# Government Advertising in Market-Based Public Programs: Evidence from the Health Insurance Marketplace*

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**Abstract**

This paper studies government advertising for a public program implemented through a private market in the context of Affordable Care Act health insurance marketplaces. By exploiting detailed TV advertising data that provide information on advertising messages, we first document differences between advertising by government and by private insurers advertising in terms of targeting and contents. We find that the government tends to advertise in markets with unhealthy populations, whereas private insurers advertise more in markets with healthy populations. Then, we estimate the impact of government and private advertising on enrollment by exploiting discontinuities of TV advertising markets. We find that government advertising has a market expansion effect, whereas private advertising tends to steal consumers from other insurers. Finally, by using an estimated equilibrium model of marketplaces, we explore the impact of alternative designs of government advertising. We find that government advertising may alleviate excessive advertising competitions by insurers.

**JEL Codes**: I1, I3, L1, M3.
**Keywords:** health insurance, government advertising, advertising competition

*__Preliminary.__ Any comments are welcome.

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# 1 Introduction

Public programs increasingly use private markets in recent years to provide in-kind benefits to targeted populations. These market-based public programs have substantially expanded over time and include different markets: health insurance, education, mortgages, etc.[1] In order to promote these programs, the government often conducts a significant amount of marketing and outreach activities through advertising or hosting various educational events.

How much the government should advertise these market-based public programs has been discussed extensively in public policy debates. For example, in earlier years of health insurance marketplaces, which were established under the Affordable Care Act (ACA), the federal and state governments spent a sizable amount of money on advertising to promote the marketplaces. The federal government spent $100 million in 2016 for the marketing activities, and this magnitude was comparable to advertising spending by private insurers for the marketplaces.[2] In 2018, however, the federal government drastically cut its spending to $10 million. This substantial change has spurred interest among both policy makers and economists about implications of government marketing activities on the stability and efficiency of publicly designed private markets.[3]

The government's marketing activities in private markets raise a number of important economic questions. For traditional public or welfare programs that are implemented directly by the government[4], main rationales for government advertising are transaction costs of enrollment for the program and consumers' lack of the information about the program (Finkelstein and Notowidigdo, 2019). In private markets, however, the government would not need to be involved in marketing activities as long as private companies conduct the socially efficient amount of marketing activities. In fact, it is well documented that private companies conduct a substantial amount of marketing activities in market-based public programs such as regulated marketplaces for health insurance (Cebul et al. (2011); Aizawa and Kim (2018)) and for privatized pension plans (Hastings et al. (2017)). Thus, the questions are: how are government marketing activities different from those by private insurers? Do

[1]For example, such public programs for health insurance benefits include health insurance marketplace under the Affordable Care Act, Medicare Advantage (Medicare benefits offered through private insurers), and Medicare Part D (prescription drug benefits). For education benefits, an example includes charter schools. Moreover, the Home Affordable Refinance Programs subsidized mortgage refinancing in the private market after the housing bust in 2008.

[2]Source: the authors' calculation using data from Campaign Media Analysis Group at the Kantar Media.

[3]For more information on this spending cut, please see news article "Trump Administration Slashes Funds for ACA Outreach" in the Wall Street Journal (July 10, 2018): https://www.wsj.com/articles/trump-administration-slashes-funds-for-aca-outreach-1531272043.

[4]Examples of such traditional public programs include Social Security, Medicare, Medicaid, the Supplemental Assistance Nutrition Program, etc.

they still effectively increase the program enrollment? How should the government design its own marketing and outreaching activities?

In this paper, we evaluate the effects and designs of the government marketing activities in a market-based public program. We study this issue in the context of the marketplace for ACA health insurance plans. We focus on advertising as a main marketing and outreaching tool. In fact, advertising consists of the largest component of government marketing activities (Kosar (2016)). Moreover, advertising typically accounts for a much larger portion of budgets for public health insurance programs than other public programs.

For the purpose of the paper, we first document facts about how the government and private insurers target their advertising. Then, we estimate the impact of government and private advertising on health plan enrollments. Finally, we explore the efficient designs of government marketing activities for the ACA.

We begin our analysis by documenting patterns of how the government (both federal and state) and private insurers target advertising with detailed advertising data. We focus on two dimensions of targeting: geography and advertising contents. We obtain advertising data from Kantar Media, which contain rich measures of contents of advertising, including transcripts of actual advertisements. This information enables us to categorize advertisements into different categories, including whether the advertisement provides information on available financial assistance under the ACA, whether the advertisement provides information about the open enrollment period, etc.

Then, we show that the government advertising is targeted very differently from private advertising. By using various measures of county characteristics from County Health Rankings (CHR) by the Robert Wood Johnson Foundation and American Community Survey (ACS), we find that the government tends to advertise in markets with less healthy populations. In contrast, private insurers tend to advertise markets with healthier populations. These patterns are consistent with a view that the government may increase the health plan enrollment with less healthy individuals who value health insurance more. In contrast, private insurers may have an incentive to engage in risk selection, i.e., attracting healthier and more profitable consumers. Moreover, we find that contents of advertising by federal and state governments tend to emphasize the affordability of health plans through marketplaces. However, main messages of private advertising are more dispersed, and they tend to emphasize quality and various insurance option provided by private plans. These findings highlight that the government and private insurers have clearly different incentives about which types of consumers they want to attract.

Next, we estimate a model for consumer demand for ACA health plans to study effectiveness of advertising by the government and private insurers. We obtain enrollment

data of federal marketplaces from Center for Medicare and Medicaid Services (CMS) and state-based marketplaces from California (Covered California) and New York (NY State of Health). In our model, we allow that the advertising by the federal and state governments and private insurers may have different effects on the decision to purchase health insurance. We also allow that the demand effect of advertising depends on the content of advertising. For identification of advertising's effect on demand, we implement a border identification strategy (e.g., Shapiro (2018), Spenkuch and Toniatti (2018), and Moshary (2017)): specifically, we exploit a discontinuity of advertising spending across TV advertising markets to address homogeneity of advertising.

We find that the government advertising, especially by the federal government, has a market expansion effect by increasing overall enrollment. Quantitatively, we estimate the demand elasticity with respect to government advertising to be about 0.04, which is comparable to findings in advertising by private insurers for many products, including health insurance. Because government advertising is targeted to markets with unhealthy populations, it may increase enrollment of individuals with higher willingness to pay for health insurance.

We also find that government advertising is more effective in earlier years in marketplace, when there was probably a much greater share of individuals new to marketplaces. This finding suggests that advertising likely reduces transaction costs of potential buyers of marketplace plans, who were likely uninsured before marketplaces became available. Those potential buyers were unlikely to be very familiar with a process of applying for health insurance.

In contrast, we find that advertising by private insurers has a limited market expansion effect, although it increases enrollments for insurers that conduct advertising. This is consistent with the view that advertising from different companies just results in business stealing without expanding the total number of individuals enrolling for ACA health plans. These results suggest that the government advertising may be more effective than private advertising in reducing transaction costs of consumers to enroll in marketplaces or increasing public awareness of the marketplaces.

We also examine which messages in each advertisement are effective in increasing enrollment in health insurance marketplaces. We find that federal advertising emphasizing financial assistance (e.g., the presence of significant premium subsidies) contributes to an increase in enrollment. Interestingly, for private insurers, we tend to find that advertising emphasizing own brands or quality of their own insurance plans are much more effective. Thus, the effectiveness of advertising depends not only on the messages, but also the sponsors.

Finally, we study alternative designs of government advertising in an equilibrium model of health insurance marketplace. We examine how changes in government advertising across markets affect market outcomes by taking into account the possibility that private insurers endogenously adjust their marketing activities. For this purpose, we specify the supply side of the health insurance marketplace, where insurers optimally choose the level of advertising spending to maximize their profits. In the first part of analysis, we first recover the perceived marginal benefit of advertising by private insurers by using observed advertising spending and our demand estimates. In the second part of analysis, we conduct counterfactual experiments to evaluate various designs of government advertising. We find that decreasing government advertising leads to significant increases in private advertising spending. However, we also find that overall market-level enrollment changes very little regardless of whether we allow private insurers to respond to changes in government advertising. This finding is consistent with the demand model estimate that shows little market-expansion effects of private advertising and that a large part of private advertising is likely to be wasteful of resources. Therefore, our result suggests that government advertising may be a more efficient marketing tool in these market-based public programs.

Our research contributes to the three strands of literature. First, this paper contributes to an active literature on government interventions that increase take-up of public programs. Among them, this paper is particularly related to a set of papers that evaluate marketing and outreach activities designs for public programs. It has been argued that many public or welfare programs, such as the Supplemental Nutrition Assistance Program (SNAP), Social Security Disability Insurance (SSDI), and Medicaid, suffer from incomplete take-up (see Currie (2006) for a survey). There are a few studies investigating the effectiveness of government marketing and outreach on the take-up rate of eligible populations. The seminal work in this literature is Aizer (2007), who explores the effectiveness of a California outreach campaign on Medicaid take-up rates. Finkelstein and Notowidigdo (2019) conduct a randomized experiment to understand the effectiveness of information provisions for the eligibility for SNAP. These papers focus on the effectiveness of government outreach in traditional public/welfare programs that are directly implemented by the government. The contribution of this paper is to study designs of marketing and outreach by the government in a *market-based* public program. This will provide new insights into a role of the government in such programs and how market equilibrium responds to the government marketing behaviors.

Second, this paper is related to the literature investigating market design of health insurance markets. The literature has extensively focused on pricing/product regulations and subsidy designs/risk adjustment, e.g., Hackmann et al. (2015) and Handel et al. (2015) for pricing regulations; Shepard (2016) and Ho and Lee (2019) for medical network provider reg-

ulations; Brown et al. (2014) for risk adjustment; Cabral et al. (2018), Curto et al. (2014), Duggan et al. (2016), Tebaldi (2017), andPolyakova and Ryan (2019) for capitation payments or subsidy designs.

We contribute to this literature by studying an equally important yet under-studied policy design tool: a design of marketing and outreach activities by the government. In fact, several studies (Cebul et al. (2011) and Aizawa and Kim (2018)) argue the importance of marketing activities by private insurers in determining market outcomes in health insurance markets. Very recently, several studies in the health policy literature (e.g., Karaca-Mandic et al. (2017) and Gollust et al. (2018)) document a positive association between government advertising and decreases in the number of uninsured individuals in the context of the ACA.[5] Compared with these studies, the main theme of our study is to assess the efficiency of government marketing activities in private markets by building an equilibrium framework that accounts for interactions between government and private marketing activities. To cleanly identify and estimate the impact of advertising, we build on recent methodological advancement in the marketing literature (e.g., Shapiro (2018) and Spenkuch and Toniatti (2018)) and use an advertising market border identification approach. Using this approach with detailed enrollment data, we provide a number of new estimates, including the impact of advertising on insurer-level enrollment, their heterogeneous impacts, the effectiveness of contents of advertising, and business stealing/spillover effects of private advertising. These estimates, combined with equilibrium model, will be crucial in understanding inter-dependence between government and private insurers in terms of marketing activities.

Third, it contributes to the literature on advertising. Recently, researchers have studied the effects of advertising by private companies in an equilibrium framework for different contexts: Goeree (2008) for the personal computer; Dubois et al. (2018) for junk food; Gordon and Hartmann (2016) and Moshary (2017), and Spenkuch and Toniatti (2018) for U.S. elections; Shapiro (2018) and Sinkinson and Starc (2018) for pharmaceuticals; and Hastings et al. (2017) for privatized pension. This paper adds to this literature by investigating the interaction between government and private advertising.

# 2 Background on the Health Insurance Marketplace

Health Insurance Marketplace is a federal/state-based health insurance program for the non-elderly (people aged less than 65) in the United States. It was established in 2014 as a part of the ACA. The marketplaces are designed to provide health insurance coverage for non-elderly

[5]Barry et al. (2018) also analyze how the content of ACA advertising over time and discuss whether they are designed to attract young and healthy individuals.

uninsured individuals, which is close to 20% of the U.S. population. In the marketplace, private insurers offer a variety of health insurance options, and the federal government offers premium and cost sharing subsidies to low-income enrollees. Each insurance product is usually categorized based on their "metal" plans, which provide different levels of coverage generosity: Bronze, Silver, Gold, and Platinum. Individuals can decide to purchase health insurance during the open enrollment period, typically starting in the beginning of October that precedes the year when the new coverage begins. Each health plan is an annual health insurance contract, and individuals need to decide whether to enroll every year.

**Rating Regions.** Each state is divided into geographical rating regions, groups of counties or zip codes. Within each geographical rating region, importantly, insurers are not allowed to explicitly discriminate their pricing and product offering based on consumer's health status. Insurers can still charge different premiums based on an individual's age and smoking status under a pre-specified rule: specifically, the maximum premium ratio between the oldest and the youngest must be equal to a factor of 3; the smoker's insurance premium is 1.5 times as high as non-smokers.

**Consumer Subsidies.** Consumers who purchase health insurance are offered generous premium subsidies from the federal government. The amount of the subsidy depends on household income. Subsidies are available only if household incomes are between 138% and 400% of the federal poverty level. Among these households, a household with a lower income receives a more generous premium subsidy. If a household income is below 138% of the federal poverty level, then individuals are not eligible for the subsidies because they would be eligible for Medicaid.[6] Consumers who purchase silver plans in marketplaces also receive income-dependent cost sharing subsidies. Overall, the government spends close to $40 billion per year on premium and cost-sharing subsidies.

**Risk Adjustment System.** The ACA created several programs to mitigate insurer's incentives to selectively enroll healthy and low-cost individuals (i.e., risk selection). Most importantly, the ACA introduced a risk adjustment system that give transfers to insurers that attract a greater number of unhealthy individuals than the market average.[7] A distinct feature of the risk adjustment under the ACA is budget neutrality. In other words, insurers

[6]This is the case when the state government expands Medicaid under the ACA. If the state government does not expand Medicaid under the ACA, then consumers are qualified for subsidies as long as a household income is between 100% and 400% of the federal poverty level. If a household income is below 100%, then they are still not qualified for the marketplace subsidies.

[7]The ACA used to incorporate two additional features into the risk adjustment program: re-insurance and risk corridors. However, both have been terminated by the end of 2016.

with a greater number of unhealthy populations than other insurers in the same state would receive transfers from other insurers; insurers with a larger portion of healthy populations than other insurers would instead have to provide payments to other insurers.[8]

This design of the ACA risk adjustment system may be relevant in our context. Even if advertising from private insurers primarily steals healthy consumers from other insures, then gains from risk selection through advertising will be diminished by the risk adjustment system. Under the risk adjustment system, an insurer with a better risk pool than other insurers will have to make a payment to other insurers, which offsets potential benefits from attracting consumers with better health risks.

**Marketplace Administration and Marketing.** State governments have three options to administer health insurance marketplace under the ACA. First, they can participate in health insurance marketplaces operated by the U.S. Department of Health and Human Services (HHS), called federally facilitated marketplace. Second, they can create own state health insurance marketplaces (state marketplaces). Third, they can partner with the federal health insurance marketplace (partnership marketplaces). Each marketplace model gives a different level of flexibility to states in designing their own exchanges. For example, under different models, states are given different levels of different ability to maintain control over their marketplace and tailor consumer outreach and assistance to their populations. Moreover, states face different funding and resource constraints under different models.[9]

Under the state marketplace model, states have full responsibility for running consumer assistance functions of their marketplaces, which include direct marketing to consumers about their marketplaces through paid advertising on various media such as TV. These activities are partially supported through federal funding. In federally facilitated marketplaces, in contrast, the federal government is responsible for conducting these functions. The federal government conducts a significant amount of marketing activities for the health insurance marketplace.

[8]This design is different from other health insurance markets, such as Medicare Advantage, where amounts of risk adjustment transfers do not depend on a relative composition of enrollees' health risks across insurers in the same market. In non-ACA health insurance markets, an insurer's payment from a risk adjustment system typically depends only on its own enrollees' risk profile, regardless of risk compositions of enrollees in other insurers.

[9]https://www.healthaffairs.org/do/10.1377/hpb20130718.132696/full/

# 3 Data and Summary Statistics

This paper combines data from multiple sources. We use the health insurance enrollment data for 2014–2017 from the Center for Medicare and Medicaid Services (CMS) to construct market shares for insurers. We also obtain detailed information on advertising from Kantar Media. This data set provides occurrence-level TV advertising information on advertisements by private insurers and the federal and state governments for 2013–2017 (both on Spot TV and Network TV). Finally, we acquire plan characteristics from the CMS.[10]

## 3.1 Data Sources

### 3.1.1 Firm- and Market-Level Data

Our analysis combines enrollment data of federal marketplaces and the two largest state-based marketplaces from California and New York. In each year, the CMS releases enrollment data for health insurance marketplaces for 38 states that are administered by the federal government. These 38 states have either federally facilitated marketplaces or partnership marketplaces. Most of enrollees in these marketplaces purchase plans through the online website "healthcare.gov". The CMS constructs a database of detailed information about enrollment at the insurer-county level for each year from 2014 to 2017. The database also provides a breakdown of enrollments by gender, age, household income, and smoking status.

In addition to these marketplaces, we also obtain enrollment data from the two largest state exchanges from California and New York. Like the federal data, the data from the two states provide total enrollments for each insurer and county in each year. However, the data from California and New York do not provide a breakdown of enrollments by different demographic groups unlike the federal data.

In order to construct market shares for each insurer in a county, we obtain the county-level market size from the American Community Survey (ACS). Specifically, following Tebaldi (2017) and Polyakova and Ryan (2019), we define the market size of each county as the sum of the number of uninsured individuals and those who individually purchased health insurance, instead of obtaining it from their employers. This number measures the number of people who would potentially purchase plans from marketplaces.

We also obtain county-level health characteristics from County Health Rankings by the Robert Wood Johnson Foundation (CHR). CHR provides information about county-level health characteristics, such as the fraction of populations with poor or fair health or the populations with diabetes.

[10]The current analysis does not utilize the large cut to the federal government's marketing budget in 2017 because the enrollment data affected by the budget cut has not been released yet.

The CMS also releases detailed plan characteristics for plans sold through "Healthcare.Gov" in the 38 states. These include information about premiums and financial characteristics, such as metal level (Bronze, Silver, Gold, and Platinum) as well as detailed benefit information (e.g., dental coverage).

### 3.1.2 Advertising Data

Our advertising data is from Campaign Media Analysis Group at the Kantar Media. The data contains advertising spending, duration, and gross rating points (GRP) at each advertisement occurrence level. Each advertisement is on either spot TV or network TV. Data on spot TV advertisements are available at the designated market area (DMA) level, while data on network TV advertisements are at the national level.

We use the per capita advertising spending as our main measure of analysis. Although our data suggest the strong positive correlation among GRP, spending, and duration, using GRP will more precisely inform us consumer exposure of advertising. Unfortunately, GRP is not reported for most of network TV advertising. In order to construct an advertising measure based on spot and network TVs, advertising spending provides a better characterization. Main results based on GRP and duration are available on request and they are quite similar with the one with spending.

The database also provides detailed characteristics of each advertisement. For example, we can precisely observe a video of an actual advertisement through a weblink for each advertisement in the database. Moreover, we can observe who sponsored each advertisement and the exact time of when each advertisement is placed.

**Identifying Advertisement Types** For our analysis, we ideally want to identify which advertisements are related to marketplaces. For this purpose, we exploit the detailed information from the database. Specifically, by transcribing each advertisement, we identify (i) which advertisements are related to marketplaces, (ii) which advertisements just promote a private insurer's brand generally, and (iii) which advertisements are about health plans in specific markets other than marketplaces such as Medicare-related plans. Using the Amazon Web Service, we transcribed each advertisement in our database, which allows us to identify different types of advertisements based on keywords. In our analysis, we only consider advertisement types (i) and (ii) and exclude type (iii).

We have slightly different ways to identify types of advertisements depending on types of advertisement sponsors: the federal government, state governments, and private insurers. First, for the federal advertisement, we initially select advertisements sponsored by HHS.[11]

[11]We also checked whether there are other federal sponsors who would place marketplace-related adver-

Among such advertisements, we identify marketplace-related advertisements by checking whether "Healthcare.gov" was mentioned in an advertisement based on transcripts. Because there are only a little more than 100 distinct advertisements by HHS, we also verified our classification visually watching each individual advertisement video. Type (ii) advertisements are likely non-existent for federal advertising, and we do not consider it. Lastly, we exclude any advertisements of type (iii), for example ones about Medicare by HHS, from our sample.

Second, for advertising by state governments, we identify names of sponsors that match names of state exchanges such as Covered California and New York State of Health. Like federal advertising, we identified advertisements of type (i) from these sponsors based on their transcripts and visual inspections of advertisement videos. We also do not consider type (ii) advertisements from these sponsors.

Third, for private advertising, it is difficult to rely on visual inspections to classify advertisements into different types because there are thousands of distinct advertisements. Thus, we mainly rely on transcripts. For these advertisements, we consider type (i) and (ii) in our sample and exclude type (iii). Based on the transcripts, we initially identify advertisements containing keywords related to type (iii) such as Medicare Advantage, Medicare Part D, Medigap, employer-sponsored insurance, etc. Then we exclude any of such advertisements from the sample. Among the rest of the sample, we identify specific keywords related to marketplace plans such as healthcare reform, open enrollment, financial assistance, etc. Then we classify advertisements with such keywords as type (i), and the rest of advertisements in the sample are classified as type (ii).

## 3.2 Summary Statistics

First, we document the volume of marketplace advertising by each sponsor type. Figure 1 reports monthly time-series patterns of advertising spending by governments and insurers. We find that private ACA-related advertising is somewhat larger than advertising by state and federal governments. However, the magnitude of total government advertising (both federal or state combined) is still sizable, which is usually more than 100 million dollars per year. This magnitude can be comparable to the total private advertising for health insurance (both ACA and non-ACA advertisements combined). Importantly, almost all ACA-related advertising, regardless of whether they are private or governments, are placed around open enrollment periods of health insurance marketplaces. This pattern is different from non-ACA private advertising, which shows similar monthly spending over the year.

tisements. However, the federal advertising seems to be done exclusively by HHS.

Figure 1: Time Series of Advertising Spending

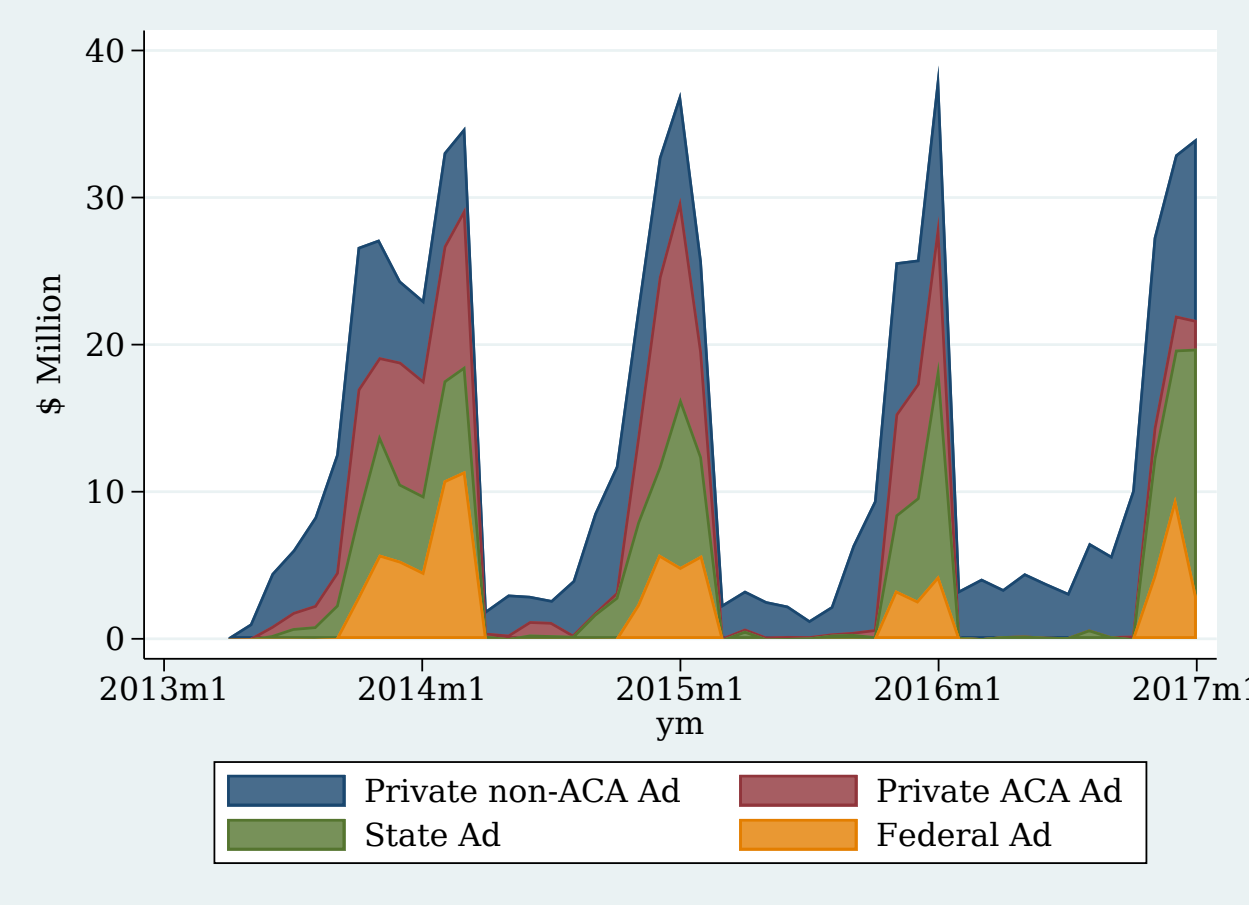
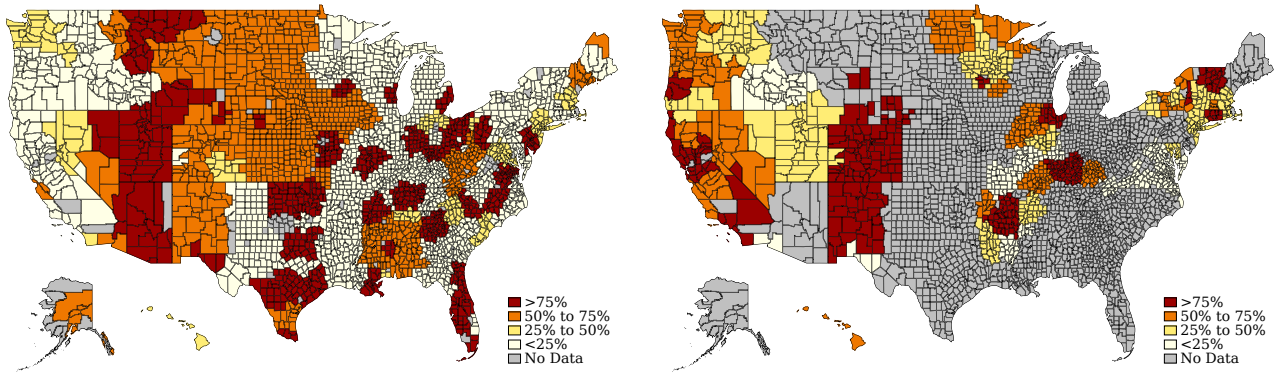
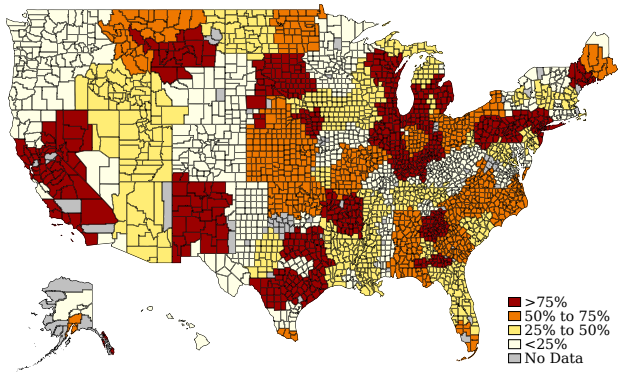


Figure 2: Geographical Patterns of Gov Advertising




(a) Fed Ad per Capita (b) State Ad per Capita

Figure 3: Geographical Patterns of Private Advertising




Figures 2 and 3 present in which DMAs different sponsor types did their advertising for the 2014 open enrollment period. First, the figures show that the federal and state governments advertised in very different DMAs. This is simply because that state advertising is done mainly in DMAs with state marketplaces, while the federal government advertised mainly in DMAs with federally facilitated marketplaces plus some national TV advertising. Second, the same figures also show that the distribution of government and private advertising spending differ significantly across DMAs. For example, compared with private insurers, the federal government advertise extensively in Arizona and Florida.

Table 1 documents summary statistics of market characteristics depending on government and private advertising spending. In the table, we combine advertising by the federal and state governments to calculate the total government advertising spending. The table shows that both government and private advertising spending are larger in DMAs with a greater number of potential buyers of marketplace plans (i.e. market size). However, they are not perfectly correlated with each other. Comparing Columns (4)–(6), it is apparent

that government advertising spending does not monotonically increases as private spending increases.

Table 1: Summary Statistics at DMA-Year Level

| | By Gov Ad Expenditure per Capita | | | By Private Ad Expenditure per Capita | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | <25% | ≥ 25% & <75% | ≥ 75% | <25% | ≥ 25% & <75% | ≥ 75% |
| Gov Ad per Capita ($) | 0.14 | 5.50 | 12.05 | 5.13 | 4.80 | 6.31 |
| Priv Ad per Capita ($) | 4.96 | 3.06 | 5.71 | 0.00 | 6.83 | 10.72 |
| No. of Insurers | 3.52 | 2.97 | 4.24 | 2.90 | 3.73 | 4.37 |
| Share of Poor or Fair Health | 0.17 | 0.17 | 0.16 | 0.17 | 0.17 | 0.17 |
| Market Size (100,000) | 1.37 | 1.80 | 5.11 | 1.22 | 2.28 | 5.23 |
| % FPL ≤ 138 | 0.25 | 0.23 | 0.22 | 0.22 | 0.25 | 0.24 |
| % FPL from 138 to 250 | 0.25 | 0.25 | 0.24 | 0.25 | 0.25 | 0.25 |
| % FPL from 250 to 400 | 0.21 | 0.22 | 0.22 | 0.22 | 0.21 | 0.21 |
| % FPL > 400 | 0.29 | 0.30 | 0.32 | 0.31 | 0.29 | 0.30 |
| % age ≤ 18 | 0.14 | 0.15 | 0.15 | 0.15 | 0.14 | 0.15 |
| % age from 18 to 34 | 0.36 | 0.35 | 0.35 | 0.35 | 0.36 | 0.35 |
| % age from 35 to 54 | 0.32 | 0.32 | 0.32 | 0.31 | 0.32 | 0.33 |
| % age ≥ 55 | 0.18 | 0.19 | 0.18 | 0.19 | 0.17 | 0.17 |
| N. Obs. | 262 | 326 | 196 | 395 | 193 | 196 |

Source: Kantar Media 2014–2017.

Table 2 shows the summary statistics of contents of advertisements depending on sponsor types (the federal and state governments, and private insurers). With transcripts of advertisements in our sample, we first consider several relevant topics in our context, including whether an advertisement mentions the healthcare reform, marketplaces, the open enrollment period, being uninsured, financial penalty of not having health insurance, financial assistance under the ACA, or pricing information (affordability) of health insurance. We then tabulate the proportion of advertisements that mention keywords related to each topic. Details on how these variables are constructed are in Appendix B.

Here are our findings. First, topics that advertisements focused on have changed over years. Federal advertising did not specifically mention the open enrollment period or financial assistance in 2014, whereas more than a half of federal advertising mentioned the open enrollment period in 2016. Second, topics that are commonly discussed in both government and private advertisements are the open enrollment period and financial assistance under the ACA. Third, we find that a half of advertising by private insurers provide contents related to the ACA. Non-ACA-related private advertising typically emphasize an insurer's brands and the quality of its plans.

Table 2: Ad Contents

| | Year = 2014 | | | Year = 2015 | | | Year = 2016 | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | Private | Federal | State | Private | Federal | State | Private | Federal | State |
| % Any ACA-related | 0.52 | 1.00 | 1.00 | 0.51 | 1.00 | 1.00 | 0.40 | 1.00 | 1.00 |
| % Healthcare Reform | 0.39 | 0.38 | 0.07 | 0.07 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| % Marketplace | 0.05 | 1.00 | 1.00 | 0.11 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 |
| % Open Enrollment | 0.26 | 0.04 | 0.07 | 0.37 | 0.01 | 0.20 | 0.24 | 0.64 | 0.26 |
| % Uninsured | 0.01 | 0.05 | 0.31 | 0.04 | 0.00 | 0.01 | 0.03 | 0.00 | 0.07 |
| % Penalty | 0.04 | 0.00 | 0.01 | 0.20 | 0.00 | 0.01 | 0.15 | 0.00 | 0.04 |
| % Financial Assistance | 0.21 | 0.12 | 0.47 | 0.41 | 0.22 | 0.39 | 0.27 | 0.59 | 0.21 |
| N. Obs. | 351,702 | 166,137 | 164,663 | 263,131 | 27,907 | 101,562 | 184,549 | 39,134 | 106,754 |

Source: Kantar Media 2014–2017.

# 4 Suggestive Evidence for Targeting Advertising

In this section, we carry out preliminary analyses to explore how advertising by governments and private insurers are targeted. In order to obtain further insights on whether geographical targeting of advertising, which is shown earlier, is related to market characteristics (e.g., income and health distributions), we estimate the following regression:

$$ad_{mt}^{\tau} = X_{mt}\gamma + \xi_t + \epsilon_{mt}. \tag{1}$$

The dependent variable $ad_{mt}^{\tau}$ represents advertising spending per capita by sponsor type $\tau \in \{f, s, p\}$, which is the federal government ($f$), state government ($s$), or private insurer ($p$). Explanatory variables $X_{mt}$ include various market-level characteristics such as the market size, the number of insurers, distributions of ages and household incomes of potential consumers in each DMA, and DMA-level average health characteristics. Next, $\xi_t$ refers to year fixed effects. We hypothesize that the advertising may be targeted based on these market-level characteristics.

Table 3: Targeting of Total Gov Advertising

| | (1) GovACA | (2) GovReform | (3) GovMarket | (4) GovOpenEnroll | (5) GovPenalty | (6) GovFinancial |
|---|---|---|---|---|---|---|
| % FPL $\leq$ 138 | -3.139*** | -0.008 | -3.139*** | -2.356*** | -0.432 | -2.893*** |
| | (0.949) | (0.514) | (0.949) | (0.859) | (0.371) | (0.918) |
| % FPL from 138 to 250 | -1.322 | 0.064 | -1.322 | -0.911 | -0.455 | -1.023 |
| | (1.118) | (0.606) | (1.118) | (1.012) | (0.437) | (1.081) |
| % FPL from 250 to 400 | -1.999 | 0.678 | -1.999 | -1.278 | 0.639 | -1.983 |
| | (1.287) | (0.697) | (1.287) | (1.165) | (0.503) | (1.244) |
| % age $\leq$ 18 | 1.328 | 0.686 | 1.328 | -0.533 | -0.984* | 0.977 |
| | (1.414) | (0.766) | (1.414) | (1.280) | (0.552) | (1.367) |
| % age from 18 to 34 | -2.172* | -0.395 | -2.172* | 0.465 | -0.770 | -0.188 |
| | (1.238) | (0.671) | (1.238) | (1.121) | (0.484) | (1.198) |
| % age from 35 to 54 | -3.858** | 0.321 | -3.858** | -1.073 | -0.884 | -2.198 |
| | (1.771) | (0.959) | (1.771) | (1.603) | (0.692) | (1.713) |
| Share of Poor or Fair Health | 3.134** | -0.486 | 3.134** | 2.204 | 1.804*** | 2.867* |
| | (1.556) | (0.843) | (1.556) | (1.409) | (0.608) | (1.505) |
| No. of Insurers | 0.008 | -0.001 | 0.008 | 0.026 | -0.006 | 0.031 |
| | (0.023) | (0.013) | (0.023) | (0.021) | (0.009) | (0.022) |
| Market Size (100,000) | 0.078*** | 0.030*** | 0.078*** | 0.077*** | 0.015*** | 0.081*** |
| | (0.010) | (0.006) | (0.010) | (0.009) | (0.004) | (0.010) |
| N. Obs. | 784 | 784 | 784 | 784 | 784 | 784 |
| Adj. $R^2$ | 0.132 | 0.419 | 0.132 | 0.202 | 0.031 | 0.194 |

Table 3 presents our preliminary estimates of geographical targeting of government advertising, which is the sum of federal and state advertising. The column (1) reports the result based on any ACA-related advertisement. The rest of the columns report results based on contents of advertisements. First, we confirm again that the government advertises more in DMAs with a greater number of potential buyers (i.e., market size). Second, interestingly, column (1) shows that the coefficient for the proportion of unhealthy population based on self-reported health status is positive and significant for government advertising on the ACA. This shows that government advertising tends to target DMAs with relatively more individuals that are unhealthy.

These results suggest that the government advertising are targeted especially to those who may benefit from gaining health insurance from marketplaces. In fact, unhealthy populations presumably would benefit more from gaining health insurance. Thus, if advertising reduces the cost of signing up for a marketplace plan, government advertising may increase the take-up rate of individuals who would benefit most from health insurance marketplaces.

Table 4 and 5 report our preliminary estimates of geographical targeting of federal and state governments separately. As in overall government advertising, both federal and state advertising are targeted toward DMAs with a greater number of potential buyers. However,

Table 4: Targeting of Federal Advertising

| | (1) FedACA | (2) FedACAPrice | (3) FedACAFinPenPrice | (4) FedReform | (5) FedMarket | (6) FedOpenEnroll | (7) FedPenalty | (8) FedFinancial | (9) FedFinPen |
|---|---|---|---|---|---|---|---|---|---|
| % FPL $\leq$ 138 | -0.008 | 1.665 | 1.269 | 0.660 | -0.008 | -0.689 | -0.188 | 0.028 | 0.016 |
| | (1.238) | (1.192) | (1.213) | (0.757) | (1.238) | (1.109) | (0.119) | (1.070) | (1.100) |
| % FPL from 138 to 250 | -0.838 | -1.182 | -1.415 | -0.712 | -0.838 | 0.015 | 0.011 | -0.309 | -0.449 |
| | (1.364) | (1.314) | (1.336) | (0.834) | (1.364) | (1.222) | (0.131) | (1.178) | (1.212) |
| % FPL from 250 to 400 | 1.335 | 1.415 | 1.130 | 0.292 | 1.335 | 1.099 | 0.010 | 1.031 | 1.030 |
| | (1.656) | (1.595) | (1.623) | (1.013) | (1.656) | (1.484) | (0.159) | (1.431) | (1.472) |
| % age $\leq$ 18 | 3.272* | 2.835* | 4.329*** | 0.529 | 3.272* | 1.189 | -0.228 | 3.688** | 3.718** |
| | (1.686) | (1.624) | (1.652) | (1.031) | (1.686) | (1.511) | (0.162) | (1.457) | (1.499) |
| % age from 18 to 34 | -0.532 | 0.407 | 0.556 | -1.315 | -0.532 | 1.126 | -0.152 | 1.808 | 1.788 |
| | (1.486) | (1.431) | (1.456) | (0.909) | (1.486) | (1.331) | (0.143) | (1.284) | (1.320) |
| % age from 35 to 54 | -1.557 | -0.313 | -0.530 | -1.434 | -1.557 | -0.248 | -0.065 | 0.681 | 0.613 |
| | (2.129) | (2.051) | (2.086) | (1.302) | (2.129) | (1.908) | (0.205) | (1.840) | (1.892) |
| Share of Poor or Fair Health | 3.044* | -1.834 | 1.077 | -0.978 | 3.044* | 2.062 | 0.376** | 2.528 | 2.622 |
| | (1.830) | (1.763) | (1.794) | (1.120) | (1.830) | (1.640) | (0.176) | (1.582) | (1.627) |
| No. of Insurers | 0.018 | -0.009 | 0.013 | -0.007 | 0.018 | 0.039* | 0.001 | 0.044** | 0.042** |
| | (0.024) | (0.023) | (0.024) | (0.015) | (0.024) | (0.022) | (0.002) | (0.021) | (0.021) |
| Market Size (100,000) | 0.110*** | 0.100*** | 0.116*** | 0.047*** | 0.110*** | 0.101*** | 0.004** | 0.119*** | 0.122*** |
| | (0.015) | (0.014) | (0.015) | (0.009) | (0.015) | (0.013) | (0.001) | (0.013) | (0.013) |
| N. Obs. | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 | 480 |
| Adj. $R^2$ | 0.251 | 0.316 | 0.337 | 0.469 | 0.251 | 0.351 | 0.025 | 0.437 | 0.416 |

Table 5: Targeting of State Advertising

| | (1) StateACA | (2) StateACAPrice | (3) StateACAFinPenPrice | (4) StateReform | (5) StateMarket | (6) StateOpenEnroll | (7) StatePenalty | (8) StateFinancial | (9) StateFinPen |
|---|---|---|---|---|---|---|---|---|---|
| % FPL $\leq$ 138 | -5.812*** | 0.722 | -6.280*** | -1.523 | -5.812*** | -5.812*** | -0.325 | -6.953*** | -6.925*** |
| | (1.582) | (1.684) | (1.666) | (0.956) | (1.582) | (1.739) | (1.085) | (1.828) | (1.787) |
| % FPL from 138 to 250 | 2.829 | 2.321 | 2.123 | 2.160* | 2.829 | -2.221 | -0.908 | 1.654 | 0.650 |
| | (2.009) | (2.138) | (2.114) | (1.214) | (2.009) | (2.208) | (1.378) | (2.320) | (2.269) |
| % FPL from 250 to 400 | 0.923 | 2.542 | 1.916 | 0.367 | 0.923 | 0.325 | 3.176** | 1.115 | 1.527 |
| | (1.995) | (2.123) | (2.100) | (1.206) | (1.995) | (2.193) | (1.368) | (2.304) | (2.253) |
| % age $\leq$ 18 | -3.037 | -0.400 | -4.809* | -1.868 | -3.037 | -2.798 | -1.309 | -4.841* | -5.704** |
| | (2.416) | (2.572) | (2.543) | (1.460) | (2.416) | (2.656) | (1.658) | (2.791) | (2.729) |
| % age from 18 to 34 | 0.182 | 4.920** | -1.042 | 0.983 | 0.182 | 2.644 | -0.255 | -0.632 | -2.350 |
| | (2.108) | (2.244) | (2.219) | (1.274) | (2.108) | (2.317) | (1.446) | (2.435) | (2.381) |
| % age from 35 to 54 | -5.464* | -3.061 | -7.487** | 2.109 | -5.464* | -1.266 | -0.702 | -6.478* | -9.315*** |
| | (3.051) | (3.247) | (3.212) | (1.844) | (3.051) | (3.354) | (2.093) | (3.524) | (3.446) |
| Share of Poor or Fair Health | -0.888 | -3.260 | 1.954 | -0.965 | -0.888 | 4.666 | 4.322** | 3.267 | 4.180 |
| | (2.928) | (3.116) | (3.082) | (1.769) | (2.928) | (3.218) | (2.009) | (3.382) | (3.307) |
| No. of Insurers | -0.007 | 0.166*** | 0.045 | -0.003 | -0.007 | -0.006 | -0.019 | 0.046 | 0.016 |
| | (0.049) | (0.052) | (0.051) | (0.029) | (0.049) | (0.053) | (0.033) | (0.056) | (0.055) |
| Market Size (100,000) | 0.039*** | 0.010 | 0.038*** | 0.019** | 0.039*** | 0.044*** | 0.019** | 0.037** | 0.044*** |
| | (0.013) | (0.014) | (0.014) | (0.008) | (0.013) | (0.014) | (0.009) | (0.015) | (0.015) |
| N. Obs. | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 |
| Adj. $R^2$ | 0.157 | 0.184 | 0.150 | 0.219 | 0.157 | 0.123 | 0.067 | 0.105 | 0.118 |

Table 6: Targeting of Private Advertising

| | (1) PrivAll | (2) PrivACA | (3) PrivACAPrice | (4) PrivACAFinPenPrice | (5) PrivReform | (6) PrivMarket | (7) PrivOpenEnroll | (8) PrivPenalty | (9) PrivFinancial | (10) PrivFinPen |
|---|---|---|---|---|---|---|---|---|---|---|
| % FPL $\leq$ 138 | 4.303*** | 4.886*** | 1.255 | 4.833*** | 2.932*** | 2.424*** | 4.541*** | 3.185*** | 4.654*** | 4.830*** |
| | (0.907) | (0.885) | (0.800) | (0.892) | (0.764) | (0.780) | (0.865) | (0.845) | (0.856) | (0.861) |
| % FPL from 138 to 250 | 1.750 | 1.220 | 0.705 | 1.871* | 1.645* | 0.490 | 1.542 | 1.280 | 2.036** | 2.176** |
| | (1.069) | (1.043) | (0.942) | (1.050) | (0.900) | (0.919) | (1.018) | (0.995) | (1.009) | (1.014) |
| % FPL from 250 to 400 | 0.657 | 1.415 | 0.870 | 2.000* | 1.034 | 0.097 | 1.545 | 0.691 | 1.365 | 1.351 |
| | (1.230) | (1.200) | (1.085) | (1.209) | (1.036) | (1.058) | (1.172) | (1.145) | (1.161) | (1.168) |
| % age $\leq$ 18 | 0.253 | 1.085 | 1.207 | -0.024 | -1.565 | 2.099* | 0.013 | -2.085* | -1.654 | -1.871 |
| | (1.351) | (1.318) | (1.192) | (1.328) | (1.138) | (1.162) | (1.288) | (1.258) | (1.276) | (1.283) |
| % age from 18 to 34 | 1.506 | 2.699** | 1.520 | 2.254* | 1.582 | 1.031 | 1.124 | 0.237 | 1.366 | 1.312 |
| | (1.184) | (1.155) | (1.044) | (1.164) | (0.997) | (1.018) | (1.128) | (1.102) | (1.118) | (1.124) |
| % age from 35 to 54 | 3.653** | 3.555** | 2.276 | 3.843** | 3.846*** | 0.009 | 2.319 | -0.560 | 3.541** | 3.149* |
| | (1.693) | (1.652) | (1.493) | (1.664) | (1.426) | (1.456) | (1.614) | (1.576) | (1.598) | (1.607) |
| Share of Poor or Fair Health | -6.136*** | -6.196*** | -1.268 | -5.185*** | -3.952*** | -3.116** | -5.205*** | -2.972** | -5.064*** | -5.334*** |
| | (1.487) | (1.451) | (1.312) | (1.462) | (1.253) | (1.280) | (1.418) | (1.385) | (1.404) | (1.412) |
| No. of Insurers | 0.160*** | 0.119*** | 0.108*** | 0.131*** | 0.101*** | 0.058*** | 0.083*** | 0.033 | 0.100*** | 0.104*** |
| | (0.022) | (0.022) | (0.019) | (0.022) | (0.019) | (0.019) | (0.021) | (0.021) | (0.021) | (0.021) |
| Market Size (100,000) | 0.050*** | 0.068*** | 0.060*** | 0.066*** | 0.040*** | 0.042*** | 0.082*** | 0.062*** | 0.068*** | 0.070*** |
| | (0.010) | (0.010) | (0.009) | (0.010) | (0.008) | (0.008) | (0.009) | (0.009) | (0.009) | (0.009) |
| N. Obs. | 784 | 784 | 784 | 784 | 784 | 784 | 784 | 784 | 784 | 784 |
| Adj. $R^2$ | 0.203 | 0.322 | 0.212 | 0.297 | 0.340 | 0.094 | 0.307 | 0.164 | 0.307 | 0.310 |

importantly, we find that only federal advertising is targeted toward DMAs with a greater number of unhealthy population. Thus, our previous finding that government advertising is targeted to unhealthy DMAs is primarily driven by advertising by the federal government.

Table 6 presents our preliminary estimates of geographical targeting of advertising by private insurers. The column (1) is the result from all private advertising, regardless of whether it is related to ACA. Column (2) is based only on ACA-related private advertising. Such advertising does not include advertising such as insurer's own brand advertising in general that is not related to the ACA. The rest of columns report results from ACA-related advertising that provide specific types of contents. We find that the coefficient for the proportion of unhealthy population based on self-reported health status is negative and significant. Thus, the private insurers tend to advertise in DMAs with healthy populations, which is opposite to the government advertising. Moreover, we find that signs of estimates for many other demographics characteristics are very different from the ones for government advertising regression. Despite these differences, we still find that private insurers advertise more in markets with a greater number of potential buyers, which is consistent with government advertising.

We think that there are several reasons why private insurers may want to target markets with healthier populations. First, it may be because of risk selection. Because the premium should be the same between healthy and unhealthy population within each rating area, insurers may gain from attracting health consumers. Thus, insurers may target more in DMAs with more healthy customers. Of course, importance of this channel depends on how well risk adjustment is designed, as discussed in Section 2. Second, it is possible that healthy consumers are more responsive to advertising. If healthy consumers face smaller search or application costs, they may respond more to advertising. For example, in the context of employer-sponsored health insurance, Handel (2013) finds that switching costs (inertia) of health insurance choice is slightly larger for individuals with chronic conditions. Moreover, in the context of Medicare Advantage, Aizawa and Kim (2018) find that healthy individuals are more responsive to advertising. In this case, even if healthy and unhealthy individuals are equally profitable for insurers, they will have incentive to advertise more in DMAs with healthy populations to increase the size of enrollment and therefore total profits.

We also examine which contents of advertising are targeted to different markets. First, we find that federal advertising emphasizing "markets" (i.e. healthcare.gov) and "penalty" (individual mandate penalty) tend to target in markets with unhealthy populations. Moreover, although we find that state government does not really advertise in markets with unhealthy populations based on overall advertisements, their advertising emphasizing "penalty" is larger in these markets. Importantly, for most advertisement categories, private insurers

advertise less in markets with unhealthy populations.

Overall, our finding clearly shows that governments and private insurers have different incentives with respect to advertising. However, at this stage, it is not clear whether advertising from different types of sponsors is effective at all, i.e., whether advertising increases enrollments. In next sections, we estimate impacts of advertising on consumer demand.

# 5 The Impact of Advertising on Consumer Demand

## 5.1 County-Level Analysis

To examine the effect of government and private advertising on consumer demand, we first examine their impact on market-level enrollments. The primary objective of this analysis is to understand whether advertising has any meaningful effects on market expansion.

### 5.1.1 Identification: Border Strategy

In estimating the effects of advertising, endogeneity of advertising is a usual concern. Private insurers may choose to advertise more in markets where expected profits from advertising are large, and they may have higher expected profits in some markets because of factors related to unobserved heterogeneity in consumer demand. For example, some insurers may have better brand images for consumers in certain markets. In contrast, it is not very clear whether the government implements a very sophisticated targeting strategy. If the government is sophisticated, it is not very clear whether the government targets markets with high or low demands for insurance. Depending on how advertising and demand for insurance is correlated, a naively regression of a county-level enrollment on advertising may lead to under- or over-estimation of the effects of advertising.

In order to address the endogeneity of advertising, we build on the works by Shapiro (2018), Tuchman (2016), Moshary (2017), Aizawa and Kim (2018), and Spenkuch and Toniatti (2018)), and implement a border identification approach.[12] The border identification strategy exploits a discontinuity of advertising expenditures across a border between DMAs. A DMA typically contains a major city and surrounding counties. Thus, there are "border counties" in an outer part of a DMA that are located right next to at least one county in a different DMA. In contrast, "non-border counties" are surrounded only by counties belonging to the same DMA.

To implement the border strategy, we first identify pairs of adjacent border counties that belong to different DMAs. We define a border area $b$ to be a distinct pair of two border

[12]The main idea behind this type of border approach is already seen in a seminal work by Holmes (1998)

counties in two distinct DMAs. Different border areas can be part of the two DMA pairs if there are multiple pairs of border counties that are part of the two same DMAs.

The main identifying assumption of the border strategy is that there is no unobserved heterogeneity across two adjacent counties within each border area in each year. Fixed effects for each combination of a border area and a year will absorb any unobservable factors that affect enrollment for each border area in each year. With the fixed effects, any differences in enrollments across border county pairs within a border area will be attributed to differences in advertising spending across the corresponding DMA border.

In order to see whether the identifying assumption is plausible, we compare observed characteristics of border counties depending on advertising spending within border areas. If the assumption is true, advertising should be exogenous even to observable characteristics of border counties, and we would expect to find that market characteristics are similar across border counties with different advertising spending within border areas.

Table 7 compares market characteristics between border counties with low and high government and private advertising spending. For the first two columns, we collect border counties with lower government advertising spending within each of border areas in Column (1) and border counties with higher government advertising spending within each of border areas in Column (2). We excluded border areas with zero government advertising from the table. For Columns (3) and (4), we group border counties similarly based on market-level private advertising spending.

The table shows that the two groups of markets are quite similar in terms of market characteristics except for advertising spending. First, the number of insurers selling marketplace plans, concentration among them (shown by HHI), and the market size are very similar between border counties with low and high advertising spending. Moreover, distributions of incomes and ages of individuals who would purchase marketplace plans are also very similar between the two groups of border counties. Lastly, health statuses shown by market-level shares of individuals with various health conditions are also identical between the two groups of border counties. These results suggest that the identifying assumption is plausible. Moreover, these results suggest that the targeting of advertising we documented in Section 4 is likely to be driven by across counties which do not share advertising market borders.

An important caveat about the border strategy is that estimated effects of advertising may be only valid to border counties. Thus, it might be difficult to extrapolate the estimated effects to non-border counties, which are excluded from the estimation sample. To gauge how serious this issue in our setting, we compare market-level characteristics between border and non-border counties. Table 8 presents market-level characteristics between border and

Table 7: Comparing Either Side of Border Areas

| | Gov Ad | | Priv Ad | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | Low | High | Low | High |
| Fed Spend ($) | 0.218 | 0.517 | 0.298 | 0.337 |
| | (0.195) | (0.477) | (0.352) | (0.402) |
| State Spend ($) | 0.142 | 0.299 | 0.147 | 0.203 |
| | (0.481) | (0.837) | (0.557) | (0.676) |
| Priv Spend ($) | 0.715 | 0.878 | 0.519 | 1.637 |
| | (1.319) | (1.844) | (1.055) | (2.431) |
| Number of Insurers | 2.847 | 2.878 | 3.006 | 3.115 |
| | (1.652) | (1.723) | (1.664) | (1.701) |
| HHI among Insuers | 0.671 | 0.674 | 0.648 | 0.630 |
| | (0.249) | (0.252) | (0.242) | (0.242) |
| Log of Market Size | 8.503 | 8.550 | 8.517 | 8.570 |
| | (1.217) | (1.256) | (1.192) | (1.265) |
| poten: % FPL $\leq$ 138 | 0.247 | 0.245 | 0.256 | 0.254 |
| | (0.087) | (0.085) | (0.086) | (0.088) |
| poten: % FPL from 138 to 250 | 0.252 | 0.255 | 0.253 | 0.252 |
| | (0.058) | (0.059) | (0.057) | (0.058) |
| poten: % FPL from 250 to 400 | 0.214 | 0.213 | 0.207 | 0.210 |
| | (0.060) | (0.060) | (0.058) | (0.057) |
| poten: % FPL $>$ 400 | 0.286 | 0.287 | 0.283 | 0.283 |
| | (0.090) | (0.090) | (0.090) | (0.089) |
| poten: % age $\leq$ 18 | 0.147 | 0.148 | 0.143 | 0.143 |
| | (0.051) | (0.054) | (0.050) | (0.052) |
| poten: % age from 18 to 34 | 0.328 | 0.327 | 0.331 | 0.332 |
| | (0.063) | (0.066) | (0.065) | (0.065) |
| poten: % age from 35 to 54 | 0.328 | 0.328 | 0.332 | 0.331 |
| | (0.051) | (0.052) | (0.049) | (0.050) |
| poten: % age $\geq$ 55 | 0.198 | 0.197 | 0.194 | 0.194 |
| | (0.053) | (0.051) | (0.051) | (0.050) |
| Poor or Fair Health | 0.177 | 0.176 | 0.182 | 0.182 |
| | (0.054) | (0.052) | (0.054) | (0.055) |
| Poor Physical Health Day | 3.921 | 3.920 | 3.984 | 3.982 |
| | (0.900) | (0.868) | (0.902) | (0.910) |
| Poor Mental Health Day | 3.741 | 3.777 | 3.788 | 3.768 |
| | (0.795) | (0.793) | (0.797) | (0.822) |
| Obesity | 0.314 | 0.313 | 0.317 | 0.316 |
| | (0.041) | (0.041) | (0.041) | (0.042) |
| Diabetes Prevalence | 0.114 | 0.114 | 0.116 | 0.116 |
| | (0.023) | (0.022) | (0.023) | (0.023) |
| Healthcare Cost (in $1000s) | 9.499 | 9.505 | 9.621 | 9.600 |
| | (1.513) | (1.363) | (1.513) | (1.416) |
| N. Obs. | 5,381 | 5,381 | 5,985 | 5,985 |

non-border counties. The table shows that although there are differences between the two groups of counties, the differences are not very large. For example, market sizes are larger for border counties than non-border counties, and it probably resulted in more insurers and lower HHI for border counties than non-border counties. However, the difference in market sizes in logarithm is smaller than 5% of its unconditional average, and the differences in the number of insurers and HHIs do not exceed 10% of their unconditional averages. Moreover, the distributions of ages and income groups are also not very different between the groups of counties. Lastly, the differences in county-level health statuses also do not exceed 10% of their unconditional averages. The result suggests that although estimates from the border strategy will not be exactly the same as ones based on the entire data sample, the estimates are unlikely to be very different from ones based on the entire sample.

Finally, one important advantage of our border strategy is that it allows us to identify the effect of advertising separately from other ways in which the government or insurers can increase enrollments. For example, the government may conduct outreaching activities beside advertising. However, our identification strategy is unlikely affected by such outreaching activities because such activities are not likely to discretely change across TV advertising market borders within county-border pairs.

### 5.1.2 Effects of Advertising on Market-level Enrollments

We estimate the following regression with the border strategy:

$$\ln(s_{bdct}) = \ln(1+\boldsymbol{ad}^{\boldsymbol{g}}_{\boldsymbol{b,m(c),t}})\boldsymbol{\beta_{d0}} + \ln(1+\boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{b,m(c),t}})\boldsymbol{\beta_{d1}} + \boldsymbol{x_{bct}\gamma_d} + \xi_{bdt} + \xi_{dc} + \xi_{r(c),dt} + \epsilon_{bdct}. \tag{2}$$

The dependent variable refers to the log of the share of individuals in a demographic group $d$ that enrolled in marketplace plans in border $b$, county $c$, and time $t$. On the right hand side, $\ln(1+\boldsymbol{ad}^{\boldsymbol{g}}_{\boldsymbol{b,m(c),t}})$ and $\ln(1+\boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{b,m(c),t}})$ refer to the vector of the log of the government and private advertising expenditures per potential marketplace enrollee in in border $b$, DMA $m(c)$ to which county $c$ belongs, and time $t$, respectively. This specification allows us to consider the effects of each component of government and private advertising separately, such as federal or state advertising, ACA-related private advertising or non-ACA private advertising, or advertising about about open enrollment or about financial characteristics. Moreover, this specification allows that effectiveness of advertising may differ by observed demographic characteristics of individuals, such as age and income groups. For market-level regressions, we define advertising by private insurers to be the sum of all of private advertising spending per potential enrollee in DMA $m(c)$ and time $t$. Note that TV advertising decisions are typically made on the basis of a DMA-year pair, which contains several counties. Thus,

Table 8: Comparing Border and Non-Border Counties

| | (1) Border Counties | (2) Non-Border Counties | (3) Overall |
|---|---|---|---|
| Number of Insurers | 3.116 | 2.863 | 2.959 |
| | (1.712) | (1.628) | (1.665) |
| HHI among Insuers | 0.629 | 0.666 | 0.652 |
| | (0.243) | (0.245) | (0.245) |
| Log of Market Size | 8.802 | 8.427 | 8.571 |
| | (1.620) | (1.238) | (1.409) |
| poten: % FPL $\leq$ 138 | 0.236 | 0.249 | 0.244 |
| | (0.081) | (0.085) | (0.084) |
| poten: % FPL from 138 to 250 | 0.248 | 0.252 | 0.250 |
| | (0.056) | (0.058) | (0.057) |
| poten: % FPL from 250 to 400 | 0.216 | 0.213 | 0.214 |
| | (0.056) | (0.060) | (0.058) |
| poten: % FPL $>$ 400 | 0.299 | 0.286 | 0.291 |
| | (0.087) | (0.088) | (0.088) |
| poten: % age $\leq$ 18 | 0.156 | 0.145 | 0.149 |
| | (0.052) | (0.052) | (0.052) |
| poten: % age from 18 to 34 | 0.336 | 0.328 | 0.331 |
| | (0.062) | (0.063) | (0.063) |
| poten: % age from 35 to 54 | 0.322 | 0.330 | 0.327 |
| | (0.050) | (0.050) | (0.050) |
| poten: % age $\geq$ 55 | 0.186 | 0.197 | 0.193 |
| | (0.050) | (0.052) | (0.051) |
| Poor or Fair Health | 0.163 | 0.179 | 0.173 |
| | (0.051) | (0.055) | (0.054) |
| Poor Physical Health Day | 3.697 | 3.947 | 3.851 |
| | (0.891) | (0.918) | (0.916) |
| Poor Mental Health Day | 3.533 | 3.753 | 3.668 |
| | (0.804) | (0.807) | (0.813) |
| Obesity | 0.306 | 0.316 | 0.312 |
| | (0.041) | (0.041) | (0.041) |
| Diabetes Prevalence | 0.107 | 0.115 | 0.112 |
| | (0.021) | (0.023) | (0.023) |
| Healthcare Cost (in $1000s) | 9.462 | 9.529 | 9.503 |
| | (1.542) | (1.478) | (1.503) |
| N. Obs. | 4,104 | 6,621 | 10,725 |

we assume individuals in different $c$ but in the same DMA ($m$) are exposed to the same advertising level. The DMA $m$, to which county $c$ belongs, is denoted by $m(c)$. We add one to the advertising variables before taking the logarithm because there are markets with zero advertising spending by the government or private insurers. Because both dependent and independent variables are in logarithm, coefficients $\beta_{d0}$ and $\beta_{d1}$ are elasticities of county-level demand by a demographic group $d$ for marketplace plans with respect to government and private advertising, respectively.

Next, $x_{bct}$ refers to a set of time-varying characteristics for each county. Moreover, we include up to three fixed effects to control any unobserved factors that affect demands flexibly: first, $\xi_{bdt}$ refers to fixed effects for a pair of a border area ($b$) and time ($t$), which captures any time-varying factors that affect enrollments for the entire county pairs in each border area. Second, $\xi_c$ refers to county fixed effects, which controls for any time-invariant unobserved characteristics for each border county. Lastly, $\xi_{r(c),t}$ refers to fixed effects for a pair of the rating area for county $c$ ($r(c)$) and time ($t$). A rating area is typically a collection of counties where each insurer set common characteristics for their plans. By including $\xi_{r(c),t}$, we control for any effects of changes in plan characteristics on enrollments, although we do not explicitly include specific plan characteristics in the regression.

### 5.1.3 Estimation Results

Table 9 presents regression results for a specification where we do not condition on demographic groups. Columns (1)–(3) present estimates where we define government advertising as the sum of advertisements by the federal and state governments. Each column has different sets of fixed effects. Columns (4)–(6) present estimates with specifications, where we allow for different effects of advertising by the federal and state governments. Columns (1) and (4) include border and time fixed effects ($\xi_{bt}$), and rating area and time fixed effects ($\xi_{r(c),t}$), but not county fixed effects ($\xi_c$). Columns (2) and (5) include border and time fixed effects ($\xi_{bt}$), and county fixed effects ($\xi_c$), but not rating area and time fixed effects ($\xi_{r(c),t}$). Columns (3) and (6) include all of the three fixed effects in Equation (2). In addition to the advertising variables and the fixed effects, we also include as extra controls the number of insurers offering marketplace plans and its quadratic term. Standard errors in all specifications are clustered at the level of DMA and time because main advertising variables vary at this level.

The table shows that government advertising, in particular one by the federal government, is more effective than private advertising across different specifications. Moreover, only the effects of government advertising are statistically significant, whereas coefficient estimates for private advertising are not significant in any specifications. Comparing Columns (1)–

(3), it is apparent that including county fixed effects reduces the magnitude of $\beta_0$ probably because government advertising is greater in markets, where consumers are more likely to enroll in marketplace plans to begin with. Including the fixed effects for rating area and time does not affect the magnitude of $\beta_0$ but only increases its standard error. This suggests that once we control for $\xi_{bt}$ and $\xi_c$, there is not much variation left in market-level enrollments that can be explained by changes in market-level plan characteristics over time (i.e. $\xi_{r(c),t}$). Accordingly, the adjusted R-squared only increase very little from Column (2) to Column (3).

The estimated coefficient in Column (3) shows that a 1% increase in government advertising leads to a 0.04% increase in market-level shares of individuals that enrolled in marketplace enrollments. Extrapolating the coefficient to a larger change in government advertising, if the government doubles advertising spending, then the market-level share will increase by 4%. Given the unconditional average of market-level shares is 0.18, a 4% increase is equal to an increase in the market-level share by 0.72 percentage points. Although the magnitude looks modest, it is still largely consistent with typical findings in the marketing literature estimating the advertising elasticity of demand. For example, Shapiro (2018) estimates advertising elasticity of 0.04 in prescription pharmaceuticals.

Columns (4)–(6) show that the positive effect of government advertising is solely due to the positive effect of advertising by the federal government. Although advertising by state governments are nearly as effective as federal advertising (but not statistically significant) in Columns (4) and (5), its coefficient becomes close to zero once we include all of the three fixed effects in Column (6). One possibility is that the state government may rely on other consumer assistance programs to provide information for state marketplaces, which reduces the importance of advertising. Because consumers can learn about marketplaces through other programs, additional information consumers can obtain solely form advertising might be limited in this case. For the federally facilitated marketplaces, in contrast, advertising may play more important role because they do not provide many other assistance programs.

In contrast to the positive effect of government advertising, private advertising is not very effective in increasing market-level enrollments. In all specifications, private advertising is not as effective as government advertising, and its estimate is statistically insignificant. Its magnitude increases as we control for more fixed effects, but even when the magnitude is the largest, its effect is not economically significant. This result suggests that more private advertising is quite limited, at best, in expanding the total number of individuals enrolled in any marketplace plans.

Table 9: The Effects of Advertising on Market-level Enrollments

| | Dep Var: Log of County-level ACA Take-up Rate | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log of Gov Spend | 0.066** | 0.040** | 0.040* | | | |
| | (0.029) | (0.016) | (0.024) | | | |
| Log of Fed Spend | | | | 0.066* | 0.039** | 0.045* |
| | | | | (0.036) | (0.016) | (0.024) |
| Log of State Spend | | | | 0.056 | 0.036 | -0.014 |
| | | | | (0.047) | (0.050) | (0.065) |
| Log of Priv Spend | 0.015 | 0.021 | 0.030 | 0.015 | 0.021 | 0.031 |
| | (0.017) | (0.016) | (0.025) | (0.017) | (0.016) | (0.025) |
| No. of Insurers | 0.063** | -0.017 | -0.019 | 0.063** | -0.017 | -0.019 |
| | (0.027) | (0.015) | (0.024) | (0.027) | (0.015) | (0.024) |
| No. of Insurers × No. of Insurers | -0.002 | 0.003** | 0.003 | -0.002 | 0.003** | 0.003 |
| | (0.003) | (0.001) | (0.002) | (0.003) | (0.001) | (0.002) |
| BorderYear FE | Y | Y | Y | Y | Y | Y |
| RatingYear FE | Y | N | Y | Y | N | Y |
| County FE | N | Y | Y | N | Y | Y |
| N. Obs. | 14,458 | 14,882 | 14,356 | 14,458 | 14,882 | 14,356 |
| Adj. $R^2$ | 0.773 | 0.928 | 0.930 | 0.773 | 0.928 | 0.930 |

### 5.1.4 Effects of Advertising in New vs. Mature Markets

One question regarding this result is whether advertising will be as effective in the future, which will have a long-run implication. One rationale for the government to be engaged in advertising for the marketplace is because the market is new. Because consumers may face some transaction costs of obtaining coverage through marketplaces (e.g., the lack of awareness about the open enrollment period), the government may want to spend more resources to increase the take-up rate in early years of operation. This channel may be particularly relevant in the health insurance marketplaces for the first several years because most of potential buyers are relatively new enrollees who have never obtained coverage from the health insurance marketplaces.[13]

On the one hand, it may be rational for the government to reduce advertising spending when marketplaces become more mature. Once consumers enroll for plans for a first few years, they may just stick to the plan, and advertising might not be very necessary to induce them to keep enrolled for marketplace plans. Thus, advertising may become less effective when marketplaces become more mature, and then the government may want to gradually reduce its advertising spending. On the other hand, if there is a steady influx of new customers to marketplaces in each year, then advertising will be effective to some extent even when marketplaces are more mature. Then the government may want keep marketing health insurance marketplaces to help the new customer to enroll for marketplace plans. Therefore, whether the government should continue advertising does depend on whether the government advertising will be effective in the long run.

We examine whether the effect of advertising has decayed over time. We compare the estimates in Table 9, which are based on data up to 2017, with estimates with data up to 2015 and 2016 separately. Although this comparison is based on relatively small differences in time, if advertising is effective only in early years of the health insurance marketplace, we should expect that our estimates will decrease rapidly over years.

Our finding is reported in Table 10. This table indicates that the effectiveness of government advertising indeed decays over time, although we still find non-negligible magnitudes in 2017. Of course, a more precise answer on this question will need a longer time horizon. However, our estimates at least suggest importance of government advertising in mitigating transaction costs for consumers.

[13] These individuals include not only permanently uninsured individuals but also newly uninsured individuals who might have had employer-sponsored health insurance before and probably did not obtain insurance individually.

Table 10: The Effects of Advertising on Market-level Enrollments

| | Dep Var: Log of County-level ACA Take-up Rate | | | | | |
|---|---|---|---|---|---|---|
| | (1) Year $\leq$ 2015 | (2) Year $\leq$ 2016 | (3) Year $\leq$ 2017 | (4) Year $\leq$ 2015 | (5) Year $\leq$ 2016 | (6) Year $\leq$ 2017 |
| Log of Gov Spend | 0.051* | 0.046* | 0.040* | | | |
| | (0.030) | (0.028) | (0.024) | | | |
| Log of Fed Spend | | | | 0.058* | 0.050* | 0.045* |
| | | | | (0.031) | (0.027) | (0.024) |
| Log of State Spend | | | | -0.005 | -0.017 | -0.014 |
| | | | | (0.087) | (0.089) | (0.065) |
| Log of Priv Spend | 0.034 | 0.055 | 0.030 | 0.033 | 0.057 | 0.031 |
| | (0.061) | (0.037) | (0.025) | (0.061) | (0.037) | (0.025) |
| No. of Insurers | -0.047 | -0.021 | -0.019 | -0.047 | -0.021 | -0.019 |
| | (0.057) | (0.035) | (0.024) | (0.058) | (0.035) | (0.024) |
| No. of Insurers $\times$ No. of Insurers | 0.002 | 0.001 | 0.003 | 0.002 | 0.001 | 0.003 |
| | (0.005) | (0.003) | (0.002) | (0.005) | (0.003) | (0.002) |
| BorderYear FE | Y | Y | Y | Y | Y | Y |
| RatingYear FE | Y | Y | Y | Y | Y | Y |
| County FE | Y | Y | Y | Y | Y | Y |
| N. Obs. | 7,094 | 10,690 | 14,356 | 7,094 | 10,690 | 14,356 |
| Adj. $R^2$ | 0.934 | 0.936 | 0.930 | 0.934 | 0.936 | 0.930 |

## 5.2 Demand Model

Next, we analyze the impact of advertising on enrollment at each insurer level. This analysis will help us understand whether private insurer advertising still increases own enrollment. Moreover, this demand model will be a basis to examine the equilibrium impacts of government advertising, which requires an equilibrium model of health insurance marketplace. We first lay out our demand model and then specify our supply side.

### 5.2.1 Utility Specification

This section presents our consumer demand model for exchange plans with advertising. We define a market of health insurance marketplace as a county-year pair ($ct$). The number of marketplace insurers available in each market is denoted by $J_{ct}$. Each insurer $j$ in a market offers a menu of plans $L_{jct}$, where each plan is indexed by $l \in L_{jct}$. Each plan is described by a combination of advertising by the private insurer ($ad^p_{j,m(c),t}$), a vector of observed characteristics ($x_{jlct}$), including a premium, plan metal and other observed characteristics, and plan-insurer-market-level unobservable characteristics ($\xi_{jlct}$). Moreover, the choice of plan is also potentially affected by the government ($ad^g_{m(c),t}$). Note that advertising variables do not include the subscript for border areas ($b$) because we will first write a general model for demand for marketplace plans for now. When we estimate the model, we will also employ

the border strategy, where we will add the subscript for border areas ($b$) to appropriate variables.

Consider individual $i$ who belongs to a demographic group $d$ and lives in market $ct$. Because the outside side option is always available, a consumer has a total of $\sum_{j \in J_{ct}} L_{jct} + 1$ options. We assume that the consumer obtains indirect utility $u_{ijlct}$ from a health insurance marketplace plan $l$ by insurer $j$ as follows:

$$u_{ijlct} = \ln\left(1 + \boldsymbol{ad}^{\boldsymbol{g}}_{\boldsymbol{m(c)t}}\right)\boldsymbol{\beta}_{\boldsymbol{d0}} + \ln\left(1 + \boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{m(c)t}}\right)\boldsymbol{\beta}_{\boldsymbol{d1}} + \boldsymbol{x}_{\boldsymbol{jlct}}\boldsymbol{\beta}_{\boldsymbol{dx}} + \xi_{jlct} + \epsilon_{ijlct} \tag{3}$$

A consumer's outside option ($j = 0$) is to stay as uninsured or insured with an off-the marketplace individual insurance plan, from which a consumer receives utility of $u_{i0ct}$:

$$u_{i0ct} = \epsilon_{i0ct}. \tag{4}$$

An important feature in our utility specification is advertising by a private insurer ($\boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{m(c)t}}$) and government ($\boldsymbol{ad}^{\boldsymbol{g}}_{\boldsymbol{m(c)t}}$).[14] First, we allow that private advertising affects the consumer demand through own insurer's advertising, $\boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{j,m(c)t}}$, as well as advertising by other insurers, $\boldsymbol{ad}^{\boldsymbol{p}}_{\boldsymbol{-j,m(c)t}}$. This allows us to capture the business stealing effect of advertising. Second, we allow for a possibility that the effects of advertising depend on advertising contents (e.g., financial assistance or open enrollment). Other observed plan characteristics ($x_{jlct}$) enter $u_{ijlct}$ in a similar way. The outside option ($j = 0$) is to stay as uninsured or insured with an off-the-marketplace individual insurance plan. Note that $\xi_{0ct}$ is normalized to 0 for all $ct$ because only the relative utilities can be identified in a discrete choice model. Lastly, $\epsilon_{ijlct}$ is an individual $i$'s preference shock for each plan. We assume that $\epsilon_{ijlct}$ is independently and identically distributed as the Type I extreme value distribution.

### 5.2.2 Identification and Estimation

To estimate the model, we exploit the one-to-one mapping between each insurer's market share and the deterministic part of $u_{ijlct}$ given in Equation (3) as in Berry (1994). Define

[14] Note that advertising affects demand through the indirect utility function in our model. Alternatively, one can model specific channels through which advertising affects demand – for example, a consumer's awareness of a product, providing experience characteristics of product quality, or enhancing the prestige or image of a product. We do not take this approach, however, because separately identifying different effects of advertising is challenging with our data.

$\delta_{jdlct} \equiv u_{ijlct} - \epsilon_{ijlct}$. Then it is easy to show, based on the assumption on $\epsilon_{ijlct}$, that

$$\delta_{jdlct} = \ln(s_{jdlct}) - \ln\left(\sum_{l \in L_{jct}, j>0} s_{jdlct}\right),$$

where $s_{jdlct}$ denotes the empirical market share of plan $l$ offered by insurer $j$. We will denote empirical counterpart of $\delta_{jlct}$ by $\hat{\delta}_{jlct}$. Then the estimating equation is given by:

$$\hat{\delta}_{jdlct} = \ln\left(1 + \boldsymbol{ad^g_{m(c)t}}\right)\boldsymbol{\beta_{d0}} + \ln\left(1 + \boldsymbol{ad^p_{m(c)t}}\right)\boldsymbol{\beta_{d1}} + \boldsymbol{x_{jlct}\beta_{dx}} + \xi_{jdlct}. \tag{5}$$

Notice that estimating coefficients in Equation (5) simply requires running a linear regression. However, estimating the coefficients with a ordinary least squared regression is likely to result in biases in our advertising coefficients ($\boldsymbol{\beta_{d0}}$ and $\boldsymbol{\beta_{d1}}$) because of endogeneity of advertising, as discussed earlier in Section 5.1. Thus, we also employ a similar border strategy to estimate the coefficients.

**Border Strategy at the Insurer Level** To employ the border strategy, we estimate the coefficients only with plans in border counties. Thus, we add the subscript for border areas ($b$) to appropriate places and border-related fixed effects. Moreover, instead of estimating coefficients $\boldsymbol{\beta_x}$, we control for the effects of plan characteristics on plan-level enrollments by including fixed effects for a combination of a plan, a rating area, and a year. Because a plan should offer the same characteristics within a rating area and a year, we can control for plan characteristics with the fixed effects without explicitly including each of plan characteristics explicitly. With these changes, the estimating equation is changed to:

$$\hat{\delta}_{bdjlct} = \ln\left(1 + \boldsymbol{ad^g_{m(c)t}}\right)\boldsymbol{\beta_{d0}} + \ln\left(1 + \boldsymbol{ad^p_{m(c)t}}\right)\boldsymbol{\beta_{d1}} + \xi_{bdjlt} + \xi_{jdlr(c)t} + \xi_{dc} + \Delta\xi_{bjdlct}. \tag{6}$$

First, $\xi_{bdjlt}$ refers to fixed effects are for a combination of a border area ($b$), demographic type $d$, an insurer ($j$), a plan ($l$), and year ($t$), which captures any common factor that affects demands for a plan in a border area and a year. Second, $\xi_{jdlr(c)t}$ refers to fixed effects for a combination of an insurer ($j$), demographic type $d$, a plan ($l$), a rating area ($r(c)$),and a year ($t$). As discussed above, we include $\xi_{jdlr(c)t}$ to control for the effects of plan characteristics on plan-level enrollments. Third, $\xi_{dc}$ refers to a combination of county-demographic fixed effects, which capture any factors that commonly affect demands for plans in a county throughout years. Lastly, $\Delta\xi_{bjdlct}$ denotes the stochastic error term in the linear regression.

### 5.2.3 Estimation Results

Table 11 presents estimates of coefficients in Equation 6 with different specifications. As the main analysis, we only consider overall demand for each insurer, instead of demand specific to each demographic group. Columns (1)–(3) present estimates for a specification where we combine federal and state advertising as government advertising. Columns (4)–(6) present estimates for a specification that allows for different effects for federal and state advertising. Moreover, different columns include different sets of fixed effects. Our preferred specifications are columns (3) and (6), which include the most exhaustive set of fixed effects.

In all specifications, we find that private advertising is effective in increasing demand for an insurer. This is in contrast to our findings with market-level regression shown in Table 9, where we find, at most, limited effects of private advertising on enrollments at the market level. Based on the estimate from Column (6), which is the most conservative estimate, the average elasticity of insurer-demand with respect to advertising is 0.04 among insurers with positive advertising spending.[15] As discussed earlier, this estimate is largely consistent with typical findings in the marketing literature estimating the advertising elasticity of demand. For example, Shapiro (2018) estimates advertising elasticity of 0.04 in prescription pharmaceuticals.

How do we reconcile this finding with our finding with the market-level regression that private advertising has limited market expansion effects? It is important to note that an increase in demand for an insurer due to advertising does not necessarily result in market expansion. If demand for an insurer increases at the expense of its rivals, private advertising will have limited effects on market expansion. In fact, rivals' advertising seem to affect demand negatively, according to estimates in Columns (4)–(6). Although the estimates are statistically significant only in Column (4), the magnitudes of the point estimates are not negligible, compared with the effect of own advertising.

The estimates for government advertising are consistent with our finding with market-level regressions. They have modest effects on increasing demand for insurers, and federal advertising is more effective than state advertising once county fixed effects are included. Therefore, our finding from insurer-level demand models highlight different roles of advertising for governments and private insurers. Government advertising primarily increases market-enrollments, whereas private advertising mainly results in changes in distributions of enrollments among within a market.

[15] Because the elasticity becomes zero for insurers with zero advertising spending, we only calculated the number among insurers with positive advertising.

Table 11: Estimated Coefficients in Insurer-Level Demand Model

| | Dep Var: Mean Utility | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log of Gov Spend | 0.039 | 0.125** | 0.090* | | | |
| | (0.051) | (0.054) | (0.053) | | | |
| Log of Fed Spend | | | | 0.026 | 0.084 | 0.092* |
| | | | | (0.061) | (0.063) | (0.055) |
| Log of State Spend | | | | 0.104 | 0.208** | 0.053 |
| | | | | (0.079) | (0.086) | (0.113) |
| Log of Priv Spend | 0.228*** | 0.079** | 0.143*** | 0.260*** | 0.091** | 0.128** |
| | (0.043) | (0.036) | (0.051) | (0.045) | (0.036) | (0.053) |
| Log of Rival Spend | | | | -0.162*** | -0.086 | -0.052 |
| | | | | (0.058) | (0.057) | (0.066) |
| No. of Insurers | -0.331*** | -0.317*** | -0.462*** | -0.333*** | -0.319*** | -0.462*** |
| | (0.042) | (0.058) | (0.063) | (0.042) | (0.058) | (0.063) |
| No. of Insurers × No. of Insurers | 0.018*** | 0.015*** | 0.030*** | 0.018*** | 0.015*** | 0.030*** |
| | (0.003) | (0.005) | (0.006) | (0.003) | (0.005) | (0.006) |
| FirmBorderYear FE | Y | Y | Y | Y | Y | Y |
| FirmRatingYear FE | N | Y | Y | N | Y | Y |
| County FE | N | N | Y | N | N | Y |
| N. Obs. | 36,856 | 35,006 | 34,958 | 36,856 | 35,006 | 34,958 |
| Adj. $R^2$ | 0.825 | 0.895 | 0.916 | 0.825 | 0.895 | 0.916 |

Note: the estimation uses data from 2014-2017.

Table 12: Heterogeneous Effects Depending on Market-level Health Status

| | Dep Var: Mean Utility | |
|---|---|---|
| | (1) | (2) |
| Log of Gov Spend | 0.160 | |
| | (0.223) | |
| Share of Fair or Poor Health × Log of Gov Spend | -0.409 | |
| | (1.241) | |
| Log of Fed Spend | | 0.208 |
| | | (0.244) |
| Share of Fair or Poor Health × Log of Fed Spend | | -0.679 |
| | | (1.323) |
| Log of State Spend | | -0.036 |
| | | (0.331) |
| Share of Fair or Poor Health × Log of State Spend | | 0.643 |
| | | (2.140) |
| Log of Priv Spend | 0.400** | 0.323* |
| | (0.156) | (0.186) |
| Share of Fair or Poor Health × Log of Priv Spend | -1.436* | -1.071 |
| | (0.760) | (1.004) |
| Log of Rival Spend | | -0.324 |
| | | (0.228) |
| Share of Fair or Poor Health × Log of Rival Spend | | 1.420 |
| | | (1.220) |
| No. of Insurers | -0.462*** | -0.462*** |
| | (0.063) | (0.063) |
| No. of Insurers × No. of Insurers | 0.030*** | 0.030*** |
| | (0.006) | (0.006) |
| N. Obs. | 34,958 | 34,958 |
| Adj. $R^2$ | 0.916 | 0.916 |

Note: the estimation uses data from 2014-2017.

### 5.2.4 Heterogeneous Effects

Table 12 presents the effects of advertising on demand depending on market-level health status, which is measured as the share of individuals in fair or poor health based on self-report health status. Estimates under Column (1) show that private advertising is slightly more-effective for markets with a greater share of healthy individuals. When we separate out federal and state advertising and include rival's advertising, the interaction coefficient becomes insignificant. However, the sign is still consistent with more effective private advertising for healthy individuals. This result suggests that insurers might want to target advertising to markets with a greater share of healthy individuals because advertising is potentially more responsive in such markets.

Table 13: Coefficient Estimates by Demographic Group

| | Age | | | | Income | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) ≤ 18 | (2) 18 to 34 | (3) 35 to 54 | (4) ≥ 55 | (5) ≤ 138k | (6) 138k to 250k | (7) 250k to 400k | (8) >400K |
| Log of Fed Spend | -0.010 | 0.034 | 0.120* | 0.070 | 0.197*** | 0.115 | 0.223*** | -0.104 |
| | (0.088) | (0.096) | (0.063) | (0.073) | (0.066) | (0.083) | (0.082) | (0.074) |
| Log of State Spend | 0.325 | -0.107 | 0.198 | -0.044 | 0.044 | 0.140 | 0.005 | 0.329* |
| | (0.436) | (0.246) | (0.157) | (0.138) | (0.227) | (0.191) | (0.168) | (0.182) |
| Log of Priv Spend | 0.049 | 0.090 | 0.090 | 0.144** | 0.020 | 0.139* | 0.063 | 0.012 |
| | (0.095) | (0.109) | (0.074) | (0.069) | (0.080) | (0.072) | (0.078) | (0.078) |
| Log of Rival Spend | -0.085 | -0.013 | -0.048 | -0.019 | -0.140** | 0.051 | -0.035 | -0.099 |
| | (0.085) | (0.088) | (0.067) | (0.065) | (0.067) | (0.076) | (0.084) | (0.069) |
| No. of Insurers | -0.282*** | -0.320*** | -0.485*** | -0.388*** | -0.382*** | -0.518*** | -0.418*** | -0.161** |
| | (0.093) | (0.099) | (0.077) | (0.091) | (0.098) | (0.098) | (0.083) | (0.064) |
| No. of Insurers × No. of Insurers | 0.017* | 0.015 | 0.032*** | 0.022** | 0.025** | 0.039*** | 0.027*** | 0.010 |
| | (0.010) | (0.009) | (0.007) | (0.009) | (0.010) | (0.010) | (0.009) | (0.007) |
| FirmBorderYear FE | Y | Y | Y | Y | Y | Y | Y | Y |
| FirmRatingYear FE | Y | Y | Y | Y | Y | Y | Y | Y |
| County | Y | Y | Y | Y | Y | Y | Y | Y |
| N. Obs. | 32,940 | 33,094 | 33,000 | 32,998 | 32,914 | 31,950 | 32,920 | 33,098 |
| Adj. $R^2$ | 0.816 | 0.786 | 0.882 | 0.883 | 0.873 | 0.895 | 0.853 | 0.738 |

Note: the estimation uses data from 2014-2017.

### 5.2.5 Additional Results: Consumer Heterogeneity

In our main specification, we do not allow possible heterogeneous effects across consumers with different characteristics. To examine which consumers are more responsive to the advertising, we examine whether the effectiveness depends on demographic groups (e.g., age and income groups.) Specifically, we estimate Equation (6) for each age and income groups. The main results are reported in Table 13. We find that federal advertising is much more effective for enrolling individuals in age group between 35-54, while private advertising is more effective to enroll age group 55 or older. Both federal and private advertising are effective in increasing enrollment who may qualify premium subsidies from marketplaces. Federal advertising is most effective to enroll individuals whose income is between 250-400% of federal poverty level (FPL), while private advertising is most effective to individuals in the 138-250% FPL group. This result suggests that federal advertising and private advertising may be informative to different type of consumers.

## 5.3 Content of Advertising

Previous results establish that advertising by the federal government and private insurers are effective in increasing either market-level enrollment or insurer-level enrollment. We now examine whether certain contents in advertisements are more effective. For this analysis, we first group advertisements into different categories depending on type of information they

provide. Then we calculate spending for different categories and estimate how advertising of each category is effective.

We consider the following four categories of advertising contents: (i) Low Price; (ii) Financial Assistance; (iii) Open Enrollment; (iv) Net Price for ACA. These advertising contents make up a majority of ACA-related advertising.We create the "Net Price for ACA" dummy variable based on the variables describing advertising contents, which are introduced in Appendix B.The "Net Price for ACA" dummy variable is equal to one if at least one of "Financial", "Low Price", and "Penalty" dummies is equal to one and if the ACA dummy is equal to one. These variables capture the overall financial incentives that affect individual decision to take up health insurance from marketplaces.

Table 14 shows impacts of different advertising categories. We find that federal advertising is effective when it contains financial assistance as a main message. We also find that advertising coefficients for the "Low Price" and "Open Enrollment" categories are large. However, these estimates have large standard errors, making them statistically insignificant. The "net price" category is not significant statistically or economically. Thus, we find that certain specific advertising messages, especially emphasizing financial assistance, are very effective in increasing enrollment, as far as federal advertising is concerned.

In contrast, these categories are not effectiveness in case of private advertising. Instead, other private advertising, which include advertising on an insurer's brands or quality of its plans, are much more effective. Thus, even when private insurers advertisements contains similar types of messages to government advertisements, their impacts on consumer demand are very different. These results indicate that the effectiveness of advertising depends not only on contents themselves, but also their sponsors.

# 6 Counterfactual Experiments

In order to analyze various design questions of government marketing activities, it is crucial to account for an endogenous response of private insurers. We first lay out the supply-side of our equilibrium model and estimation strategy. Then, we describe how to conduct counterfactual experiments.

## 6.1 Supply-Side Model of Advertising in Health Insurance Marketplaces

In the model, we assume that each insurer $j$ chooses a menu of advertising $\boldsymbol{ad}_{\boldsymbol{jmt}}^{\boldsymbol{p}}$, which consists of different components advertising (e.g., ACA, non-ACA, open enrollment, and

Table 14: Coefficient Estimates for Advertising Contents

| | (1) Price | (2) Fin Pen Price | (3) Financial | (4) Open Enroll |
|---|---|---|---|---|
| Log of Fed Spend (ACAPrice) | 0.291 | | | |
| | (0.182) | | | |
| Log of State Spend (ACAPrice) | 0.226 | | | |
| | (0.179) | | | |
| Log of Priv Spend (ACAPrice) | -0.041 | | | |
| | (0.113) | | | |
| Log of Fed Spend (ACAFinPenPrice) | | 0.114 | | |
| | | (0.155) | | |
| Log of State Spend (ACAFinPenPrice) | | 0.126 | | |
| | | (0.107) | | |
| Log of Priv Spend (ACAFinPenPrice) | | -0.018 | | |
| | | (0.066) | | |
| Log of Fed Spend (Financial) | | | 0.246* | |
| | | | (0.144) | |
| Log of State Spend (Financial) | | | 0.142 | |
| | | | (0.141) | |
| Log of Priv Spend (Financial) | | | -0.027 | |
| | | | (0.073) | |
| Log of Fed Spend (OpenEnroll) | | | | 0.232 |
| | | | | (0.151) |
| Log of State Spend (OpenEnroll) | | | | -0.021 |
| | | | | (0.196) |
| Log of Priv Spend (OpenEnroll) | | | | -0.000 |
| | | | | (0.088) |
| Log of Fed Spend (rest) | -0.101 | 0.020 | 0.041 | 0.060 |
| | (0.133) | (0.122) | (0.060) | (0.062) |
| Log of State Spend (rest) | 0.031 | 0.057 | 0.046 | 0.148 |
| | (0.117) | (0.145) | (0.127) | (0.139) |
| Log of Priv Spend (rest) | 0.137** | 0.179** | 0.161** | 0.151** |
| | (0.055) | (0.073) | (0.066) | (0.067) |
| Log of Rival Spend | -0.066 | -0.065 | -0.058 | -0.060 |
| | (0.046) | (0.044) | (0.044) | (0.044) |
| No. of Insurers | -0.456*** | -0.456*** | -0.455*** | -0.456*** |
| | (0.062) | (0.062) | (0.062) | (0.062) |
| No. of Insurers × No. of Insurers | 0.030*** | 0.030*** | 0.030*** | 0.030*** |
| | (0.006) | (0.006) | (0.006) | (0.006) |
| FirmBorderYear FE | Y | Y | Y | Y |
| FirmRatingYear FE | Y | Y | Y | Y |
| County FE | Y | Y | Y | Y |
| N. Obs. | 34,958 | 34,958 | 34,958 | 34,958 |
| Adj. $R^2$ | 0.917 | 0.917 | 0.917 | 0.917 |

Note: the estimation uses data from 2014-2017.

financial characteristics) in DMA-year $mt$. To simplify the analysis, we take insurance companies' geography choices and product characteristics, including pricing, as exogenous in these counterfactuals. Let $\pi_{jmt}$ be the average flow profit of insurer $j$ by enrolling an individual in a DMA market $m$in year $t$, net of claim costs to insure this consumer, without considering the cost of advertising. Then, firm's profit at DMA market is expressed as:

$$\Pi_{jmt} = \pi_{jmt} q_{jmt}(\boldsymbol{ad^p_{mt}}, \boldsymbol{ad^g_{mt}}) - C_{jmt}(\boldsymbol{ad^p_{jmt}}), \tag{7}$$

where $q_{jmt}$ is the DMA level consumer demand of insurer $j$ given the advertising by private insurers $\boldsymbol{ad^p_{mt}}$ and governments $\boldsymbol{ad^g_{mt}}$, and $C(\cdot)$ is the cost of advertising by insurer $j$, $\boldsymbol{ad^p_{jmt}}$ Note that $\pi_{jmt}$ captures not only the premium revenue and expected reimbursement costs for this enrollee but also other relevant ACA policies such as risk adjustment. Instead of fully specifying different components that determine profitability, we focus on endogenous responses by insurers through advertising in our counterfactual analysis. Moreover, we also make several simplifying assumptions. First, private insurers only choose the total advertising spending at each DMA market. Second, we abstract potential heterogeneity in profits from consumers with different characteristics. Although it is certainly possible to relax both assumptions, main economic mechanisms that we highlight in this analysis will remain the same even in such extended environment.

In this model, government advertising can alter an insurer's incentives for advertising because both types of advertising can affect demand for an insurer. Moreover, there is possible strategic interactions among insurers because demand for an insurer depends not only on its own advertising but also other insurers' advertising.

We consider that each insurer chooses own advertising to maximize the total profits $\Pi_{jmt}$ in each DMA-year market, $mt$.[16] Then, we characterize the static Bertrand-Nash equilibrium. As a result, under the Bertrand-Nash equilibrium, the equilibrium advertising expenditure are given as the solution to the first-order condition:

$$\frac{\partial \Pi_{jmt}}{\partial ad_{jmt}} = 0. \tag{8}$$

We use this equilibrium condition in our counterfactual analysis. Moreover, we also utilize Equation (8) to estimate the average flow profit per enrollee $\pi_{jmt}$. The main idea is that the first order condition will allow us to express $\pi_{jmt}$ as a function of the derivative of insurer-level enrollment with respect to advertising $ad_{jmt}$ evaluated at the observed level. We can calculate the derivative using our estimates of the consumer demand model. The

[16]This is a limited approach because insurers may decide advertising to maximize their long-run profits. Fully characterizing the dynamic problem is a very challenging task; therefore, we plan to approach them after obtaining main results under the static decision problem.

detail of estimation procedure is described in Appendix A.

We find that the median of estimated $\pi_{jmt}$ among insurers with positive advertising is about \$729. We view that this magnitude is reasonable. The average benchmark premium in marketplace in 2017 is about \$4,320 according to Kaiser family Foundation[17]. If insurers expect to have 10 to 15% profit margin, especially given the presence of 80% medical loss ratio requirement under the ACA, an insurer's perceived profitability we recovered looks reasonable.

## 6.2 Design of Government Advertising

We use the estimated equilibrium model to examine importance of government advertising by exogeneously changing government advertising. Based on our estimates from the consumer demand model that advertising by state governments is not statistically significant, we only consider designs of federal government advertising spending. We first calculate market outcomes in a scenario where private insurers do not respond to the change. Then we calculate market outcomes by solving for an equilibrium where private insurers optimally adjust their advertising spending.

Table 15: Counterfactual Experiments: Changes in Federal Government Advertising Spending

| | | benchmark | 0×fed ads | | 3×fed_ads | |
|---|---|---|---|---|---|---|
| | | overall | partial eq. | full eq. | partial eq. | full eq. |
| All | enrollment (%) | 18.5 | 18.2 | 18.2 | 19.0 | 19.0 |
| markets | private advertising (\$) | 1.71 | 1.71 | 1.84 | 1.71 | 1.57 |
| large government spending | enrollment (%) | 18.0 | 17.1 | 17.1 | 19.7 | 19.7 |
| market (>0.6) | private advertising (\$) | 2.16 | 2.16 | 2.85 | 2.16 | 1.53 |

Note: both enrollment and private spending are at the DMA-level. We calculate private advertising as per capital private advertising spending at the DMA level. In the benchmark economy, the magnitude of federal advertising is \$0.31 per capita.

Table 15 shows main results. First, we find that reducing federal government spending to zero modestly reduces the market-level enrollment. Although the overall effect is small (18.5% to 18.2%), it depends on the baseline government spending. When the baseline government spending is more than \$0.60 per capita(mean is \$0.31 per capita), then we find that the decline in enrollment is about to 1 percentage point. Importantly, equilibrium responses of private insurers have little effects on market-level enrollment. This finding is important because we find that private insurers indeed increase their advertising substantially. On average, the magnitude of increase in advertising is one-third of federal advertising spending per capita (\$0.31 per capita). In markets with large baseline government spending, we

[17]https://www.kff.org/health-reform/state-indicator/average-marketplace-premiums-by-metal-tier

find that private advertising increases by \$0.70 per capita, which is close to a half of the baseline government advertising, which is \$1.18 per capita.[18] The finding that market-level enrollment changes little suggests that private advertising does have very limited market expansion effects. Note that our estimates in the consumer demand model shows substantial effects of private advertising on own demand. Thus, private advertising is instead driven by rent-seeking competition among insurers, which may lead to a waste of resources. Moreover, this finding also indicates that government and private advertising are substitutes in the sense that a reduction in government advertising increases private advertising. However, the substitution is not perfect because private insurers may target different markets from the government.

Table 15 also reports results from another counterfactual experiment, where government advertising is increased by three times. We find that market enrollment increases, close to 2 percentage points in market with large baseline government spending. Consistent with results from the scenario where we shut down government advertising, these additional government advertising lowers private advertising. However, the overall market-level enrollment will remain the same despite the decrease in private advertising. This finding suggests that government advertising may be beneficial not only to increase enrollment but also to mitigate possibly excessive advertising competition among private insurers. It also suggests that marketing campaign by the government will be beneficial and possibly an effective tool to mitigate consumer frictions in newly created private markets.

## 6.3 Welfare Implication of Targeting of Government Advertising

Finally, we use our model to investigate how much the government and private insurers have different objectives in deciding where to target advertising. We first specify the government objective function to choose their advertising as follows:

$$\max_{ad^g_{mt}} W_{mt} q_{mt}(\boldsymbol{ad^p_{mt}}, \boldsymbol{ad^g_{mt}}) - C(\boldsymbol{ad^g_{mt}}),$$

where $W_{mt}$ is the government's perceived social welfare from enrolling a consumer in DMA $m$ in year $t$. This specification is similar to the specification of a private insurer's profit function. An important difference is $W_{mt}$ and $\pi_{jmt}$. We consider that the parameter $W_{mt}$ captures both a weighted average of consumer and producer surplus, government expenditures on subsidies, and redistributional preference held by the government. We can back out this parameter

[18] This result may be also affected by our specification of demand model, where we do not include the interaction between private and government advertising as a determinant of consumer demand. We also examined the robustness exercise by adding the interaction but the coefficient of the interaction is not statistically significant.

using the same approach to recover an insurer primitive $\pi_{jmt}$. We use this parameter to understand how heterogeneous government and firms are in terms of targeting advertising.[19]

We find that the median estimate of $W_{mt}$ is about \$81. Although the magnitude is much smaller than our estimates of an insurer's profitability, it looks very reasonable if we take into account sizable government spending on premium subsidies. Importantly, although $W_{mt}$ and $\pi_{jmt}$ are positively correlated, the magnitude of their correlation coefficient is very small, only about 0.02. Given this large difference in profitability between private insurers and the government, it is likely very difficult for private markets to generate welfare-maximizing level of advertising. Our finding therefore provides additional evidence that marketing activities by the government will be desirable in these markets.

# 7 Conclusion

This paper has studied government advertising in the publicly designed private markets in the context of health insurance marketplaces. We first show the targeting nature of government advertising compared with private advertising. The government tends to advertise more in markets with unhealthy population, whereas private insurers advertise more in markets with healthy population. Then, we estimate the impact of government and private advertising on marketplace enrollment. Importantly, our empirical design exploits the discontinuity of TV advertising markets to address the endogeneity of advertising. We find that the government advertising has a market expansion effect, while the private advertising tends to steal consumers from other insurers. These findings suggest that government advertising may play an important role by reducing the possible information frictions that consumers face to sign up for health insurance plans. Finally, we estimate an equilibrium model of health insurance marketplace to examine alternative designs of government advertising. We show that government advertising may possibly mitigate excessive advertising competition across private insurers.

This is obviously a first step toward understanding how to market and outreach publicly designed private markets. There are a number of interesting areas of research. First, it is important to explore the role of government advertising in other markets, such as mortgage or education markets. Moreover, another interesting research is to consider other marketing and outreaching tools that the government and private insurers exploit and understand its efficiency compared with government advertising.

[19]Note that this analysis assumes that the government optimally choose the advertising based on their objective. This exercise is, therefore, different from our analysis in Section **??** which does not impose any assumptions on the actual choice of government advertising.

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# A Supply-Side Specification and Estimation

In our empirical analysis, we assume that the cost of advertising for each insurer is the actual advertising spending and the fixed (unobserved) cost, $C_{jmt}(\boldsymbol{ad^p_{jmt}}) = \boldsymbol{ad^p_{jmt}} + \triangle_{\boldsymbol{jmt}}$.

This specification allows us to recover an insurer's primitive in a straightforward manner. First, among firms with positive advertisement expenditures, we can recover the profitability$\pi_{jmt}$ by utilizing an insurer's first order condition. First, from consumer-side demand estimates, we can analytically calculate the marginal enrollment at the observed advertising level. Then, we can obtain the estimates of $\pi_{jmt}$ nonparametrically from the first order condition. Among firms with zero advertisement expenditure, we need to recover $\triangle_{jmt}$ and $\pi_{jmt}$ jointly. A straightforward approach is to specify the functional form of $\triangle_{jmt}$ (e.g., Goeree (2008)); an alternative is to exploit the moment inequality approach to identify the bound of these estimates. Although both approaches could be implemented, we only reoptimize insurers that spent positive amounts of advertising spending. This choice is less problematic for our counterfactual that marginally change spending of government advertising.

# B Content of Advertising

We first obtain the transcript of each advertisement through Amazon Web Service. Based on these transcripts, we create a list of dummy variables about the content of advertisement. To create these dummy variables, we thoroughly looked at a number of advertisement transcripts in details and list up the potential keywords that characterize contents of advertisements. We then classify each advertisement based on the following list of keywords. Although this approach is still not perfect, we find that they are very comprehensive and accurate based on our own ex post verification. The detailed are as follows:

- Reform: This dummy variable takes one if an advertisement contains at least one of the following words: "affordable care act", "new law", "health care law", "health care reform law", "health care reform", "new health care", "reform", "health care act", "recent changes in health care", "changes that are coming in the health care system", "health care changes", and "changes in our health care"'.

- Market: This dummy variable takes one if an advertisement contains at least one of the following words: "marketplace", "market place", "medical insurance market", "exchange", "health insurance market", "healthcare dot", and "

- Healthcare: This dummy variable takes one if an advertisement contains at least one of the following words: "healthcare dot."'

- Open Enrollment:. This dummy variable takes one if an advertisement contains at least one of the following words: "open enrollment", "deadline","choose or change plan", "last day", "enrollment period", "registration period", "open registration", "enrollment is now open", "February fifteen", "fifteenth of February", "December fifteen", "fifteen of December", "march thirty", "December 15", "January thirty first", "enroll-a-thon"'. If advertising contains "open enrollment for state and county employees","April thirtieth", then we assign the dummy to take zero.

- Uninsured: This dummy variable takes one if an advertisement contains at least one of the following words: "uninsured", "still need health insurance", and "existing condition"'.

- Penalty: This dummy variable takes one if an advertisement contains at least one of the following words: "penalty", "penalties", "the fine", "required to have health insurance", "required by law", "requirement", "required to have".

- Financial: This dummy variable takes one if an advertisement contains at least one of the following words: "financial assistance", "financial help", "income information", "estimated income", "tax credit", "financial aid", "subsidy", "subsidies", "federal assistance", "government aid", "government to help", "money from the government", "qualify for assistance", "help pay", "help with their monthly payment", "eligible for money", "how much money you could get from the government", "government helping to pay", "federal help", "assistance to pay", "eligible for money", "getting money to help", "sum city", "financial health", "national assistance", "receive financial", "qualify for assistance", and "aid for your health insurance"'.

- ACA: this dummy variable takes one if at least one of dummy variables created above takes one.

- Low Price: This dummy variable takes one if an advertisement contains at least one of the following words: "discount", "low monthly", "lower monthly", "lowest monthly", "afford health care", "less money", "budget friendly", "save money", "pay less", "fits your budget", "fits your options in your budget", "cheaper", "affordable option", "affordable coverage", "affordable health insurance", "affordable premium", "affordable plan", "affordable price", "lowest cost", "low cost", "low-cost", "low premium", "lower premium", "lowest premium", "low price", "lower price", "lowest price", "best price", "price you can afford", and "price that's not too big"' "

  - The ACA dummy can be equal to zero for an advertisement with the "Low Price" dummy equal to one.

- Net Price for ACA: this dummy variable takes one if at least one of "Financial", "Penalty" and "Affordability" dummies take one and if the ACA dummy takes one.