Ethnic Diversity and Cigarette Tax Shifting: Evidence from Supermarket Scanner Data

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Abstract

This paper examines the impact of ethnic heterogeneity on the shifting of cigarette excise taxes to consumer prices. Recent studies report that cigarette taxes are less than fully shifted to consumer prices and that ethnic minorities are more responsive to cigarette price increases. This paper points out that cigarette taxes are shifted less to consumer prices in a racially diverse locality—because its stores take into account that consumers are more price-responsive. Using the scanner data on cigarette sales in over 1,600 stores across 53 US cities, January 2009 to December 2011, we find that racial diversity has a robust, negative impact on the tendency of cigarette taxes to increase prices. Our finding suggests that increasing cigarette taxes may not be an effective means to reduce smoking consumption in racially diverse places.

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

Keywords: Tax shifting, Cigarette excise tax, Tax incidence, Racial and ethnic diversity, Scanner data

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1 Introduction

This paper documents that ethnic diversity critically influences the incidence of cigarette excise taxes. Patterns of tax incidences by race have important implications on welfare, tax efficiency, and public health. In general, minorities such as Blacks and Hispanics have lower incomes, are more responsive to cigarette prices, and have higher death rates from cancer (Farrelly et al. 2001; Adda and Cornaglia 2006; American Cancer Society 2015).

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 owing to price search behavior—for instance, cross-state tax avoidance (Harding et al. 2012; DeCicca et al. 2013; Chiou and Muehlegger 2014).

Moreover, recent studies reported that cigarette tax shifting varies with demographic characteristics, including income, education, and ethnicity. In particular, 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 costs. DeCicca et al. (2013) noted that Blacks and Hispanics are less likely to buy cigarettes by the carton—searching for volume discounts—instead of pack. However, they were unable to test that taxes are shifted at different rates to the minority groups.

Different racial and ethnic groups are known to respond differently to changes in cigarette prices and taxes. In particular, Blacks and Hispanics are more responsive to cigarette price increases than Whites (e.g., Chaloupka and Pacula 1999; Farrelly et al. 2001; DeCicca et al. 2000; Gruber and Zinman 2001; Tauras 2007; Nonnemaker and Farrelly 2011; Myers et al. 2013).

We build on the literature by bringing the role of racial composition into the analysis of cigarette tax incidence. Our central finding is that cigarette taxes are shifted less to consumer prices in racially heterogeneous communities. This finding is in line with the principle that sales taxes are shifted away from the individuals who are most able to change their behavior in response to the tax (DeCicca et al. 2013). Intuitively, if ethnic minorities are more responsive to the increase in cigarette price, localities with a greater minority population have a greater ability to escape tax.

Throughout the paper, we maintain that stores' decision to pass on taxes to consumers significantly depends on racial demographics of the market. As is well known, retail stores in oligopoly competition set prices strategically—taking seriously consumer purchase patterns that vary by demographic characteristics.[1] Although a strand of theoretical literature focused on tax incidence in differentiated product oligopoly (Seade 1985; Stern 1987; Anderson et al. 2001), the effects of demographic characteristics on tax shifting is an empirical matter that has not been much studied.[2] In addition, marketing literature emphasizes that supermarket chains tailor their pricing strategies to consumer demographics of the local market (Hoch et al. 1995; Mulhern et al. 1998; Ellickson and Misra 2008). For instance, Ellickson and Misra (2008) found that stores prefer everyday low pricing (i.e., consistently low prices across the board) to promotional pricing (i.e., deep but temporary discounts) in a racially diverse market. Note that retail stores have substantial flexibility to alter cigarette prices through deals with tobacco producers (Bloom 2001; Toomey et al. 2009).

We use supermarket scanner data from Information Resources, Inc (IRI) to estimate cigarette tax incidence. The data provide weekly store prices (converted to monthly prices in this study) for each cigarette product sold in 1,687 stores across 53 cities in 28 US states. Most previous studies used either aggregate data on prices or a limited sample of micro data (in terms of product variety or regional coverage). Because our dataset is more detailed and comprehensive (in terms of product coverage and time frequency), we are able to assess cigarette tax incidence with more accuracy.[3] Contrary to the previous studies (e.g., Harding et al. 2012; DeCicca et al. 2013), our study employs prices collected at the store level, rather than prices paid by sampled consumers.[4] Because the store level data capture sufficient variation in prices both across entire products and across stores, we can control for the pricing behavior of stores as well as the search behavior of consumers—in response to tax changes. Our data show substantial differences in the responsiveness of cigarette prices to

[1] See Berry et al. (1995), Nevo (2001), Petrin (2002), Goolsbee and Petrin (2004), Smith (2004), Ellickson and Misra (2008), and Jia (2008).

[2] Barnett et al. (1995) and Griffith et al. (2012) estimated the incidence of cigarette taxes in oligopolistic markets with differentiated products, but they did not focus on demographic characteristics.

[3] Only a few studies have used scanner data to study cigarette taxes. Harding et al. (2012) employed household level scanner data to estimate tax incidences with a primary focus on consumer search behavior. More recently, Chiou and Muehlegger (2014) used store level scanner data to examine consumer responses to tax changes such as stockpiling and substitution between products.

[4] Prices paid by consumers mainly capture the endogenous product selection or price search process of consumers. For instance, using the Nelson 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 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.

taxes across chains and brands.

Using the scanner data on store prices, January 2009 to December 2011, we test the hypothesis that tax shifting to consumers is decreasing in racial heterogeneity. The empirical methodology used in this paper inspects the effects of state taxes on cigarette prices under different racial compositions. This means adding to the standard cigarette price regression interactions between state tax and racial democratic variables. To identify exogenous sources of variation in the interaction term, we include the cross-border effect (to control for cross-state purchasing behaviors) and four sets of fixed effects: the UPC fixed effects (to control for altered purchasing patterns), the chain fixed effects (to control for the pricing strategy of specific supermarket chains), the state fixed effects (to deal with the potential issue of endogeneity in tax increases), and time effects. The empirical results of this paper suggest that racial heterogeneity significantly reduces the tendency of cigarette excise taxes to increase cigarette prices.

This paper is organized as follows. Section 2 discusses the link between ethnic diversity and cigarette tax elasticity. Section 3 describes the data, explains our empirical strategy, and reports the results. Section 4 discusses our findings and concludes the paper.

2 Racial Diversity and Cigarette Tax Elasticity

A vast literature suggests that different ethnic groups respond differently to a change in cigarette prices and taxes. Using data from the National Health Interview Surveys, 1976 to 1996, Farrelly et al. (2001) found that non-Whites are more responsive to cigarette price increases than Whites. In particular, Blacks were more than two times as price elastic as Whites, and Hispanics were more than six times as price elastic as Whites. Using the National Longitudinal Survey of Youth, Nonnemaker and Farrelly (2011) found that cigarette tax and prices significantly reduce smoking initiation for minorities relative to Whites. DeCicca et al. (2000) used data from the Monitoring the Future surveys and found that higher cigarette prices reduce smoking among Black and Hispanic youth, but not White youth. Similarly, Chaloupka and Pacula (1999) and Gruber and Zinman (2000) showed that Black youth are more sensitive to cigarette price and taxes than White youth. These findings are consistent with the substantial decrease in smoking prevalence rates among Blacks and Hispanics relative to Whites during the 1997-2005 period of unprecedented increases in

state excise taxes (Tauras 2007).

Ethnic groups' demand for cigarettes reflects their budget constraints, which depend on income, prices of cigarettes, anti-smoking policies, and social mores. This implies that ethnic diversity can affect consumption of cigarettes that have seemingly little ethnic dimension. In particular, Farrelly et al. (2001) found that lower-income adults are more responsive to increases in cigarette prices. We control for the income levels of minority groups in the empirical work.

Racial minorities are more responsive to cigarette price increases, potentially because cigarette smoking behavior has strong cultural dimensions (Baluja et al. 2003). For instance, Blacks smoke each cigarette more intensively than Whites—extracting significantly more nicotine per cigarette (Adda and Cornaglia 2006; Caraballo et al. 1998; Perez-Stable et al. 1998). The racial differences in smoking intensity 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). Blacks are more likely than Whites to smoke cigarettes that are mentholated and stronger (Adda and Cornaglia 2006). Thus, ethnic minority smokers are more likely to compensate for tax increases by smoking more intensively or by smoking cigarettes higher in tar and nicotine (see for the discussion of compensatory behaviors, Evans and Farrelly 1998; Farrelly et al. 2004; Adda and Cornaglia 2006).

In addition, immigrants from higher smoking countries may respond differentially to anti-smoking policies such as cigarette taxes than native born Americans—depending on the smoking rates in the country of origin as well as the pattern of assimilation into natives (Leung 2014; Maclean et al. 2013). If immigrants' descendants inherit their cultural traits, they may also respond differently to cigarette taxes than native born Americans.

The higher tax elasticity among racial minorities also indicates that communities characterized by a higher proportion of minorities are more likely to have formal and informal networks that allow circumvention of the cigarette taxes—including purchasing untaxed cigarettes from duty-free stores, on-line vendors, Indian reservations, private suppliers, and cross-border states (Merriman 2010; Shelley et al. 2007; Coady et al. 2013; Maclean et al. 2013). 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). Maclean et al. (2013) suggested that living in ethnic enclaves may allow more opportunity to obtain untaxed cigarettes. As anecdotal evidence, a large tax increase in New York City led to pervasive illegal cigarette markets in Black and Hispanic communities (Coady et al. 2013). For instance, using a focus groups study, Shelley et al. (2007) documented a large-scale purchasing of untaxed cigarettes in Central Harlem in New York City—a phenomenon known as the "5 dollar man."

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 geographic markets (or cities) in 28 US states.

For cigarette prices, our dependent variable, we use the supermarket scanner data collected by IRI.[5] Since 2008, IRI has made available to researchers detailed transaction-level data spanning 30 product categories including cigarettes. The dataset contains store level information—sales, pricing, and promotion for a complete set of items sold—collected via scanning devices. The IRI data cover a large number of chain retailers (grocery stores, drug stores, and mass merchandisers) over a broad array of geographic markets (usually major metropolitan areas such as Chicago, IL).[6]

Our data set contains information on store level monthly price and quantity for each product at the level of Universal Product Code (UPC). (We computed the monthly prices by averaging weekly prices over a month.)[7] The UPC distinguishes each cigarette product uniquely by detailed attributes, including brand, size, package, flavor, and nicotine content. Most of our 1,687 sample stores belong to 123 different supermarket chains, and carry about 4,490 cigarette products.

Our price data—that cover the entire products offered by each store—provide a clear advantage

[5] See Bronnenberg, Kruger, and Mela (2008) for further details on the data.

[6] For confidentiality reason, 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 for which the geographic market is ambiguously defined by IRI—because demographic information would not properly match. This reduces our sample stores to 1,687. In addition, our data are potentially limited because they do not include independent stores (or convenience stores). However, given the growing market concentration in the US supermarket industry (driven by consolidation among the leading supermarket chains), we expect that our sample stores fairly represent a national sample of stores.

[7] This helps reduce the computational burden in estimation without undermining the virtue of disaggregate level information because relatively little variation in price is observed within a month.

over the aggregate data (e.g., quarterly average prices) or a smaller sample of micro data (e.g., prices paid by survey respondents or store prices collected from a small set of areas).[8] In effect, our price measure enables us to identify the extent to which store pricing responds to taxes—conditional on racial demographics that influence brand loyalty and substitution between products.[9]

Cigarette excise taxes of each state were collected from *The Tax Burden on Tobacco* (Orzechowski and Walker 2012).[10] Among 28 states in our data, cigarette excise taxes have increased at least once in 11 states between 2009 and 2011. The size of tax changes is 72 cents on average, ranging between 10 cents and $1.60. Similar to Harding et al. (2012), we control for the effects of consumer search behavior by using information on the location of stores—that is, latitude and longitude of the centroid of 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.[11] Table 1 presents the mean cigarette prices and taxes for each state in our sample.

[Table 1 here]

For each city nesting the sample stores, we compute the Herfindahl index as the degree of racial heterogeneity, using eight ethnic/racial categories: White, Black, Hispanic, Asian, Native American and Native Alaskan, Hawaiian and Pacific Islander, two or more races, and other. The heterogeneity 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). For our sample, the average score of the index is 0.575 in 2010.

Because the heterogeneity index does not take into account the composition of racial groups, the index gives the same score whether the city has 70% White and 30% Black or 30% White and 70% Black (Lee et al. 2015). As alternative measures of racial heterogeneity, we include the

[8] See Besley and Rosen (1999), Hanson and Sullivan (2009), Sullivan and Dutkowsky (2012), DeCicca et al. (2013), and Chiou and Muehlegger (2014).

[9] For instance, stores may shift taxes more to the price of menthol cigarettes relative to non-menthol cigarettes if menthol smokers (predominantly Blacks) are less likely to switch to other products (owing to strong brand loyalty) than non-menthol smokers.

[10] 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).

[11] Lovenheim (2008) and Harding et al. (2012) computed the distance from each census tract to a road crossing into the lower-tax state. In this 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 the previous literature.

population shares of six minority groups: Blacks, Hispanics, Asians, Native Americans, mixed, and others.

In line with previous literature, we control for various demographic characteristics in the market. The variables include population, the median household income, the percentage of residents with a bachelor's degree, and the percentage of population over age 65. All these variables are demand shifters for cigarette markets in equilibrium (Keeler et al. 1996; DeCicca et al. 2013). All the demographic data were obtained from the U.S. Census.

We also collect information on tobacco control at the state level to capture state-wide anti-smoking sentiment or policies. The variables are the gross rating points (GRPs) that measure the intensity of tobacco counter-marketing media campaign (collected by Nielsen Media Research); the indicator of state smoke-free policies in indoor areas (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)).[12] Table A shows the summary statistics for the demographic and other control variables used in this study.

3.2 Empirical Model

This paper uses a reduced-form equation of prices to estimate the pass-through of cigarette taxes (Kenkel 2005; Hanson and Sullivan 2009; Chaloupka et al. 2010; Harding et al. 2012; DeCicca et al. 2013). The basic estimation equation at the UPC level is

$$\begin{aligned} P_{ijmt} = \beta_0 + \beta_{1m}\tau^h_{st} + \beta_2(\tau^h_{st} - \tau^b_{st}) + \beta_3 ln(D_{jst}) \\ + \ \beta_4(\tau^h_{st} - \tau^b_{st})ln(D_{jst}) + \Phi \cdot X_m + \delta_i + \theta_j + \mu_s + \lambda_t + \epsilon_{ijmt}, \end{aligned} \tag{1}$$

where P_{ijmt} is price per pack for UPC i sold in store j in city m at time t, τ^h_{st} is the per-pack state tax in home state s (where the store is located), τ^b_{st} 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. X_m is a vector of demographic and socioeconomic characteristics of the city. Parameters δ_i, θ_j, μ_s, and λ_t are the set of UPC, supermarket chain, state, and time (month and year) fixed effects, respectively.[13]

[12] See the Tobacco Control State Highlights 2012 (issued by the Centers for Disease Control and Prevention) for more details on the variables.

[13] Alternatively, we can 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

The tax difference $\tau^h - \tau^b$ captures the potential search behavior—that is, a cross-state avoidance opportunity. 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 tax shifting changes as stores are located farther from the border. In Equation (1), $\beta_{1m} + \beta_2 + \beta_4 ln(D)$ shows the full marginal effect of excise taxes on cigarette prices. This baseline specification is in line with previous studies that examined the effect of consumer price search on tax shifting (Harding et al. 2012; DeCicca et al. 2013; Chiou and Muehlegger 2014).

More importantly, we allow the coefficient β_{1m} on the home state tax τ^h to vary across cities according to racial composition. Specifically, β_{1m} in Equation (1) can be decomposed as follows:

$$\beta_{1m} = \beta_1 + \beta_{1z} \cdot Z_m \tag{2}$$

where Z_m denotes the vector of racial composition such as the index of heterogeneity or the shares of minority groups. In Equation (2), β_{1z} identifies the difference in tax incidence across different racial compositions. For instance, if Z_m is the heterogeneity index (Hetero), $\beta_1 + \beta_{1z} + \beta_2 + \beta_4 ln(D)$ constitutes the tax shifting for the city with complete heterogeneity (Hetero = 1). Our discussion in Section 2 implies that $\beta_{1z} < 0$—that is, taxes are passed through less in more heterogeneous cities.

We include UPC fixed effects to examine within-UPC changes in prices when tax increases.[14] The UPC fixed effects control for the possibility that retail stores adjust prices across products when excise taxes increase. 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; Harding et al. 2012). Retail stores may adjust their pricing in response to the altered purchase behavior of consumers.

The chain fixed effects are included because chain level prices capture the pricing behavior of chain stores for a multitude of cigarette products. One of the key features that distinguish

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.

[14] Harding et al. (2012) also included UPC fixed effects in order to control for the potential for consumers to change their product choices when taxes increase.

supermarket chains is their pricing strategy (e.g. heavy discounters, Everyday Low Price, and High/Low). Chain fixed effects thus control for the potential for different chain stores to respond differently in pricing when taxes increase. 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 prices.[15]

Including both UPC fixed effects and chain fixed effects is important because total effects of tax on prices reflect both demand and supply side behaviors—the direction of which is an empirical question. Our data show substantial variations in prices across products and chain stores. As anecdotal evidence, Table 2 presents average price changes of cigarette brands after a $1 tax increase in Washington state (in May 2010). We picked top 50 UPCs (in quantity sales) sold in three major chains. To suppress monthly seasonal effects, we measure the price change by the difference in average prices over 12 months before and after the excise tax increase.

Table 2 shows substantial variations in price changes across brands, chains, and cities. While taxes are overshifted to consumer prices for some top-sales UPCs (for instance, Marlboro, Camel, Newport, and Kool), the price changes are less than 50 cents or even negative for other UPCs, including Marlboro Lights, Ultra Lights, and Medium, and Basic Lights. Table 2 also shows that different chains shift the tax at different rates to consumer prices of given products. 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 Newport brand. These variations in price changes indicate that chain pricing strategies reflect various factors in demand and supply (e.g., substitution patterns between products, competitions among chains, and demographic compositions). Note finally that patterns of tax shifting differ across cities. In general, a $1 tax increase leads to a larger increase in average prices for top 50 UPCs in Spokane relative to Seattle and Tacoma. Given that Spokane is much less diverse place than Seattle and Tacoma, this result implies that racial diversity is associated with the responsiveness of cigarette prices to excise taxes. In Section 3.3, we provide a more rigorous test of the impact of racial demographics on tax shifting.

[15]The literature examines the effect of price competition on tax incidence using the oligopoly model with differentiated products (Barnett et al. 1995; Anderson et al. 2001). Because this approach is difficult to consider in our empirical framework, we instead included as one of the regressors the number of stores operating within varied thresholds of radius. 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.

[Table 2 here]

Finally, the state fixed effects control for unobservable state characteristics that may affect cigarette prices (e.g., Harding et al. 2012). For instance, if a state with strong anti-smoking sentiment (and thus strict regulation) is more likely to increase tax levels, omitting state-specific factors would result in a bias in the estimate of β_{1m}. Including state fixed effects thus mitigates the potential endogeneity of cigarette tax.

3.3 Empirical Results

As a benchmark, we first estimate cigarette prices without allowing the impact of cigarette tax to vary across markets. Table 3 thus shows the result of estimating equation (1) where $\beta_{1m} = \beta_1$ for all cities. Column 1 takes a basic equation that includes only excise tax and the time (month and year) fixed effects. Columns 2 through 4 show the results of adding successively the UPC fixed effects, the chain fixed effects, and the state fixed effects. Column 5 adds demographics as well as consumer search behavior—by including the tax difference, log distance to the lower-tax border, and the interaction of the two.

[Table 3 here]

In column 1, the estimate of tax pass-through rate is about 0.99, which indicates that a one dollar increase in taxes is associated with 99 cent increase in price per pack. When UPC fixed effects are added in column 2, however, the pass-through rate decreases to 0.90. This result is largely consistent with Harding et al. (2012) who found that adding UPC fixed effects significantly reduces the pass-through rate—because consumers alter their purchasing patterns when taxes increase. Adding chain fixed effects (in column 3) and state fixed effects (in column 4) further reduces the pass-through rate to about 0.75.[16] This result indicates that (1) supermarket chains adjust their pricing in response to tax increases, and (2) the benchmark estimates of β_1 are biased upward because of unobservable state characteristics.

Previous studies found that cigarette taxes are either fully or over-shifted to prices (e.g., Keeler et al. 1996; Hanson and Sullivan 2009). On the contrary, our results show that the pass-through

[16] The estimates of pass-through rate in columns 2 through 4 are statistically different from one another. In addition, all the coefficients for chain dummies are statistically different from zero.

rate is less than one throughout the specifications. In general, this under-shifting of cigarette taxes is consistent with the findings of more recent studies that used scanner data with a complete cigarette product mix (Harding et al. 2012; Chiou and Muehlegger 2014).[17]

In column 5, the full specification with the demographic variables and the border effects, the estimation results are largely consistent with the previous studies that focused on price search behavior with cross-state tax evasion among smokers (Lovenheim 2008; Merriman 2010; Goolsbee et al. 2010; Harding et al. 2012).[18] The signs of tax difference and its interaction with the distance to a lower-tax border indicate that stores located closer to the lower-tax state shift taxes to consumer prices at lower rates. The tax incidence for consumers who purchase cigarettes on the border is 0.56 per dollar (= 0.899 - 0.343), and the incidence increases as the stores are located farther from the border.

Among the control variables, several factors appear significant and have a substantial influence on cigarette prices. The coefficients of population share over age 65, share with a bachelor's degree, shares of Blacks and Hispanics, and median household income are negative and significant. Note that these results do not necessarily mean that taxes are shifted less, for instance, to the prices for higher-income consumers. Rather it simply implies that the demand for cigarettes may be lower in wealthier neighborhoods. On the contrary, population and shares of Native Americans and Asians are positively associated with cigarette prices.

More importantly for our purpose, Table 4 reports the estimates of equation (1) allowing the tax coefficient β_{1m} to vary by racial composition and median income. All specifications control for demographic characteristics, border effects, and four fixed effects (time, UPC, chain, and state) as in column 5 of Table 3. Column 1 of Table 4 includes an interaction term between tax and the index of racial heterogeneity. Columns 2 through 4 add successively the interactions of tax with the shares of Blacks, Hispanics, and Native Americans. Column 5 adds the interactions with other

[17] Note that our estimated pass-through rate in column 1 is larger by about 0.19 (i.e. 19 cents per dollar) than that of Chiou and Muehlegger (2014) who used store scanner data for Chicago Metropolitan areas. The reasons for the difference in the estimates include that (1) the opportunity for tax avoidance is relatively large in Chicago area (as pointed out by Harding et al. (2012)), and (2) Chiou and Muehlegger's study only covers stores of a single supermarket chain, whereas our data include more than 120 different chains.

[18] 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 (4). This result does not imply that the demographic variables are unrelated with the pass-through rate, but it simply means that UPC, chain, state, and time fixed effects sufficiently control for store pricing behavior that are associated with cigarette taxes and demographic profiles (Harding et al. 2012). We will show in Table 4 that racial demographics indeed have a significant impact on the pass-through rates.

minority groups: Asians, mixed, and others. All columns also include interaction terms of tax and median household income (in logs).

[Table 4 here]

Throughout the columns, it is clear that tax shifting is decreasing in the degree of racial heterogeneity as well as the population shares of Blacks, Hispanics, and Native Americans. All the coefficients on the interaction terms for heterogeneity and the three racial groups are negative and significant at the 1 percent level. This is consistent with the general principle—taxes are shifted away from consumers who are most sensitive to prices changes. As discussed in Section 2, these minority groups are more responsive to cigarette price increases than Whites—for instance, due to more opportunity to obtain low or untaxed cigarettes.

In addition, the pass-through rate of tax is decreasing in 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 communities. Note that our finding does not contradict the recent findings (e.g., Harding et al. 2012) that taxes are passed through less to prices for lower-income households (because these households increase search behavior to find lower tax alternatives). Our results instead suggest that controlling for the search behavior, wealthier consumers may be more responsive to cigarette price increases—due to a higher demand for health and the ability to find other viable substitutes (e.g., nicotine replacements that are usually more costly than cigarette smoking).

With interaction terms included in a regression, the marginal effects often give the most meaningful results. Table 5 presents the marginal effect of cigarette tax on prices, conditional on the level of the interacting variables (index of heterogeneity and shares of Blacks, Hispanics, and Native Americans)—that is, $\beta_1 + \beta_{1z} \cdot Z_m + \beta_2 + \beta_4 ln(D)$ in Section 3.2, where D is held constant at the median distance from the lower-tax border. More specifically, we examine tax shifting at three different levels of Z_m: mean, mean - one standard deviation (SD), and mean + one standard deviation. Note that all the marginal effects are smaller in magnitude when racial composition is more heterogeneous or when the population shares of the minority groups are larger. In column 1, for instance, at the mean - one SD level of racial heterogeneity (that is, 0.46 or the level in Portland, OR), cigarette taxes are passed through to prices at a rate of 1.04. The tax pass-through rate

decreases to 0.9 at the mean level of heterogeneity (that is, 0.58 or roughly the level in Indianapolis, IN), and further decreases to 0.76 at the mean + one SD level of heterogeneity (that is, 0.7 or the level in Providence, RI). Similar pictures emerge for other interacting variables. For instance, at the mean + one SD level of the share of Blacks (that is, 0.46 or the level in St. Louis, MO), the pass through rate is only about 0.47, although one has to take caution because the shares of other minority groups are held constant at the median levels.

[Table 5 here]

Our results indicate that cigarette tax shifting is conditional on racial composition of the market, possibly because racial minorities are more responsive to cigarette price increases. Since perfect price discrimination is infeasible, retail stores' optimal pricing must reflect the racial demographics of the city.

3.4 Robustness Checks

Since ethnic minorities are more constrained by income, one may argue that income differences between the racial groups explain racial differences in price responsiveness. In panel *A* of Table 6, we control for the potential relationship between race and income by including the median household income of Blacks, Hispanics, and Asians.[19]

In panel *B* of Table 6, we replace the state fixed effects with the state-specific variables that capture the anti-smoking sentiment or policies of the state. The variables are the intensity of tobacco counter-marketing media campaign, the indicator of state indoor smoke-free policies, and the percentage of adults who think secondhand smoke is very harmful. The state fixed effects control for the potential endogeneity of cigarette tax, but may absorb the effects of demographics if the cities nested by a state have insufficient variation in demographic characteristics.[20]

Panel *C* of Table 6 excludes the cities that impose local cigarette taxes in addition to state taxes—because in such cities, store prices may respond differently to the changes in state taxes.[21]

[19] Median household incomes for other minority groups are not available.

[20] Most of the demographic variables in our data have substantial variations across cities within each state. However, 12 states (among 28 states) only include a single city—thus no within-state variation in demographic variables for the states.

[21] The cities are Birmingham (AL), Montgomery (AL), San Francisco (CA), Chicago (IL), Kansas City (MO), St. Louis (MO), New York City (New York), Cleveland (Oh), Philadelphia (PA), Norfolk (VA), and Roanoke (VA).

[Table 6 here]

Finally, DeCicca et al. (2013) found that taxes are shifted at lower rates to consumers who buy cartons instead of packs. If more price-sensitive consumers (for instance, Blacks) search more for volume discounts (that is, buying cartons rather than packs), the impact of racial heterogeneity on tax shifting could simply capture consumer search behavior rather than store pricing behavior. DeCicca et al. showed, however, that smokers of menthol brands (predominantly Blacks) are less likely to make a carton purchase. Table 7 examines the marginal effects of taxes by different product types: pack versus carton and non-menthol versus menthol.

In both Tables 6 and 7, the marginal effects of cigarette tax remain qualitatively similar to the results in Table 5. The effects of cigarette tax on prices are smaller in more racially heterogeneous communities. These results indicated that it is more than income difference between racial groups, anti-smoking sentiment, or search for volume discounts that determines the impact of racial composition on tax shifting.

[Table 7 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 points out that chain stores pass on cigarette taxes at lower rates to consumers in racially diverse cities because minorities such as Blacks and Hispanics are more sensitive to cigarette prices. This implies that retail stores' pricing takes into account racial compositions of the market.

Using novel data on the prices scanned at 1,687 grocery and drug stores across 53 major US cities, we found that cigarette taxes are indeed shifted at lower rates to buyers in more racially diverse localities. Our results are robust to controlling for a variety of observable characteristics—cross-border effect, income differences between the racial groups, anti-smoking sentiment or policies, and different product types (pack, carton, and menthols)—and to various unobservable characteristics—UPC, chain, state, and time fixed effects.

Note that the lower pass-through rate in racially diverse localities effectively reduces the regres-

sive nature of cigarette taxes. However, the lower pass-through rate also implies that cigarette taxes may not reduce smoking consumption in racially diverse communities. This potentially explains why death rates from cancer are higher for ethnic minorities, in particular Blacks and Hispanics. Our finding thus suggests that increasing cigarette tax may not be an effective measure to reduce smoking consumption and smoking-related cancers in racially diverse places.

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Table 1. Cigarette Prices and Taxes by State

State	Mean 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. Price Changes after Tax Increase by Brand (Washington State)

Tax increase: $1.00	Seattle (Hetero: 0.53)			Tacoma (Hetero: 0.60)			Spokane (Hetero: 0.29)		
	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 top 50 products in quantity sales (only for pack products). The chain with the highest market share of cigarette is in bold.

Table 3. Effects of Cigarette Taxes on Prices

	(1)	(2)	(3)	(4)	(5)
Excise tax (dollars)	0.988***	0.896***	0.874***	0.753***	0.899***
	(0.000498)	(0.000433)	(0.000652)	(0.00161)	(0.00187)
Tax Difference					-0.343***
					(0.00338)
Distance Border (log)					-0.0146***
					(0.000617)
(TaxDifference) × (DistBorder)					0.0560***
					(0.000852)
Population (log)					0.0540***
					(0.00121)
Age65					-12.60***
					(0.0563)
BA grad					-0.0101***
					(0.000123)
Hetero					0.314***
					(0.00895)
Black					-1.024***
					(0.00883)
Hispanic					-0.272***
					(0.0151)
Native					7.533***
					(0.0969)
Asian					4.336***
					(0.0208)
Mixed					-1.227***
					(0.172)
Other					-20.49***
					(0.282)
Median Income (log)					-0.934***
					(0.0101)
Constant	3.735***	3.827***	3.805***	4.053***	14.83***
	(0.00165)	(0.00141)	(0.00305)	(0.00453)	(0.0991)
Demographics	X	X	X	X	O
State fixed effects	X	X	X	O	O
Chain fixed effects	X	X	O	O	O
UPC fixed effects	X	O	O	O	O
Time fixed effects	O	O	O	O	O
No. Obs.	6,409,440	6,409,440	6,409,440	6,409,440	6,409,440
R^2	0.481	0.718	0.797	0.818	0.822

Notes: Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 4. Effects of Heterogeneity on Cigarette Tax Shifting

	(1)	(2)	(3)	(4)	(5)
Excise tax (dollars)	8.291***	12.58***	12.37***	12.57***	18.91***
	(0.0356)	(0.0475)	(0.0477)	(0.0476)	(0.0836)
Tax × Hetero	-1.177***				
	(0.00793)				
Tax × Black		-1.051***	-1.050***	-1.089***	-1.031***
		(0.00680)	(0.00685)	(0.00703)	(0.00738)
Tax × Hispanic			-0.767***	-0.807***	-1.284***
			(0.00832)	(0.00832)	(0.0104)
Tax × Native				-2.413***	-1.038***
				(0.153)	(0.164)
Tax × Asian					3.910***
					(0.0381)
Tax × Mixed					-2.199***
					(0.0947)
Tax × Other					14.58***
					(0.266)
Tax × Median Income (log)	-0.610***	-1.058***	-1.022***	-1.038***	-1.658***
	(0.00331)	(0.00433)	(0.00436)	(0.00433)	(0.00791)
Hetero	2.035***	0.0237***	0.208***	0.229***	0.810***
	(0.0171)	(0.00881)	(0.00895)	(0.00905)	(0.0105)
Black	-0.878***	0.810***	0.868***	0.928***	0.472***
	(0.00860)	(0.0143)	(0.0142)	(0.0142)	(0.0147)
Hispanic	1.179***	0.883***	1.711***	1.760***	1.574***
	(0.0154)	(0.0155)	(0.0183)	(0.0182)	(0.0205)
Native	-1.063***	-4.459***	-5.034***	-0.335	0.983***
	(0.0982)	(0.110)	(0.110)	(0.328)	(0.362)
Asian	3.463***	2.947***	2.736***	2.754***	-0.922***
	(0.0210)	(0.0224)	(0.0222)	(0.0224)	(0.0443)
Mixed	13.65***	10.73***	8.575***	8.579***	-0.135
	(0.174)	(0.175)	(0.178)	(0.178)	(0.310)
Other	-3.863***	2.775***	12.34***	11.43***	3.226***
	(0.315)	(0.309)	(0.322)	(0.332)	(0.440)
Median Income (log)	-0.315***	0.353***	0.527***	0.559***	0.941***
	(0.0103)	(0.0109)	(0.0109)	(0.0109)	(0.0122)
Constant	3.490***	-2.875***	-5.311***	-5.744***	-8.649***
	(0.103)	(0.117)	(0.117)	(0.116)	(0.127)
No. Obs.	6,409,440	6,409,440	6,409,440	6,409,440	6,409,440
R^2	0.824	0.824	0.824	0.824	0.825

Notes: Only the coefficients on the tax, racial demographics, and median income are reported from the full equation that is similar to the specification in column 5 in Table 2. All columns include time (month and year), UPC, and chain fixed effects. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 5. Marginal Effects of Cigarette Taxes with Heterogeneity

Specifications from Table 3	Column (1)	Column (5)		
	Hetero	Black	Hispanic	Native American
Mean - One SD	1.041***	0.858***	0.795***	0.698***
	(0.0018)	(0.0026)	(0.0027)	(0.0027)
Mean	0.900***	0.662***	0.639***	0.688***
	(0.0014)	(0.0026)	(0.0025)	(0.0026)
Mean + One SD	0.760***	0.466***	0.484***	0.679***
	(0.0016)	(0.0032)	(0.0029)	(0.0032)

Notes: Marginal effects of tax are based on the estimates in columns (1) and (5) in Table 3—evaluated at the three levels of racial variables (index of heterogeneity and population shares of Blacks, Hispanics, and Native Americans): mean - one standard deviation, mean, and mean + one standard deviation. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 6. Robustness Checks

Panel A: Control for the median household income by race

Specifications from Table 3	Column (1)	Column (5)		
	Hetero	Black	Hispanic	Native American
Mean - One SD	1.041***	0.901***	0.807***	0.769***
	(0.0018)	(0.0031)	(0.0029)	(0.0030)
Mean	0.899***	0.651***	0.629***	0.633***
	(0.0014)	(0.0028)	(0.0029)	(0.0028)
Mean - One SD	0.758***	0.401***	0.451***	0.497***
	(0.0016)	(0.0032)	(0.0034)	(0.0034)

Panel B: Specification with state-specific variables

Specifications from Table 3	Column (1)	Column (5)		
	Hetero	Black	Hispanic	Native American
Mean - One SD	0.926***	0.953***	0.962***	0.986***
	(0.0011)	(0.0014)	(0.0010)	(0.0012)
Mean	0.876***	0.858***	0.826***	0.791***
	(0.0008)	(0.0009)	(0.0010)	(0.0011)
Mean + One SD	0.826***	0.762***	0.691***	0.596***
	(0.0010)	(0.0009)	(0.0012)	(0.0019)

Panel C: Cities with local cigarette taxes omitted

Specifications from Table 3	Column (1)	Column (5)		
	Hetero	Black	Hispanic	Native American
Mean - One SD	1.048***	0.917***	0.665***	0.685***
	(0.0020)	(0.0032)	(0.0032)	(0.0031)
Mean	0.920***	0.619***	0.664***	0.650***
	(0.0017)	(0.0028)	(0.0028)	(0.0028)
Mean + One SD	0.792***	0.320***	0.663***	0.615***
	(0.0024)	(0.0037)	(0.0038)	(0.0035)

Notes: Marginal effects of tax are based on the estimates in columns (1) and (5) in Table 3. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table 7. Marginal effects by product type

	Pack						Carton					
	Non-Menthol			Menthol			Non-Menthol			Menthol		
	Hetero	Black	Hispanic	Hetero	Black	Hispanic	Hetero	Black	Hispanic	Hetero	Black	Hispanic
Mean - One SD	1.093***	0.894***	0.838***	1.069***	0.860***	0.800***	0.777***	0.736***	0.597***	0.663***	0.703***	0.565***
	(0.0025)	(0.0039)	(0.0040)	(0.0032)	(0.0046)	(0.0046)	(0.0062)	(0.0079)	(0.0089)	(0.0108)	(0.0125)	(0.0141)
Mean	0.940***	0.709***	0.686***	0.926***	0.666***	0.642***	0.677***	0.468***	0.464***	0.611***	0.417***	0.408***
	(0.0020)	(0.0038)	(0.0037)	(0.0024)	(0.0044)	(0.0044)	(0.0045)	(0.0075)	(0.0071)	(0.0077)	(0.0111)	(0.0104)
Mean + One SD	0.787***	0.524***	0.534***	0.783***	0.472***	0.485***	0.576***	0.200***	0.330***	0.558***	0.131***	0.252***
	(0.0023)	(0.0048)	(0.0043)	(0.0027)	(0.0054)	(0.0050)	(0.0044)	(0.0089)	(0.0081)	(0.0069)	(0.0123)	(0.0121)

Notes: Marginal effects of tax are based on the estimates in columns (1) and (5) in Table 3. Robust standard errors are reported in parentheses. ***p <0.01, **p <0.05, *p <0.1.

Table A. 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
Poverty	0.21	0.05	0.12	0.35
Median HH Income	42882.3	9024.6	27349	71304
Median White HH Income	53757.1	14298.6	29289	100996
Median Black HH Income	28960.3	5767.4	17288	42311
Median Hispanic HH Income	34587.9	7513.2	15899	55985
Hetero	0.58	0.12	0.18	0.75
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
Crime	835.2	348.5	208	1887
Density	5265.7	4472.6	875.3	26847.8
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
GRPs	558.1	697.8	0	2656.1
Indoor smoke-free policy	0.57	0.50	0	1
Knowledge of secondhand smoke	0.64	0.04	0.57	0.72