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THE EFFECT OF CONTRACEPTIVE ADVERTISING AND SEXUAL EDUCATION
ON CONDOM SALES

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ABSTRACT

In this dissertation, I consider the effect of contraceptive advertising and different forms of sexual education on condom sales. Because condoms are a readily available, easy-to-use, and inexpensive form of contraception, understanding factors that may affect usage—such as advertising and sexual education—can have meaningful policy implications. To estimate the effect of advertising and sexual education, I use discontinuities in both created by television market and state borders. I find the effect of condom advertising is lower and return on marketing investment is negative when abstinence is stressed. Hence, from a managerial perspective, firms may want to consider the status of sexual education when making targeting decisions. I also find comprehensive sexual education has different effects on condom sales depending on how it is disbursed. From a policy perspective, this research opens avenues for asking further questions about the effect of sexual education on contraceptive choices and sexual behavior.

CHAPTER 1

INTRODUCTION

Television advertising for contraception is a relatively new phenomenon in the United States. The recency of television advertising for hormonal birth control can be attributed to Food and Drug Administration (FDA) restrictions on prescription drug advertising that were in place until 1997 (Donohue [2006]). By contrast, condoms were not widely advertised until 2005. Their relatively late entry into television advertising can be partially explained by negative social attitudes towards contraception and sexuality in the US (Lebow [1994]). Some of this negative attitude has manifested in the form of abstinence-only education (AOE), also known as abstinence-until marriage education. This form of sexual education stresses abstinence as the sole means of birth control and safe sex, often excluding information on how to use contraception or describing it in medically inaccurate ways, by claiming, for instance, condoms cause AIDS or cervical cancer (Planned Parenthood [2011]).

Though the United States overall has experienced a decline in unplanned teenage pregnancies in the past decade, this decline may be attributed to increased access to oral contraceptives or long-acting reversible contraceptives, or LARCs (Lindberg et al. [2016]), versus any success on the part of AOE. Additionally, despite this decline, teenage pregnancy rates in the US are still higher than in other developed countries (Secura et al. [2014]). Overall, critics believe evidence is at best mixed for whether AOE is able to prevent unplanned pregnancies or unsafe sexual practices, and at worst, proves AOE simply inhibits contraceptive usage without lowering intercourse rates (e.g., Santelli et al. [2006], Kearney and Levine [2015]).

Because condoms are the cheapest and most easily available form of contraception on the market, and the primary product for preventing transmission of sexually transmitted diseases (STDs), I focus on how marketing and policy intersect on condom usage. Specifically, I ask the following questions: What is the effect of advertising for contraceptives on condom consumption? How does sexual education affect condom consumption? Does the impact

of advertising differ based on sexual education regime, and vice versa? What is the overall impact of both on condom sales?

Intuitively, one might expect that AOE should lower condom purchases if it indeed promotes abstinence (or simply because on its own, it does not promote contraceptive use). However, this intuition need not apply to comprehensive sexual education (CSE), which promotes abstinence alongside contraceptive use. In fact, advocates of CSE claim that by providing more information about the consequences and mechanics of sex, CSE may on net promote abstinence more effectively than AOE. Moreover, rather than having a causal effect, sexual education might instead be a choice based on observed (or perceived) sexual behavior. For instance, policymakers may react to higher rates of teenage pregnancies by requesting more sexual education funding. Because advertising may be endogenous, it is also unclear what effect, if any, contraceptive advertising may have on condom consumption. Hence, the causal effects of sexual education and advertising on condom sales are open empirical questions.

To answer these questions, I use the border strategy developed by Shapiro [2016a] and employed by Tuchman [2015] to measure the effect of advertising and sexual education on sales. I use a similar idea with condom advertising and sexual education: Borders exist not only between different media markets, but also between different states with different sexual education policies. That is, comparing sales along borders of two designated marketing areas (DMAs) within one state (i.e., controlling for sexual education policies) identifies the effectiveness of condom advertising; similarly, comparing the sales along the borders of multiple states with different sexual education policies within a market (i.e., controlling for advertising levels) would speak to the effect of sexual education and condom purchases.

The ideal data set would have been a comprehensive survey on sexual education and sexual behavior—particularly on condom or hormonal birth consumption, paired with prices. Unfortunately, such data do not exist. To my knowledge, surveys on sexual behavior in their current form do not ask questions specific enough to describe purchasing habits or advertising

viewing habits; rather, they ask for broad descriptions of habits (e.g., the National Survey of Family Growth conducted in five-year cycles asks whether the respondent used a condom in the sexual encounter prior to taking the survey).

Instead, for contraceptive advertising and condom consumption, I use Nielsen media and scanner data from 2007 to 2012. For sexual education, I use publicly available data from the Sexuality Information and Education Council of the United States (SIECUS) on annual federal grants for sexual education to both state and local organizations, which, combined with Census population data, provides per-capita county-level expenditures on sexual education. Moreover, I use specific state laws on sexual education policies collected by the Guttmacher Institute. I also augment this data with state-level survey responses on sexual education instruction from the Centers for Disease Control and Prevention (CDC) in Section C.2 of the Appendix.

I find that condom advertising has a positive effect on condom sales in the absence of sexual education. On their own, state policies on teaching abstinence have the effect of lowering condom sales, though this effect is not estimated precisely. The effect of covering CSE is somewhat ambiguous. CSE funding granted directly to local organizations raises condom sales, whereas funding granted at the state level lowers them. To my knowledge, there has not been any research that has drawn a distinction between these types of grants. This finding may be consistent with the possibility that these grants differ in implementation or teach the abstinence versus contraceptive portions of CSE differently. The effect of condom advertising is lower in the presence of education that stresses abstinence, even when CSE is covered.

After accounting for the interaction effects between advertising and sexual education, condom advertising raises sales the most when abstinence and CSE are covered. However, they have an overall negative effect when abstinence is stressed, particularly without CSE. Hence, from a targeting perspective, firms may be better off eschewing areas in states with sexual education policies that stress abstinence. Additionally, public health advocates who

hope that condom advertising can serve a pro-social role in raising condom usage in the United States may want to reconsider that position; advertising does not appear to serve as a substitute for AOE.

This dissertation contributes to the stream of marketing literature on advertising effectiveness; in particular, it has close similarities to Shapiro [2016a] and Tuchman [2015], as mentioned earlier, as well as to Shapiro [2016b] and Spenkuch and Toniatti [2016]. This body of work uses the discontinuity in advertising along DMA borders to measure the effect of advertising. Using geographic borders as a source of natural experiments itself is not a new identification strategy; examples of previous work using borders to identify the effects of policies include work on minimum wage laws (Dube et al. [2010]), right-to-work laws (Holmes [1998] or Ellwood and Fine [1987]), banking deregulation (Huang [2008]), and the effect of school quality on home values (Black [1999]). In the marketing context, Shapiro [2016a] finds evidence of positive spillovers in television advertising for the antidepressant industry. Tuchman [2015] considers the effects of e-cigarette advertising on traditional cigarettes, and Spenkuch and Toniatti [2016] find advertising may have a positive effect on vote shares, but no impact on aggregate turnout.

Another body of marketing research has found evidence advertising can have null effect on sales. Shapiro [2016b] finds television advertising has no effect in the context of health insurance markets for the elderly. This result is consistent with arguments by Lewis and Rao [2015] that measuring advertising effectiveness is nearly impossible (campaigns would need to be unrealistically large to have enough power for measurement) and their results showing that a small amount of endogeneity can drastically bias results. Similarly, Blake et al. [2015] confirm that endogeneity can positively bias the effectiveness of advertising, and once endogeneity has been accounted for, the actual benefits of advertising are extremely low. Hence, to the extent that I find contraceptive advertising in some cases does not have a statistically significant effect on sales, this dissertation can also be viewed as being part of this niche of the advertising literature.

Research in economics and marketing specifically on contraceptive advertising and the condom industry is relatively thin. Economists studying contraception tend to focus on labor force participation or socioeconomic outcomes of hormonal contraception (e.g., Goldin and Katz [2002], Bailey [2006], and Ananat and Hungerman [2012]). By comparison, the public health literature has paid more attention to the role of condom advertising and condom usage; work in that field proposes condom advertisements may serve a pro-social role in lowering STDs or encouraging safe sex behavior (e.g., Solomon and DeJong [1989], Keller and Brown [2002], Knerr [2011], Purdy [2011], and Sweat et al. [2012]). Less attention has been paid to direct-to-consumer advertising of prescription contraceptives (i.e., hormonal birth control and LARCs), though Wu et al. [2016] document trends in LARC advertising, finding that increased LARC advertising has been correlated with increased uptake of LARCs.

The role of sexual education has also been studied in the public health literature, and the general consensus is that AOE is correlated with negative sexual outcomes (see, e.g., the meta-analysis by Silva [2002]), and CSE may be more effective at lowering teen pregnancy and transmission of STDs in comparison to AOE (Haignere et al. [1999], Santelli et al. [2007], Kohler et al. [2008], and Lindberg and Maddow-Zimet [2012]). That said, to my knowledge, this literature is primarily observational.

From a broader public health perspective, more clarity on the effects of condom usage may be beneficial. Based purely on “technological” features, condoms should be a reasonably foolproof tool for contraception and protection against STDs; according to the CDC, the condom breakage rate with correct usage is 2% (Centers for Disease Control and Prevention [1998]), which makes condoms one of the most effective non-hormonal contraceptive methods available (Centers for Disease Control and Prevention [2011]). Additionally, some evidence suggests that condom usage is correlated with positive sexual habits (e.g., Shafii et al. [2004] and Shafii et al. [2007]). One would expect, then, that higher condom usage should unequivocally mean lower undesirable outcomes from sexual intercourse.

Unfortunately, despite low breakage rates, due to incorrect or inconsistent usage, preg-

nancy rates from condom use are roughly 18%. Some researchers have even found contexts in which pregnancies per use have ranged from 12 to 70% (Haignere et al. [1999]). In the economics literature, Arcidiacono and Khwaja [2011] estimate a dynamic discrete choice model of teenage sex and pregnancy that assumes habit persistence in teen sex, and estimate a long run increase in teenage pregnancies from increased access to contraception. Buckles and Hungerman [2016] study the effect of providing free condoms in schools during the early 1990s, and find that teenage fertility actually increased. However, consistent with research by Kirby [2002], who considers the role of education and sexual habits (including condom usage), Buckles and Hungerman find this effect disappears with mandated counseling, suggesting the importance of sexual education in condom usage. Hence, this dissertation in some ways serves as a complement to this line of inquiry.

In short, this dissertation takes a step toward filling in existing gaps in the contraceptives literature and understanding the broader universe of contraceptive advertising, contraceptive usage, and public health. Future research might incorporate data on sexual behavior and outcomes or usage of other contraceptives to understand whether advertising might affect other categories, or to draw further conclusions on public health implications. For instance, lowered condom usage may be indicative of actual abstinence, or instead unsafe sex—ability to distinguish between the two would be beneficial, especially as the causal link between condom usage and sexual outcomes is not without ambiguity.

The rest of the dissertation proceeds as follows. Section 2 provides background on the contraceptive industry and sexual education in the United States. Section 3 describes the data. Section 4 explains the model and Section 5 provides the results. Section 6 concludes and points to future directions.

CHAPTER 2

BACKGROUND

2.1 The contraceptive industry in the United States

Currently, the most prominent birth control products in the market are male latex condoms, long-acting reversible contraceptives (LARCs), and hormonal birth control that is shorter acting. LARCs can range in effectiveness from three to 12 years and include both hormonal and non-hormonal intrauterine devices (IUDs) as well as subdermal contraceptive implants. Hormonal birth control that is not long-acting typically include once-a-day oral contraceptive pills, but also include weekly hormonal patches, monthly vaginal rings, and quarterly injectable shots.¹ The American College of Obstetricians and Gynecologists has recently stated that LARCs—IUDs in particular—are the best and most efficacious form of contraception (ACO [2015]); this stance likely reflects the current consensus among medical professionals. That said, condoms are still recommended for their cost effectiveness (Planned Parenthood [2011]) and for their importance as prophylactics. For instance, in the CDC's recommendations for birth control, the CDC emphasizes the choice of contraception should include considerations for preventing the contraction of STDs. To that end, the CDC strongly recommends using male condoms even if other forms of contraception are used (Curtis et al. [2016]); this recommendation, too, is likely reflective of the consensus medical opinion.

For the purposes of brevity, I will henceforth describe the two female contraceptive methods as hormonal birth control and LARCs, though the majority of LARC brands employ hormones. Since the history of oral contraceptives has been discussed at length in the economics literature (see, e.g., Goldin and Katz [2002]), I will focus primarily on the background of the condom and LARC industries.

Hormonal contraception in oral form was first approved by the FDA in 1960 while the first

1. Note: This nomenclature is not the only convention used by the medical field; in some designations, the quarterly injectable shots are described as long-acting, but I believe the differences in timeframes lead more naturally to these groupings.

documented use of the non-hormonal IUD was in 1909 (Jones [1991]) and hormonal LARCs have only gained prominence recently. By contrast, the technology for male contraception and prevention of STDs—namely, the condom—has existed for centuries.² Throughout its history, condoms have mostly been viewed with disfavor due to their association with sexual promiscuity, prostitution, and overall debauchery. It was—and in some segments of society, still—viewed as encouraging sexual intercourse, especially outside of marriage. Beginning formally with the Comstock Laws of 1873, US legislation criminalized the advertising and distribution of all forms of contraception; for example, Margaret Sanger, the founder of what became Planned Parenthood, was arrested in 1916 for distributing pamphlets on diaphragms. To avoid violating the Comstock Laws and being classified as obscene speech, advertisements did not describe condoms as a mode of contraception and only euphemistically described their usage. This wariness persisted for many years—when television was introduced to the American public, advertisements for condoms were not. The National Association of Broadcaster's code of conduct kept advertisements off-air from the 1960s through the majority of the 1970s (Chang [2001]).

Over time—particularly with soldiers abroad in WWII experiencing high rates of sexually transmitted infections—social mores towards condom usage became looser, as did discussion of its usage. Under Justices Warren and Burger, the Supreme Court eased the Comstock Laws in a series of rulings related to contraceptives.³ In 1977, these rulings culminated in *Carey v. Population Services International*, in which the court held advertising restrictions on condoms violated the First and Fourteenth Amendments (Cohen [1978]). Furthermore, the Department of Justice lifted the National Association of Broadcaster's code of conduct in 1979.

2. Some evidence suggests condoms have appeared in 15,000-year old cave paintings and Greek myths. The earliest definitive description of the usage of a prophylactic covering device was in 1564 (Quarini [2005]), and the condom as we know it was produced in 1855, after the invention of the rubber vulcanization process (Youssef [1993]).

3. Specifically, these rulings were on the distribution of contraceptives (*United States v. One Package* in 1936), free speech (e.g., *Roth v. United States* in 1957, *Miller v. California* in 1973) and privacy (e.g., *Griswold v. Connecticut* in 1965, *Roe v. Wade* in 1973).

From the firm side, the key impetus for condom advertising was the HIV/AIDs epidemic of the 1980s. Advertising was still minimal (and sometimes still banned or rescinded by networks), but condom manufacturers began to make forays into television advertising, primarily in the form of public safety announcements after prime-time (Chang [2001]). In 1991, Fox was the first broadcast TV network to air a condom ad; when the FDA allowed prescription drugs to be advertised on TV, the condom industry took this move as a cue to raise advertising for condoms. In 2005, the informal taboo against running advertising for condom was lifted on prime time network TV—NBC aired Trojan advertisements during prime-time and the WB, a teenage-focused channel, also began airing Trojan advertisements.

Advertising for prescription hormonal contraceptives is also relatively recent, because direct-to-consumer advertising was banned by the FDA until the mid-1980s, and only increased after the FDA loosened advertising content restrictions in 1997 (Donohue [2006], Watkins [2012]). It is worth noting that of the various prescription contraceptive methods, IUD usage in the United States has grown significantly in recent years (specifically, 0.8% to 5.6% between 2006 to 2010; Jones et al. [2006]), and has been the main driver of LARC category growth. That said, the LARC category is still smaller in the United States compared to other developed countries (Jerman et al. [2012]). The IUD industry's relative dormancy in the United States can be attributed to the notorious safety issues of the Dalkon Shield in the 1970s, which have played a role in driving consumers away from the entire category. Consistent with these trends, advertising for IUDs is relatively recent as well (Wu et al. [2016]).

2.2 Sexual education in the US

Concurrent with societal shifts favoring condom usage and advertising was growing federal and state support for formal sexual education—specifically, AOE. AOE itself was not new; the earliest documented form of AOE in the United States arose in response to high rates of STDs among Civil War soldiers. Traditionally, states have had purview over educational

requirements and content, including on sexual education—for instance, states can determine whether sexual education is mandatory and place requirements on its content. However, in the 1970s and 1980s, concerns over the spread of HIV/AIDs and unintended teenage pregnancies played a role in ushering in federal involvement with sexual education. In 1981, Congress began funding AOE through the Adolescent Family Life Act (AFLA, also known as “The Chastity Act”) as part of Title XX of the Public Health Service Act. Even though the Act did not provide any specific stipulations for what constituted AOE, its purpose clearly was to encourage abstinence until marriage. Program content was not required to be evidence-based or medically accurate.

The next milestone in AOE funding was the passage of the Temporary Assistance for Needy Families Act (i.e., welfare reform) in 1997. Under Title V Section 510(b) of this act, the federal government gave funding to states for AOE, which states were required to match at a ratio of three state dollars to every four federal dollars. Funding could be spent at the state level or sub-granted to local organizations. Recipients of both AFLA and Title V funding were required to provide education adhering to a specific, eight-point definition of AOE (which I provide in Section A.1), and could lose funding if they taught contraception. Not all states accepted this funding—notably, California has never accepted Title V funding in the program’s entire history.

In 2000, however, the federal government began to grant funding directly to local organizations via the Community-Based Abstinence Education (CBAE) program. Grant recipients also needed to adhere to the eight-point definition established by Title V (Sexuality Information and Education Council of the United States [2010], Perrin and DeJoy [2003]). Programs were not required to provide medically accurate information until 2007; however, critics argued that the information provided still was not medically accurate. Congress even held a hearing in April 2008 to debate the effectiveness and accuracy of AOE, and decided to allow all funding for AOE to expire in 2009. However, Title V funding was reintroduced with the Affordable Care Act (ACA), and has continued to fund programs in the present. Further

detail on these grants, examples of grantees, and examples of curricula is provided in Section A.2 of the Appendix.

Yet another shift in funding occurred in 2010, when Congress began to fund CSE via the Personal Responsibility Education Program (PREP), which was passed under the ACA. Akin to Title V, PREP is a state-level grant, but to incentivize state participation in the program, PREP does not require states to match federal funds. As with Title V, states have a great deal of control over the funding—for instance, states have decided not to apply or have even returned PREP funds (specifically, Florida in 2010 and Wyoming in 2011). PREP programs still advocate abstinence, but also teach the usage of various forms of contraception, including condoms (Sexuality Information and Education Council of the United States [2010]).

Finally, the federal government also created additional funding sources for evidence-based, medically accurate programs that local organizations could apply for directly in 2010 and 2012. Some of these programs are for the purpose of research and evaluation—for example, an organization might receive funding as part of a randomized controlled trial testing the effectiveness of a PREP curriculum. Though these grantees could be thought of as providers of CSE, SIECUS has found examples of recipients who instead taught curricula that heavily emphasized abstinence or only taught abstinence in ways it believes are not evidence-based or medically accurate. Hence, conservatively speaking, these grants perhaps should be viewed as funding programs that span from being “abstinence-plus”—that is, based on abstinence—to being comprehensive. However, in the spirit of accepting these programs are making good faith efforts toward being holistic and evidence-based, and avoiding the proliferation of nomenclature, I will classify these grants as falling underneath the umbrella of CSE. I provide further detail on these grants and grantees in Section A.3 of the Appendix.

CHAPTER 3

DATA

3.1 Sales data

I use condom sales and price data from the Nielsen scanner data for the period between 2007 to 2012. These data are at the store and weekly level. As hormonal birth control and LARCs are only available via prescription, they are not included in the Nielsen data. The Nielsen data records sales for 108 condom brands and 442 UPCs in 38,069 stores from 134 retailers over 2007 to 2012. The data cover sales of condoms in drug, food, liquor, and mass merchandiser stores, although drug stores account for the majority of sales (48.8% of unit sales), followed by food (23.5%) and liquor stores (27.1%).

As Table B.1 indicates, Trojan has most of the market share in condoms, followed by Durex and Life Styles. Condoms are sold in one or two packs, ranging from one condom to 48 condoms. The volume weighted average price of condoms is \$11.60 and exhibits a wide range, from a minimum of \$0.01 to \$86.99. Figure B.1 shows weekly condom unit sales per 1000-capita; the industry appears to be declining in sales and exhibits some seasonality (sales appear to rise in January and July). Some geographic variation appears to exist in sales; as an example, Figure B.2 is a heatmap of unit sales per thousand people aged 15 and over (i.e., potential population of sexually active individuals) in 2010.

3.2 Advertising data

I use the Nielsen advertising data from 2007 to 2012 for condoms, hormonal birth control, and LARCs. Nielsen tracks the number of households that view a firm's television advertisement at the spot-time DMA level, as well as the firm's expenditures on the advertisement. Nielsen also provides information on the parent company of the product being advertised, the duration of the ad, some information on the advertisement's content, and limited demographic

information of the advertisement's viewers.

Using the Nielsen data and the US Census population data, I can calculate the total gross rating points (GRPs) in advertising for each of these categories. The GRP for an advertisement is the number of households that watched the ad (i.e., impressions) as a percentage of the total population in the DMA; it is a typical unit of sales between firms buying advertising space from a television network. As Figures B.3a-B.3c indicate, even though national advertising varies the most, some variation in local condom GRPs is present, but much less is present for hormonal birth control and LARCs. Local hormonal birth control advertising appears to exhibit more geographic variation than advertising for condoms and LARCs; see Figures B.4a-B.4c for an example of how average monthly GRPs varied across the United States in 2010.

Table B.1 shows the advertising expenditures for the top brands in each category. Advertising expenditures from hormonal birth control brands by far exceed expenditures by condom firms, followed by LARCs. The bulk of advertising is national. In the case of condoms, Trojan is the primary advertiser, and in LARCs, Mirena by Bayer is. Expenditures in local advertising for condoms and hormonal birth control have declined over time while expenditures in national advertising have not (in the case of condoms, they have increased), suggesting that firms in these industries may be focusing more on national than on local advertising. Additional summary statistics are available in Table B.2.

3.3 Sexual education data

I use two types of sexual education data: Data on sexual educational funding and state-level sexual education policies. From SIECUS, I obtain federal funding for AOE and CSE funding given to organizations within each state and each year. From the Guttmacher Institute, I obtain data on the different types of state-level sexual education requirements for each year in the time period—specifically, whether sexual education is mandated; abstinence is stressed or covered (or not mandated either way); and whether contraception is covered. These data

are at the annual and state level.

As discussed in Section 2.2, there are essentially two different types of federal funding streams available for sexual education: An organization can receive funding via a state grant (Title V or PREP) or apply for funding directly from the federal government, which for the purpose of brevity, I will call “local grants.” From SIECUS, I obtain a list of funding recipients in each year between 2007 to 2012. To my knowledge, this list represents the most complete source of information on sexual education grants and grantees available. Within this time period, 1,006 entities received funding, 74 of which were state-level government agencies, e.g., state departments of health, education, or children’s welfare. The remaining 932 were local organizations, such as religious groups, foster homes, local youth programs, county-level health departments, or school districts. Programs varied in format—e.g., small discussion groups within school environments, one-on-one sessions with an educator—or for different target audiences—e.g., rural versus urban youth, specific races, or male- versus female-only audiences. Overall, programs aim to target teenagers who are homeless, living in foster care, living in rural areas or areas with high teenage birth rates, or teenagers who are members of minority groups (e.g., in terms of race, ethnicity, or sexual orientation). For further examples, see Sections A.2 and A.3 of the Appendix.

Table B.4 provides some summary statistics of the funding received by recipients of each type of grant. Each type of funding stream exhibits a great deal of variation. Local AOE and state CSE grants appear to attract the most participation (341 and 344 organizations, respectively). Note that the totals for each type of recipient are greater than 1,006, because some organizations are recipients of multiple grants. Specifically, 111 of the 528 organizations receiving funding between 2010 to 2012 received both AOE and CSE funding. The preponderance of these organizations applied for both state AOE and state CSE grants (101 versus 10), and on average, received more in CSE grants than AOE grants at a ratio of one AOE dollar to \$1.30 CSE ($sd = 0.54$). In Columns (1) and (2) of Table B.5, I consider the possibility of crowding out in the sense that organizations may apply to less funding if they

are receiving the same type of funding from the state. As the correlations between state and local funding are negative, crowing out may be occurring.

To obtain county-level data on funding, I determine which counties each recipient served and aggregate funding accordingly. SIECUS provides this information from 2010 onward. For recipients prior to that period, I use state-provided information on areas served by grant recipients. When that information was unavailable, I use self-reported information from each organization provided on their web page or web archives of their web pages. Finally, in the cases where that information is unavailable for a given recipient, I infer their geographic reach based on their address and verify them with third-party listings (e.g., online charity directories).

In contrast to the case with organizations, Column (3) of Table B.5 shows that at the county level, crowding out does not appear to be occurring for state AOE grants. Column (4) actually shows the opposite; there appears to be a positive correlation between state and local CSE grants. As noted before, funding is in theory prioritized towards for communities with high unplanned teenage pregnancy rates, poverty rates, or minority populations. However, Table B.6 regresses funding versus some of these demographics and includes a county as well as state-year fixed effect, and shows that for each type of grant, $R^2 < 1$ in each specification. That is, not all the variation in funding can be explained purely by observable demographics. This is not surprising, since funding can be determined by time-varying unobservables, such as the varied ability of or interest from local organizations for acquiring funding, as I will discuss further in Section 4.

To a certain extent, funding attached to sexual education speaks to the content of the sexual education being funded (for example, state and local AOE grant recipients are required to adhere to the eight-point definition as set forth in Title V). By contrast, state policies do not *per se* provide information on whether that state implements AOE or CSE. For instance, stressing abstinence is common to both AOE and CSE. Instead, I designate a sexual education regime as being comprehensive if (1) sexual education is mandatory, (2) abstinence

is covered or stressed, and (3) contraception is covered. This follows most conventional ideas of the necessary components of CSE. As an example, Figures B.8a-B.8d show maps of state policies in 2010.

Access to school- or district-level data, particularly on the implementation of sexual education policies, would have been ideal, as the absence of these data can lead to measurement error. For instance, it is conceivable that in a state requiring that abstinence be stressed or covered, teachers deviate and do *not* cover abstinence, or in a state that does not require CSE, teachers *do* teach CSE. However, such data tend to be geographically masked, barring prominent (and non-representative) school districts, and obtaining this data directly from school administrators is nontrivial.

As such, estimates of the effect of sexual education policy should be interpreted as estimates of the effect of the intent to treat, which provides valuable insights on the effect of setting policies at the state level. Given the likely proclivity of teachers toward deviating from abstinence policies, we would expect estimates of the effect of abstinence policies to be lower bounds. We may not necessarily expect this to be the case for estimates of the effects of CSE, as it is both possible for teachers to deviate away from covering CSE when it is required by the state, or towards covering it when the state does not require it. For a further discussion of estimating treatment effects (as opposed to intent to treat), see Section C.2.

Time and geographic variation in policies is somewhat scarce. Between 2007 to 2012, 14 states changed their policy on either abstinence education or CSE (or both), as listed in Table B.3. However, funding for AOE and CSE does change annually, as can be seen from Figure B.9. Sexual education funding is not dispersed uniformly and is very left-skewed, as can be seen in Figures B.10a and B.10b, which shows overall per-capita county-level funding for sexual education (i.e., state as well as local grants). Recipients of local grants unsurprisingly are expected to serve local communities, which leads to some geographic variation. Though state grants can be distributed state-wide, as described earlier, funding is prioritized for communities that are deemed to be higher need. These are typically urban or

rural communities. Thus, even within the same states, funding is not disbursed uniformly; as an example, Figures B.11a-B.12b show the variation in county-level funding in 2010 for Mississippi and Louisiana as well as California and Oregon.

Finally, Table B.7 shows some summary statistics for advertising and sexual education funding in the different policy settings as a check for any indication that firms may have targeted markets differently on the basis of sexual education policies, or whether states with different policies receive different levels of funding. On average, condoms appear to be advertised less where abstinence is stressed or covered. Additionally, on average, CSE funding is higher when CSE policies are in place. Unsurprisingly, local sexual education grants exhibit more variance than state grants.

3.4 Other data sources

I obtain county-level demographics data on race, gender, median income, and percent in poverty from the Census, as well as birth data from the CDC. Following Shapiro [2016a] and Duggan and Morton [2006], I use quarterly state Medicaid reimbursement rates as a proxy for hormonal birth control and LARC prices, namely, total units reimbursed by Medicaid during the quarter. As hormonal birth control usage is monthly (e.g., 28 pills over the course of a month) versus LARCs (e.g., one IUD over the course of five years), I rescale LARC prices by duration of use to make them more comparable to hormonal birth control.

CHAPTER 4

MODEL

4.1 Endogeneity issues and identification

My goal is to measure the causal impact of advertising for contraceptives on condom sales, as well as the impact of sexual education on condoms. However, advertising may be endogenous in the sense that firms may target markets with high demand with higher levels of advertising. Identifying the effect of sexual education is not straightforward either. For instance, the same underlying social norms (e.g., social conservatism or religiosity) that motivate the choice of sexual education may also affect condom sales, in which case, attributing any treatment effect to sexual education itself would be wrong. Another possibility is that states choose sexual education policies in response to outcomes of sexual behavior (e.g., unplanned teen pregnancies or STD rates), which themselves may be a function of condom sales.

In light of these sources of potential biases, I use the spatial discontinuity in local advertising markets as well as states. Using state borders as a source of discontinuity has precedence in both the economics and marketing literature (see, e.g., Black [1999] and Shapiro [2016a], Shapiro [2016b], and Tuchman [2015]). Identification rests on assuming that any difference in sales that would arise from either side of the border could only be attributable to differences in advertising or sexual education. For identification to be valid, any unobserved shocks that may occur need to be common to both sides of these borders, and consumers on both sides of a DMA or state border need to be comparable groups of people at every point in time. That is, consumers need to be similar on unobservable characteristics that might be correlated with advertising or sexual education and available choice sets of products. Time invariant unobservables are not a concern, since they would be absorbed by county fixed effects.

These assumptions arguably hold because the nature of DMA and state borders gives rise to a natural experiment. DMA borders only relate to television, since Nielsen defined

DMA^s by grouping counties based on the television stations that households residing in those counties watched the most. In the past, these groupings were determined by proximity to stations viewers could pick up on air. Even though many households now watch cable television, television providers still respect those boundaries and show the same advertisements within a given DMA. In the case of states, river or railroad routes historically determined state borders. Thus, none of these features of DMA or state borders have any relation to condoms or sexual education, but counties on opposing sides of each border will receive different levels of advertising and be subject to different sexual education policies, respectively.

To illustrate this argument, consider the case of two recipients of sexual education funding that serve populations across state borders, e.g., The Women's Clinic of Kansas City, which serves the Greater Kansas City area. This region includes parts of Kansas and Missouri. Additionally, consider the Planned Parenthood of the Greater Northwest, which serves Alaska, Idaho, Montana, Oregon, and Washington. The fact these organizations serve communities across state borders indicates they consider these communities to be similar in culture or social norms, which is consistent with the quasi-random nature of (in this case, state) borders. However, the grants these organizations received were specified for counties within a single state (in this case, Missouri and Washington, respectively). That is, communities along these borders were similar to the point that organizations served both of them, but these organizations received grants that were specifically only for one side of the state borders.

In the case of sexual education policies, the relevant concern is that state-level events—e.g., condom-related legislation—might affect one side of the state border and not the other. However, the only legislation regarding condoms between 2007 to 2012 was enacted in Los Angeles, California,¹ which is not one of the border counties. Therefore, we can use state

1. Specifically, the law passed in November 2012 was Measure B, which is also known as the County of Los Angeles Safer Sex In the Adult Film Industry Act. This law related to usage of condoms in scenes in pornography. Even if it is conceivable that other parts of California, such as the border counties, were somehow influenced by the law being passed, it was not legislation targeting the average consumer and therefore likely would not be relevant.

borders to identify the effect of sexual education policies.

Next, consider the case of sexual education grants. Note that state grants are not controlled by counties; instead, state governing bodies decide how to allocate the funding they receive from the federal government. Hence, funding for these grants is exogenously determined at the state level and to some extent, on the federal level, as budgets for sexual education are ultimately set by Congress, then by federal departments like the Department of Health and Human Services.

In the case of local grants, we might be concerned that we are measuring the effect of underlying social norms instead of a true causal effect. This is because unlike state grants and state-level policies, local grants are distributed when local organizations—presumably ones aligned with the tastes and social norms of their communities—apply for funding. However, akin to the case of state grants, variation in the dollar amount of local grants is subject to factors other than social norms, such as the ability of local organizations to obtain funding from the government (e.g., skills for navigating the grant process well) or potentially other behavior unlikely to be tied to underlying social norms. That is, decisions around funding may not necessarily be reflections of sudden swings in county-level social norms, but would affect county-level funding.

For example, Father Flanagan’s Home for Boys in Nebraska, a prominent recipient of AOE funding, decided to stop applying for AOE funding and instead apply for a local CSE grant in 2010. At the end of 2011, the organization changed direction again, terminating participation in the CSE program. While these actions affected county-level funding, it is unlikely that these changes in behavior were due to changes in unobservable social norms. The presence of 28 organizations that applied for both AOE and CSE grants is another example of how funding may not necessarily reflect social norms. Hence, including local grants does not threaten the feasibility of identifying the effect of advertising, sexual education policy, and sexual education grants.²

2. If anything, skeptics of the border strategy who believe that consumers have unobserved time-varying

Moreover, much as the CDC survey data would show how closely teachers adhere to (or deviate from) state policies, data on local grants show county-level efforts to augment (or detract) from state-level funding. For instance, several local organizations in California applied for local AOE grants despite their state government's stance against accepting AOE grants. Therefore, failing to include local grant funding would lead to measurement error of the effect of state grants.

Finally, the quasi-random nature of borders makes it unlikely that violations of the common trend assumption in condom demand could occur. That is, it is unlikely for scenarios to arise in which an unobserved shock would only occur on one side of the border but not the other. For instance, if something like an STD epidemic raised demand for condoms, there is no clear reason why it should respect state or DMA boundaries.

In short, having considered the factors influencing advertising, policy, and funding, it is unlikely that consumers would differ on time-varying unobservables across borders, e.g., changes in religiosity or social conservatism. Hence, identification using spatial borders is sound. For further argumentation, see Shapiro [2016a], Tuchman [2015], or Spenkuch and Toniatti [2016]).

Figure B.13a depicts an example of the type of border used to identify the effect of advertising, showing a border between two DMAs—Sacramento-Stockton-Modesto and Fresno-Visalia—which are both in California. Sexual education policies will be identical on both sides of the border, while advertising will not; hence, we can identify the causal impact from advertising from borders such as these. Analogously, Figure B.13b is an example of the type of border used to identify the effect of sexual education—it shows three sets of state borders between Ohio, Indiana, and Kentucky that are fully contained within the Cincinnati DMA. Borders such as these control for advertising while allowing sexual education to vary. Finally,

differences across borders should note that including local grant funding addresses this concern. This is because any remaining variation in local grant funding not explained by demographics or behavior from local organizations would control for the unobserved time-varying characteristics that concern them, e.g., changes in social norms.

Figure B.13c shows a border between two different DMAs (Oklahoma City and Amarillo) and two states (Oklahoma and Texas), which identifies the interaction between advertising and sexual education.

With these categorizations, there are 111 DMA borders fully contained in states between 93 DMAs and 86 state borders fully contained in DMAs between 45 states, and an additional 69 borders that are both DMA and state borders. The scanner data contain sales for 587 counties along the DMA borders, 371 along the state borders, and 246 counties in both.

Table B.8 shows some demographic characteristics of the non-border, state border, and DMA border counties. Counties along DMA borders have the lowest population densities relative to non-border counties, which in turn are less populous than state border counties. This observation is consistent with the fact that DMAs are centered around metropolitan areas—and as a consequence, the counties along their borders tend to be sparsely populated, rural areas—whereas state borders were historically based on river and railroad routes, which were desirable locations for larger towns and cities. State borders also tend to have lower poverty rates relative to DMA borders. Compared to DMA borders they have higher populations of adults aged 20 to 44 and teenagers aged 15 to 19; DMA borders, compared to both non-borders and state borders, have a higher average age. Finally, state borders appear to have higher teenage and adult birth rates than DMA borders.

For identification to be possible, variation in advertising and sexual education across borders and time need to exist. Namely, if all the variation in both advertising and sexual education were at the national level, border-time fixed effects would completely sweep away all the variation in local advertising and sexual education. This concern is particularly pressing for sexual education, which rarely varies over time and at least in the case of sexual education policies, may sometimes be equivalent across borders.

To address this concern, I graph the residual variation in sexual education policies, sexual education funding, and GRPs after including county and border-time fixed effects, as shown in Figures B.14a-B.14c and B.15a-B.17b. Advertising and sexual education appear to exhibit

some residual variation, though sexual education to a much lesser degree.

4.2 Specification

After aggregating data to the county and month level, for counties c in DMA border b and state border s in month t , I estimate

$$\begin{aligned} \log Q_{cbst} = & \alpha_\ell \ell_{ct} + \beta_E E_{ct} + \beta_s F_{ct}^s + \beta_\ell F_{ct}^\ell \\ & + \gamma_E E_{ct} \ell_{ct} + \gamma_S F_{ct}^S \ell_{ct} + \gamma_L F_{ct}^L \ell_{ct} + \eta_E E_{ct} n_{ct} + \eta_S F_{ct}^S n_{ct} + \eta_L F_{ct}^L n_{ct} \\ & + \tau_E E_{ct} (\text{quarter dummy}) + \tau_S F_{ct}^S (\text{quarter dummy}) + \tau_L F_{ct}^L (\text{quarter dummy}) \\ & + \omega_c + \omega_{bt} + \omega_{st} + \delta X_{cbst} + \epsilon_{cbt}, \end{aligned} \quad (4.1)$$

where Q_{cbt} represents the total units sold, and X_{cbt} includes average unit price and demographics. ω_c represents the county fixed effect, and ω_{bt} (ω_{st}) represents a DMA (state) border-month fixed effect absorbing trends common to both sides of the border. Note that the DMA and state borders fixed effects only both appear for counties that are on DMA *and* state borders (i.e., a DMA border fully contained in a state does not have a state border, and analogously for a state border fully contained in a DMA). ℓ_{ct} are GRPs for local condom, hormonal birth control, and LARC ads, while n_{ct} represents the GRPs for national advertising of these categories. The sexual education variables include

- State sexual education policies E_{ct} : Dummy variables for whether abstinence was stressed, abstinence was covered, and whether education was comprehensive (mandatory, abstinence stressed or covered, and contraception is covered)
- State (local) sexual education funding F_{ct}^S (F_{ct}^L): State funding for AOE and CSE per teenager between 15 and 19 years of age (in thousands of dollars). This group is most likely to be sexually active and at risk of unintended pregnancy, so normalizing funding

in this manner makes sense.³

Note that abstinence can be covered, stressed, or neither; it cannot be stressed and covered at the same time. A component of CSE is abstinence, so including dummies for the type of abstinence education is beneficial for understanding what role abstinence education plays on its own, separate from CSE.

To account for the possibility of county-level heterogeneity that may be correlated with advertising or sexual education, I include a county fixed effect. Additionally, I include a border-month fixed effect to sweep out shocks that may be common to both sides of the border. Finally, I interact the sexual education variables with a quarter-dummy to address the possibility of time-dependent effects of sexual education (e.g., effects may differ depending on whether school is in session or states allocate funding on a rolling or quarterly basis).

Given that some of the sexual education comes in the form of funding, per-capita expenditures as a measure of advertising might seem more appropriate for a more apples-to-apples comparison as opposed to using per-capita impressions. However, there simply was not enough variation in per-capita expenditures to estimate effects with any precision; furthermore, sexual education funding is not *per se* comparable to advertising expenditures. Relative to television advertisements, sexual education purportedly provides content over long durations of time (e.g., repeated sessions in community-based programs, or one or more semesters of a school year). By contrast, television advertisements tend to be short messages that may or may not include information about the product and its usage. Only hormonal birth control and LARC ads are required—by the FDA—to provide information; condom ads in this time period very likely were not informative in nature, having shifted away from providing the explicitly public safety announcement-type information that was common prior to the 2000s. Hence, I chose to use GRPs as my measure for advertising, particularly as my

3. However, this normalization might have the effect of inflating the per-capita funding for small counties, which is a valid concern for rural areas. I considered other alternatives—specifically, normalizing by number of classrooms—but because sexual education is offered in a variety of settings outside of schools, this normalization was still the most appropriate.

primary interest is in how sexual education and advertising interact in the presence of each other versus making a (potentially invalid) direct dollars-to-dollars comparison.

CHAPTER 5

RESULTS

Table C.1 shows the results from this specification, which I estimate in steps. Specifically, in Column (1), I only consider the effect of condom ads and restrict attention to borders between advertising markets. The main effect of local ad GRPs appears to be negative, but not measured with precision.

In Column (2), I consider the effect of sexual education on counties along state borders. The effect of both abstinence-related sexual education policies is negative but not significant. The estimates for the effect of covering CSE and CSE state funding are not significant, but the effect of local CSE grants are. Raising local CSE grants by an additional unit (i.e., an additional dollar per thousand 15 to 19 year old) raises condom sales by roughly 192.1%.

In Columns (3) and (4), I look at the heterogeneity of the effect of condom ads and sexual education by interacting local condom advertising GRPs with the sexual education dummies and policies. While I still display the main effects for sexual education and advertising, I only show estimates for the interaction terms with p-values less than 0.10. Note that the relevant borders in Column (3) are DMA borders and in Column (4), they are state borders. Hence, there is no main effect of sexual education policies in Column (3), as sexual education policies will not vary within state; similarly, in Column (4), there is no main effect from advertising, as it does not vary within market. However, state and local grants will vary from county to county, which is why there is a correlation between sales and grants, but these estimates should not be interpreted as representing a causal effect of sexual education funding.

As with Column (1), the main effect of advertising is not estimated with precision, but condom advertisements appear to have a positive interaction with higher state grants for CSE funding. This result is consistent with the possibility that because CSE promotes contraception as well as abstinence, it may leave viewers more receptive to condom ads. Similarly, Column (4) suggests that the state policy of stressing abstinence has a negative interaction with local condom advertising, whereas the state policy of CSE has a positive

interaction with national advertising. By contrast, AOE local grants appear to have a positive interaction with local condom advertising.

In Column (5), I estimate the full specification, i.e., with interaction terms between advertising and sexual education, and in Column (6), I include average hormonal birth control and LARC prices as well as local and national advertising GRPs for hormonal birth control and LARCs to account for the possibility that hormonal birth control and LARCs may be substitutes for condoms. Since national advertising is identical across borders, identifying its main effect is not possible, though estimating interaction effects is.

Before quantifying and comparing the effect of advertising versus sexual education, I can make some brief qualitative observations. As before, the main effect for local advertising is not estimated with precision, though it is positive. The negative (positive) effect of state (local) CSE grants is still estimated. The effect of state grants may differ from those of local grants for several reasons. One may relate to presence of dueling pressures on condom sales that are present in CSE. That is, while CSE teaches condom usage, which would tend to raise sales, there are portions of its curricula which would tend to lower sales. Proponents of CSE have posited that the net effect of CSE on sexual behavior may be negative, claiming programs teach how to be abstinent in more practical ways (e.g., without relying on fear or shame). They have also posited that CSE teaches better usage of all contraception, including non-condom methods such as hormonal contraception, which, to some extent, may be a substitute for condoms. These two effects would tend to lower condom sales. Additionally, as discussed, state and local grants differ in implementation and content—for instance, local grants do not all emphasize abstinence to the same extent, and some are granted to programs that are more experimental in design. Hence, due to these differences, it may be the case that the effects of CSE that would tend to lower condom sales dominate in programs funded by state grants but do not in programs funded by local grants. Verifying the underlying mechanisms explaining this result requires further data on sexual behavior and sexual outcomes.

The negative interaction between stressing abstinence and local condom advertising suggests that AOE is a substitute for (local) condom advertising, while the positive interaction between CSE and (national) condom advertising suggests they are complements.¹ In a similar vein, the estimates suggest that state CSE grants and national condom advertising are substitutes, while local grants and national advertising are complements, which again speaks to the possibility they are different programs in nature. Though the interaction between local abstinence grant funding and local condom advertising is positive, it is not significant at the 5% level; hence, it could be a false positive.

The final specification includes advertising and prices for hormonal birth control and LARCs, which are of interest from the public health perspective, since using condoms is recommended along with hormonal and LARC contraceptive methods. The negative cross-price elasticity for hormonal birth control suggests hormonal birth control may be a (weak) substitute of condoms; such evidence is not apparent for LARCs, though LARC ads appear to have a positive effect on condom sales significant at the 10% level. However, the interaction of CSE funding and hormonal birth control advertising is positive, which is a promising sign that these programs are successful in recommending hormonal birth control be used in tandem with condoms. The messaging from LARC brands and recommendations from evidence-based educational entities that condoms should be used along with LARCs is fairly consistent (and insistent), which would have the effect of raising condom sales. However, LARCs also have the lowest failure rate among all contraceptive products, and until recently were mostly positioned as a product for women in monogamous, long-term relationships (i.e., a group of women that may have a relatively low risk of contracting an STD). These factors would tend to lower condom sales. The negative interaction between local CSE grants and LARC advertising is consistent with the possibility that the latter effect may be dominating. Certainty over what is actually driving these effects requires more data beyond the scope of

1. These relationships also hold for the policy of covering abstinence, but were not estimated with precision.

this paper, but merits further investigation.

To understand the magnitude of the interaction between advertising and sexual education, I calculate the elasticities of local advertising, sexual education funding, and policies for each month, which are equal to:

$$\frac{\partial Q_{ct}/Q_{ct}}{\partial \ell_{ct}/\ell_{ct}} = (\beta_A + \gamma_E E_{ct} + \gamma_S F_{ct}^S + \gamma_L F_{ct}^L) \cdot \ell_{ct} \quad (5.1)$$

$$\frac{\partial Q_{ct}/Q_{ct}}{\partial F_{ct}/F_{ct}} = (\beta + \gamma \ell_{ct} + \eta n_{ct} + \tau) \cdot F_{ct} \quad (5.2)$$

$$\frac{(Q_{ct}|E_{ct} = 1) - (Q_{ct}|E_{ct} = 0)}{(Q_{ct}|E_{ct} = 0)} = \exp(\beta_E + \gamma_E \ell_{ct} + \eta_E n_{ct} + \tau_E) - 1, \quad (5.3)$$

where I have suppressed the state and local grant superscripts for parsimony in Equation 5.2.

I calculate the elasticities at the means for each continuous value (GRPs and sexual education), and for all permutations of sexual education policy settings: (1) no abstinence education or CSE, (2) abstinence stressed without CSE, (3) abstinence stressed with CSE, (4) abstinence covered without CSE, and (5) abstinence covered with CSE. I focus attention on local advertising, because without a main effect for national advertising, there is not as much context to understand its effect outside of its interaction with sexual education. Since this specification was estimated on the border counties and not the full data set, I calculate the effects for only border counties.

Table C.2 shows the estimates with 95% confidence intervals, though estimates that are significant at the 10% level are also indicated. Note that the effect of sexual education policies should be thought of as switching to that policy while maintaining the other aspects of the status quo. For example, when I consider the effect of stressing abstinence in a regime where abstinence and CSE are covered in Column (6), I look at the effect of switching from covering abstinence to stressing it while maintaining CSE.

In Column (1), I consider the overall effect of condom and LARC ads, sexual education funding, and sexual education policy; that is, I do not discriminate between the different

policy scenarios. The effects of advertising are not estimated with precision, though the effect of state (local) CSE are negative (positive). Overall, an additional \$10 increase in state CSE grants per 15 to 19 year old (i.e., a 1% change in thousands of dollars per capita) would lower condom sales by 0.360%, while it would raise sales by 0.343% in the case of local grants.

In Columns (2) through (6), I consider the elasticities under the different policy settings described earlier. Column (2) shows the elasticities of advertising and sexual education where abstinence is neither covered nor stressed and CSE is not taught. As before, the effect of condom advertising is still not measured with precision. However, in Column (3), a 1% increase in GRPs lowers unit sales by 0.273% when abstinence is stressed without covering CSE. By contrast, when abstinence is covered, the elasticity of condom advertising is 0.232% without CSE (Column (4)) and 0.335% with CSE (Column (5)). These results suggest that covering abstinence as opposed to stressing it or covering CSE mitigates the negative effect of stressing abstinence. The effect of LARC ads are not significant except in Columns (2) and (4), where the elasticity is positive. Without further information on the content and mechanism by which LARC ads operate, explanations as to why this effect is present would be speculative, albeit of interest from the public health perspective.

Consistent with results in Column (1), the elasticities of state and local CSE grants are estimated to be negative and positive in Columns (2) through (6), respectively. Note the magnitude of the elasticity of state grants is larger than the magnitude for local grants except where abstinence is stressed and CSE is not covered (Column (3)). Additionally, the magnitude of the effect of state and local grants rises when CSE is covered versus when it is not (i.e., comparing Column (4) to (3) and Column (6) to (5)). This suggests that the portions of state (local) grants that would tend to lower (raise) condom sales dominate more when the state policy is to cover CSE than when it is to not cover it, or that CSE policies amplify the underlying effects of CSE funding.

With the exception of the scenario in which abstinence is stressed and CSE is covered in

Column (4), the effect of sexual education policies (as interpreted as the intent to treat) is not precisely measured. That said, when I use the CDC Profiles survey data on implementation of sexual education to calculate elasticities, I am able to estimate the effect of stressing and covering abstinence with precision (as shown in Table C.5). These estimates are negative and much larger in magnitude—for instance, the overall effect of stressing abstinence lowers condom sales by 8.367% and covering abstinence lowers it by 8.708%. The estimates for other elasticities are still generally consistent with results from not using the CDC Profiles data, but are no longer estimated with precision. For further discussion, see Appendix C.2.

Finally, in Table C.3, I calculate the return on marketing assuming a 30% gross margin. The ROI from condom advertising is negative when abstinence is stressed, and is larger in magnitude when CSE is not covered (538.66% versus 167.37%). When abstinence is covered instead of being stressed, the ROI is positive, but is only estimated with 10% significance for the case where abstinence and CSE are covered.

I would not suggest abstracting from these effects estimated at the borders to the rest of the United States. However, I believe the results indicate that while condom advertising may potentially have positive effects on condom sales where there are no sexual education policies, they are lower in the presence of education that stresses abstinence, although CSE might mitigate this effect. By contrast, condom ads have a positive effect on sales when the state's policy is to cover, as opposed to stress, abstinence. The overall effects of state policies are somewhat ambiguous, though augmenting the data with the CDC Profiles survey results would seem to indicate that stressing or covering abstinence has a negative effect on condom sales. Finally, state grants for CSE have the effect of lowering condom sales whereas local grants may have the effect of raising them, suggesting that programs funded by state and local grants are fundamentally different.

CHAPTER 6

CONCLUSION

In this paper, I contribute to the marketing literature on advertising effectiveness and, to a lesser extent, the public and sexual health literature, by considering the effect of contraceptive advertising and sexual education on condom sales. The United States clearly lacks a consensus on sexual education, as evidenced by the variation in sexual educational standards and funding. As recently as July 2017, the Trump administration decided to reduce CSE funding by over \$200 million (Thompson [2017]), lending greater urgency to understanding the effects of sexual education. Additionally, though the United States has exhibited promising trends in unplanned teenage pregnancies and women's health, it still lags behind developed nations and exhibits inconsistent levels of support for women's reproductive health and contraception. Because condoms are an easy-to-use, readily available, and very inexpensive form of contraception, studying the effect of sexual education on condom sales is a useful starting point for understanding how sexual education affects sexual practices. From the marketing perspective, understanding the effectiveness of contraceptive advertising when it intersects with sexual education can have useful managerial implications.

I use the discontinuities from market and state borders to find that although measuring the effect of advertising is in general difficult, condom advertising has a positive effect on condom sales except when abstinence is stressed; in this scenario, it may even have a negative return on investment. Hence, from a managerial perspective, condom companies might be better off keeping their advertisements off air in areas where the state policy is to stress abstinence.

State and local CSE grants have opposite effects on sales, suggesting the two may have differences that warrant further study from a public health and educational perspective. The possibility these grants may have opposite effects is a novel result. When I augment the data with CDC Profiles survey responses on sexual education instruction, the effects of stressing and covering abstinence are estimated with precision and are negative. These results on

the whole suggest that the pro-social possibilities for condom advertising as a substitute for sexual education in the US may be limited, though advertising is more effective when abstinence is covered instead of stressed.

These findings come with some caveats. For instance, the generalizability of these results are unclear, as they were estimated on a particular subset of the United States (i.e., market and state boundaries), which are not necessarily representative of the rest of the country. Additionally, the effects of advertising, funding, and policy were estimated over entire sexual education regimes; that is, while the effects of state or local funding may cancel out over an area in which abstinence is covered (for instance), their effects within a county contained in that area may not, depending on the level of state or local funding within that county.

Furthermore, these results only relate to condom sales and may not be generalizable to hormonal birth control or LARCs. Specifically, sexual education and advertising may have a different effect on hormonal birth control usage or LARC sales particularly as birth control and LARC advertisements almost exclusively feature information for potentially unfamiliar and novel products. By contrast, condom advertisements are more persuasive in nature and are trying to sell a product in a mature product category that, relative to prescription birth control, is very familiar to consumers. Finally, the sexual education data did not exhibit much variation, so estimates of effects and interactions were imprecise. Hence, one possible direction for future research would be to incorporate finer data that may be relevant to this setting, such as finer data on sexual education or social mores (e.g., church attendance, surveys on social attitudes towards sexual intercourse and relationships, etc.).

This dissertation focused on condom sales, but future research may include incorporating the possible effect of advertising and sexual education on sales of hormonal birth control and LARCs—two product categories which exhibited significant growth in recent history. Including this data would give a fuller picture of the effect of advertising and sexual education on contraceptive usage and provide greater context for the results found in this paper. For instance, lower condom sales are not troubling in and of itself; they are only troubling if they

are indicative of higher unprotected sex.

In a similar vein, another more policy-oriented direction may include relating the effect of contraceptive advertising and condom sales (or other contraception) on sexual outcomes. The goal of sexual education is to avoid undesirable sexual outcomes, such as unplanned teenage pregnancies. However, as mentioned before, the specter of reverse causality still may be present in the sense that the magnitude of these undesirable outcomes can influence the choice of sexual education. Even drawing a causal relationship between condom sales and sexual outcomes may not be so obvious; for instance, high preferences for sex may also result in higher condom sales as well as higher rates of teenage pregnancy. In sum, while this dissertation takes a step toward linking education and advertising to one form of contraception—namely, condoms—linking sexual education or advertising to other forms of contraception or to sexual outcomes will be a fruitful and important next step for future research.

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Appendices

APPENDIX A

BACKGROUND ON FEDERAL GRANT PROGRAMS FOR SEXUAL EDUCATION

A.1 Title V 8-point abstinence-only education criteria

Section 510 (b) of Title V of the Social Security Act, P.L. 104-193: For purposes of this section, the term “abstinence education” means an educational or motivational program which

- (a) has as its exclusive purpose, teaching the social, psychological, and health gains to be realized by abstaining from sexual activity;
- (b) teaches abstinence from sexual activity outside marriage as the expected standard for all school age children;
- (c) teaches that abstinence from sexual activity is the only certain way to avoid out-of-wedlock pregnancy, sexually transmitted diseases, and other associated health problems;
- (d) teaches that a mutually faithful monogamous relationship in context of marriage is the expected standard of human sexual activity;
- (e) teaches that sexual activity outside of the context of marriage is likely to have harmful psychological and physical effects;
- (f) teaches that bearing children out-of-wedlock is likely to have harmful consequences for the child, the child's parents, and society;
- (g) teaches young people how to reject sexual advances and how alcohol and drug use increases vulnerability to sexual advances; and
- (h) teaches the importance of attaining self-sufficiency before engaging in sexual activity.

A.2 Background information on abstinence-only sexual education grants between 2007 to 2012

<i>Grant program:</i>	<u>Adolescent Family Life Act (AFLA)</u>
<i>Duration:</i>	1981 - 2010
<i>Administered by:</i>	Office of Adolescent Pregnancy Prevention (OAPP) w/in the Dept of Health & Human Services (HHS)
<i>Program type:</i>	N/A
<i>Description:</i>	<ul style="list-style-type: none">• Beginning in 1997, programs were required to satisfy the Title V eight-point definition of AOE• In prior years, requirements were less clearly defined and had religious undertones.• Congress cut all AFLA funding from 2010 onward
<i>Ex. (sub-)grantees (2009):</i>	<ul style="list-style-type: none">• Our Lady Lourdes Memorial Hospital, NY (\$300,000)• Father Flanagan's Boy's Home, NE (\$300,000) Non-profit, faith-based provider of child & family care services in residential, group, and family treatment settings. Also offers foster care services.• Ingham County Health Department, MI (\$276,826)
<i>Ex. programs:</i>	N/A

<i>Grant program:</i>	<u>Title V Abstinence Education Grant Program (Title V AEGP)</u>
<i>Duration:</i>	1996 - present

Administered by: Family & Youth Services Bureau (FYSB) w/in the Administration for Children & Families (ACF)

Program type: Funding to state

Description:

- HHS allocates federal funds to states.
- Participating states must match funds at a ratio of four federal dollars to three state dollars. They may distribute funds to community-based sub-grantees.
- Programs must satisfy the Title V eight-point definition of AOE.
- Programs may only discuss contraception with relation to failure rates.
- Every state with the exception of CA has accepted Title V AEGP funds during the grant program's history.
- Congress allowed the program to expire in June 30, 2009, but states that had already accepted funding received 3/4 of the funding allocated for the full fiscal year.
- Title V funding was reintroduced as part of the Affordable Care Act (ACA).

Ex. (sub-)grantees (2009): • Nebraska Department of Health and Human Services, NE (\$164,055)

- Southside Pregnancy Center, IL (\$75,000)

Crisis pregnancy center (CPC).

- New Brighton School District, PA (\$24,000)

Ex. programs: *WAIT (Why Am I Tempted) Training*

- Exclusively promotes heteronormative marriage / gender roles.
- E.g.: “When it comes to sex, men are like microwaves and women are like crockpots... [M]en respond sexually by what they see and women respond sexually by what they hear and how they feel...”

Choosing the Best

- Target audience: 6-12th graders.
- According to SIECUS, curriculum is based on fear and shame, with little medical or biological information.
- E.g.: Suggested answers to assignment on ‘emotional consequences’ of premarital sex include “guilt, feeling scared, ruined relationships, broken emotional bonds.”

Grant program:

Community-Based Abstinence Education (CBAE)

Duration:

2000 - 2010

Administered by:

Maternal & Child Health Bureau (MCHB) w/in the HHS

Program type:

Direct to local organizations

Description:

- Intended to bypass state approval.
- Programs must satisfy the Title V 8-point definition of AOE.
- Programs promoting use of contraception were ineligible for funding.

Ex. (sub-)grantees (2009):

- Juvenile Assistance Diversion Effort, CA (\$560,000)
Non-profit for counseling juvenile offenders with the goal of diverting them away from future criminal activity.
- The Women's Clinic of Kansas City, MO (\$512,500)
CPC.

Ex. programs: N/A

Grant program: **Competitive Abstinence Education Grant Program (CAE)**

Duration: 2012 - present

Administered by: FYSB w/in the ACF

Program type: Direct to local organizations

Description:

- Two-year awards
- Programs must satisfy the Title V 8-point definition of AOE.
- Required to be medically accurate.

Ex. (sub-)grantees (2012):

- Mission West Virginia, WV (\$617,333)
Non-profit for building stronger communities in West Virginia through collaboration with public & private entities, (especially faith-based).
- Administration for Children & Families, OR (\$412,430)

Ex. programs: N/A

A.3 Background information on comprehensive sexual education grants between 2007 to 2012

Grant program: **Personal Responsibility Education Program (PREP)**

Duration: 2010 - present

Administered by: FYSB w/in the ACF

Program type: Funding to state

Description:

- Established through the ACA; includes three sub-programs.
- Recipients: Primarily state health agencies.
- No state matching requirement; goal was to incentivize participation.
- Must teach evidence-based, medically accurate, age-appropriate sexual education covering both abstinence and contraception.
- Must teach at least three of: Healthy relationships, adolescent development, financial literacy, education and career success, and healthy life skills

Ex. grantees / sub-grantees (2012):

- Arkansas Department of Health, AR (\$495,595)
- Planned Parenthood of West Northern Michigan, MI (\$175,000)

Ex. curricula / programs: *Reducing the Risk: Building Skills to Prevent Pregnancy, STD, and HIV*

- Target audience: 9th-10th graders.
- 16-lesson curriculum on both abstinence and contraception.
- *Family Planning Perspectives:* Delayed initiation of sex, reduced incidence of unprotected sex.

Safer Sex

- Target audience: Female teens.
- One-on-one with a female educator with one-, three-, and six-month voluntary follow-ups.
- Focuses on condom usage and other contraception.
- *Archives of Pediatrics and Adolescent Medicine:* Participants had lower incidence of multiple sexual partners than control group at the six-month mark.

Be Proud! Be Responsible!

- Target audience: Black males aged 13 to 18 in urban areas.
- Six 5-hour sessions for small groups, but can be for larger settings.
- Teaches negotiation, refusal, and condom-use.
- *American Journal of Community Psychology:* Intervention decreased measures of sexual intercourse and increased condom use.

Grant program: **Personal Responsibility Education Innovative Strategies (PREIS)**

Duration: 2010 - present

Administered by: Collaboration b/t ACF and Office of Adolescent Health (OAH)

Program type: Direct to local organizations

Description:

- One of the PREP sub-programs.
- Recipients: Local entities (public or private).
- For teen pregnancy prevention and evaluation of “innovative” programs adhering to PREP criteria.

Ex. (sub-)grantees

- Father Flanagan’s Boy’s Home, NE (\$300,000)

(2012):

Non-profit, faith-based provider of child & family care services in residential, group, and family treatment settings.
Also offers foster care services.

Ex. programs: *Project AIM (Adult Identity Mentoring)*

- Target audience: Blacks aged 11-14; also can be used with Latino teens.
- Aims to help participants envision future goals and how risky behavior could impact those goals.
- School-based intervention of 10 sessions; can be adapted for other community-based settings.
- *Journal of Adolescent Medicine:* Participants less likely to report having had sex than control group.

Power Through Choices

- Target audience: Residents of group homes, foster homes, or other residential care settings ages 13-18.
- Focuses on reducing risky sexual behaviors and teaching contraception usage, communication skills, and accessing community services.
- Ten 90-minute sessions twice a week for five weeks.
- *Child Welfare:* Potential reduction of risky sexual behaviors.

Grant program: **Teen Pregnancy Prevention Initiative (TPPI)**

Duration: 2010 - present

Administered by: Collaboration b/t ACF, OAH, and Centers for Disease Control & Prevention (CDC)

Program type: Direct to local organizations

Description:

- Recipients: Local entities (public or private).
- Funding is divided into two tiers.
- Tier 1: Replicate evidence-based programs from the HHS. Grantees required to use random assignment or quasi-experimental design.
- Tier 2: “Research and demonstrate” program effectiveness.

Ex. (sub-)grantees (2012):

- Florida Department of Health, FL (\$3,565,451)
- Women Accepting Responsibility, MD (\$890,790)
- Morehouse School of Medicine, GA (\$1,500,000)

Ex. programs:

Past programs have tested / implemented PREP as well as Title V curricula.

Grant program: **Competitive Personal Responsibility Education Program (CPREP)**

Duration: 2012 - present

Administered by: FYSB w/in the ACF

Program type: Direct to local organizations

Description:

- One of the PREP sub-programs.
- Recipients: Community-based organizations (including faith-based) in states / territories that did not apply for PREP state grants in FY 2010-2013.

Ex. (sub-)grantees (2012):

- Planned Parenthood of Southeastern Virginia, VA (\$405,780)
- Ambassadors for Christ Youth Ministries, TX (\$850,000)

Ex. programs: *Promoting Health Among Teens! (Abstinence-Only Intervention)*

- Target audience: Urban, Black youth in small groups; can be adapted for larger groups or rural settings.
- Aim is abstinence, but neither encourages / discourages condom use.
- 8 one-hour modules for school, community based settings.
- *Archives of Pediatrics & Adolescent Medicine:* After 2-year followup, sexually inexperienced participants less likely to have initiated sex than control group.

Making Proud Choices

- Target audience: Blacks, Latinos, whites aged 11-13.
- Relates poor reasoning / decision-making to STDs / HIV, unintended pregnancy.
- Teaches confidence, negotiation skills, and condom usage.
- 8 one-hour sessions for school and community-based settings.
- *Journal of American Medical Association:* Participants reported more consistent and more frequent condom usage than control group.

Grant program:

Tribal Personal Responsibility Education Program

(TPREP)

Duration:

2012 - present

Administered by:

FYSB w/in the ACF

Program type:

Direct to local organizations

Description:

- One of the PREP sub-programs.
- Recipients: Tribal community-based organizations (including faith-based) in states / territories that did not apply for PREP state grants in FY 2010 - 2013

Ex. (sub-)grantees (2012):

- Riverside-San Bernardino County Indian Health, Inc., CA (\$363,530)
- Inter Tribal Council of Arizona, Inc., AZ (\$723,345)

Ex. programs:

N/A

APPENDIX B

DESCRIPTIVE STATISTICS

Table B.1: Market share and advertising expenditures for top brands between 2007-2012

Brand	Units sold (M)	Market share (%)	Local ad expenditures (\$M)	Share of local ad expenditures (%)	Nat'l ad expenditures (\$M)	Share of nat'l ad expenditures (%)
<i>Condoms</i>						
Trojan	881.08	70.62	0.06	81.30	29.33	98.22
Durex	197.44	12.42	0.00	0.00	0.00	0.00
Life Styles	154.99	12.63	0.00	0.00	0.53	1.77
<i>HBCs</i>						
Nuvaring			0.17	2.10	57.64	38.79
Lo Loestrin			0.10	1.28	27.01	18.18
Seasonique			7.73	96.29	25.12	16.90
Beyaz			0.00	0.03	18.27	12.29
<i>LARCs</i>						
Mirena			2.25	100.00	52.1	92.04
Paragard			0.00	0.00	4.51	7.96

Figure B.1: Monthly condom unit sales per 1000 capita
(All figures created by the author)

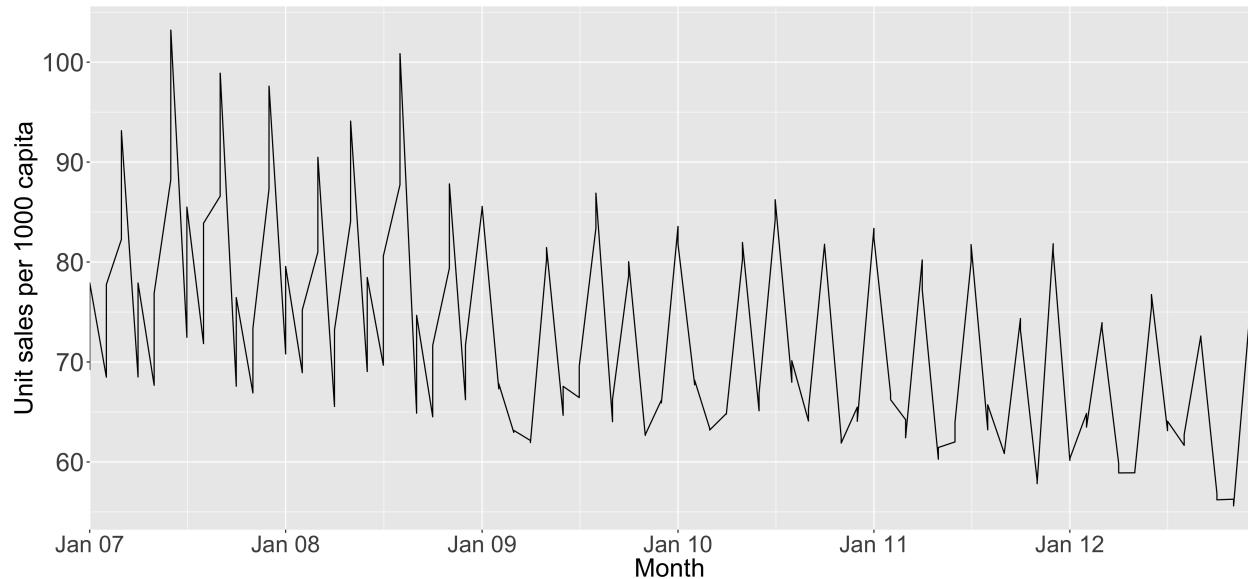


Figure B.2: Unit sales per people aged 15+ ('000 capita): 2010

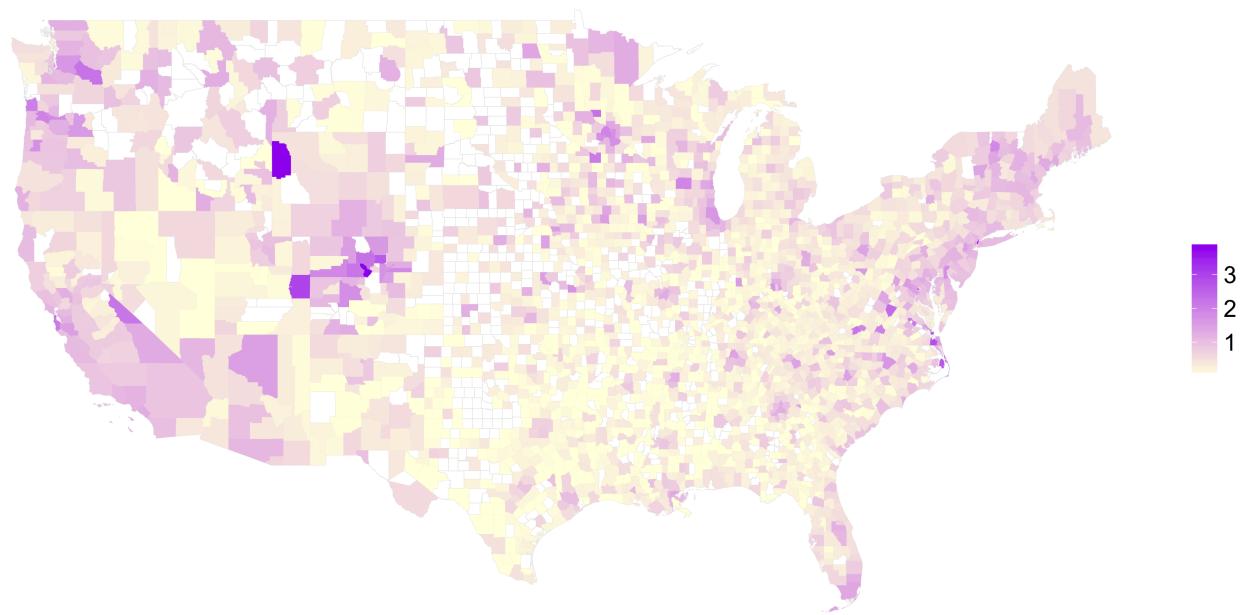
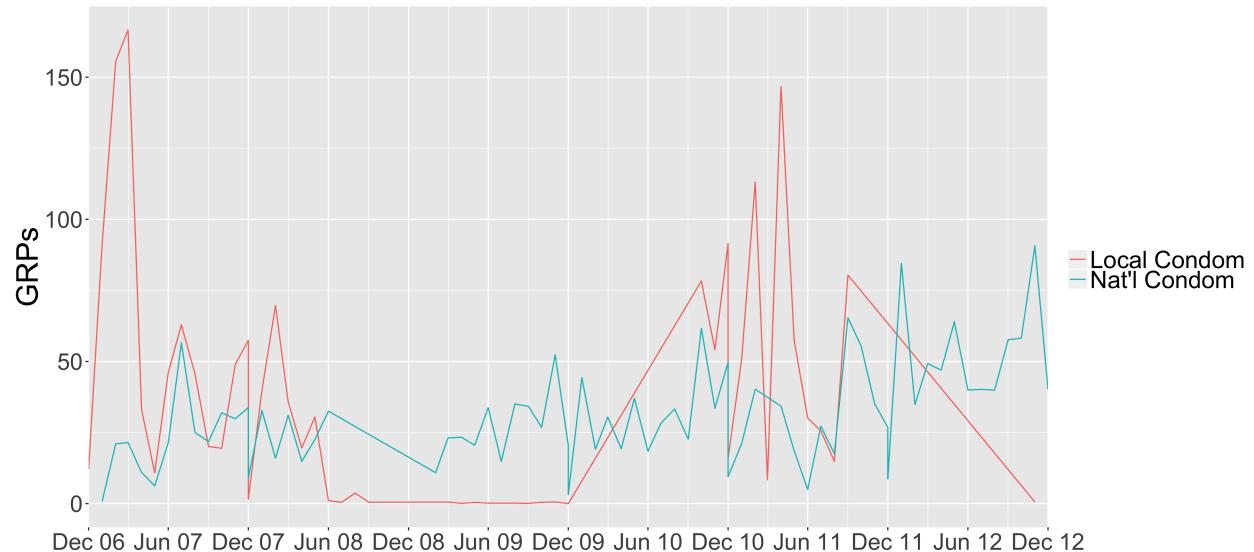


Figure B.3: Monthly GRPs

(a) Monthly condom GRPs



(b) Monthly hormonal birth control GRPs

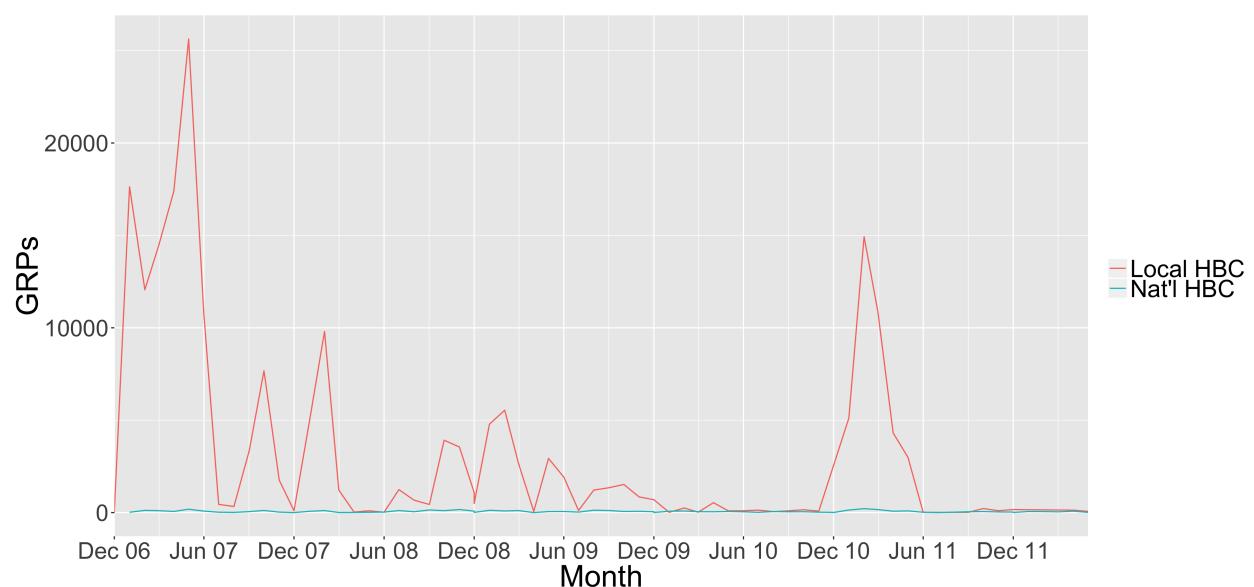


Figure B.3, continued

(c) Monthly LARC GRPs

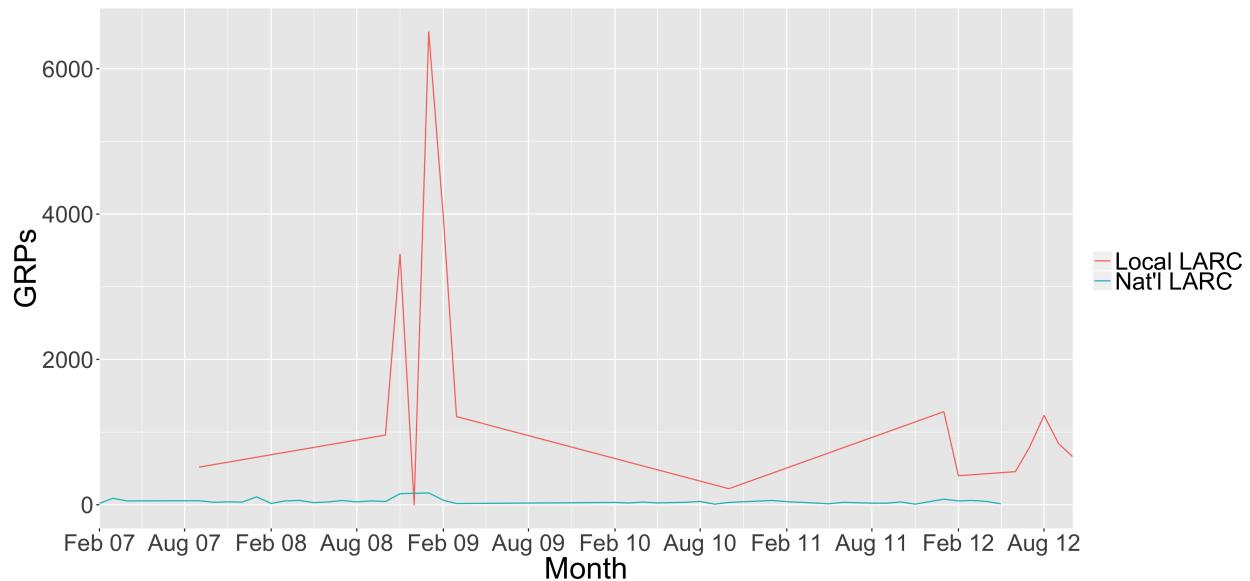
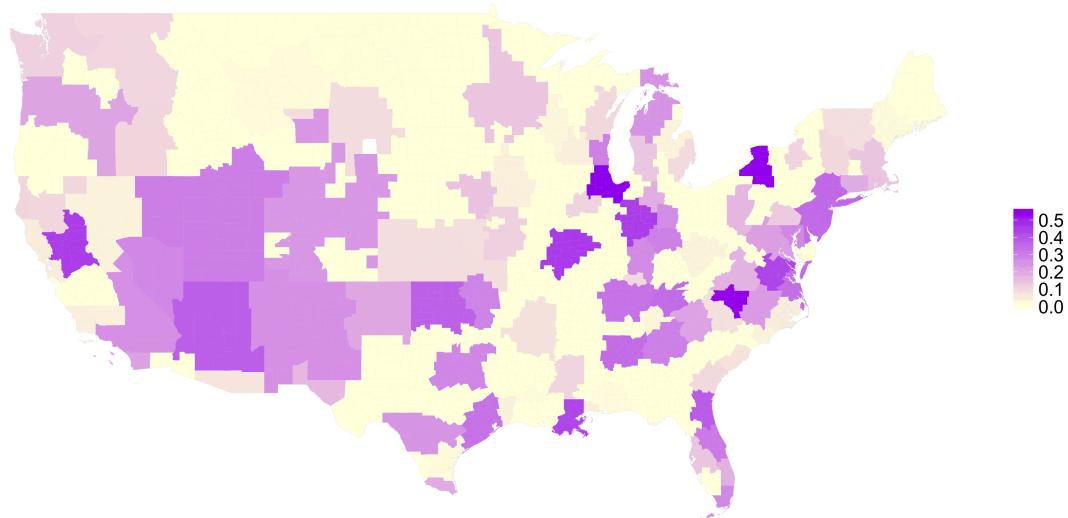


Figure B.4: Example of geographic variation in ads: 2010

(a) Local condom ad GRPs



(b) Local hormonal birth control GRPs

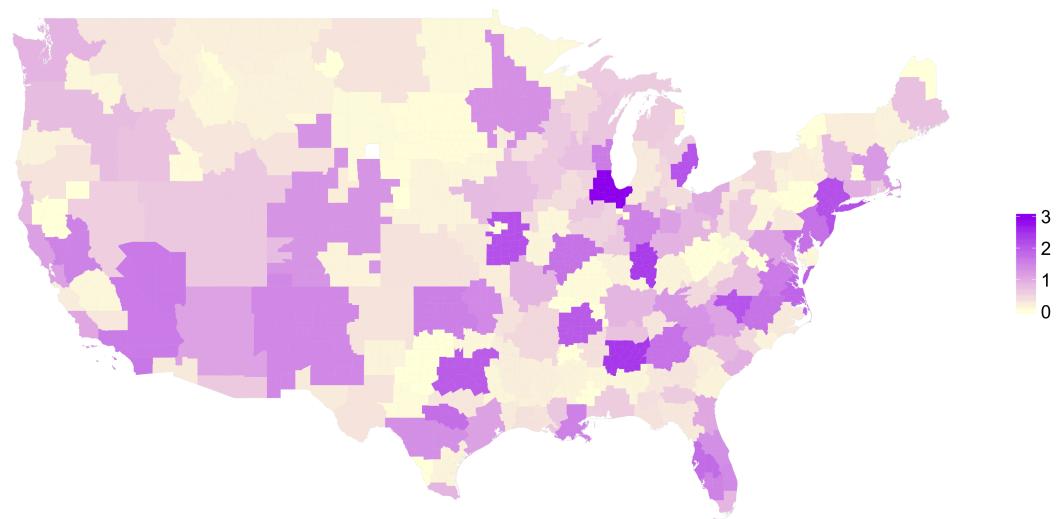


Figure B.4, continued

(c) Local LARC GRPs

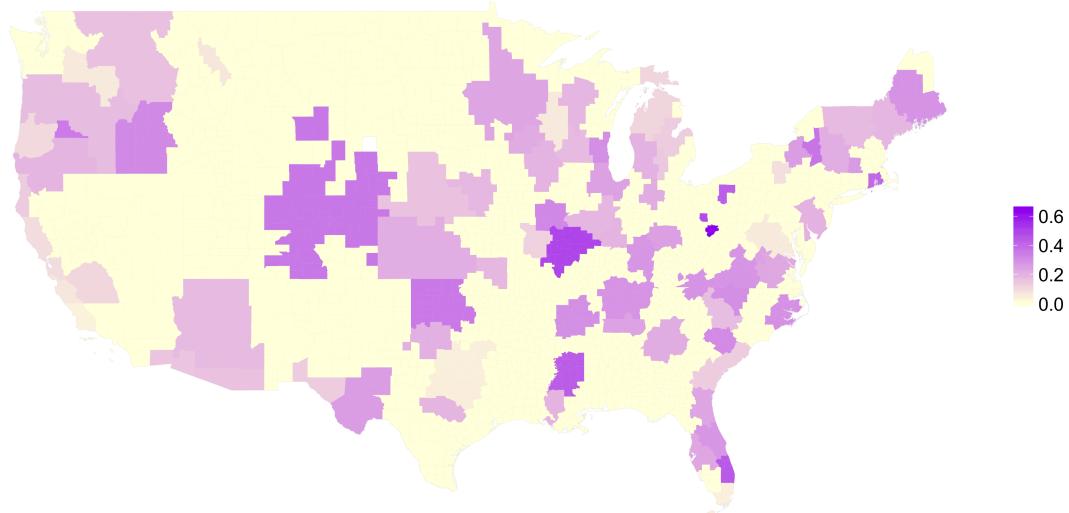
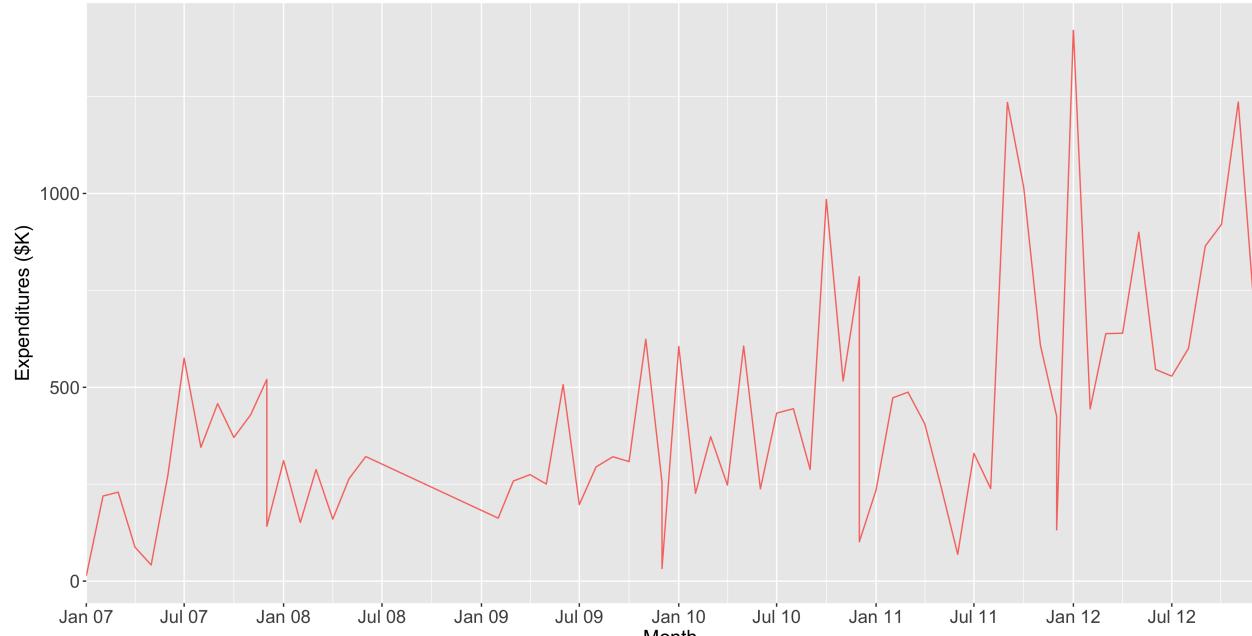


Table B.2: Summary statistics at the monthly and county level

	Mean	SD	1st	Median	3rd	Max.
Condoms						
Local GRPs	0.147	1.529	0.000	0.000	0.000	82.030
Nat'l GRPs	30.340	20.133	17.550	28.800	40.520	95.370
Average price	0.842	0.200	0.701	0.832	0.966	9.990
Hormonal birth control						
Local GRPs	15.616	34.710	0.000	0.596	11.164	299.040
Nat'l GRPs	60.510	49.516	21.640	49.000	98.080	194.970
Average price	1.150	0.394	1.021	1.245	1.406	2.100
LARCs						
Local GRPs	1.758	9.478	0.000	0.000	0.000	121.950
Nat'l GRPs	28.270	34.303	0.000	20.730	46.440	176.610
Average price	11.883	43.195	8.182	9.746	12.071	1727.180

Figure B.5: Monthly condom advertising expenditures

(a) Expenditures on national advertising



(b) Expenditures on local advertising

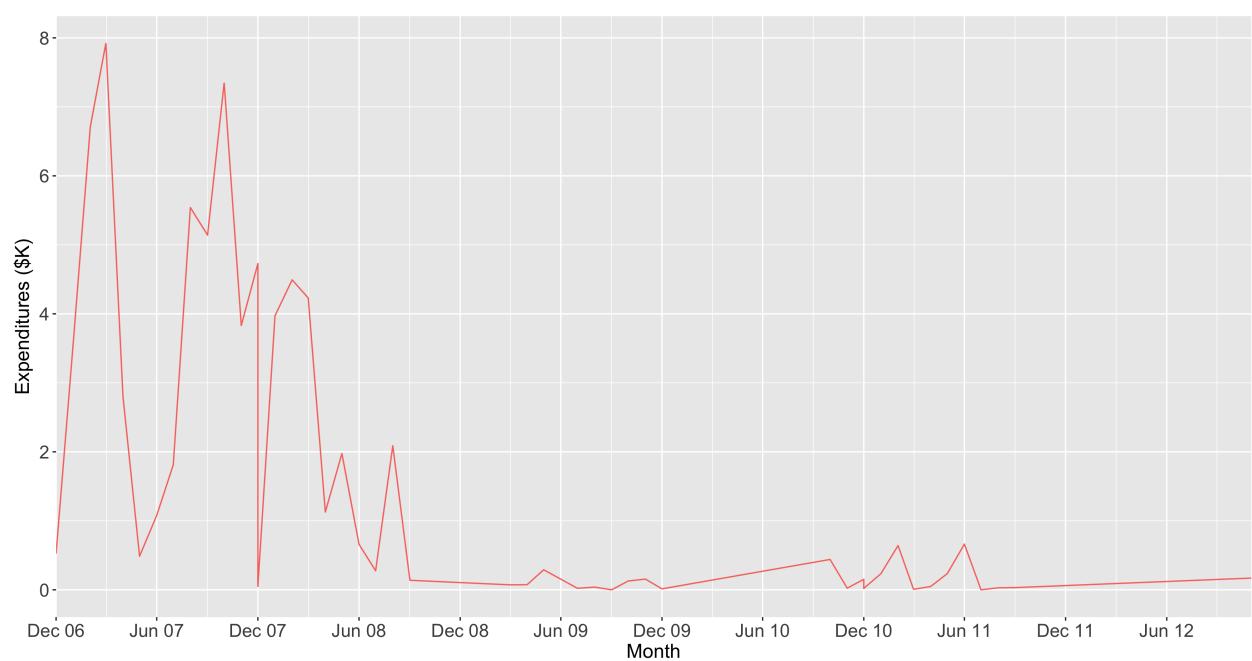
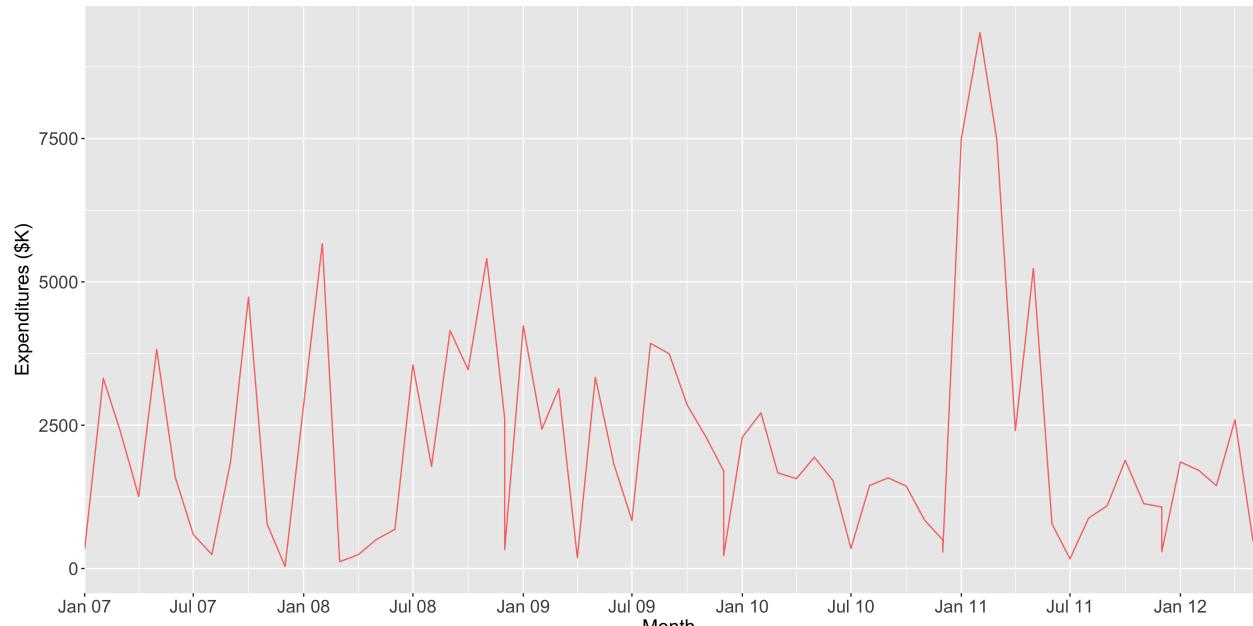


Figure B.6: Monthly HBC advertising expenditures

(a) Expenditures on national advertising



(b) Expenditures on local advertising

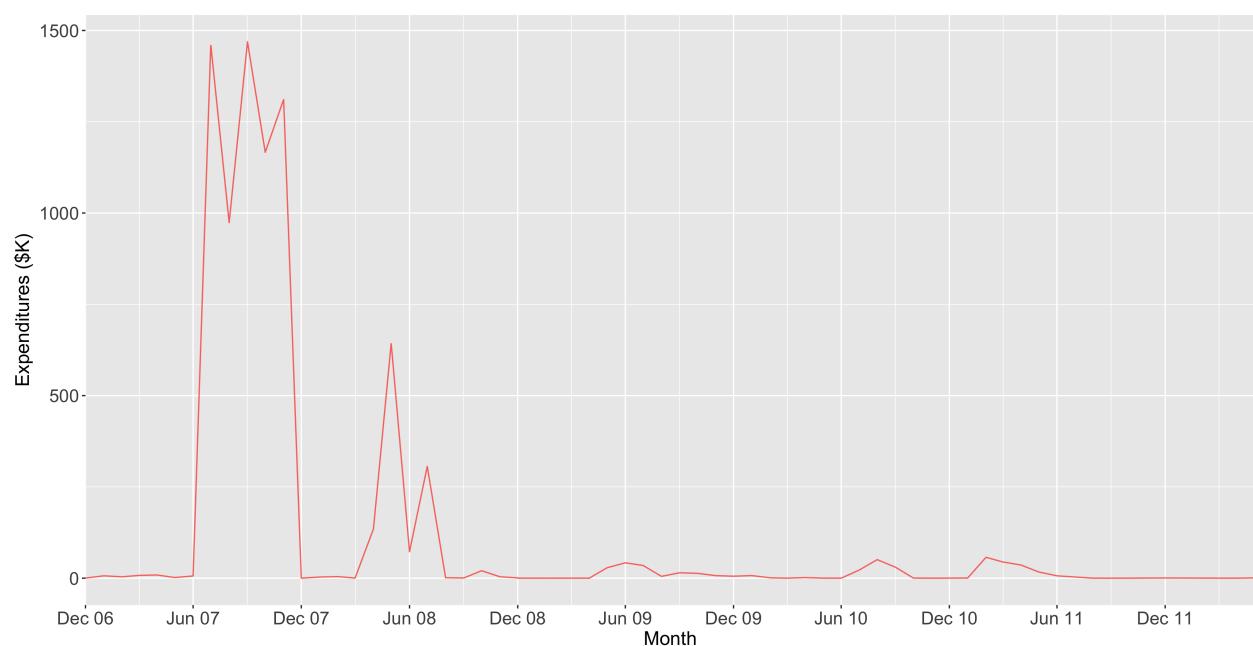
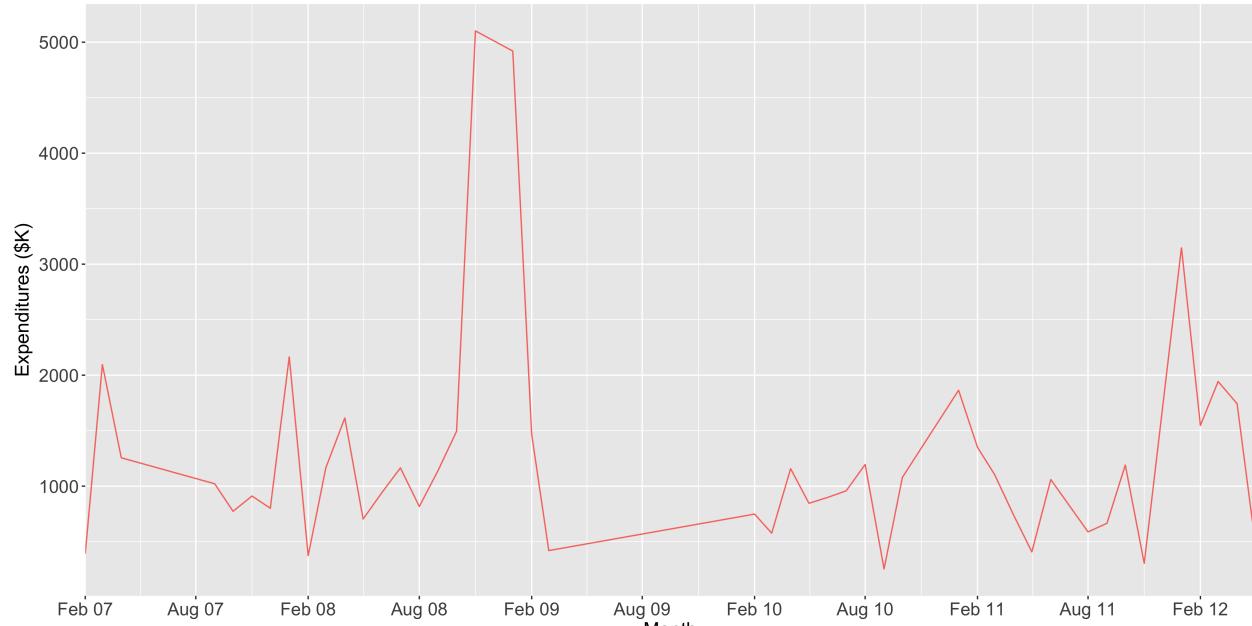


Figure B.7: Monthly LARC advertising expenditures

(a) Expenditures on national advertising



(b) Expenditures on local advertising

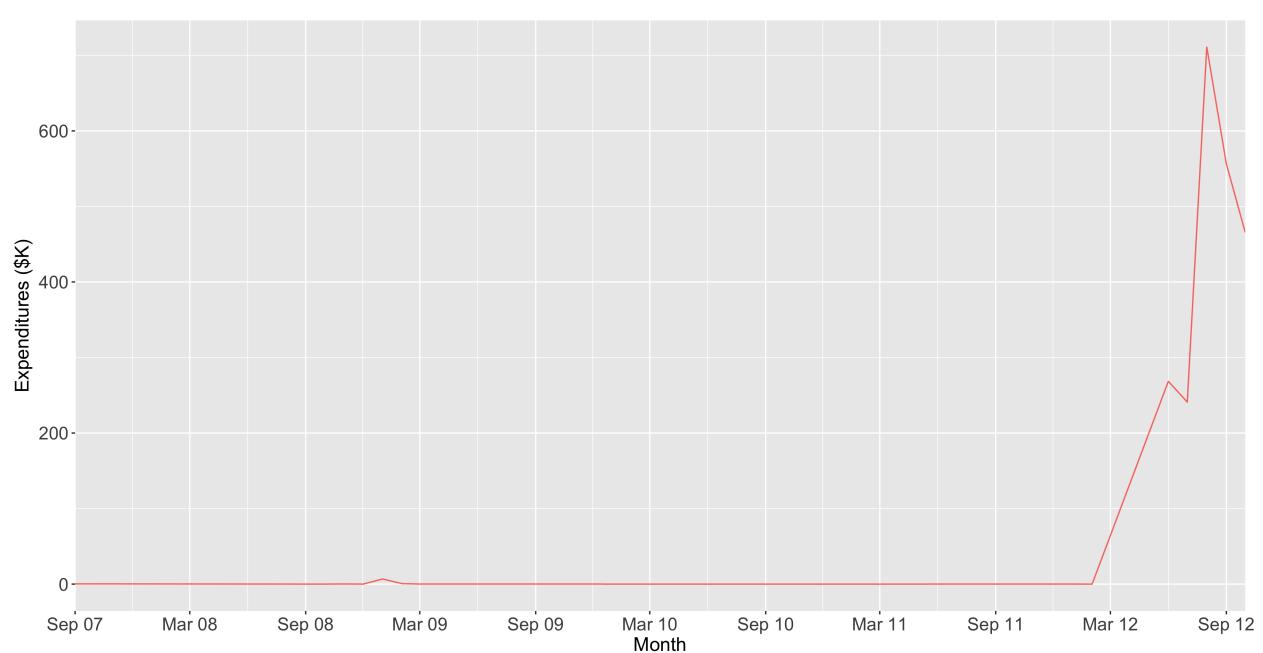
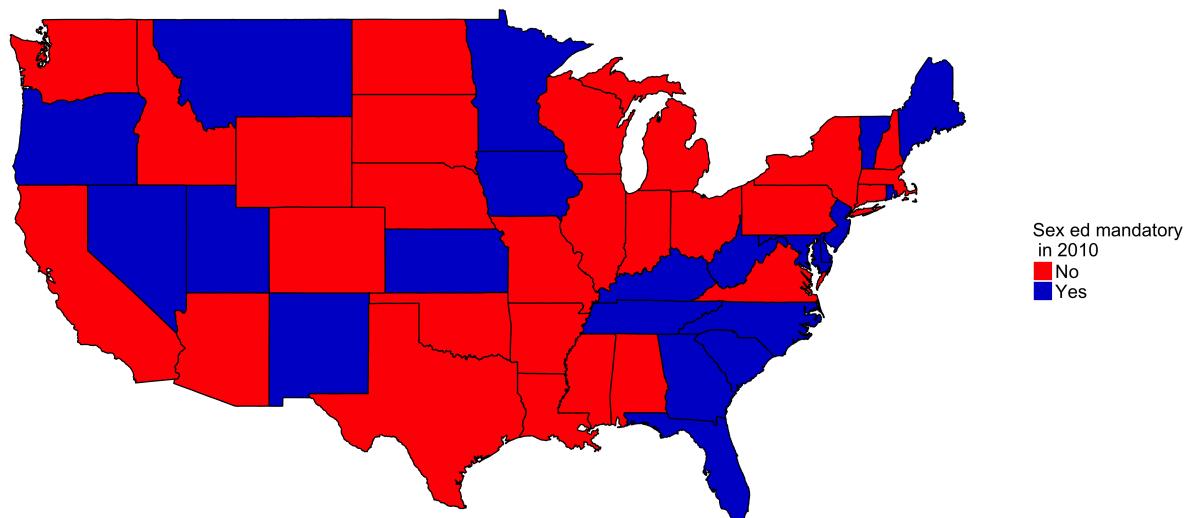


Table B.3: Sexual education policies for states which changed policies between 2007-2012

Year	DE	FL	GA	HI	MN	NC	NJ	NM	OH	OR	PA	RI	SD	WV
<i>Abstinence education policy</i>														
2007	Covered	Covered	Covered	Stressed	-	Stressed	-	-	-	Stressed	-	Stressed	-	Stressed
2008	Covered	Covered	Covered	Stressed	-	Stressed	-	-	-	Stressed	-	Stressed	-	<i>Stressed</i>
2009	Covered	Covered	Covered	Stressed	-	Stressed	-	Covered	-	Stressed	-	Stressed	-	<i>Covered</i>
2010	<i>Covered</i>	<i>Covered</i>	<i>Covered</i>	<i>Stressed</i>	-	Stressed	-	<i>Covered</i>	-	Stressed	-	<i>Stressed</i>	-	Covered
2011	<i>Stressed</i>	<i>Stressed</i>	<i>Stressed</i>	<i>Covered</i>	<i>Covered</i>	Stressed	<i>Stressed</i>	<i>Covered</i>	<i>Covered</i>	Stressed	<i>Stressed</i>	-	<i>Stressed</i>	Covered
2012	Stressed	Stressed	Stressed	Covered	Covered	Stressed	Stressed	Covered	Covered	Stressed	Stressed	-	Stressed	Covered
<i>Comprehensive sexual education policies</i>														
2007	Covered	-	-	Covered	-	-	-	-	-	Covered	-	Covered	-	-
2008	Covered	-	-	Covered	-	-	-	-	-	Covered	-	Covered	-	-
2009	Covered	-	-	Covered	-	-	-	Covered	-	Covered	-	Covered	-	<i>Covered</i>
2010	Covered	-	-	<i>Covered</i>	-	Covered	-	Covered	-	<i>Covered</i>	-	<i>Covered</i>	-	Covered
2011	Covered	-	-	-	-	Covered	<i>Covered</i>	Covered	-	<i>Covered</i>	-	<i>Covered</i>	Covered	Covered
2012	Covered	-	-	-	-	Covered	Covered	Covered	-	Covered	-	Covered	Covered	Covered

Figure B.8: State-level sexual education policies

(a) States with mandatory sexual education: 2010



(b) Abstinence education policies: 2010

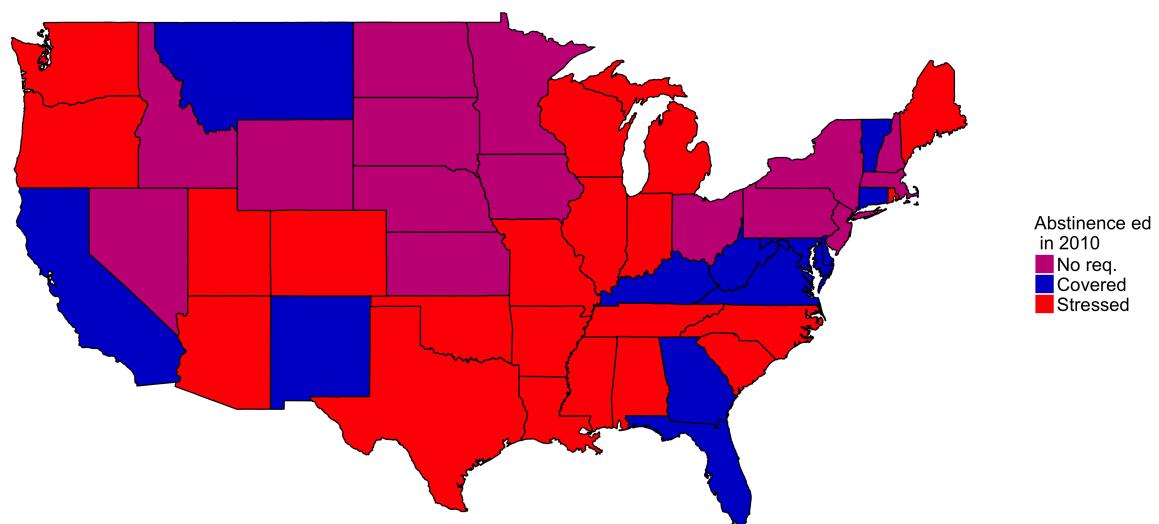
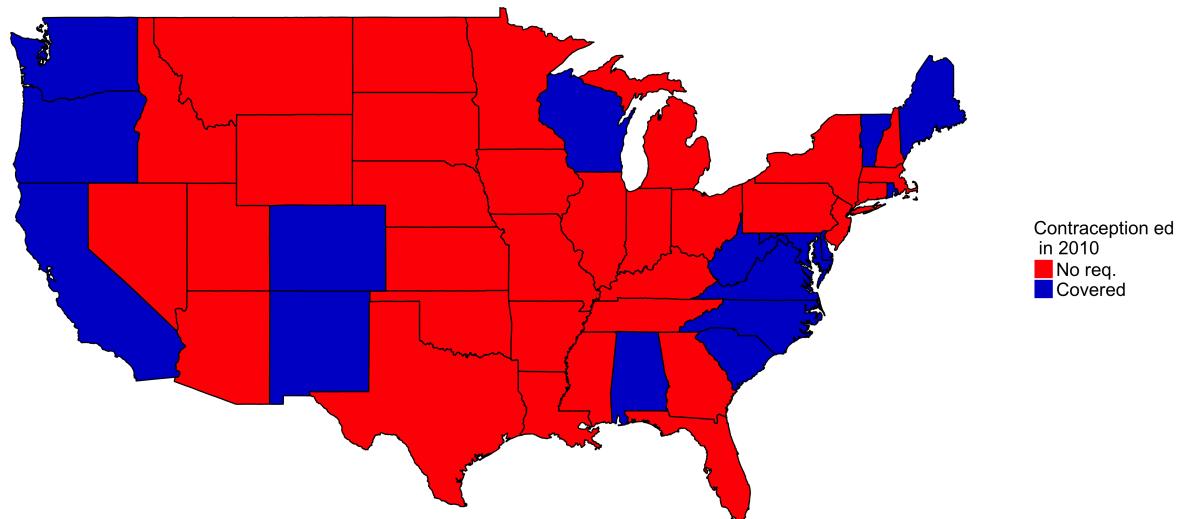


Figure B.8, continued

(c) Contraception education policies: 2010



(d) Contraception education policies: 2010

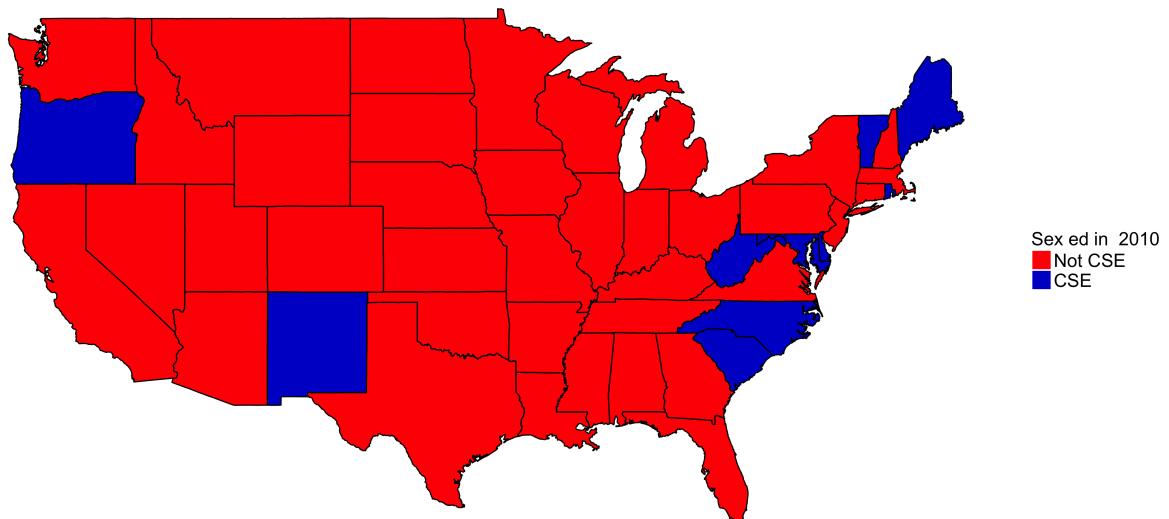


Figure B.9: Average sexual education funding per 15-19 year old

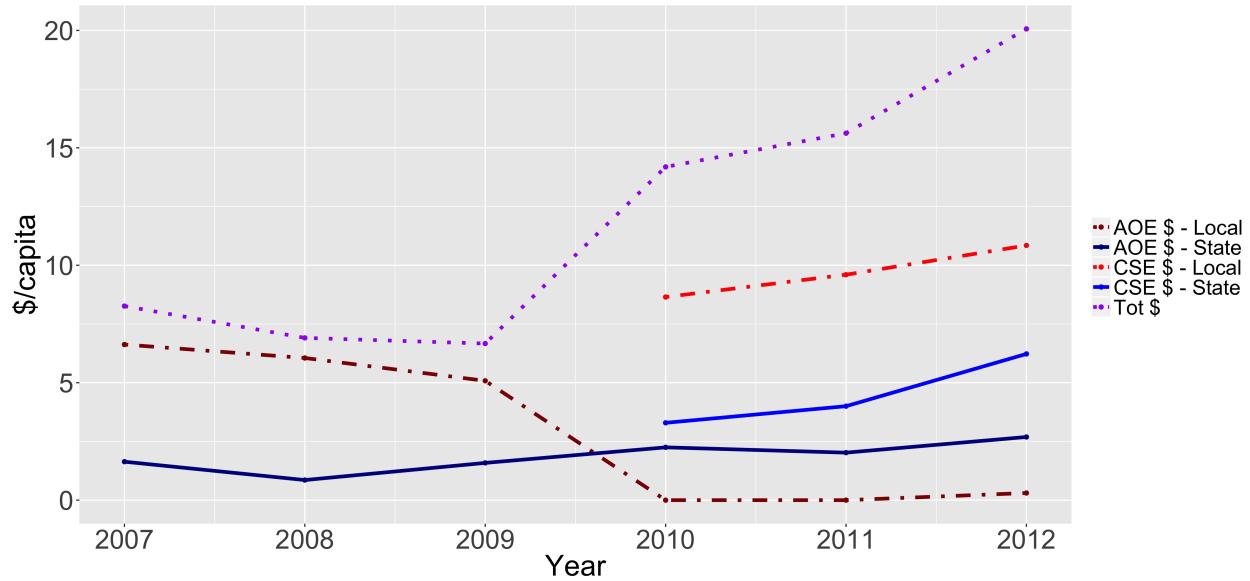
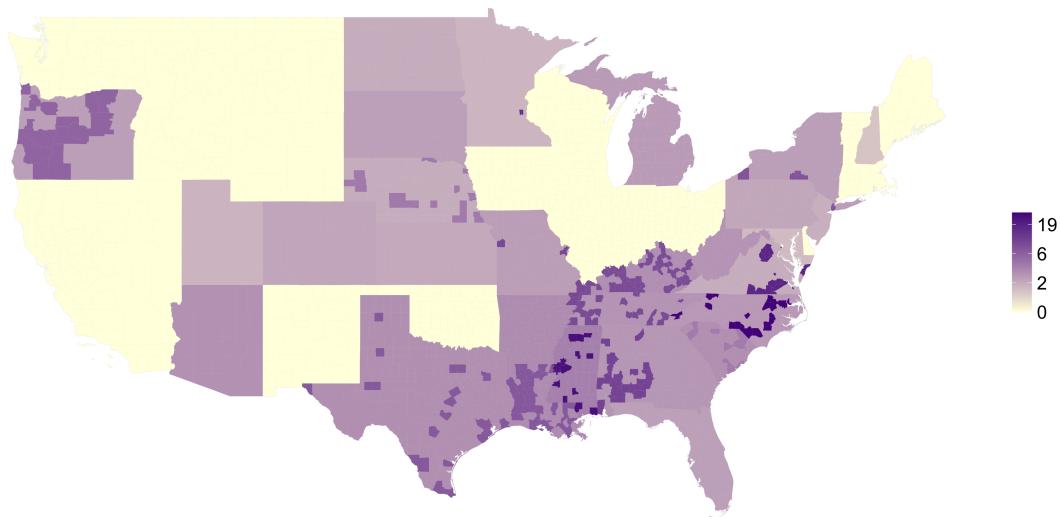


Table B.4: Summary statistics for annual funding (\$K) received by organizations between 2007-2012

	N	Mean	SD	Min	1st	Median	3rd	Max
AOE grants								
State	293	433.700	390.867	1.000	31.790	93.980	427.000	427.000
Local	341	495.700	265.353	8.976	380.300	549.800	727.000	727.000
CSE grants								
State	344	337.400	359.042	4.200	45.630	100.000	538.000	538.000
Local	185	828.100	469.810	60.000	463.900	675.000	417.000	417.000

Figure B.10: Sexual education funding per 15-19 year old across states

(a) AOE funding per 15-19 year old awarded in federal grants for 2010



(b) CSE funding per 15-19 year old awarded in federal grants for 2010

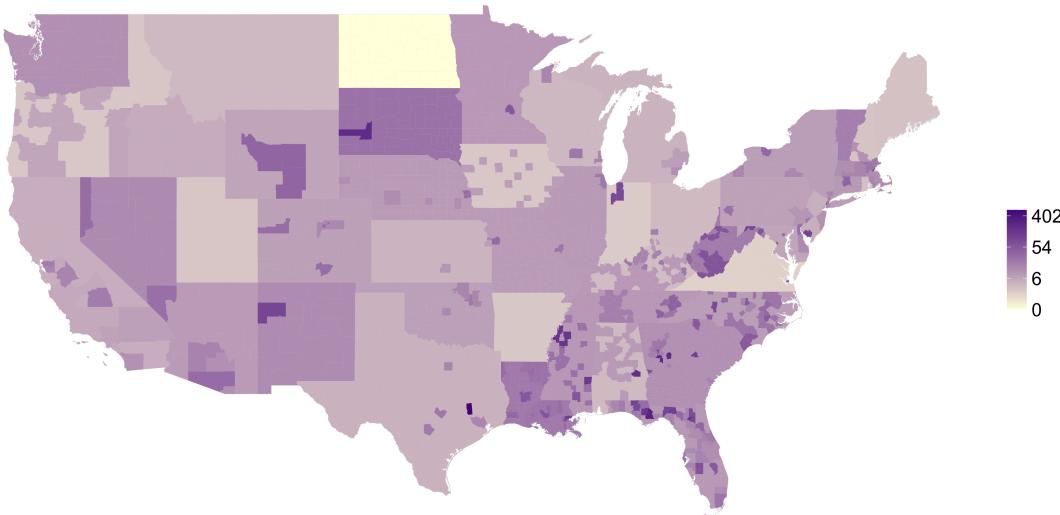


Figure B.11: Example of geographical variation in sexual education funding per 15-19 year old in 2010: Mississippi vs. Louisiana

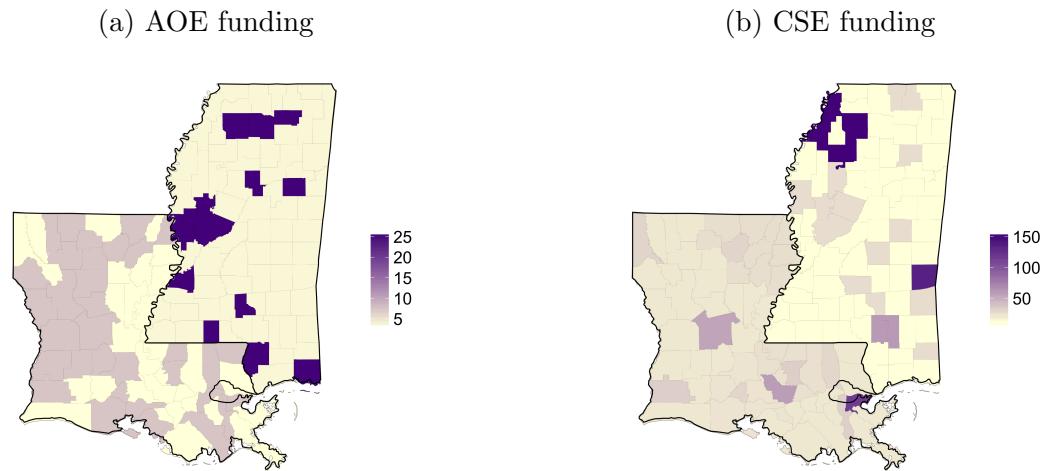


Figure B.12: Example of geographical variation in sexual education funding per 15-19 year old in 2010: California vs. Oregon

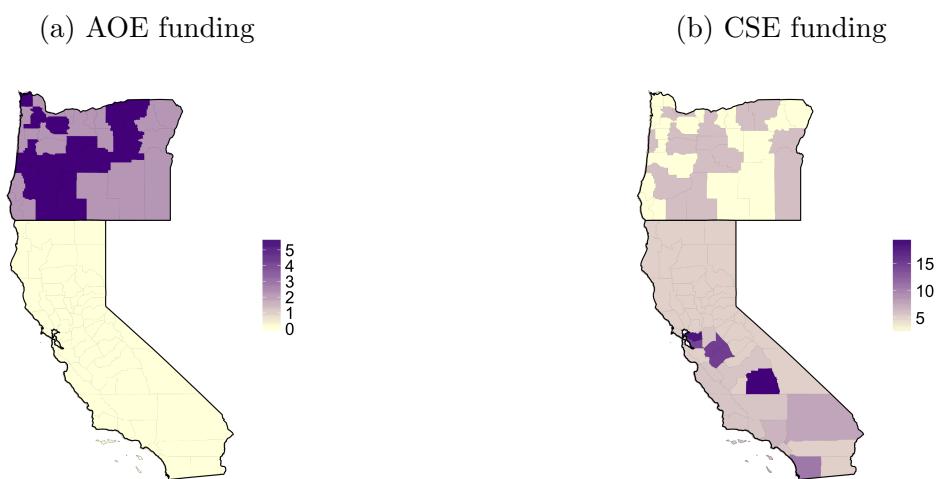


Table B.5: Correlation between funding for state and local grants (\$)

	State AOE grants - Organizations	State CSE grants - Organizations	State AOE grants - Counties	State CSE grants - Counties
State AOE grants	−0.120*** (0.015)		−0.302 (0.393)	
State CSE grants		−0.199*** (0.041)		0.695** (0.233)
Organization FE	x	x		
Year FE	x	x		
County FE			x	x
State-year FE			x	x
<i>N</i>	2140	2140	18855	18855
<i>R</i> ²	0.863	0.753	0.492	0.578

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $\circ p < 0.1$

Table B.6: Demographic predictors of funding (\$M) for AOE and CSE

	State AOE	State CSE	Local AOE	Local CSE
Prev. yr county births per 15-19 y/o	−5.611*** (0.310)	−15.975*** (0.695)	17.950*** (0.696)	−40.250*** (1.363)
Prev. yr % in poverty	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Prev. yr % Black	0.143 (0.147)	−0.151 (0.330)	−0.364 (0.331)	−0.434 (0.647)
Prev. yr % Hispanic	0.234* (0.101)	0.714** (0.225)	−0.565* (0.225)	1.305** (0.442)
County FE	x	x	x	x
State-year FE	x	x	x	x
<i>N</i>	15705	15705	15705	15705
<i>R</i> ²	0.686	0.552	0.452	0.634

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $\circ p < 0.1$

Table B.7: Summary statistics: Local advertising and sexual education funding for regions with different sexual education policies from 2007-2012

	No abstinence ed or CSE		Abstinence is stressed & CSE is not covered		Abstinence is stressed & CSE is covered		Abstinence is covered & CSE is not covered		Abstinence is covered & CSE is covered	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Local advertising										
Condom GRPs	0.195	2.637	0.128	0.775	0.120	0.429	0.162	1.599	0.089	0.351
HBC GRPs	15.711	32.786	16.004	35.645	12.571	31.592	16.640	36.851	10.593	26.301
LARC GRPs	1.557	8.240	1.866	9.981	1.789	9.754	1.640	9.165	2.104	10.661
Condom CPMs	0.011	0.208	0.003	0.065	0.001	0.013	0.005	0.112	0.000	0.008
HBC CPMs	0.135	1.534	0.060	0.968	0.020	0.176	0.201	2.356	0.158	1.984
LARC CPMs	0.021	0.561	0.060	0.813	0.136	1.226	0.011	0.288	0.239	2.195
Sexual education funding (\$ per 15-19 y/o)										
State AOE grants	1.076	1.597	2.012	4.406	2.006	2.79	2.512	11.359	2.797	5.0000
Local AOE grants	2.487	22.624	4.096	38.525	2.992	20.805	3.244	36.045	1.531	11.502
State CSE grants	1.685	4.105	1.997	4.856	5.612	9.45	1.617	7.491	6.563	13.793
Local CSE grants	1.810	6.497	2.743	11.434	11.26	16.298	4.388	15.839	7.272	13.487
<i>N</i>	39,447		85,254		12,587		33,683		6,567	
Number of counties	688		1485		318		651		120	
Number of states	98		42		24		107		35	

Figure B.13: Examples of borders

(a) Borders between markets & within states (different advertising, same sexual education): Sacramento-Stockton-Modesto & Fresno-Visalia (CA)



(b) Borders between states & within markets (same advertising, different sexual education): Cincinnati (OH, IN, KY)



(c) Borders between states & markets (different advertising and sexual education): Oklahoma City (OK) & Amarillo (TX)

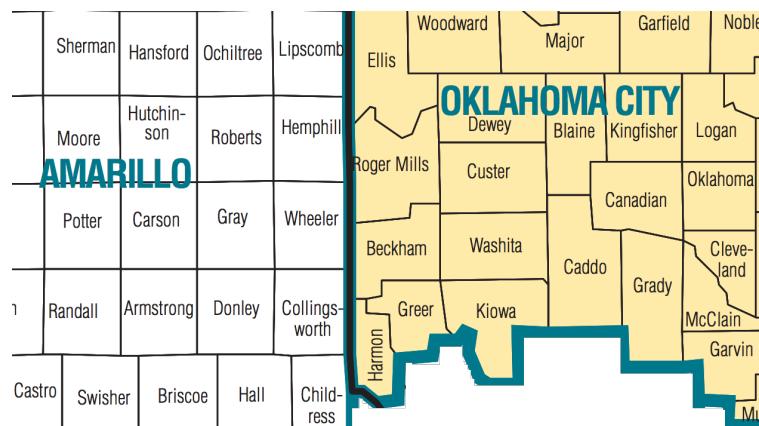
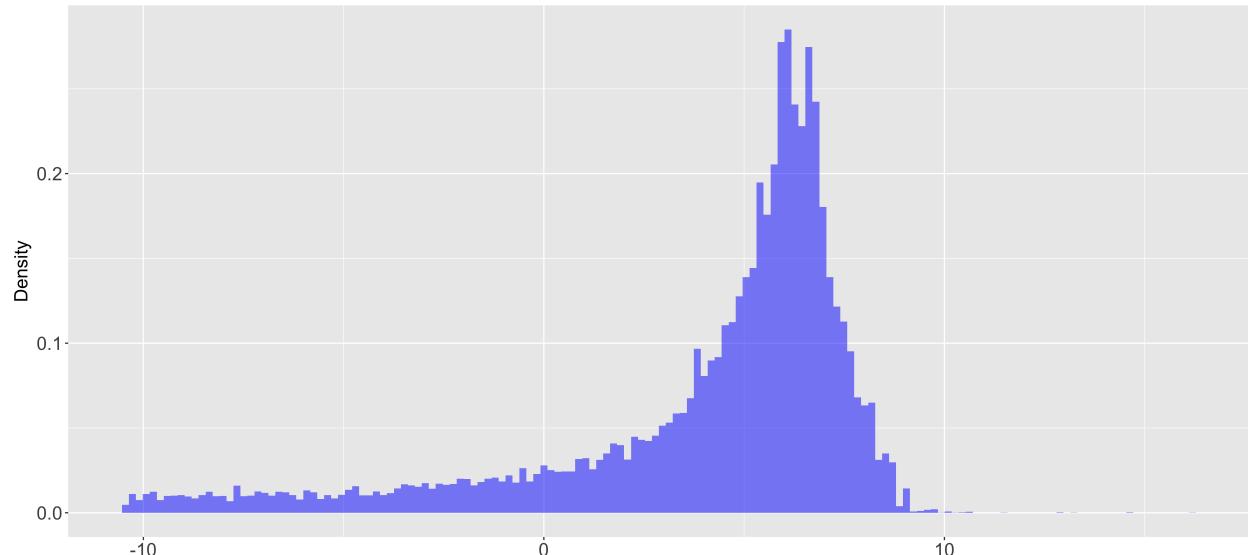


Figure B.14: Residual variation in GRPs (in percentage terms)

(a) Local condom GRPs



(b) Local HBC GRPs

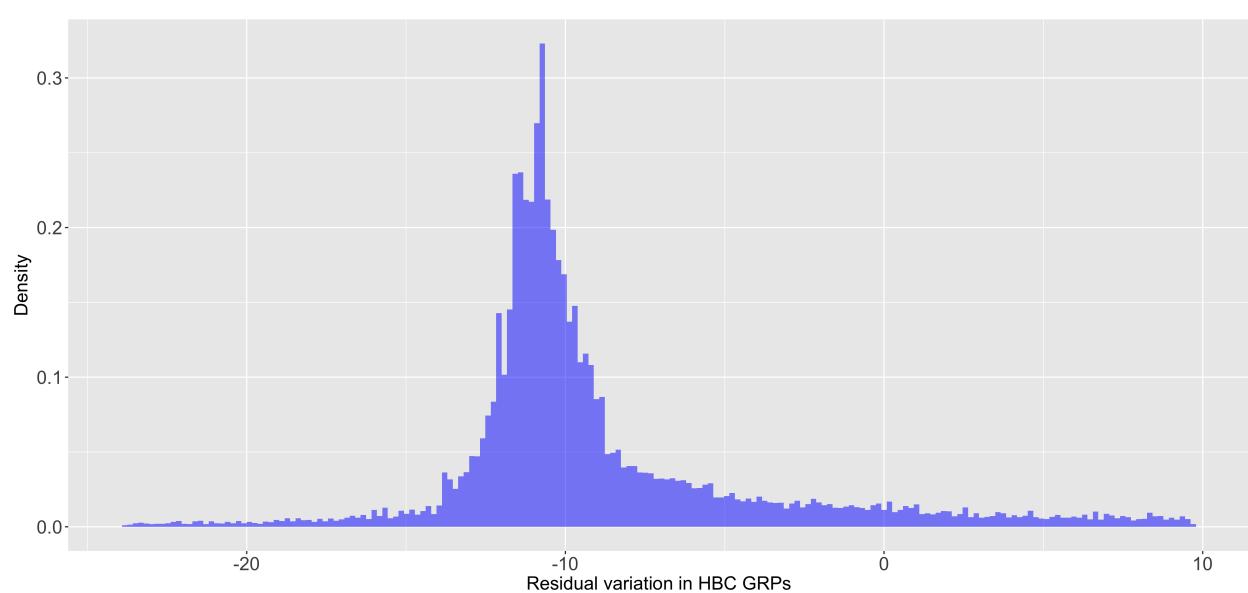


Figure B.14, continued

(c) Local LARC GRPs

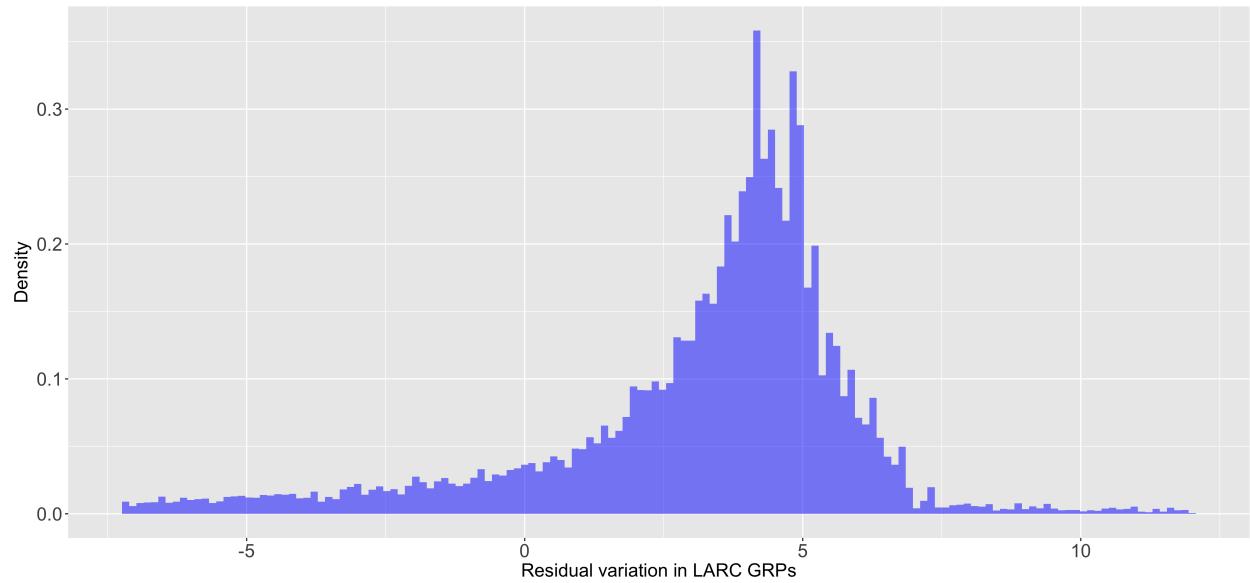
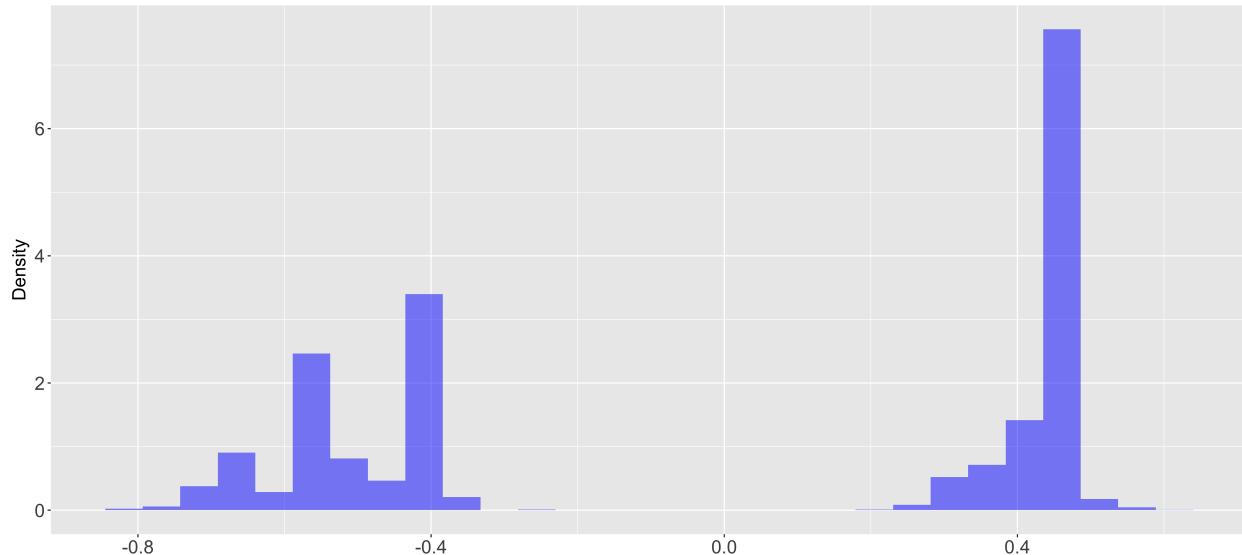


Figure B.15: Residual variation in sexual education policies

(a) Abstinence stressed



(b) Abstinence covered

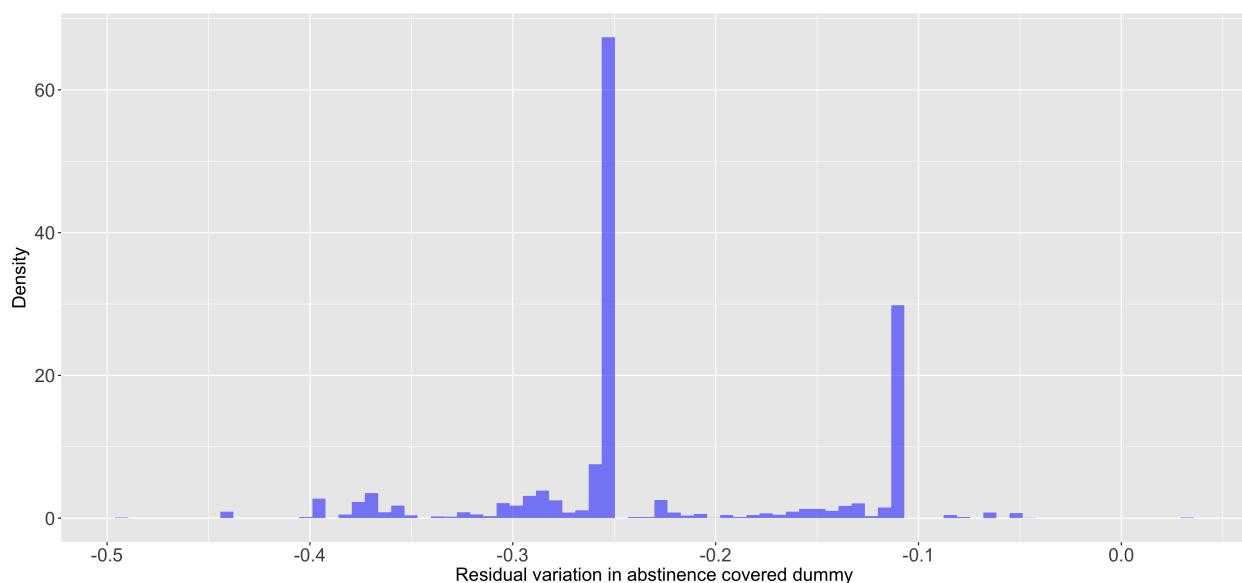


Figure B.15, continued

(c) CSE covered

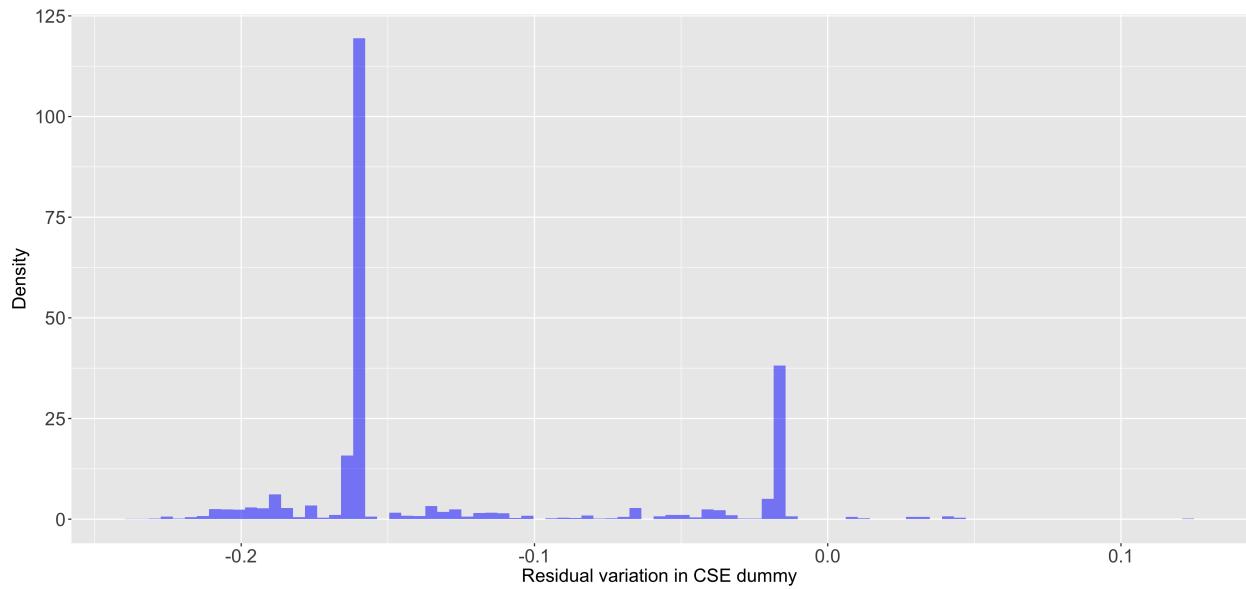
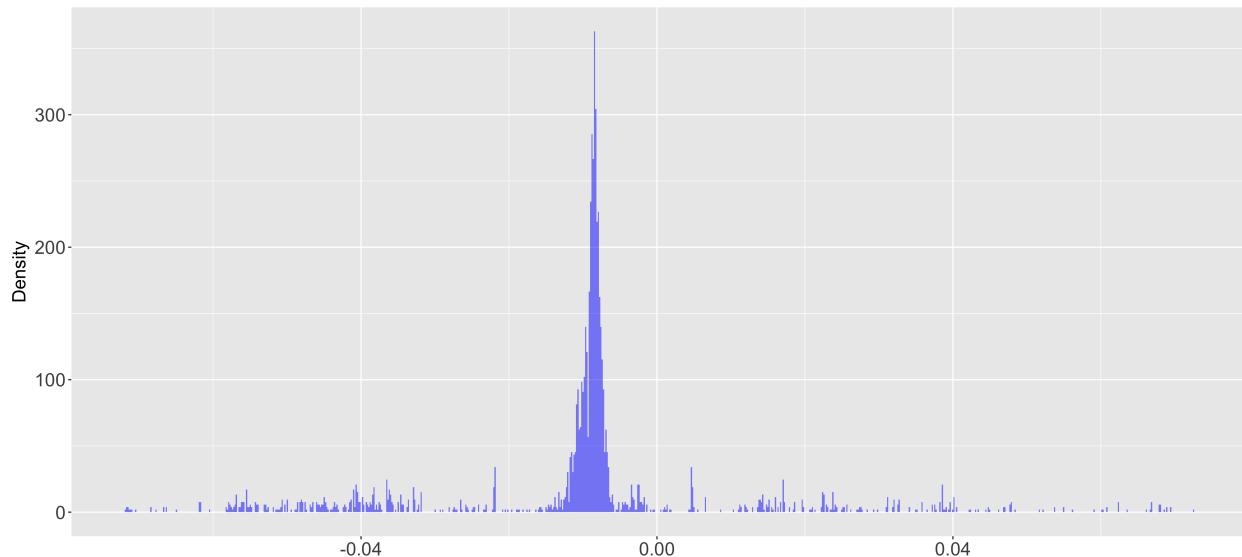


Figure B.16: Residual variation in sexual education funding: AOE grants

(a) State AOE funding (\$K) per capita



(b) Local AOE funding (\$K) per capita

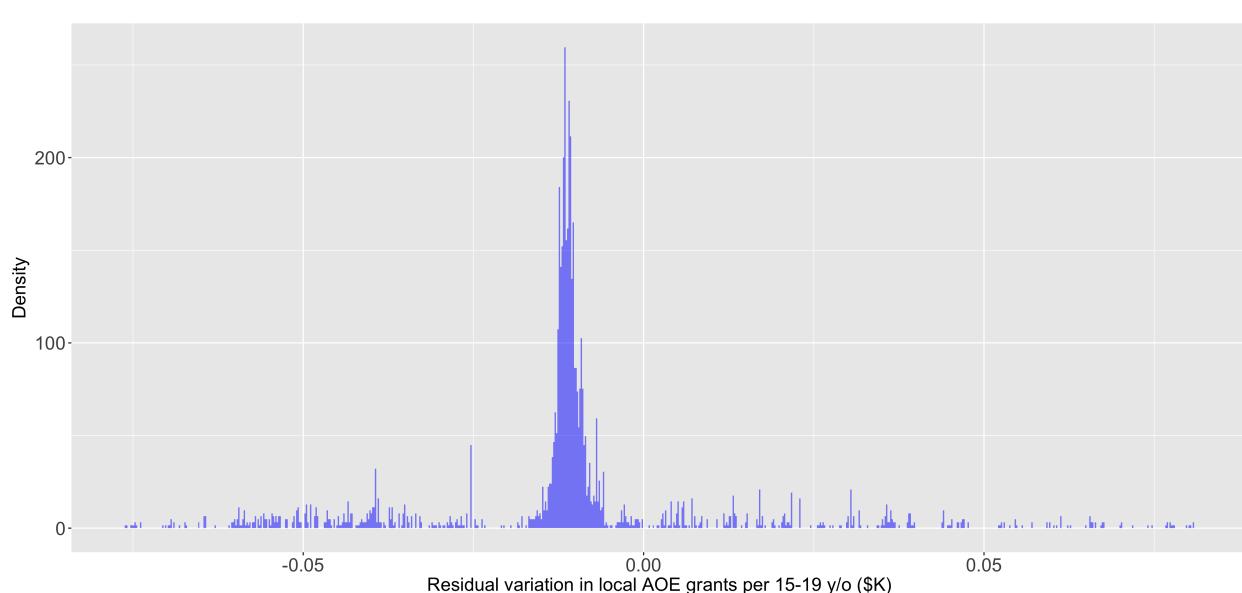
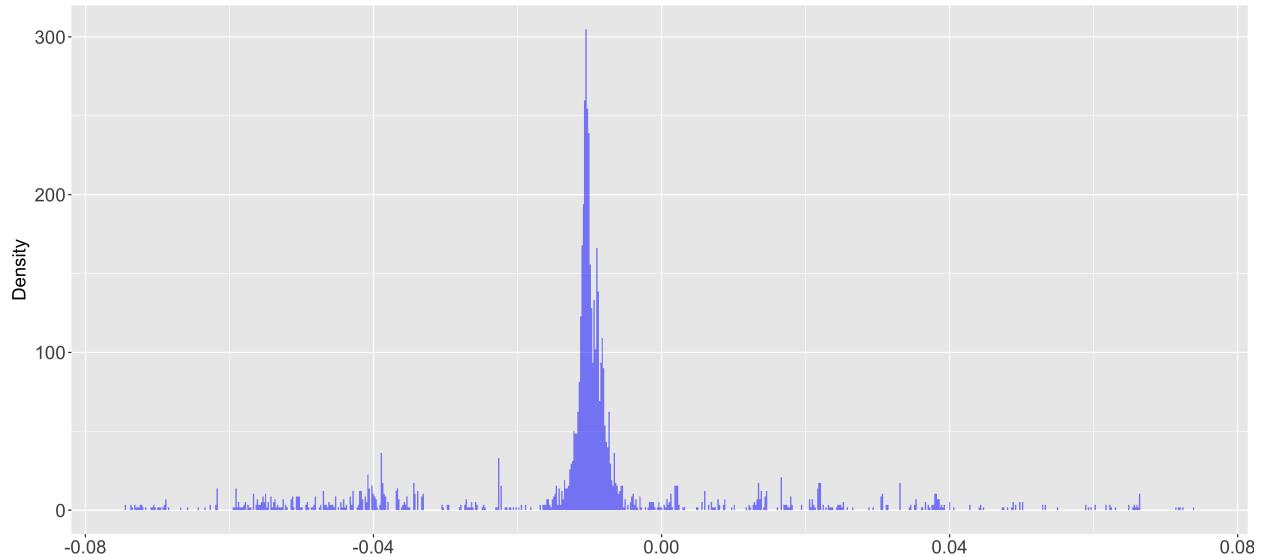


Figure B.17: Residual variation in sexual education funding: CSE grants

(a) State CSE funding (\$K) per capita



(b) Local CSE funding (\$K) per capita

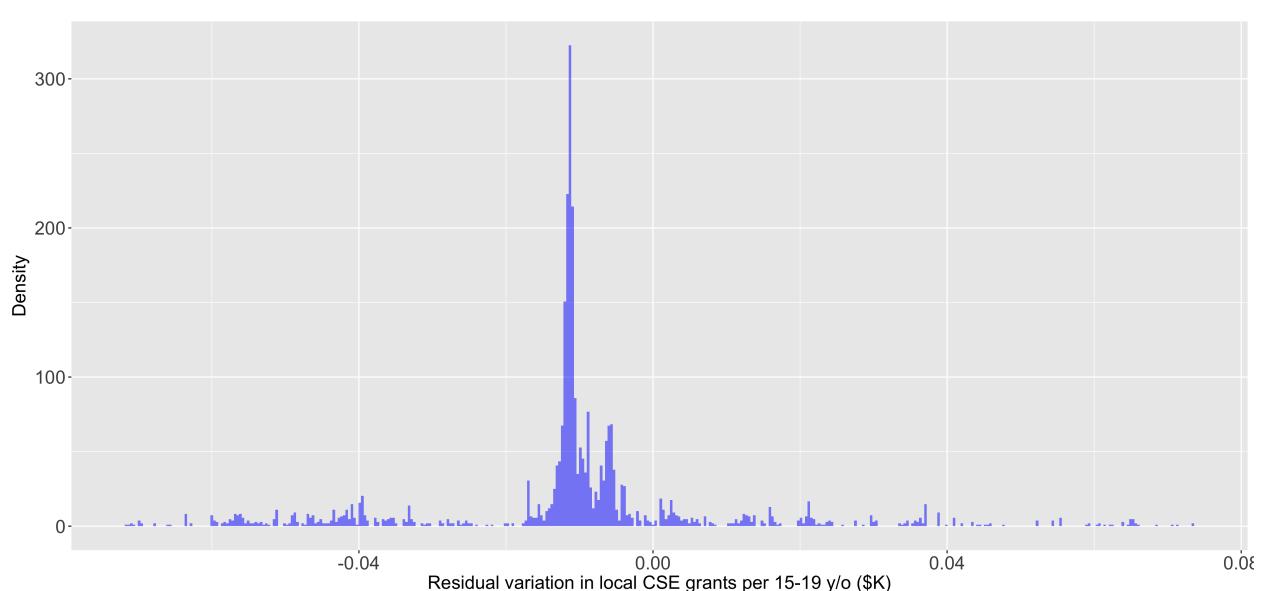


Table B.8: Demographics of non-border counties, state border counties, and DMA border counties from 2007-2012

	Non-border	State border	DMA border	t-test p-values		
				Non- vs. state border	Non- vs. DMA border	State vs. DMA border
Population per sp. mile	271.07	430.66	162.09	0.00	0.00	0.00
Poverty rate (%)	16.03	15.11	16.45	0.00	0.00	0.00
% White	78.42	81.53	79.99	0.00	0.00	0.00
% Black	9.09	10.17	9.78	0.00	0.01	0.30
% Hispanic (non-White)	0.73	0.63	0.75	0.00	0.29	0.00
Average age	39.10	38.46	39.39	0.00	0.00	0.00
% Population aged 15-19	7.03	6.94	6.88	0.00	0.00	0.02
% Population aged 20-44	29.85	31.17	30.10	0.00	0.00	0.00
Births per 15-19 y/o (%)	1.71	1.59	1.45	0.01	0.00	0.00
Births per 20-44 y/o (%)	3.48	3.55	3.37	0.01	0.00	0.00
<i>N</i>	1,937	371	587			

APPENDIX C

RESULTS

C.1 Main results

Table C.1: Border regressions: Effect of advertising and sexual education

Local condom ad GRPs	-0.000 (0.006)	-0.010 (0.018)	0.010 (0.013)	0.012 (0.014)
Abstinence stressed	-0.086 (0.061)	-0.039 (0.075)	0.091 (0.122)	0.048 (0.110)
Abstinence covered	-0.113 (0.076)	-0.087 (0.095)	0.013 (0.117)	0.005 (0.098)
CSE covered	0.049 (0.053)	0.005 (0.064)	-0.058 (0.075)	-0.063 (0.064)
State AOE \$K per 15-19 y/o	-3.562 (3.933)	3.478** (1.331)	-8.432 (5.830)	-1.215 (3.098)
Local AOE \$K per 15-19 y/o	0.224 (0.317)	-0.233 (0.615)	0.275 (0.316)	0.282 (0.493)
State CSE \$K per 15-19 y/o	-0.135 (1.340)	-2.303*** (0.369)	1.736 (1.933)	-0.827* (0.340)
Local CSE \$K per 15-19 y/o	1.921° (1.073)	1.123* (0.554)	1.313° (0.763)	0.711 (0.564)
Local condom ad GRPs				
x Abstinence stressed	-0.009 (0.018)	-0.064** (0.021)	-0.032* (0.013)	-0.033* (0.014)
x Local AOE \$K per 15-19 y/o	3.037 (2.351)	0.028* (0.013)	0.035 (0.024)	0.034° (0.020)
x State CSE \$K per 15-19 y/o	1.925*** (0.407)	-2.245 (2.100)	0.972* (0.463)	0.754 (0.590)
Nat'l condom ad GRPs				
x CSE covered		0.002** (0.001)	0.001° (0.001)	0.002* (0.001)
x State CSE \$K per 15-19 y/o		-0.038 (0.029)	-0.016* (0.006)	-0.013* (0.006)
x Local CSE \$K per 15-19 y/o		0.013 (0.020)	0.022*** (0.005)	0.024*** (0.005)
Local HBC ad GRPs				-0.000 (0.000)
x Local CSE \$K per 15-19 y/o				0.030* (0.013)
Nat'l HBC ad GRPs				0.013*** (0.003)
x State CSE \$K per 15-19 y/o				0.001° (0.001)
Local LARC ad GRPs				-0.002° (0.001)
x Abstinence covered				-0.053*** (0.001)
x Local CSE \$K per 15-19 y/o				-0.053*** (0.001)

Table C.1, continued

	(1)	(2)	(3)	(4)	(5)	(6)
						(0.015)
Nat'l LARC ad GRPs						
x Local AOE \$K per 15-19 y/o						0.004° (0.002)
x Local CSE \$K per 15-19 y/o						-0.015* (0.006)
log \bar{p}_t^c		-0.758*** (0.102)	-0.609*** (0.152)	-0.759*** (0.101)	-0.609*** (0.152)	-0.606*** (0.110)
log \bar{p}_t^{HBC}						-0.036* (0.015)
log \bar{p}_t^{LARC}						-0.001 (0.022)
County, border-month FEs	x	x	x	x	x	x
Demographics	x	x	x	x	x	x
(Sex ed variables) x (quarter)		x		x	x	x
<i>N</i>	42934	27137	42934	27137	89448	89448
<i>R</i> ²	0.982	0.984	0.982	0.984	0.982	0.982

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ° $p < 0.1$

Table C.2: Elasticities (%) at means of advertising, sexual education policies, and sexual education funding with 95% confidence intervals

	Overall effect (1)	No abstinence ed or CSE (2)	Abstinence is stressed & CSE is not covered (3)	Abstinence is stressed & CSE is covered (4)	Abstinence is covered & CSE is not covered (5)	Abstinence is covered & CSE is covered (6)
Local advertising						
Condom ads	-0.044 [-0.338 , 0.25]	0.130 [-0.121 , 0.381]	-0.273* [-0.437 , -0.108]	-0.075 [-0.342 , 0.193]	0.232* [0.009 , 0.455]	0.335* [0.037 , 0.633]
LARC ads	0.063 [-0.203 , 0.328]	0.241° [-0.006 , 0.488]	0.009 [-0.169 , 0.187]	0.276° [-0.034 , 0.585]	-0.08 [-0.25 , 0.091]	0.132 [-0.039 , 0.303]
Sex ed funding per 15-19 y/o (\$K)						
State CSE grants	-0.360* [-0.557 , -0.163]	-0.276* [-0.421 , -0.13]	-0.279* [-0.431 , -0.127]	-1.087* [-1.718 , -0.456]	-0.293* [-0.455 , -0.131]	-0.806* [-1.274 , -0.338]
Local CSE grants	0.343° [-0.005 , 0.692]	0.121° [-0.007 , 0.25]	0.429° [-0.007 , 0.865]	0.569* [0.029 , 1.108]	0.191* [0.001 , 0.38]	0.724° [-0.047 , 1.496]
Sex ed policies						
Abstinence stressed	0.637 [-3.047 , 4.32]	1.115 [-2.61 , 4.84]			0.652 [-3.033 , 4.338]	0.203 [-3.46 , 3.866]
Abstinence covered	-3.663 [-8.145 , 0.819]	-3.44 [-7.952 , 1.071]	-3.679 [-8.162 , 0.804]	-4.225° [-8.677 , 0.227]		

* $p < 0.05$, ° $p < 0.1$

Table C.3: ROI from 1-unit increase in local condom GRPs (with 95% CIs)

	Incremental revenue (\$)	Incremental cost (\$)	ROMI (%)
Overall	-6.698	9.314	-171.905 [-650.383 , 306.573]
No abstinence or CSE	30.858	12.035	156.405 [-338.999 , 651.809]
Abstinence is stressed & CSE is not covered	-32.322	7.368	-538.656* [-802.835 , -274.476]
Abstinence is stressed & CSE is covered	-7.671	11.386	-167.37 [-409.258 , 74.518]
Abstinence is covered & CSE is not covered	41.222	9.870	317.647 [-83.3 , 718.593]
Abstinence is covered & CSE is covered	68.641	16.710	310.782° [-54.863 , 676.427]

* $p < 0.05$, ° $p < 0.1$

C.2 Results from using the CDC Profiles data

As described in the main body of the dissertation, survey data on education tend to be inapplicable—specifically, with rare exception, they tend to be geographically masked—or difficult to obtain, as directly contacting school administrators nationwide is beyond the scope of this dissertation. However, state-level data on sexual education is available from the CDC Profiles surveys that might speak to the implementation of school policy. In particular, two of the survey questions ask teachers whether their curricula includes the (1) “benefits of being sexually abstinent” and (2) “all HIV, STD, and pregnancy prevention topics.”

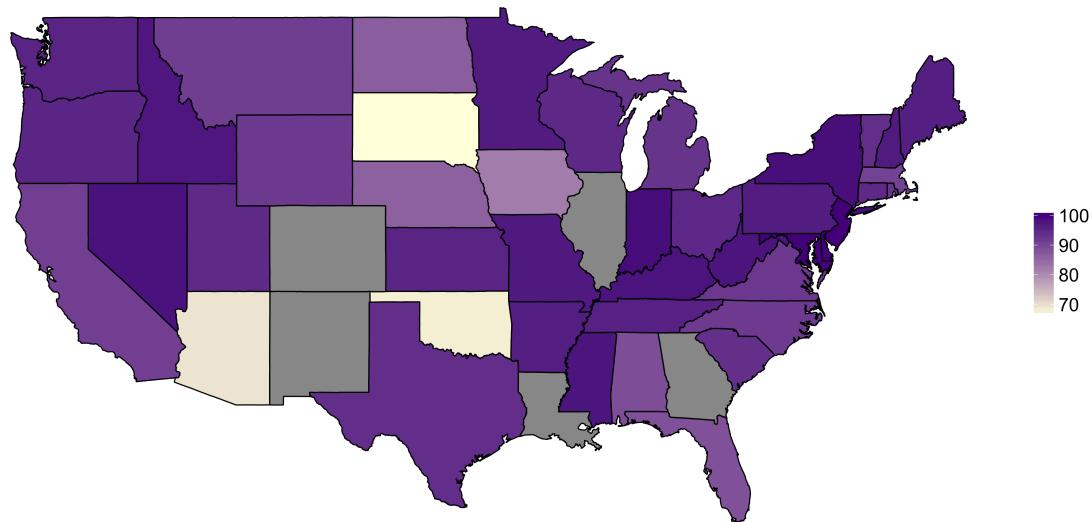
Unfortunately, the data have serious limitations. Data for 10 states are unavailable, which accounts for 18% of the relevant observations; furthermore, the data only include the 2007 to 2008, 2009 to 2010, and 2011 to 2012 school years. Finally, the definitions of what constitutes “all” topics changed over time—in the 2007 to 2008 school year, this definition included 11 topics, but was expanded to 22 by the 2011 to 2012 school year. Thus, answers to this question are not comparable across years. Given these limitations, I did not use these data for the main analyses, and interpret the estimates for sexual education policies as the intent to treat. But, in this section, I explore the results obtained from using these data to provide intuition on what treatment effect sexual education policies may have.

Figures C.1a and C.1b show the geographic variation in how sexual education is taught for the 2009 to 2010 academic year. Note that for the most part, states do not have 100% of schools teaching abstinence or “all” topics, suggesting that teachers deviate from state policies. These deviations from state policies have implications on estimates of the treatment effect of sexual education policies. For instance, because we can expect teachers to deviate away from teaching abstinence even when it is required, estimates of the effect of abstinence policies when conceptualized as intent to treat represent lower bounds on the treatment effect of abstinence policies.

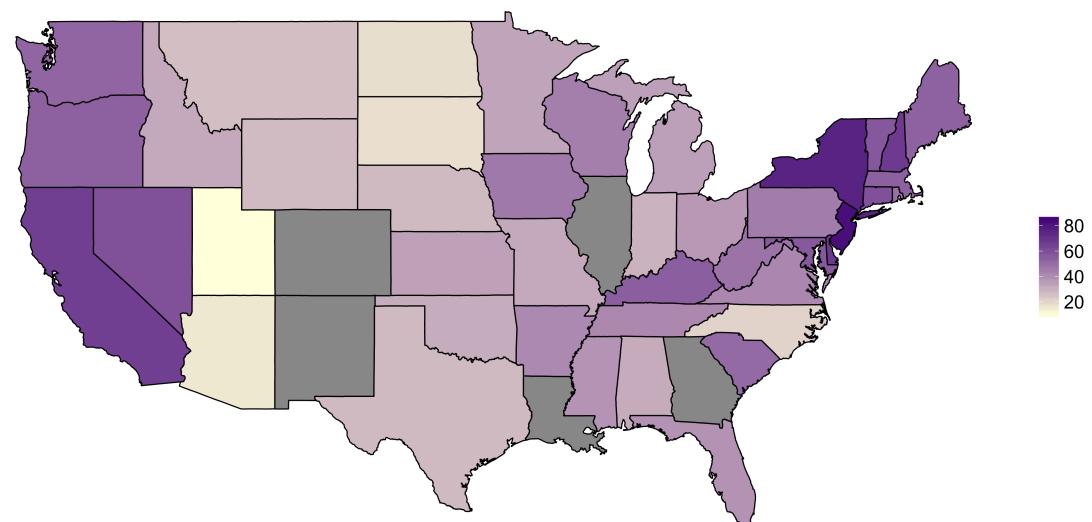
Indeed, incidences of deviations away from abstinence appear to be supported by the data. Figures C.2a and C.2b show the median and interquartile ranges of survey responses

Figure C.1: Survey results from the 2009-2010 academic year

(a) Percentage of schools teaching benefits of abstinence



(b) Percentage of schools teaching all HIV, STD, and pregnancy prevention topics



and indicate that teachers do not all teach the benefits of abstinence when it is required. Additionally, to the extent that the “all topics” question is a gauge for whether CSE is being taught, it appears teachers deviate from state sexual education policies on CSE, teaching it when it is *not* required and not teaching it even when it *is* required (though the percentage of teachers teaching all topics is higher when state policy is to cover CSE than when it is not).

Hence, I estimate a modification of Equation 4.1 as follows:

$$\begin{aligned}\log Q_{cbst} = & (1) + \beta_A P_{ct}^A + \gamma_A P_{ct}^A \times (ads_{ct}) + \tau_A P_{ct}^A (\text{quarter dummy}) \\ & + \beta_T P_{ct}^T + \gamma_T P_{ct}^T \times (ads_{ct}) + \tau_T P_{ct}^T (\text{quarter dummy}),\end{aligned}\quad (\text{C.1})$$

where ads_{ct} represents local and national ads, P_{ct}^a represents the percentage of schools teaching the benefits of abstinence, and P^t represents the percentage of schools teaching “all” HIV, STD, and pregnancy prevention topics. Recall that the definition of “all” topics expanded over time. To address this, I interact the survey response with a dummy for whether the relevant year falls within the 2009 to 2010 and 2011 to 2012 school year. That is, suppressing all indices except time, if p^t represents the percentage of teachers teaching “all” topics, I define

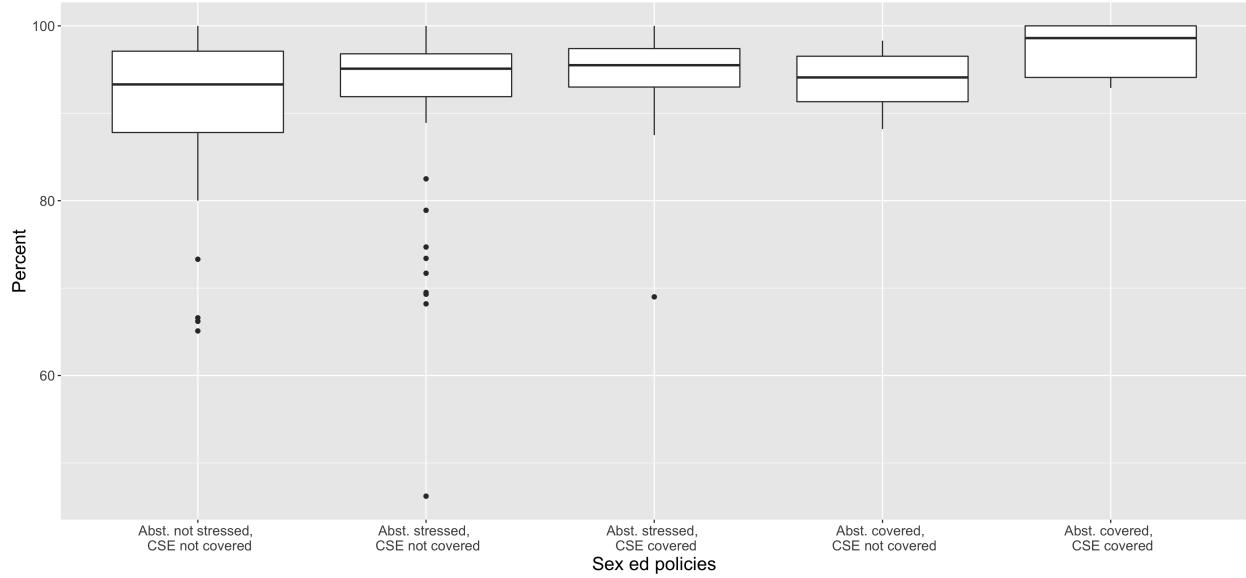
$$P_t^T := p_t^T + p_t^T \times \mathbf{1}(t \text{ in } 2009 - 2010) + p_t^T \times \mathbf{1}(t \text{ in } 2011 - 2012). \quad (\text{C.2})$$

I assume academic years are inclusive of endpoints, i.e., survey results for the 2007 to 2008 academic year apply to 2007 and 2008, inclusive, and so on. I drop the relevant borders for the 10 states that are missing from the CDC data. These accounted for 77 out of the 267 borders and constituted 18% of the original border-month-counties dataset.

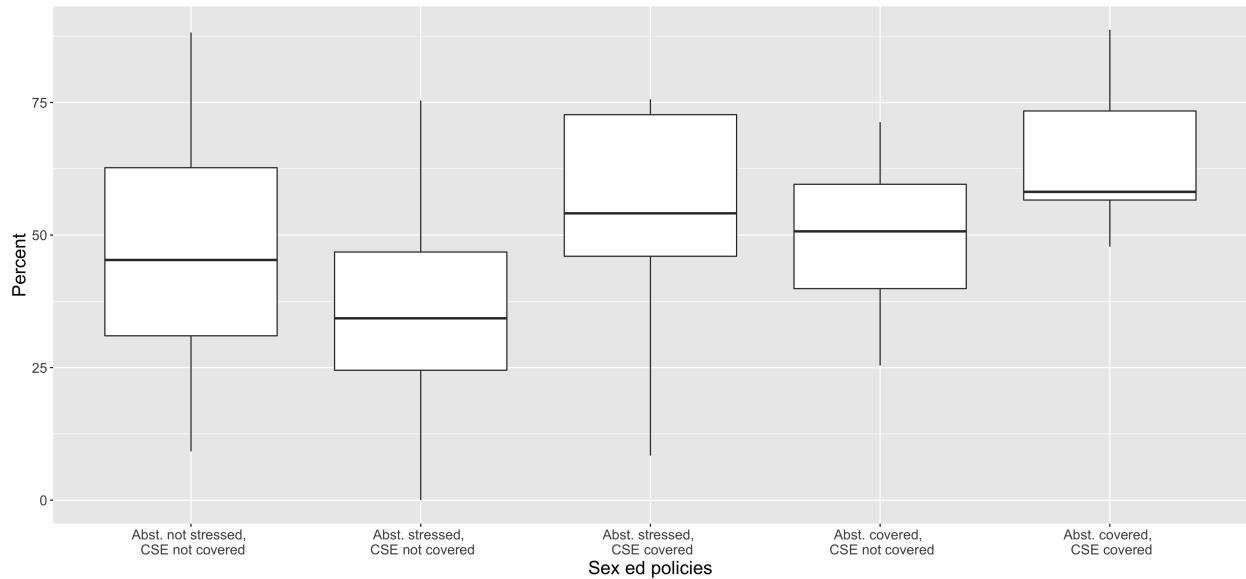
As the updated results in Tables C.4, C.5, and C.6 show, the effect of advertising and sexual education funding are no longer precisely estimated, though they do not contradict results from estimating Equation 4.1. However, estimates for the effect of stressing abstinence

Figure C.2: Box plots of CDC Profiles survey responses in states with different sexual education policies

(a) Percentage of schools teaching the benefits of abstinence



(b) Percentage of schools teaching all HIV, STD, and pregnancy prevention topics



and covering abstinence are estimated with precision, and are much larger in magnitude than estimates from the main analyses, ranging from -8.261% in Column (2) to -8.846% in Column (4).

Table C.4: Border regressions with CDC Profiles data: Effect of advertising and sexual education

	(1)	(2)	(3)	(4)	(5)	(6)
Local condom ad GRPs	-0.000 (0.006)		-0.015 (0.068)		-0.032 (0.092)	-0.027 (0.092)
Abstinence stressed		-0.125° (0.074)		-0.100 (0.083)	-0.059 (0.114)	-0.091 (0.101)
Abstinence covered		-0.128 (0.084)		-0.165 (0.105)	-0.059 (0.128)	-0.053 (0.112)
CSE covered		0.050 (0.050)		0.052 (0.067)	-0.052 (0.086)	-0.062 (0.069)
% teaching benefit of abstinence		-0.001 (0.007)		0.002 (0.006)	0.003 (0.003)	0.005 (0.003)
% teaching all topics		-0.004 (0.003)		-0.005° (0.003)	-0.003 (0.002)	-0.003 (0.002)
State AOE \$K per 15-19 y/o	-3.432 (4.093)	3.065* (1.297)	-10.807 (7.459)	-0.986 (2.870)	2.112 (2.463)	
Local AOE \$K per 15-19 y/o	0.301* (0.148)	-0.263 (0.618)	0.279° (0.151)	0.170 (0.552)	0.124 (0.495)	
State CSE \$K per 15-19 y/o	0.925 (1.524)	-1.520*** (0.352)	2.871 (2.840)	-0.362 (0.431)	-1.637° (0.981)	
Local CSE \$K per 15-19 y/o	1.110 (1.139)	1.161 (1.007)	0.602 (0.621)	0.681 (0.633)	1.476 (1.325)	
Local condom ad GRPs						
x Abstinence stressed		0.004 (0.019)	-0.063** (0.024)	-0.011 (0.014)	-0.014 (0.016)	
x 1(year in 2009-2010)		-0.000 (0.000)	-0.004° (0.002)	-0.000 (0.000)	-0.000 (0.000)	
x State AOE \$K per 15-19 y/o		1.949 (3.294)	11.467* (5.405)	0.936 (1.996)	0.978 (1.695)	
x State CSE \$K per 15-19 y/o		1.797*** (0.396)	-3.027 (2.527)	1.088** (0.341)	0.891 (0.563)	
x Local CSE \$K per 15-19 y/o		-0.017 (0.379)	1.635** (0.610)	0.068 (0.293)	0.052 (0.263)	
Nat'l condom ad GRPs						
x % teaching benefit of abstinence			-0.000 (0.000)	0.000* (0.000)	0.000 (0.000)	
x State CSE \$K per 15-19 y/o			-0.035 (0.038)	-0.015** (0.005)	-0.012* (0.005)	
x Local CSE \$K per 15-19 y/o			0.006 (0.026)	0.024 (0.015)	0.029° (0.016)	
Local HBC ad GRPs					0.002 (0.002)	
x Abstinence covered					0.001° (0.000)	
Nat'l HBC ad GRPs						
x State AOE \$K per 15-19 y/o					-0.059° (0.031)	
x State CSE \$K per 15-19 y/o					0.015*** (0.003)	
Local LARC ad GRPs					0.001 (0.005)	

Table C.4, continued

	(1)	(2)	(3)	(4)	(5)	(6)	
x Abstinence covered						-0.002** (0.001)	
x CSE covered						0.002* (0.001)	
x Local CSE \$K per 15-19 y/o						-0.056** (0.017)	
Nat'l LARC ad GRPs							
x % teaching all topics						-0.000° (0.000)	
x Local AOE \$K per 15-19 y/o						0.004° (0.002)	
log \bar{p}_t^c		-0.758*** (0.102)	-0.820*** (0.125)	-0.780*** (0.108)	-0.818*** (0.125)	-0.741*** (0.084)	-0.743*** (0.083)
log \bar{p}_t^{HBC}						-0.019 (0.013)	
log \bar{p}_t^{LARC}						0.000 (0.018)	
County, border-month FEs	x	x	x	x	x	x	
Demographics	x	x	x	x	x	x	
(%age teaching all topics)		x		x	x	x	
x (year range dummies)							
(Sex ed variables) x (quarter)		x		x	x	x	
N	42934	20645	39072	20645	74336	74336	
R^2	0.982	0.987	0.982	0.987	0.984	0.984	

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ° $p < 0.1$

Table C.5: Elasticities using CDC Profiles data at means of advertising, sexual education policies, sexual education funding, and sexual education topic coverage with 95% confidence intervals (%)

	Overall effect (1)	No abstinence ed or CSE (2)	Abstinence is stressed & CSE is not covered (3)	Abstinence is stressed & CSE is covered (4)	Abstinence is covered & CSE is not covered (5)	Abstinence is covered & CSE is covered (6)
Local advertising						
Condom ads	-0.077 [-0.393 , 0.239]	-0.013 [-0.253 , 0.228]	-0.174° [-0.38 , 0.032]	-0.051 [-0.35 , 0.248]	0.005 [-0.25 , 0.26]	0.163 [-0.193 , 0.52]
LARC ads	0.03 [-0.307 , 0.366]	0.235 [-0.082 , 0.553]	0.011 [-0.183 , 0.205]	0.305* [0.008 , 0.603]	-0.208° [-0.424 , 0.007]	0.056 [-0.365 , 0.478]
Sex ed funding per 15-19 y/o (\$K)						
State CSE grants	-0.236* [-0.42 , -0.052]	-0.167* [-0.298 , -0.037]	-0.176* [-0.317 , -0.035]	-0.746* [-1.312 , -0.18]	-0.219* [-0.383 , -0.055]	-0.321* [-0.595 , -0.047]
Sex ed policies						
Abstinence stressed	-8.367* [-12.019 , -4.716]	-8.261* [-11.913 , -4.609]			-8.372* [-12.029 , -4.714]	-8.513* [-12.171 , -4.856]
Abstinence covered	-8.708* [-14.011 , -3.405]	-8.709* [-14.022 , -3.397]	-8.703* [-14.018 , -3.388]	-8.846* [-14.151 , -3.542]		

∞ ^{*} $p < 0.05$, [°] $p < 0.1$

Table C.6: ROI from 1-unit increase in local condom GRPs (with 95% CIs) using CDC Profiles data

	Incremental revenue (\$)	Incremental cost (\$)	ROMI (%)
Overall	-12.847	9.688	-232.6
No abstinence ed or CSE	-2.072	12.192	[-697.511 , 232.311] -116.997 [-552.305 , 318.311]
Abstinence is stressed & CSE is not covered	-19.641	7.056	-378.35* [-647.552 , -109.147]
Abstinence is stressed & CSE is covered	-5.108	11.219	-145.532 [-366.814 , 75.751]
Abstinence is covered & CSE is not covered	1.309	10.858	-87.945 [-565.493 , 389.603]
Abstinence is covered & CSE is covered	37.030	20.071	84.495 [-238.646 , 407.637]

* $p < 0.05$, ${}^\circ p < 0.1$