Reproductive Policy Uncertainty and Defensive Investments in Contraception*

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Abstract

We investigate the role of abortion access and insurance coverage for contraception in determining women's contraceptive choice and welfare. Using Planned Parenthood data on individual contraceptive choices in a difference-in-differences design, we provide causal evidence on how both realized and expected policy change affects contraceptive choice. Next, we build a model of dynamic discrete choice under uncertainty that recognizes forward-lookingness and the multiple attributes bundled into each contraceptive method, including cost, efficacy, comfort, and side effects. Estimating the model on nationally representative data from the National Survey of Family Growth, we show that restrictive policy causes women to make defensive investments in more effective and/or longer-lasting contraception, shifting them away from their preferred methods and driving large welfare losses even among women who avoid pregnancy. We estimate that eliminating abortion access and insurance coverage for contraception would reduce welfare for 65% of women with an average loss of $2,847, while providing free abortion access and free contraception would increase welfare for 80% of women.

Keywords: Dynamic discrete choice, Contraception, Abortion, Family Planning

JEL: D81, I12, I18, J13

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1 Introduction

Ninety-nine percent of American women use birth control at some point during their reproductive years (Daniels and Jones, 2013). The ability to time and limit births is crucial for nearly every aspect of women's lives,[1] including health, relationships, financial stress, education, employment, and their children's well-being. In the aggregate, contraceptive choice influences national economic activity and social structures through its impact on demographics.[2] In this paper, we ask how policies governing abortion access and health insurance coverage for contraception affect women's choice of contraceptive method and welfare.

We answer this question by making three contributions. First, we exploit panel data on individual contraceptive choices in a difference-in-differences design to provide causal evidence on how both realized and expected policy change affects contraceptive choice. Second, we build a model of dynamic discrete choice under uncertainty that recognizes forward-looking behavior and describes how the policy environment interacts with the multiple attributes bundled into each contraceptive method, including cost, efficacy, frequency and method of application, comfort, forgettability, side effects on acne, weight, and menstrual cycle, STI protection, and duration (Fiebig et al., 2011; Madden et al., 2015) to determine contraceptive choices. Third, we estimate the model on nationally representative data from the National Survey of Family Growth to quantify the welfare costs of policy counterfactuals for all women, including those who do not experience abortion or birth. While the existing literature mainly examines policy impacts on abortion and births, these outcomes only capture part of how policies can impact welfare. Policies which restrict abortion access or increase contraceptive prices also impact women by changing their choice of contraceptive method. We show that restrictive policy causes women to make defensive investments in more effective and/or longer-lasting contraception, shifting them away from their preferred methods and driving large welfare losses even among women who avoid pregnancy.

We first study the causal impact of four shocks to the realized and expected policy en-

[1] Throughout, we use the term 'woman' to refer to cisgender women of reproductive ages who have sex with cisgender men. Due to limited data on the contraceptive and abortion decisions of trans and gender-diverse people, we are unable to extend our analyses to cover these populations as well.

[2] See for example Bailey (2012); Cesur et al. (2023); Kearney and Levine (2009); Kelly et al. (2020); Guldi (2008); Goldin and Katz (2002); Bailey et al. (2012) and Bailey (2013), discussed further below.

vironment on contraceptive choice. Drawing on a panel of patient-level data from all visits to Planned Parenthood of Wisconsin and Planned Parenthood of Northern New England from 2014-2020, we observe the contraception used at the beginning and end of each visit, pregnancy status, abortion care, insurance plan, and age. Using a difference-in-differences event study design comparing women who visit clinics in treated and untreated states, we find that switches to more effective methods spiked by an average of 146.9% in Wisconsin after the governor proposed a new abortion restriction in 2015. After the restriction passed, switches increased by an additional 51.9%. We also find that switches to higher-cost, higher-efficacy methods increased by an average of 21.3% in Northern New England after Maine and Vermont expanded health insurance coverage in 2016. Finally, the 2016 presidential election allows us to test whether joint shocks to expectations about future costs and abortion access caused women to preemptively switch to methods that could shield them from future policies.[3] We find that switches to Long-Acting Reversible Contraceptives (LARCs) increased in all states in the six months after the 2016 election by an average of 18.8%. All estimates are significant at the one percent level and survive multiple robustness checks. These estimates suggest that beliefs about future abortion and contraception costs induce women to make defensive investments in contraceptive methods that can shield them from future shocks.

Next, we build a dynamic discrete choice model of contraceptive choice under uncertainty about the future policy environment. Agents choose a sequence of contraceptive methods to maximize utility over their reproductive years based on utility from method attributes, disutility from unintended pregnancy and birth, and disutility from out of pocket costs. The choice of a method today affects future pregnancy, births, and costs. The current political and legislative environment determines agents' beliefs about future access to abortion, which shape their expectations about the probability of carrying an unintended pregnancy to term conditional on choosing a given method. They also form beliefs about future contraceptive method costs based on policy discussions about health insurance coverage. This dynamic setting lets us identify how a political shift which does not change current abortion or

[3]There is strong qualitative evidence that women were worried about reduced access to reproductive healthcare after the 2016 election. The winning candidate campaigned on restricting abortion access and repealing the Affordable Care Act (ACA), which had widely expanded health insurance coverage including coverage for contraception.

contraceptive costs could still impact women's contraceptive choices and subsequent welfare today if it changes *expectations* about the future.

We bring the model to data on individual contraceptive and fertility decisions from the National Survey of Family Growth to estimate the impact of policy shocks on beliefs and to conduct a series of counterfactual exercises. First, we estimate the size of the shock to beliefs about future abortion access and insurance coverage that explains the number of women who switched to LARCs following the 2016 election. Using maximum likelihood to match contraceptive and abortion decisions in the 2015-2017 wave of the NSFG, we show that women would have to believe that there was a 21% chance they would lose access to insurance coverage for contraception and a 16% chance that they would lose access to abortion to explain the sizeable shift towards LARCs. Next, we use the model to explore several policy counterfactuals including free access to all contraceptive methods and abortion; elimination of insurance coverage for contraception; elimination of access to abortion; and elimination of both insurance coverage and abortion access. We estimate that welfare in the fully free model improves by 1.0% per woman, whereas welfare falls by 1.5% per woman if both abortion and contraception become more costly.[4] The majority of women in our model (65%) experience utility declines from the costly contraception and abortion scenario, and the loss in welfare stems in large part from switches to methods that are more effective but provide less utility for others reasons (e.g., side effects, increased doctor visits, ease of use). If our sample is representative of the reproductive preferences of the 55 million women aged 20-44 in the United States, this implies total welfare losses of $157 billion in the restrictive policy environment, compared to an $81 billion welfare increase in the unconstrained environment.

These findings are particularly important because the regulation of reproductive healthcare has become a volatile issue. In the absence of clear federal policy, narrow majorities in state legislatures can pass laws that dramatically change women's access to affordable family planning services and abortion (Myers, 2022).[5] Within 30 days of the Supreme Court's overturning of the federal protection for abortion established in Roe vs. Wade (1979), thirteen

[4]Welfare in our setting is defined as total utility from reproductive outcomes from age 20 to 44.

[5]Throughout, we use the term 'woman' to refer to cisgender women of reproductive ages who have sex with cisgender men. Due to limited data on the contraceptive and abortion decisions of trans and gender-diverse people, we are unable to extend our analyses to cover these populations as well.

states had banned nearly all abortions,[6] and some states are debating restricting access to contraceptives like Plan B and intrauterine devices (IUDs) that would end a pregnancy if used soon after conception. This intensification of policy uncertainty follows decades of state laws that weakened the protections described in Roe (Myers, 2022). Indeed, more than 1,300 abortion restrictions were passed between the deciding of Roe vs. Wade and June of 2021. Our results suggest that increased uncertainty alone has reduced welfare in all states, with higher welfare losses in states which have restricted abortion access.

This paper contributes to three main strands of the literature. First, we contribute to the literature on dynamic models of targeted fertility. Economists began modeling fertility decisions using dynamic frameworks in the 1980s, exploring how couples achieve a target number of children under uncertainty about infant survival (Wolpin, 1984; Newman, 1988) and fecundity (Rosenzweig and Schultz, 1985). In their seminal paper introducing conditional choice probabilities as a way to estimate dynamic discrete choice models, Hotz and Miller (1993) use couples' contraceptive choice to achieve optimal fertility as the example application. Carro and Mira (2006) model couples' dynamic discrete contraceptive choice to maximize utility from the number and timing of children. Michael and Willis (1976) model women choosing contraception to prevent a target number of pregnancies, showing that they prioritize methods with low marginal costs if they want to prevent many pregnancies and low fixed costs if they want to prevent only a few. Most of these models address optimal fertility among committed female-male couples,[7] where children provide utility and contraception only impacts utility through its price and impact on having children. In contrast, we study the direct utility women get from the attributes of their contraceptive method.

Second, this paper contributes to a literature examining how people adapt to adverse environmental shocks through defensive investments in costly technology. Previous economic models tend to frame contraceptive choice as a tradeoff between efficacy and cost, suggesting that budget constraints are the main reason that women don't always choose costly methods like LARCs that offer near-perfect fertility control. Our results indicate that it is not accurate to treat contraception as a simple consumption good; instead, contracepting women

[6] Guttmacher Institute, August 2022.

[7] An exception is Arcidiacono et al. (2012), which models teenagers' joint dynamic discrete choice of sexual activity and contraceptive method.

may weigh disutility from various contraceptive attributes against the larger disutility of an unplanned birth. As with defensive investments in response to environmental bads like tropical cyclones (Hsiang and Narita, 2012), heat waves (Barreca et al., 2016), and poor air and water quality (Deschenes et al., 2017; Zivin et al., 2011), women pay an upfront cost now (i.e., by choosing an effective method which is expensive or has negative side effects) to hedge against the risks caused by uncertainty about future access to abortion or health insurance coverage. We find that women respond to shocks to their expectations about future contraceptive costs and abortion access by switching to methods that insulate them from risk. These defensive investments in new contraceptive methods shield women from adverse policy shocks, but they also drive large welfare losses when they involve switching away from preferred methods in an unconstrained world.

Third, these results contribute to our understanding of how expansions and restrictions to reproductive health care access impact women's fertility and well-being. A large literature establishes that increasing access to family planning drives significant, persistent reductions in fertility, especially among poor women (Bailey, 2012; Cesur et al., 2023; Kearney and Levine, 2009; Kelly et al., 2020; Guldi, 2008; Kane and Staiger, 1996). Better control over the number and timing of children helps women achieve more in their careers (Goldin and Katz, 2002; Bailey et al., 2012) – indeed, access to the pill drove 10% of the convergence of the gender wage gap in the 1980s and 30% in the 1990s (Bailey et al., 2012). Papers exploring more recent policy changes that restrict access to contraception and abortion show that these laws cause significant reductions in the abortion rate and increases in the birth rate (Lindo and Packham, 2017; Packham, 2017; Fischer et al., 2018; Lindo et al., 2017; Venator and Fletcher, 2021), disrupting educational attainment and career paths. Out-of-pocket costs also continue to prevent uninsured, low-income women from purchasing their preferred contraceptive (Bailey et al., 2023).

While these papers represent a rich literature on the impact of reproductive policy on fertility outcomes, less work explores the impacts of reproductive healthcare restrictions on contraceptive choice. Levine and Staiger (2002) model abortion as an insurance policy against unwanted pregnancies, predicting that freer access to abortion would cause pregnancy to increase and births to decrease because women would have less incentive to avoid pregnancy in the first place. Similarly, Jones (2015) finds that Ghanaian women use abortion as a substitute for reduced access to contraception as they try to achieve a target fertility goal. Finally, Sabia and Anderson (2016) show that parental involvement laws, which require parental consent for a teenager's abortion, cause teens to increase their use of birth control. In contrast, this paper offers important insight into how women trade off key attributes of different contraceptive methods and how restrictions on access to reproductive care may shift women away from the methods that best suit their body and lifestyle. Understanding the tradeoffs women face in making this choice has important implications for federal and state policymakers, as well as reproductive healthcare providers.

The next section overviews contraceptive methods in the US, the policy environment, and our conceptual framework. Section 3 presents the data, empirical strategy, and results. Section 4 introduces the dynamic discrete choice model of contraceptive and abortion decisions. Section 5 describes the model estimation and section 6 presents results and discusses several policy counterfactuals. Section 7 concludes.

2 Contraception in the United States

By the start of the study period in 2014, contracepting women in the US could choose from a wide variety of methods in six broad categories: over the counter, scheduled hormonal, LARCs, partner sterilization (vasectomy), and sterilization. Over the counter methods can be bought at a pharmacy; they include male and female condoms, spermicide, and the sponge. Scheduled hormonal options like the pill, patch, ring, and injection require a prescription and must be applied on a precise schedule to release hormones that prevent pregnancy. LARCs, including the IUD and implant, are small devices inserted into the body that continuously release hormones or copper ions toxic to sperm. Vasectomy refers to male sterilization via a minor surgery that prevents sperm from entering semen. Female sterilization refers to tubal ligation, a surgery in which a woman's fallopian tubes are sealed so that the egg cannot be fertilized.

These methods vary meaningfully in key attributes that women value, including the failure rate, side effects such as weight gain and acne, the impact on menstruation,[8] frequency and method of application, whether the method is 'forgettable' or requires repeated action, the difficulty of obtaining it, and the ease of stopping use (Madden et al., 2015; Fiebig et al., 2011). Table 1 summarizes contraceptive attributes and Table 2 summarizes costs based on Planned Parenthood's sliding scale. The least effective category is over the counter methods. Conservatively, these methods have a typical use failure rate of 15% and a perfect use failure rate of 2%. The pill, patch, and ring have a typical use failure rate of 8% and a perfect use failure rate of 0.3%, and the rates for injections are 3% and 0.3%. LARCs are much more effective because they eliminate the gap between typical and perfect use. Once inserted, they are fully 'forgettable.' LARCs have a failure rate of 0.05%, comparable to the failure rate for vasectomy and female sterilization (0.04%).

Although LARCs and sterilization are the most effective methods, there are tradeoffs that mean some women prefer other methods. Table 1 also summarizes side effects on menstruation, how to obtain the method, and the ease of stopping use. Methods that are not 'forgettable' are easy to stop – you just stop administering them. In contrast, LARCs must be removed by a nurse and sterilization is permanent. Costs also vary significantly, and cost barriers prevent many women from choosing more expensive, more effective methods (Trussell et al., 2009; Foster et al., 2015; Lindo and Packham, 2017; Secura et al., 2010), even though they may be more cost-effective over time considering the costs of unintended pregnancy and birth (Trussell et al., 2009). Since the technology improved in the 1980s, more women have been choosing to use LARCs, especially women aged 25-34 and women who have already had at least one birth (Branum, 2015). If cost and knowledge barriers were fully eliminated, experts predict that LARC use would more than double (Foster et al., 2015). However, even without any barriers, many women would still prefer another method due to variation in body and lifestyle suitability (Foster et al., 2015; Secura et al., 2010).

2.1 Policy environment

The passage of the Affordable Care Act (ACA) in 2011 expanded healthcare coverage dramatically, reducing the number of uninsured Americans by an estimated 20 million by 2016

[8]Some hormonal methods reduce or eliminate menstruation, although the impact varies across women.

(Garrett and Gangopadhyaya, 2016). The ACA also requires insurers to cover the full cost of at least one brand of each contraceptive method without co-payments, deductibles, or other cost sharing by patients (Tschann and Soon, 2015). This contraceptive mandate had a particularly large impact on costs for LARCs given their high up-front costs. The cost of an IUD fell to $0 for 87% of women by March 2014, compared to only 42% of women in January 2012 (Bearak et al., 2016). However, while a majority of people now pay nothing for their contraception, 13.9% continue to pay out of pocket costs due to non-compliance, exemptions,[9] or choosing a brand of contraceptive other than the covered brand (Dalton et al., 2018; Magoon et al., 2019).

Since 2011, Wisconsin has repeatedly restricted access to reproductive care. In 2011, Act 32 denied state and federal family planning funding to entities that provide abortion. Planned Parenthood, then Wisconsin's sole federal Title X grantee,[10] lost roughly $1 million in state funding. In 2012, Act 217 required women to make multiple in-person appointments before an abortion. In 2013, Act 37 implemented a series of Targeted Regulation of Abortion Providers (TRAP) laws that created new barriers to abortion. The law requires women to undergo fetal ultrasounds and listen to a verbal description of the fetus, and physicians to have admitting privileges at a hospital within 30 miles, although a court injunction partially blocked the admitting privileges requirement. From 2009-2017, two of Wisconsin's five abortion health centers closed (Venator and Fletcher, 2021).

These earlier policy changes provide context for understanding women's perceptions of the risk of losing future access to reproductive care during the study period from 2014-2020. The threat of policy change was highly credible when Scott Walker announced a plan to enact a 20-week abortion ban on March 3, 2015.[11] This legislation, Act 56, was introduced

[9]Grandfathered plans – insurance plans purchased before the enactment of the ACA – are exempted from this mandate. Religious nonprofits are also exempted under the original legislation. In 2014, the Supreme Court's decision in Burwell v. Hobby Lobby expanded the exemption to include not only religious nonprofits but any employer with a religious affiliation. In 2017, the Trump administration expanded the exemption further to allow employers with "moral objections" to opt out of coverage for contraception simply by notifying employees of a change in their health insurance plan.

[10]Title X of the federal Public Health Service Act is a program of federally-funded family planning health centers. Passed in 1970, the Act funds health centers to provide contraceptive services to "all persons desiring such services...without regard to religion, creed, age, sex, parity, or marital status" (Public Health Service Act 1970; 1978).

[11]Kertscher, Tom. "Scott Walker and Abortion." Politifact, 3 March 2015. https://www.politifact.com/article/2015/mar/03/scott-walker-and-abortion/

in the state legislature in May 2015 and passed in July 2015. Under the law, doctors who terminate pregnancies after 20 weeks in non-emergency situations can be charged with a felony, fined $10,000, and face up to three years in prison.

In contrast, Maine, New Hampshire, and Vermont provide relatively expansive reproductive healthcare. They have all either expanded their Medicaid programs under the ACA or introduced their own plans to extend reproductive healthcare to low-income state residents, and they do not restrict coverage for abortion in private insurance plans or have TRAP laws.

In 2016, both Maine and Vermont introduced policies that significantly reduced the cost of reproductive healthcare. The MaineCare Limited Family Planning Benefit extended free family planning coverage to low-income Mainers, reaching an estimated 12,000-14,000 additional people.[12] Vermont Act 120 codified the ACA contraceptive mandate into state law so that even if the ACA were repealed, state residents would retain access to free female birth control as well as vasectomies, which are not covered federally. It also enabled women to fill a full year's prescription for the pill at once and eliminated financial barriers for LARCs. Given their geographic proximity, integrated Planned Parenthood system, and joint shocks, we treat all of Northern New England as receiving a negative shock to contraceptive costs in 2016.[13]

Finally, the 2016 presidential election created a national shock to expectations about future reproductive policy. The winning candidate campaigned on restricting abortion access and repealing the ACA. Although neither campaign promise came to pass, the possibility was widely reported. In an online survey of 2,158 US women ages 15-44, 42% said they worried that contraception would be harder to get after the election due to rising prices, closures of Planned Parenthood and other family planning health centers, and abortion restrictions (Judge and Borrero, 2017). Nearly one in ten switched to a new contraceptive method after the election, and 5.3% chose a LARC. Ninety percent of these new LARC users said that the election directly influenced their decision. They wanted a method that would last longer (86%) and/or worried they wouldn't be able to get a LARC in the future (68%). Using commercial health insurance data, Pace et al. (2019) document a 21.6% increase in LARC

[12] "MaineCare Benefits Manual." Maine Department of Health and Human Services, 2016.

[13] The data include the health center that each woman visited, but not their residence. This means we cannot observe whether some Vermont residents visited a New Hampshire health center, for example.

insertions among enrolled women aged 18 to 45 in the month after the election compared to the month before. In our own data, we find that monthly LARC insertions are positively and significantly correlated with Google searches for the terms “Repeal and Replace,” “ACA,” “ACA Birth Control,” “Trump Abortion Executive Order,” and “Roe v. Wade.”[14]

In June 2022, the Supreme Court’s decision in Dobbs vs. Jackson removed the federal protection for abortion access established in Roe vs. Wade (1973) and upheld in Planned Parenthood vs. Casey (1992). The removal of these protections immediately reverted Wisconsin to an 1849 law banning abortion except when three physicians agree it is necessary to save the life of the mother.[15] In September 2023, a circuit judge in Wisconsin ruled that this law referred to feticide rather than abortion and Planned Parenthood WI resumed abortion care at its Milwaukee location.[16] Abortion policy in Maine, New Hampshire, and Vermont has not changed. Although Dobbs vs. Jackson was decided after our study period, our model counterfactuals speak directly to its impact on contraceptive choice, abortion, and welfare.

2.2 Conceptual Framework

In this changing policy environment, the choice of an optimal sequence of contraceptive methods is a dynamic discrete choice under uncertainty. The choice is dynamic because the choice of a method today affects the probability of pregnancy and birth in the future and because long-lasting contraceptives can lock in the price paid for contraception in the future.

The choice is made under three sources of uncertainty. First, the probability of unintended pregnancy conditional on choosing j is given by its failure rate, which we assume that women know. Second, the probability of remaining pregnant, if unwanted, depends both on having become pregnant and on abortion access. Women form beliefs over future access to abortion that inform their expectations about the probability of carrying an unwanted

[14]See Appendix Table A-1. We report coefficients from regressing the count of monthly LARC insertions at each health center on the prevalence of searches for the terms “Repeal and Replace”,“ACA”, “ACA Birth Control”, “Trump Abortion Executive Order”, and “Roe v. Wade.” Prevalence is measured on a scale from 0 to 100, where 100 is peak prevalence. Each search term is positively and significantly correlated with the number of LARC insertions, controlling for health center and year fixed effects and state-year trends.

[15]“Crimes Against Life and Bodily Security 940.04.” Wisconsin State Legislature, 1849.

[16]Despite resuming limited abortion provision, the current policy environment in Wisconsin is still in flux as of 2023, with the case to go before the State Supreme court and calls for impeachment challenges to state justices from the Republican-controlled state senate.

pregnancy to term conditional on choosing j. Finally, women form beliefs about the future monetary costs of each method based on policy discussions about health insurance coverage.

Consider each contraceptive method to have four dimensions: monetary costs; non-pecuniary costs and benefits such as side effects, ease of use, requiring a doctor's visit; duration; and failure rate. The first two dimensions impact current utility, but the duration and failure rate affect future utility. If costs vary across periods, choosing a long-lasting method locks in the current price with certainty. The failure rate impacts utility through the likelihood of getting pregnant in the next period. For people who want to avoid births, a lower failure rate is preferable and its weight relative to costs in the current period will vary depending on the cost of birth, the cost of avoiding a birth through abortion, and how they compare a current, certain cost against an uncertain future cost. Again, the most effective methods often cost more up-front and have non-pecuniary costs that some people dislike, such as requiring the insertion of an IUD by a nurse rather than taking a daily pill at home.

This framework in which women choose between high-cost, high-efficacy and low-cost, low efficacy methods generates clear predictions about how changes to these costs would impact decisions. First, a policy which reduces expected future abortion access should cause women to switch to more effective methods because it increases the expected future costs associated with pregnancies. Second, a policy that subsidizes the monetary cost of contraceptives should cause women to switch to more expensive methods. These switches could be driven either by a preference for the lower failure rates offered by costlier methods, or by idiosyncractic preferences for non-pecuniary attributes (e.g., switching from the pill to the injection, which have similar failure rates but different durations and side effects). Lastly, a policy which increases uncertainty about future costs (e.g., repeal of the ACA) should increase switches specifically to LARCs because uncertainty over future costs increases the value of locking in a certain price for contraceptives now relative to paying a new, unknown price every period.

3 Empirical strategy

3.1 Data

We construct an individual panel of contraceptive choices, pregnancies, and abortions from the universe of visits to Planned Parenthood health centers in Maine, New Hampshire, Vermont, and Wisconsin from 2014-2020. We restrict the sample to women ages 15-45 who do not report having a same-sex partner, leaving us with a sample of 280,900 women.

Planned Parenthood is a major provider of reproductive care in these states, serving approximately 36,000 individuals age 15-44 (15.4% of all women age 15-44) in Maine, 43,000 (17.5%) in New Hampshire, 56,000 (48.5%) in Vermont, and 126,000 (10.0%) in Wisconsin from 2014 to 2019. Figure 1 maps health centers over the county population of women aged 15-44. Although Planned Parenthood offers prenatal care and fertility therapy, women seeking to avoid pregnancy are likely to be overrepresented relative to the general population.[17]

Tables 3, 4, and 5 report balance tables for the windows surrounding the events we study. Overall, visitors range in age from 15 to 45, with an average age of 26. Most visitors have either health insurance or access to a state family planning program, although only around a third have private insurance. The majority of visitors reported their race as White, though Black and Hispanic patients are overrepresented relative to the general population in these states.[18] Overall, only 12.0% of visits were for care while pregnant, and only 8.9% were for abortion care.[19] The most common motivation for a visit is contraceptive care.

Rates of pregnancy and abortion vary widely by contraceptive method. Figure 2 shows that the most effective methods are sterilization, partner sterilization, injection, and LARCs. Pregnancy rates are higher in this sample than in clinical trials due to selection – women may go to Planned Parenthood *because* they became pregnant unexpectedly.[20]

[17]Many women with private insurance are likely to visit another provider for pre- and postnatal care during desired pregnancies. That selection works in our favor since our goal is to study the decisionmaking of women seeking to avoid pregnancy. The inclusion of some women who do want pregnancy introduces downward bias, making our estimates conservative.

[18]In the 2010 Census, the share of White residents was 86.6% Wisconsin, 94.4% in Maine, 92.8% in New Hampshire, and 94.0% in Vermont.

[19]These overall statistics are computed using all four states. The pregnancy rate is computed over all years, and the abortion rate is computed from 2016 on because it is not reported in Wisconsin before 2016.

[20]Some women use more than one contraceptive method concurrently in order to protect against both pregnancy and STDs. For example, women may use a barrier method like condoms at the same time as a

3.2 Research design

We exploit four shocks to expected abortion access and contraceptive costs. Wisconsin governor Scott Walker's announcement of a plan to pass a 20-week abortion ban provides a negative shock to expectations about future abortion access in Wisconsin only; similarly, its passage reduces abortion access in Wisconsin only. We treat Maine and Vermont's healthcare coverage expansions as a negative shock to costs and a positive shock to abortion access across all three states in Northern New England, since we do not observe women's state of residence and women may seek care in any nearby health center. Finally, the 2016 presidential election created a positive shock to expected future costs and a negative shock to expected future abortion access in every state.

We study two main outcomes: switches to LARCs and switches to any lower-failure method. This outcome depends on an individual woman's current method and new method, so that a switch from condoms to the pill and a switch from a LARC to sterilization both count as a switch to more effective methods.

First, we run difference-in-differences event studies to pinpoint the differential effect of the Wisconsin abortion restriction and the Maine and Vermont healthcare expansions. We use a two-way fixed effects model where the untreated region serves as a control during a limited event window to avoid contamination with other policy shocks. For woman i visiting health center c in state s in monthyear t, the probability of switching methods is:

$$y_{icst} = \sum_{\tau}^{T} \beta_\tau d_{s\tau} + X_{it}\alpha + X_i\delta + \gamma_c + \gamma_t + t_s + \epsilon_{icst} \tag{3.1}$$

where $d_{s\tau}$ is a dummy for being in the treated state at time τ; X_{it} includes age, the contraceptive method used before the visit, insurance status, number of past pregnancies, number of past abortions, a dummy for being pregnant at time t, and a dummy for having an abortion at time t; and X_i includes race and ethnicity. We include monthyear fixed effects γ_t, health center fixed effects γ_c and state-specific time trends t_s, and cluster standard errors at the health center level.

low-failure rate method like a LARC. In our analysis, we assign women to the most effective method they report using, so that someone who uses both condoms and a LARC would be categorized as a LARC user.

Next, we use an event study to examine the impact of the 2016 presidential election. There is no control group here because all states were simultaneously treated. For woman i visiting health center c in state s in monthyear t, the probability of switching methods is:

$$y_{icst} = \sum_{\tau}^{T} \beta_\tau d_\tau + X_{it}\alpha + X_i\delta + \gamma_c + t_s + \epsilon_{icst} \tag{3.2}$$

with the same set of controls.

3.3 Empirical results

We find that switches to methods with lower failure rates increased differentially in Wisconsin after the announcement of the abortion ban agenda in 2015 (a decrease in expected future abortion access) and after its passage later that year (a realized decrease in abortion access). Figure 3 shows that the abortion restriction caused a sustained 20.5 percentage point (198.9%) increase in the probability of switching to a lower failure rate method and a much smaller but significant increase in the probability of switching to a LARC.

Second, we find that switches to more effective methods increased differentially in Northern New England immediately after Maine and Vermont's healthcare expansion in 2016.[21] Figure 4 shows that women were 4.1 percentage points (21.3%) more likely to switch to a more effective method in the four months after the expansion. Again, switches to LARCs comprised only a small share of these switches.

Finally, we find that switches to LARCs increased by an average of 1.66pp (18.8%) in the six months after the 2016 presidential election compared to the six months before (Figure 5). In contrast to the previous two policy shocks, switches to LARCs comprised the majority of switches to lower failure methods after the presidential election. We take this as additional evidence in support of the model predictions. LARCs are the only reversible method that can shield against future cost increases, and LARC uptake increased most after the only policy shock that increased expectations about future costs. Interestingly, the spike in switches to LARCs fades within 6 months, while the probability in switches to any more effective method remains elevated. This may be because the group of women for whom the shock to

[21] See the Appendix for very similar results using higher cost methods.

expectations made a LARC more desirable had all switched within six months of the shock.

3.4 Robustness checks

The difference-in-differences specification 3.1 controls for trends or events shared across states, but it is possible that the treated state may have experienced a concurrent confounding shock. We address this concern by exploiting within-state variation in the intensity of exposure to the Wisconsin abortion restriction, following the intuition that it increases the cost of abortion more for women who are farther away from unaffected out-of-state clinics. We run specification 3.1 separately for women who visit Wisconsin health centers closer or farther than 320km (200 miles) from the nearest out-of-state clinic. Figure 6 shows a stark contrast in responses by distance. Women far from out-of-state health centers respond immediately to the change in expectations about future abortion access, becoming roughly 40pp more likely to switch to a lower failure method and 5pp more likely to switch to a LARC. In contrast, women near unaffected health centers respond only after the restriction passes, and the response is much smaller and only significant at the 10% level.

The identifying variation in specification 3.2 comes from the timing of the election, leaving open the possibility that the results could be confounded by coincident unobserved events. In the appendix, we show that there was no change in unemployment around the 2016 election (Figure A-1). We also verify that the presidential election did not drive a change in switches to methods that our framework does not predict should respond. Figure 7 shows that the probability of switching to injection or to sterilization did not change. Injections offer a similar low failure rate to LARCs, but no protection from potential future price increases. Sterilization is highly effective but not reversible. This suggest that the election did not change women's preferences over parenthood; rather, it increased the importance of contraception in achieving desired timing.

Next, we compare the change in switches to any lower failure method versus LARCs after each event. Our framework predicts that switches to all lower failure methods should increase after the Wisconsin abortion ban (a shock to abortion access) and Maine and Vermont healthcare expansion (a reduction in costs), but switches specifically to LARCs should increase differentially after the 2016 presidential election (a shock to expected future costs).

As expected, LARCs make up a very small share of switches to lower failure methods after the abortion ban and healthcare expansion, but a very large share after the 2016 election.

Finally, we conduct a leave-out test to make sure that the results are not driven by changes in particular clinic behaviors. It is possible that staff in some clinics responded to the shocks by advising patients to switch methods. This would not change the conclusion that women chose to make defensive investments in contraception in response to policy shocks, but it would suggest that the mechanism was a change in healthcare providers' behavior. The point estimates from running the event studies after dropping any of the 46 clinics from the data remain within the 95% confidence intervals from the full sample.

4 A model of contraceptive choice under uncertainty

These results support the conceptual framework from section 2.2: women respond to changes in their beliefs about future policy change when they choose a contraceptive method today. The effect of the healthcare expansion also demonstrates that in the absence of cost constraints and abortion restrictions, women choose a variety of methods according to individual preferences over attributes other than the failure rate. We next ask: how do these defensive investments in contraception change welfare? Are these defensive investments driven more by concern about abortion or contraceptive costs? How would welfare change in plausible policy scenarios, from a national abortion ban to universal free contraception and abortion? To answer these questions, we build a model where the policy environment directly influences women's choice of contraception.

4.1 Model Timing

Agents are fertile women who have sex with men. An agent enters the model at age 20 with a starting state given by their current contraception ($j_0 \in J$), pregnancy status ($p_1 \in \{0, 1\}$), parity, and insurance status.

Each one-year period has two stages. At the start of the period, an agent realizes their pregnancy status, the abortion policy environment, and their period-specific preferences over having an abortion. If pregnant, they decide whether or not to get an abortion. Next, they realize their period-specific preferences over contraceptive methods and the policy environment for insurance coverage. Finally, they choose contraception for the next period from the choice set of five contraceptive methods (no method, OTC, hormonal, injection, or LARC) or seeking pregnancy.

The agent enters the next period with a set of state variables which include both deterministic characteristics (e.g., age increases by one) and choice characteristics (e.g., starting contraceptive in period 2 is j_1). Pregnancy is a function of the contraceptive decision made in the prior period. This process repeats for 25 years, ending at age 44.

4.2 Model Decisions

Each period, an agent makes decisions with certainty about their current preferences and the current costs of accessing contraception and abortion, but uncertainty about future preferences, contraceptive costs, and abortion access.

First, there is some probability ($1-\pi_C$) that the agent will lose contraceptive insurance coverage and face the full price for a method in future periods. If there are frictions which make switching costly, this uncertainty about future costs may induce them to choose a less costly method or a long-lasting LARC which has a zero up-front monetary cost with insurance and zero per-period maintenance costs even if insurance coverage is revoked, compared to methods like the pill or injection which require high monetary costs every period without insurance.

Second, agents cannot perfectly control their fertility and are uncertain about abortion access in future periods. They choose a contraception method j based on both their expectation of pregnancy with the method (its probability of failure π_j) and their expectation of the probability $1-\pi_A$ of being in a high-cost abortion policy environment. This high cost state of the world can nest any number of policy environments: a national abortion ban, living prohibitively far from a clinic, credit constraints that make the monetary cost too high, etc. We define the high-cost state of the world to mean that the costs of getting an abortion are infinite and model policy changes as shocks to the probability that this state of the world is realized.

An agent's value function depends on their previous period's contraceptive method $j_{i,t-1}$, pregnancy status P_{it}, number of children K_{it}, and individual characteristics X_i:

$$V(j_{i,t-1}, P_{it}, K_{it}, X_i) = B_{it} + \max_{\text{Abort, Not Abort}} \left[F_{it} + \varepsilon^{A}_{it} + \mathbb{E} \max_{j} \left(U_{ijt} + \varepsilon^{Cj}_{it} + \beta \mathbb{E} V(j_t, P_{i,t+1}, K_{it}, X_i) \right) \right] \tag{4.1}$$

where B_{it} is agents' baseline utility in period t, F_{it} is utility from the fertility decision (whether or not to have an abortion, depending on pregnancy), and U_{ijt} is utility from choosing contraceptive method j. ε^{A}_{it} is an additive taste shock for abortion and ε^{Cj}_{it} is an additive taste shock for contraceptive decisions. Finally, utility is also a function of static demographic characteristics X_i. Future iterations of the paper will allow all parameters in the model to differ depending on women's race (White, Non-White) and women's educational status (No College, Any College).

Agents' baseline utility in period B_{it} is a function of age and K_{it}, regardless of decisions:[22]

$$\begin{aligned} B_{it} &= \delta_1 \mathbb{1}(K_{it} = 1) + \delta_2 \mathbb{1}(K_{it} = 2) + \delta_3 \mathbb{1}(K_{it} >= 3) \\ &+ \mathbb{1}(\text{age}_{it} > 30) \big(\delta_4 \mathbb{1}(K_{it} = 0) + \delta_5 \mathbb{1}(K_{it} = 1) + \delta_6 \mathbb{1}(K_{it} = 2) + \delta_7 \mathbb{1}(K_{it} >= 3) \big) \end{aligned}$$

4.2.1 Stage 1: Fertility decision F_{it}

An agent enters the period knowing their previous contraceptive method ($j_{i,t-1}$), their pregnancy status ($P_{it} = [0, 1]$), their persistent characteristics(X_i), and the realization of both the policy state of the world and their individual specific preferences for abortion (ε^{A}_{it}). If pregnant, they decide whether or not to get an abortion.

Flow utility from the fertility decision (omitting the preference shock ε^{A}_{it}) is given by:

$$F_{it} = \begin{cases} 0 & \text{if } P_{it} = 0 \\ \gamma_1 + \gamma_2 \mathbb{1}(\text{age}_{it} > 30) + \gamma_3 \mathbb{1}(j_{i,t-1} = \text{trying}) + \gamma_4 K_{it} + \zeta + \beta_1 \text{price}_A & \text{if } P_{it} = 1,\, A_{it} = 1 \\ \gamma_1 + \gamma_2 \mathbb{1}(\text{age}_{it} > 30) + \gamma_3 \mathbb{1}(j_{i,t-1} = \text{trying}) + \gamma_4 K_{it} & \text{if } P_{it} = 1,\, A_{it} = 0 \end{cases}$$

We normalize utility from fertility to be zero when the agent is not pregnant. The utility

[22] We use a binary indicator for being older than 30 rather than a continuous measure due to the fact that contraceptive and abortion decisions do not change monotonically, making non-parametric binned measures of age a better fit to the data.

from a pregnancy, whether or not it is carried to term, is given by γ parameters, where we allow the γ to differ by age, by number of children, and by whether they entered the period seeking pregnancy. The additional utility from an abortion relative to carrying the pregnancy to term depends on the monetary cost $\beta_1 \text{price}_A$ and the non-pecuniary value ζ. If they choose not to get an abortion, their number of children (K_{it}) increases by one entering the next period.

Based on their pregnancy status, the monetary cost of abortion, and the non-pecuniary value of abortion, the agent makes their fertility decision.

4.2.2 Stage 2: Contraceptive decision

Next, the agent realizes the state of the world for their contraceptive decision: 1) whether their insurance will cover contraception and 2) their taste shock for contraception this period. Then the agent chooses from either seeking pregnancy or from one of five method categories: no method, over-the-counter, short-term hormonal (pill/patch/ring), injection, and LARCs.[23] Notably, we do allow women to not be actively seeking pregnancy but also not actively preventing pregnancy through use of contraception.[24]

Flow utility from contraception (omitting the preference shock ε_{it}^{j})is given by:

$$U_{ijt} = \beta_1 \text{price}_j^{ins(\tau)} + \theta_1^j + \theta_2^j \mathbb{1}(\text{age}_{it} > 30) + (\alpha_1 + \alpha_2 \mathbb{1}(j_{i,t-1} = \text{trying } \& \ P_{it} = 1))\, \mathbb{1}(j_t \neq j_{t-1})$$

Each method varies in its failure rate π_j which determines the probability of pregnancy in the next period, monetary cost with and without insurance coverage $price_j$, and other attributes such as ease of use, doctor visits required, and side effects (see Table 1 for a

[23]These groups are based on similarities in cost and duration use (e.g., hormonal short-term all require regular use while over-the-counter are used at time of intercourse), and allow for good data coverage across age and method. Over-the-counter methods include condoms, diaphragms, spermicide, natural family planning, and withdrawal. We categorize natural family planning and withdrawal as over-the-counter rather than none because their failure rates are more similar to over-the-counter methods than to truly using no method. Hormonal short-term includes the pill, the patch, and the ring.

[24]In our model, no method and seeking pregnancy differ in terms of how likely they are to result in a pregnancy. Trussell et al. (2009) reports the likelihood that a woman seeking pregnancy has a pregnancy in a year as the efficacy of 'no method'. To properly adjust for the fact that women who are not actively seeking pregnancy but report no method of usual contraception are likely engaging in a different frequency of sexual activity, we scale the 'no method' failure rate from Trussell et al (0.85) by the relative difference in pregnancy for women in the NSFG who are seeking pregnancy and those who are using no method but not seeking pregnancy to get the failure rate for no method(0.23).

summary of different method attributes). Because many of these other attributes are difficult to quantify, we capture these characteristics with method fixed effects (θ_j) that we allow to vary by age.

The insurance policy state of the world determines $price_j$. In the high-cost state, insurance does not cover contraception and the agent faces prices from the 'full price' column in Table 2. In the low-cost state, $price_j$ depends upon the agent's insurance coverage type τ, which indicates having insurance that covers contraception. While the ACA has eliminated contraceptive cost-sharing for most women, 13.9% of insured women continue to pay out of pocket costs.[25] In the low-cost state, agents with $\tau = 1$ and insurance enjoy free contraception while agents with $\tau = 0$ or no insurance face the Planned Parenthoods' full cost prices. We assume that the population frequency of $\tau = 0$ is 13.9% and that agents with insurance know their current type, but this is unobserved to the econometricians. Second, we assume that agents face uncertainty about whether their insurance will cover contraception in future periods , expecting to be in the low-cost state with probability π_C. We set $\pi_C = 1$ in the pre-2016 period and then estimate how this probability changes in response to the 2016 election shock as part of our model exercises.

All methods except LARCs last for one period, so the agent must pay the monetary cost every period. We model LARCs as lasting for five periods[26] so that an agent only pays the costs in the first period and pays zero for the next four. They can still choose to switch off the LARC at any point. Thus, we can think of the choice of a LARC as a choice either to start a LARC or to continue to year 2, 3, 4, or 5.

Lastly, agents face non-pecuniary switching costs α_1 when they change methods. This switching cost represents the average non-monetary cost associated with leaving your current method for any other method, net of the taste shock. These non-monetary costs include factors like the need to visit the doctor, hormonal disruption from stopping or starting a new hormonal method, discovering the side effects of the new method, and the cognitive

[25]As discussed, this can be due to grandfathered plans, non-compliant plans, and women's choice of method not being a covered brand (Dalton et al., 2018; Magoon et al., 2019). In some cases, this non-coverage of contraception may be known to woman prior to making her decision (i.e., grandfathered plans) and in others it may be unexpected.

[26]Hormonal LARCs often last for 5-7 years and copper IUDs last for 10 years, but doctors recommended replacements every 3-5 years for many of the popular hormonal options available during the study period. We chose five periods to be conservative.

load of making a new decision, for example. For agents who entered the period pregnant and were previously seeking pregnancy, we allow this switching cost to differ by the amount α_2 to capture the fact that once the sought-after pregnancy is realized a woman may be more likely to switch back onto contraception than the average woman who is continuously using a different method.

5 Model Estimation

5.1 Data

To estimate the model, we use the 2013-2015 wave of the NSFG, restricted to the sample to women aged 20-44. We use the NSFG rather the Planned Parenthood data for several reasons. First, the Planned Parenthood data provides snapshots of women's contraceptive choices when they visit a clinic, rather than a continuous diary of their decisions. While this is ideal for observing method switches in the empirical exercises, it means that we would undercount how often women switch to methods that don't require a doctor visit such as no method or over-the-counter methods. In contrast, the NSFG includes a three-year retrospective of all contraceptive methods used, allowing us to observe year-to-year method use. Second, Planned Parenthood patients are a selected sub-sample of women who are more likely to be seeking to avoid pregnancy, more likely to use abortion to manage their fertility outcomes, and not representative of national demographics because they are drawn only from Wisconsin, Maine, New Hampshire, and Vermont. Lastly, Planned Parenthood has limited information on women's demographics beyond race. By using the NSFG, we can observe women's realized parity and socioeconomic information, such as education level.

Table 6 compares summary statistics for the Planned Parenthood data used in the prior empirical exercises restricted to 2013-2015 and for the NSFG data used to estimate the model. We see that the Planned Parenthood women are more likely to be White and are more likely to be on public health insurance. Planned Parenthood patients are more likely to be using methods that require contact with a doctor such as the Pill/Patch/Ring, Injections, and LARCs. While pregnancy rates are similar between the samples, pregnancies are ten times more likely to aborted in the Planned Parenthood sample. A limitation of the NSFG data is that abortions are heavily under-reported (Desai et al., 2021)– the national abortion rate was 12.1 abortions per 1000 women whereas we observe 8 abortions per 1000 women in the NSFG. Nonetheless, the rates in the NSFG are much closer to the national average than observed at Planned Parenthood (72 abortions per 1000 observations). We expect our estimates of welfare benefits of abortion are thus conservative as we are calibrating the model to a data set that under-reports how often women choose abortion.

Each year of life is a period in the model. In the NSFG, women report a retrospective two-year contraceptive method calendar; the dates in that calendar make up the observations used to estimate the model. We assign contraception starting method as the method a woman reported entering a year using and the ending method at the method a woman reported ending the year with. While women also report a full lifetime fertility history, we only use fertility events that occur during the time period of the method calendar. Women's pregnancy and abortion status in a year is based on whether a woman is reported as having a pregnancy in a given month and whether she reports that the pregnancy ended in an abortion. Parity is calculated from an individual's full fertility history plus the number of live births they had at the beginning of a year.

The observable characteristics used to estimate the model include an agent's age, parity (0, 1, 2, or 3+ children), pregnancy status this period, and contraceptive method category (no method, over-the-counter, short-term hormonal, injection, LARCs, or seeking pregnancy). We drop women who report sterilization (own or partner) as their primary method. Seeking pregnancy status is based on two questions. First, for each pregnancy in the fertility history, women are asked if they had stopped using contraception prior to the pregnancy and if so, if the reason was because they were trying to become pregnant. Second, for women who reported no method used in the contraceptive period before a reported pregnancy in the contraceptive retrospective, they were asked if the reason was because they were trying to get pregnant. Affirmative answers to either question are classified as 'seeking pregnancy'. The price of each contraceptive method is given by the full price column in Table 2. The price of abortion, $price_A$, is proxied for with the mean out-of-pocket cost ($820) reported by women in an analysis of the Turnaway Study (Roberts et al., 2014)[27].

5.2 Agents' beliefs in a dynamic setting

The choice of contraception, j_t, impacts the continuation value $V(j_t, P_{i,t+1}, X_{i,t+1})$ both directly through switching costs and indirectly through the likelihood of pregnancy in period $t+1$. Decisions about abortion impact future fertility through changes to parity. This means that beliefs about future states of the world will impact both contraceptive choice and abortion in the present. To illustrate how this dynamic process works, Online Appendix A.1.1 describes the mathematical solution to the model in a two-period setting for an agent with $\tau = 1$ (i.e., the 'good' insurance type which complies with the ACA mandate).[28]

Given that beliefs impact outcomes, we need to address a limitation in our data by making a simplifying assumption. We cannot separately identify the value of a high- or low-cost state and the agent's beliefs about the likelihood that those states occur. Specifically, we cannot distinguish between a change in beliefs that makes the low cost abortion state more likely from a change in the relative value of the low abortion state compared to the high cost abortion state, which is determined by the parameter estimate of ζ. Both increase the cost of becoming pregnant, inducing the same observed behavior in the data.

We address this issue by assuming that women did not have uncertainty about the future policy setting before the 2016 election, so that $\pi_A = 1$ and $\pi_C = 1$. That is, they assumed that there was zero chance of losing coverage (if insured) or losing access to abortion. We estimate the remainder of the model parameters on the 2013-2015 data. Then we combine these parameters with data from the 2015-2017 wave of the NSFG to estimate how beliefs changed after the election, using method of moments to estimate post-2016 values of π_A and π_C Lastly, we estimate a series of counterfactual scenarios to test how policies that permanently shut down abortion (i.e., $\pi_A = 0$) or insurance coverage ($\pi_C = 0$) change behavior.

[27]The Turnaway Study is a longitudinal study which compares the trajectories of 1,000 women who received a wanted abortion to those who were turned away because they were past the provider's gestational age limit.

[28]This solution generalizes to a T-period model in which we are describing the solution to the decision in period T-1.

In practice, as the probability of a future high-cost insurance state increases, women are induced to switch to methods which will have low costs in the future (e.g., no method or a LARC which is free in the future if chosen in the present). As the probability of the high-cost abortion state increases, women are induced to switch to methods which will be more effective at preventing pregnancy (e.g., injection or a LARC).

5.3 Pre-2016 Estimation Strategy

Table 7 lists the model parameters to be estimated. We assume that the contraception and abortion taste shocks are drawn from a Type I Extreme Value Distribution with variance normalized to 1. Pregnancy shocks are drawn from a uniform distribution and a women enters the next period pregnant if that draw is lower than the failure rate for her chosen contraceptive method. We assume the discount rate is 0.95. We set the proportion of the sample that has the unobserved 'non-coverage' insurance type to be 0.139, based on estimates from Dalton et al. (2018). The remaining parameters are estimated within the model using maximum likelihood. Online Appendix Section A.1.2 provides the full functional form of the log-likelihood.

Given these distributional assumptions and any set of parameters Ω, we can solve the model recursively to recover the value functions in all states of the world. Then we use these value functions to calculate the probability that a woman chooses a given contraceptive method and abortion pair, conditional on entering the period pregnant. The parameters $\hat{\Omega}$ are the set of parameters which maximize this log-likelihood given the actual realized contraceptive method and abortion choices $d(j_{it})$ and $d^A(A_{it})$.

We maximize the likelihood using the LBFGS algorithm and choosing a starting point for the algorithm by drawing 1000 draws from a Sobol hypercube.[29] We compute standard errors by inverting the information matrix.

[29] We implement this with the function Optim in Julia 1.9.

5.4 Post-2016 Beliefs Estimation Strategy

Next, we estimate the change in beliefs π_A and π_C that explain the contraceptive choices observed after the election. As shown in section 3.3, changes in beliefs about future access to insurance coverage and abortion caused women to choose more effective and longer-lasting methods. We select the 2,618 women observed in 2017 in the NSFG 2015-2017 sample and prepare the data as described in Section 5.1. We use the same likelihood function as in the pre-2016 estimation, but hold the utility parameters constant and instead estimate π_A and π_C. We maximize the likelihood using the LBFGS algorithm and choosing a starting point for the algorithm based on the minimum of a grid search of 400 equally spaced points in the grid between 0 and 1. We compute standard errors by inverting the information matrix.

6 Model results

6.1 Parameters

Table 7 reports the estimated values for the pre-2016 model parameters and their standard errors, which we calculate by inverting the Hessian of the likelihood function.

Because the parameters are measured in utils rather than dollars, it can be difficult to interpret how the magnitudes of the parameters demonstrate differences in how agents value a given contraceptive method or obtaining an abortion. To illustrate how these parameters translate into different pecuniary and non-pecuniary costs, we describe two sets of scenarios and their associated utility.

Table 8 reports the flow utility in dollars from different contraceptive choices for selected types of women. These utilities do not include the individual specific preference shocks (ε_{it}^{A}, ε_{it}^{Cj}) or the continuation value of choosing method j associated with future pregnancy outcomes. Instead, they express the flow utility that a person of the given type would receive from each choice relative to the flow utility from choosing no method (which is normalized to have utility of 0 net of switching costs).

Table 9 reports in the first panel the flow utility in dollars from the decision to have an abortion or give birth, including the utility from pregnancy, abortion costs, and the present discounted value of the associated number of children for the remaining years of your life. This is a simplified scenario which assumes that there are no further pregnancies that change the number of children in a future year. The second panel of Table 9 reports the expected value of pregnancy versus non-pregnancy in the previous year, prior to realizing the preference shocks.[30]

Our parameter estimates and their interpretation in Table 8 and 9 suggest four main findings about what makes women choose different contraceptive methods.

First, the monetary costs of contraceptives are small relative to non-pecuniary considerations. The most expensive method, a LARC without private insurance, costs approximately \$500; in contrast, the differences in utility across methods are on the order of thousands of dollars. For example, a 20-year old woman with no insurance who currently uses OTC methods would receive \$3,948 less in utility from switching to a LARC compared to keeping their existing method (\$483 - \$4,431). The monetary cost only accounts for 12% of this decline in utility.

Second, women greatly value not having to switch methods. Notably, all types of women in Table 8 get the highest utility from continuing to use their current method. The switching cost parameter, β_2, implies that women at age 20 are willing to pay around \$4,194 to avoid switching methods, net of individual-specific method preferences ε_{it}^{Cj}. The example person described above receives \$4,431 from staying with OTC. For any other method, they receive the utility stated in the table which includes the switching cost of -\$4,194. If this switching cost were removed, this person would receive \$4,677 (\$483 + \$4,194) in utility from a LARC, and they would prefer the LARC to the OTC method. Similarly, they would prefer hormonal methods to OTC in the absence of switching costs. However, they would still prefer OTC over injections, which give a value of \$3,885 without switching costs, and over no method, which is normalized to deliver a utility of \$0 without switching costs.

While these high average switching costs may partially reflect both information barriers or access barriers like doctor's appointments, it should be noted that these are average switching costs, not the switching costs faced by women who actually change methods. These

[30]The expected value is based on closed form solution for expectations with Type I EV: $EV[\text{Pregnancy}] = \gamma * ln\left(exp(\text{Birth Utility}) + exp(\text{Abortion Utility})\right)$ where γ is Euler's constant and the birth utility and abortion utility are the utility values from Panel 1.

switching costs are the estimated costs for a hypothetical move to an arbitrary alternative method, whereas in the model people will only actually choose a method that has high pay-offs including the ε_{it}^{Cj} term. A more complete measure of the cost of switching is $\beta_2 + \max_j\{\epsilon_{i0t} - \epsilon_{ijt}\}$ where the last term is the difference in preference shocks for staying with current method 0 relative to switching to your most preferred method j. Because the mean of ϵ_{ijt} conditional on choosing method j is higher than the unconditional mean, these average switching costs are higher than the costs a woman who actually chooses to switch methods will face once we account for the individual method preference shocks.[31]

Third, younger women value abortion more. Since our model predicts that having children is costly, abortion is more valuable at younger ages because it prevents more years of costly child-rearing. This is consistent with the fact that women increasingly prefer to delay fertility until later in life. Women who are 20 without children will be willing to pay \$18,243 for an abortion; in contrast, women at age 30 have a lower willingness to pay of \$9,772. The value of an abortion also changes as women have more children, decreasing for 20 year olds and increasing for 30 year olds.

Lastly, there is a large difference in expected utility in the period prior to realizing the pregnancy and preference shocks. The difference in expected value between non-pregnancy and pregnancy at age 20 with zero children is \$37,845. The size of the difference in utility between pregnancy and non-pregnancy is an order of magnitude larger than the differences in utility across contraceptive methods in Table 8 which did not include the continuation value associated with future pregnancies associated with that method. This means that part of the value of choosing a more effective method like a LARC is the higher likelihood that one will not experience a pregnancy and receive this lower continuation value.

6.2 Pre-2016 Model fit

To test model fit, we compare the observed data on contraceptive choice, pregnancy, and abortion to the predicted behavior of women in the model who start in the same state as the

[31]This is a common feature of switching cost parameters in discrete choice problems in which only a small number of agents choose to switch consumption. See Kennan and Walker (2011) for a discussion of this issue in the context of high average migration costs relative to average migration costs conditional on moving.

observed data. Figure 8 compares nine moments in the data to the model: the proportion of women who switch methods, the proportion who get an abortion, the percent of pregnancies aborted, the proportion using each contraceptive method (5 moments), and the proportion who are pregnant. We currently slightly overestimate the switching rates, but are able to match the levels of pregnancy and method use relatively well.

As an out-of-sample validation exercise, we test whether our model parameters can predict contraceptive and abortion decisions for an earlier wave of the NSFG. We use starting state values from the 2006-2008 NSFG wave and the parameters estimated on the 2013-2015 wave. Figure 9 shows that we are able to match out-of-sample data moments: in the mid-2000s, women were less likely to use LARCs, more likely to use the Pill/Patch/Ring, and less likely to switch methods than in 2013-2015.

6.3 Post-2016 Belief Parameters

Next, we estimate π_A and π_C following the 2016 election shock to beliefs. We find that women's belief that they will have access to insurance that covers contraception drops by 21.1% ($\pi_C = 0.789$, s.e.$= 0.26$), consistent with anticipating that the ACA might be repealed. We find that women's belief that they will have access to an in-state abortion decreases by 15.9% ($\pi_A = 0.841$,s.e. $= 0.22$), consistent with increased concerns about abortion access under the Trump administration. In future drafts of the paper, we plan to explore the welfare impacts of these belief changes.

6.4 Policy Counterfactuals

The previous exercise explored how women responded to a change in beliefs about future healthcare access after the 2016 election. Now we consider a series of policy counterfactuals that model a change in realized healthcare access, again using pre-election beliefs as the baseline.[32] We start by exploring how behavior changes if women were not constrained by

[32] We choose not to use the post-2016 election beliefs as the baseline due to the concerns that the women's expected probability of losing access to contraceptive coverage was an incorrect forecast. Because the ACA did not get repealed, women were overestimating the likelihood of the 'bad' state. Rather than assume incorrect beliefs, we choose the pre-period as a baseline and assume women have rational and correct beliefs in both the baseline and in each counterfactual scenario.

monetary costs: how would women's contraception and abortion choices change if contraception and abortion were universally free?

There are two ways in which credit constraints might cause a woman to choose a contraceptive method that they prefer less in terms of side effects or other non-pecuniary characteristics. First, they may choose a less expensive method because they can't afford a more expensive one. Second, if abortion is too costly, they may choose a method that is more effective at preventing pregnancies but has other characteristics that they dislike.

Making contraception free (scenario 1 of Table 10) induces women to switch away from no method (-2.7pp or -6.1%) and into each of the other costly methods, with the largest shifts to OTC methods (+1.9pp or +9.0%), Pill/Patch/Ring (+1.0pp or +5.4%), and LARCs (0.4pp or +3.7%). These shifts to more effective methods reduce the pregnancy rate by 0.5pp (3%). Making abortion free (scenario 2) does not substantially change contraceptive use, but does increase the abortion rate by 0.6pp or 66%. If abortion and contraception are both free (scenario 3), women increase their use of more expensive methods, become pregnant less often (-0.4pp or +2.4%), and have more abortions (+0.5pp or +56%). Nearly 80% of women are better off compared to baseline, with an average increase in utility of $1,480 increase per women (1.0%).

Next, we consider policy counterfactuals which constrain access to reproductive healthcare.

In the fourth scenario, we model the elimination of the contraceptive insurance mandate by setting contraceptive costs equal to their uninsured cost for all women. Women respond by increasing the use of no method (+4.4pp or +10.1%) and over the counter methods (+2.1pp or +9.9%), which are the cheapest options and do not change in price when insurance is removed. Women decrease their usage of expensive methods such as hormonal methods (-3.9pp or -21.3%), injections (-102pp or -28.52%), and LARCs (-1.5% or -14.0%). This overall shift towards less effective methods results in a higher pregnancy rate (+0.8pp or +4.6%). The abortion rate increases slightly (0.1pp or +11%) in response, so that a similar proportion of pregnancies are carried to term.

Next, we consider the expansion of abortion bans. Scenario five shuts down access to abortion. While contraceptive methods only change by small amounts ($<$ 0.1 pp), the shifts are typically away from lower efficacy methods[33] This results in a 0.1pp decline in the pregnancy rate. When abortion is unavailable but contraception is free, women shift away from no method to more effective methods, resulting in a lower pregnancy rate (-0.6pp or 3.4%). While utility declines by 0.8% on average when abortion is restricted in scenario 5, it only declines by 0.4% when contraception is free because women can afford to make defensive investments in more effective methods.

Finally, we explore a fully constrained policy environment with no insurance coverage for contraception and no access to abortion (scenario 7). Women shift from using more expensive, more effective contraceptive methods towards no method and over the counter methods, resulting in a pregnancy rate increase of 0.8pp. Because women are both shifted away from their preferred methods and more likely to experience a birth, utility declines more substantially than in the other scenarios (-1.5%). The average utility decline in dollar terms is -$2,874. There were approximately 54.9 million women between the age of 20 and 44 in the United States as of 2022 (ACS, 2022); aggregating this cost up to the full population implies that this policy reduces welfare by $157.8 billion dollars.

The bottom panel of Table 10 sheds light on the full distribution of the impacts of these policies. The majority of women are negatively impacted by constraints on abortion and contraception: in the fully constrained scenario, 65% of women experience a decline in utility and 13% would be willing to pay over $10,000 to avoid this policy scenario. Conversely, removing financial constraints to reproductive healthcare increases utility for 80% of women; 8% of women would be willing to pay over $10,000 to implement this policy scenario.

6.5 Model Limitations

While the data on contraceptive method choices are rich, they are missing some information that imposes limitations on our model. First, our counterfactual exercises rely on the assumption that policy shocks do not change preferences. That is, we assume that the parameters governing preferences, such as the non-pecuniary value of an abortion or switching

[33] The largest shift is from seeking pregnancy which is caused by women achieving higher parity earlier reducing their likelihood to seek pregnancy in their 30s when higher parity no longer reduces utility by as much.

costs for contraceptive methods, are invariant to an abortion ban. The θ values we recover are estimates of the average value of each method for the population who used the method prior to any policy shock. If there are heterogeneous preferences for method, the women who select into a new method may have a lower preference for method θ_{ij} compared to women who chose it in a less constrained world. This would mean we underestimate the welfare costs of women switching to these methods due to an adverse policy change. Future research on selection patterns by demographic group of women who select into LARCs following abortion restrictions could help shed light on the degree to which our model underestimates the welfare costs.

We also assume that the failure rate of different contraceptive methods is invariant to the counterfactual policies. This is a stronger assumption, because agents may adjust their contraceptive use in other ways in addition to switching their primary method. For example, someone who continues to use condoms after an abortion ban may use them more carefully, reduce sexual activity, or supplement condom use with greater use of Plan B. These additional behavioral changes imply that the pregnancy rate for condom users could fall after an adverse policy change, which is not captured in our model. However, the impact of omitting these behavioral channels on our welfare estimates is ambiguous. On the one hand, overestimating the likelihood of pregnancy after a policy shock may lead us to overestimate the welfare losses in these counterfactuals. On the other hand, we are also omitting any welfare losses associated with reduced sexual activity or increased effort, which would underestimate the welfare losses. Future work should explore how much women's sexual activity levels respond to reproductive policy changes and whether these changes impact the observed efficacy of different contraceptive methods.

Third, NSFG data is based on survey responses and is subject to under-reporting of abortions (and pregnancies that result in abortion). While we try to adjust for this in the model by using contraceptive efficacy rates that come from Trussell et al. (2009) and are adjusted for abortion under-reports, we underestimate the true value of abortions due to under-reports. Our welfare estimates can thus be thought of as conservative estimates of the true value of abortion.

Lastly, we have to make an assumption about the degree of risk aversion because we cannot separately identify risk preferences from beliefs about the likelihood of being in a high or low cost state of the world. Since we do not observe agents' consumption levels, we think risk neutrality is the most sensible assumption. When utility over monetary costs is linear, it is equivalent to model the effect of buying contraception on consumption as $-P_j$ or as $Y - P_j$, where P_j is the price of the method and Y is consumption absent of purchasing the method, because Y is constant across choices and only relative utility impacts agents' choices. Conversely, if utility is non-linear in consumption, then the level of baseline consumption impacts the utility lost from spending P_j. Without the reference points of income and consumption, adding risk aversion would introduce additional measurement error. Instead, we make the more conservative choice of assuming risk neutrality: if agents are actually risk averse, this mis-specification would underestimate the costs associated with policy shocks that increase the chance of the high-cost state.

7 Conclusion

Nearly every woman in the United States chooses to use a contraceptive method during their lifetime (Daniels and Jones, 2013). The choice of which method to use is deeply consequential for both individual and aggregate economic outcomes. This paper provides a model for understanding how women make this choice, demonstrating that it depends not only on the method's attributes, but also on the policy environment. We show that women are forward-looking about future access to reproductive care. When they expect the policy environment to become more restrictive, women make defensive investments in methods that can shield them from an increase in out-of-pocket costs or a reduction in abortion access.

We first provide causal evidence on how women responded to three policy shocks: Wisconsin's 2015 abortion ban, Maine and Vermont's 2016 insurance coverage expansion, and the 2016 presidential election. Using a panel of de-identified patient-level method choices, we show that women switch to more expensive methods when costs fall; more effective methods when they expect abortion access to fall; and longer-lasting methods when they expect out-of-pocket costs to rise.

Next, we build a structural model to evaluate how women would respond to a set of possible policy scenarios and compare welfare effects across each one. We show that policy change drives many women to change their method, with restrictive policies shifting women away from the method they prefer in an unconstrained world. This shift imposes measurable welfare costs: while preventing pregnancy and birth are certainly very important, they are not the only important attributes of a birth control method. The structural model reveals that women value the non-pecuniary attributes of different methods very highly and that they experience high costs from switching between methods. We estimate that a policy that eliminated access to abortion and insurance coverage for contraception would decrease welfare by $2,847 per woman. If our sample is representative of preferences in the broader population, this represents a total loss of more than $157 billion for the population of 55 million women ages 20-44 in the US. In contrast, providing free universal access to all contraceptive methods and to abortion would raise welfare by $1,480 per woman ($81 billion total).

This paper is one of the first to demonstrate the effects of reproductive policy change on women who do not experience an abortion or birth. Our patient-level data allow us to provide a fuller understanding of how reproductive policy change affects women's welfare not only through its impact on pregnancy and abortion rates but also through its impact on contraceptive method choice. Uncovering the impact of the policy environment on women's welfare is urgent as American reproductive healthcare policy continues to change.

8 Tables

Table 1: Contraceptive Method Attributes

	Frequency	Failure rate: typical use	Failure rate: perfect use	Forget-table	Impact on period	How to get it	Ease of stopping
Over the counter	Each time	0.15	0.02	No	None	Pharmacy	High
Pill	Daily	0.08	0.003	No	Variable	Prescription	High
Patch	Weekly	0.08	0.003	No	Variable	Prescription	High
Ring	Monthly	0.08	0.003	No	Variable	Prescription	High
Injection	3 months	0.03	0.003	No	Variable	Doctor visit	High
IUD/Implant	3-10 years	0.0005	0.0005	Yes	Variable	Doctor visit	Medium
Vasectomy	Once	0.0015	0.001	Yes	None	Surgery	Low*
Sterilization	Once	0.004	0.004	Yes	Eliminated	Surgery	Can't

Note: Failure rates are reported from Trussell et al. (2009)'s estimates based a comprehensive literature review, package inserts, and expert opinion for failures within the first year of use. The over the counter failure rate reported here is Trussell et al. (2009)'s estimate for condoms, which is both the most effective and most common over the counter method.

*The success rate for reversing vasectomies falls with time since the procedure.

Table 2: Approximate Annual Costs for Contraceptive Methods

	No insurance: Sliding scale by % federal poverty line					Insurance
	≤100%	101-150%	151-200%	201-250%	Full price	
Over the counter	-	-	-	-	80	80
Pill	0	90	180	270	360	0
Patch	0	180	360	540	720	0
Ring	0	120	240	360	480	0
Injection	0	120	240	360	480	0
IUD/Implant	0	125	250	375	500	0
Vasectomy	-	-	-	-	400	0
Female sterilization	-	-	-	-	2000	0

Note: This table displays approximate annual out-of-pocket costs for Planned Parenthood patients with and without health insurance. The actual cost may vary across health centers and insurance policies. Annual costs are calculated by multiplying methods by number of applications per year. The one-time costs of LARC insertion, vasectomy, and female sterilization vary widely, from $1,000-1,500, $350-1,000 and $1,500-6,000 respectively. Annual costs are calculated assuming LARCs are used for 3 years and vasectomy/female sterilization are used for 5 years. This generates conservative cost estimates, since LARCs last for 3-10 years and most people who opt for vasectomy or sterilization are older than 35 ("Sterilization as a Family Planning Method," 14 Dec 2018. Kaiser Family Foundation. https://www.kff.org/womens-health-policy/fact-sheet/sterilization-as-a-family-planning-method/).

Table 3: Wisconsin Balance Table

	Wisconsin			Control		
	Pre	Post	Difference	Pre	Post	Difference
Age	25.169	25.469	0.3***	26.167	26.435	0.267***
Insured	0.857	0.83	-0.027**	0.831	0.839	0.007*
Private	0.239	0.258	0.019	0.418	0.444	0.026***
Black	0.28	0.294	0.014	0.023	0.024	0.001
White	0.595	0.559	-0.036	0.893	0.893	0.001
Hispanic	0.135	0.171	0.036**	0.037	0.038	0.001
Pregnant	0.011	0.04	0.028***	0.102	0.103	0.001
Past pregnancy	0.013	0.049	0.036***	0.228	0.266	0.039***
Contraceptive visit	0.169	0.316	0.147***	0.442	0.423	-0.019***
Switch	0.119	0.327	0.208***	0.273	0.31	0.036***
Switch to lower failure	0.092	0.275	0.183***	0.195	0.215	0.019***
Switch to LARC	0.011	0.049	0.038***	0.093	0.105	0.012***
Monthly visitors	181	380	199***	312	296	-16
Monthly visits	186	405	219***	339	324	-15

Note: This table provides summary statistics on visits to Planned Parenthood clinics in Wisconsin and control states (Maine, New Hampshire, and Vermont) during the event window beginning 8 months before and ending 11 months after the announcement of Wisconsin's 2015 abortion restriction. Abortion is not included because data is only available for Wisconsin in the post-period. Contraceptive visits are visits whose purpose was related to contraceptives. Monthly visits and visits are rounded to the nearest integer. *p<0.1; **p<0.05; ***p<0.01.

Table 4: Northern New England Balance Table

	Maine, New Hampshire, Vermont			Control		
	Pre	Post	Difference	Pre	Post	Difference
Age	25.288	25.729	0.441***	26.305	26.489	0.184*
Insured	0.831	0.815	-0.016	0.85	0.794	-0.056***
Private	0.253	0.3	0.047***	0.451	0.453	0.002
Black	0.289	0.309	0.02	0.022	0.027	0.005***
White	0.559	0.53	-0.029**	0.898	0.879	-0.019***
Hispanic	0.178	0.196	0.018*	0.038	0.042	0.004**
Pregnant	0.044	0.079	0.035	0.086	0.139	0.053***
Past pregnancies	0.054	0.132	0.078	0.238	0.361	0.122***
Contraceptive visit	0.337	0.272	-0.065***	0.426	0.369	-0.056***
Switch	0.348	0.407	0.059***	0.278	0.379	0.101***
Switch to lower failure	0.294	0.374	0.08***	0.195	0.237	0.042***
Switch to LARC	0.052	0.078	0.026***	0.107	0.101	-0.005
Monthly visitors	368	508	140***	223	357	84***
Monthly visits	392	554	162***	293	399	106***

Note: This table provides summary statistics for visitors to Planned Parenthood clinics in Maine, New Hampshire, Vermont, and control state (Wisconsin) during the event window beginning 4 months before and ending 12 months after Vermont and Maine's 2016 healthcare expansions. Abortion is not included because it is not available for Wisconsin until the post-period. Contraceptive visits refer to visits whose purpose was related to contraceptives. Monthly visits and visits are rounded to the nearest integer.*p<0.1; **p<0.05; ***p<0.01.

Table 5: Presidential Election Balance Table

	Pre	Post	Difference
Age	25.958	26.232	0.274***
Insured	0.806	0.817	0.01**
Private	0.369	0.402	0.032***
Black	0.2	0.196	-0.004
White	0.66	0.663	0.003
Hispanic	0.138	0.144	0.006
Pregnant	0.119	0.138	0.018
Abortion	0.067	0.09	0.023
Past abortion	0.118	0.197	0.079***
Past pregnancy	0.257	0.345	0.088***
Contraceptive visit	0.301	0.303	0.002
Switch	0.445	0.483	0.039***
Switch to lower failure	0.322	0.369	0.046***
Switch to LARC	0.088	0.107	0.019***
Monthly visitors	460	438	-22
Monthly visits	508	486	-22

Note: This table provides summary statistics for visitors to Planned Parenthood clinics in Maine, New Hampshire, Vermont, and Wisconsin during the event window beginning 6 months before and ending 12 months after the 2016 presidential election. Contraceptive visits refer to visits whose purpose was related to contraceptives. Monthly visits and visits are rounded to the nearest integer. *p<0.1; **p<0.05; ***p<0.01.

Table 6: Data moments in the NSFG vs. Planned Parenthood

	NSFG	PP
White	0.492	0.764
Under 30	0.542	0.694
Any health insurance	0.819	0.929
Public health insurance	0.274	0.478
% Switch	0.261	0.390
Pregnancy rate	0.139	0.119
Abortion rate	0.008	0.072
% Pregnancies aborted	0.060	0.509
No method	0.366	0.104
Over the counter	0.235	0.249
Pill/Patch/Ring	0.210	0.337
Injection	0.040	0.087
LARC	0.123	0.158
Seeking pregnancy	0.025	0.015
Parity	0.385	–
College	0.633	–

Note: This table presents data moments for the NSFG sample and compares them with moments from a similar sample drawn from the Planned Parenthood (PP) data. The NSFG data contains women age 20-44 from the 2013-15 wave of the survey. Each observation is based on the two-year contraceptive method calendar responses, aggregated to an annual level. Switches are defined as women who use a different method at the end of a calendar year than at the beginning. Pregnancy and abortion rates are based on self-reported retrospective pregnancies and abortions in the year of the contraceptive calendar. Parity is the number of children a woman had at the end of each calendar year during the contraceptive calendar The PP data include visits from January, 2013 to October, 2016, restricted to the same age span as the NSFG data and simplified to a maximum of one observation per person in a given year. Switching is defined as leaving a visit with a method other than the one you arrived with. The PP abortion rate and share of pregnancies aborted are calculated using only the 2016 data because of high rates of missingness in earlier years. Parity cannot be calculated accurately in the PP data.

Table 7: Model Parameters

	$\hat{\theta}$	$\sigma_{\hat{\theta}}$
Monetary scaling	0.577	0.113
Switching cost	−2.421	0.021
Switching × seeking pregnancy	1.528	0.142
Over the counter	0.183	0.042
Pill/Patch/Ring	0.484	0.066
Injection	0.099	0.092
LARC	0.573	0.107
Seeking pregnancy	−3.679	2.631
No method ×over 30	−1.970	0.283
Over the counter ×over 30	−2.072	0.282
Pill/Patch/Ring ×over 30	−2.216	0.281
Injection ×over 30	−2.206	0.285
LARC ×over 30	−2.115	0.291
Seeking pregnancy ×over 30	−2.107	0.387
Pregnancy	4.199	3.389
Pregnancy ×over 30	−0.177	0.353
Pregnancy ×N children	0.430	0.078
Pregnancy ×seeking pregnancy	2.508	3.439
Abortion cost	−2.769	0.172
1 child	−1.385	0.183
2 children	−1.237	0.299
3 or more children	−1.295	0.409
0 child ×over 30	5.196	0.658
1 child ×over 30	5.709	0.703
2 children ×over 30	5.320	0.756
3 or more children ×over 30	5.237	0.830
Woman-year observations	14,872	

Note: This table presents estimated model parameters $\hat{\theta}$ and their standard errors $\sigma_{\hat{\theta}}$, estimated via maximum likelihood on NSFG 2013-2015 data restricted to women 20-44. See text for details on the sample construction and formation of the likelihood function.

Table 8: Flow utility from contraceptive methods relative to switching to no method

Starting method	Over the counter				LARC			
Insurance type	Private		None		Private		None	
Age group	20s	30s	20s	30s	20s	30s	20s	30s
Over the counter	4,431	4,255	4,431	4,255	237	61	237	61
Pill/Patch/Ring	838	413	478	53	838	413	478	53
Injection	171	−236	−309	−716	171	−236	−309	−716
LARC	993	743	483	233	5,187	4,937	5,187	4,937
Seeking pregnancy	−6,373	−6,610	−6,373	−6,610	−6,373	−6,610	−6,373	−6,610

Note: This table reports the flow utility in dollars for choosing each contraceptive method for different types of women. A woman's type is defined by her insurance status, the method she starts the period with, and her age group. All utility is relative to the omitted choice, no method. Utility is calculated based on the contraceptive utility equation $U_C(j_{i,t-1}, S_{it}) = \theta_j \theta_j^A \cdot \text{age} + \beta_1 \cdot cost_{j,t,ins} + \beta_2 \times \mathbb{1}(j_t \neq j_{t-1})$.

Table 9: Flow utility from fertility

	Age 20		Age 30	
Outcome	0 children	1 child	0 children	1 child
Abortion	93,430	70,313	93,122	102,936
Birth	75,186	72,584	83,350	79,842
Difference	18,243	−2,271	9,772	23,094
Exp value of no pregnancy	91,774	67,914	91,774	76,385
Exp value of pregnancy	53,929	42,135	53,755	59,416
Difference	37,845	25,778	38,019	16,969

Note: This table reports the flow utility in dollars for having either an abortion or a birth if pregnant, and for the expected value of not getting pregnant or getting pregnant. Utility is calculated based on the cost of pregnancy ($\gamma_1 + \gamma_2 \mathbb{1}(\text{age} > 30) + \gamma_3 K_{it}$), the cost of abortion ($\zeta + \beta_1 \text{Price}$), and the PDV of the resulting parity ($\sum_t \beta^t B(K_{i,t-1} + \mathbb{1}(\text{Birth} = 1))$ where $B(\cdot)$ is the function for parity.

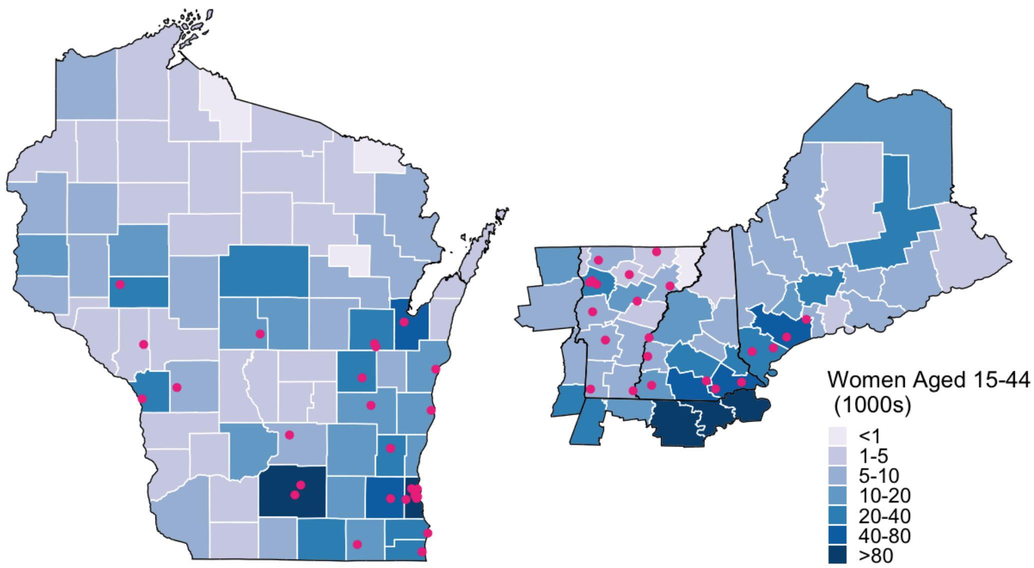
Table 10: Counterfactual policy scenarios

Outcome	Model	Free Contra-ception	Free Abortion	Fully Uncon-strained	Costly Contra-ception	No Abortion	Free Cont., No Abortion	Fully Con-strained
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pregnancy rate	0.175	0.170	0.175	0.171	0.183	0.174	0.169	0.183
Abortion rate	0.009	0.009	0.015	0.014	0.010	0	0	0
% Switch	0.240	0.245	0.241	0.246	0.226	0.239	0.245	0.225
No method	0.437	0.410	0.438	0.410	0.481	0.439	0.411	0.483
Over the counter	0.211	0.220	0.211	0.220	0.232	0.210	0.222	0.230
Pill/Patch/Ring	0.183	0.193	0.183	0.193	0.144	0.183	0.192	0.144
Injection	0.035	0.039	0.035	0.039	0.025	0.035	0.039	0.025
Seeking pregnancy	0.027	0.027	0.028	0.027	0.027	0.026	0.025	0.027
LARC	0.107	0.111	0.105	0.110	0.092	0.107	0.110	0.092
% Pregnancies aborted	0.053	0.052	0.085	0.085	0.053	0	0	0
Total utility ($)	172439	172903	173457	173919	170735	171082	171514	169591
Change in utility from baseline ($)	-	463	1018	1480	-1704	-1356	-925	-2847
% Change in utility	-	0.004	0.006	0.010	-0.009	-0.008	-0.004	-0.015
% Women who changed behavior	-	0.283	0.143	0.387	0.490	0.221	0.445	0.610
% Change in utility for changers	-	0.003	0.038	0.018	-0.009	-0.034	-0.014	-0.019
% Women who are better off	-	0.797	0.357	0.801	-		0.670	
% Women who are worse off	-				0.584	0.253	0.303	0.647
% Women who are ≥ $10,000 better off	-	0.041	0.041	0.079	-		0.040	
% Women who are ≥ $10,000 worse off	-				0.098	0.041	0.082	0.133
% Women who are ≥ $5,000 better off	-	0.096	0.060	0.148	-		0.087	
% Women who are ≥ $5,000 worse off	-				0.237	0.081	0.130	0.297

Note: his table reports the results of several counterfactuals. CF1 sets the price of contraception equal to zero, CF2 sets the price of abortion equal to zero, and CF3 sets both prices equal to zero. CF4 sets the price of contraception equal to its out-of-pocket cost without insurance. CF5 shuts down abortion and leaves contraceptive costs unchanged. CF6 shuts down abortion and sets the price of contraception to zero. CF7 shuts down abortion and sets the price of contraception equal to its out-of-pocket cost.

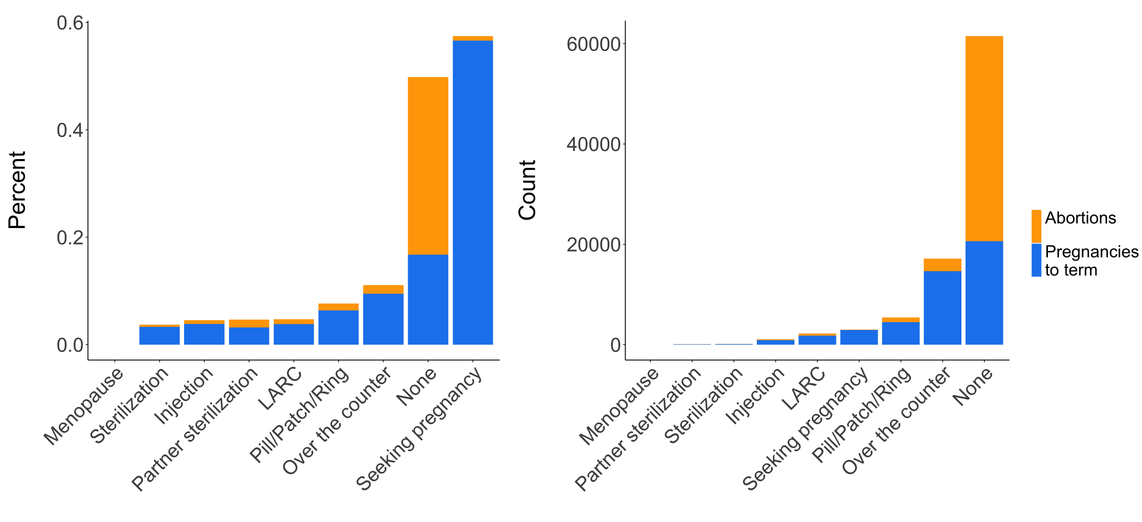
9 Figures

Figure 1: Map of PPWI and PPNNE health center locations



Note: Health centers in Wisconsin (left) and Maine, Vermont, and New Hampshire plus adjoining Massachusetts counties (right) are mapped over the county populations of women aged 15-44 from U.S. Census Bureau Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States, States, Counties and Puerto Rico Commonwealth and Municipios: April 1, 2010 to July 1, 2018.

Figure 2: Incidence of pregnancy and abortion by method

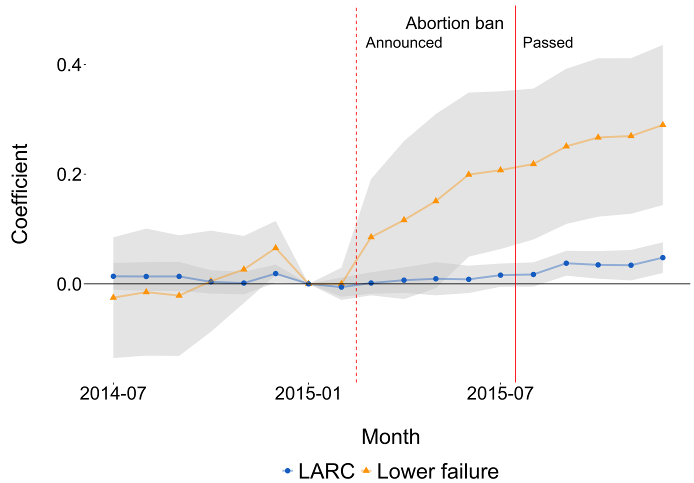


(a) Rates

(b) Counts

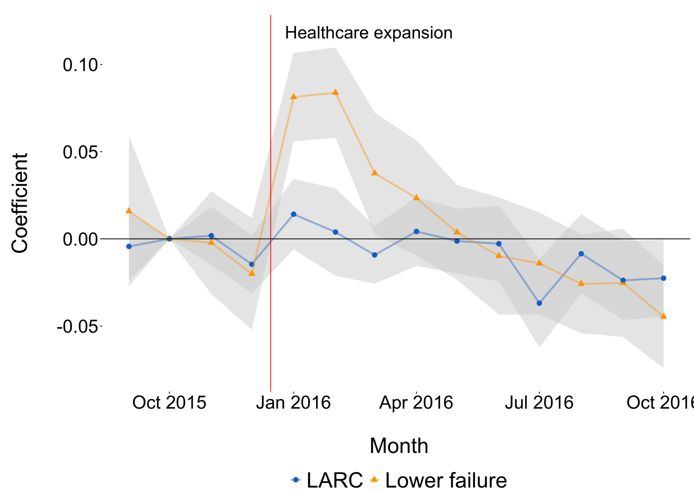
Note: These plots show total pregnancies and abortions observed in the sample by contraceptive method. Observed pregnancies with no abortion appointment are assumed to have been carried to term, although it is possible they were miscarried or aborted outside of the Planned Parenthood clinics in our sample.

Figure 3: Impact of Wisconsin abortion ban on contraceptive method switches



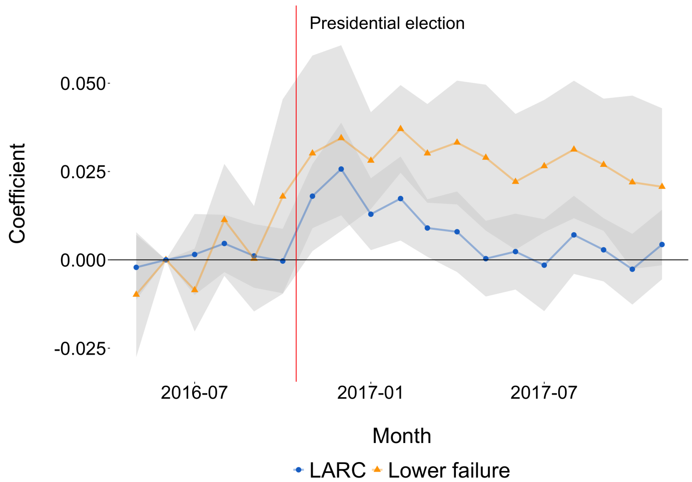
Note: These plots show coefficients and 95% confidence intervals from running the difference-in-differences specification 3.1 on the window surrounding the announcement and passage of the Wisconsin abortion restriction in 2015, using Northern New England as the control group. Standard errors are clustered at the health center level.

Figure 4: Impact of Northern New England healthcare expansion on contraceptive method switches



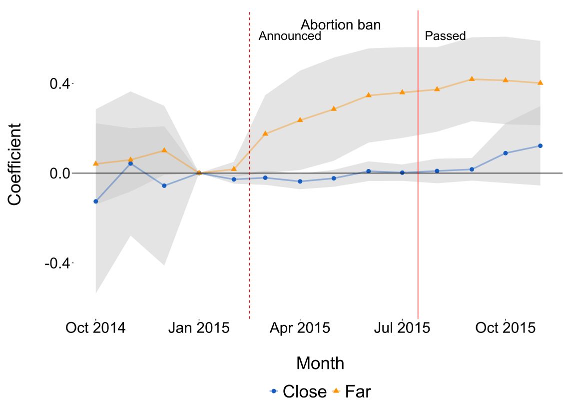
Note: This plot shows coefficients and 95% confidence intervals from running the difference-in-differences specification 3.1 for the window surrounding the 2016 healthcare coverage expansion in Northern New England, using Wisconsin as the control group. Standard errors are clustered at the health center level.

Figure 5: Switches in all states after the 2016 presidential election

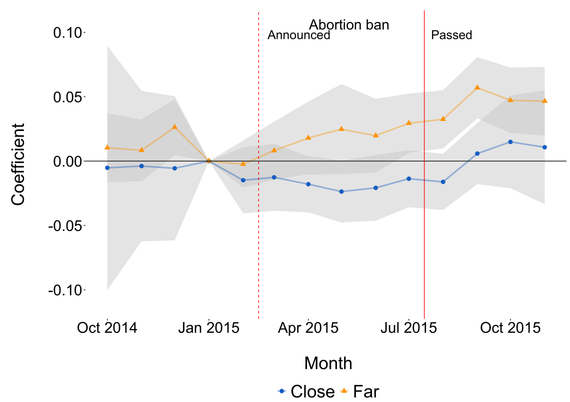


Note: This plot shows coefficients and 95% confidence intervals from running specification 3.2 on the full sample for the window surrounding the 2016 presidential election. Standard errors are clustered at the health center level.

Figure 6: Heterogeneity in the response to the abortion ban by distance to out-of-state health centers



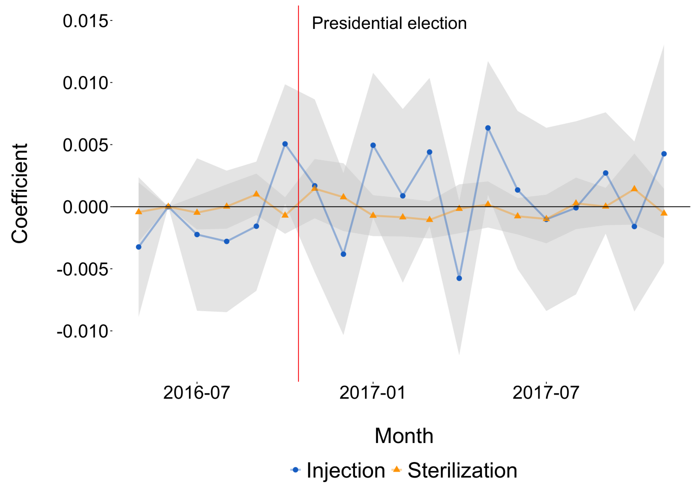
(a) Switches to Lower-Failure Methods



(b) Switches to LARCs

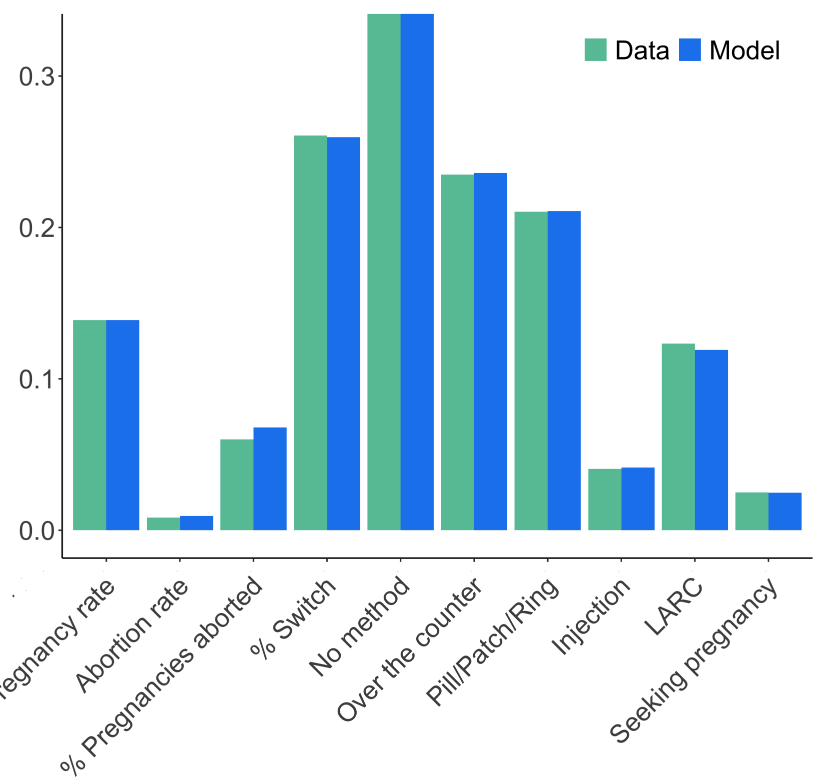
Note: These plots show the coefficients and 95% confidence intervals from running specification 3.1 using only Wisconsin clinics within 320km of the nearest out-of-state clinic for the 'Close' group or farther than 320km for the 'Far' group. Standard errors are clustered at the health center level.

Figure 7: Switches to Other Methods



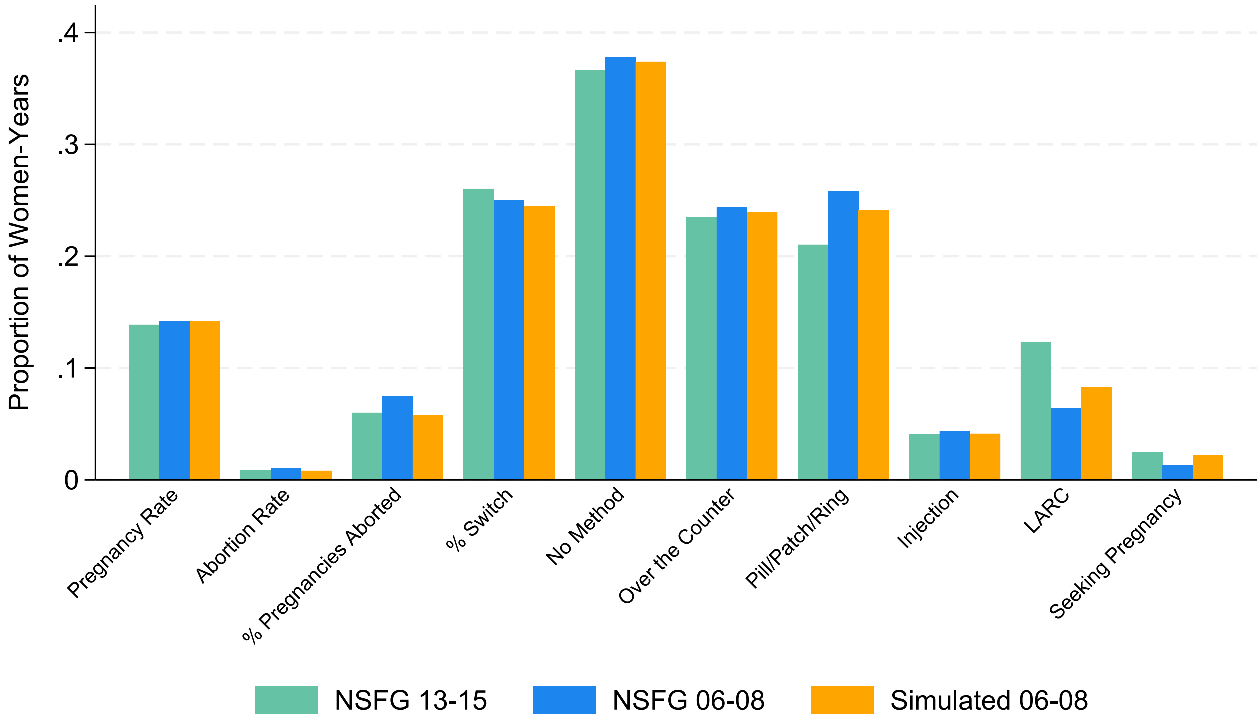
Note: This plot shows coefficients and 95% confidence intervals from running specification 3.2 on the full sample for the window around the 2016 presidential election. Standard errors are clustered by health center.

Figure 8: Model Fit



Note: This figure compares the moments observed in the data (green) with the moments simulated by our model (blue). The top panel tabulates the pregnancy rate per visit, abortion rate per visit, percent of pregnancies that are aborted, rate of method switches, and use rates for various contraceptives.

Figure 9: Validation Exercise: NSFG 2006-08 Fit



Note: This figure compares the moments observed in the NSFG 2013-15 data we fit the model to, the moment observed in the NSFG 2006-08 data, and the moments simulated by our model using starting values from the NSFG 2006-08. The panel tabulates the pregnancy rate per visit, abortion rate per visit, percent of pregnancies that are aborted, rate of method switches, and use rates for various contraceptives.

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A Online Appendix

A.1 Model Appendix

A.1.1 Model Solution

To begin, we need to make some assumptions about the agent's beliefs about the distribution of shocks. First, we will assume that the two taste shocks are IID across individuals and time periods and are drawn from Type I EV distributions where the scale is normalized to 1. This gives us a nicely simplified model similar to a nested Type I EV distribution, resulting in a closed form for both the continuation values used in the model solution and the likelihoods in our estimation. We will assume that the three uncertain states of the world are draws from a uniform distribution in which an agent is in the 'good' state of the world if their draw is lower than some threshold value. For contraception and abortion, these are constant thresholds π_C and π_A to be estimated in the model. For pregnancy, we define the 'good' state as the non-pregnant state and the threshold value is $1 - \pi_j$, where π_j is the failure rate of the contraceptive method chosen in the previous period.

The final decision of the second period is a choice of contraception. Since $V_3 = 0$ by construction, the agent is choosing the j_2 which solves

$$j_2 = argmax \left[U_{ij2} + \varepsilon_{i2}^{Cj}\right] \quad s.t. \quad U_{ij2} = \beta_1 \text{price}_j^{ins} + \theta_j' X_{i2} + (\beta_2)\,\mathbb{1}(j_2 \neq j_1)$$

Using the functional form assumptions about the structure of ε_{i2}^{Cj}, the probability that a woman chooses method $\hat{j}$ is given by

$$Pr(j_2 = \hat{j}) = \frac{exp\left(\beta_1 \text{price}_{\hat{j}}^{ins} + \theta_{\hat{j}}' X_{i2} + (\beta_2)\,\mathbb{1}(\hat{j} \neq j_1)\right)}{\sum_{s \in J} exp\left(\beta_1 \text{price}_s^{ins} + \theta_s' X_{i2} + (\beta_2)\,\mathbb{1}(s \neq j_1)\right)}$$

The expected value of the second period contraception choice prior to observing ε_{i2}^{Cj} is:

$$VF_2^{[C,NC]}(j_1, P_2, X_2) = \log \sum_{j=1}^{5} exp\big[U_{ij2}\big]$$

where the value differs depending on the insurance state $[C, NC]$ where C indicates insurance does cover contraception and NC indicates contraception is not covered.

Moving backwards, at the start of period before realizing the contraceptive decision, there are three possible states that the women enters period 2, resulting in three distinct expected continuation values.

First, if a woman is not pregnant: $F_{i2} = 0$ and

$$\mathbb{E}V(j_1, P_2 = 0, X) = \pi_c VF_2^C(A_2 = 0) + (1 - \pi_c)VF_2^{NC}(A_2 = 0)$$

Because we allow contraceptive non-pecuniary value to vary based on whether the woman got an abortion in the past year, the value function is a function of the abortion choice – which in this case is zero by default.

Second, if a woman is pregnant and in the high-cost state, under our assumption that $\zeta_A^{HC} = \infty$, they do not have the option of getting an in-state abortion and they receive $F_{i2} = \gamma_1 + \gamma_2 \cdot age_{it}$. This results in the following expected continuation value in the high-cost state:

$$\mathbb{E}V_B(j_1, P_2 = 1, X) = \big(\gamma_1 + \gamma_2 \cdot age_{it}\big) + \pi_c VF_2^C(A_2 = 0) + (1 - \pi_c)VF_2^{NC}(A_2 = 0)$$

Lastly, if a woman is pregnant and in the low-cost abortion state, they decide whether or not to get an abortion. The probability they get an abortion is:

$$\Pr(A_{i2} = 1) = \frac{exp\big(\zeta + \beta_1 \text{price}_A) + \pi_c VF_2^C(A_2{=}1) + (1-\pi_c)VF_2^{NC}(A_2{=}1)\big)}{exp\big(\zeta' X_{it} + \beta_1 \text{price}_A + \pi_c VF_2^C(A_2{=}1) + (1-\pi_c)VF_2^{NC}(A_2{=}1)\big) + exp\big(\pi_c VF_2^C(A_2{=}0) + (1-\pi_c)VF_2^{NC}(A_2{=}0)\big)}$$

Notice that the value of the outside option drops out of the expression, demonstrating that the cost of pregnancy in the model is primarily identified not by the decision to carry the pregnancy to term but by the decision to choose a more effective contraceptive to avoid a pregnancy. This results in the following expected continuation value in the low-cost state:

$$\begin{aligned}\mathbb{E}V_G(j_1, P_2 = 1, X) = \log\Big[&\exp\big(\gamma_1 + \gamma_2 \cdot age_{it} + \zeta' X_{it} + \beta_1 \text{price}_A + \pi_c VF_2^C(A = 1) + (1 - \pi_c)VF_2^{NC}(A = 1)\big) \\ &+ \exp\big(\gamma_1 + \gamma_2 \cdot age_{it} + \pi_c VF_2^C(A = 0) + (1 - \pi_c)VF_2^{NC}(A = 0)\big)\Big]\end{aligned}$$

We now can move back to the first period decision of contraception and be more explicit about how the agent takes expectations over pregnancy and policy state shocks. The agent's decision is:

$$\max_{j_1} \quad U_{ij1} + \varepsilon_{i1}^{Cj} + \beta \Bigg[(1-\pi_j) \left(\pi_c VF_2^C(j_1, P_2 = 0) + (1-\pi_c) VF_2^{NC}(j_1, P_2 = 0) \right)$$

$$+\pi_j \Bigg(\pi_A \log \Bigg[\exp\left(\gamma_1 + \gamma_2 \cdot age_{it} + \zeta + \beta_1 \text{price}_A \right) + \pi_c VF_2^C(A = 1) + (1-\pi_c) VF_2^{NC}(A = 1) \Big)$$

$$+ \exp\left(\gamma_1 + \gamma_2 \cdot age_{it} + \pi_c VF_2^C(A = 0) + (1-\pi_c) VF_2^{NC}(A = 0) \right) \Bigg]$$

$$+(1-\pi_A) \left(\gamma_1 + \gamma_2 \cdot age_{it} + \pi_c VF_2^C(A = 0) + (1-\pi_c) VF_2^{NC}(A = 0) \right) \Bigg) \Bigg]$$

The choice of j_1 impacts the continuation value through both the probability of future pregnancy and future switching costs, so that the probability of choosing a given method depends both on the current period flow utility and the utility in future states of the world.

Now consider how a shock to beliefs about future contraceptive policy would change this decision. If the likelihood of the 'good' state for insurance coverage decreases, there is a higher weight on the continuation value VF^{NC}. The no-insurance continuation value VF^{NC} differs most from VF^C for methods which have a large increase in price when not covered by insurance, such as injections or the short-term hormonal methods like the pill, patch, and ring. If the agent chooses one of these methods and ends up in the high-cost state, they will either have to pay the utility cost of switching or the pecuniary cost of the higher price. Thus, a higher weight on the 'bad' state induces women to switch away from a methods with large price differences between the two states. In contrast, if the agent chooses a LARC in period 1 while they are still covered, they will have zero costs in period 2 regardless of which state of the world they are in. This means that the relative value of LARCs goes up when the likelihood of losing insurance coverage increases.

We can also examine the impact of shocks to beliefs about future abortion access on contraceptive choice. Assuming that obtaining an in-state abortion is preferred over the outside option (i.e., $\mathbb{E}V_G > \mathbb{E}V_B$), a decrease in the probability of the low-cost state reduces the utility value from the terms to the right of π_j. Since this reduction is weighted by the likelihood of pregnancy conditional on the contraceptive method, the value of selecting a low efficacy method decreases more compared to a high efficacy method. This encourages women to switch to more effective methods.

A.1.2 Log Likelihood

The joint log likelihood function for contraceptive method choice and abortion for the N women in our sample, each observed for T_i periods, is given by:

$$\log \mathcal{L}(\Omega) = \sum_{i}^{N}\sum_{t}^{T_i}\sum_{j}^{J} 0.139\Big(d(j_{it}) \log\big(Pr(j_{it} = j|S_{it}, A_{it}, \tau = 0)\big) + d^A(1) * p_{it} \log\big(Pr(A_{it} = 1|S_{it}, p_{it} = 1, \tau = 0) + d^A(0) * p_{it} \log\big(Pr(A_{it} = 0|S_{it}, p_{it} = 1, \tau = 0)\big)\Big) + 0.861\Big(d(j_{it}) \log\big(Pr(j_{it} = j|S_{it}, A_{it}, \tau = 1)\big) + d^A(1) * p_{it} \log\big(Pr(A_{it} = 1|S_{it}, p_{it} = 1, \tau = 1) + d^A(0) * p_{it} \log\big(Pr(A_{it} = 0|S_{it}, p_{it} = 1, \tau = 1)\big)\Big)$$

where $d(j_{it})$ and $d^A(A_{it})$ are indicator functions equal to one if, respectively, person i chose j_{it} for their contraceptive method and A_{it} for their abortion decision in period t. p_{it} is an indicator equal to one if person i was pregnant in period t (note that if a person was not pregnant, the abortion choice falls out and their likelihood is only the probability that they chose a given contraceptive method). τ is an indicator for the women's unobservable insurance coverage type, and we set the likelihood she has insurance but that insurance does not cover contraception to be 0.139. Ω are the set of parameters to be estimated.

A.2 Appendix Tables

Table A-1: Prevalence of Google Search Terms and Switches to LARCs

	Dependent variable: Switch to LARC				
	"Repeal and Replace" (1)	"ACA" (2)	"ACA Birth Control" (3)	"Trump Abortion Executive Order" (4)	"Roe v. Wade" (5)
N searches	74.620***	33.519***	27.677***	41.101***	27.728***
	(21.695)	(12.466)	(7.270)	(11.860)	(9.509)
N searches squared	−42.096***	22.642**	3.745	−11.107	21.168
	(13.081)	(10.789)	(10.007)	(10.567)	(13.569)
N searches cubed	52.629***	−26.465**	19.594***	23.364	−12.111
	(14.662)	(10.456)	(6.827)	(15.609)	(10.265)
Observations	2,816	2,816	2,816	2,816	1,973
R^2	0.797	0.797	0.797	0.797	0.764
Adjusted R^2	0.793	0.793	0.792	0.793	0.758

All specifications are run at the health center-month level on observations from January 2013-August 2018, and include health center and year fixed effects and state-year trends. Standard errors are clustered at the health center level. Search term prevalence is measured on a scale from 0 to 100, with 100 being peak searches for that term. *p<0.1; **p<0.05; ***p<0.01.

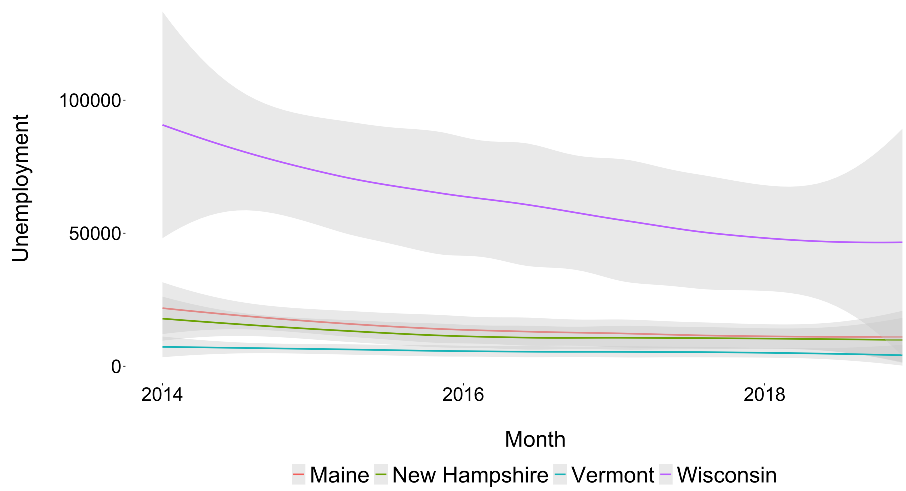
Table A-2: Predictors of pregnancy and abortion

Dependent variable:	Pregnant	Abortion
Seeking pregnancy	0.233***	0.015
	(0.021)	(0.015)
None	0.145***	0.141***
	(0.026)	(0.038)
Over the counter	0.021*	0.027*
	(0.013)	(0.014)
Pill/Patch/Ring	0.001	0.017
	(0.010)	(0.013)
Injection	−0.009	0.025
	(0.012)	(0.015)
LARC	−0.028***	−0.014
	(0.010)	(0.013)
Partner sterilization	−0.015	0.003
	(0.012)	(0.014)
Sterilization	−0.006	0.006
	(0.011)	(0.014)
Age	−1.655**	0.327
	(0.724)	(0.345)
Age sq	1.259***	0.769**
	(0.376)	(0.309)
N past pregnancies	0.209***	0.002
	(0.018)	(0.007)
N past abortions	−0.025	0.251***
	(0.034)	(0.048)
Asian	0.010	0.001
	(0.010)	(0.011)
Black or African American	−0.016*	−0.014*
	(0.009)	(0.008)
White	−0.003	−0.003
	(0.008)	(0.008)
Hispanic	0.002	0.003
	(0.025)	(0.015)
Not Hispanic	0.002	0.006
	(0.024)	(0.015)
Observations	588,595	415,511
R^2	0.501	0.696
Adjusted R^2	0.501	0.696

Note: The sample for abortion begins in 2016, the first year in which data on abortions are available. The omitted contraceptive method category is menopause. The omitted category for race is American Indian/Alaska Native. The omitted category for ethnicity is Declined to specify. Standard errors are clustered at the person level. *p<0.1; **p<0.05; ***p<0.01.

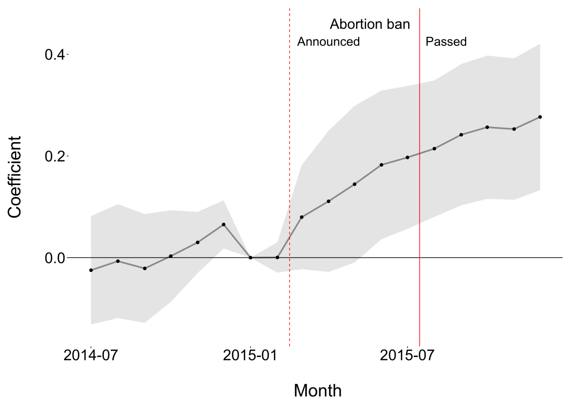
A.3 Appendix Figures

Figure A-1: Trends in unemployment by state

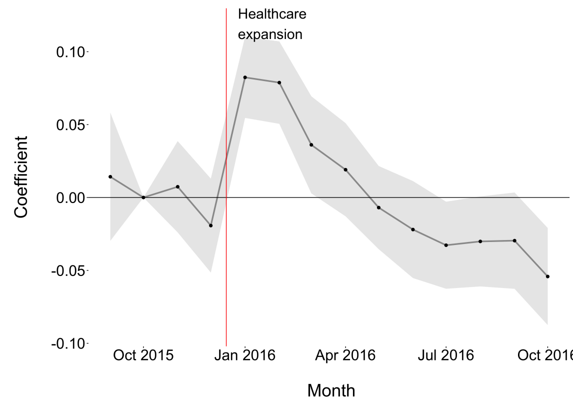


Note: This plot shows the trend in seasonally adjusted unemployment by state during our study period, using data from the US Bureau of Labor Statistics.

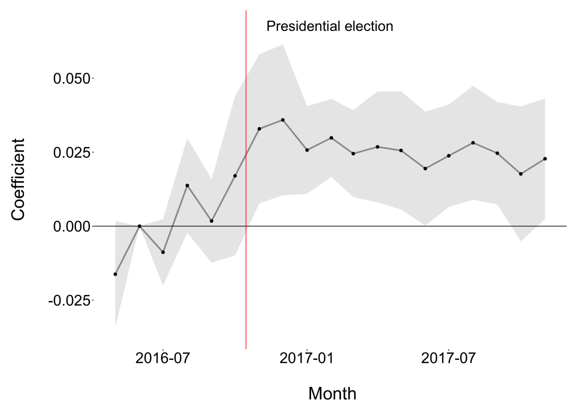
Figure A-2: Changes in switches to higher cost methods



(a) 2015 Wisconsin abortion ban



(b) 2016 NNE healthcare expansion



(c) 2016 presidential election

Note: This plot shows the results from running specification 3.2 for the presidential election and 3.1 for Wisconsin and Northern New England on a dummy variable for switching to a higher cost method during the event windows surrounding each policy shock.

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