifications. In general, this under-shifting of cigarette taxes is consistent with the findings of the previous studies that used scanner data (Harding et al. 2012; Chiou and Muehlegger 2014).

In column 4, the full specification with the demographic variables and border effects, the estimation results are largely consistent with previous studies that focused on cross-state tax avoidance (Lovenheim 2008; Goolsbee et al. 2010; Harding et al. 2012).[27] The signs of tax difference (−) and its interaction with the distance to a lower-tax border (+) indicate that stores located closer to the

[25] As indirect evidence, the cross-city variations in prices (measured by the coefficient of variation) is 8.9% overall while the within-city variations is only 3.4%.

[26] The estimates of pass-through rate in columns 2 and 3 are statistically different from one another. In addition, all the coefficients for chain dummies are statistically different from zero.

[27] Adding only demographic variables without border effects has little impact on tax shifting—that is, the pass-through rate does not change significantly from that in column 3. This result does not imply that the demographic variables are unrelated with the pass-through rate, but simply means that time, state, chain, and UPC fixed effects sufficiently control for store pricing behaviors that are associated with cigarette taxes and demographic profiles (Harding et al. 2012). We show in Table 4 that racial demographics indeed have a significant impact on pass-through rates.

lower-tax state shift taxes to consumer prices at lower rates. The tax incidence for consumers who purchase cigarettes on the lower-tax border is 0.70 per dollar ($= 1.079 - 0.382$), and the incidence increases as the stores are located farther from the border. Our results imply that a cross-state avoidance opportunity is dissipated about 40 miles from a lower-tax border, where the pass-through rate is 0.91 ($= 0.70 + ln(40) \times 0.057$)—close to the average pass-through rate in column 3.

Among the control variables, several factors are significantly associated with cigarette prices. The coefficients of the population share over age 65, population share with a bachelor's degree, shares of blacks and Hispanics, and median household income are all negative and significant. For instance, moving from average population share over age 65 (0.11) to the maximum level (0.16) would be associated with, on average, a decrease in cigarette prices of about 66 cents per pack. On the contrary, population and population shares of Asians, Native Americans, and mixed are positively associated with cigarette prices.[28] Notice that the estimated impacts of demographics should be interpreted as correlations, not necessarily as causal.

More importantly for our purposes, Table 4 reports the estimates of Equation (1), allowing the impacts of tax to vary by racial demographics and median income. All columns include the interactions of tax with the shares of racial minority groups (blacks, Hispanics, Asians, Native Americans, mixed, and other), as well as the interaction terms of tax and median household income (in logs). The interaction term in median household income controls for the confounding effect of average income levels in the area. Omitting the median income interaction biases the estimates for the interactions in minority population shares because income levels, on average, are lower in high-minority areas. For instance, the estimates for the minority share interaction terms would be biased upward if tax pass-through is higher in lower-income areas. Thus, the median income interaction separates between the impact of racial demographics on tax pass-through (reflecting income differences between groups) and the impact of average income levels of the city. All specifications also control for demographic characteristics and border effects (not shown). Column 1 of Table 4 includes time and state fixed effects. Columns 2 and 3 add successively the chain fixed effects and the UPC fixed effects.

[Table 4 here]

[28] Our sample cities do not include Native American reservations that sell lower price cigarettes.

Throughout the columns, tax pass-through decreases with the population shares of blacks, Hispanics, and Native Americans. All the coefficients on the interaction terms for the three racial groups are negative and significant at the 1% level. This means that cigarette taxes are shifted less to consumer prices in cities with larger population shares of these three groups. Thus, taxes are shifted away from consumers who live in these areas. On the contrary, the estimates of the interaction terms in Asians are positively related with consumer prices.[29]

In addition, the pass-through rate of tax decreases with income. The coefficients on the interaction terms between tax and median income are negative and significant, indicating that taxes are passed through less to prices for higher-income areas. One explanation for this finding is that higher-income consumers are more likely to engage in price search (duty-free stores, on-line vendors, Indian reservations, and cross-border states) because they have lower direct costs of search (i.e., higher rates of air travel, automobile ownership, and internet access). This is consistent with DeCicca et al. (2013) finding that consumer search behavior tends to increase with income. This result also indicates that increasing cigarette taxes may be more effective in reducing smoking in low-income areas, but it makes the tax more regressive.

Table 5 presents the marginal effect of cigarette tax on prices, conditional on selected interacting variables Z_j: population shares of blacks, Hispanics, Native Americans, and the level of income. That is, we estimate $\beta_1 + \beta_2 \cdot Z_j + \beta_3 + \beta_5 ln(D)$ in Section 3.2. Each column in Table 5 reports tax pass-through rates at three different levels of Z_j: mean, mean $-$ one standard deviation (SD), and mean + one standard deviation. Population shares of other minority groups and D (distance from the lower-tax border) are held constant at the mean level, so the marginal effects at the mean level of interacting variables are the same across columns.

It is clearly seen from Table 5 that the marginal effects of taxes are smaller in magnitude when the population shares of blacks and Hispanics are larger or when income is higher. In the first column, for instance, an increase in the share of blacks from the mean level (that is, 0.27 or the

[29] As an alternative measure of racial composition, we have computed the Herfindahl index as the degree of diversity, using eight racial/ethnic categories: white, black, Asian, Hispanic, Native American and Native Alaskan, Hawaiian and Pacific Islander, mixed, and other. The diversity index shows the probability of two randomly drawn people in the city to be of different racial/ethnic groups, ranging from 0 (complete homogeneity) to 1 (complete heterogeneity). The correlation between the diversity index and the share of white population is -0.56. Not surprisingly, we obtained a similar result: that tax shifting decreases with the index of diversity (not reported). As is well known, however, the diversity index does not take into account the composition of specific racial groups, so the index gives the same score whether the city has 70% white and 30% black or 30% white and 70% black.

level in Toledo, OH) to the mean + one SD level (that is, 0.49 or the level in St. Louis, MO) would be associated with a decrease in the pass-through rate of about 19 cents per $1 tax per pack (i.e., from the estimated pass-through of 0.963 to 0.778).[30]

Similar pictures emerge for Hispanics and income in that the pass-through rates decrease with the interacting variables. The decreases in pass-through are somewhat larger in magnitude for income relative to blacks and Hispanics. For Native Americans, however, the decreases in pass-through rates appear economically insignificant.

[Table 5 here]

For illustration purpose, Figure 2 shows a scatter plot of pass-through rates versus shares of black population for the 53 sample cities. The pass-through rate of each city is calculated based on the estimates in Table 4 (column 3), using the population shares of African Americans in the city.[31] The figure demonstrates that the pass-through rate is negatively associated with the share of black population. Cities with a larger black share of population such as Washington D.C. are expected to have a lower pass-through rate than cities with a smaller black population such as Eau Claire (WI). (See Figure 1 for comparison.)

[Figure 2 here]

In summary, our results indicate that cigarette tax shifting is conditional on the racial demographics (population shares of blacks and Hispanics) of the market. A potential explanation is that blacks and Hispanics respond differently to cigarette price increases due to the differences in compensating and search behavior.

So far, our analysis has used city-level measures of the population shares of minority groups. Many U.S. cities are segregated by race, however. Within these cities, some neighborhoods have a higher share of minority population than other neighborhoods. For instance, even in cities with relatively high population shares of minorities, some chain stores could sell mostly to white consumers.

[30] The pass-through estimate of 0.963 is obtained by $16.168 - 0.329 + 0.010 \times$ (mean of log distance to the lower-tax border) $- 0.975 \times$ (mean Black share) $- 1.238 \times$ (mean Hispanic share) $+ 1.880 \times$ (mean Asian share) $- 0.610 \times$ (mean Native share) $- 2.502 \times$ (mean Mixed share) $+ 9.237 \times$ (mean Other share) $- 1.367 \times$ (mean of log median income)—based on column 3 (Table 4). Note that population shares of non-black minority groups and income levels are held constant at the mean level.

[31] The median household income and the distance from the lower-tax border are held constant at the sample mean values.

Using a finer geographic measure, however, leads to the potential for price search behavior across stores within a city. This may bias estimates of the magnitude of the true relationship between local racial composition and cigarette tax shifting.

Suppose that more price-sensitive consumers travel across neighborh boundaries to purchase their cigarettes in high-minority areas with lower tax pass-through. It is reasonable to say that this increases the average price of cigarettes in these areas. In this case, the resulting upward bias would mean that the estimates would understate the magnitude of the negative relationship between minority populations and cigarette tax shifting.

In order to test this hypothesis, Table 6 presents the marginal effects of cigarette taxes on prices at a finer geographic level. In Table 6, demographic variables (including population shares of minority groups) of each store are measured at the county level.

The results generally confirm our hypothesis. Similar to the city-level analysis in Table 5, the marginal effects of taxes decrease as the population shares of blacks and Hispanics or the level of income increase. However, the magnitude of the changes in marginal effects is now smaller. For instance, an increase in the share of blacks from the mean level to the mean + one SD level is now associated with a decrease in the pass-through rate of about 6 cents per $1 tax per pack—relative to 19 cents in Table 5. Similar patterns appear in Hispanic shares and income. These results indicate that price search of price-sensitive consumers poses a more severe problem of biased estimates across counties than across cities.[32]

[Table 6 here]

As robustness checks, Table 7 presents the estimates from alternative specifications. In panel *A*, we exclude the cities that impose local (city or county) cigarette taxes in addition to state taxes. In such cities, store prices may respond differently to the changes in state taxes. Such cities are: Birmingham (AL), Montgomery (AL), Chicago (IL), Cook County (IL), Kansas City (MO), St. Louis (MO), New York City (NY), Cuyahoga County (OH), Norfolk (VA), Richmond (VA), and Roanoke (VA).

[32] We also used the population shares of minority groups at the census tract level. The results (not reported) show that the potential for price search behavior across census tracts (with a population size ranging between 1,200 and 8,000) leads to even more biased estimates of the magnitude of the relationship between local racial composition and cigarette tax shifting.

In Panel B, we replace the state fixed effects with the state-specific variables that capture state-wide anti-smoking sentiments or policies. The variables are the intensity of tobacco counter-marketing media campaigns (collected from Nielsen Media Research), the indicator of state indoor smoke-free policies (collected from the State Tobacco Activities Tracking and Evaluation System), and the percentage of adults who think secondhand smoke is very harmful (collected from the 2009-2010 National Adult Tobacco Survey (NATS)).[33] The state fixed effects control for the potential endogeneity of cigarette taxes, but may absorb the effects of demographics if the cities within a state have insufficient variation in demographic characteristics.[34]

Since racial minorities are more constrained by income, one may argue that income differences between racial groups entirely explain the differences in tax pass-through rates according to local racial composition. In panel C of Table 7, we control for the potential relationship between race and income by including the median household income of Blacks, Hispanics, and Asians.

Throughout the panels, the marginal effects of cigarette taxes remain qualitatively similar to the results in Table 5. The marginal effects of cigarette taxes are generally decreasing in the share of blacks and Hispanics and the level of income. In Panel A, the pass-through rates are now increasing in the share of Hispanics, but the differences are not economically significant. For Native Americans, the decrease in pass-through rates now appears economically significant (in all Panels). Panel C indicates that it is more than income differences between racial groups that influence the relationship between racial demographics and tax shifting.

[Table 7 here]

Purchase patterns of racial minorities may vary by product types, potentially limiting our findings. Using data from the 2003 and 2006-2007 Current Population Survey Tobacco Use Supplements, DeCicca et al. (2013) found that cigarette taxes are undershifted to the prices paid by consumers who buy cartons relative to packs. In addition, racial minorities and smokers of menthol brands (predominantly blacks) are more likely to purchase cigarettes by the pack rather than by

[33]The intensity of tobacco counter-marketing media campaigns is measured by the gross rating points (GRPs). GRPs are defined as total reach (i.e., the total number of households that could potentially be exposed to an ad campaign) multiplied by frequency of exposure to the ad (i.e., the number of times households in a given media market are exposed to the ads in a given time frame). GRPs are averaged across media markets in each state for 2010. See the Tobacco Control State Highlights 2012 (issued by the Centers for Disease Control and Prevention) for more details on the variables.

[34]Most of the demographic variables in our data have substantial variations across markets within each state.

the carton. Table 8 presents the marginal effects of taxes by different product types: pack versus carton and non-menthol versus menthol. Notice that the pass-through rates are lower for the carton than for the pack—which is consistent with the findings of DeCicca et al. Pass-through rates are somewhat similar between menthol and non-menthol products, however. Overall, the marginal effects of cigarette taxes on prices are smaller in cities with a larger minority population.

[Table 8 here]

4 Concluding Remarks

Previous studies found that the shifting of cigarette excise taxes to consumer prices varies by demographic characteristics such as income and education. This paper builds on the literature by examining the patterns of tax incidence by racial composition of the population.

Using novel data on the prices scanned at 1,687 grocery and drug stores across 53 major U.S. cities, we found that cigarette taxes are shifted at lower rates to consumer prices in areas with a larger minority (black and Hispanic) population. In particular, an increase in the population share of blacks (Hispanics) by one standard deviation is associated with a decrease in the pass-through rate of about 19 cents (15 cents) per $1 tax a pack. Our results are robust to alternative specifications—controlling for local cigarette taxes, income differences between racial groups, different product types, as well as measuring demographics at a finer geographic level.

The lower pass-through rate in racially diverse areas effectively reduces the regressive nature of cigarette taxes. However, the lower pass-through rate also implies that cigarette taxes may not reduce smoking consumption in high-minority communities. Our finding thus suggests that increasing cigarette taxes may not be an effective measure to reduce smoking consumption and smoking-related cancers in high-minority areas.

Finally, we should note that our data are limited to cigarette sales in grocery and drug stores, lacking information on independent stores (or convenience stores). If independent stores are more important sources of cigarettes for minorities, tax shifting by racial demographics might be different in these other types of stores. We showed that our estimates of average pass-through rates are similar to homescan estimates in Harding et al. (2012) that include purchases at gas stations and convenience stores. So, we infer that our store data track national trends. Nonetheless, our results

need to be interpreted as only applying to tax shifting in grocery and drug stores.

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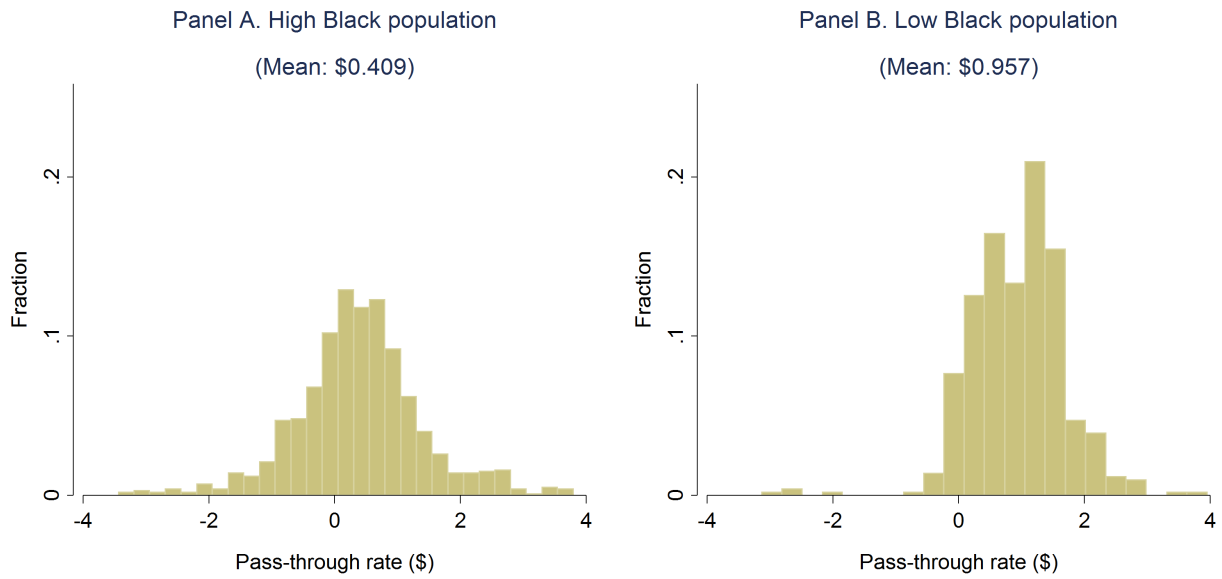
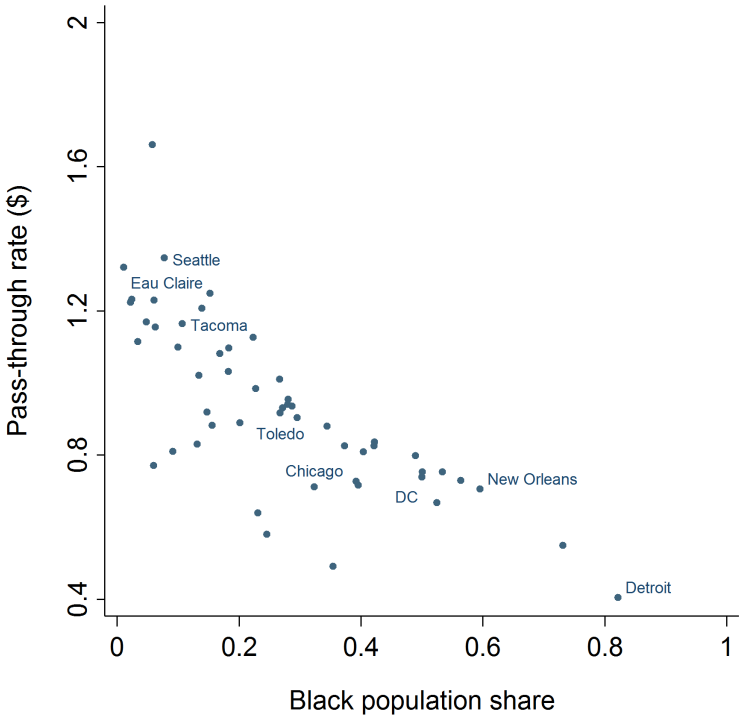
Figure 1. Distribution of Consumer Price Changes per $1-a-pack Tax Increase



Notes: Figure 1 shows the distribution of tax pass-through rates for all (pack and carton) products sold in Washington D.C. (Panel *A*) and Eau Claire (WI) (Panel *B*). The two cities have the highest and the lowest average share of blacks—0.5 for Washington D.C. and 0.01 for Eau Claire—among the 17 cities with tax increases (out of 53 cities in our sample).

Figure 2. Share of black population and tax pass-through for 53 sample cities



Source: Authors' calculation

Table 1. Cigarette Prices and Taxes by State

State	Mean consumer prices in dollars	Taxes in dollars (month and year of change)	Cities (number of sample stores)
Alabama	4.61	0.43	Birmingham (13), Montgomery (10)
Arizona	6.50	2.00	Phoenix (65)
California	5.42	0.87	Los Angeles (139), Sacramento (28), San Diego (46), San Francisco (45)
Connecticut	7.13	2.00 → 3.00 (Oct 2009) 3.00 → 3.40 (Jan 2011)	Hartford (39)
Georgia	4.16	0.37	Atlanta (42)
Iowa	5.06	1.36	Des Moines (9)
Illinois	5.82	0.98	Chicago (68), Peoria (8), Springfield (5)
Indiana	4.85	0.995	Indianapolis (31)
Louisiana	4.52	0.36	New Orleans (23)
Massachusetts	7.46	2.51	Boston (65), Pittsfield (13)
Michigan	5.81	2.00	Detroit (42), Grand Rapids (21)
Minnesota	5.40	1.23	Minneapolis (11), St Paul (9)
Missouri	4.47	0.17	Kansas City (31), St Louis (29)
Nebraska	4.77	0.64	Omaha (15)
North Carolina	4.32	0.35 → 0.45 (Sept 2009)	Charlotte (41), Durham (20), Raleigh (19)
New York	7.59	2.75 → 4.35 (July 2010)	Buffalo (16), New York (168), Rochester (6), Syracuse (23)
Ohio	5.26	1.25	Cleveland (15), Toledo (17)
Oklahoma	4.95	1.03	Oklahoma City (8), Tulsa (8)
Oregon	5.85	1.18	Portland (38)
Pennsylvania	5.81	1.35 → 1.60 (Nov 2009)	Philadelphia (81), Scranton (11)
Rhode Island	7.48	2.46 → 3.46 (April 2009)	Providence (16)
Tennessee	4.34	0.62	Knoxville (22)
Texas	5.39	1.41	Dallas (56), Houston (45)
Utah	5.04	0.695 → 1.70 (July 2010)	Salt Lake City (17)
Virginia	4.32	0.30	Norfolk (18), Richmond (13), Roanoke (34)
Washington	7.40	2.025 → 3.025 (May 2010)	Seattle (38), Spokane (12), Tacoma (8)
Wisconsin	6.30	1.77 → 2.52 (Sept 2009)	Eau Claire (9), Green Bay (9), Milwaukee (18)
District of Columbia	5.78	2.00 → 2.50 (Oct 2009) 2.50 → 2.86 (Oct 2011)	DC (94)

Source: The Tax Burden on Tobacco; The IRI

Table 2. Consumer Price Changes after Tax Increase by Brand (Washington State)

Tax increase: $1.00	Seattle (Blacks: 0.08)			Tacoma (Blacks: 0.11)			Spokane (Blacks: 0.02)		
	Chain A	Chain B	**Chain C**	Chain A	**Chain B**	Chain C	**Chain A**	Chain B	Chain C
Marlboro	1.35	1.25	1.38	1.33	1.11	1.39	1.42	2.12	1.27
	(20.9%)	(19.1%)	(20.3%)	(20.8%)	(16.7%)	(20.4%)	(22.9%)	(38.7%)	(19.4%)
Marlboro Lights	0.46	0.72	0.01	0.09	0.10	0.01	-	2.50	-
	(7.1%)	(11.0%)	(0.1%)	(1.3%)	(1.4%)	(0.18%)	-	(44.5%)	-
Marlboro Ultra Lights	0.08	0.13	-0.05	0.08	0.10	0.01	-	-	-
	(1.2%)	(1.9%)	(-0.7%)	(1.2%)	(1.5%)	(0.2%)	-	-	-
Marlboro Smooth (menthol)	1.29	1.26	1.38	1.19	1.13	1.42	1.41	1.90	1.27
	(19.5%)	(18.9%)	(20.3%)	(17.8%)	(16.5%)	(20.4%)	(22.1%)	(31.8%)	(19.2%)
Marlboro Medium	-0.60	-0.47	-0.62	-0.58	-0.58	-0.63	-	-	-
	(-9.6%)	(-7.5%)	(-9.4%)	(-9.2%)	(-8.9%)	(-9.5%)	-	-	-
Camel	1.23	1.11	1.32	1.31	1.12	1.31	1.37	1.16	1.18
	(17.9%)	(15.4%)	(17.7%)	(19.1%)	(15.5%)	(17.7%)	(20.5%)	(16.0%)	(16.8%)
Camel Blue	1.27	1.09	1.33	1.26	1.15	1.32	1.37	1.18	1.18
	(18.5%)	(15.2%)	(18.1%)	(18.3%)	(16.0%)	(17.8%)	(20.5%)	(16.4%)	(16.8%)
Camel Wides	1.39	1.12	1.43	1.48	1.28	1.44	1.46	1.25	1.25
	(20.6%)	(15.7%)	(19.5%)	(22.0%)	(17.9%)	(19.6%)	(22.3%)	(17.4%)	(18.0%)
Camel Crush (menthol)	1.37	-	1.39	1.35	-	1.41	1.41	-	1.25
	(20.1%)	-	(18.9%)	(19.5%)	-	(19.3%)	(21.3%)	-	(18.0%)
Newport (menthol)	1.32	1.22	1.45	1.30	1.23	1.44	1.41	1.24	1.32
	(17.5%)	(17.0%)	(18.1%)	(17.3%)	(17.1%)	(18.0%)	(19.3%)	(17.3%)	(17.2%)
Liggett Select	1.38	1.27	1.63	1.38	1.36	1.57	1.50	1.40	1.70
	(26.8%)	(21.0%)	(28.5%)	(26.9%)	(22.5%)	(27.4%)	(29.7%)	(23.1%)	(29.8%)
Kool (menthol)	1.39	1.15	1.41	1.37	1.15	1.44	1.48	1.23	1.24
	(20.6%)	(16.1%)	(19.3%)	(20.3%)	(16.0%)	(19.6%)	(22.5%)	(17.1%)	(17.9%)
Basic	1.61	1.45	1.71	1.69	1.39	1.79	1.69	1.36	1.68
	(25.0%)	(23.0%)	(24.7%)	(26.1%)	(21.7%)	(25.8%)	(27.0%)	(25.5%)	(25.9%)
Basic Lights	0.05	-0.01	0.08	-0.01	0.07	0.08	-	-	-
	(0.8%)	(-0.2%)	(1.1%)	(-0.1%)	(1.0%)	(1.2%)	-	-	-
American Spirit	1.35	1.21	1.51	-	1.20	1.51	1.47	1.24	1.18
	(18.5%)	(16.9%)	(19.7%)	-	(16.7%)	(19.7%)	(20.3%)	(17.4%)	(15.8%)
American Spirit Lights	1.35	1.21	1.46	-	1.34	1.47	1.47	1.25	1.18
	(18.5%)	(16.9%)	(19.0%)	-	(18.9%)	(19.1%)	(20.2%)	(17.5%)	(15.8%)
All top 50 UPCs	1.06	0.98	1.10	0.98	0.89	1.10	1.46	1.66	1.35
	(16.2%)	(14.8%)	(15.8%)	(15.2%)	(13.2%)	(15.8%)	(23.1%)	(28.5%)	(20.3%)

Notes: Price change in dollars (percentage change in parentheses) is defined as the difference in average prices over 12 months before and after a $1 tax increase. Price changes are reported for the top 50 products in quantity sales (only for pack products). The chain with the highest market share of cigarettes is in bold.

Table 3. Effects of Cigarette Taxes on Consumer Prices

	1	2	3	4
Excise tax (dollars)	0.971***	0.973***	0.907***	1.079***
	(0.0019)	(0.0018)	(0.0090)	(0.0105)
Tax Difference				-0.382***
				(0.0115)
Distance Border (log)				0.003
				(0.002)
TaxDifference × DistBorder (log)				0.057***
				(0.0030)
Population (log)				0.072***
				(0.0028)
Age-65				-13.148***
				(0.2137)
BA grad				-0.008***
				(0.0002)
Black				-1.057***
				(0.0279)
Hispanic				-0.121***
				(0.0305)
Asian				4.658***
				(0.0593)
Native				6.805***
				(0.2730)
Mixed				2.128***
				(0.3522)
Other				-17.723***
				(0.9693)
Median Income (log)				-1.059***
				(0.0296)
Constant	3.955***	2.743	4.004***	15.804***
	(0.0091)	(39.371)	(0.0257)	(0.3112)
Time fixed effects	X	X	X	X
State fixed effects	X	X	X	X
Chain fixed effects		X	X	X
UPC fixed effects			X	X
Demographics				X
No. Obs.	6,409,440	6,409,440	6,409,440	6,409,440
R^2	0.535	0.598	0.810	0.814
Tax incidence (dollars)	0.971	0.973	0.907	

Notes: Consumer prices (dependent variables) and excise taxes are in dollars per pack. Tax incidence in column 4 is computed based on mean values of the distance to the lower-tax border and the tax difference. Cluster-robust (state level) standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 4. Effects of Ethnic Composition on Cigarette Tax Shifting

	1	2	3
Excise tax (dollars)	12.393***	14.381***	16.168***
	(0.1034)	(0.1102)	(0.3680)
Tax × Black	-0.857***	-0.970***	-0.975***
	(0.0107)	(0.0113)	(0.0284)
Tax × Hispanic	-0.825***	-1.382***	-1.238***
	(0.0140)	(0.0160)	(0.0368)
Tax × Asian	0.352***	0.572***	1.880***
	(0.0448)	(0.0473)	(0.1238)
Tax × Native	-0.950***	-0.950***	-0.610***
	(0.2719)	(0.2863)	(0.4017)
Tax × Mixed	-4.519***	-1.223***	-2.502***
	(0.1458)	(0.1472)	(0.3475)
Tax × Other	-5.565***	7.409***	9.237***
	(0.1458)	(0.4136)	(0.6864)
Tax × Median Income (log)	-1.013***	-1.178***	-1.367***
	(0.0097)	(0.0104)	(0.0352)
Black	0.463***	0.554***	0.544***
	(0.0241)	(0.0245)	(0.0514)
Hispanic	1.815***	2.490***	2.342***
	(0.0302)	(0.0321)	(0.0660)
Asian	3.014***	2.798***	1.537***
	(0.0520)	(0.0542)	(0.1530)
Native	-2.709***	-6.118***	-2.371***
	(0.5863)	(0.6088)	(0.8703)
Mixed	-8.963***	10.744***	12.736***
	(0.4333)	(0.4536)	(1.026)
Other	40.243***	17.356***	10.816***
	(0.6853)	(0.7114)	(1.2561)
Median Income (log)	0.711***	0.450***	0.574***
	(0.0168)	(0.0188)	(0.0479)
Constant	-7.063***	27.372	-6.057***
	(0.1814)	(26.7933)	(0.5122)
Time fixed effects	X	X	X
State fixed effects	X	X	X
Chain fixed effects		X	X
UPC fixed effects			X
No. Obs.	6,409,440	6,409,440	6,409,440
R^2	0.548	0.606	0.817

Notes: Consumer prices (dependent variables) and excise taxes are in dollars per pack. Only the coefficients on tax, racial demographics, and median income are reported from the full equation. Cluster-robust (state level) standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 5. Marginal Effects of Cigarette Taxes with Racial Demographics

Specification: Column (3) in Table 4	Black	Hispanic	Native American	Income
Mean - One SD	1.149***	1.113***	0.969***	1.249***
	(0.0086)	(0.0127)	(0.0114)	(0.0074)
Mean	0.963***	0.963***	0.963***	0.963***
	(0.0102)	(0.0102)	(0.0102)	(0.0102)
Mean + One SD	0.778***	0.813***	0.958***	0.678***
	(0.0138)	(0.0093)	(0.0102)	(0.0161)

Notes: Marginal effects of tax are based on the estimates in columns (3) in Table 4—evaluated at the three levels of racial variables: mean − one standard deviation, mean, and mean + one standard deviation. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 6. Marginal Effects of Cigarette Taxes: County Level

Specification: Column (3) in Table 4	Black	Hispanic	Native American	Income
Mean - One SD	0.993^{***}	1.008^{***}	0.942^{***}	1.028^{***}
	(0.0093)	(0.0088)	(0.0090)	(0.0092)
Mean	0.934^{***}	0.934^{***}	0.934^{***}	0.934^{***}
	(0.0090)	(0.0090)	(0.0090)	(0.0090)
Mean + One SD	0.875^{***}	0.860^{***}	0.926^{***}	0.840^{***}
	(0.0090)	(0.0096)	(0.0091)	(0.0089)

Notes: Marginal effects of tax are based on the estimation at the county level. The specification is the same as columns (3) of Table 4—evaluated at the three levels of racial variables and median household income: mean − one standard deviation, mean, and mean + one standard deviation. Cluster-robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 7. Robustness Checks

Panel A: Cities with local cigarette taxes omitted

Specification:				
Column (3) in Table 4	Black	Hispanic	Native American	Income
Mean - One SD	1.067***	0.780***	0.831***	1.108***
	(0.0083)	(0.0130)	(0.0121)	(0.0076)
Mean	0.782***	0.782***	0.782***	0.782***
	(0.0121)	(0.0121)	(0.0121)	(0.0121)
Mean + One SD	0.496***	0.784***	0.733***	0.455***
	(0.0174)	(0.0131)	(0.0139)	(0.0198)

Panel B: Specification with state-specific variables

Specification:				
Column (3) in Table 4	Black	Hispanic	Native American	Income
Mean - One SD	1.041***	1.002***	1.088***	1.087***
	(0.0035)	(0.0034)	(0.0047)	(0.0046)
Mean	0.906***	0.906***	0.906***	0.906***
	(0.0036)	(0.0036)	(0.0036)	(0.0036)
Mean + One SD	0.771***	0.809***	0.724***	0.725***
	(0.0054)	(0.0047)	(0.0067)	(0.0048)

Panel C: Control for the median household income for Blacks, Hispanics, and Asians

Specification:				
Column (3) in Table 4	Black	Hispanic	Native American	Income
Mean - One SD	1.140***	1.099***	1.053***	1.266***
	(0.0092)	(0.0133)	(0.0119)	(0.0078)
Mean	0.897***	0.897***	0.897***	0.897***
	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Mean + One SD	0.654***	0.695***	0.741***	0.527***
	(0.0137)	(0.0101)	(0.0117)	(0.0169)

Notes: Marginal effects of tax are based on the estimates in columns (4) and (5) in Table 4. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 8. Marginal Effects by Product Type

	Pack						Carton					
	Non-Menthol			Menthol			Non-Menthol			Menthol		
	Black	Hispanic	Native	Black	Hispanic	Native	Black	Hispanic	Native	Black	Hispanic	Native
Mean - One SD	1.149***	1.117***	0.993***	1.153***	1.121***	0.984***	1.097***	1.027***	0.800***	1.132***	1.065***	0.823***
	(0.0132)	(0.0192)	(0.0178)	(0.0135)	(0.0207)	(0.0167)	(0.0189)	(0.0317)	(0.0293)	(0.0275)	(0.0458)	(0.0341)
Mean	0.977***	0.977***	0.977***	0.974***	0.974***	0.974***	0.836***	0.836***	0.836***	0.846***	0.846***	0.846***
	(0.0160)	(0.0160)	(0.0160)	(0.0158)	(0.0158)	(0.0158)	(0.0231)	(0.0231)	(0.0231)	(0.0267)	(0.0267)	(0.0267)
Mean + One SD	0.805***	0.838***	0.962***	0.795***	0.827***	0.963***	0.576***	0.646***	0.873***	0.561***	0.627***	0.870***
	(0.0217)	(0.0146)	(0.0161)	(0.0217)	(0.0138)	(0.0168)	(0.0336)	(0.0227)	(0.0203)	(0.0329)	(0.0286)	(0.0254)

Notes: Marginal effects of tax are based on the estimates in columns (3) of Table 4. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table A1. Summary Statistics for Demographic and Control variables

	Mean	Std. Dev	Min	Max
Population (thousand)	715.7	1258.8	65.9	8175.1
BA Graduate	30.5	9.8	11.8	55.1
Median HH Income	42882.3	9024.6	27349	71304
Black	0.27	0.19	0.01	0.82
Hispanic	0.15	0.12	0.02	0.48
Asian	0.054	0.055	0.010	0.330
Native	0.007	0.009	0.001	0.050
Mixed	0.025	0.011	0.008	0.066
Other	0.004	0.004	0.0009	0.022
Age$\geq$65	0.11	0.02	0.08	0.16
Border distance from store (miles)	99.6	75.0	1.2	335.5
Border tax difference from store (dollars)	0.44	0.51	0.005	2.75