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Josephine Jacobs & Maria Stanfors

Abstract

Understanding women's decisions regarding whether and how to use contraception has been the aim of a number of studies. Few have employed economic models that explore the role of future costs in a woman's choice of contraception. In this study we use an economic framework that takes into account contraceptive costs at the time of consumption (i.e. the presence of health insurance) and future costs in the event of contraceptive failure (i.e. expected abortion costs) to explain the choice of contraceptive intensity for women at risk for an unintended pregnancy in the United States. Using a multinomial logit regression, we determine the relative risk of using hormonal and other contraceptive methods versus no method. We use the 1995 and 2002 cycles of the National Survey of Family Growth. The results indicate a positive and significant association between having insurance and using hormonal contraceptives across years. A positive and significant association between using hormonal contraceptives and living in a state where abortion access is restricted confirms that restricted abortion access is associated with more efficient contraceptive use among women in the United States and that women are forward looking in their decision to contracept. Although the years between 1995 and 2002 were interesting from a family planning perspective, there is no difference between years when it comes to this policy effect.

Introduction[1]

Since the 1960s, fertility rates in the developed world have undergone rapid and steady declines. Though a number of factors have contributed to falling fertility rates, the inception the oral contraceptive pill has undoubtedly been an important facilitator of this decline. The pill's direct impact on fertility rates has been of debate, with some arguing that changes in women's fertility intentions have had more impact on fertility decisions than contraceptive technology itself (Pritchett, 1994: 1). However, access to such a reliable contraceptive method without doubt played a pivotal role in allowing women to achieve their fertility intentions.

Goldin and Katz (2002) established the pill as a key mechanism in lowering the cost of long-duration professional education for women and in raising the age at first marriage. The study outlined how highly effective contraceptive methods, such as the pill, can translate into a higher earnings capacity for women due to the ability to avoid unwanted pregnancies and to better time pregnancies to suit a woman's career goals. Along this strand of argument are also the works by Ananat, Gruber & Levine (2007), Ananat & Hungerman (2007), and Bailey (2006). More recently, Miller (2010) has quantified the earnings premium associated with the ability to delay births for American women, finding that for each year of birth delay, women's earnings increase by nine percent. Given these longer term ripple effects, it is not surprising that policy makers are trying to encourage the use of more effective contraceptive methods. Indeed, in 2002, the United States federal and state governments spent an estimated US$1.73 billion on family planning, safe sex, and contraceptive promotion (Martin et. al., 2004).

Nevertheless, the United States has one of the highest rates of unintended (i.e. unwanted and mistimed) pregnancies in the developed world. Based on data from 2002, it is estimated that 49 percent of pregnancies in the United States are unintended. Of these unintended pregnancies, 52 percent and 43 percent respectively occur due to contraception non-use and imperfect contraception use (Trussell & Wynn, 2008: 2). The implications of this are twofold. Firstly, it is

[1] This work has been done within the project *Health Insurance, Abortion Policies, and Women's Choice of Contraception in the United States*, financed by the Centre for Economic Demography. Maria Stanfors also acknowledges financial support from the Swedish Research Council. Christopher Rogers at the CDC/National Center for Health Statistics is acknowledged for research assistance.

apparent that a relatively high proportion of unintended pregnancies are occurring because women are not opting to use contraception. Second, even when women do use contraception, it would appear that the methods chosen are dependent on user compliance and, therefore, less effective than other available methods (Speidel, Harper & Shields, 2009: 197).

A number of studies explore which factors influence a woman's choice to contracept and her subsequent choice of contraception. The majority of these studies employ psychosocial models to predict contraception behavior. Less emphasis has been placed on using economic demand models to analyze how the cost of various alternatives may impact a woman's contraception decisions (Sen, 2006: 315). When economic analyses have been conducted, the focus has primarily been on analyzing how costs at the time of consumption may impact a woman's contraceptive decisions. In particular, a number of studies have examined the impact of health insurance on contraceptive choice. For example, Culwell & Feinglass (2007a), Sonfield et al. (2004), Stolk et al. (2008) all find that prescription contraceptive users are more likely to have insurance.

A far less frequently explored cost component relates to how factors influencing *future* cost aversion may impact contraceptive choices. The impact of state regulated abortion laws, for instance, has been less thoroughly examined, even though abortion and its associated costs become very relevant in the case of contraceptive failure. A handful of studies (e.g. Averett, Rees & Argys, 2002; Levine, 2000, 2003; Sen, 2006) have explored the role that abortion can play in sexual behavior decisions; but there has not been much attempt to incorporate state-level abortion policies into a model of the type of contraception a woman will choose. The time period between 1995 and 2002 was an interesting one from a family planning perspective. During that period, new methods were introduced, but alongside this, there were important family planning policy changes occurring at the state level that, for example, changed abortion access.

The aim of this paper is to analyze the factors that contribute to whether or not a woman at risk for unintended pregnancy chooses to use hormonal contraceptive methods or other less effective contraceptive methods relative to no method. We investigate whether having health insurance and living in a state where abortion access is limited will impact a woman's choice of contraceptive intensity. We also explore whether there is change over the time period 1995-2002 in these respects by estimating a number of models of mandatory delay laws for abortions, parental consent requirements, and Medicaid funding restrictions on contraceptive intensity. Our study addresses a question with potential policy implications: Is restricted abortion access associated with more effective contraceptive use among women in the United States?

The remainder of the paper is organized as follows: Section 2 provides an overview of previous research relating to cost determinants of contraceptive use and outlines the theoretical model. Section 3 describes the data, models, and statistical methods used. Section 4 presents the results that are discussed further in Section 5. Section 6 concludes with a summary and remarks about the implications of our findings.

Previous research

A substantial amount of research has been conducted in an attempt to identify the cost determinants of contraceptive use. A review of the existing literature reveals that there has not been any research looking explicitly at the impact of future costs on contraceptive intensity (i.e. on a woman's choice of contraceptive method). The majority of the research focuses on costs at the time of consumption, and specifically how contraceptive use could be impacted by the presence of health insurance. A number of articles deal with the impact of contraceptive use on abortion. However, studies that look at the impact of abortion access on contraceptive use are far less common and focus on teenage pregnancy. In Table A1, we summarize previous research exploring whether the presence of health insurance or state policies that restrict abortion access were found to have a positive or negative impact on female contraception use, and whether these findings were statistically significant.

Health insurance and contraception

In general, there is a positive association between health insurance and contraception use. Culwell & Feinglass (2007a) finds that American women without health insurance were 30 percent less likely to use oral contraceptives than women with public or private health insurance (cf. Culwell & Feinglass, 2007b). While focusing on insurance type, Frost (2008) finds that Medicaid users were half as likely as women with private insurance to use the pill. This finding is supported by Nearns (2009) who also finds that women with private insurance or Medicaid are three times more likely than uninsured women to use prescription contraceptives. Krings et al. (2008) looks at the determinants of pill use among urban women from New England, finding that users of the pill are more likely to have private insurance than women who identify the male condom as their primary contraceptive choice. In a Dutch study, Stolk et al. (2008) finds that a policy change suspending reimbursement for the pill for women over the age of 21 likely led to three percent fewer women using the pill (p. 401). A shortcoming of these studies revolves around the limited range of contraceptives considered. While comparisons of women using no contraception versus women using the pill were considered in Culwell & Feniglass (2007a) and Nearns (2009), these studies omit women using alternative methods of contraception. Meanwhile, none of the studies aside from Culwell & Feinglass (2007b) consider other highly effective hormonal contraceptive choices, such as IUDs, the patch, or injectables.

Kearney & Levine (2009), Sonfield et al. (2004), Pritchett (1994), and Heavey et. al. (2008), all find that health insurance has a positive, but not significant, impact on contraceptive use. Kearney & Levine (2009) find indirect evidence that health insurance in the United States impacts contraceptive use. They interpret lower teen birth rates for those with health insurance as being the result of women's increased health insurance access. Heavey et. al. (2008) finds that among uninsured American teens, those who could receive free hormonal methods from a family planning clinic were more likely to choose those methods as opposed to barrier methods. Pritchett (1994) looks at a number of developing countries and concludes that health insurance does not have large impacts on contraception use in these countries. For the US, Sonfield et al. (2004) studies the impact of contraceptive mandate laws on oral contraceptive use and finds that states with these mandates can attribute 30 percent of an increase in pill coverage to these mandates. None of the studies cited look directly at the impact of different types of insurance on contraception use.

Abortion policy

We have found no articles that explore whether a woman's choice to use hormonal contraceptives is impacted by the state abortion context. Guldi (2008) assesses whether age-restricted access to abortion and the birth control pill influenced young women's fertility and finds negative associations in these respects. Sen (2003) studies the impact of abortion policies on STD rates and refers to a number of articles looking at the impact of abortion policies on birthrates – both factors being indirect indicators of contraception use; however, she does not find a consistent impact in the literature nor in her study (Sen, 2003: 314). There have also been a handful of studies that use micro data to test the impact of various abortion policies on more general contraception use. The majority of these studies focus on teenage contraception use and parental involvement laws.

Levine (2003) finds a positive and significant impact of state restrictions to teen abortions on contraceptive use. Using two waves of the National Survey of Family Growth (NSFG), Levine finds that parental involvement laws leads to a six percent reduction in unprotected sexual activity for women aged 15 to 18. This effect is largely attributable to the greater reliance on contraception among teens, which is estimated to increase by 16.5 percent in response to a parental involvement law (Levine, 2003: 874). Two other studies find a positive but not statistically significant impact of abortion restrictions on contraception use. Averett et. al. (2002) uses the 1995 wave of the NSFG and finds that parental notification laws have a weak, positive effect on contraception use. These results, however, were not robust to the inclusion of various county level controls. Meanwhile, restrictions on Medicaid funding for abortions and other cost variables were not significant predictors of contraceptive use at last intercourse in this study. Sen (2006) also finds that Medicaid funding restrictions on abortion do not seem to impact the use of contraception among teens in the United States. However, she finds a positive but insignificant impact of parental involvement laws on contraception use. Finally, Levine (2000) provides mixed results indicating that Medicaid funding restrictions and the mandatory waiting period laws had very small positive impacts on contraception use, while parental consent laws had a small negative impact. He does not interpret these results as supporting the hypothesis that abortion laws impact contraception use and attributes the results to the limited variation in the abortion variables (Levine, 2000: 37). As none of the abovementioned studies have considered the impact of abortion access on the choice of contraceptive method or considered a sample of women beyond their teenage years, the current study can contribute to filling this considerable gap in the literature.

Overall, the findings of this literature review would indicate that health insurance is the cost variable that has most consistently been shown to impact women's contraception use. Abortion context has not been as widely explored in the literature. In part, this has been attributed to the cross-sectional nature of the data used, which can impede conclusions about causality if unobservable beliefs and attitudes in a state's population are not being controlled for (Sen, 2006: 319). Given these challenges, the findings surrounding abortion laws' impact on contraception use have not been as robust. The inconsistent findings referred to, nevertheless, provide further motivation for this study.

Theoretical considerations

The decision-making framework surrounding contraceptive choices has been explored extensively from a psychosocial vantage point, and the majority of the literature dealing with contraceptive decision-making employs these frameworks. However, there is a body of work that uses the economic decision-making approach which will be applied in this paper.

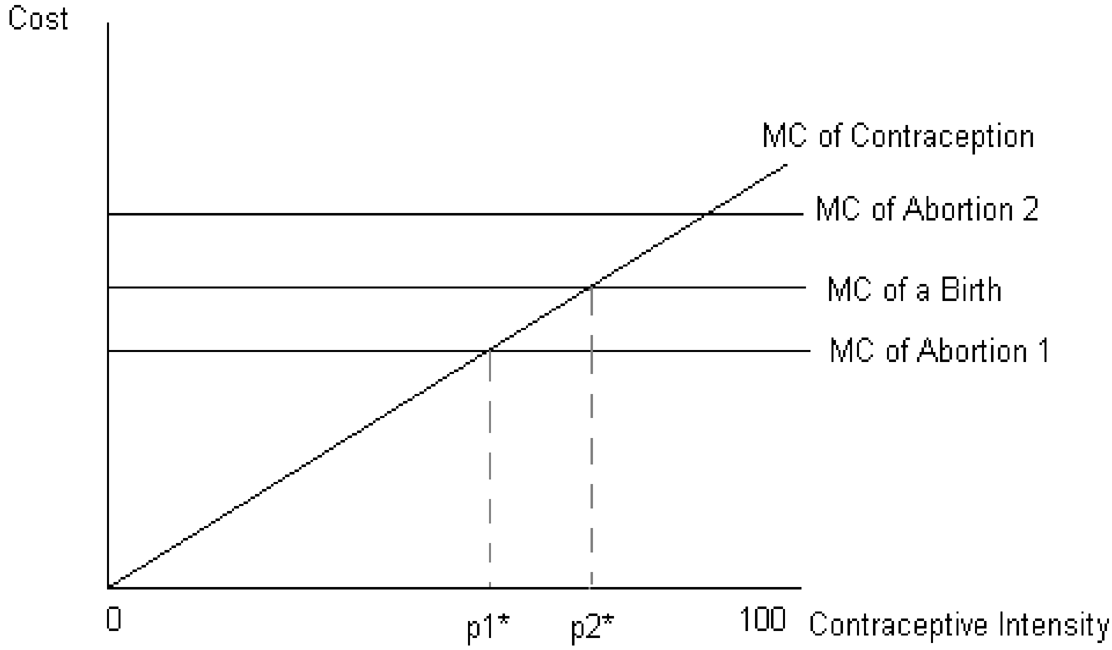
Economic models of fertility behavior have their roots in Gary Becker's New Home Economics model (e.g., Becker 1960). At its simplest, this demand model assumes the people have varying tastes for goods and services including children. Given people's time and income constraints, people will maximize their utility functions by allocating their time and money to the activities that maximize utility. If the cost of an activity – in this context, the costs of childbearing and childrearing – increases, people will demand less of the activity. Two simplifying assumptions within Becker's framework are important to note before these models can be applied to contraceptive behavior. The first is that women take all relevant economic considerations into account. The second is that women can obtain perfect methods of contraception at zero cost (Levine, 2004: 45). Holding the first assumption while relaxing the second – so that contraception is assumed to be costly and imperfect – introduces the possibility of "unwanted" births into fertility models. These can be considered births that impose a cost, as opposed to net benefit, onto the parents (Levine, 2004: 47). Knowing the costs and benefits associated with a birth, a woman can then take measures to reduce the likelihood of pregnancy. However, it is assumed that each additional measure to avoid pregnancy that she takes is increasingly costly.

When it comes to decision to avert a birth, there are certain model assumptions. The model employed in this paper to explain a woman's choice of contraceptive intensity is largely based on the economic model of abortion and contraception outlined in Levine (2004). The model has five assumptions.

The first assumption is that the model represents the choices made by one woman looking forward. Women can use contraception and then have an abortion if contraception fails. A woman can choose alternative combinations of levels of contraception and probabilities of abortions and must decide how much she is willing to spend on that combination in order to avert a birth.[2]

[2] It should be noted that contraception in this context is only considered for its function as a method of birth control. Contraceptive functions with respect to the prevention of sexually transmitted diseases, for instance, are not factored into this model.

Figure 1. Contraceptive intensity as marginal cost (MC) of contraception. Birth and abortion shift.



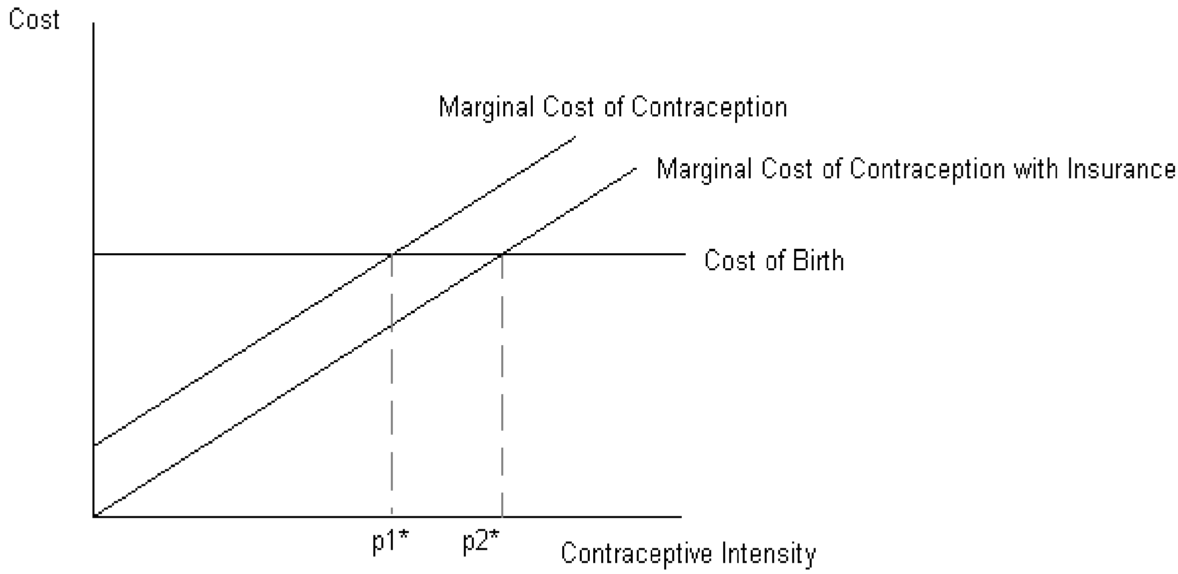
Source: Adapted from Levine, 2004: 53.

The second assumption involves the marginal cost of contraceptive intensity, that is, the additional cost associated with a shift from a less effective contraceptive method to a more effective (i.e. higher intensity) method. The marginal cost can be defined as follows: $MC = \Delta C/\Delta P$, where MC is the marginal cost of a unit reduction in the probability of a pregnancy, ΔC is the change in cost of moving from one method to a higher intensity method, and ΔP represents the change in the probability with which one avoids a pregnancy (Levine, 2004: 50). This model assumes that as the contraceptive intensity increases, so does the marginal cost of contraceptive intensity. In Figure 1, this increasing marginal cost of contraceptive intensity can be seen in the upward slope of the line representing the marginal cost of contraception.

The third assumption involves the marginal cost of abortion. The expected marginal cost of abortion represents the cost of an abortion to a woman multiplied by the probability that she will require the abortion (i.e. the probability of contraceptive failure). The model assumes that as the probability of requiring an abortion to avert a birth decreases, the marginal cost with respect to increasing contraceptive intensity remains constant. This implies that for every percentage reduction in the probability of requiring an abortion, the woman is paying the same additional amount. In Figure 1, this constant marginal cost is captured by the zero-slope marginal cost of abortion lines. The next assumption pertains to the marginal penalty cost for a birth. Births have positive and negative aspects; in the case of an unwanted birth, we assume that the net cost is positive. The marginal cost of a birth is the total cost of the birth to a woman multiplied by the probability of the birth occurring. As with abortion, the model assumes that the marginal cost remains constant, so the woman gets the same benefit for every percentage decrease in the probability of a birth. While this birth cost is a penalty to the woman, it is important to note that the reduction of the penalty represents the expected benefit conferred to a woman by her birth aversion methods (contraception use and abortion). In Figure 1, the constant marginal cost of a birth is represented by the zero-slope birth penalty line. These costs take into account opportunity costs of childbearing and childrearing for a woman, which are predicted to increase as a woman's education and income increase. The final assumption of this model is that the woman is a utility maximizer. To optimize her expected utility, the woman will choose the contraceptive method that maximizes her benefits when taking into consideration all costs and benefits in the model.

Meanwhile, the impact of health insurance on a woman's choice of contraceptive intensity is quite straightforward. Using Figure 2, we can demonstrate the impact of a co-payment-based health insurance plan on the marginal cost of contraception to a woman.

Figure 2. Impact of health insurance on contraceptive intensity.



Source: Adapted from Levine, 2004: 50.

With a plan where the user pays a certain dollar amount per unit of contraception, the presence of health insurance acts to shift the marginal cost of contraception curve downwards relative to a case where there is no health insurance. With this lowered cost, a woman can choose a more expensive and effective method of contraception – that is, she can shift her choice from p1* to p2*.

When it comes to other shift factors, previous research has shown that there are a number of factors that may impact a woman's attitude towards births, abortions, and contraceptive methods. These factors include age, children ever born, race, income, education, labor force participation and attitude towards gender roles, family status, and religiosity. Age[3], the presence of a partner[4], the number of children ever born, and religiosity have been found to have a negative impact on contraceptive use, although in a not entirely consistent manner[5] (Culwell & Feinglass, 2007a; Evans, 2002; Frost, Singh & Finer, 2007; Hansen, 2009; Heck, 1997; Mosher, 2004; Scott, 1998; Raine, Minnis & Padian, 2003). Meanwhile, education and labor force participation can be expected to have a positive impact (cf. Culwell & Feinglass, 2007a; Frost & Daroch, 2008; Luker, 1984; Mosher et al., 2004; Sen, 2006). The impacts of household income (Frost & Daroch, 2008; Frost, Singh & Finer, 2007; Jones, Finer & Singh, 2008), and race (Culwell & Feinglass, 2007a; Frost & Daroch, 2008; Lichter, McLaughlin & Ribar, 1998; Wilcox, 1997; Zabin, Astone & Emerson, 1993) on contraceptive intensity are less clear in the literature.

With respect to the impact of abortion costs on the choice of contraceptive intensity, it is predicted that, holding all shift factors constant, as the cost of an abortion increases, the intensity of the contraceptive choice will increase. With respect to the research question at hand, this implies that as an abortion becomes less accessible for a woman – for instance, through restrictive state abortion laws – she will be more inclined to choose the more effective hormonal contraceptive methods over less effective methods and over no method.

The model also predicts that if a woman is covered by a copayment-based insurance plan, her contraceptive intensity will

[3] Young women are the most likely to use the pill. Mosher (1990), however, finds that between 1982 and 1988, use of oral contraceptives increased significantly among women age 20-34.

[4] Sexually active unmarried women are more likely to use prescription contraceptives according to Culwell & Feinglass (2007). Finer et al. (2005) reports that being married is for many a prerequisite for being able to afford a child.

[5] Sen (2006) for example finds that unmarried sexually active teens who belong to pro-life religious groups are more likely to use contraceptives. This is in line with the reasoning that individuals who do not see terminating an unwanted pregnancy as an option may be more careful when choosing their method of contraception.

increase. With respect to the research question, this implies that if a woman is covered by public or private insurance – both of which cover most hormonal contraceptive methods – she is more likely to choose a hormonal contraceptive method.

Data and methods

The primary data source consists of two waves (V and VI) from the National Survey of Family Growth (NSFG) together with macro-level abortion policy indicators based on data from the Alan Guttmacher Institute and NARAL Pro-Choice America. The NSFG is a nationally representative survey conducted by the Research Triangle Institute for the National Center for Health Statistics (NCHS). The NSFG data was collected from personal interviews, which were conducted in the homes of women aged 15 to 44 in the civilian, non-institutionalized population in the United States[6]. For the 1995 and 2002 cycles, 10,847 and 7,643 women were respectively interviewed. The interview sample was taken from across the United States, with over-samples of Black and Hispanic households. The data is not nationally representative in its original form, but can be made so with the use of sample weights included in the dataset. These weights correct for oversampling, non-response, and non-coverage (Lepkowski et al., 2006: 25).

Our sample is made up of women identified as being at risk for an unintended pregnancy if they were currently not pregnant, not seeking pregnancy, they or their partners were not sterile (due to natural causes or due to sterilization procedures), and if they had reported heterosexual intercourse in the three months preceding the interview (Nearns, 2008: 106). After limiting the study sample to woman at risk for an unintended pregnancy, the sample size decreased to 4,775 women for the 1995 cycle and to 3,713 women for the 2002 cycle. The most common reason for exclusion from the sample was sterilization (2,950 and 1,540 exclusions) and never sexually active (967 and 780 exclusions).

It should be noted that by creating a sub-sample of sexually active women, there is an implicit assumption that the contraception decision-making process is undertaken only after a woman has made the decision to be sexually active. Sen (2006) notes that there are other studies that have taken this approach to studying contraception behavior (see Hogan, Astone & Kitagawa, 1985). While we acknowledge this as

[6] Details regarding the data collection procedure are available from the U.S. Dept of Health and Human Services, National Center for Health Statistics.

a potential source of bias, we have opted not to employ a Heckman sample selection bias correction approach for this paper. Previous studies that have employed this technique focused on teenage contraception use and were able to find a valid identification restriction for sexual activity in a woman's age since menarche. This was not possible here given the age range of the women in this study. Instead, we assume that the decision to become sexually active is independent of the decision to contracept.

Table 1. Variable summary and description.

Theoretical variable	**Empirical variable**	**Description**
Contraceptive intensity	*Constat*	Categorical variable constructed for those that identified hormonal methods as being their current contraception method, those who identified other methods and those who identified no method.
Age	*Age*	Age as a continuous variable.
Race	*Hispanic, White, Black, Other*	Race dummies for Hispanic, Non-Hispanic White (base category), Non-Hispanic Black, and Non-Hispanic Other respectively.
Presence of a partner	*Partner*	A dummy variable for whether the woman has a husband or is living with a partner vs. does not have a husband or live-in partner.
Family orientation	*Children*	Number of children (number of babies less the ones placed for adoption), as a categorical variable ranging from 0 to 3+.
Religiosity	*Very religious, somewhat religious, not religious*	Dummies for religiosity from frequency of attending religious services: weekly or more, monthly, or never (base category) respectively.
Education (opportunity cost of a birth)	*Education*	Number of years of schooling as a continuous variable.
Employment status (opportunity cost of a birth) but also gender attitudes	*FT, PT, No LFP*	Current labor force status (dummies for full-time, and part-time work versus not employed).
Income	*<$20,000, $20K-39K, $40K-70K, >$70,000*	Total income of individual's family, divided into intervals < US$20,000; US$20,000-40,000; US$40,000-70,000 (base category, or > US$70,000.
Presence of health insurance	*Private ins, Public ins, No ins*	Method of insurance coverage constructed as dummies for public (Medicaid and military); private; and no insurance.
Abortion cost	*State*	State indicator.

Variables

The NSFG questions focus on reproductive health, pregnancy, and childbearing. Demographic information as well as socio-economic indicators on education, income, and labor force participation were also collected. The variables explored in the empirical analysis are motivated by previous research and theoretical considerations presented above. They include a measurement of a woman's contraceptive intensity and factors impacting the relative costs of contraceptives, a birth, and an abortion to a woman.

These include factors such as health insurance, state abortion regulations, and other shift factors like age, race, partnership status, number of children, religiosity, educational attainment, labor force status, and income. Table 1 provides a summary of the variables used in the empirical models, along with a brief description of how they were constructed and what they measure.

Table 2. Effectiveness rates of contraceptive methods after one year of use.

Method	**Typical use**	**Perfect use**
Abstinence (No Sexual Contact)	100.00	100.00
IUD – Mirena	99.90	99.90
Male sterilization (Vasectomy)	99.85	99.90
NuvaRing	92.00	99.70
Evra Patch	92.00	99.70
Birth control Pill	92.00	99.70
Depo Provera	97.00	99.70
Female sterilization (Tubal ligation)	99.50	99.50
IUD - Copper T	99.20	99.40
Male condom	85.00	98.00
Natural family planning	75.00	96.25
Withdrawal	73.00	96.00
Female condom	79.00	95.00
Diaphragm	84.00	94.00
Sponge (Nulliparous Women)	84.00	91.00
Chance	15.00	15.00

Source: Adapted from Trussell & Wynn, 2008: 3.

The dependent variable in the models estimated is c*ontraceptive intensity*, which subdivides women into three groups: those who use hormonal methods of contraception (the pill, injectables, implants, or an intrauterine device[7]); those who use alternative methods (diaphragm, male or female condom, foam, cervical cap, sponge, suppository, jelly or cream, natural family planning, calendar rhythm, withdrawal, etc.), and those who use no method at all (chance). The rationale for this subdivision follows from the theoretical model and research question at hand. As can be seen from Table 2, hormonal methods can be considered the highest intensity contraceptives, with typical use effectiveness rates ranging from 92 to 99.9 percent. These are also typically the most expensive methods and cannot be attained without consulting a physician, which implies a higher cost to the woman. The remaining methods range in effectiveness from 73 to 85 percent with typical use, and these tend to be much less expensive and more easily available than hormonal methods.[8] Finally, no method has a pregnancy prevention effectiveness rate of 15 percent. We believe that, given our intent to determine if women using hormonal methods are different from women using other or no methods, constructing the dependent variable in this way can be justified.

As for the independent variables, most of them are measured by fairly direct proxies. Health insurance status coverage is measured by an indicator variable for the presence of public (Medicaid or military) or private versus no health insurance. We expect women covered by health insurance to be more likely to use hormonal contraceptives than women who are not covered. Abortion accessibility is ascertained through a series of state level indicator variables based on whether there were Medicaid funding restrictions to abortion cases outside the federally mandated rape, incest, or life endangerment requirements within the woman's state of residence in 1995 and 2002.[9] In total, 18 states had wider abortion access in 1995 and 2002, though there were two changes in this respect over the time span[10]. When it comes to parental

[7] The NSFG does not differentiate between hormonal and non-hormonal IUDs. However, as the effectiveness rates (99.9% and 99.2%) and implantation process for both methods are very similar, we categorize all IUDs as hormonal methods.

[8] It should be noted that while most of these methods can be obtained over the counter in the United States, the cervical cap and diaphragm require a health care professional for implantation. The cost and effectiveness, however, are still comparatively lower than hormonal techniques.

[9] A state was deemed to have the restriction in place only if it was judged to be constitutional and enforceable. The construction of this variable was based on information from Levine (1996), Solloman (1997), and NARAL Pro-Choice America (2011).

[10] One was Arizona which expanded abortion access, and another was Idaho which introduced Medicaid funding restrictions.

involvement laws, 22 states did not have parental consent laws, though six states introduced that law between 1995 and 2002.[11] All in all, fewer states had enacted so called mandatory delay laws that also restrict abortion access. During the period 1995-2002, seven states changed in this respect, all introducing mandatory delay laws except for Ohio[12]. A summary of these changes and indicators of abortion access by state can be found in Table A2. In relation to our main question and hypotheses, we expect that relative to women in states with wider abortion access, women in states with restricted abortion access would choose higher contraceptive intensities.

Table 3 provides a brief descriptive overview of the data sample, broken down by year. We provide the weighted proportion of the population exhibiting each trait and the weighted mean values for continuous variables, the linearized standard error, and the unweighted number of observations. For the 1995 data, we have complete information for 4,771 women, as frequency of religious service attendance could not be ascertained for four individuals. Overall, we find that the majority of the women in this sample are contraceptive users, with a slightly higher proportion using hormonal contraceptives (45%) as opposed to other methods (43%). Most women have private insurance (74%), with only 13% of women not indicating insurance coverage. We also find that the majority of women in this sample (57%) live in states where there are Medicaid funding restrictions, and close to half (45%) in states where there are parental consent laws. Only 15% of the sample is subject to mandatory delay laws.

The 2002 sample is smaller, with a total of 3,713 women at risk for an unintended pregnancy. Insurance status and religiosity could not be ascertained for 19 and 4 women respectively. State of residence was not indicated for 158 individuals, which implies that state-level abortion law context could also not be determined for these women.[13] As a result, the sample decreases to 3,532 women.

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[11] These states were Arizona, Idaho, Iowa, Tennessee, Texas, and Virginia.

[12] Whereas Ohio temporarily withdrew the mandatory delay laws through an injunction from 1998-2005, the other states (i.e. Alabama, Arkansas, Kentucky, Michigan, Virginia, and Wisconsin) enacted these laws.

[13] A comparison of the characteristics of women with and without state indicators was conducted to determine if there were substantial differences between these groups. It was found that women without state information were more likely to use non-hormonal contraceptive methods (46% vs. 34%) and less likely to be insured (73% vs. 88%). They were also more likely to be Hispanic, have a partner, have fewer children, be in the lower income bracket, and be labor force non-participants. Despite these differences, our regression results for individual characteristics in the following section demonstrate consistency prior to and following the exclusion of these observations.

Table 3. Descriptive statistics. Means and proportions of variables in regressions.

	1995			2002		
Variables	**N**	**Mean/ Proportion**	**Standard error**	**N**	**Mean/ Proportion**	**Standard error**
Contraceptive method						
Hormonal Methods	2,136	44.99%	0.0077	1,809	48.95%	0.0117
Other Methods	2,059	43.34%	0.0076	1,269	35.24%	0.0103
No Method	580	11.68%	0.0051	635	15.80%	0.0082
Insurance						
Private	3,410	74.25%	0.0073	2,585	73.75%	0.0118
Public	753	12.81%	0.0062	678	15.60%	0.0109
None	612	12.94%	0.0055	450	10.65%	0.0059
Race						
Hispanic	656	10.14%	0.0062	739	13.92%	0.0096
White	2,932	72.54%	0.0093	2,075	67.48%	0.0123
Black	1,035	13.19%	0.0067	699	13.01%	0.0078
Other	152	4.13%	0.0040	200	5.58%	0.0050
Religiosity						
Very	1,412	27.77%	0.0074	1,057	28.54%	0.0129
Medium	2,252	46.84%	0.0083	1,728	47.80%	0.0120
Low	1,107	25.40%	0.0074	923	23.67%	0.0084
Presence of partner						
Yes	2,090	57.58%	0.0080	1,922	57.19%	0.0150
No	2,685	42.42%	0.0080	1,791	42.81%	0.0150
Labor force status						
Full Time	2,115	43.99%	0.0082	1,695	45.24%	0.0121
Part Time	1,244	27.36%	0.0074	856	24.55%	0.0109
No Participation	1,416	28.65%	0.0073	1,162	30.21%	0.0107
Household income						
<$20,000	1,239	23.24%	0.0073	1,046	24.79%	0.0118
$20-$40,000	1,425	30.13%	0.0065	1,119	28.62%	0.0110
$40-$70,000	1,317	28.78%	0.0078	950	27.61%	0.0110
>$70,000	794	17.84%	0.0072	598	18.98%	0.0086
Age	4,775	28.60	0.1220	3,691	28.63	0.1920
Years of education	4,775	13.27	0.0506	3,691	13.44	0.0704
Children ever born						
0	1,948	45.95%	0.0094	1,661	45.35%	0.0152
1	1,175	22.97%	0.0071	922	23.06%	0.0097
2	1,072	20.68%	0.0068	716	19.57%	0.0090
3 or more	580	10.40%	0.0047	414	12.02%	0.0089
Restrictive abortion laws						
Delay Law	4,775	15.35%	0.0175	3532	25.87%	0.0122
Parental Consent Law	4,775	45.13%	0.0207	3532	60.64%	0.0154
Medicaid Restriction	4,775	57.04%	0.0196	3532	63.45%	0.0138

Source: National Survey of Family Growth 1995 and 2002.

In the 2002 sample, we note a slightly higher rate of hormonal contraceptive users (49%) and women using no method (16%) than in the 1995 sample. The proportion of women with insurance is comparable, though there is a slight shift towards public insurance (16%) and away from no insurance (11%). There is also a marked increase in the proportion of women who are exposed to restrictive abortion laws, with 10, 15, and 6 percentage point increases in women living in states with mandatory delay laws, parental consent laws, and Medicaid funding restrictions.

Across the two samples, the racial composition changed slightly with an increase in the proportion Hispanic and a decreased proportion of White women. The degree of religiosity remained stable, with most women identifying medium service attendance (around once a month). Across both years, around 57% of women had a partner, and approximately 45% indicated full time labor force participation, versus around 30% indicating no participation in both years. The proportion of women in each income category also remained stable, with a fairly even distribution across categories. The mean age (28.6 years) and years of education (13) also remained stable. Finally, the proportion of women with zero, one, two, or three or more children ever born was consistent across the years.

Empirical strategy

In the absence of panel data, where the same individuals can be followed through time, we study differences in women's contraceptive intensity to get an idea of what affects their choice and how this has changed over time, from 1995 to 2002. The statistical models employed are logistic regressions. The logistic model estimates the effects of various determinants on the transformed probability of contraceptive status. The multiple-choice setting of hormonal contraceptives versus other methods or no method leads to the set up of a multinomial logit model that applies individual-specific data and state identifiers (Greene, 1993: chapter 21). In the multinomial logit model, a set of coefficients corresponding to each outcome category (*y)* is estimated.

The multinomial logit model can be written as:

$$Pr\ (y_i=j) = exp\ \{x_i'\beta_j\}/1+ exp\{x_i'\beta_2\}+\ldots + exp\{x_i'\beta_M\},\ j = 1,2,\ldots M,$$

where $Pr\ (y_i=j)$ denotes the probability that an individual will select alternative j.

Slope coefficients and an intercept can be calculated for all but one of the alternatives (i.e. the base category) with the multinomial logit model. In this model, a positive β coefficient implies that people attach positive utility to the corresponding characteristic (Verbeek, 2008: 222). One important feature of the multinomial logit model revolves around its error term, ε_i. The error terms in a multinomial logit model are assumed to be independent across observations and identically distributed (IID).[14] As with other maximum likelihood estimation techniques, the estimators from a multinomial logistic model are not considered unbiased; however, they have large sample properties of consistency, normality, and efficiency (Dow & Endersby, 2004: 10).

The IID property also forces an assumption known as the independence of irrelevant alternatives (IIA) (Kropko, 2008: 2). This property stipulates that among the alternatives, the relative odds of selecting between two alternatives should be independent of the number of alternatives (Dow & Endersby, 2004: 109). That is, if one of the alternatives was removed or another alternative was added, the probability of selecting a given alternative would not change. To determine whether our model met this criterion, a modified version of the Hausman test was conducted, comparing the estimation results before and after the collapse of the contraceptive intensity variable into two categories.[15] The results of this test can be found in Table A3. These results indicate that the null hypothesis of misspecification can be rejected. If there is uncertainty about meeting the IIA property, then alternative models that waive the IIA assumption – such as the multinomial probit model – should be considered (Verbeek, 2008: 223). To further substantiate our method, we compared the marginal effects from our multinomial logit regressions to the marginal effects from identical multinomial probit models. As the marginal effects from both of these models were highly similar, we decided that a multinomial logit model would be employed, not least for computational and interpretation reasons.

Our empirical model is a model of the optional outcomes of contraceptive status (*Constat*), i.e. using hormonal contraceptives versus other methods or no method at all for a woman (i). The model contains a set of explanatory variables, including individual characteristics, insurance coverage, indicators of state-level abortion access, and state fixed effects.

[14] The IID assumption is satisfied when a simple random sample has been used. In the case of complex survey data, however, the IID assumption is not satisfied because the survey weights are already specified (Pitblado, 2009: 4).

[15] Because we have modified the estimation process with survey weights, our estimators are not fully efficient, which is a requirement for a Hausman test. As such, a modified version of the Hausman test was conducted using seemingly unrelated estimation techniques.

The model is specified as follows:

$$Constat_{is} = \beta_1\mathbf{X}_i + \beta_2\,Insurance_i + \beta_3\mathbf{Z}_s + \beta_4\mathrm{G}_{is} + \varepsilon_{is}$$

where **X** is a vector of individual characteristics; *Insurance* denotes if the individual is covered by health insurance; **Z** is a vector of state policies with respect to abortion access; and G is the unobserved group fixed effect for individuals living in the same state (*s)*.[16]

First, the model is estimated for each of the years 1995 and 2002. Due to the use of complex sample survey data with over-samplings of certain population segments, the statistical estimation technique require the use of weights to properly compute regression coefficients. The sampling weights can be thought of as the number of women in a given population that a woman represents (Lepkowski et al., 2006: 3). Further adjustments were also required for the estimation of standard errors.[17] As such, estimation techniques that accounted for stratification, clustering, and weighting were integrated using pre-estimation commands. The results are presented as relative risks. We use the relative risk ratio of the first two contraceptive choice alternatives, *Hormonal* and *Other method*, compared to the base category of *No Method*. The relative risk ratio will indicate how the probability of choosing a given alternative relative to the base category changes if the independent variable is increased by one unit. In our case, it is actually likely that a woman would decide upon a relative contraceptive intensity by comparing the different alternatives available to her. Furthermore, a base category of *No Method* is likely to factor into her decision making process, as it represents an extreme alternative in terms of cost and effectiveness with which a woman is likely to compare all her alternatives.

To calculate the relative risk ratios, we would first take the probability of a certain outcome for an individual (Spermann, 2008):

$$P(y_i=j)=p_{ij}$$

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[16] State fixed effects were employed in these models. However, certain states had limited observations, and so were combined with near-by states. These combined groups included North Dakota, South Dakota, and Nebraska; Rhode Island, Main, Vermont, New Hampshire, Massachusetts, and Delaware; Idaho, Wyoming, and Montana; and Arkansas and Mississippi.

[17] Because standard software treats data as though the sample was selected with simple and random sampling methods, standard errors will be underestimated if estimated without accounting for the complex sample design. This underestimation would result in inflated test statistics that overstated coefficient significance.

The relative risk ratio would be:

$exp(\beta_j)= (p_{ij}`/p_{i0}`)/(p_{ij}/p_{i0})$, where $p_{ij}/p_{i0}=exp(x_{ij}\beta_j)$ and $(p_{ij}`/p_{i0}`)=exp((x_{ij}+1)\beta_j)$.

Then, the two waves are combined, and models taking into account changes with respect to abortion access across states and over time are estimated.[18] The impact of individual characteristics is assessed with and without state fixed effects. By including a time trend we take into consideration that trends may be changing over time. For example, Mosher et al. (2004) reports that the share of sexually active women not using contraceptives is increasing. By including interaction terms between abortion policies and time, we are able to assess whether there is an impact of state level policy and if there is change in this impact over time.

Results

Tables 4 and 5 display the multinomial logit estimates of how a number of variables impact the latent level utility of contraceptive intensity, respectively for 1995 and 2002. We include regression results with and without state fixed effects. In Table 6, we summarize the merged regression results that control for time trends and policy changes across years.[19]

For each wave, relative risk ratios were obtained with and without state fixed effects to control for unobservable state-level characteristics. When interpreting the impact of policy, we refer to the estimates with no state fixed effects. When interpreting the impact of various individual characteristics, we refer to the state fixed effects estimates that control for state-specific factors that do not vary over time. The latter models take into consideration that states may differ with respect to factors that are important determinants of contraceptive use which are correlated with state policies but omitted from the model. For example, if a general democratic and liberal attitude, or a progressive social policy climate is positively associated both with wider abortion access and higher contraceptive intensity, the exclusion of these variables may bias the results upwards.

[18] In the pooled regressions, the model is expressed as:

$$\textit{Contraceptive intensity}_{ist} = \beta_1\mathbf{X}_i + \beta_2 \textit{Insurance}_i + \beta_3\mathbf{Z}_{ist} + \beta_4\mathrm{G}_{is} + \beta_5\mathrm{T}_t + \beta_6\,\mathrm{Z}_{ist}\,\mathrm{T}_t + \varepsilon_{ist},$$

[19] We consistently estimated various models for robustness checks. The results are very stable.

From Table 4, we see that for the 1995 wave, there is a positive and statistically significant impact of insurance on the use of hormonal contraceptives, and that these results are robust to the addition of state fixed effects. Women with insurance are 67 percent more likely to use hormonal contraceptives as opposed to no method relative to women without insurance. With respect to abortion policy, it appears that Medicaid funding restrictions on abortion will increase a woman's likelihood of using hormonal contraceptives by 36 percent.[20] It does not appear that mandatory delay laws have a significant impact on contraceptive choice, though it is interesting to note that mandatory delay laws appear to consistently decrease the likelihood of choosing hormonal and other methods of contraception.

For the 2002 wave, there is again a consistent positive impact of insurance coverage on hormonal contraceptive use of around 20 percent; however, this is much smaller than in 1995 and is not statistically significant. The 2002 outcomes indicate a positive impact of mandatory delay law, parental consent laws, and Medicaid funding restrictions on hormonal contraceptives, though again these impacts are statistically insignificant.

With respect to the individual characteristics, having a partner, working full time, and increasing the years of education appear to play a statistically significant role in the choice of contraceptive intensity across both waves, increasing the use of hormonal and non-hormonal contraceptive methods over no method. Household income does not appear to be associated with contraceptive use, net of all factors, in any of the years. The significance of age is inconsistent, though its impact is stable. Age and its squared term are highly significant in 1995, indicating a diminishing impact of age on the likelihood of choosing hormonal contraceptives over the years. However, this finding does not carry over to the 2002 wave. For the 1995 wave, lower religiosity increases the likelihood of hormonal contraceptive use, but has no impact on the use of other contraceptive methods. Net of all other factors, religiosity does not seem to matter for the 2002 estimates.

[20] This effect becomes statistically insignificant once we control for state-level characteristics, which is what we expect since the two are highly correlated.

Table 4. Relative risks from multinomial logit regressions assessing associations between characteristics of women at risk of unintended pregnancy and contraceptive intensity in 1995. [21] ***No method = reference category.*** [22]

	No state fixed effects				State fixed effects			
	Hormonal		**Other methods**		**Hormonal**		**Other methods**	
Variable	RRR	Std. error	RRR	Std. error	RRR	Std. error	RRR	Std. error
Insurance (No)	1.00		1.00		1.00		1.00	
Yes	1.61***	0.26	1.20	0.18	1.67***	0.26	1.19	0.18
Race (White)	1.00		1.00		1.00		1.00	
Hispanic	0.95	0.15	1.02	0.20	1.02	0.18	1.10	0.22
Black	0.82	0.13	0.86	0.13	0.83	0.13	0.83	0.12
Other	1.16	0.36	2.39***	0.76	1.25	0.40	2.69***	0.87
Religious (Very)	1.00		1.00		1.00		1.00	
Medium	1.36**	0.17	1.19	0.14	1.41***	0.19	1.18	0.14
Not religious	1.28*	0.18	1.20	0.17	1.35**	0.20	1.22	0.18
Partner (No)	1.00		1.00		1.00		1.00	
Partner present	1.64***	0.25	1.56***	0.22	1.60***	0.25	1.53***	0.23
Labor force participation (Not)	1.00		1.00		1.00		1.00	
Full-time	1.37**	0.20	0.98	0.15	1.36**	0.21	0.97	0.15
Part-time	1.39**	0.19	1.22	0.17	1.39**	0.19	1.19	0.17
Income (<$20K)	1.00		1.00		1.00		1.00	
$20-$39K	0.91	0.13	0.99	0.16	0.92	0.14	1.00	0.17
$40-$70K	0.90	0.16	1.14	0.21	0.93	0.17	1.15	0.22
>$70K	0.87	0.16	1.22	0.25	0.95	0.18	1.25	0.27
Age	1.44***	0.09	1.17***	0.07	1.45***	0.09	1.17***	0.07
Age squared	0.99***	0.00	1.00***	0.00	0.99***	0.00	1.00***	0.00
Years of education	1.13***	0.03	1.15***	0.03	1.13***	0.03	1.16***	0.03

[21] Results are estimated using the using the Huber-White sandwich estimator to correct for heteroskedasticity.

[22] It should be noted that while pseudo R-squared values can normally be calculated for multinomial logit regressions, this calculation is not possible when survey weights have been applied to the estimation. This stems from the fact that survey data is not independently and identically distributed. The pseudo R-square depends upon the calculation of likelihood ratios, which require the IID property to be met. In its absence, an F-test is conducted, the null hypothesis of which is: all of the slope parameters are jointly equal to zero. The null hypothesis is rejected (p=0.00) for the regression outputs without state fixed effects. However, for models with state fixed effects, an F-statistic could not be calculated due to limited degrees of freedom.

Table 4. Continued								
	No state fixed effects				**State fixed effects**			
	Hormonal		**Other methods**		**Hormonal**		**Other methods**	
Children born (0)	1.00		1.00		1.00		1.00	
One child	1.42**	0.23	1.36*	0.22	1.46**	0.24	1.38*	0.23
Two children	1.51**	0.29	1.77***	0.30	1.54**	0.29	1.82***	0.31
Three or more children	1.41	0.32	1.67**	0.38	1.49*	0.34	1.75**	0.41
Delay law	0.82	0.14	0.88	0.16				
Parental consent law	1.07	0.14	0.98	0.14				
Medicaid restriction	1.36**	0.16	0.96	0.12				
	N= 4,771				N= 4,771			

Note: Reference categories in parentheses.
* $p < .10$, ** $p < .05$, *** $p < .01$.
Source: National Survey of Family Growth 1995 and 2002.

Having any number of children relative to being childless is highly significant in the 1995 regressions and impacts the use of both hormonal and other contraceptive methods. For 2002, however, it only has a statistically significant impact on women's choice to use non-hormonal contraceptive methods. Finally, the results indicate that race is not very important in 1995, but more so in 2002 with Blacks being consistently less likely to contracept and non-Hispanic Others being significantly less likely to use hormonal contraceptive relative to no methods.

Our main concern is to assess the impacts of health insurance and access to abortion on women's decision on what contraceptive to use and how this changed between 1995 and 2002. Merged regressions of the two waves allow us to assess whether the impact of policy variables change across the years. We introduce a survey year dummy to measure any time trend, acknowledging that trends may change between 1995 and 2002. The results of these regressions are outlined in Table 6. The first thing to note is that there is a negative time trend, both for hormonal contraceptives versus no method and for other methods over no method. This is to be related to the overall increase of about four percentage points when it comes to the use of hormonal contraceptives. Obviously, it is important to adjust for various demographic, socio-economic, and policy related variables that may be important determinants of this.

Table 5. Relative risks from multinomial logit regressions assessing associations between characteristics of women at risk of unintended pregnancy and contraceptive intensity in 2002.[23] *No method = reference category.*

	No state fixed effects				State fixed effects			
	Hormonal		**Other methods**		**Hormonal**		**Other methods**	
Variable	RRR	Std. error	RRR	Std. error	RRR	Std. error	RRR	Std. error
Insurance (No)	1.00		1.00		1.00		1.00	
Yes	1.26	0.23	0.84	0.15	1.20	0.23	0.81	0.15
Race (White)	1.00		1.00		1.00		1.00	
Hispanic	0.86	0.18	0.98	0.19	0.92	0.20	1.06	0.21
Black	0.57***	0.11	0.73*	0.13	0.63**	0.12	0.77	0.13
Other	0.43***	0.12	1.03	0.26	0.45***	0.13	1.08	0.29
Religious (Very)	1.00		1.00		1.00		1.00	
Medium	1.04	0.15	1.16	0.17	1.01	0.15	1.19	0.17
Not religious	1.02	0.16	1.18	0.20	1.06	0.17	1.31	0.22
Partner (No)	1.00		1.00		1.00		1.00	
Partner present	1.50**	0.24	1.84***	0.26	1.47**	0.24	1.82***	0.28
Labor force participation (Not)	1.00		1.00		1.00		1.00	
Full-time	1.34**	0.19	1.16	0.15	1.33*	0.19	1.15	0.16
Part-time	1.28	0.20	1.25	0.20	1.24	0.22	1.23	0.21
Income (<$20K)	1.00		1.00		1.00		1.00	
$20-$39K	1.16	0.22	1.45**	0.27	1.27	0.25	1.59**	0.31
$40-$70K	1.27	0.30	1.33	0.30	1.44	0.34	1.50*	0.34
>$70K	1.11	0.31	1.16	0.30	1.21	0.34	1.36	0.35
Age	1.05	0.08	1.03	0.08	1.05	0.08	1.01	0.07
Age squared	1.00*	0.00	1.00	0.00	1.00*	0.00	1.00	0.00
Years of education	1.12***	0.03	1.09***	0.03	1.12***	0.03	1.08***	0.03
Children born (0)	1.00		1.00	1.00	1.00		1.00	
One child	0.96	0.17	1.26	0.22	0.99	0.17	1.41*	0.25
Two children	1.26	0.27	1.78**	0.41	1.33	0.29	1.94***	0.46
Three or more children	1.05	0.24	1.42	0.36	1.15	0.28	1.66*	0.45
Delay law	1.16	0.24	1.01	0.22				
Parental consent law	1.01	0.17	0.99	0.19				
Medicaid restriction	1.07	0.16	0.99	0.18				
	N=3,532				N=3,532			

Note: Reference categories in parentheses.
* $p < .10$, ** $p < .05$, *** $p < .01$.
Source: National Survey of Family Growth 1995 and 2002.

[23] Results are estimated using the using the Huber-White sandwich estimator to correct for heteroskedasticity.

The results of the merged regressions indicate that, after controlling for various factors, insurance coverage has a consistently positive and statistically significant impact on the use of hormonal contraceptives. Relative to women with no insurance coverage, insured women are 42 percent more likely to use hormonal contraceptives versus no method. We also find that Medicaid funding restrictions on abortion have a positive and statistically significant impact on the use of hormonal contraceptives. The presence of abortion restrictions increases the likelihood of their use by 22 percent, all other factors kept constant. All the individual characteristics and the time trend render highly robust results, with or without state fixed effects indicating that the average variation is the same across states. However, as with the individual waves, once we control for state level factors, the impact of all abortion policies on hormonal contraceptive use becomes statistically insignificant.

Table 6. Relative risks from multinomial logit regressions assessing associations between characteristics of women at risk of unintended pregnancy and contraceptive intensity for merged regressions.[24] No method = reference category.

	Policy effects				**State fixed effects**				**Policy*time effects**			
	Hormonal		**Other methods**		**Hormonal**		**Other methods**		**Hormonal**		**Other methods**	
Variable	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**
Insurance (No)	1.00		1.00		1.00		1.00		1.00		1.00	
Yes	1.44***	0.18	1.00	0.12	1.42***	0.18	0.99	0.12	1.43***	0.17	1.00	0.14
Race(White)	1.00		1.00		1.00		1.00		1.00		1.00	
Hispanic	0.88	0.12	1.01	0.14	0.94	0.14	1.07	0.15	0.88	0.13	1.01	0.14
Black	0.66***	0.09	0.78**	0.10	0.70***	0.09	0.80**	0.10	0.66***	0.09	0.78**	0.10
Other	0.57***	0.12	1.30	0.26	0.58**	0.13	1.41	0.29	0.57**	0.12	1.30	0.26
Religious (Very)	1.00		1.00		1.00		1.00		1.00		1.00	
Medium	1.16	0.12	1.16	0.11	1.17	0.12	1.17*	0.11	1.16	0.12	1.15	0.11
Not religious	1.11	0.12	1.17	0.13	1.17	0.13	1.26**	0.14	1.11	0.12	1.18	0.14
Partner (No)	1.00		1.00		1.00		1.00		1.00		1.00	
Partner present	1.54***	0.18	1.68***	0.17	1.50***	0.18	1.66***	0.18	1.54***	0.18	1.68***	0.17
Labor force participation (Not)	1.00		1.00		1.00		1.00		1.00		1.00	
Full-time	1.36***	0.14	1.07	0.11	1.33***	0.14	1.07	0.11	1.35***	0.14	1.07	0.10
Part-time	1.34***	0.14	1.25**	0.14	1.32**	0.15	1.25**	0.14	1.33**	0.14	1.25**	0.14
Income (<$20K)	1.00		1.00		1.00		1.00		1.00		1.00	
$20-$39K	1.04	0.13	1.20	0.16	1.08	0.14	1.24*	0.17	1.04	0.13	1.20	0.16
$40-$70K	1.08	0.17	1.24	0.19	1.17	0.19	1.31*	0.20	1.08	0.17	1.23	0.19
>$70K	0.99	0.18	1.19	0.21	1.06	0.19	1.28	0.23	0.99	0.18	1.19	0.21

[24] Results are estimated using the using the Huber-White sandwich estimator to correct for heteroskedasticity.

Table 6. Continued												
	Policy effects				**State fixed effects**				**Policy*time effects**			
	Hormonal		**Other methods**		**Hormonal**		**Other methods**		**Hormonal**		**Other methods**	
Variable	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**	**RRR**	**Std. error**
Age	1.20***	0.06	1.09*	0.05	1.21***	0.06	1.08*	0.05	1.20***	0.06	1.09*	0.05
Age squared	1.00***	0.00	1.00**	0.00	1.00***	0.00	1.00**	0.00	1.00***	0.00	1.00**	0.00
Years of education	1.12***	0.02	1.12***	0.02	1.12***	0.02	1.12***	0.02	1.12***	0.02	1.12***	0.02
Children born (0)	1.00		1.00		1.00		1.00		1.00		1.00	
One child	1.15	0.14	1.28**	0.16	1.17	0.14	1.34**	0.17	1.15	0.14	1.29**	0.16
Two children	1.37**	0.20	1.77***	0.25	1.42**	0.21	1.83***	0.27	1.37**	0.20	1.77***	0.25
Three or more children	1.19	0.20	1.50**	0.26	1.26	0.22	1.61***	0.29	1.19	0.20	1.50***	0.26
Year (2002=1)	0.79***	0.07	0.59***	0.05	0.81**	0.07	0.57***	0.05	0.85	0.11	0.54***	0.07
Delay law	1.03	0.15	0.98	0.15					0.81	0.14	0.88	0.15
Parental consent law	1.01	0.11	0.98	0.11					1.05	0.14	1.00	0.13
Medicaid restriction	1.22**	0.12	0.96	0.10					1.34**	0.16	0.90	0.11
Delay law*year									1.47	0.40	1.13	0.32
Parental consent*year									0.96	0.20	0.96	0.22
Medicaid*year									0.81	0.16	1.16	0.24
	N=8,303				N=8,303				N=8,303			

Note: Reference categories in parentheses.
* $p < .10$, ** $p < .05$, *** $p < .01$.
Source: National Survey of Family Growth 1995 and 2002.

The merged regressions yield robust results for the individual level characteristics, and their impact on contraceptive intensity is in line with our expectations. It should be noted that race comes out more strongly in the merged regressions. When controlling for state level factors, it appears that, relative to White women, being Black or in the non-Hispanic Other category decreases a woman's likelihood of using hormonal contraceptives by 30 percent and 42 percent. Meanwhile, having full time or part time employment increases the likelihood of using hormonal contraceptives versus no method by 33 percent and 32 percent respectively. Part time employment also significantly increases non-hormonal contraceptive use by 25 percent. Having a partner and an additional year of education respectively increase hormonal contraceptive use by 50 percent and 12 percent and non-hormonal use by 66 percent and 12 percent. Finally, we also observe a positive relationship between age and contraception use for both hormonal and non-hormonal methods.

When assessing the policy effects, it is evident from columns 9 to 12 that, when it comes to hormonal contraceptive use, there is a positive and statistically significant effect of Medicaid funding restrictions on abortion in 1995 equivalent to 34 percent. The insignificant interaction term indicates no significantly different or additional effect in 2002; i.e. that there is not any difference in the policy effect across the years, keeping all other factors constant. Thus, restricted abortion access is associated with more efficient contraceptive use among women at risk of an unintended pregnancy.

Discussion

The results suggest that women at risk of an unintended pregnancy having private or public insurance coverage were more likely than uninsured women to use hormonal contraceptives over no method, while insurance did not matter for the use of other methods over no method at all. This is in line with our expectations because insurance dramatically reduces costs of more efficient yet also more expensive contraceptives for the individual woman. The insignificant coefficient in 2002 together with results from merged regressions, however, make us believe that insurance has become less important over the years, given all other factors.

Unadjusted figures indicated that the use of hormonal contraceptives together with non-use increased somewhat between 1995 and 2002, with a concurrent decrease in the use of other methods. However, multivariate regressions that capture the significance of change over the years, while adjusting for a number of individual characteristics and other factors, indicate that women at risk of unintended pregnancy in 2002 were actually about 20 percent less likely to use hormonal contraceptives relative to using no methods than were comparable women in 1995. Apparently other variables included in our model account for this, which may reflect changes in behavior and/or composition. It calls for further investigation, but, nevertheless, it shows the importance of multivariate analysis, and not relying on univariate analyses.

When it comes to the impact of abortion access and whether restrictive abortion policies are associated with more efficient contraceptive use, we find indications that they are. The positive effect of policy does not change across years, which implies that women are forward looking, incorporating not only present but also future costs in the decision of what contraceptive method to use.

Earlier cited studies looking at similar questions – Averett, Rees & Argys (2002), Sen (2006), and Levine (2001, 2003) – all outline insignificant findings for the impact of policy on teenage contraception use, with the exception of parental consent laws for Averett, Rees & Argys (2002) and Levine (2003). These studies largely find that the coefficients are not robust to the addition of state fixed effects. In the present study, we find that when the population being considered is extended beyond teenagers, Medicaid funding restrictions have an impact on contraceptive intensity. While the significance of this finding is not robust to the addition of state fixed effects, unlike previous literature the direction of the impact and relative magnitude remain consistent. Given our insignificant results regarding the impact of policy changes over time, we cannot conclude that the transition to a more restrictive abortion policy within a state will lead to a higher contraceptive intensity.

There may of course be many other processes at work, which we cannot observe. The fact that our results are highly robust irrespective of model and the inclusion of state fixed effects, indicate that what is determining contraceptive intensity on an individual level is not really varying across states. Although states differ when it comes to attitudes regarding family planning and sex, as well as gender roles, family matters, and social progressiveness, it is probably the case that insurance and individual characteristics (i.e. age, education, labor market attachment, and family status) are most important for the individual woman’s choice of contraceptive method, irrespective of context. One example would be that a woman’s concerns about sexually transmitted deceases may affect her choice of contraception and lead her to favor the condom over the pill, but more on an individual level (perhaps through no partner present but multiple sexual contacts) and not particularly on a state-level basis.

The results also indicate that contraceptive intensity is influenced by individual as well as structural factors. The fact that non-White women, especially Black women and women categorized as non-Hispanic Others, are considerably less likely to use hormonal contraceptives indicate that cultural factors, net of religiosity, may be at work in the contraceptive decision-making process. The finding that women with more education are more likely to use hormonal contraceptives than less educated peers is far from surprising, but calls for more research on how education influences women’s health and sexual behavior, and whether it is the same across the educational gradient.

There are several limitations of this study. Firstly, there is an issue of endogeneity, which makes it difficult to separate out the effect of certain state level attributes and policy factors on contraceptive intensity and on each other. Assuming away endogeneity has implications with respect to biasing results, but in the absence of a valid instrument, is difficult to remedy without more robust panel data. There is also concern, as noted in both Sen (2006) and Levine (2003) that limited variation in the state abortion policies makes their impact very difficult to differentiate from the wider state-level context. Further, we see the most variation in the parental consent law, which impacts only a limited subset of our population, and the mandatory delay law, which is predicted to have the weakest effect. This points to a need to learn more about these reforms and how people perceive of them.

With respect to data, the National Survey of Family Growth is limited in itself, and few observations in some states made it necessary to collapse some neighboring states for estimation reasons. In addition, the study design involves potential problems and non-sampling errors such as recall bias, or bias toward providing socially desirable answers, as is present in all survey studies, and could affect the results. And finally, although this analysis is a trend analysis comparing contraceptive use patterns between two time periods, individual respondents were not followed over time, and therefore, this analysis cannot be considered longitudinal in nature. It would be useful to be able to follow the same individuals over time, and also to have information on previous contraceptive failures or side-effects that may affect the choice of contraceptive method.

Concluding remarks

To conclude, insurance coverage is an important factor when a woman chooses a contraceptive method because of its powerful effect on cost at the time of consumption. Hormonal contraceptives are not only more expensive in and of themselves, but are also more costly to obtain since they need a medical examination and a prescription. This should be considered in light of the fact that many women of reproductive age in the United States lack health insurance. It is, of course, important that all women, regardless of insurance status, have equal access to efficient contraceptive methods options, and that they are not hindered to make any decision regarding contraception due to cost reasons. Reducing costs for contraception, through greater insurance coverage of the female population or other kinds of subsidies, is an important step towards increasing the use of more effective contraceptive methods.

The positive impact of restricted abortion access indicates that women are forward looking in their decision making, incorporating not only present but also future costs in their decision of what contraception to use. This finding is important from a policy making perspective. It should not imply that abortion should be restricted in order to encourage more effective contraceptive use, but rather points to the need to understand the broader contraceptive decision making process when designing public health policies and, particularly, reproductive health policies. We should also note that these findings should be interpreted in the wider policy context, as women in states with more restrictive abortion access face much higher abortion or birth costs in the case of contraceptive failures. Given these higher costs, policy makers should also consider the impact that restrictive abortion policies may have on the proportion of women going through with unwanted births and what the downstream effects of these births may be.

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Appendix

Table A1. Overview of previous research findings.

Author	**Year**	**Country**	**Data**	**Dependent variable**	**Method**	**Contra-ception impact**
			Health Insurance			
Culwell & Feinglass	2007 (a)	USA	Behavioral Risk Factor Surveilla-nce Survey	Risk of unintended pregnancy, prescription contraceptive use and insurance status	Logistic regression	+ +
Culwell & Feinglass	2007 (b)	USA	National Survey of Family Growth, 1995, 2002	Choice of contraceptive method (hormonal, other, no method)	Logistic regression	++
Frost, Singh & Finer	2007	USA	Phone survey of 2000 women	Choice of contraception (most effective vs. less effective methods) and consistency of use	Logistic regression	+ +
Heavey et. al.	2008	USA	Patient level data from a family planning clinic	Likelihood of using types of contraception pre and post visit to a family planning clinic	Logistic regression	+
Kearney & Levine	2009	USA	Vital stats, Guttmacher abortion data, 88/95/02 NSFG	Contraceptive use in the past 3 months, births and births by eligible women	Difference-in-difference	+
Krings et al.	2008	USA (Urban New England)	Micro survey data (collected in a RCT)	Use of OC, condom, no contraception	Multi-variable robust Poisson regression	+
Nearns	2009	USA	NSFG 2002	Use of prescription contraceptives (implant, injection, pill, patch, IUD, diaphragm, or cervical cap)	Logistic regression	+ +

Author	Year	Country	Data	Dependent variable	Method	Contra-ception impact
Pritchett	1994	71 LDCs	Country-level macro data	AINC, DTFR, WTFR	OLS multiple regression	+
Sonfield et al.	2004	USA	Survey of insurance providers	Contraceptives covered	Trend comparison between states	+
Stolk et al.	2008	Nether-lands	Micro data on patients using OC	Discontinuation and switching patterns of OC use	Multivariat e regression	+ +
Abortion Policy						
Averett, Rees & Argys	2002	USA	NSFG 1995	Decision to have sex, decision to use contraception at last sexual encounter	Bivariate probit	+
Levine	2000	USA	Youth Risk Behavior Survey and state-level data	Contracepted teen sexual activity	Probit regression	+/-
Levine	2003	USA	NSFG 1988, 1995	Impact on abortions, births, and pregnancies; sexual activity and contraception use	Difference-in-difference	+ +
Sen	2006	USA	NLSY 1997	Frequency of intercourse and non-contracepted intercourse	Zero-inflated negative binomial (count) model	+

Note: ++ and - - indicate statistically significant findings, while + and - indicate that the findings were not statistically significant.

Table A2. Abortion restrictions by state in 1995 and 2002.

	Medicaid funding restrictions		Parental consent laws		Mandatory delay laws	
State	**1995**	**2002**	**1995**	**2002**	**1995**	**2002**
Alabama	Yes	Yes	Yes	Yes	No	Yes
Alaska	No	No	Yes	Yes	No	No
Arizona	Yes	No	No	Yes	No	No
Arkansas	Yes	Yes	Yes	Yes	No	Yes
California	No	No	No	No	No	No
Colorado	Yes	Yes	Yes	Yes	No	No
Connecticut	No	No	No	No	No	No
Delaware	Yes	Yes	Yes	Yes	No	No
Distr of Columbia	No	No	No	No	No	No
Florida	Yes	Yes	No	No	No	No
Georgia	Yes	Yes	Yes	Yes	No	No
Hawaii	No	No	No	No	No	No
Idaho	No	Yes	No	Yes	Yes	Yes
Illinois	No	No	No	No	No	No
Indiana	Yes	Yes	Yes	Yes	No	No
Iowa	Yes	Yes	No	Yes	No	No
Kansas	Yes	Yes	Yes	Yes	Yes	Yes
Kentucky	Yes	Yes	Yes	Yes	No	Yes
Louisiana	Yes	Yes	Yes	Yes	Yes	Yes
Maine	Yes	Yes	Yes	Yes	No	No
Maryland	No	No	Yes	Yes	No	No
Massachusetts	No	No	Yes	Yes	No	No
Michigan	Yes	Yes	Yes	Yes	No	Yes
Minnesota	No	No	Yes	Yes	No	No
Mississippi	Yes	Yes	Yes	Yes	Yes	Yes
Missouri	Yes	Yes	Yes	Yes	No	No
Montana	No	No	No	No	No	No
Nebraska	Yes	Yes	Yes	Yes	Yes	Yes
Nevada	Yes	Yes	No	No	No	No
New Hampshire	Yes	Yes	No	No	No	No
New Jersey	No	No	No	No	No	No
New Mexico	No	No	No	No	No	No
New York	No	No	No	No	No	No
North Carolina	Yes	Yes	Yes	Yes	No	No
North Dakota	Yes	Yes	Yes	Yes	Yes	Yes
Ohio	Yes	Yes	Yes	Yes	Yes	No

	Medicaid funding restrictions		Parental consent laws		Mandatory delay laws	
State	**1995**	**2002**	**1995**	**2002**	**1995**	**2002**
Oklahoma	Yes	Yes	No	No	No	No
Oregon	No	No	No	No	No	No
Pennsylvania	Yes	Yes	Yes	Yes	Yes	Yes
Rhode Island	Yes	Yes	Yes	Yes	No	No
South Carolina	Yes	Yes	Yes	Yes	Yes	Yes
South Dakota	Yes	Yes	Yes	Yes	Yes	Yes
Tennessee	Yes	Yes	No	Yes	No	No
Texas	Yes	Yes	No	Yes	No	No
Utah	Yes	Yes	Yes	Yes	Yes	Yes
Vermont	No	No	No	No	No	No
Virginia	Yes	Yes	No	Yes	No	Yes
Washington	No	No	No	No	No	No
West Virginia	No	No	Yes	Yes	No	No
Wisconsin	Yes	Yes	Yes	Yes	No	Yes
Wyoming	Yes	Yes	Yes	Yes	No	No

Source: Adapted from NARAL Pro-Choice America and the Alan Guttmacher Institute.

Table A3: Test statistics for a modified Hausman test for independence of irrelevant alternatives.

	1995		**2002**	
Omitted	1	2	1	2
F-Stat	12.07	15.8	4.38	5.66
P>F	0	0	0	0
Evidence	Against null	Against null	Against null	Against null

Note: Estimation results for merged (two-category) independent variable = results from estimation results for the three-category independent variable.
Source: National Survey of Family Growth 1995 and 2002.

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