Direct-to-Consumer Advertisement and Prescription Contraceptive Choices*

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Abstract

This paper investigates the impact of direct-to-consumer advertising (DTCA) on women's decisions regarding prescription contraceptives. I use television advertisement data and claims data, applying the Border Approach proposed by Shapiro (2018) to estimate the causal effects of television advertisements. My findings indicate that a 10% increase in DTCA for short-term contraceptive methods, such as pills, increases demand for the advertised product by 2.7% but also generates positive spillover effects on other branded and generic products within the same category. Conversely, these advertisements reduce the demand for Long-Acting Reversible contraceptives (LARCs), such as IUDs and implants, leading to a substitution towards short-term methods.

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1 Introduction

This article investigates the effect of direct-to-consumer advertisement (DTCA) on women's prescription contraceptive decisions. The market for prescription contraceptives comprises a large set of consumers[1] and the decision is usually patient-driven (Wu et al., 2016). Different from anti-cholesterol drugs, which were commonly studied to evaluate the effects of DTCA, women can choose products of different types that vary considerably in price, efficacy, and administration. Therefore, it is not clear if DTCA creates product differentiation by directing women only to the specific advertised brand and/or if it generates spillovers to other prescription contraceptives affecting the decision among the different methods. I address this question using television advertisement and claims data and the Border Approach (Shapiro, 2018) to measure the causal effect of advertisements. I find that DTCA increases the demand for short-term drugs, such as pills, but reduces the demand for Long-Acting Reversible contraceptives (LARCs), such as IUDs and implants, promoting substitution for less effective methods.

Television advertisement on prescription drugs is allowed in only two countries, the United States and New Zealand, and despite being extensively regulated there is still controversy around this topic. In the United States, until 50 years ago any information on contraception was considered obscene and banned under federal and many state laws (Bailey and Lindo, 2017). So DTCA appeared in the 80s as a tool to overcome the stigma that prevented many women from getting information. However, an advertisement can also be misleading. The pill YAZ produced by Bayer, one of the most popular pills in the United States, was punished by the Federal Drug Administration (FDA) for a deceiving television campaign where the manufacturer overstated the effects and minimized the risks of the drug.[2]

This market also faced major changes in the trends of television advertisement in the past decade. Before 2012, the advertisements were dominated by brands of short-term methods,

[1] According to the National Survey of Family Growth (NSFG) 2015-2017, 80.5% of the women between 15 and 49 have ever taken contraceptive pills and 23.5% have ever used IUDs or implants https://www.cdc.gov/nchs/nsfg/key statistics/c 2015-2017.htmcontraception

[2] In 2009 the Federal Drug Administration (FDA) required Bayer to spend $20 million on corrective advertisement for its television campaign on the pill YAZ. forhttps://www.nytimes.com/2009/02/11/business/11pill.html

such as pills and vaginal rings, and after, there was an increase in the advertisements by brands of Long-Acting Reversible Contraceptives (LARC), such as implants and IUDs, and permanent methods. Wu et al. (2016) suggests that this change is related to the reduction in out-of-pocket costs for prescription contraceptives mandated by the Affordable Care Act that took place in January 2013[3], since it allowed more women to get access to methods with higher upfront costs. Although many studies investigate the effect of the ACA on the adoption of different methods (Becker, 2018; Heisel et al., 2018; Sonfield et al., 2015) this is the first to provide evidence of the effect of advertisement in this context.

The main challenge to capturing the causal effect of advertisement on consumer choices is that firms direct their campaigns to people who are already more likely to consume their products. Therefore, in the estimation, I deal with the endogeneity of the television advertisements using the border approach proposed by Shapiro (2018). The econometric approach relies on the fact that the local advertisements, which are only screened in a few television markets and not in the entire country, generate quasi-random variation on the stock of advertisements that women are exposed to, allowing the identification of the causal effect.

Using advertisement and commercial claims data, I find that the advertisements for short-term methods increase the demand for this entire category of prescription contraceptives. The results show that the advertisements not only direct women to the product being advertised, but also generate positive spillovers to other drugs of the same type. I also find that these effects on the advertised product are driven by older women. These results suggest that the advertisements might not so pervasive since they attract women to take short-term prescription contraceptives but there is still room for them to find with their doctors the product that best suits their needs.

However, part of this increase in the number of claims for short-term methods comes from substitution from LARCs. This substitution can be interpreted as a concerning effect of the advertisements since LARCs are in general more effective short-term methods. But it is worth noting that contraceptive choices go beyond effectiveness, they involve other factors such as price, health conditions, lifestyle, and personal preferences. Therefore, choosing a

[3]According to the provision all private health insurers must cover contraceptive methods without co-payments or any other out-of-pocket costs with exceptions for grandfather plans and specific employers

less effective method is not necessarily problematic and can even provide a better fit for the women's needs.

I do not find a significant effect of LARC advertisements on the product being advertised nor spillovers to other products and methods. Since the upfront costs of these products are in general much higher than short-term methods, I used the variation in cost-sharing introduced by the ACA for prescription contraceptives to understand if the effect of the advertisements would change when women have to pay less for the procedure. However, the only significant differential effect found after the ACA comes from advertisements for permanent methods which sightly decrease the demand for short-term products and increase the demand for LARCs.

The results for the direct effect of DTCA on the product being advertised for short-term methods are in line with the results found by Sinkinson and Starc (2019), Shapiro (2018) and Jayanti (2019) in the markets for cholesterol drugs, anti-diabetics, and antidepressants. However, in those studies, they investigate products that are closer substitutes and the patients have less freedom in choosing the treatment, so the results that I find for LARCS and permanent methods are less comparable. Therefore, this article brings novel evidence for a market where patients do not need to be diagnosed with a particular condition and can choose among different types of products that range from drugs to devices. This research also contributes to a broader literature on contraceptive choices (Delavande, 2008; Myers, 2017; Miller et al., 2020) shedding light on the decision among different products.

2 Prescription contraceptives

There are a variety of contraceptive methods available to women that can be divided into non-prescription methods, which are sold over the counter such as condoms, and prescription methods which are the focus of this study. Here I explore the prescription contraceptive market due to the controversial nature of the television advertisement for these products and the availability of information on these prescription choices through claims data.

Prescription contraceptives can be grouped into three categories depending on the length

of time for which the patient can use the product. The first type is short-term methods that must be used daily or weekly, for which a prescription provides a supply that lasts up to three months. The second group is Long-Acting Reversible Contraceptives (LARC) composed of devices that are inserted once by a physician and provide protection against pregnancies from three up to ten years depending on the product chosen. The last group includes permanent methods that last indefinitely. Given the different frequency of prescriptions for these three types I investigate the effect of DTCA on these groups separately in the empirical analysis.

Besides the length of use, the methods are delivered to patients in different forms and provide varying levels of protection against unintended pregnancies, as can be seen in table 1. In general, LARCs are more effective than the short-term methods but are more expensive not only because of the price of the devices but also because they require procedures for their insertion. The permanent method is also considerably more expensive than the other types because it involves a surgical process. The prices shown in table 1 are a reference of the maximum cost a woman would pay if she were to pay the entire cost of the method, but these costs can vary a lot depending on where she gets the product, and given that I only observe insured women in my data most of them have at least some level of coverage for those products.

Table 1 – General Information - Prescription contraceptives

Type	Method	Delivery Method	Effectiveness*1	Price*2
Short-Term	Diaphragm/Cap	Barrier	12%	$75
	Injection	Injection	6%	$150
	Pill	Oral	9%	$50
	Patch	Cutaneous	9%	$150
	Ring	Intravaginal	9%	$200
LARC	Implant	Subcutaneous	0.05%	$1300
	IUD	Intravaginal	0.2% (Hormonal) 0.8% (Cooper)	$1300
Permanent	Sterilization	Surgical	0.5%	$6000

Note: *1 Unintended pregnancies per 100 women in the first year of use (Source: CDC). *2 Maximum prices displayed for reference (Source: Planned Parenthood).

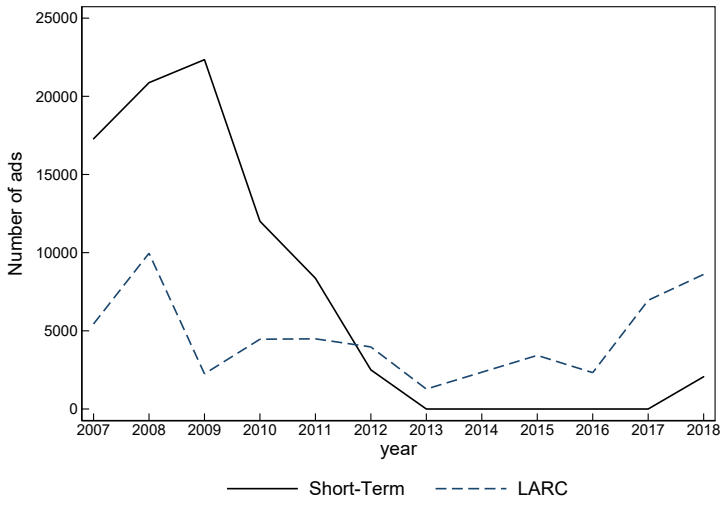
It is also worth noting that within each short-term method there are many products available, mainly for the pill which is the most common prescription method used by American women according to the National Survey of Family Growth (NSFG). The claims data from

Optum's de-identified Clinformatics Data Mart Database, which is used in this study, also supports the wide diversity of products available to women who choose the pill. I find about 160 different contraceptive pills including generics, while there are 5 brands of intrauterine devices (IUDs).

3 Data

To answer my research question, I am using advertisement and commercial claims data for prescription contraceptives. The advertisement data comes from Kantar Media and contains information on the expenditure on DTCA and the number of advertisements screened at the product and month levels for the 101 major television markets (DMAs) in the United States. Between 2007 and 2018, advertisements for prescription contraceptives were screened nationally and in different selected television markets as shown in figures 1 and 2.

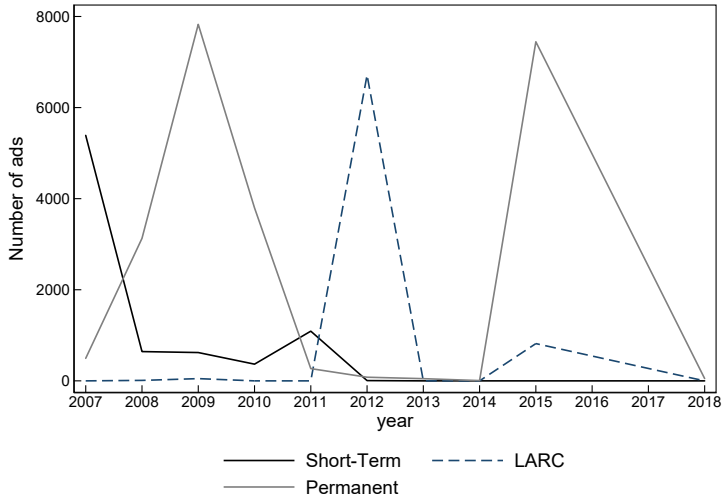
FIGURE 1. National Television Advertisements by Contraceptive Type



Note: Data from Kantar Media, it includes national advertisements screened on network, cable and spot tv.

Before 2011, short-term methods dominated the national DTCA for prescription contraceptives, with mostly pills being advertised. Between 2007 and 2010, the products advertised were Femcon FE and Loestrin 24FE from Allergan, Seasonique from Duramed Pharmaceuticals, and Yaz from Bayer. The 2009 increase in the national advertisements for short-term

FIGURE 2. Local Television Advertisements by Contraceptive Type



Note: Data from Kantar Media, it includes local advertisements screened on network, cable and spot tv.

methods is explained by the regulatory action from the FDA that required Bayer to spend 20 million dollars on corrective advertisements for a misleading campaign on the pill YAZ that was screened in 2008. In the years following 2009, the national and local advertisements were mostly directed to launching new products, with Beyaz by Bayer and Lo Loestrin FE by Allergan being released in 2011. The same brands also had local advertisements targeted at specific DMAs during this period.

For the LARCs, Bayer dominated the advertisements in the sample period with sequential campaigns for its three IUDs Mirena, Kyleena, and Skyla. In 2012, there was a spike in the local advertisements for LARCs led by a campaign of the cooper IUD Paragard from CooperSurgical, which was accompanied by an increase in the advertisements for Mirena. For the permanent methods, the only product that was advertised over the period was Essure, also from Bayer, and it was only screened in targeted markets. Table 8 in the appendix presents the number of total advertisements per product advertised in the period of analysis.

I present the trends of television advertisements screened nationally and locally to show the general context, but with the border approach, I will be able to use only the variation in local advertising to identify the effect of the advertising. Table 2 shows that all methods

screened advertisements in different DMAs during the period of analysis. In particular, from the 101 DMAs included in my data almost half of them had at least one DTCA for contraceptives in the period of analysis.

Table 2 – Local Prescription Contraceptive DTCA

Type	DMAs	Products	Avg. Number Local Ads	Avg. Spending Local Ads (million $)
Short-Term	100	7	8,118	11.40
LARC	41	3	7,591	2.40
Permanent	48	1	23,147	12.00

Note: Averages at the DMA levels.

For the drug choices, I am using commercial claims data from Optum's de-identified Clinformatics Data Mart Database which contains information from a major national health insurance provider. My sample includes all women enrolled with ages between 15 and 44 from 2007 through 2018 and I have access to all their pharmacy and medical claims. In particular, I capture their contraceptive choices via the pharmacy prescriptions for short-term contraceptives such as pills and via medical procedure claims for LARCS and permanent methods. My sample includes more than 16 million claims for prescription contraceptives and almost 90% of them are for pills (table 3). The patients can have multiple claims throughout enrollment and, in the case of short-term methods, they can have refills for the same product.

Table 3 – Claims by Contraceptive Method in the Sample

Type	Method	Number of Claims	%
Short-Term	Diaphragm/Cap	2,825	0.02
	Injection	329,037	2.01
	Pill	14,741,891	89.99
	Patch	199,205	1.22
	Ring	972,773	5.94
LARC	Implant	42,001	0.26
	IUD	88,281	0.54
Permanent	Sterilization	6,482	0.04
Total		16,382,495	100.00

Note: Claims data for prescription contraceptives from Optum's de-identified Clinformatics Data Mart Database. Each patient can have multiple claims over the period were they are enrolled in the insurance.

An important feature of the data is the information of the patient's residence at the zip code level, which I use to match them to the television markets where the television advertisement was screened. However, to maintain confidentially I do not have access to any demographic information besides age which limits the investigation of heterogeneous effects among different types of consumers. For the estimation, I restrict the sample to those that lived in the DMAs for which I have advertisement data.

In the analysis, I only consider women that were continuously enrolled for at least 6 months. As shown in figure 3 in the appendix, there is a decrease in the number of women in my sample from 2007 to 2013 and the number starts to increase again after 2014. Also, there is a change in age composition, at the beginning of the period most of the women in the sample were between 35 and 44 years old and across time the majority shifted to women between 25 and 34 years old. These patterns in enrollment and age composition are not specific to my sample and can be found when looking at all women enrolled and when looking at men covered by the same insurance provider. In my empirical analysis, I control for the enrollment in the different age groups to guarantee that these changes are not driving the results.

4 Endogeneity of Television Advertisement

Estimating the causal effect of DTCA requires dealing with the endogeneity of advertisement. Firms direct their marketing resources to areas where they expect to have higher returns (Gordon and Hartmann, 2013). So if we just compared the demand of people who were exposed to the advertisements with the demand of people who were not exposed to them we would be overestimating the effect of the advertisements, since the people who were exposed would consume more even in the absence of advertisement.

Given this selection of where to screen the television advertisements, simply regressing the the quantity demanded Q_{jdt} for a product j, in a DMA d and, time t on stock of advertisement A_{jdt} for that product would generate biased estimates of the effect of the advertisement γ_1 shown in equation (1). The literature commonly considers advertisement as a stock because are exposed to it multiple times over the period when it is screened and

its effects build over time.

$$log(1 + Q_{jdt}) = \gamma_1 log(1 + A_{jdt}) + \epsilon_{jdt} \tag{1}$$

There is a vast literature on the effects of DTCA on the demand for prescription drugs addressing the endogeneity issue using different methods depending on the specific context. Recently, Shapiro (2018); Li et al. (2019); Tuchman (2019) used a quasi-random variation on the population that is exposed to local television advertisements to identify the causal effect of advertisement. While other papers Sinkinson and Starc (2019); Jayanti (2019) used an exogenous variation on the stock variation of DTCA generated by political advertising.

I use the border strategy proposed by Shapiro (2018) to estimate the causal effect of the DTCA for prescription contraceptives. There is considerable variation in the number of advertisements only screened in local markets which is ideal for this approach, as it will be described in more detail in the next section. Besides that, the contraceptive decisions might be correlated with political preferences which would be problematic to use variation in political advertisements as instruments for the contraceptive advertisements.

5 Econometric Model: Border Approach

The border approach relies on quasi-random variation generated by the borders of the television markets to identify the effect of DTCA. Nielsen defines the DMAs as including counties with similar television tastes; however, close to the border of the DMAs, the households are otherwise similar but are exposed to different sets of local television advertisements.

Therefore, I link the women in the claims data to the advertisement screened where they live I compare their contraceptive choices across those borders and the differences between their choices are the effect of the advertisement. More precisely, grouping the information as a panel of border counties this approach is very similar to the differences in differences estimator, where the main assumption is that by comparing the counties on the two sides of a DMA border any differential trends in the number of claims for a specific product is due

to differences in the local advertisement.

With this method I also separately identify the effect of the advertisements on the demand of the product being advertised and the effects on other types of prescription contraceptives. These separate effects provide intuition on whether the advertisements lead women to switch products towards the advertised option or generate spillovers to other products increasing the demand for prescription contraceptives in general.

Using the border approach, a pair of DMAs at a border is considered a separate experiment for each product. So I estimate the elasticity of demand with respect to the number of advertisements screened using the following equation with fixed effects.

$$\begin{aligned} log(1+Q_{jbdt}) = \gamma_1 log(1+A_{jbdt}) + \gamma_2 log(1+\sum_{k\neq j} A_{kbdt}) + \\ \beta_1 log(E^{ages}_{bdt}) + \xi_{jbt} + \xi_{jbd} + \epsilon_{jbdt} \end{aligned} \tag{2}$$

$$A_{jbdt} = \sum_{\tau=t-2}^{t} a_{jbd\tau} \tag{3}$$

Where Q_{jbdt} is the number of claims for product j, at the border b, DMA d, and month t. A_{jbdt} is the stock of advertisements for product j in the past two months at this DMA-border-time and, $\sum_{k\neq j} A_{kbdt}$ is the sum of the stock of advertisements of all the other products at the same level. In the results, I further split $\sum_{k\neq j} A_{kbdt}$ among products of different types (Short-term, LARC, and Permanent), but the idea of capturing spillovers from the advertisements of product j being advertised is analogous.

Here the product-border-time fixed effect ξ_{jbt} captures shocks in demand that are common to both sides of the border, for example, national advertisements and changes in policies that apply to both sides like the ACA. The product-border-DMA fixed effect ξ_{jbd} captures persistent differences between the demand for product j on the two sides of the border, for example, if on one side of the border women are always more likely to take pills of a certain brand despite the advertisements, this term will account for that. I also control for the number of enrolled women with ages between 15 to 24, 25 to 34, and from 35 to 44 years old (E^{ages}_{bdt}) to account for the change in age distribution in the data. Therefore, all the

remaining variation between the number of claims of the two border DMAs is due to the television advertisement, allowing us to identify the own effect of the advertisement γ_1 and the spillovers to rival products γ_2 in equation (2).

I estimate the above specification dividing by claims of Short-Term, LARCs, and Permanent Methods, Since the procedures and the frequency of claims for different methods, vary significantly the effects of the advertisements can be heterogeneous among the types of contraceptives. Besides that, I divide the effect of the advertisements from those coming directly from the product being advertised and the spillovers from advertisements of products from the same type and products from other types of prescription contraceptives. This separation allows to understand the cross effects among different types of contraceptives.

This methodology is well established in the literature, but it has limitations because it can only capture the effect of the television advertisement close to the borders of the television markets. Although the results provide interesting insights into the role of advertising in this market, they cannot be automatically extended for areas beyond the borders of the television markets.

6 Estimation Results

In this section I present the causal effects of the border approach which deals with the endogeneity of the television advertisements. For comparison, table 9 shows the biased results when including only time-product and product-DMA fixed effects, without considering the border pairs. As expected, in that case, the results are overestimated because the firms tend to direct the advertisements to local markets where they expect them to be the most effective.

Using the border strategy I find a positive and significant effect of the television advertisements on the number of claims of the product being advertised for short-term products, such as pills and injections. There are also positive spillovers from the short-term advertisements to their rivals within the same type. Table 4 shows that 10% in the number of advertisements for short-term drugs increases the demand for the product being advertised by 2.66%. This result is greater in magnitude than the effect of advertisement found for

anti-diabetics (2.29%) (Jayanti, 2019) for anti-cholesterol drugs (1.47%) by (Sinkinson and Starc, 2019). The 10% increase in the number of advertisements also increases the demand for its rival short-term products by 1.77%, which differs from the mentioned papers where there are negative spillovers between rival products of the same type. I find a small and significant spillover from the advertisement of the permanent method, but there is no significant spillover from LARC advertisements.

TABLE 4 – Effect of DTCA on claims for prescription contraceptives - Border Approach

	Claims Short-Term	Claims LARC	Claims Permanent
Own Ads	0.266***	-0.006	0.002
	(0.097)	(0.007)	(0.002)
Rivals Ads Short-Term	0.177***	-0.126**	0.004
	(0.024)	(0.055)	(0.052)
Rivals Ads LARC	0.001	-0.001	-0.001
	(0.001)	(0.002)	(0.001)
Rivals Ads Permanent	0.001*	0.000	-0.001
	(0.000)	(0.001)	(0.001)
Product-border-time FE	Yes	Yes	Yes
Product-border-DMA FE	Yes	Yes	Yes
R^2	.858	.765	.599
N	4,879,706	227,136	93,288

Notes: Observations are at the product-border-dma-month levels. There are 169 pairs of border DMAs, including a total of 888 counties which appear in up to 4 different borders. Includes only products that had claims between 2007 and 2018. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I find no significant effect for own advertisements on claims for LARCS and permanent methods. The lack of significance might be due to the smaller number of LARC advertisements being screened in local markets. However, I negative find spillovers from short-term advertisements to LARCs. A 10% in the number of advertisements for short-term products decreases the demand for LARCs by 1.26%. Since LARCs and permanent contraceptives require medical procedures for their insertion, it is harder to compare their results with the effects found by related papers that focused on drugs with oral administration.

The greater own effect and the positive spillovers for short-term drugs might be explained

by the fact that women do not need to be diagnosed with a specific disease to take these drugs. So they might attract women that were not taking any prescription contraceptives to this type of drug. Also, this is the type of prescription contraceptive most widely prescribed, so if the advertisements direct women to visit their doctors without a specific method in mind they are most likely going to be prescribed a short-term method.

The results for the short-term contraceptives on table 4, I exclude refill claims because I am mostly interested in women making an active choice on contraceptives. In Table 10 I present the same results including refills. This is not a problem for LARCS and permanent methods, once the woman has the device inserted there is no need to have refill claims.

I also investigate differential spillovers of the advertisements on claims for short-term methods among branded products that were advertised on television in the periods I have data for, branded products not advertised, and generic products that were never advertised. Table 5 shows that the positive spillovers are greater for branded products that were also advertised. With these results alone, I cannot tell if they were being advertised at the same time or during different periods. There are also important spillovers for generic products and in smaller magnitude to branded products not advertised.

TABLE 5 – Effect of DTCA on non-advertised drugs - Border Approach

	Claims Short-Term		
	Brand Advertised	Brand Non-advertised	Generic Non-Advertised
Own Ads	0.250***		
	(0.094)		
Rivals Ads Short-Term	0.464***	0.098***	0.179***
	(0.139)	(0.028)	(0.032)
Rivals Ads LARC	-0.003	0.001	0.001
	(0.003)	(0.001)	(0.001)
Rivals Ads Permanent	0.003	-0.001	0.001
	(0.002)	(0.000)	(0.001)
Product-border-time FE	Yes	Yes	Yes
Product-border-DMA FE	Yes	Yes	Yes
R^2	.905	.81	.859
N	300,482	2,522,832	2,056,392

Notes: Observations are at the product-border-dma-month levels. There are 169 pairs of border DMAs, including a total of 888 counties which appear in up to 4 different borders. Includes only claims for products that were advertised at least once between 2007 and 2008. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The advertisements for short-term methods increase the demand for this entire class of contraceptives. This result provide some evidence to question a common argument for of banning DTCA is that it would lead consumers to switch from less expensive drugs to more expensive branded drugs. The television advertisements for branded products increase not only increase the demand for the advertised product which is general more expensive but also increases the demand for other similar branded and generic products. However, this result needs to be taken carefully once my sample includes only insured women which are subject to their insurer's formulary, so it is not obvious what are the least expensive products in terms of out of pocket costs.

However, the fact that part of this increase in the demand for short-term methods comes from consumers switching from LARCs can be seen as an issue, since women are switching to a less effective method. Nevertheless, the quality of contraceptives choice depends on multiple factors such as health conditions, life style and personal preferences. So choosing a less effective method is not necessarily worse and can even provide a better fit to the women.

6.1 Heterogeneus effects among age groups

Here I explore the heterogeneity in the effect of the advertisement among patients in different age groups, focusing on Short-Term methods given that the previous results have shown that the effect more relevant for this type of prescription contraceptive. Table 6 shows that the effect of own advertisement is positive and significant only for women in the age group of 34 to 45 years old, while it is not significant for the younger age groups. There are positive spillovers to rival short term products with similar magnitudes for the three groups.

TABLE 6 – Effect of DTCA on non-advertised drugs - Border Approach

	Claims Short-Term		
	Ages 15 to 24	Ages 25 to 34	Ages 34 to 45
Own Ads	0.111	0.074	0.155**
	(0.078)	(0.058)	(0.068)
Rivals Ads Short-Term	0.104***	0.108***	0.120***
	(0.020)	(0.019)	(0.017)
Rivals Ads LARC	0.001	-0.000	0.000
	(0.001)	(0.000)	(0.000)
Rivals Ads Permanent	0.000	0.001*	0.000
	(0.000)	(0.000)	(0.000)
Product-border-time FE	Yes	Yes	Yes
Product-border-DMA FE	Yes	Yes	Yes
R^2	.816	.804	.761
N	4,879,706	4,879,706	4,879,706

Notes: Observations are at the product-border-dma-month levels. There are 169 pairs of border DMAs, including a total of 888 counties which appear in up to 4 different borders. Includes only claims for products that were advertised at least once between 2007 and 2008. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results suggest that the advertisements are more effective in directing older women to the specific brand being advertised, while younger women are attracted to the category more generally. With this analysis, I cannot pin down through which mechanism this heterogeneous effect materializes. One conjecture is that older women watch more television than the younger ones, another non-exclusive possibility is that they bring their brand preference more explicitly to their doctors, and/or the doctors take their brand request more into account when making a prescription.

6.2 Differential Effects ACA

The extent to which the advertisement can affect women's contraceptive decisions may also depend on the cost of the drugs for each consumer. As seen in table 1, LARCs and permanent methods have higher upfront costs than short-term methods. So this could be one of the explanations for why the advertisements are much more effective to attract women to short-term drugs rather than the other methods. To shed light on this hypothesis, I explore the differential effects of the television advertisements before and after the Affordable Care Act (ACA) provision on prescription contraceptives.

In August of 2012, it was approved a provision of the ACA mandating all private health insurers to contraceptive methods without co-payments or any other out-of-pocket costs, with exceptions for grandfather plans and specific employers. Although several states already had contraceptive laws that required plans to cover some or all methods women's cost-sharing typically applied (Sobel et al., 2018). The provision was particularly important in reducing the costs faced by women for the insertion of LARCs (Heisel et al., 2018).
Graphs 1 and 2 show that this period coincides with a change in the trends of television advertisement. Before 2012, the advertisements were dominated by brands of short-term methods, such as pills and vaginal rings, and after, there was an increase in the advertisements by brands of Long-Acting Reversible Contraceptives (LARC), such as implants and IUDs, and permanent methods. Wu et al. (2016) suggests that this change is related to the ACA since it allowed more women to get access to methods with higher upfront costs.

It is noteworthy that the border approach controls for the effect of the ACA. As the ACA affected women on both sides of the DMA borders during the period where it occurred, the border-time fixed effect included in the regressions captures any changes that affected women on both sides of the borders.

In this section, I use the border approach to investigate whether there were differential advertising effects before and after the ACA provision on prescription contraceptives. Here I interact the stock of DTCA for the good being advertised and of the other goods with an ACA indicator that equals 0 before August of 2012 and 1 after that date and the results are reported in table 7. It is not possible to estimate the own DTCA effect for short-term

methods after the ACA because there were no local advertisements for this type after 2013.

I do not find significant evidence that after the ACA the television advertisements for LARCS were able to increase the demand for those methods. They just benefited from positive spillovers generated by the advertisements for permanent methods, an increase of 10% in the number of advertisements for permanent products increase the demand for LARCs by 0.08% when compared to the effect before the ACA.

While an increase in the advertisements for LARCs after the ACA decreased the demand for permanent methods when compared to the effect before the provision. However, I cannot tell if this reduction in demand results from women switching to other methods or not taking prescription contraceptives more generally.

The lack of significant differential effect for the advertisements is not due to invariability to the ACA. Other studies (Becker, 2018; Sonfield et al., 2015) with the same data found that the ACA indeed reduced the spending on prescription contraceptives, increasing the number of claims for these methods. So the lack of significant effect might be related to the fact that the border approach only captures the causal effect of local advertisements and although there was an increase around the ACA the number of advertisements is still small in magnitude when compared to the number of national advertisements.

TABLE 7 – Effect of DTCA before and after the ACA - Border Approach

	Claims Short-Term	Claims LARC	Claims Permanent
Own Ads	0.266***	0.007	0.001
	(0.097)	(0.012)	(0.002)
Own Ads x ACA	0.000	-0.017	0.004
	(.)	(0.013)	(0.004)
Rivals Ads Short-Term	0.177***	-0.126**	0.004
	(0.024)	(0.055)	(0.052)
Rivals Ads Short-Term x ACA	0.000	0.000	0.000
	(.)	(.)	(.)
Rivals Ads LARC	0.002	-0.005	0.003
	(0.001)	(0.005)	(0.002)
Rivals Ads LARC x ACA	-0.001	0.004	-0.005*
	(0.001)	(0.006)	(0.003)
Rivals Ads Permanent	0.001**	-0.002	-0.001
	(0.001)	(0.001)	(0.001)
Rivals Ads Permanent x ACA	-0.001*	0.008**	-0.001
	(0.001)	(0.004)	(0.002)
Product-border-time FE	Yes	Yes	Yes
Product-border-DMA FE	Yes	Yes	Yes
R^2	.858	.765	.599
N	4,879,706	227,136	93,288

Notes: Here the ACA is an indicator variable that equals 1 after August of 2012, when the ACA provision that reduced the out-of-pocket costs for prescription contraceptives was enacted. Observations are at the product-border-dma-month levels. There are 169 pairs of border DMAs, including a total of 888 counties which appear in up to 4 different borders. Includes only claims for products that were advertised at least once between 2007 and 2008. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

7 Conclusion

This paper discussed the effects of DTCA on the market for prescription contraceptives. The television advertisements increase the demand for the class of short-term prescription contraceptives, mostly composed of pills. In particular, the advertisements increase the number of claims for the advertised product, but also generate positive spillovers to other branded and generic short-term products. This result suggests that the advertisements can be relevant to informing women about short-term methods, although I cannot pin down through which mechanism the advertisements lead them to choose products that are not exactly the ones advertised. The process of getting a claim also involves their doctors' decision, so even if women request one specific product due to watching television they might be directed to other products that would provide a better fit for their needs.

I also found evidence that the advertisements lead women to switch to less effective methods. The results show that the advertisements for short-term methods generate a decrease in the demand for LARCs, which are in general less effective. This can be a concerning effect of DTCA. However, we need to consider that contraceptive choices depend on multiple factors beyond effectiveness. So choosing less effective products does not necessarily mean that women are making inferior choices. They may find a better fit with less effective products.

The reduced form estimates presented here provide a causal estimate of the effect of product advertisements on its demand and the demand of the rival products of different types of prescription contraceptives. However, they do not allow to understand how the demand would react to a general ban in DTCA for prescription contraceptives or to shutting down the advertisements for particular products such as what was made by the regulatory action on the pill YAZ. Therefore, there is room for further research using structural models of the demand and supply in the market for prescription contraceptives which would allow to simulate counterfactuals and evaluate different policies related to advertisements.

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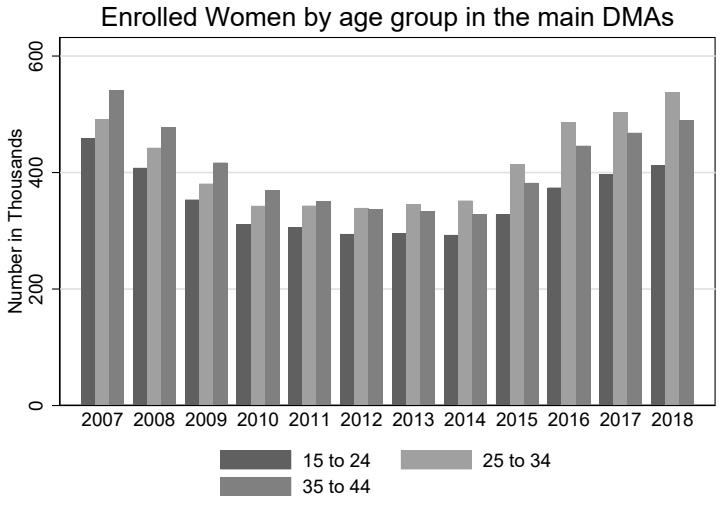
Appendix

FIGURE 3.



Note: Number of women enrolled for at least six continuous months with ages between 15 to 44 years old that appear in the Optum's de-identified Clinformatics Data Mart Database and live in the DMAs for which I have television advertisement data.

TABLE 8 – Total advertisements by Product

Product	Method	Manufacturer	2007	2008	2009	2010	2011	2012	2013	2015	2016	2017	2018
Beyaz	Pill	Bayer	0	0	0	0	3646	0	0	0	0	0	0
Femcon FE	Pill	Allergan	2694	0	0	0	0	0	0	0	0	0	0
Lo Loestrin Fe	Pill	Allergan	0	0	0	0	1625	0	0	0	0	0	2065
Loestrin 24 FE	Pill	Allergan	4987	818	0	0	0	0	0	0	0	0	0
Seasonique	Pill	Duramed	4540	2421	3067	4913	1607	0	0	0	0	0	0
Yaz	Pill	Bayer	9491	10176	11932	3908	0	0	0	0	0	0	0
NuvaRing	Vaginal Ring	Merck	958	8101	7966	3556	2579	2509	0	0	0	0	0
Nexplanon	Implant	Merck	0	0	0	0	0	0	0	9	14	0	0
Kyleena	IUD	Bayer	0	0	0	0	0	0	0	0	0	6954	8611
Mirena	IUD	Bayer	5441	9974	2300	4463	4489	8357	1277	0	0	0	0
Paragard	IUD	CooperSurgical	0	0	0	0	0	2328	0	0	0	0	0
Skyla	IUD	Bayer	0	0	0	0	0	0	0	4238	2311	0	0
Essure	Sterilization	Bayer	495	3129	7827	3797	269	80	48	7445	0	0	51

Note: Table built with data from Kantar Media, it includes advertisements bought on network, cable and spot tv.

TABLE 9 – Effect of DTCA on claims for prescription contraceptives - OLS

	Claims Short-Term	Claims LARC	Claims Permanent
Own Ads	1.253***	-0.001	0.036***
	(0.181)	(0.015)	(0.009)
Rivals Ads Short-Term	0.284***	-1.307***	0.062
	(0.071)	(0.365)	(0.140)
Rivals Ads LARC	0.001	0.013*	-0.004
	(0.002)	(0.007)	(0.004)
Rivals Ads Permanent	0.002*	-0.013***	-0.004*
	(0.001)	(0.004)	(0.002)
Time-product FE	Yes	Yes	Yes
Product-DMA FE	Yes	Yes	Yes
R^2	.886	.717	.393
N	1,499,244	69,690	29,088

Notes: Observations are at the product-dma-month levels. Includes only products that had claims between 2007 and 2018. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TABLE 10 – Comparing all claims with first claims for short term

	Claims Short-Term	
	All Prescriptions	New Prescriptions
Own Ads	0.357**	0.266***
	(0.146)	(0.097)
Rivals Ads Short-Term	0.212***	0.177***
	(0.035)	(0.024)
Rivals Ads LARC	-0.000	0.001
	(0.001)	(0.001)
Rivals Ads Permanent	0.002***	0.001*
	(0.001)	(0.000)
Product-border-time FE	Yes	Yes
Product-border-DMA FE	Yes	Yes
R^2	.907	.858
N	4,879,706	4,879,706

Notes: Observations are at the product-border-dma-month levels. There are 169 pairs of border DMAs, including a total of 888 counties which appear in up to 4 different borders. Includes only products that had claims between 2007 and 2018. The estimation in log-logs so the results can be interpreted as elasticities. All the remaining estimated coefficients are significant at the 1% level, but are omitted to facilitate the reading. Standard errors are clustered at the DMA-product level and are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$