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Per-pack price reductions available from different cigarette purchasing strategies: United States, 2009–2010☆

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Abstract

Objective—Following cigarette excise tax increases, smokers may use cigarette price minimization strategies to continue their usual cigarette consumption rather than reducing consumption or quitting. This reduces the public health benefits of the tax increase. This paper estimates the price reductions for a wide-range of strategies, compensating for overlapping strategies.

Method—We performed regression analysis on the 2009–2010 National Adult Tobacco Survey (N = 13,394) to explore price reductions that smokers in the United States obtained from purchasing cigarettes. We examined five cigarette price minimization strategies: 1) purchasing discount brand cigarettes, 2) using price promotions, 3) purchasing cartons, 4) purchasing on Indian reservations, and 5) purchasing online. Price reductions from these strategies were estimated jointly to compensate for overlapping strategies.

Results—Each strategy provided price reductions between 26 and 99 cents per pack. Combined price reductions were possible. Additionally, price promotions were used with regular brands to obtain larger price reductions than when price promotions were used with generic brands.

Conclusion—Smokers can realize large price reductions from price minimization strategies, and there are many strategies available. Policymakers and public health officials should be aware of the extent that these strategies can reduce cigarette prices.

Keywords

Price reduction; Cigarette purchasing strategy; United States

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Introduction

Higher cigarette prices decrease cigarette consumption and smoking prevalence (Chaloupka et al., 2011; Hopkins et al., 2001; Institute of Medicine, 2007; Task Force on Community Preventive Services, 2001; USDHHS, 2000, 2012). However, not all smokers respond to price increases by reducing consumption or quitting. Some smokers sustain their use by either using price minimization strategies, or paying the higher prices (Choi et al., 2012; DeCicca et al., 2010; Frieden et al., 2005; Goolsbee et al., 2010; Hyland et al., 2004, 2005, 2006; Licht et al., 2011a,b; White et al., 2005; Xu et al., 2013). A majority of United States smokers use price minimization strategies to obtain substantial price reductions (Xu et al., 2013). These strategies include purchasing discount brands, purchasing cigarettes by the carton, using coupons or other price promotions, purchasing cigarettes online, and purchasing cigarettes from no- or low-tax sources (e.g. from lower-tax states, municipalities, or black markets). In the United States, purchasing cigarettes on Indian reservations is another common strategy for obtaining reduced price cigarettes because taxes are often lower on these reservations (Hyland et al., 2004, 2005).

Tobacco companies are strategic when offering price promotions, such as providing coupons to target populations. Evidence suggests that young adults are more frequently targeted for these promotions (Choi et al., 2013). One study by Sfekas and Lillard (2013) suggests that cigarette brands with low market share target younger individuals with the price promotions of free packs of cigarettes and coupons, with the goal of encouraging brand switching. Major cigarette brands, on the other hand, target the price promotion of free packs of cigarettes to older smokers to encourage them to continue purchasing the major brand and to discourage cigarette quitting (Sfekas and Lillard, 2013). Given cigarette companies' ability to target price promotions such as coupons and free packs of cigarettes to specific types of individuals, including individuals with a higher propensity to quit smoking, this strategy is of particular interest in tobacco control regulatory efforts.

In this study, we estimate the average per pack price reduction that can be attributed to different purchasing strategies. We performed regression analysis to account for overlapping price reductions. Except for one 2006–2007 study with limited strategies (Pesko et al., 2013), this approach has not been used in other studies of cigarette price reductions (DeCicca et al., 2010; Hyland et al., 2004; Licht et al., 2011a; White et al., 2005; Xu et al., 2013). We also focus on the strategy of price promotions by investigating if individuals receive differential price reductions from this strategy depending on cigarette brand.

Methods

We used the nationally representative 2009–2010 National Adult Tobacco Survey (NATS) to evaluate the price reduction associated with each price minimization strategy while simultaneously controlling for other strategies, smokers' socio-demographic characteristics, smoking behaviors, and other residence factors. NATS is a stratified, national, landline and cellular phone-based cross-sectional survey of non-institutionalized adults ≥18 years old. Informed consent was obtained from all respondents (N = 118,581) and cell phone

respondents were offered an incentive for participation. Respondents were interviewed between October 2009 and June 2010. Additional information about the NATS survey is available online (http://www.cdc.gov/tobacco/data_statistics/surveys/nats/pdfs/methodology-report.pdf).

We excluded non-smokers (86.1% of the sample, N = 102,039), smokers who did not provide price paid for the last pack or carton of cigarettes (N = 1243), smokers providing price paid below the federal excise tax of $1.01 (N = 26), smokers providing price paid greater than $16 (N = 4), and smokers who did not report if they used a special promotion at last purchase or if they had purchased cigarettes online during the past year (N = 37). Our sample consists of current smokers who smoked at least 100 cigarettes in their entire life and smoked within the past 30 days.

In total, 15,232 current smokers were identified, and among them, 13,394 without any missing values were used in our complete case analysis. We also performed sensitivity analysis using the full sample of current smokers.

Using the survey responses, we identified respondents engaging in any of the five cigarette price-minimization activities: 1) made their most recent cigarette purchase by the carton rather than by the pack, 2) took advantage of a price promotion (coupon, rebates, buy 1 get 1 free, 2 for 1, or any other special promotions) on their most recent purchase, 3) purchased cigarettes on an Indian reservation during the previous year, 4) mostly smoked generic cigarettes during the previous 30 days, or 5) purchased cigarettes over the internet during the previous year. We identified use of these strategies from the following questions. If individuals reported buying cigarettes for themselves over the past month, they were asked: “During the past 30 days, that is, since [DATE FILL], what brand of cigarettes did you buy most often?”. Interviewers could check one of 10 regular brands, 6 discount brands, an “other” brand option, and an option to indicate not having a preferred brand.[1] Reported prices for smokers who were missing information on their cigarette brand and those who were classified as using “other” cigarette brands were lower than reported prices paid for discount brands. All three (discount, other, and missing) are classified as using the generic brand price minimization strategy. Alternatively, these brands are regrouped as high market share brands and low market share brands, using the identification strategy of Sfekas and Lillard (2013), for additional analysis.[2]

To identify other price minimization strategies, smokers were asked: “The last time you bought cigarettes for yourself, did you buy them by the pack or by the carton?”. If individuals reported either option, they were asked the price last paid for their usual quantity purchased. For individuals reporting that they usually purchase cigarettes by the carton and providing a price last paid per carton, we divided this carton price by 10 to obtain a per pack price. Smokers were also asked: 1) The last time you bought cigarettes, did you take advantage of coupons, rebates, buy 1 get 1 free, 2 for 1, or any other special promotions for

[1]The ten regular brands are Camel, Forsyth (private label), Kool, Marlboro, Newport, Pall Mall, Parliament, Salem, Virginia Slims, and Winston. The six discount brands are Basic, Doral, GPC, Misty, Sonoma, and USA Gold.
[2]High market share brands are Marlboro, Newport, and Camel and low market share brands are Kool, Pall Mall, Winston, Salem, Parliament, and Virginia Slims. Other brands are Forsyth, Misty, Sonoma, USA Gold, Doral, Basic, and GPC.

cigarettes?; 2) In the past 12 months, that is, since [DATE FILL], have you bought cigarettes over the Internet?; and 3) In the past 12 months, that is, since [DATE FILL], have you bought cigarettes on an Indian reservation?

Note that smokers could potentially use zero, one, or multiple strategies. None of the strategies supersede another. Smokers practiced zero strategies 44.4% of the time, one strategy 37.5% of the time, two strategies 14.5% of the time, and three or more strategies 3.6% of the time.

Using self-reported strategies practiced, we estimated the following equation:

$$price_{ist} = a + \beta_1 X_{ist} + \beta_2 smoke\_char_{ist} + \beta_3 surrounding\_char_{st} + \beta_4 strategies_{ist} + \gamma_s + \gamma_t + \varepsilon_{ist}$$

where i = individual, s = state, t = time, X = socio-demographic characteristics, and ε is the error term. To determine the price reduction associated with each strategy, we estimate the equation using a linear probability model and we use dependent variables of either 1) price paid per pack at last purchase, or 2) the natural log of price paid per pack at last purchase. The five cigarette price minimization strategies are jointly included as independent variables. Control variables include socio-demographic characteristics, smoking characteristics, residence surrounding characteristics, and state and quarter fixed effects (4th quarter of 2009, and 1st and 2nd quarters of 2010). We affirmed the association between each vector of variables and price using joint F-statistics tests ($p < 0.02$ for each vector).

Socio-demographic characteristics are gender, race/ethnicity, age, education, annual household income, marital status, health insurance status, and employment status. The smoking characteristics are number of cigarettes smoked daily and the number of days (every day or some day) that the individual has smoked over the past 30 days. Both socio-demographic and smoking characteristics are included in the regression as control variables primarily because they may be correlated with omitted variables that influence both price minimization strategies and price paid, such as the use of uncontrolled strategies (e.g. black market purchases).

The residence surrounding characteristics are county population density, strength of state smoke free air laws, state cigarette excise tax rates, and state average motor gasoline prices (to account for travel costs to cheaper cigarette sources).[3] These characteristics can influence an individuals' decision to smoke and the price they pay for cigarettes, so controlling for these is useful to remove confounding that could otherwise impact our estimates of the per-pack price reductions attributable to each strategy. Similarly, time-

[3]Monthly state cigarette excise tax rates were provided by the Tax Burden on Tobacco (Orzechowski and Walker, 2011). Smoke free air law data was collected by the ImpacTeen project (http://www.impacteen.org). This data measures the strength of each state's restaurant, workplace, and bar smoke-free air laws respectively (on a scale of 0–2, 2 being the strongest restrictions). This information is summed to create an index value of between 0 and 6 and matched to the data based on each respondent's state of residence. The Census Bureau's July 2009 county population estimates and land area data were used to determine population densities by county. If county identifiers were missing in the NATS data, which it was for 4.9% of respondents, then the average population density for respondents in the state was used. Finally, motor gasoline prices were merged for the years 2009 and 2010 from the State Energy Data System operated by the U.S. Energy Information Administration (http://www.eia.gov/state/seds).

invariant changes in cigarette prices across states and seasonal changes in cigarette prices are removed by the inclusion of state and quarter fixed effects. All statistical analyses used population weights provided in the data and standard errors are cluster-corrected at the levels of state/sub-state and phone type.

Results

The mean price paid per pack was $5.14. Column 2 of Table 1 provides population weighted descriptive statistics for our sample of smokers. Linear probability model results suggest that the average per pack price reductions were $0.65 for generic brand purchases, $0.99 for carton purchases, $0.26 for price promotions, and $0.40 for purchases on Indian reservations (Table 1, Columns 3–4). These price reduction estimates were jointly determined to compensate for overlapping strategies. We do not interpret the coefficient on the strategy of internet purchase over the past year because of a small sample (1.2% of respondents), and we include it in our analysis purely for control purposes.

Smokers practicing multiple strategies can save substantially more; for example, additive properties of linear probability models suggest that a purchaser of a carton of discount brand cigarettes saves, on average, $1.64 per pack. Conditional on an individual's use of these price minimization strategies, additional price reductions were associated with being male, White, non-Hispanic, older, lower income, married, and unemployed. Additionally, smoking characteristics of smoking on some day (compared to every day) and smoking a higher number of cigarettes daily were also associated with additional price reductions.

Our estimate of the price reduction from Indian reservation purchases should be interpreted cautiously as the question asks if a purchase has been made on an Indian reservation over the past year, a strategy that may or may not have been used at last purchase. To see if the non-overlapping time intervals between the Indian reservation strategy and other price minimization strategies that are captured by the survey at last purchase affect our price reduction estimates, we re-estimated the model not controlling for Indian reservation purchases and Internet purchases (another variable that asks about purchasing behavior over the past year). The price reductions associated with these three strategies (results available upon request) changed by at most 3 cents from our estimates in Table 1, suggesting that the price reduction from Indian reservation purchases were independent from the impacts of other price minimization strategies that were in different time intervals.

We also log transformed our dependent variable to provide a different interpretation of our coefficients, which are now as a percentage of the price paid per pack (Table 1, Columns 5–6). Linear probability model results of the natural log transformed dependent variable of price paid per pack suggests that smokers on average save 16.9% for generic brand purchases, 22.6% for carton purchases, 4.9% for price promotions, and 8.2% for purchases on Indian reservations.

Table 2 provides results for if individuals receive differential price reductions for using price promotions based on usual brand purchased. We find some evidence that individuals purchasing brand-name cigarettes realize *larger* price reductions from price promotions than

individuals purchasing generic cigarettes. High or low market share was not predictive of differential price reductions from price promotions, although an “other” category, which contains several generic brands, was predictive.

We performed several sensitivity analyses to see how our results may be influenced by missing data. We first examined missing data for our independent variables by re-estimating the model in Table 1 and using categorical variables for any missing data, with the results presented in Appendix Table A.1. Price reductions differed by at most 2 cents and none of these differences were statistically significant from our estimates in Table 1, suggesting little difference in the size of price reductions for individuals with and without complete information.

We also examined missing data for the dependent variable of the price paid for the last pack of cigarettes. Starting with the sample we used in the complete case analysis, we added back 906 observations with unknown price information. In Appendix Table A.2, we report that these individuals were less likely to be young, Black, Non-Hispanic, and high school educated. These individuals were also more likely to report purchasing generic brand cigarettes and were less likely to practice the other price minimization strategies. To the extent that these individuals with incomplete information obtain different sized price reductions than individuals with complete information, this could influence our estimates; however, the relatively small number of observations with missing price information (4.9%) attenuates the influence of any potential bias.

Discussion

Each cigarette price minimization strategy was associated with significant price reductions. The per pack price reductions associated with these strategies ranged from $0.26 for using price promotions to as much as $1 for purchasing cigarettes by the carton. The size of these price reductions may be increasing with rising cigarette excise taxes: the price reductions for carton purchasing were previously estimated at $0.68 in 2006–07 (Pesko et al., 2013) and is estimated at $0.99 in this research in 2009–10, during which time 21 states increased their cigarette excise taxes at least once and the federal government increased its excise tax from $0.33 to $1.01 a pack. Our findings suggest that price-sensitive smokers may have low-priced alternatives that allow them to continue to purchase cigarettes within their budget when facing price increases. Thus, smokers' purchasing behaviors may substantially mitigate the effect of increased cigarette excise taxes on retail prices and undermine the positive public health impact of price increases.

Because participants' usage of each price minimization strategy can be substantially different (Choi et al., 2012; Hyland et al., 2005; White et al., 2005), prohibiting industry promotions alone, a widely considered public policy effort, may not be sufficient to uphold the effect of cigarette taxes and reduce the prevalence of smoking. For instance, prohibiting industry promotion alone is less likely to affect smoking behaviors of price sensitive smoker subpopulations, such as users of generic brands or cigarette carton purchasers, who might have quit without discount options within their budget. Therefore, comprehensive policy efforts are needed to facilitate public health improvements from rising cigarette prices. In

addition to prohibiting industry coupons and promotions, other potential strategies that could offset the effect of price minimization strategies include setting a high floor price for cigarettes and expanding state-level negotiations with Indian reservations on the collection of state excise taxes (Chaloupka, 2011; Feighery et al., 2005, 2009; Samuel et al., 2012; Tynan et al., 2013).

This study has at least four limitations that were not discussed previously. First, 18.2% of NATS smokers were not asked whether they had purchased cigarettes on an Indian reservation, mostly due to an approval delay in the first two months of the survey. Second, the NATS did not include all possible price minimization behaviors used by smokers, such as purchases from no- or lower-tax sources besides Indian reservations. The potential impact of these uncontrolled strategies is at least partly mitigated by including smokers' socio-demographic characteristics and residence contextual variables, which may be correlated with unobserved use of strategies. Additionally, like other surveys, the information collected is subject to recall bias when respondents are asked to recall past strategies and price paid. However, asking individuals about the price that they paid for their last purchase of cigarettes should mitigate recall bias. Additionally, the average of self-reported prices per pack in the 2009–2010 NATS was very consistent with the corresponding 2009 national average price reported in the Tax Burden on Tobacco (TBOT) (Xu et al., 2013). Fourth, the data was collected three years ago and the industry is constantly evolving its strategies, so the size of these price reductions may have changed over time.

Conclusion

Understanding the extent to which price minimization strategies dilute the price paid for cigarettes is important for informing tobacco control efforts on how cigarette taxes can be partially offset or completely avoided through these strategies. Cigarette price minimization strategies result in large price reductions, which can be compounded when individuals practice multiple strategies. These price reductions can mitigate the impact that cigarette excise tax increases would otherwise have on reducing cigarette consumption and increasing cessation. We recommend further research in this area, as well as research on how price promotions are targeted to vulnerable populations.

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Appendix A

Appendix Table A.1

Sensitivity analysis of Table 1, using missing data categories.[a,b]

Dependent variable:		**Price per pack (in cents)**		**Natural log of price per pack**	
Weighted means:		**514**		**6.2**	
N:		**15,232**		**15,232**	
R-squared:		**0.561**		**0.515**	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Weighted means	**Coefficient (margin)**	**95% CI**	**Coefficient (percent)**	**95% CI**
Price minimization strategies[c]					
Generic brands	25.0	−67.6***	−76.0, −59.2	−17.7***	−19.7, −15.6
Cartons	24.1	−98.2***	−106.2, −90.2	−22.5***	−24.5, −20.5
Price promotions[d]	19.7	−27.3***	−34.8, −19.8	−5.3***	−6.9, −3.6
Indian reservations	7.2	−39.8***	−53.4, −26.2	−8.1***	−11.0, −5.2
Internet purchase[e]	1.2	−59.8**	−98.5, −21.2	−14.0**	−23.0, −5.0
Gender					
Male (Ref)	55.4	0.0	0.0, 0.0	0.0	0.0, 0.0
Female	44.4	8.7**	2.7, 14.8	2.2**	0.9, 3.6
Other, missing	0.2	182.5	−18.2, 383.1	27.0*	4.2, 49.7
Race/ethnicity					
White, non-Hispanic (Ref)	68.8	0.0	0.0, 0.0	0.0	0.0, 0.0
Black, non-Hispanic	12.7	24.2***	13.4, 35.1	4.2***	1.9, 6.5
Asian, non-Hispanic	1.0	32.7*	1.6, 63.8	5.8*	0.5, 11.0
Native American, non-Hispanic	2.9	11.4	−5.3, 28.0	1.4	−1.7, 4.6
Hispanic	11.6	16.5*	3.1, 30.0	2.7	−0.0, 5.4
Other, multiracial	3.1	15.0	−2.5, 32.5	2.4	−1.1, 5.9
Age					
18–24 (Ref)	16.1	0.0	0.0, 0.0	0.0	0.0, 0.0
25–44	43.5	−8.5	−18.3, 1.3	−2.0	−4.0, 0.1
45–64	32.9	−18.5***	−28.8, −8.1	−3.3**	−5.4, −1.1
≥65	6.5	−12.7	−26.5, 1.1	−1.5	−4.7, 1.6
Missing data	1.0	−28.9	−61.5, 3.7	−4.8	−10.7, 1.0
Education					
Some high school (Ref)	23.9	0.0	0.0, 0.0	0.0	0.0, 0.0
High school	37.2	2.6	−6.2, 11.4	0.1	−1.8, 2.0
Some college	29.3	0.5	−8.6, 9.6	−0.4	−2.4, 1.5
College	9.2	12.2*	0.7, 23.6	1.9	−0.4, 4.2
Missing education	0.4	−39.2	−120.9, 42.5	−5.9	−18.1, 6.4
Annual household income, $					
<20,000 (Ref)	20.7	0.0	0.0, 0.0	0.0	0.0, 0.0
20,000–29,999	13.3	6.8	−3.5, 17.0	2.7*	0.4, 4.9
30,000–39,999	13.7	9.1	−2.3, 20.4	3.0*	0.3, 5.6

Dependent variable:		Price per pack (in cents)		Natural log of price per pack	
Weighted means:		514		6.2	
N:		15,232		15,232	
R-squared:		0.561		0.515	
(1)	(2)	(3)	(4)	(5)	(6)
	Weighted means	Coefficient (margin)	95% CI	Coefficient (percent)	95% CI
40,000–49,999	12.6	20.4***	9.2, 31.7	5.3***	2.9, 7.7
50,000–69,999	13.4	21.0***	9.7, 32.3	5.5***	3.1, 7.9
70,000–99,999	9.0	34.8***	22.6, 47.0	8.7***	6.2, 11.3
100,000–149,999	5.5	39.0***	23.6, 54.5	9.3***	6.2, 12.4
≥150,000	2.4	33.9**	12.8, 54.9	8.5***	4.5, 12.6
Missing data	9.4	13.1	−0.4, 26.6	3.7	0.5, 6.8
Marital status					
Married or cohabiraring (Ref)	48.9	0.0	0.0, 0.0	0.0	0.0, 0.0
Widowed, divorced, or separated	23.7	8.2*	0.5, 15.9	1.6	−0.2, 3.3
Never married, not cohabitating	26.8	18.7***	10.4, 27.1	3.3***	1.6, 5.1
Other, refused	0.6	3.0	−45.9, 51.8	−3.0	−15.4, 9.4
Health insurance					
Yes (Ref)	62.4	0.0	0.0, 0.0	0.0	0.0, 0.0
No	36.9	−0.2	−7.1, 6.7	−0.1	−1.6, 1.4
Don't know, refused	0.7	−27.8	−70.4, 14.9	−5.5	−13.8, 2.8
Employment status					
Employed (Ref)	55.6	0.0	0.0, 0.0	0.0	0.0, 0.0
Unemployed	44.2	−11.5***	−18.4, −4.7	−3.0***	−4.5, −1.5
Don't know, refused	0.3	24.4	−19.5, 68.3	6.3	−1.9, 14.5
Cigarette number					
<6 (Ref)	25.6	0.0	0.0, 0.0	0.0	0.0, 0.0
6–14	26.1	−9	−18.5, 0.4	−2.1*	−4.1, −0.1
>14	46.1	−11.5*	−21.3, −1.7	−2.7*	−4.8, −0.5
Missing data	2.2	−37.4*	−67.1, −7.8	−9.0*	−16.6, −1.4
Smoking days					
Every (Ref)	77.4	0.0	0.0, 0.0	0.0	0.0, 0.0
Some	22.6	−13.5**	−23.4, −3.6	−3.4**	−5.6, −1.3

*Significant at 5% level.

**Significant at 1% level.

***Significant at .1% level.

[a]The regressions included state fixed effects, quarter fixed effects, county population density, strength of state smoke free air laws, state cigarette excise tax rates, motor gasoline prices, and a constant term, but those terms are not reported.

[b]Statistical significance and confidence intervals are determined using standard errors that are cluster-corrected at the state/sub-state and phone type level.

[c]Cigarette price minimization strategy estimates are compared to a reference category of non-use of each strategy. Statistically significant negative coefficients for the priceminimization strategies suggest that individuals practicing these strategies are reducing prices by the amounts given by the coefficients (in cents or as a percent of the price).

[d] Price promotions include coupon, rebates, buy 1 get 1 free, 2 for 1, or any other special promotions.

[e] This estimate should be interpreted with caution due to a low sample size.

Appendix Table A.2

Odds ratios of reporting an invalid price per pack of cigarettes.

Dependent variable:	**Invalid price per pack**	
Weighted means	**4.9%**	
N	**14,300**	
	Coefficient (odds ratio)	**95% CI**
Price minimization strategies		
Generic brands	2.32***	1.64, 3.26
Cartons	0.70*	0.50, 0.99
Price promotions	0.38***	0.25, 0.58
Indian reservations	0.39***	0.23, 0.67
Internet purchase	0.23*	0.07, 0.77
Gender		
Male (Ref)	1.00	1.00, 1.00
Female	0.90	0.70, 1.15
Race/ethnicity		
White, non-Hispanic (Ref)	1.00	1.00, 1.00
Black, non-Hispanic	0.45**	0.27, 0.74
Asian, non-Hispanic	0.58	0.21, 1.57
Native American, non-Hispanic	0.94	0.50, 1.74
Hispanic	1.02	0.50, 2.08
Other, multiracial	1.22	0.68, 2.19
Age		
18–24 (Ref)	1.00	1.00, 1.00
25–44	1.12	0.63, 1.99
45–64	1.79*	1.01, 3.15
≥65	3.33**	1.46, 7.62
Education		
Some high school (Ref)	1.00	1.00, 1.00
High school	0.51**	0.33, 0.80
Some college	0.77	0.51, 1.17
College	0.99	0.61, 1.63
Annual household income, $		
<20,000 (Ref)	1.00	1.00, 1.00
20,000–29,999	0.81	0.51, 1.31
30,000–39,999	1.09	0.62, 1.95
40,000–49,999	1.07	0.63, 1.83
50,000–69,999	1.18	0.73, 1.91
70,000–99,999	0.87	0.50, 1.52
100,000–149,999	1.01	0.55, 1.84
≥150,000	0.95	0.46, 1.98

Dependent variable:	Invalid price per pack	
Weighted means	4.9%	
N	14,300	
	Coefficient (odds ratio)	95% CI
Marital Status		
Married or cohabitating (Ref)	1.00	1.00, 1.00
Widowed, divorced, or separated	0.78	0.54, 1.11
Never married, not cohabitating	0.80	0.56, 1.15
Health insurance		
Yes (Ref)	1.00	1.00, 1.00
No	0.99	0.73, 1.36
Employment status		
Employed (Ref)	1.00	1.00, 1.00
Unemployed	0.86	0.58, 1.28
Cigarette number		
<6 (Ref)	1.00	1.00, 1.00
6–14	0.64	0.39, 1.05
>14	0.76	0.39, 1.48
Smoking days		
Every (Ref)	1.00	1.00, 1.00
Some	1.41	0.78, 2.55

* Significant at .5 % level.

** Significant at .1 % level.

*** Significant at .1 % level.

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Table 1

Average price reduction for price minimization strategies from linear probability model multivariate regression analysis[a,b].

Dependent variable:		**Price per pack (in cents)**		**Natural log of price per pack**	
Weighted means:		**514**		**6.2**	
N:		**13,394**		**13,394**	
R-squared:		**0.567**		**0.521**	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Weighted means	**Coefficient (margin)**	**95% CI**	**Coefficient (percent)**	**95% CI**
Price minimization strategies[c]					
Generic brands	25.1	−65.2***	−73.7, −56.6	−16.9***	−18.9, −14.9
Cartons	24.4	−98.6***	−107.0, −90.3	−22.6***	−24.7, −20.5
Price promotions[d]	20.0	−26.4***	−34.2, −18.6	−4.9***	−6.6, −3.3
Indian reservations	7.3	−40.2***	−54.8, −25.5	−8.2***	−11.4, −5.1
Internet purchase[e]	1.2	−56.7**	−95.0, −18.5	−13.4**	−21.8, −5.0
Gender					
Male (Ref)	55.7	0.0	0.0, 0.0	0.0	0.0, 0.0
Female	44.3	7.6*	1.3, 13.9	2.0**	0.6, 3.4
Race/ethnicity					
White, non-Hispanic (Ref)	69.6	0.0	0.0, 0.0	0.0	0.0, 0.0
Black, non-Hispanic	12.4	22.9***	11.4, 34.5	4.2***	1.8, 6.6
Asian, non-Hispanic	1.0	32.1	−1.4, 65.5	5.7	−0.0, 11.4
Native American, non-Hispanic	2.8	2.9	−11.5, 17.2	0.2	−3.1, 3.5
Hispanic	11.4	12.2	−2.0, 26.3	1.8	−1.1, 4.7
Other, multiracial	2.9	16.1	−4.3, 36.5	2.1	−1.9, 6.2
Age					
18–24 (Ref)	15.0	0.0	0.0, 0.0	0.0	0.0, 0.0
25–44	44.9	−13.2*	−23.4, −3.0	−3.2**	−5.1, −1.2
45–64	33.7	−22.3***	−33.2, −11.5	−4.5***	−6.6, −2.3
≥65	6.4	−21.4**	−35.8, −7.0	−3.7*	−6.8, −0.6
Education					
Some high school (Ref)	22.6	0.0	0.0, 0.0	0.0	0.0, 0.0
High school	37.6	2.4	−6.8, 11.6	−0.1	−2.1, 1.9
Some college	30.3	−0.7	−10.6, 9.1	−0.7	−2.8, 1.4
College	9.6	6.9	−4.6, 18.5	1.0	−1.4, 3.4
Annual household income, $					
<20,000 (Ref)	22.6	0.0	0.0, 0.0	0.0	0.0, 0.0
20,000–29,999	14.7	6.6	−3.7, 16.8	2.6*	0.4, 4.8
30,000–39,999	15.4	8.7	−2.8, 20.2	2.8*	0.2, 5.5

Dependent variable:		Price per pack (in cents)		Natural log of price per pack	
Weighted means:		514		6.2	
N:		13,394		13,394	
R-squared:		0.567		0.521	
(1)	(2)	(3)	(4)	(5)	(6)
	Weighted means	Coefficient (margin)	95% CI	Coefficient (percent)	95% CI
40,000–49,999	13.9	20.3***	9.0, 31.6	5.2***	2.7, 7.6
50,000–69,999	14.9	20.8***	9.3, 32.3	5.4***	2.9, 7.8
70,000–99,999	10.1	36.9***	24.5, 49.2	9.1***	6.5, 11.6
100,000–149,999	6.1	40.6***	24.9, 56.2	9.6***	6.5, 12.8
≥ 150,000	2.4	39.7***	21.2, 58.2	9.4***	5.7, 13.1
Marital status					
Married or cohabirating (Ref)	50.0	0.0	0.0, 0.0	0.0	0.0, 0.0
Widowed, divorced, or separated	24.5	9.6*	1.5, 17.8	1.9*	0.1, 3.7
Never married, not cohabirating	25.6	17.7***	9.1, 26.4	3.2***	1.5, 4.9
Health insurance status					
Yes (Ref)	63.3	0.0	0.0, 0.0	0.0	0.0, 0.0
No	36.7	−1.8	−8.9, 5.4	−0.7	−2.2, 0.9
Employment status					
Employed (Ref)	56.7	0.0	0.0, 0.0	0.0	0.0, 0.0
Unemployed	43.3	−9.1*	−16.3, −1.9	−2.5**	−4.1, −1.0
Cigarette number					
<6 (Ref)	25.9	0.0	0.0, 0.0	0.0	0.0, 0.0
6–14	26.4	−6.7	−16.9, 3.4	−1.7	−3.8, 0.5
>14	47.8	−11.8*	−22.4, −1.2	−2.6*	−5.0, −0.3
Smoking days					
Every (Ref)	78.8	0.0	0.0, 0.0	0.0	0.0, 0.0
Some	21.2	−13.4*	−24.0, −2.8	−3.4**	−5.8, −1.1

*Significant at 5% level.

**Significant at 1% leve.

***Significant at .1% level.

[a]The regressions included state fixed effects, quarter fixed effects, county population density, strength of state smoke free air laws, state cigarette excise tax rates, motor gasoline prices, and a constant term, but those terms are not reported.

[b]Statistical significance and confidence intervals are determined using standard errors that are cluster-corrected at the state/sub-state and phone type level.

[c]Cigarette price minimization strategy estimates are compared to a reference category of non-use of each strategy. Statistically significant negative coefficients for the price minimization strategies suggest that individuals practicing these strategies are reducing prices by the amounts given by the coefficients (in cents or as a percent of the price).

[d]Price promotions include coupon, rebates, buy 1 get 1 free, 2 for 1, or any other special promotions.

[e] This estimate should be interpreted with caution due to a low sample size.

Table 2

Price reduction estimates from use of price promotions, interacted with brand and age.[a]

Dependent variable:	**Price per pack (in cents)**	
Weighted means	**514**	
N	**13,394**	
	Coefficient (margin)	**95% CI**
Model #1		
Price promotion × regular brand (Ref)	0.0	0.0, 0.0
Price promotion × generic brand	22.9*	−0.5, 46.4
Model #2		
Price promotion × high market share brand (Ref)	0.0	0.0, 0.0
Price promotion × low market share brand	−10.3	−30.3, 9.6
Price promotion × other/missing brand	24.1**	0.5, 47.7

*Significant at 5% level.

**Significant at 1% level.

[a]Themodels are estimated identically to the model in Table 1, with the addition of reported interaction terms. All constitutive elements of the interaction term are included as standalone variables (Brambor et al., 2006; Braumoeller, 2004).