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DEMAND FOR SMOKELESS TOBACCO: ROLE OF MAGAZINE ADVERTISING

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ABSTRACT

While the prevalence of smokeless tobacco (ST) is low relative to smoking, the distribution of ST use is highly skewed with consumption concentrated among certain segments of the population (rural residents, males, whites, low-educated individuals). Furthermore, there is suggestive evidence that use has trended upwards recently for groups that have traditionally been at low risk of using ST, and thus started to diffuse across demographics. This study provides the first estimates, at the national level, of the effects of magazine advertising on ST use. The focus on magazine advertising is significant given that ST manufacturers have been banned from using other conventional media since the 1986 Comprehensive ST Act and the 1998 ST Master Settlement Agreement. This study is based on the 2003-2009 waves of the National Consumer Survey (NCS), a unique data source that contains extensive information on the reading habits of individuals, matched with magazine-specific advertising information over the sample period. This allows detailed and salient measures of advertising exposure at the individual level and addresses potential bias due to endogeneity and selective targeting. We find consistent and robust evidence that exposure to ST ads in magazines raises ST use, especially among males, with an estimated elasticity of 0.11. Estimates further indicate that both ST taxes and cigarette taxes reduce ST use, suggesting complementarity between these tobacco products. Sub-analyses point to some differences in the advertising and tax response across segments of the population. The advertising effects from this study inform the debate in the literature with respect to whether, and the extent to which, tobacco advertising affects primary demand at the market level versus brand-shifting.

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I. Introduction

The consumption of smokeless tobacco (ST) in the U.S. underwent a resurgence in the 1970s, following increased public awareness of the hazards of cigarette smoking and consequent declines in smoking prevalence. While the production of smokeless tobacco had declined by 38% between 1944 and 1968, the trend subsequently reversed and production increased by 47% until 1985 (USDHHS 1986) when two significant events took place (Chaloupka et al. 1997). The first was the release in 1986 of the Surgeon General's report (U.S. Department of Health and Human Services - USDHHS 1986) on the health consequences of using smokeless tobacco, which reached four major conclusions: 1) ST represents a significant health risk; 2) ST can cause cancer and a number of non-cancerous oral conditions; 3) ST can lead to nicotine addiction and dependence; and 4) ST is not a safe substitute for cigarette smoking. The report further cautioned that ST can increase the risk of cardiovascular disease, including heart attacks.[1] Also in the same year, Congress passed the Comprehensive Smokeless Tobacco Act, which banned advertising of ST products on broadcast media and required health warnings to be displayed on ST packages. These actions were followed by declining ST sales over the 1990s, though more recently sales have again trended upwards (see Figure 1).

Smokeless tobacco (ST) is not subject to combustion, and generally consumed orally in two forms in the U.S.: chewing tobacco, which is chewed or held in the cheek or lower lip to release flavor and nicotine, and moist snuff, which has a much finer consistency, does not require chewing or spitting, and comprises the vast majority of ST sales (87%) and ST users

[1] Since ST products contain nicotine, users demonstrate signs of dependence similar to those of cigarette smokers, including tolerance with repeated use and symptoms of withdrawal upon cessation of use.

(79%).[2] In 2010, 3.6% of adults reported current use of smokeless tobacco, and while this overall prevalence rate is low relative to cigarette smoking (24.6%), there are segments of the population with high usage of ST. The distribution of ST use has traditionally been highly skewed with use concentrated among certain population sub-groups. For instance, as shown in Table 1, in rural counties the prevalence of past-month ST use is 7.1% compared with 2.2% in large metropolitan counties. Among young adult males between the ages of 18-34, 10.4% report using ST in the past month; past year and lifetime prevalence for this group are 15.3% and 36.5% respectively. Use of ST is also significantly higher among low-educated individuals, and among residents in the Midwest and South relative to other areas of the country.[3]

Furthermore, recent waves indicate that smokeless tobacco use may be on the rise for certain demographic groups (Table 1). Past month prevalence of ST use declined among adults until the late 1990s, but since then has trended slightly upwards. Among specific sub-groups, the rise is more prominent; for instance, among non-Hispanic white males between the ages of 18 and 34, use has increased from 10.2% in 1998 to 15.7% in 2010. Use has also increased among urban residents, among Hispanics and other races (besides white and black), and among those with high levels of educational attainment. Since these are groups which traditionally have had low prevalence rates, the recent trends suggest that ST use may be diffusing across demographic segments.

[2] Snuff is also produced in dry form, which can be sniffed or inhaled, though the use of this form of smokeless tobacco is not highly prevalent in the U.S.

[3] Data from 2003-2009 waves of the National Consumer Survey (described in the Data section) show that prevalence among adult males residing in the Northeast was 2.8%, 5.0% among those residing in the Midwest, 6.2% among Southern residents, and 3.6% among those residing in the West. Prevalence is especially high among adult males in the following census divisions: West North Central (6.5%), East South Central (10.5%), West South Central (6.6%), and Mountain (6.4%).

While on their own these recent trends may not appear pronounced, they are in contrast to the decline in ST use that occurred over most of the 1990s. The recent trends appear even more divergent when compared with trends in cigarette smoking. The number of current smokers has steadily declined over the past three decades. Among adults, past-month smoking decreased from 38.3% in 1978, to 28.7% in 1998, to 24.6% in 2010 (National Survey on Drug Use and Health - NSDUH). Thus, while smoking rates have declined over recent years for adults and youth, the decline in smokeless tobacco use that occurred throughout the 1990s has stagnated and even reversed course within some demographic groups, suggesting that part of the decrease in smoking may have been offset by an increase in the use of ST.

As smoking bans are imposed across the nation and cigarette sales continue to decline, new ST products are marketed to smokers for use in situations where they may be unable to smoke. Tobacco manufacturers are capitalizing on the "anytime, anywhere" function of ST products to target smokers with nicotine cravings in settings where smoking is not permitted.[4] Renewed marketing efforts by ST manufacturers are designed to attract new demographic groups, which have previously been at low-risk of using ST products, and to expand the ST market. These efforts include specific targeting of print advertising (and other promotion)

[4] Meija (2008) describes the new Camel snus advertising campaign, which departs from historic marketing that had targeted rural low-income males and instead targets urban users and women. Camel's smokeless tobacco ads, for instance, use the slogan "Before, During, and After – Boldly Go Everywhere" (http://oppose.ning.com/profiles/blogs/anytime-anywhere-the-appeal-of) and "NYC Smokers: Rise above the Ban" (http://www.adrants.com/2011/05/reynolds-touts-smokeless-cigs-country.php); Marlboro uses the slogan "Smokeless for Smokers" (http://www.voicenews.com/articles/2012/02/21/news/doc4f4408539072a058762743.txt) ; Exalt Snus, a type of snuff, was marketed with the slogan "No Smoking? No Problem" (http://tobaccoproducts.org/index.php/Exalt_Snus).

towards youth, women, non-whites, and other users beyond the traditional market segments as well as a new generation of ST products that are designed to appeal to these groups.[5]

The Family Smoking Prevention and Tobacco Control Act, signed into law in June 2009, gives the Food and Drug Administration (FDA) authority to regulate the content, marketing, and sale of tobacco products. It requires new and larger health warning labels for smokeless tobacco products. The FDA is also considering whether to allow tobacco companies to market some tobacco products as "modified-risk" or safer alternatives to cigarettes. A recent Institute of Medicine (IOM) report warned, however, that relative health effects of such modified-risk tobacco products remain uncertain and suggested that makers of ST products "face high hurdles before they can market them as less harmful".[6]

Despite claims that ST use is less harmful than smoking or that ST products may be used as a tool to help smokers quit smoking, the evidence on this debate is mixed. Some studies suggest that use of ST products is associated with a higher probability of quitting smoking (Ramström and Foulds 2006; Ault et al. 2004). Critics contend however that increased ST use could reduce smoking cessation because smokers who would otherwise quit due to the inconvenience of smoking bans may use ST products when smoking is not allowed and resort back to smoking when permitted (Gartner et al. 2007). Indeed, some evidence suggests that smokeless tobacco may be a gateway product for subsequent smoking among male youths and may have little beneficial effects on the likelihood of quitting smoking (Tauras et al. 2007; Bask and Melkersson 2003; Tomar 2003). In any case smokeless tobacco exposes users to harmful

[5] Philip Morris and R.J. Reynolds have introduced new ST products using the familiar brand names, Marlboro and Camel, and based on flavorings, such as mint or fruit flavors, and new delivery methods such as lozenges or small pouches that eliminate the need to spit.
[6] http://online.wsj.com/article/SB10001424052970204844504577098850885101984.html

carcinogens and magnifies a user's risk for the same types of health harms as smoking, and poses a significant public health concern (USDHHS 1986).

The shift in trends, marketing, and declines in smoking, combined with the 1998 Smokeless Tobacco Master Settlement Agreement that imposed further restrictions on advertising practices, suggest that the tobacco market landscape has shifted. Thus, current estimates of the effects of various policy-relevant factors on the demand for ST take on added relevance. This study examines the determinants of smokeless tobacco use, with a particular focus on estimating the impact of magazine advertising, based on 2003-2009 waves of the National Consumer Survey (NCS). The focus on magazine advertising is especially salient given that advertising expenditures in magazines increased by 83% between 1995 and 2005. Magazines comprise the single largest component of media advertising for ST, and their share in total advertising (which includes both media ads and point-of-sale promotion) has also doubled from 19% in 1997 to 38% in 2005 (Federal Trade Commission - FTC 2011).

Identifying the causal effects of advertising remains a challenge in the literature due to potential bias from simultaneity and the selective targeting of potential users. This study is based on the National Consumer Survey (NCS), a unique data source that contains extensive information on the reading habits of individuals, allowing detailed and salient measures of magazine advertising exposure at the individual level.[7] Models exploit this variation in individual-specific advertising exposure, within magazine groups, to identify plausibly causal

[7] Cawley et al. (2011) note that the media usage and consumer demographic information from the NCS is used by virtually all major marketing and advertising firms in the country; thus, the use of the NCS allows the researcher to observe the same consumer information and characteristics as the advertiser, limiting the potential for ads being targeted based on factors that may remain unobserved by the researcher (Avery et al. 2007).

effects on ST use within a fully-specified demand model that also considers the role of ST taxes and cigarette taxes. For instance, two persons reading the same types of magazines (for instance, automobile magazines) may be exposed to different levels of ST ads because one reads *Car & Driver* and one reads *Popular Mechanics*.

These measures of advertising exposure, which vary at the individual level, significantly improve upon much of the tobacco advertising literature that has relied on aggregate measures (Dave and Kelly 2012).[8] Most of this literature is confined to cigarettes, and no study has specifically estimated the effects of ST advertising using national data. Given recent strategic shifts in ST marketing and the suggestive rise in ST use among certain demographic groups, this study also assesses differential responses to advertising and tobacco taxes across various segments of the population, providing the most comprehensive picture of the determinants of ST use to date.

Owing to the external and internal costs of tobacco use[9], the key debate on advertising has understandably centered on whether, and the extent to which, tobacco advertising and promotion impacts primary (market) demand versus selective (brand-specific) demand. The industry maintains the latter viewpoint in contending that their advertising practices are intended only to affect brand-specific sales and market share, whereas the concern for public health centers on the potential for advertising to raise total consumption and expand the size

[8] One notable exception is the study by Avery et al. (2007) who also use NCS data with a similar identification strategy to examine the link between smoking cessation product ads and smoking cessation.

[9] External costs of cigarette smoking stem from passive smoking and the potentially higher burden on the public health care system as well as privately insured non-smokers due to a higher prevalence of adverse health conditions among smokers. Internal costs stem from time-inconsistent preferences and self-control problems as well as potential informational asymmetry if individuals do not comprehend the full costs of tobacco use. With the exception of externalities due to passive smoking, ST use also imposes similar external costs as smoking related to a higher burden on the health care system and insured non-users.

of the overall market. Empirical studies have been challenged in trying to isolate the causal effects of advertising in health care markets, and no prior study has provided evidence on whether ST advertising affects total ST demand. Thus, estimates from this study are also relevant in informing this broader debate with respect to whether advertising for tobacco products is effective in expanding primary demand.[10]

II. Background

Advertising

In November of 1998, the Smokeless Tobacco Master Settlement Agreement (STMSA) was signed by the United States Smokeless Tobacco Company (USST), which has about a 60% market share in the U.S., and by the Attorneys General of 44 states. In addition to monetary payments to the states, the STMSA required the elimination of tobacco advertisements on billboards, in arenas, stadiums, shopping malls, video arcades and on private or public transit vehicles or waiting areas. Advertising in the broadcast media was already banned since 1986 by the Comprehensive Smokeless Tobacco Act.

Figure 2 shows trends in total promotional expenditures in real terms, which includes both media advertising as well as other promotions such as sampling and price discounts, for ST products in the U.S. between 1986-2008. Figure 3 shows trends in magazine and other media advertising. Despite the 1986 broadcast media ban, there was not a significant decline in total promotional spending due to a shift in marketing towards magazines, outdoors, point-of-sale, public entertainment venues and especially price-based promotion through coupons and direct discounts to retailers for product placement. Over the period shown, total advertising and

[10] See Dave and Kelly (2012 Forthcoming) for issues relating to advertising in the health care markets, including markets for addictive goods such as tobacco and alcohol.

promotion increased by 242% after adjusting for inflation. In 2008, total advertising and promotion comprised almost 20% of ST sales, compared to an all-industry average of about 2-3% (Dave and Kelly 2012). The bulk of total marketing (68.5%) in 2008 comprised coupons and price discounts. Figure 3 shows that, as media outlets such as television, radio, outdoor billboards and venues, and transit vehicles were banned from carrying ads for ST products, companies shifted their media advertising towards magazines and point-of-sale displays. In real terms, magazine advertising expenditures increased by 177% over 1988-2004, raising their share of total media spending from 30% to 51% over this period. A slight decline in both magazine ads as well as total media spending ensued over the next three years, though media ads have resurged since 2007; analyses data suggest a 60% increase in magazine ad expenditure between 2007 and 2009.[11]

Another event that altered the tobacco market in the U.S. and affected the marketing of tobacco occurred in November of 1998, when the Attorneys General for 46 states and the District of Columbia also signed a comprehensive Master Settlement Agreement (MSA) with the nation's largest tobacco companies, settling a number of lawsuits brought by these states against the manufacturers. In addition to banning outdoor and transit advertising and any advertising targeted at youth, the MSA also committed the industry to pay $206 billion to the participating states over 25 years.[12] As a result of the MSA, substantial new funding became available to the states, which could be used for anti-smoking programs. Subsequent to the MSA, 31 states and the District of Columbia initiated a counter-advertising campaign that may

[11] The share of magazine ad expenditures increased from 19% in 1986 to 57% in 2002, but since then has declined to about a third of all media spending.

[12] The four states that are not part of the MSA - Florida, Minnesota, Mississippi, and Texas - reached individual settlements totaling $40 billion over 25 years.

have affected smoking behaviors (Farrelly et al. 2003). Part of the shift in advertising and promotional spending on ST, after 1999, may also be a response to the shrinking market for cigarettes.

The STMSA required that ST manufacturers stop targeting youth through advertising and promotion.[13] Subsequent to the STMSA, magazines have become a primary form of media advertising for ST manufacturers, which underscores the importance of studying the impact of this form of advertising. Since many magazines generally have very specific readership demographics, they can be ideal for targeting advertising messages to various groups. A report by the Massachusetts Department of Health (2002) examined the overall level of ST advertising and the youth-targeted level of advertising in magazines from 1997 to 2001. The report finds that total ST advertising expenditures and youth-targeted ST advertising expenditures increased after the STMSA. A more recent study by Morrison et al. (2008) uses industry data to assess the level of ST advertising in popular magazines with a large youth-based audience. They conclude that advertising of ST products are increasingly targeted at youth.

Table 2 documents trends in exposure to ST advertising in magazines across various population segments over 2003-2009 based on the analyses data. Column 1 shows the percent of the adult population who have read a magazine issue that carried an ST ad over the past month (see Data section for further details). This exposure measure generally tracks the recent trend in magazine advertising expenditure shown in Figure 3. In 2003, 42.7% of the adult population was exposed to some magazine ST ad; this proportion decreased to 23.9% in 2005 and then subsequently increased to over 60% in 2008.

[13] The Food and Drug Administration (FDA) has defined youth magazines to be those with more than 15% of their readers under 18 years of age or more than two million readers who are under 18 years of age.

Evidence bearing on the targeting of ST ads can be gleaned from comparing the demographic breakdown of persons exposed to ST ads with their prevalence in the general population. For instance, in 2003, 63% of those who were exposed to a magazine ST ad were males, a fraction that is significantly higher than their representation in the overall sample (48%), which is suggestive of targeting of ST ads to males. There is also some evidence that ST ads are targeted towards magazines whose audience is relatively more white, educated (more than a high-school education), and residents of MSA's. Since the focus of this study is on adults ages 18 and older, the analyses data do not permit an examination of magazine advertising exposure among minors. However, the data do indicate that at least in the early part of the sample period, youths ages 18-24 had a greater exposure to magazine ST ads (16-18%) relative to their prevalence in the population (12%). The proportion of youths exposed has declined since then. While smokeless tobacco advertising continues to be targeted towards other conventional user segments, demographic groups that were traditionally at low-risk of using ST products also appear to be increasingly targeted. For instance, in 2003, 37.2% of individuals who had read a magazine in the past month which had some ad for a smokeless tobacco product were females; this exposure increased to 40.8% in 2009; similarly, exposure among Hispanics and older adults also increased over this period. There is also some suggestive evidence of increased targeting of MSA residents, as the portion of exposed adults residing in an MSA county increased from 40% (2004) to 42.1% (2009). ST ads began to appear for the first time in magazines such as *Vogue*, *Marie Claire*, *Glamour*, *Latina*, and *Golf Magazine,* whose primary audience was traditionally at low-risk of being an ST user. These trends in exposure are

suggestive of a possible shift in the demographic targeting of ST advertising in an effort to recruit new populations into ST use.

Related Literature

There are three strands of the literature that inform the analyses undertaken in this study. The first set of studies has examined the effects of tobacco taxes and prices on the use of ST. These studies consistently find that higher ST taxes reduce ST use. Chaloupka, Tauras, and Grossman (1997) utilize information on smokeless tobacco use among adolescent males from the 1992, 1993, and 1994 Monitoring the Future (MTF) Surveys. Site-specific smokeless tobacco tax data and several measures of limits on youth access to tobacco products were appended to the survey data. They find that increases in ST taxes are associated with significant reductions in both the number of adolescent males using smokeless tobacco and in the frequency of smokeless tobacco use. The overall own-tax (own-price) elasticity ranges from -0.06 to -0.10 (-0.4 to -0.7). In addition, strong limits on youth access to smokeless tobacco products are found to be effective in reducing participation and frequency of smokeless tobacco use by young males. Similarly, Tauras et al. (2007), based on biennial data from the 1995-2001 Youth Risk Behavior Survey (YRBS), also find that higher smokeless tobacco taxes significantly reduce the number of male student users of ST and their frequency of use. Ohsfeldt, Boyle, and Capilouto (1997) use data from the 1985 Current Population Survey (CPS) to estimate the effects of tobacco taxes and state laws restricting smoking in public places on the use of ST products. Their results show that ST excise tax rates are associated with a reduced probability of ST use, though state restrictions on public smoking have no effects on ST use. Their 1998 study (Ohsfeldt, Boyle, and Capilouto 1998) confirms the negative own-tax

response with additional waves of data from the CPS (September 1992, January 1993 and May 1993), estimating a tax elasticity for snuff of -0.10. In contrast to their 1997 study, they conclude that laws restricting smoking in workplaces or other public places tend to discourage the use of snuff (though the effects are not always consistent).

Whereas the literature points to consistent evidence on negative own-tax effects, the evidence on cross-effects with respect to cigarette taxes or prices is mixed. Tauras et al. (2007) and Bask and Melkersson (2003) for instance find negative cross-price effects of ST use with respect to cigarette prices, suggesting that ST and cigarettes are economic complements. Ohsfeldt and Boyle (1994) and Ohsfeldt, Boyle, and Capilouto (1997, 1998), on the other hand, find that higher cigarette excise tax rates are associated with an increased probability of ST use, suggesting that ST and cigarettes are economic substitutes.

These mixed findings on the direction of the cross-price effects, which has implications for the substitution or complementarity between ST and cigarettes, are also reflected in the second strand of the literature that has examined the relationship between ST use and smoking. Bask and Melkersson (2003) apply a rational addiction framework and jointly model the demand for cigarettes and ST. Based on negative cross-price elasticities, they conclude that use of snus contributes to increased smoking. Ault et al. (2004) consider whether an increase in ST use could lead to reduced smoking rates, based on data from the Third National Health and Nutrition Examination Surveys (NHANES III). They find that the use of ST by an average male smoker would increase the likelihood of smoking cessation by over 10%, with the effects declining after age 65. The study is careful to account for the addictive stock accrued from lifetime smoking, though the simultaneity between smoking and ST use is not addressed.

Ramström and Foulds (2006) study patterns of initiation and current use of ST and cigarettes among 6,752 Swedes in 2001. They find that the odds of initiating daily smoking were significantly lower among males who had started using snus (a form of snuff) relative to those who had not. Among males who made attempts to quit smoking, snus was the most commonly used cessation aid (used by 24% on their last cessation attempt). Among male smokers who used snus as a cessation aid, 66% succeeded in quitting completely. The authors conclude that use of snus in Sweden is associated with a reduced probability of becoming a daily smoker and an increased likelihood of smoking cessation. Tomar (2003) assessed 4-year initiation rates of ST use and cigarette smoking based on the 1989 Teenage Attitudes and Practices Survey and its 1993 follow-up study. He finds that non-smoking teen males in 1989, who had regularly used ST, were more than three times as likely to be current smokers four years later compared to those who had never used ST. The study concludes that ST may be a "starter product" for subsequent smoking among young males and may have little effect on smoking cessation. Haddock et al. (2002) study ST as a precursor of smoking among young adult males. They employ a sample of U.S. Air Force recruits who never smoked cigarettes. Among these recruits, 5.1% reported current ST use and 2.5% reported a past history of ST use. At the 1-year follow-up, current ST users were 233% more likely to have initiated smoking than non-users. Similarly, recruits who reported past ST use were 227% more likely to begin smoking than participants who had never used ST. The study concludes that ST use is a predictor of smoking initiation among young adult males. These studies are suggestive of a complex relationship between ST use and smoking that may vary across countries and population groups. However, the analyses

do not account for the simultaneity between ST use and smoking or allow for unobserved individual heterogeneity, which in turn limits causal inference.

The third strand of the literature, directly relevant for this study, concerns the effects of ST advertising but it is also the most limited. No prior study has estimated the effects of ST advertising on use based on national data from the U.S. Choi et al. (1995), for instance, study ST use among adolescent boys sampled in three waves of the California Tobacco Surveys (1990, 1992, and 1993). Using logistic regression models, they find that ST advertisements are positively associated with ST use. Cigarette smokers were also at higher risk of using ST (consistent with a complementary relation between the two tobacco products). The advertising effects, however, are based on recalled exposure to ST ads and thus subject to endogeneity bias; users or potential users are more likely to recall ST ads. Tomar (2007) reviews the literature on ST use relative to smoking in Sweden and Norway, and concludes that increased promotion of ST has contributed to increased sales primarily among adolescents and young adult males. In contrast to the very sparse literature on ST advertising, there have been many studies that have examined the effects of cigarette advertising. Dave and Kelly (2012) provide a review of this literature. While the evidence on whether cigarette ads expand primary demand is also generally mixed and needs to be interpreted with caution due to endogeneity concerns and lack of statistical variation in the advertising measures, some of the more sophisticated analyses that have addressed these challenges tend to find that advertising in the cigarette market does raise the size of the overall market (see, for instance, Saffer and Chaloupka 2000; Tye, Warner, and Glantz 1987).

Avery et al. (2007) utilize a similar identification strategy and dataset as used in the present study to examine the effects of smoking cessation advertisements.[14] Specifically, they match information on individual magazine-reading habits from the 1995-1999 Simmons National Consumer Survey (NCS) with all print advertisements for smoking cessation products, tobacco products, and smoking-related public service announcements that appeared between January 1985 and May 2002 in 26 consumer magazines. They find that smokers who are exposed to more magazine ads are more likely to attempt to quit and are more likely to have successfully quit. They also find that, while some of this effect expectedly operates through the purchase of cessation products, ads can also increase the likelihood of quitting without the use of any cessation product.

Summary and Contributions

A limited set of studies have found consistent evidence that higher ST taxes can reduce participation and consumption, while the evidence on the effects of cigarette taxes and/or prices is quite mixed. All of these studies, however, with the exception of Tauras et al. (2007) (which is based on high school students) utilize pre-STMSA data. Given the recent rising trends in ST use, diffusion of use across demographics, and a shifting tobacco market landscape with respect to advertising and promotion, the results from the reviewed studies may not be reflective of current conditions. In response to a declining cigarette market and restricted opportunities to attract initiators into smoking as a result of the MSA, tobacco manufacturers have focused on smokeless tobacco. Anecdotal evidence and advertising content analysis suggest that ST firms may be trying to attract new demographic segments into the market and

[14] Also see Cawley, Avery, and Eisenberg (2011). They also use the NCS to examine the effects of ads in 26 magazines for over-the-counter weight-loss products on the use of such products.

to capture smokers who may be trying to quit. And, magazine advertising has become a key mode for marketing ST given the bans on other media (broadcast, outdoor billboards, transit, shopping malls, waiting areas, public entertainment and sporting venues) instituted by the 1986 Comprehensive Smokeless Tobacco Act and 1998 STMSA. However, no prior study has estimated whether, and the extent to which, such advertising impacts the demand for ST in the U.S.

This study addresses these gaps, provides the first national estimates of the effects of magazine advertising on ST use, and updates the estimated elasticities with respect to tobacco taxes. The analyses exploit unique individual-level data from the 2003-2009 waves of the NCS to address endogeneity bias and identify plausibly causal effects of advertising, a key challenge that has plagued virtually all non-experimental studies of advertising in cigarette and other markets (Dave and Kelly 2012; Chaloupka and Saffer 2000). Most of the above noted results for ST are based on teens and adolescents, with few studies conducted among young adults and adults – another gap which is addressed by the utilization of the NCS data. Given the rise in ST use among certain demographic groups, suggestive shifts in advertising targeting, and prior evidence of heterogeneous effects in the alcohol and cigarette markets (see Chaloupka an Warner 2000 and Saffer and Dave 2006, for instance), this study also examines differential advertising and tax responses across segments of the population.

III. Analytical Framework

Advertising Theory

It is often presumed that the average consumer is responsive to advertising and promotion.[15] However, one of the key questions with respect to advertising by firms in the tobacco market is whether advertising raises "selective" or brand-specific demand versus "primary" or industry-wide demand (Bagwell 2007; Dave and Kelly 2012). Due to the externalities and internalities associated with tobacco use, the answer to this question has normative implications and relevance for public health. Under the persuasive view, advertising can help firms to differentiate their products, generate an outward shift in firm-level demand, and make demand relatively less elastic. Advertising impacts demand by altering consumers' tastes and preferences. The informative view of advertising points to the transfer of information to consumers as another explanation for why consumers respond to advertising. In markets characterized by imperfect information, advertising can effectively reduce search costs by conveying direct or indirect information to consumers regarding the existence, quality, price and other attributes of products.

Nelson (1970) distinguishes between search goods, wherein the consumer can determine quality prior to purchase though perhaps after incurring some search costs, and experience goods, wherein the consumer can assess quality or attributes only after consumption. Advertising addresses an informational imbalance for experience goods by providing indirect information content regarding quality, and advertising intensity is thus predicted to be higher for experience goods. Especially for new users, ST products may have experience attributes, consistent with the high advertising-to-sales ratio for the industry.

[15] See Bagwell (2007) and Dave and Kelly (2012) for an expanded discussion on the economics of advertising in health care markets.

A third view of advertising provides a framework under which advertising is complementary to the advertised product. That is, advertising does not need to exert any direct influence on consumer preferences, and it may or may not possess information content. Within a household production framework, Stigler and Becker (1977) model the advertised product with its associated advertising expenditures as inputs into the production function for each final commodity, implying a complementarity between the advertised product and its advertising. Under this framework, a higher level of advertising can raise demand since the consumer now believes that he can obtain a greater output of the final commodity from a given input of the advertised good. In a related but separate framework, Becker and Murphy (1993) directly model advertising as an input into the individual's utility function. Advertising raises demand in this framework by increasing the marginal utility of the advertised good.[16]

Both of these paradigms, which impart a complementary role to advertising, also bridge back to the informative view. For instance, if advertising enables consumers to produce information at lower cost, then consumers can indeed more efficiently convert market goods into valued final commodities, as assumed in Stigler and Becker (1977). And, even if advertising in uninformative, consumers may value it directly, as assumed in Becker and Murphy (1993).

The upshot of this discussion is that there are elements of each view of advertising that apply to ST products. Recently, tobacco manufacturers have launched a new generation of ST products, including adding new brands with different attributes such as flavoring, packaging and nicotine delivery systems to existing brand families, which are designed to appeal to new consumers. New or potential users have limited information about the actual costs and

[16] Note that this complementarity follows from the fact that there does not exist a separate market for advertising messages – considerable transactions and monitoring costs make it infeasible to separately sell advertising to consumers.

benefits of ST. Advertising, along with other marketing techniques and observations of social norms, provide potential users with information about these costs and benefits. For instance, ST ads often "inform" consumers that ST products can be used as an alternative nicotine delivery system in situations where smoking is not permitted. Consistent with the Becker and Murphy (1993) framework, ST advertising is also designed to create positive imagery related to consumption. Advertising-supplied information can result in more positive expectancies about ST, which can change actual or intended consumption behavior. Since ST advertising can therefore affect both selective (brand-centric) as well as primary (market) demand under these views, the question cannot be resolved based on theory alone and empirical evidence needs to bear upon the specific demand effects of ST advertising.

Methodology

The objective of this study is to estimate whether, and the extent to which, magazine ST advertising affects the use of ST. Drawing from the above framework, the following demand function relates ST use to advertising and taxes.

$$(1) \quad ST_{icmt} = \alpha + \beta_1(ADEXP_{imt}) + \beta_2(STTAX_{cmt}) + \beta_3(CIGTAX_{cmt}) + X_{icmt}\,\lambda + Z_{ct}\,\Phi + MONTH_m\,\Omega + YEAR_t\,\Psi + \mu_{icmt}$$

Equation (1) denotes that the use of smokeless tobacco (*ST*) by the i^{th} individual, residing in state *c* and interviewed in month *m* of year *t*, is a function of the person's exposure to magazine ST advertising (*ADEXP*), tax rate for ST products (*STTAX*), excise tax for cigarettes (*CIGTAX*), a vector of individual-specific (*X*) factors such as socio-economic characteristics, and a vector of time-varying state-specific (*Z*) factors. The parameter μ represents an individual error term.

As a proxy for the cost of ST products and cigarettes, tax rates are utilized for several reasons. First, focusing on the state tax bypasses simultaneity between price and demand. Changes in the state-level tax rate are plausibly exogenous to the individual's ST use, often changing in response to the state's budgetary needs. Studies have also confirmed that changes in tobacco taxes are strongly correlated with changes in price. For instance, for the average consumer, cigarette taxes are fully passed on one-to-one with respect to retail prices (DeCicca, Kenkel, and Liu 2010). Second, the focus on taxes provides direct estimates of the effect of an important public policy tool. There remains substantial variation in tobacco taxes across states; states have enacted widely differing rates, leaving considerable room for policy manipulation. Furthermore, the own-price and cross-price elasticity of ST use can be recovered from the estimated tax elasticity based on the percent of the tax represented in the price and the tax pass-through rate.

Given that the outcome variable is a dichotomous measure of current ST use, probit models are estimated in all cases.[17] Average marginal effects are reported.[18] All models include indicators for month of interview (*MONTH*), to capture seasonal variation in tobacco use, and year indicators (*YEAR*), to capture unobserved national trends including variation in other forms of marketing and promotional activities related to ST. Standard errors are adjusted on the conservative side to account for all arbitrary correlation within state cells over time.

[17] All models adjust for sampling weights. Logit models yield very similar results (available upon request).
[18] With the average marginal effect, a marginal effect is computed for each individual observation and then all the computed effects are averaged. This contrasts with the marginal effect computed at the mean (MEM), which uses the mean values for all covariates when computing a single marginal effect. MEMs have been criticized since no actual individual may have mean values for all covariates, no actual individual has a mean value for any dichotomous indicator, and effects are computed at only one set of values. Nevertheless, estimates and conclusions are robust with MEMs.

We extend the basic model specified in Equation (1) in a number of ways to address specific issues and to assess robustness and plausibility. First, we estimate specifications that address the potential endogeneity of advertising by including indicators for detailed magazine groups and controlling for magazine reading intensity (total number of different magazines read and number of issues read). These specifications exploit variation in ad exposure that occurs due to individual differences in the magazines read within the same magazine group. For instance, two males who decide to read sporting magazines and who have the same overall magazine reading habits (read the same number of different magazines and read the same number of total issues over all magazines) may be exposed to different levels of ST ads because one male reads more *Sports Illustrated* while another reads more *Sporting News*.

Second, we control for an expanded set of individual factors, including attempted smoking cessation, children in the household, and past and present participation in the armed forces, to address residual unobserved person-specific heterogeneity. It is notable that the NCS database is also used by major advertisers, allowing us to observe the same consumer demographic and media usage information, and thus reduces the potential for systematic targeting on further unobservables (Avery et al. 2007; Cawley et al. 2011).[19] Third, specifications further include indicators for the nine census divisions and control for measures of state-level tobacco control spending to account for unobserved area-specific factors that may be driving targeting decisions and ST use. For instance, as noted earlier, ST use has been traditionally high among males in the Midwest and South, and advertisers also tend to target ads to rural residents. Thus, these area-specific measures capture these systematic differences

[19] The exact method through which consumer demographic and media information (for instance, non-linearities in the formula) are used in targeting decisions remains unobserved.

in the use of ST products and advertising exposure due to the targeting of ads based on geographic residence.

Third, we assess differential responses to magazine advertising and tobacco taxes through sub-analyses based on gender, age, race, and educational attainment. Finally, we assess robustness of the findings to alternative specifications and measures of advertising exposure. First, we test for diminishing returns of the advertising response function by including a quadratic term for the requisite measure of ad exposure. However, it should be noted that diminishing returns is already captured through the concavity of the probit specification (Saffer and Dave 2008). Second, according to prior studies in the advertising literature, the impact of advertising can linger beyond the time of its presentation. Thus, alternative models utilize a measure of the advertising exposure stock, constructed to include the current's month's exposure and a decay-weighted sum of past advertising, to capture any durable effects of the ads. Third, we utilize alternate constructs of advertising exposure (defined in the next section) to gauge the consistency of the advertising elasticity estimates under alternative assumptions. Finally, we implement a placebo test to confirm that the results are not driven by residual unobserved heterogeneity.

IV. Data

National Consumer Study

The empirical analyses are based on individual records from the 2003-2009 Simmons National Consumer Survey (NCS). The NCS is nationally-representative of the non-institutional civilian adult population (ages 18+) in the 48 contiguous states plus D.C., and includes about 25,000 individuals in each wave. The NCS data are used by major marketing and advertising

agencies in the U.S. Thus, as noted by Avery et al. (2007), the researcher is able to observe and control for the same consumer demographics and media usage information that are typically available to marketing firms.

A dichotomous indicator is defined for whether the respondent currently uses any smokeless tobacco product, including moist snuff, chewing tobacco, or other types of ST. The NCS does not contain any information on frequency of ST use. However, this is less of a limitation than it may appear for two reasons. First, the majority of adult ST users are daily or almost-daily users. For instance, data from the 2010 National Survey on Drug Use and Health (NSDUH) indicate that over 50% of adults (ages 18 and older) who used ST in the past month did so daily, and almost two-thirds of users consumed ST on at least 20 days in the past month. Second, prior studies have shown that the bulk of the demand response to taxes, for both cigarettes and smokeless tobacco, occurs at the extensive margin (the decision to use) rather than at the intensive margin (intensity of consumption among users) (Colman and Remler 2008; Tauras et al. 2007; Chaloupka and Warner 2000; Chaloupka, Tauras and Grossman 1997). Thus, given that most ST users are high-frequency users and much of the response to policy occurs at the user vs. non-user margin, the focus on participation in ST use is warranted.

The average prevalence of ST use over 2003-2009 in the NCS sample is 2.5%. This figure masks significant gender differences. For instance, the prevalence among males is 4.7% compared to only 0.4% among females.[20] While we estimate and report models for the full sample, the main analyses are restricted to males given that very few adult women consume ST products.

[20] The prevalence rate among females has trended upwards from 0.35% (2003) to 0.50% (2009).

The NCS also contains an extensive set of socio-demographic individual characteristics related to age, gender, race/ethnicity, education, employment status, income, smoking behaviors, veteran status, children, and geographic residence, which are listed in Table 3.

Magazine Advertising

The NCS data are particularly well-suited to the study of advertising since they measure in-depth media use for each respondent. Specifically relevant for this study, the NCS includes information on the reading habits of each respondent with respect to 198 major magazines that account for virtually all of the U.S. magazine circulation. For each magazine, the individual reports whether they read or looked into it in the past six months. Respondents further report on the number of issues that they read out of every four issues, on average. This information can be used to construct an individual-specific probability of reading an issue of each of the 198 magazines, ranging from 0 for those who did not read the magazine at all in the past six months to 1 for those who read all issues of the magazine.

Information on the advertising of ST products in each magazine is obtained from Kantar Media Intelligence for the years 2003-2009. National advertising expenditures for all ST products are appended to each individual respondent based on the magazines read by the respondent and by month and year of interview. As shown in Equation (2) below, total exposure to ST magazine ads (*AdExp*), for a given respondent *i* in month *m* and year *t*, can be defined as the product of the respondent's probability of reading an issue of each magazine (*Read*) multiplied by the amount of advertising (*Advertising*) that took place in that magazine in the given month and year, summed over all 198 magazines (denoted by the subscript *j*).

(2) $$AdExp_{imt} = \sum_{j=1}^{198} (Read_{ijmt})(Advertising_{jmt})$$

Ideally, *Advertising* would capture some measure of the quantity of ads that appear in each magazine, which can be derived by deflating advertising expenditures in each magazine by the magazine-specific unit cost of advertising. While information on magazine-specific ad costs is not available, the single most significant predictor of these advertising rates is the magazine's audience size or total circulation (Koschat and Putsis Jr. 2002).[21] We therefore proxy the total number of ST ads in each magazine by dividing the advertising expenditures with the magazine's annual circulation.[22] This scales the magazine advertising expenditure to the issue level and also deflates expenditures with a proxy for the advertising cost. To assess sensitivity of the estimates to this adjustment for audience size, in alternative specifications (reported in the Appendix Tables), we construct and utilize the above advertising exposure measure without adjusting for circulation, instead directly using advertising expenditures as a proxy for the amount of ST ads in each magazine.

That the individual's probability of reading each magazine (*Read*) is directly observed above in Equation (2) constitutes a major advantage of the NCS. Most prior studies in the tobacco literature do not observe this person-specific exposure and have instead relied on aggregate national ad expenditures (which potentially confound other national trends) or

[21] Magazine ad costs also depend on the socio-economic composition of the audience. However, these measures are already controlled for in all models. Thus, conditional on the demographic and income composition of the sample, total circulation is a strong predictor of ad costs across magazines and over time.

[22] Two alternate measures of audience size are tested, both derived from the NCS. The first captures the audited per-issue circulation figures, and the second captures the total number of readers derived from the NCS sample. The latter can differ from the circulation figures since a magazine issue may be read by multiple individuals, for instance in the household or in a physician's office. Reported estimates are based on the circulation figures since these are based on external and internal audits and have less sampling error relative to the total number of readers. Both measures, nevertheless, yield highly similar estimates.

aggregate local ad expenditures (which potentially confound area differences and capture only a small portion of total advertising).

Preferred specifications control for detailed indicators for 27 magazine groups and the intensity of the individual's magazine reading habits, captured by the total number of different magazines read and by the total number of magazine issues read across all magazines. The controls for magazine groups (which are defined by the NCS and observed by the advertisers) accounts for unobserved heterogeneity across individuals based on their reading habits. The controls for the intensity of reading accounts for the fact that some individuals may be exposed to more ST ads simply because they read many different magazines or because they read these magazines more intensely. Since this source of variation in ad exposure may be correlated with other person-specific heterogeneity (for instance, related to education or socio-economic status, opportunity cost of time, other material resources), it is not used for identification. Instead, identification of the impact of magazine ads comes solely from variation within magazine groups, conditional on reading intensity. Two males, for instance, who both choose to read a given type of magazines (for instance, news weeklies), who read the same number of magazines, and who read the same number of issues across all magazines, would be exposed to different levels of ST ads because one person reads (more) *Time* and the other person reads (more) *Newsweek*.[23] Conditional on all observed demographics and other factors from the NCS, this variation in advertising exposure is plausibly exogenous across individuals and bypasses bias due to potential simultaneity between advertising and demand.

[23] There is also temporal variation within a given magazine. That is, a person reading *Time* may be exposed to more or less ads due to changes in ad content over time.

The measure defined in Equation (2) represents current ad exposure. An alternative measure of the stock of ad exposure is also constructed in order to assess durable effects of advertising. Empirical studies of consumer goods find that most of the effects of advertising are short-lived and tend to fully depreciate within a few months to a year (Bagwell 2007). Thus, the advertising stock is constructed to include the current month's advertising and a decay-weighted sum of advertising over the past six months. Specifically, a decay rate (*d*) of 0.2 was used to construct the advertising stock for each magazine, for month *t*, defined as:

(3) $$AdStock_{jmt} = \sum_{k=0}^{6}(Advertising_{t-k})(1-d)^{k}$$

This advertising stock (*AdStock*) is then used in lieu of the current month's magazine advertising, multiplied by the probability of reading each magazine, and summed over all 198 magazines, similar to Equation (2), to construct the individual-specific stock of advertising exposure.

(4) $$AdExpStock_{imt} = \sum_{j=1}^{198}(Read_{ijmt})(AdStock_{jmt})$$

With a decay rate of 0.2, 74% of the impact of advertising has depreciated by the 6th month and virtually all of the effect has depreciated by the 12th month.[24]

Other Appended Variables

Based on each respondent's state of residence and time of interview (month and year for taxes; and year for other measures), tobacco tax and tobacco control policy data were matched to the individual records. Measures of state-level taxes for cigarettes and smokeless tobacco products are obtained from The *Tax Burden on Tobacco: Historical Compilation*

[24] Results and conclusions are not materially affected with alternate measures of the advertising stock based on decay rates of 0.1, 0.3 and 0.4 respectively. We utilize stock measures based on the past 6 months in order to preserve sample size. Alternate measures of the stock based on the past 12 months yield similar elasticity estimates, which are only slightly larger (by 5-10%) than those reported in Tables 6 and 7.

(Orzechowski and Walker 2010 and various years). While all states impose excise taxes on cigarettes, very few states impose excise taxes on ST products; instead, ST taxes in virtually all states are expressed as a percentage of the wholesale price. Due to lack of consistent information on wholesale or retail smokeless tobacco prices (at the state-year level), an estimate of the ST excise tax as a percentage of price could not be constructed for those states that do impose an excise tax. We therefore follow prior studies (for instance, Tauras et al. 2007; Chaloupka, Tauras, and Grossman 1997) and limit the analyses to those respondents who reside in states that expressed the ST tax rate consistently as a percentage of the price during the time of the interview; this exclusion omits about 9% of the sample.[25] Table 3 presents weighted means for key dependent and independent variables. The analysis sample (column 2), which excludes the 9% of observations from the excise tax states, is highly similar to the full sample (column 1) across all covariates. The overall prevalence of ST use is also virtually identical across the two samples (2.46% vs. 2.44%).

States impose separate taxes on snuff and chewing tobacco, both of which are highly collinear across states and over time (correlation of 0.985). In order to bypass this collinearity, all models control for the state tax rate on snuff since the vast majority of ST consumers in the U.S. use snuff (82% in the NCS and 87% in the 2010 NSDUH). The average tax rate on snuff over the sample period is 30.3% of the wholesale price (Table 3).

Specifications further control for the state's spending towards tobacco control activities, the fraction of the CDC (Centers for Disease Control and Prevention) recommendation that is

[25] This limits our analyses to 44 states plus D.C. States not represented for any sample period in the analyses include AK, AL, AZ, CT, HI, and ND.

spent on tobacco control, and the state population.[26] On average, states spent $25 million on tobacco control, which represented only about 35% of the CDC recommended spending levels (Table 3).

V. Results

Main Analyses

Table 4 presents estimates of Equation (2) for the full sample and for males, based on current month ST advertising exposure. Model (1) presents the results for the full sample. Magazine advertising exposure is significantly associated with higher ST use, with an advertising elasticity estimated at 0.10. A higher tax rate on snuff significantly reduces ST use. The cigarette excise tax is also negatively associated with ST use, suggesting that ST products and cigarettes are economic complements, at least contemporaneously and cross-sectionally. The coefficient of the male indicator is positive and highly significant, consistent with the documented gender differences in ST use; conditional on other observable characteristics, the probability of ST use among males is 4.9 percentage points higher relative to females.

Given that the ST users are predominantly male (comprising about 85% of all users), the remainder of the analyses in Table 4 are restricted to males. The baseline specification, presented in column (2), shows that ST use among males responds positively to advertising exposure. The magnitude of the elasticity estimate of 0.14 is larger relative to the full sample (0.10), suggesting that adult males are more responsive to advertising than adult females. Higher tobacco taxes (for both snuff and cigarettes) reduce the use of ST among males. The

[26] These data are obtained from http://www.tobaccofreekids.org/ and http://www.impacteen.org/.

somewhat smaller magnitudes of both tax elasticities (relative to the overall sample) are suggestive of a lower own-tax and cross-tax response among males relative to females.[27]

The elasticity of ST use with respect to the snuff *tax rate* is estimated at -0.23. This tax rate elasticity can also be translated into the price elasticity for comparison. Specifically, by differentiating ST Use with respect to price, the price elasticity of ST can be related to the tax rate elasticity as follows:

(5) $\text{Elasticity}_{\text{ST Price}} = \text{Elasticity}_{\text{ST TaxRate}} * \text{AdjustmentFactor}$, where

$$\text{AdjustmentFactor} = \{[\text{TaxPassThrough}_{\text{wholesalePrice}} - \text{TaxRate}]* (1+\text{RetailMargin})*(1/\text{TaxRate})*(1/\text{WholesalePricePassThrough}_{\text{RetailPrice}})\}$$

Under reasonable assumptions, the adjustment factor above is approximately 2.1, suggesting a ST participation price elasticity of -0.48.[28] This is comparable to the participation-price elasticity for cigarettes, which has been found to range from -0.3 to -0.6 in the literature (Chaloupka and Warner 2000). The elasticity of ST participation with respect to cigarette excise taxes is also negative (-0.15) , indicative of complementarity between the two tobacco products.[29] This cigarette excise tax elasticity can be translated into a price elasticity as follows:

[27] Gender differences in the price or tax-elasticity for cigarettes and alcohol have also been documented, though the evidence is mixed. See, for instance, Saffer and Dave (2006), Hersch (2000), Chaloupka and Warner (2000).

[28] The pass-through rate of the tax amount to wholesale prices (*TaxPassThrough*) is assumed to be 1-to-1, consistent with evidence from the cigarette market (DeCicca, Kenkel, and Liu 2010); the mean snuff tax rate (*TaxRate*) is 0.303 in the analysis sample; the retail margin on ST products (*RetailMargin*) is assumed to be 30% (based on Da Pra and Arnade 2009); and the pass-through of the wholesale price to the retail price (*WholesalePricePassThrough*) is assumed to be 1.3 based on the retail margin. There is some evidence that the price pass-through rate of the tax was higher than one during the 1980s and early 1990s (see Gruber 2001 and Chaloupka et al. 2002), consistent with market concentration and the oligopolistic structure of the tobacco market. The tax pass-through rate generally increases with the Herfindahl index of the market. More recent evidence suggests, however, that the pass-through rate is close to one-to-one (Chaloupka et al. 2002; DeCicca, Kenkel and Liu 2010). Under a higher tax pass-through-rate of 1.3 or 1.5, the ST price elasticity would be higher (0.75 and 0.85, respectively).

[29] This is consistent with Tauras et al. (2007) and Bask and Melkersson (2003), who also find negative cross-price responses between ST and cigarettes.

(6) $\text{Elasticity}_{\text{Cig Price}} = \text{Elasticity}_{\text{Cig Tax}} * \text{AdjustmentFactor}$, where

$\text{AdjustmentFactor} = 1 / [\text{TaxPassThrough}_{\text{RetailPrice}} * (\text{Tax} / \text{Price})]$

Under reasonable assumptions, this adjustment factor is approximately 2.9, suggesting a cross-price elasticity of ST participation with respect to cigarette prices of -0.44.[30]

The effects of the other covariates in Model (2) are consistent with the literature and follow patterns of use reflected across socio-economic factors (shown in Table 1). Individuals who are non-white and/or Hispanic are significantly less likely to currently use ST products, relative to whites and Hispanics. ST use also consistently decreases with educational attainment. This is consistent with prior studies which suggest that education makes individuals more allocatively efficient in producing health, and hence educated individuals are less likely to engage in unhealthy behaviors such as tobacco use (Grossman and Kaestner 1997). There are no significant effects of income on ST use, conditional on education and employment, though unemployed males are less likely to consume ST products (by about 1.7 percentage points) relative to males who are not in the labor force. This may partly reflect an income effect as well as a reduced demand for ST products if these individuals, who are not working and therefore not constrained by workplace or public smoking bans, have a lower need for ST. ST use follows a mostly declining profile over the life cycle, increasing up to ages 24 or 25 and then subsequently decreasing with age.

The estimated marginal effect of magazine advertising exposure in Model (2) may potentially reflect unobserved heterogeneity across persons based on the types of magazines

[30] The pass through of cigarette excise taxes to retail prices is assumed to be 1-to-1 (see DeCicca, Kenkel, and Liu 2010), and the cigarette excise tax comprised about 34% of the price on average over the sample period (*Tax Burden on Tobacco*, Orzechowski and Walker 2010). Also see footnote 28 for discussion of the tax pass-through rate.

that they read as well as their reading intensity. For instance, males who are more likely to read sports magazines or outdoor magazines are more likely to be exposed to ST ads and are also more likely to use ST; however, this correlation may be confounded by unobserved differences between males who choose to read sports magazines and those who do not. Similarly, males who read more of different types of magazines or who read more intensely (read more issues) would also be exposed to more ST ads. Some of this variation may also reflect confounding person-specific heterogeneity. Thus, estimates of the advertising elasticity may be biased upwards in Model (2).

In order to address this possibility, Model (3) controls for magazine categories (27 indicator variables), variety of magazines read (total number of different magazines that the respondent reads), and intensity of reading (total number of issues that the respondent reads for all magazines). Advertising exposure differs from person to person (and over time) in these models due to variation in the magazines that are read *within detailed magazine groupings*, for instance because one male reads (more) *Playboy* while another reads (more) *Penthouse*. Conditional on all observed factors including socio-demographics and the intensity and variety of magazines read, this variation is plausibly exogenous to demand and targeting decisions. The effect of advertising expectedly diminishes somewhat in magnitude (elasticity of 0.082), but remains highly significant. The tobacco tax elasticity estimates remain robust.

Model (4) explicitly controls for a quadratic term of the respondent's advertising exposure to capture any additional diminishing returns to advertising beyond the concavity of the probit functional form. While the quadratic effect is negative, consistent with diminishing

returns, it is insignificant and the magnitude of the advertising elasticity is virtually unchanged (0.082).

Model (5) controls for additional individual-level characteristics that are observed in the NCS. If the identifying variation in advertising exposure is plausibly exogenous and orthogonal to residual person-specific heterogeneity, then the advertising effects should not be sensitive to these additional controls. It is validating that the effect indeed remains robust, with an estimated elasticity of 0.096. Based on the marginal effects of the additional covariates, members of the armed forces have a significantly higher likelihood of ST consumption (by about 2.8 percentage points) as do individuals who have previously attempted (either successfully or unsuccessfully) to quit smoking. This latter effect is consistent with studies which find that ST products are sometimes used as a cessation aid, though whether they increase or decrease the chances of successfully quitting smoking remains unclear in the literature (see for instance, Ramström and Foulds 2006 and Tomar 2003). Males who have young children present in the household are significantly more likely to be ST users (by about 0.7 percentage points), possibly suggesting a substitution of ST for cigarettes in order to reduce children's exposure to passive smoking.

The final model in Table 4 accounts for stable area-specific heterogeneity by including indicators for the nine census divisions and controlling for the state's population and measures of tobacco control spending. It is again validating that the advertising effect remains robust (elasticity of 0.081), as does the elasticity estimate for the snuff tax rate. Cigarette excise taxes continue to be negatively associated with ST use, though the elasticity diminishes in magnitude (-0.06) and is statistically insignificant. We also estimate models with state indicators (not

reported). With these controls for state-specific time-invariant hetergoegeneity, the tax effects become statistically insignificant.[31] However, the effects of ad exposure remain robust and virtually unchanged.

Table 5 presents estimates from sub-analyses in order to assess differential responses to advertising and taxes across socio-demographic factors. All models control for the detailed magazine categories and the respondent's magazine reading habits. One concern with using any ST use as the outcome is that it potentially conflates two separate behaviors, namely initiation into ST use and current participation conditional on initiation. The NCS does not contain any information on the onset age or initiation of ST use. However, data from the NSDUH (2009 and 2010) suggest that the vast majority of male users (90%) initiate the consumption of ST products prior to age 25. Model (1) therefore restricts the sample to males ages 25 and older in order to bypass initiation effects and to obtain cleaner estimates of the ST participation elasticity with respect to advertising and taxes. Comparing the results from this age-restricted sample to those for all males (Model 3 in Table 4), the advertising elasticity estimate is not substantially different, suggesting that both initiation and participation in ST use are responsive to advertising. The tobacco tax elasticities are also robust to excluding males between the ages of 18-24.

Models (2) and (3) compare effects for younger adult males (ages 18-34) versus older adult males (ages 35-54). While both groups are about equally responsive to advertising, younger males are more price responsive; the snuff tax rate elasticity for younger males is -0.28 compared to -0.09 of older males. This latter effect is consistent with some studies that also

[31] This may be due to limited variation in the tax rates within states over our 7-year sample period.

find higher own-tax elasticities for cigarette use among youths (Chaloupka and Warner 2000). The magnitude of the cross-tax elasticity of ST use with respect to the cigarette excise tax is slightly lower (-0.12 vs. -0.16) among younger adults, suggesting that these tobacco products are weaker complements than for older adults. This may be driven by a higher accumulated tobacco addictive stock among older adults.

Model (4) restricts the sample to white males. The effects of advertising and the snuff tax rate are slightly larger, compared to pooled-race estimates (Model 3 in Table 4), suggestive of larger advertising and tax responses among whites. The cross-cigarette tax elasticity is smaller in magnitude; higher cigarette excise taxes elicit a slightly smaller decrease in ST use among whites relative to non-whites. Models (5) and (6) estimate effects separately for low-educated (less than college) and high-educated (college or above) males. ST use among higher-educated males is more responsive to advertising and tobacco taxes.

The advertising elasticities presented thus far capture the effects of advertising exposure in the interview month on current ST use. Given that advertising may have durable effects that linger over time, models in Tables 6 and 7 are based on the stock of advertising exposure defined as the current month's exposure plus a depreciation-weighted stock of exposure over the past six months. The effects of advertising are significant and robust across all specifications. The elasticity magnitudes are also expectedly larger by about 13-15% (0.092 ~ 0.157 compared with 0.081 ~ 0.137), suggesting that, while there are some durable effects of magazine advertising exposure, most of the impact is short-lived. The magnitudes of the tobacco tax elasticities remain robust, as do the general patterns in the tax and advertising responses across demographic segments (Table 7).

Robustness Checks

We implement several checks to assess plausibility and verify that the results are not driven by unobserved heterogeneity across individuals.[32] Smokeless tobacco ads appeared in 42 magazines at varying points over the sample period. About 17.5% of males do not read any of these 42 magazines. Though the prevalence of current ST use among these males is relatively similar (4.5% versus 4.7%) to those that do read some subset of the magazines which ever-advertise, these individuals may nevertheless differ based on unobservable characteristics. Omitting them from the analysis sample does not materially change the elasticity estimates; for instance, the magnitude of the advertising stock elasticity is now estimated at 0.13 (compared to 0.10 – 0.12 based on the full sample utilized in Table 6).

We also implement a placebo test in order to gauge that individuals do not substantially differ based on their magazine reading habits, within magazine groupings, in ways that are correlated with their ST use. Specifically, we estimate models by defining a measure of pseudo-advertising exposure – a dichotomous indicator that equals one if an individual reads any of the 42 magazines (that carry ST ads over our sample span) *during time periods when no ST ads appeared in these magazines*. Since the individual is not exposed to any ST ads, there should be no significant or substantial causal effect of this pseudo-exposure on their ST use. If we do find significant effects, then this is reflective of unobserved person-specific factors correlated with their magazine reading habits, within magazine groupings, and with their ST use. For instance, among the News Weekly subgroup of magazines, *Time* and *Newsweek* carried ST ads across different periods, and *U.S. News and World Report* did not carry ST ads. Individuals who are

[32] Full results (not reported in the tables) are available upon request.

otherwise similar across all observable characteristics will be exposed to different levels of ads based on which of these magazines they read and when they read them. The identification assumption is that unobservables across individuals, who read these different magazines at different times or with varying intensity, are not correlated with ST use; these unobservables would be picked up by the pseudo-exposure measure. Across seven specifications estimated for the full sample and the sub-samples, the marginal effect of the pseudo-exposure measure is insignificant and close to zero in all but one of these models (for which it is negative, less than 0.01 in magnitude, and only marginally significant at the 10% level). We therefore conclude that the advertising effects are not being driven by unmeasured heterogeneity across respondents.

Appendix Tables A1-A4 present specifications reported in the main analyses, using an alternative measure of magazine advertising exposure that is based on advertising expenditures rather than expenditure adjusted for audience size. The advertising elasticity and tobacco tax elasticity estimates are highly robust and similar to those presented above.

VI. Discussion

While the prevalence of smokeless tobacco (ST) is relatively low compared to smoking, the distribution of ST use is highly skewed with consumption concentrated among certain segments of the population (rural residents, males, whites, low-educated). In addition, there is suggestive evidence that use has trended upwards recently for certain groups, which have traditionally been at low risk of using smokeless tobacco (for instance, Hispanics, females, older adults, urban residents), and thus diffusing across demographics. Smokeless tobacco is hazardous to health and is not a safe substitute for smoking (USDHHS 1986). Though the

evidence on its link to smoking cessation is mixed, some studies suggest that ST use may be a gateway into smoking and may reduce the likelihood of subsequent smoking cessation (Haddock et al. 2002; Tomar 2003).

While these trends may be driven by various factors, they are consistent with a shifting landscape in the tobacco market as manufacturers of ST are re-allocating promotion towards price-based discounting and magazine advertising, and trying to capture new users as well as current and former smokers.[33] After adjusting for inflation, advertising in magazines increased by 171% between 1988 and 2004 as other media (television, radio, billboards, transit vehicles, sports and entertainment venues, malls) were banned from carrying ST ads due to the 1986 Comprehensive Smokeless Tobacco Act and the 1998 Smokeless Tobacco Master Settlement Agreement (STMSA).

This study is the first to estimate the effects of ST magazine advertising on ST use at the population level. Empirically identifying the causal effects of advertising is a challenge in the literature. We address this challenge by exploiting plausibly exogenous variation in person-specific exposure to ST ads based on the 2003-2009 National Consumer Survey, a novel national dataset that contains in-depth information on individuals' magazine reading habits. Furthermore, no study has investigated the simultaneous effects of ST advertising, ST tax rates, and cigarette taxes on ST use, and most of the estimates of the tax response in the literature are based on pre-1998 (pre-STMSA and pre-MSA) data when the tobacco marketplace was different.

[33] The marketing of ST encourages smokers to use ST products in order to meet their nicotine cravings in settings where they cannot smoke, which may also substitute for other potentially more effective smoking cessation products.

We find consistent and robust evidence that exposure to magazine advertising raises the probability of using ST products, especially among males. These effects also inform the broader debate on whether advertising in the tobacco market impacts upon primary demand; the results from this study suggest that advertising is effective in raising the overall market for ST and does not represent solely a brand-shifting process as claimed by the industry (Saffer and Chaloupka 2000), which may have adverse implications for population health. The elasticity of ST use with respect to the stock of ad exposure is estimated to be about 0.11. ST use among males increased by 13% (from 4.5% to 5.1%), while the stock of advertising exposure increased by 43% over the sample period. The elasticity suggests that this increase in magazine ad exposure among males is responsible for about 4.7 percentage points of the 13% increase in ST use. *Healthy People 2020* aims to reduce the overall prevalence of ST use among adults by two percentage points, from 2.3% to 0.3%.[34] Since the prevalence rate of ST use among females is currently only 0.5%, most of the decrease needs to be realized for males who have a relatively high prevalence of ST use. Banning advertisements of ST from magazines would reduce the prevalence of ST use among males by 0.6 percentage point, ceteris paribus, and close about 30% of the gap between current use and the stated *Healthy People 2020* objective.[35]

We also find consistent evidence that both ST taxes and cigarette taxes reduce the use of ST (estimated own-tax elasticity of -0.21 and cross-tax elasticity of -0.14). Massachusetts currently imposes the highest tax rate on smokeless tobacco products at 90% of the wholesale price, which compares to a national average (excluding MA) of 33.1%. Raising the ST tax rate to 90% among all states would reduce adult males' ST use by 1.4 percentage points, ceteris

[34] http://www.healthypeople.gov/2020/default.aspx.
[35] There are virtually no ST ads in newspapers, and no ads in other traditional media due to the 1986 and 1998 bans.

paribus, which would further narrow 60% of the gap between current use and the target proposed in *Healthy People 2020*. The negative cross-tax effect with respect to cigarette taxes suggests that ST products and cigarettes are economic complements for the average male, at least at a point in time. This is consistent with a significantly higher prevalence of ST use among current smokers relative to never-smokers (10.4% vs. 2.9%). As smoking bans are imposed across the nation and cigarette sales continue to decline, new ST products are being marketed to smokers for use in situations where they are unable to smoke. Thus, a large fraction of smokeless tobacco users (45%) are also current smokers. The negative cigarette tax elasticity provides an additional rationale for raising cigarette excise taxes. The results from this study suggest that, in addition to reducing smoking, higher cigarette taxes would also reduce the use of ST.

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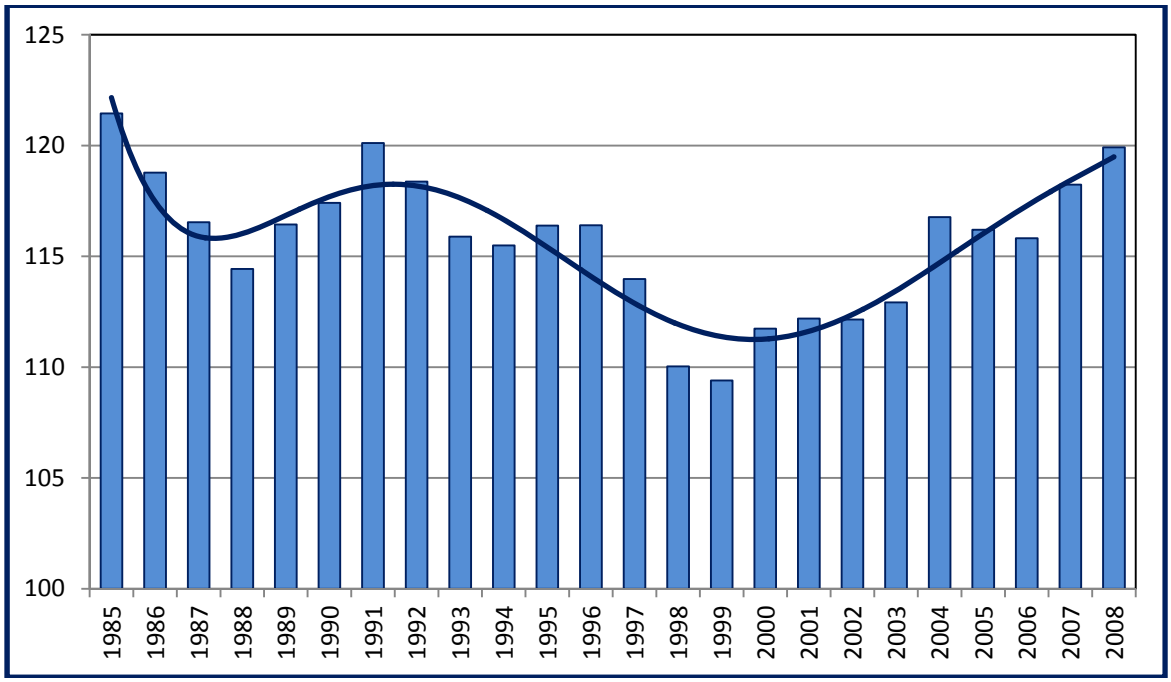
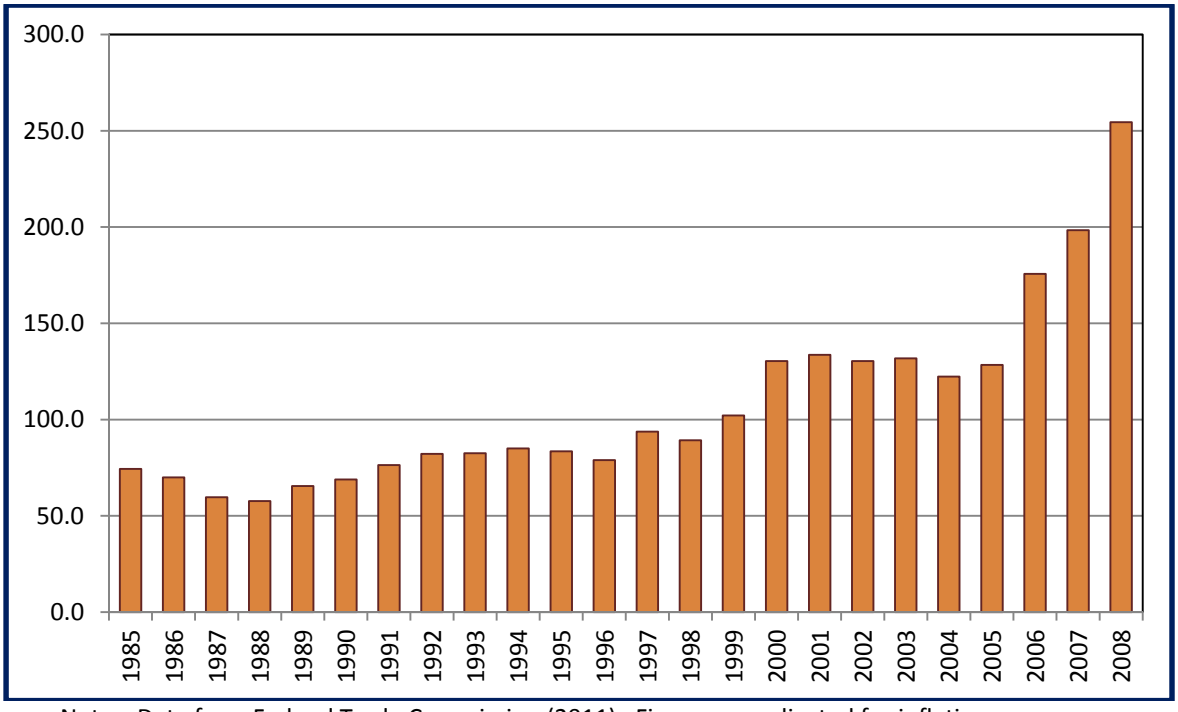
Figure 1
U.S. Smokeless Tobacco Sales (in millions of pounds)



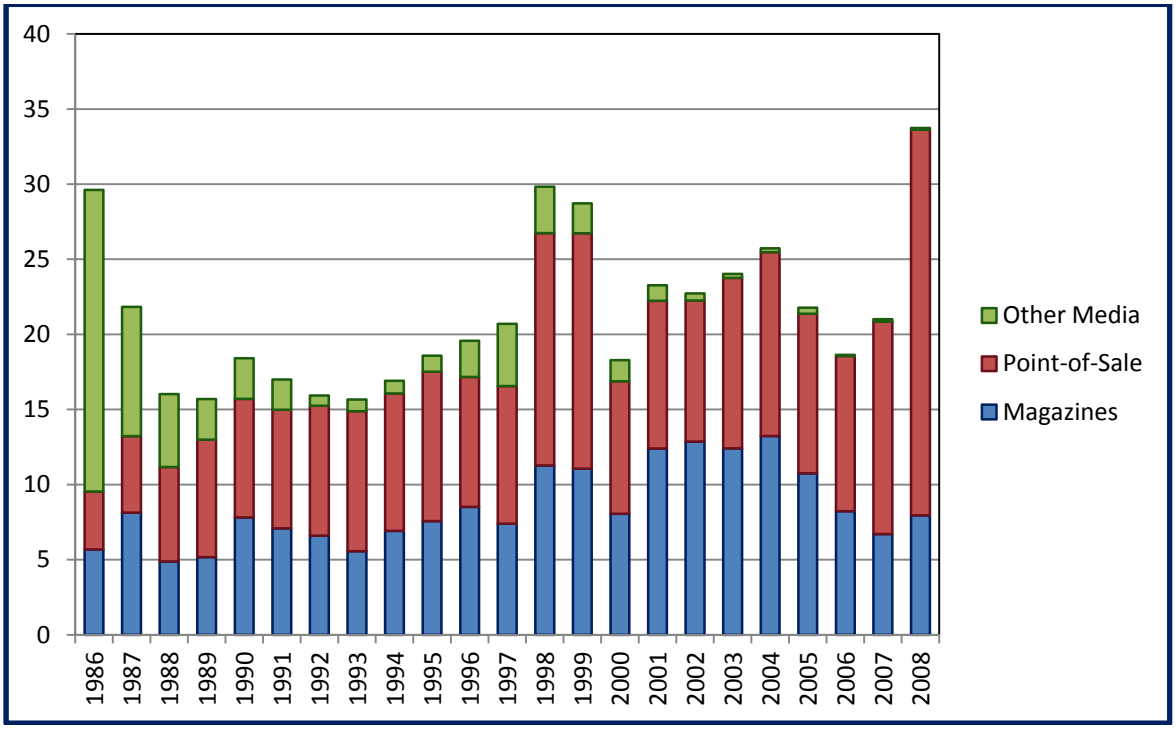
Notes: Data from Federal Trade Commission (2011). Trend line of polynomial order 6 is shown.

Figure 2
Advertising and Promotional Expenditure on ST Products (in millions of 1982 $)



Notes: Data from Federal Trade Commission (2011). Figures are adjusted for inflation.

Figure 3
Magazine & Other Media Advertising Expenditure on ST Products (in millions of 1982 $)



Notes: Data from Federal Trade Commission (2011). Figures are adjusted for inflation.

Table 1
Prevalence and Trends in Smokeless Tobacco Use by Selected Demographic Groups

Prevalence of Past Month Smokeless Tobacco Use (%) Adults Ages 18 and older				
Year	1992	1998	2006	2010
All	3.8	3.3	3.5	3.6
Male	7.4	6.3	7.0	7.0
Female	0.5	0.5	0.3	0.4
Ages 18 - 25	6.0	5.4	5.3	6.4
Ages 26 - 34	3.9	4.3	4.8	4.7
Ages 35 +	3.2	2.6	2.9	2.7
Non-Hispanic White	4.4	3.9	4.4	4.6
Non-Hispanic African-American	2.2	2.3	1.9	1.4
Non-Hispanic Other Race	2.2	0.7	2.2	1.6
Hispanic	0.8	0.8	0.9	1.0
Large Metropolitan Areas	2.2	1.8	1.9	2.2
Small Metropolitan Areas	3.5	3.3	4.7	4.1
Rural	7.1	6.4	8.8	7.1
Less than High School Education	4.7	4.3	4.6	3.6
High School Graduates	3.8	3.6	3.9	4.6
Some College or above	3.1	2.6	2.8	3.0

Notes: Weighted means are reported based on data from the National Household Surveys of Drug Abuse (NHSDA) and the National Surveys of Drug Use and Health (NSDUH).

Table 2
Exposure to ST Advertising in Magazines

Percent of Sample Exposed to Any Magazine Advertising in Past Month (Read a magazine issue with positive ST advertising expenditures)							
Sample	% of Adults Exposed	%Males	%Females	%White	%Black	%Other Race	%Hispanic
2003	0.427	0.628	0.372	0.805	0.106	0.089	0.080
2004	0.280	0.752	0.248	0.790	0.110	0.100	0.094
2005	0.239	0.591	0.409	0.819	0.091	0.090	0.077
2006	0.640	0.548	0.452	0.795	0.102	0.103	0.123
2007	0.629	0.549	0.451	0.787	0.106	0.107	0.130
2008	0.603	0.553	0.447	0.783	0.110	0.107	0.124
2009	0.355	0.592	0.408	0.801	0.103	0.096	0.120
Prevalence of Group in Overall Population	_	0.482	0.518	0.783	0.110	0.107	0.129
Sample	%Ages 18-24	%Ages 25-44	%Ages 45-64	%Less than High School	%High School Graduate	%MSA Resident	%Non-MSA Resident
2003	0.155	0.389	0.312	0.103	0.292	0.433	0.567
2004	0.176	0.426	0.279	0.127	0.316	0.400	0.600
2005	0.116	0.359	0.367	0.090	0.305	0.419	0.581
2006	0.117	0.372	0.347	0.129	0.327	0.412	0.588
2007	0.115	0.365	0.356	0.139	0.331	0.405	0.595
2008	0.116	0.372	0.351	0.123	0.329	0.413	0.587
2009	0.116	0.364	0.359	0.093	0.312	0.421	0.579
Prevalence of Group in Overall Population	0.116	0.367	0.345	0.142	0.331	0.411	0.589

Notes: Calculations based on 2003-2009 NCS data matched with ST advertising expenditures from Kantar Media Intelligence (see text). Weighted means are reported.

Table 3
Simmons National Consumer Survey (NCS) 2003-2009
Weighted Means

Variable	(1) All	(2) States with Percent-of-Price ST Tax	(3) Males
Current Smokeless Tobacco Use	0.024592	0.024350	0.046779
Ad Exposure (Current) Adjusted for Circulation	0.000034	0.000034	0.000054
Ad Exposure (Stock) Adjusted for Circulation	0.000121	0.000120	0.000193
Ad Exposure (Current)	69.161	68.537	103.482
Ad Exposure (Stock)	239.075	237.088	363.554
Snuff Tax	0.302831	0.302831	0.303187
Cigarette Tax	16.298090	17.442790	17.325470
Male	0.482103	0.482578	1.000000
Age	46.196660	46.095630	45.525960
Age-squared	2411.271	2401.704	2341.055
White	0.783494	0.780405	0.787857
Black	0.109986	0.111860	0.100753
Other Race	0.106520	0.107735	0.111390
Hispanic	0.129592	0.129438	0.136147
Less than High School Graduate	0.142115	0.142554	0.149852
High School Graduate	0.330735	0.330182	0.327595
Some college	0.271678	0.271586	0.258187
College Graduate	0.255472	0.255678	0.264366
Income (in 10,000 $)	2.691638	2.679209	3.479267
Employed	0.632521	0.633146	0.698887
Unemployed	0.051449	0.051623	0.057684
State Population	1,310,0000	1,370,0000	1,370,0000
State Tobacco Control Spending (in millions $)	24.837	25.409	25.571
State Tobacco Control Spending (% of CDC Recommendation)	0.347420	0.349242	0.348780
Total Magazines Read	8.108	8.150	7.047
Frequency of Reading (Total number of issues)	14.148	14.213	12.172
Attempt Smoking Cessation (Past Year)	0.090674	0.090476	0.087702
Armed Forces - Current	0.005797	0.005920	0.009413
Armed Forces - Past	0.137087	0.137723	0.261037
Any Children under Age 12 in Household	0.326363	0.328021	0.309439
Observations	173,029	157,197	69,592

Notes: Weighted means are presented. Observations represent the maximum sample size; for some variables, the sample size is slightly lower due to missing information

Table 4
Any Current ST Use: NCS 2003-2009
Probit Marginal Effects
Full Sample & Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full	Males	Males	Males	Males	Males
Ad Exposure - Current	47.627108***	79.649573***	47.952788***	48.515147**	59.546136***	45.674402***
(Adjusted for Circulation)	(5.904050)	(11.196144)	(16.201918)	(23.630561)	(18.043107)	(16.632789)
	ε = 0.102	ε = 0.137	ε = 0.082	ε = 0.082	ε = 0.096	ε = 0.081
Ad Exposure - Squared				-1063.307317		
				(28201.634246)		
Snuff Tax	-0.016574**	-0.031409*	-0.027464*	-0.027462*	-0.019900	-0.025688*
	(0.007604)	(0.015486)	(0.013859)	(0.013857)	(0.015154)	(0.014605)
	ε = -0.270	ε = -0.231	ε = -0.212	ε = -0.211	ε = -0.146	ε = -0.203
Cigarette Tax	-0.000195***	-0.000360***	-0.000323***	-0.000323***	-0.000399***	-0.000081
	(0.000055)	(0.000101)	(0.000093)	(0.000093)	(0.000124)	(0.000070)
	ε = -0.183	ε = -0.151	ε = -0.142	ε = -0.142	ε = -0.147	ε = -0.057
Male	0.049016***					
	(0.004434)					
Age	0.000570**	0.001172**	0.000725	0.000726	0.001295*	0.000765
	(0.000259)	(0.000550)	(0.000583)	(0.000581)	(0.000736)	(0.000586)
Age-squared	-0.000012***	-0.000024***	-0.000018***	-0.000018***	-0.000024***	-0.000019***
	(0.000003)	(0.000006)	(0.000006)	(0.000006)	(0.000009)	(0.000006)
Black	-0.014760***	-0.059295***	-0.047742***	-0.047743***	-0.044416***	-0.047943***
	(0.003332)	(0.009310)	(0.008109)	(0.008117)	(0.007951)	(0.007591)
Other Race	-0.016646***	-0.033607***	-0.030408***	-0.030406***	-0.025794***	-0.028887***
	(0.003225)	(0.006619)	(0.006218)	(0.006209)	(0.007212)	(0.006186)
Hispanic	-0.031946***	-0.064533***	-0.057344***	-0.057344***	-0.056607***	-0.056845***
	(0.005205)	(0.010696)	(0.009792)	(0.009795)	(0.011322)	(0.011872)
High School Graduate	-0.006219***	-0.005748	-0.005134	-0.005135	-0.003570	-0.004388
	(0.002400)	(0.004723)	(0.004758)	(0.004750)	(0.005232)	(0.004740)
Some College	-0.015824***	-0.024545***	-0.018919***	-0.018921***	-0.017705***	-0.018288***
	(0.002897)	(0.005089)	(0.005032)	(0.005015)	(0.005464)	(0.004839)
College Graduate	-0.023628***	-0.039817***	-0.027075***	-0.027076***	-0.022149***	-0.026711***
	(0.003556)	(0.006006)	(0.006558)	(0.006547)	(0.007017)	(0.006386)
Income	0.000142	0.000101	0.000442	0.000442	0.000453	0.000436
	(0.000230)	(0.000438)	(0.000439)	(0.000438)	(0.000584)	(0.000387)
Employed	0.001069	0.001417	-0.001583	-0.001584	-0.002727	-0.001110
	(0.002021)	(0.004207)	(0.004139)	(0.004144)	(0.004969)	(0.003931)
Unemployed	-0.004477	-0.016620*	-0.016111*	-0.016113*	-0.013584	-0.015349
	(0.004669)	(0.009828)	(0.009633)	(0.009629)	(0.010390)	(0.009265)
Number of Magazines Read			0.000770**	0.000769**	0.000765**	0.000765**
			(0.000348)	(0.000350)	(0.000380)	(0.000342)
Frequency of Reading			-0.000273**	-0.000271*	-0.000338**	-0.000240*
			(0.000127)	(0.000141)	(0.000139)	(0.000127)
Attempt Smoking Cessation					0.031144***	
					(0.004978)	
Armed Forces - Current					0.028053**	
					(0.011647)	
Armed Forces - Past					0.002421	
					(0.004515)	
Any Children under Age 12					0.006770*	
					(0.003813)	
Magazine Group Indicators	No	No	Yes	Yes	Yes	Yes
Census Division Indicators	No	No	No	No	No	Yes
State Factors	No	No	No	No	No	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	157197	69592	69592	69592	52748	69592

Notes: Average marginal effects from probit models are reported. All models adjust for sampling weights. Standard errors are adjusted for arbitrary correlation within state cells, and reported in parentheses. Elasticity estimates (ε) are computed at the sample means. State factors include the state population, state tobacco control spending, and the percent of the CDC recommendation that the state spends on tobacco control. Statistical significance is denoted as follows: *** p-value ≤ 0.01, ** 0.01 < p-value ≤ 0.05, * 0.05 < p-value ≤ 0.10.

Table 5
Any Current ST Use: NCS 2003-2009
Probit Marginal Effects
Demographic Sub-populations among Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Ages 25+	Ages 18-34	Ages 35-54	White	Less than College Educated	College Graduate or above
Ad Exposure - Current	55.657172***	68.942084**	71.145001***	55.299491**	47.127046**	51.441392***
(Adjusted for Circulation)	(18.702943)	(30.604130)	(22.535747)	(22.113076)	(19.532369)	(19.423032)
	ε = 0.093	ε = 0.106	ε = 0.098	ε = 0.085	ε = 0.071	ε = 0.126
Snuff Tax	-0.027257*	-0.039830**	-0.012515	-0.040173**	-0.031403**	-0.022105
	(0.014755)	(0.017227)	(0.018029)	(0.015973)	(0.015582)	(0.013828)
	ε = -0.211	ε = -0.278	ε = -0.085	ε = -0.255	ε = -0.211	ε = -0.284
Cigarette Tax	-0.000362***	-0.000282*	-0.000398**	-0.000353***	-0.000346***	-0.000230**
	(0.000100)	(0.000146)	(0.000165)	(0.000107)	(0.000111)	(0.000124)
	ε = -0.158	ε = -0.122	ε = -0.158	ε = -0.129	ε = -0.134	ε = -0.166
Magazine Factors & Group Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62575	16975	27621	54855	48519	21073

Notes: Average marginal effects from probit models are reported. All models adjust for sampling weights. Standard errors are adjusted for arbitrary correlation within state cells, and reported in parentheses. Elasticity estimates (ε) are computed at the sample means. All models control for the covariates listed in Model (3) in Table 4. Statistical significance is denoted as follows: *** p-value ≤ 0.01, ** 0.01 < p-value ≤ 0.05, * 0.05 < p-value ≤ 0.10.

Table 6
Any Current ST Use: NCS 2003-2009
Probit Marginal Effects
Full Sample & Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full	Males	Males	Males	Males	Males
Ad Exposure - Stock	15.741352***	25.315788***	15.551529***	22.785067**	19.723879***	14.786388***
(Adjusted for Circulation)	(1.808019)	(3.137314)	(4.247217)	(9.166423)	(4.966826)	(4.451378)
	ε = 0.119	ε = 0.157	ε = 0.096	ε = 0.132	ε = 0.117	ε = 0.092
Ad Exposure - Squared				-4184.679262		
				(4162.093248)		
Snuff Tax	-0.017637**	-0.033670**	-0.029508**	-0.029461**	-0.021441	-0.028690*
	(0.007737)	(0.015760)	(0.014240)	(0.014242)	(0.015179)	(0.014840)
	ε = -0.290	ε = -0.250	ε = -0.229	ε = -0.229	ε = -0.160	ε = -0.229
Cigarette Tax	-0.000242***	-0.000471***	-0.000435***	-0.000437***	-0.000441***	-0.000173
	(0.000079)	(0.000150)	(0.000138)	(0.000137)	(0.000168)	(0.000112)
	ε = -0.153	ε = -0.130	ε = -0.126	ε = -0.127	ε = -0.108	ε = -0.085
Magazine Group Indicators	No	No	Yes	Yes	Yes	Yes
Census Division Indicators	No	No	No	No	No	Yes
State Factors	No	No	No	No	No	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	148320	65421	65421	65421	50035	65421

See notes to Table 4.

Table 7
Any Current ST Use: NCS 2003-2009
Probit Marginal Effects
Demographic Sub-populations among Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Ages 25+	Ages 18-34	Ages 35-54	White	Less than College Educated	College Graduate or above
Ad Exposure - Stock	17.868771***	18.734421**	26.753699***	17.685445***	16.373709***	16.403519***
(Adjusted for Circulation)	(5.284817)	(9.045443)	(6.343843)	(5.992938)	(5.556523)	(5.958573)
	ε = 0.108	ε = 0.106	ε = 0.135	ε = 0.097	ε = 0.089	ε = 0.146
Snuff Tax	-0.029611*	-0.041704**	-0.013541	-0.042822**	-0.033082**	-0.024347*
	(0.015212)	(0.017673)	(0.019082)	(0.016537)	(0.016040)	(0.013922)
	ε = -0.232	ε = -0.302	ε = -0.092	ε = -0.274	ε = -0.225	ε = -0.312
Cigarette Tax	-0.000511***	-0.000299	-0.000629***	-0.000486***	-0.000522***	-0.000141
	(0.000153)	(0.000212)	(0.000247)	(0.000159)	(0.000179)	(0.000175)
	ε = -0.148	ε = -0.086	ε = -0.163	ε = -0.113	ε = -0.136	ε = -0.064
Magazine Factors & Group Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	58890	15824	25939	51436	45783	19638

See notes to Table 5.

Appendix Table A1
Any Current ST Use: NCS 2003-2009
Alternate Measure of Ad Exposure
Full Sample & Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full	Males	Males	Males	Males	Males
Ad Exposure - Current	0.000021***	0.000035***	0.000024***	0.000028**	0.000032***	0.000025***
	(0.000003)	(0.000006)	(0.000009)	(0.000014)	(0.000010)	(0.000009)
	ε = 0.094	ε = 0.117	ε = 0.080	ε = 0.092	ε = 0.099	ε = 0.083
Ad Exposure - Squared				-0.00000005		
				(0.0000001)		
Snuff Tax	-0.016753**	-0.031803*	-0.027567*	-0.027551*	-0.019988	-0.025825*
	(0.007693)	(0.015640)	(0.013923)	(0.013917)	(0.015213)	(0.014645)
	ε = -0.272	ε = -0.233	ε = -0.212	ε = -0.212	ε = -0.146	ε = -0.204
Cigarette Tax	-0.000197***	-0.000363***	-0.000325***	-0.000325***	-0.000402***	-0.000083
	(0.000055)	(0.000101)	(0.000092)	(0.000092)	(0.000123)	(0.000070)
	ε = -0.184	ε = -0.152	ε = -0.143	ε = -0.143	ε = -0.148	ε = -0.059
Male	0.049666***					
	(0.004484)					
Age	0.000573**	0.001174**	0.000724	0.000728	0.001291*	0.000763
	(0.000261)	(0.000558)	(0.000582)	(0.000582)	(0.000733)	(0.000585)
Age-squared	-0.000012***	-0.000024***	-0.000018***	-0.000018***	-0.000024***	-0.000019***
	(0.000003)	(0.000006)	(0.000006)	(0.000006)	(0.000009)	(0.000006)
Black	-0.014904***	-0.059632***	-0.047883***	-0.047907***	-0.044515***	-0.048072***
	(0.003400)	(0.009550)	(0.008192)	(0.008202)	(0.008039)	(0.007690)
Other Race	-0.016658***	-0.033682***	-0.030474***	-0.030468***	-0.025900***	-0.028951***
	(0.003279)	(0.006682)	(0.006219)	(0.006213)	(0.007208)	(0.006180)
Hispanic	-0.032417***	-0.065422***	-0.057570***	-0.057559***	-0.056879***	-0.057010***
	(0.005257)	(0.010797)	(0.009784)	(0.009782)	(0.011303)	(0.011855)
High School Graduate	-0.006223***	-0.005679	-0.005238	-0.005247	-0.003780	-0.004490
	(0.002390)	(0.004697)	(0.004726)	(0.004718)	(0.005162)	(0.004706)
Some College	-0.016014***	-0.024770***	-0.019073***	-0.019090***	-0.017959***	-0.018430***
	(0.002913)	(0.005079)	(0.005021)	(0.005015)	(0.005434)	(0.004825)
College Graduate	-0.024173***	-0.040700***	-0.027379***	-0.027386***	-0.022539***	-0.026996***
	(0.003551)	(0.005950)	(0.006515)	(0.006507)	(0.006926)	(0.006338)
Income	0.000164	0.000143	0.000454	0.000452	0.000462	0.000448
	(0.000235)	(0.000440)	(0.000437)	(0.000436)	(0.000583)	(0.000385)
Employed	0.001112	0.001495	-0.001508	-0.001519	-0.002582	-0.001023
	(0.002020)	(0.004158)	(0.004117)	(0.004126)	(0.004944)	(0.003919)
Unemployed	-0.004577	-0.016767*	-0.016085*	-0.016114*	-0.013481	-0.015287
	(0.004648)	(0.009734)	(0.009593)	(0.009588)	(0.010321)	(0.009230)
Number of Magazines Read			0.000773**	0.000765**	0.000772**	0.000772**
			(0.000355)	(0.000355)	(0.000387)	(0.000348)
Frequency of Reading			-0.000236*	-0.000224*	-0.000303**	-0.000212*
			(0.000128)	(0.000133)	(0.000139)	(0.000127)
Attempt Smoking Cessation					0.031223***	
					(0.004982)	
Armed Forces - Current					0.027546**	
					(0.011716)	
Armed Forces - Past					0.002518	
					(0.004533)	
Any Children under Age 12					0.006950*	
					(0.003828)	
Magazine Group Indicators	No	No	Yes	Yes	Yes	Yes
Census Division Indicators	No	No	No	No	No	Yes
State Factors	No	No	No	No	No	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	157197	69592	69592	69592	52748	69592

See notes to Table 4.

Appendix Table A2
Any Current ST Use: NCS 2003-2009
Alternate Measure of Ad Exposure
Demographic Sub-populations among Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Ages 25+	Ages 18-34	Ages 35-54	White	Less than College Educated	College Graduate or above
Ad Exposure - Current	0.000029***	0.000035**	0.000034***	0.000028**	0.000026**	0.000021**
	(0.000010)	(0.000016)	(0.000012)	(0.000012)	(0.000011)	(0.000010)
	ε = 0.094	ε = 0.109	ε = 0.092	ε = 0.083	ε = 0.074	ε = 0.106
Snuff Tax	-0.027225*	-0.040558**	-0.012406	-0.040377**	-0.031564**	-0.021978
	(0.014825)	(0.017481)	(0.017956)	(0.016072)	(0.015657)	(0.013919)
	ε = -0.211	ε = -0.283	ε = -0.084	ε = -0.256	ε = -0.212	ε = -0.282
Cigarette Tax	-0.000365***	-0.000286**	-0.000398**	-0.000355***	-0.000348***	-0.000232**
	(0.000100)	(0.000145)	(0.000165)	(0.000107)	(0.000111)	(0.000124)
	ε = -0.159	ε = -0.123	ε = -0.158	ε = -0.129	ε = -0.134	ε = -0.168
Magazine Factors & Group Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62575	16975	27621	54855	48519	21073

See notes to Table 5.

Appendix Table A3
Any Current ST Use: NCS 2003-2009
Alternate Measure of Ad Exposure
Full Sample & Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full	Males	Males	Males	Males	Males
Ad Exposure - Stock	0.000007***	0.000011***	0.000007***	0.000009*	0.000010***	0.000007***
	(0.000001)	(0.000002)	(0.000002)	(0.000005)	(0.000003)	(0.000002)
	ε = 0.108	ε = 0.130	ε = 0.083	ε = 0.096	ε = 0.113	ε = 0.083
Ad Exposure - Squared				-0.0000000001		
				(0.000000001)		
Snuff Tax	-0.017816**	-0.034072**	-0.029639**	-0.029608**	-0.021570	-0.028858*
	(0.007846)	(0.015936)	(0.014296)	(0.014289)	(0.015229)	(0.014909)
	ε = -0.291	ε = -0.252	ε = -0.230	ε = -0.230	ε = -0.161	ε = -0.230
Cigarette Tax	-0.000244***	-0.000474***	-0.000437***	-0.000438***	-0.000444***	-0.000174
	(0.000080)	(0.000151)	(0.000138)	(0.000138)	(0.000168)	(0.000112)
	ε = -0.153	ε = -0.131	ε = -0.127	ε = -0.127	ε = -0.108	ε = -0.085
Magazine Group Indicators	No	No	Yes	Yes	Yes	Yes
Census Division Indicators	No	No	No	No	No	Yes
State Factors	No	No	No	No	No	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	148320	65421	65421	65421	50035	65421

See notes to Table 4.

Appendix Table A4
Any Current ST Use: NCS 2003-2009
Alternate Measure of Ad Exposure
Demographic Sub-populations among Males

Model	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Ages 25+	Ages 18-34	Ages 35-54	White	Less than College Educated	College Graduate or above
Ad Exposure - Stock	0.000009***	0.000009*	0.000013***	0.000009***	0.000008***	0.000007**
	(0.000003)	(0.000005)	(0.000003)	(0.000003)	(0.000003)	(0.000003)
	ε = 0.104	ε = 0.102	ε = 0.125	ε = 0.094	ε = 0.081	ε = 0.125
Snuff Tax	-0.029602*	-0.042336**	-0.013370	-0.043010**	-0.033318**	-0.024144*
	(0.015272)	(0.017855)	(0.019022)	(0.016624)	(0.016110)	(0.013983)
	ε = -0.232	ε = -0.306	ε = -0.091	ε = -0.275	ε = -0.227	ε = -0.309
Cigarette Tax	-0.000515***	-0.000301	-0.000629***	-0.000488***	-0.000526***	-0.000142
	(0.000153)	(0.000211)	(0.000248)	(0.000159)	(0.000179)	(0.000175)
	ε = -0.149	ε = -0.087	ε = -0.163	ε = -0.113	ε = -0.137	ε = -0.064
Magazine Factors & Group Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	58890	15824	25939	51436	45783	19638

See notes to Table 5.