Cigarette Tax Pass-Through by Product Characteristics: Evidence from Nielsen ScanTrack Data

Xiaojin Wang, PhD Student
Department of Agricultural Economics, University of Kentucky
312 Charles E. Barnhart Bldg. Lexington, KY 40546-0276
E-mail: xiaojin.wang2010@uky.edu

Yuqing Zheng, Assistant Professor
Department of Agricultural Economics, University of Kentucky
317 Charles E. Barnhart Bldg. Lexington, KY 40546-0276
E-mail: yuqing.zheng@uky.edu

Michael Reed, Professor
Department of Agricultural Economics, University of Kentucky
308 Charles E. Barnhart Bldg. Lexington, KY 40546-0276
E-mail: mrreed@uky.edu

Chen Zhen, Research Economist
Research Triangle Institute
Research Triangle Park, NC 27709-2194
E-mail: czhen@rti.org

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Abstract

We use market-level scanner data collected from U.S. convenience stores in 2011 and 2012 to examine who bears the economic burden of cigarette taxes. We find cigarette taxes are fully passed through to consumer prices, suggesting consumers pay all the excess burden of these taxes. Tax incidence differs by class of cigarette; pass-through rates for premium packs and cartons are higher than those for discount packs and cartons, indicating possibilities of substitution in consumptions across tiers and brands.

Key words: cigarette; excise tax; tax pass-through; tax avoidance.
JEL codes: D1, H2, H7, L6

Introduction

The subject of cigarette taxation in the United States has attracted particular attention in recently years, especially since two major events occurred in the cigarette industry. In 1998, cigarette manufacturers and state attorneys general settled a group of lawsuits in an agreement known as the Master Settlement Agreement (MSA), which required that participating manufacturers (the four largest cigarette manufacturers) pay states about

$250 billion, including payments to the four states that settled separately (Lillard and Sfekas, 2013). On April 1, 2009, the federal tax rate for cigarettes raised from $0.39 per pack to $1.01 per pack (Alcohol and Tobacco Tax and Trade Bureau).

Cigarette tax increases are regarded as the most effective means of reducing consumption and smoking rate, but the effectiveness depends on tobacco companies' pricing strategies, specifically whether overshift tax increases or undershift the taxes. Pass-through studies on cigarette tax examine who bears the economic burden of cigarette taxes, help understand the effectiveness of tax impositions and give references for policy implications. The recent literature on cigarette excise tax pass through can be roughly categorized into two groups, according to their research emphases, methods and data sources.

First group focuses on tax pass-through and consumer behavior heterogeneity (i.e. heavy smoker versus light and intermittent smokers (LITS); smokers who use versus who do not use price-minimizing strategies) and usually uses survey data. DeCicca, Kenkel, and Liu (2010) and Pesko Licht and Kruger (2013) both use consumer-reported prices from the 2003 and 2006-2007 Current Population Survey Tobacco Use Supplements (TUS-CPS) to estimate the pass-through of excise taxes to consumer prices. The former study finds that a pass-through rate is about one and does not vary much by the frequency with which the consumer smokes. Results from the latter show that cigarette excise tax increases are effective in raising the price of cigarettes (97% pass-through), but this exact shift may be undermined by the increases in price reductions due to price minimization strategies. Xu, Malarcher, and Kruger (2014) use data from the 2009–10 National Adult Tobacco Survey (NATS), and find that cigarette tax depends upon smokers' price-

minimizing strategies (carton purchase, coupon use, purchase from Indian reservations and purchase of generic brands). Excise tax was under-shifted to some smokers who use price-minimizing strategies (with a pass-through rate ranges from 30% to 83%), while excise tax was over shifted to smokers of premium brands who purchased by pack outside Indian reservations (pass-through rate 1.07 to 1.10%).

Second group concentrates on relationships between tax pass through and product characteristics and cross-border purchasing by using market data. Harding, Leibtag, and Lovenheim (2012) use the Nielsen Homescan panel data from January 1, 2006 through December 31, 2007 and find that cigarette taxes are less than fully passed through (86 percent pass-through rate) to consumer prices on average, suggesting consumers and producers split the excess burden of these taxes. Espinosa and Evans (2012) use 2001–2006 monthly retail scanner data in supermarkets in 29 states and estimate that retail prices increase dollar for dollar with excise tax changes. Their results demonstrate that smokers pay the entire tax burden of higher excise taxes with an almost complete pass through (99 percent pass-through rate). Chiou and Muehlegger (2014) study how consumers adapt to cigarette tax increases in the short and long-term by using store-level scanner data for 85 supermarkets (Dominicks retail chain) in the Chicago metropolitan area from 1989 to 1996. They consider four cigarette classes (branded vs. discount, pack vs. carton) and find that tax incidence varies across each class of cigarette: pass-through rates for premium packs and cartons are lower than discount packs and cartons, indicating possible substitution towards high-tier cigarettes.

Our study is most closely related to the second group literature aforementioned, as we use Nielsen ScanTrack data from January 2011 to December 2012. Similar to several

other recent papers, we estimate pass-through at the UPC-level, which eliminates shifts between price tiers as a source of bias. But different from previous studies, we use convenience store retail sales data because a majority of sales of tobacco products occur in convenience stores. Also, in order to take into account both the heterogeneity across states and the spatial autocorrelation, we adopt a two-way effects spatial Durbin model in cigarette tax shifting analysis.

Empirical Model

Following several other recent papers (Hanson and Sullivan, 2009; Harding, Leibtag, and Lovenheim, 2010; Chiou and Muehlegger, 2014), we estimate cigarette tax incidence by assume that the cigarette price is a function of the relevant state excise tax, the excise tax interacted with our proxy for the incentive to border-cross (the tax of the neighboring state divided by the distance to the county), product attributes, county economic and demographic controls and time fixed effects:

$$(1) \qquad P_{uijt} = \varphi \tau_{jt} + \lambda \frac{1}{d_{jn}} * \tau_{nt} + \ \mu \, A_u + \beta X_{jt} + \delta_t + \varepsilon_{uijt}$$

where P_{it} cigarette (tax inclusive) price per pack paid for UPC u in store i located in county j at time t; tax inclusive price includes federal, state and local excise taxes. τ_{jt} is the key variable of interest: state excise tax on cigarette per pack in county j and its the coefficient, φ, represents the pass-through rate of excise tax. d_{jn} is the distance from county j to its nearest county n, where the excise tax is τ_{nt}.

A_u is a vector of attribute variables for each product at UPC level u. X_{it} is a vector of other explanatory variables, which include demographic and economic

variables (percentage of black population; percentage of Hispanic population; percentage of Asian population; per capita income, unemployment rate). δ_t are the time effects, capturing unobserved transitions. ε_{uijt} are independently and identically distributed error terms with zero mean and variance σ^2;

Variable construction and data sources

In this section we discuss the construction of variables for estimation as well as the sources of our data. Table 1 summarizes variable descriptions and our predictions about the signs of the estimated coefficients, as well as providing summary statistics.

Nielsen Retail Scanner Data. —We use the Nielsen Retail Scanner data from January 1, 2011 through December 31, 2012 that cover a total of about 20 million transactions at the Universal Product Code (UPC) level made in 1865 convenience stores throughout the 48 Contiguous states plus the District of Columbia. We aggregate the data by time (month/year), location (store) and product (UPC). Monthly average prices for each UPC are calculated. One of the major advantages of our data is that we observe the UPC code of each product purchased. Each UPC represents a unique cigarette product with some characteristics, such as flavor type (regular, menthol, or other flavors, etc.), style (filtered or non-filtered), strength (regular, light, or ultra light) and feature (whether the product appears in major ads, line ads, or retailer coupons, etc.). This allows us to construct product attribute variables, which may play important roles in determining the cigarette price. In addition, we use the brand information in Nielsen data and group brands of cigarettes into premium and discount cigarettes, following the industry brand

categorization used in Cornelius, et al (2013). By definition, a premium product (such as Marlboro, Newport, and Camel, etc.) is one that is perceived to have a higher value than one that is merely marketed as a discount product (detailed brand classifications see Appendix). In our dataset, 79.5 % of the cigarette are sold in pack versus 20.5% are sold in carton. Premium pack accounts for majority of the cigarettes at 59.4%, followed by discount pack at 20.1%. Premium and discount brands sold in carton constitute the rest at 15.5% and 5%, respectively.

Tax data. —Federal Excise Tax for cigarette is $1.0066 per package of twenty cigarettes, effective April 1, 2009 (TTB, 2012). State excise tax data and information about general sales tax application to cigarettes is from Tax Foundation, Orzechowski & Walkeron(2014), and state revenue departments. From 2011 to 2012, the national mean state cigarette excise tax among all states increased by one cent from $1.37 per pack in 2011, to $1.38 per pack in 2012. For both years 2011 and 2012, New York State has the highest state cigarette excise tax in the United States, at $4.35 per-20 pack, while Missouri has the lowest, at $0.17 per pack. During the period from 2011 to 2012, there are four states which increased their excise tax on cigarette: Connecticut increased excise tax by $0.40 from $3.00 to $3.40 since July 1st, 2011; Vermont increased by $0.38 to $2.62 since July 1st, 2011; Illinois increased its tax by $1.00 to $1.98 from June 24, 2012; Rhode Island increase by $0.04 to $3.50 since July 1st, 2012. New Hampshire is the only state, which has decreased tax from $1.78 by $0.10 since July 1st, 2011; the first time a state decreased its cigarette excise tax since 2004(CDC, 2012).

Economic and demographic data. —We match Nielsen data with economic, demographic and geographic data for each county. Monthly unemployment rate data by

country is from Local Area Unemployment database, U.S. Bureau of Labor Statistics. Annual county population estimates by age, sex, race, and Hispanic origin data is from County Characteristics Resident Population Estimates, U.S. Census Bureau, Population Division, released on June 2014. Annual per capita personal income is from Local Area Personal Income and Employment dataset, Bureau of Economic Analysis. Education data is a 5-year average of 2009-13 from the Census Bureau's American Community Survey, available in County-level Data Sets, ERS, USDA.

Geographic information, the latitudes and longitudes of the centroid of the census tract, is retrieved from the National Counties Gazetteer File, 2014 Census Gazetteer Files, U.S. Census Bureau. We calculate the crow-flies distance (or the "Great Circle" distance in miles) from the centroid of the county where a store is located to the closest county that is in another state. The average distance is 82 miles.

Empirical Results

Table 2 presents results from estimation of equation (1). Each column of the table contains estimates from a separate regression that adds time fixed effects, product attributes, economic and demographic controls sequentially across columns in order to understand how each set of controls impacts our estimates.

In column 1, we only include state excise tax as a regressor. We find over-shifting of taxes to consumer prices: a one-dollar increase in taxes is associated with a 1.12 dollar increase in price per pack. In column 2, we add time fixed effects, which slightly reduces the estimated pass-through rate. The reason including month-specific dummy variables

reduces the size of the coefficient is because there are some changes in cigarette prices which were not from state tax increases. Those changes might include increases in production costs, adjustments in retailer pricing and discounting practices, and most likely are from raises in local (i.e., county, city, or other jurisdiction) cigarette excise taxes, which are not included in our analysis due to the lack of data. Most counties and cities do not have their own cigarette tax rates because state law prohibits them, but there are major exceptions. More than 600 local jurisdictions nationwide have their own cigarette tax rates or fees, notably New York City ($1.50 per pack) and Chicago-Cook County ($2.68 per pack) (Campaign for Tobacco-Free Kids, 2015).

Column (3) presents the results after product attribute variables, which expect to eliminate shifts between price tiers as a source of bias, are included. The UPC level product characteristics reduce the pass-through estimate to 1.07, due to the fact that prices can vary substantially across products with different brand, style, package, etc. For instance, prices for premium brands cigarettes are $0.76 higher than discount brands. Cigarettes sold in cartons (usually contains 10 packs) are $ -0.54 cheaper per pack than those sold in single packs.

Adding county demographic and economic characteristics further decreases the pass-through rate to 1.05, as shown in Column (4). Cigarette prices are lower in counties that have higher percentages of high school grads, male, black, Hispanic, and age 45-64 populations. All those consumer groups are reported to have higher prevalence rates of smoking (CDC, 2015). Counties with higher unemployment rate also have lower cigarette prices. Interestingly, counties that have higher percentages of American Indian/Alaska Natives have higher cigarette prices, given the fact that tobacco sold on

tribal lands is typically not subject to state and national taxes. American Indian/Alaska Natives (AI/ANs) have a higher prevalence of current smoking than most other racial/ethnic groups in the United States (CDC, 2015). In general, we find a higher pass-through rate than in these other analyses, especially Harding, Leibtag, and Lovenheim (2010), which also use nationally representative micro-data.

Column (5) shows the results when we expand the regression by incorporating distance weighted neighboring state's excise tax. The pass through rate for home state tax now declines to 0.995, showing that neighboring state's tax does affect the incidence of state cigarette taxes. At the mean of distance, which is 81 miles, the pass-through rate is 0.03 (=2.193× (1/81)), i.e. a one-dollar increase in cigarette excise taxes of neighboring state increases cigarette prices by three cents.

Table 3 presents the separately estimated tax pass-through for each class of cigarette, considering four cigarette classes (branded vs. discount, pack vs. carton). Recall in Column (4) of Table 2, we estimate a general pass-through tax rate of 1.05, assuming it is relatively uniform for all types of cigarette. In Column (1), we include an interaction term for carton sales and find that pass-through for cigarettes sold in carton is 13 cents higher than those sold by pack. In Column (2), we include an interaction term for premium brand cigarettes. Consumers bear 0.07 cents more for the premium brands than the discount brands. In Column (3), we include three interaction terms and estimate incidence for each combination of cigarettes and find a similar pattern. Compared to discount packs, pass-through for premium packs and cartons, discount cartons are 0.07, 0.22 and 0.06 more, respectively. Our results are different with findings in the previous study Chiou and Muehlegger (2014), which find premium pack and carton cigarettes

have lower tax pass through rates than discount pack and carton cigarettes for the Chicago area from 1989 to 1996. Large differences in datasets might explain these discrepancies.

Conclusions

We empirically investigate the cigarette excise tax pass-through by using Nielsen ScanTrack data for sales in convenience stores from January 2011 to December 2012. Our micro-level data allow us to observe product attributes at the UPC level, which can eliminate variations between price tiers as a source of bias. County economic and demographic variables are used as controls. We find cigarette taxes are fully passed through to consumer prices, suggesting excise taxes are heavily borne by consumers. Tax incidence differs by class of cigarette; pass-through rates for premium packs and cartons are slightly higher than those for discount packs and cartons, suggesting a possible consumption trend to substitute towards lower tier cigarettes in response to tax increases.

References

Alcohol and Tobacco Tax and Trade Bureau. http://www.ttb.gov/main_pages/schip-summary.shtml.

Bell, K. P., & Bockstael, N. E. 2000. "Applying the generalized-moments estimation approach to spatial problems involving micro-level data." *Review of Economics and Statistics*, *82*(1), 72-82.

Campaign for Tobacco-Free Kids, 2015. Cigarette Tax Increases By State Per Year 2000-
2015. https://www.tobaccofreekids.org/research/factsheets/pdf/0275.pdf.

Centers for Disease Control and Prevention (CDC). 2012. State Cigarette Excise Taxes
— United States, 2010-
2011.http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6112a1.htm.

CDC. 2015. Cigarette Smoking in the United States: Current Cigarette Smoking Among
U.S. Adults Aged 18 Years and
Older.http://www.cdc.gov/tobacco/campaign/tips/resources/data/cigarette-
smoking-in-united-states.html.

Centers for Disease Control and Prevention. Current Cigarette Smoking Among Adults—
United States, 2005–2013. Morbidity and Mortality Weekly Report
2014;63(47):1108–12 [accessed 2015 Mar 26].

Chiou, Lesley and Muehlegger, Erich, Consumer Response to Cigarette Excise Tax
Changes (May 27, 2014). Available at SSRN: http://ssrn.com/abstract=1693263
or http://dx.doi.org/10.2139/ssrn.1693263

Cornelius, M. E., Driezen, P., Fong, G. T., Chaloupka, F. J., Hyland, A., Bansal-Travers,
M., ... & Cummings, K. M. (2013). Trends in the use of premium and discount
cigarette brands: findings from the ITC US Surveys (2002–2011). *Tobacco
control*, tobaccocontrol-2013.

DeCicca, P., Kenkel, D., & Liu, F. 2013. "Excise tax avoidance: the case of state
cigarette taxes." *Journal of health economics*, *32*(6), 1130-1141.

ERS. USDA. Education (2009-13 latest). County-level Data Sets.
http://www.ers.usda.gov/data-products/county-level-data-sets/.aspx.

Espinosa, J., & Evans, W. N. 2012. "Excise taxes, tax incidence, and the flight to quality: evidence from scanner data." *Public Finance Review*, 1091142112460724.

Federation of Tax Administrators. State General Sales Tax Rates, 2011-2012. http://www.taxadmin.org/fta/rate/sales.pdf.

Harding, M., Leibtag, E., & Lovenheim, M. F. 2012. "The heterogeneous geographic and socioeconomic incidence of cigarette taxes: Evidence from Nielsen Homescan Data." *American Economic Journal: Economic Policy*, *4*(4), 169-198.

Lillard, D. R., & Sfekas, A. 2013. "Just passing through: the effect of the Master Settlement Agreement on estimated cigarette tax price pass-through." *Applied economics letters*, *20*(4), 353-357.

Kelejian, H. H., & Piras, G. 2014. "Estimation of spatial models with endogenous weighting matrices, and an application to a demand model for cigarettes." *Regional Science and Urban Economics*, *46*, 140-149.

New York State. Department of Taxation and Finance. Cigarette and tobacco products tax. http://www.tax.ny.gov/bus/cig/cigidx.htm.

Orzechowski & Walker. 2014. Tax Burden on Tobacco. *Historical compilation*: 48. Arlington, VA.

Pesko, M. F., Licht, A. S., & Kruger, J. M. 2013. "Cigarette price minimization strategies in the United States: price reductions and responsiveness to excise taxes." *Nicotine & Tobacco Research*, *15*(11), 1858-1866.

Tax Foundation. State Cigarette Excise Tax Rates, 2009-2013. http://taxfoundation.org/article/state-cigarette-excise-tax-rates-2009-2013.

US Alcohol and Tobacco Tax and Trade Bureau (TTB). 2012. Federal Excise Tax

Increase and Related Provisions.http://www.ttb.gov/main_pages/schip-summary.shtml.

U.S. Bureau of Labor Statistics.Local Area Unemployment Statistics. http://www.bls.gov/lau/.

U.S. Census Bureau. 2014 Census Files. National Counties Gazetteer File. http://www.census.gov/geo/maps-data/data/gazetteer2014.html.

U.S. Census Bureau, Population Division. 2014. Vintage 2013 County Population Datasets. https://www.census.gov/popest/data/datasets.html.

US Bureau of Economic Analysis. GDP & Personal Income .Regional Data. http://www.bea.gov/iTable/index_regional.cfm.

Xu, X., Malarcher, A., & Kruger, J. 2014. "Does Every US Smoker Bear the Same Cigarette Tax?. "*Addiction*.

Zheng, Y., Zhen, C., Nonnemaker, J., & Dench, D. 2014. "*US Demand for Tobacco Products in a System Framework* (No. 174110)." Agricultural and Applied Economics Association.

Table 1. Summary statistics

Variable	Variable description	Mean	Std. Dev.	Min	Max
cigpp	Price of cigarette ($ per 20-pack)	5.746	1.466	2.359	20
Tax ($ per 20-pack)					
fedtax	Federal Excise Tax rate	1.0066	0	1.0066	1.0066
sttax	State excise tax rate on cigarette	1.551	1.049	0.170	4.350
sstax	State sales tax paid	0.320	0.171	0.000	1.400
totaltaxburden	Federal and state excise taxes plus state sales tax	2.878	1.181	1.227	6.157
Product attributes					
type	=0 regular, =1 menthol, menthol variants (menthol gold, menthol blue, etc.) and other flavors (bold taste fresh, etc.)	0.374	0.484	0	1
style	=0 filtered, =1 non-filtered	0.027	0.163	0	1
strengthL	=1 light, =0 all others	0.318	0.466	0	1
strengthU	=1 ultra light, =0 all others.	0.102	0.303	0	1
strengthR	=1 regular, =0 all others	0.580	0.494	0	1
carton	=0 single pack, =1 carton	0.205	.404	0	1
feature	=0 not in any advertisement, =1 on advertisement	0	0.002	0	1
premium	=1 premium brand, =0 discount brand	0.749	0 .433	0	1
Economic variables					
pcpi	Per capita personal income, annual ($1,000)	42.758	9.951	21.403	121.459
unrate	Monthly unemployment rate	7.708	2.350	0.800	22.600
Demographic variables					
malepop	Percentage of male population	0.493	0.012	0.466	0.603
femalepop	Percentage of female population	0.507	0.012	0.399	0.534
whitepop	Percentage of white population	0.858	0.113	0.191	0.987
blackpop	Percentage of black population	0.082	0.102	0.001	0.734

AIANpop	Percentage of American Indian and Alaska Native population	0.013	0.035	0.000	0.768
asianpop	Percentage of Asian population	0.026	0.027	0.001	0.186
hispanicpop	Percentage of Hispanic	0.112	0.133	0.004	0.955
nonhispanicpop	Percentage of Non-Hispanic	0.888	0.133	0.045	0.996
agebelow15	Percentage of population in age group <15 years old	0.193	0.027	0.067	0.308
age1524	Percentage of population in age group 15-24 years	0.140	0.032	0.050	0.334
age2544	Percentage of population in age group 25-44 years	0.252	0.030	0.135	0.369
age4564	Percentage of population in age group 45–64 years	0.272	0.029	0.146	0.401
age65up	Percentage of population in age group 65 years and older	0.143	0.041	0.059	0.492
lessHS	Percent of adults with less than a high school diploma	0.125	0.053	0.031	0.382
HSgrad	Percent of adults with a high school diploma only	0.303	0.062	0.124	0.515
collegenhigher	Percent of adults completing some college or associate's degree, bachelor's degree or higher	0.571	0.089	0.265	0.815

Table 2. Estimates of the Effect of Cigarette Excise Taxes on Consumer Prices

Independent variables	Dependent variable: Tax inclusive cigarette price per pack				
	(1)	(2)	(3)	(4)	(5)
State excise tax	1.118***	1.115***	1.078***	1.054***	0.995***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance weighted nearest state tax					2.193***
					(0.007)
Feature			0.109	0.251**	0.118
			(0.121)	(0.117)	(0.116)
Style			0.599***	0.609***	0.610***
			(0.002)	(0.002)	(0.002)
Type			0.035***	0.043***	0.042***
			(0.001)	(0.001)	(0.001)
Strength Light			0.301***	0.301***	0.300***
			(0.001)	(0.001)	(0.001)
Strength Ultra Light			0.474***	0.464***	0.461***
			(0.001)	(0.001)	(0.001)
Carton			-0.542***	-0.504***	-0.499***
			(0.001)	(0.001)	(0.001)
Premium brand			0.760***	0.770***	0.772***
			(0.001)	(0.001)	(0.001)
Unemployment rate				-0.042***	-0.051***
				(0.000)	(0.000)
Per capita income ($1,000)				0.006***	0.002***
				(0.000)	(0.000)
High school grads				-0.334***	0.895***
				(0.015)	(0.015)
College degree and higher				0.185***	1.219***
				(0.010)	(0.010)
Male population				-3.478***	-1.531***
				(0.026)	(0.027)
Black				-0.766***	-0.457***
				(0.003)	(0.004)
AIAN				0.703***	0.937***
				(0.008)	(0.008)
Asian				0.099***	0.626***
				(0.015)	(0.015)
Hispanic				-0.345***	-0.036***
				(0.004)	(0.004)
Age 15-24				0.144***	-0.518***
				(0.012)	(0.012)
Age 45-64				-0.936***	-1.824***

				(0.017)	(0.017)
Age 65 +				0.318***	0.975***
				(0.010)	(0.010)
Constant	4.012***	3.983***	3.402***	5.542***	(0.001)
	(0.001)	(0.002)	(0.002)	(0.017)	(0.018)
Month fixed effects	No	Yes	Yes	Yes	Yes
Product attributes	No	No	Yes	Yes	Yes
Economic and demographic controls	No	No	No	Yes	Yes
Observations	6,730,094	6,730,094	6,721,093	6,721,093	6,721,093
R-squared	0.639	0.645	0.729	0.746	0.750

Note: Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Sample size reduces once product attribute variables are included because there're 9,001 observations that have missing product attributes.

Table 3. Cigarette Excise Tax Incidence by Brand and Package

Independent variables	Dependent variable: Tax inclusive cigarette price per pack		
	(1)	(2)	(1)
State excise tax (tax)	1.036***	1.000***	0.986***
	(0.000)	(0.001)	(0.001)
Carton*tax	0.129***		
	(0.001)		
Premium*tax		0.073***	
		(0.001)	
Premium*carton*tax			0.222***
			(0.001)
Premium*pack*tax			0.067***
			(0.001)
Discount*carton*tax			0.056***
			(0.001)
Feature	0.266**	0.242**	0.261**
	(0.117)	(0.117)	(0.116)
Style	0.612***	0.607***	0.613***
	(0.002)	(0.002)	(0.002)
Type	0.043***	0.043***	0.044***
	(0.001)	(0.001)	(0.001)
Strength Light	0.302***	0.300***	0.301***
	(0.001)	(0.001)	(0.001)
Strength Ultra Light	0.467***	0.462***	0.466***
	(0.001)	(0.001)	(0.001)
Carton	-0.665***	-0.505***	-0.665***
	(0.001)	(0.001)	(0.001)
Premium brand	0.770***	0.655***	0.641***
	(0.001)	(0.001)	(0.001)
Unemployment rate	-0.041***	-0.041***	-0.041***
	(0.000)	(0.000)	(0.000)
Per capita income ($1,000)	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)
High school grads	-0.464***	-0.345***	-0.474***
	(0.015)	(0.015)	(0.015)
College degree and higher	0.081***	0.183***	0.080***
	(0.010)	(0.010)	(0.010)
Male population	-3.456***	-3.474***	-3.450***
	(0.026)	(0.026)	(0.026)
Black	-0.765***	-0.765***	-0.766***
	(0.003)	(0.003)	(0.003)
AIAN	0.655***	0.700***	0.648***

	(0.008)	(0.008)	(0.008)
Asian	0.065***	0.121***	0.081***
	(0.015)	(0.015)	(0.015)
Hispanic	-0.391***	-0.345***	-0.391***
	(0.004)	(0.004)	(0.004)
Age 15-24	0.163***	0.147***	0.168***
	(0.012)	(0.012)	(0.012)
Age 45-64	-0.871***	-0.905***	-0.840***
	(0.017)	(0.017)	(0.017)
Age 65 +	0.259***	0.311***	0.256***
	(0.010)	(0.010)	(0.009)
Constant	5.648***	5.627***	5.740***
	(0.017)	(0.017)	(0.017)
Time fixed effects	Yes	Yes	Yes
Observations	6,721,093	6,721,093	6,721,093
R-squared	0.747	0.747	0.748

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix: Categorization of Cigarette Brands as either Premium or Discount

Brand Description	Category
1839	Discount
1st Class	Discount
305's	Discount
305's Silver	Discount
Basic	Discount
Benson & Hedges	Premium
Cambridge	Discount
Camel	Premium
Camel Crush	Premium
Camel Exotic Blends	Premium
Camel Ninety Nines	Premium
Camel No. 9	Premium
Camel Signature	Premium
Camel Turkish Gold	Premium
Camel Turkish Jade	Premium
Camel Turkish Royal	Premium
Camel Turkish Silver	Premium
Camel Wides	Premium
Capri	Premium
Carlton's	Premium
Checkers	Discount
Chesterfield	Premium
Ctl Br	Discount
Decade	Discount
Doral	Discount
Eclipse	Discount
Eve	Discount
Fortuna	Discount
Gold Coast	Discount
Gpc	Discount
Grand Prix	Discount
Kamel	Discount
Kent	Premium
Kent Golden Lights	Premium
Kent Iii	Premium
Kool	Premium
Kool Flow	Premium
Kool Groove	Premium
Kool Xl	Premium
L & M	Premium

L & M Turkish Night	Premium
Liggett Select	Discount
Lucky Strike	Premium
Major Brand	Discount
Marlboro	Premium
Marlboro Blend No. 27	Premium
Marlboro Blend No. 54	Premium
Marlboro Eighty-Threes	Premium
Marlboro Nxt	Premium
Marlboro Skyline	Premium
Marlboro Special Blend	Premium
Maverick	Discount
Maverick Silver	Discount
Merit	Premium
Merit Ultima	Premium
Misty	Discount
Monarch	Discount
More	Premium
More White Lights	Premium
Natural American Spirit	Premium
Newport	Premium
Newport Ice	Premium
Newport M Blend	Premium
Now	Premium
Old Gold	Discount
Pall Mall	Discount
Pall Mall Red	Discount
Parliament	Premium
Pyramid	Discount
Raleigh	Discount
Rave	Discount
Salem	Premium
Salem Green Label	Premium
Saratoga	Premium
Sonoma	Discount
Tahoe	Discount
Tareyton	Premium
Tourney	Discount
True	Premium
Tuscany	Discount
Usa	Discount
Usa Gold	Discount
Vantage	Premium

Viceroy	Discount
Virginia Slims	Premium
Virginia Slims Luxury	Premium
Virginia Slims Superslims	Premium
Wave	Discount
Wides	Discount
Wild Horse	Discount
Winston	Premium
Winston S2	Premium
Winston Select	Premium