THE IMPACT OF THE AFFORDABLE CARE ACT CONTRACEPTIVE MANDATE ON FERTILITY AND ABORTION RATES

by
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Abstract

Background: There are a variety of public health and social welfare motivations to reduce unintended pregnancies. Despite efforts to address this issue, approximately 45 percent of US pregnancies are unintended. The Affordable Care Act (ACA) contraceptive mandate increased the availability of prescription contraceptives and reduced copayments starting in August 2012. Previously, 30 states had mandates requiring contraceptive coverage but without price reductions comparable to the ACA. Current literature has not determined the effect of the ACA contraceptive mandate on fertility and abortion rates.

Methods: Fixed effects models were used to estimate the impact of the ACA contraceptive mandate on fertility and abortion rates, utilizing NCHS public-use Birth Files from 2007-2017 and CDC Abortion Surveillance Reports from 2008-2015. Models included variables to test the effect of state-specific mandates alone and interacted with the ACA. The fertility and abortion analyses included 50 and 15 regression subpopulations, respectively, allowing modeling by age group, race/ethnicity, or combined. Tests were run for model specification and robustness.

Results: The best fit fertility model estimated a decrease of 4.277 births/1,000 women (95% CI [-6.86, -0.22]) with an additional decrease in fertility of 0.844 births/1,000 women (95% CI [-1.20, -0.49]) in states with mandates, equivalent to a 6.8 and 8.1 percent decrease from the 2012 fertility rates, respectively. This translates to an estimated 299,179 births averted annually. Twenty-nine of the 50 subpopulations also estimated a statistically significant decrease in fertility.

The final abortion model estimated a decrease of 4.677 abortions/1,000 women (95% CI [-6.055, -3.299]) and an additional decrease of 0.877 abortions/1,000 women (95% CI [-1.347, -0.406]) for states with mandates. This estimated decrease represents a 37.1 and 44.1 percent reduction from the mean 2012 abortion rate and translates to roughly 325,219 averted abortions annually. Fourteen of the fifteen regression subpopulations estimated a statistically significant decrease in abortion rates.

Conclusion: The ACA contraceptive mandate decreased fertility and abortion rates for nearly all subpopulations in the analysis, with greater effects for younger and minority populations. Future federal, state, or insurance company policy should ensure free access to prescription contraceptives to improve health outcomes and reduce unintended pregnancy.

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Thank you.

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1.0 Introduction

1.1 Overview and Significance

A variety of public health and social welfare motivations have established a policy rationale for measures to help people avoid unintended pregnancies (Herd, Higgins, Sicinski, & Merkurieva, 2016; Sonfield, Hasstedt, Kavanaugh, & Anderson, 2013; Wendt, Gibbs, Peters, & Hogue, 2012). In the US, the Department of Health and Human Services' Healthy People 2020 objective was to decrease unintended pregnancies by ten percent by the year 2020 (Office of Disease Prevention and Health Promotion, 2011). Despite these efforts, unintended pregnancy rates remain high. Of the approximately 6.1 million pregnancies in the US in 2011, 2.8 million (45 percent) were unintended (Finer & Zolna, 2016), which is among the highest rates in developed countries (Sedgh, Singh, & Hussain, 2014).

Evaluating the impact of healthcare policy measures on unintended pregnancies is important for accountability and efficiency. It is especially important because current spending to avoid unintended pregnancies is already high, with industry experts estimating the size of the US contraceptive market to have been over $5 billion in 2015 (Ugalmugale & Swain, 2017). The financing for contraceptives is divided among insurance companies, the US government, and out of pocket spending by the approximately 61.7 percent of the nearly 61 million women of childbearing age (15-44) in the US who currently use some form of contraception (Daniels, Daugherty, Jones, & Mosher, 2015). There has been an enduring element of family planning policies directed at shifting the cost burden away from individuals. The policies are based on a common-sense idea that lowering contraceptive cost barriers might help reduce unintended pregnancy rates.

The Patient Protection and Affordable Care Act's (ACA) mandate for coverage of preventive health services significantly changed how the healthcare system attempts to help people avoid unintended pregnancies. In March 2010, President Obama signed the ACA, which included a mandate for coverage of preventive health services (Patient Protection and Affordable Care Act, 2010). The mandate was later defined to include all FDA-approved contraception, changing the out-of-pocket cost of all prescription contraceptives to $0 for most private health plans[1] (Preventive care benefits for women, 2020).

Although the contraceptive mandate may be viewed by some as a victory for women's reproductive health, it is politically controversial and many have sought to weaken or remove the mandate entirely (Charo, 2012; Guttmacher Institute, 2015). Both interest in and political action toward "repealing and replacing" or "repairing" the ACA increased throughout the 2016 election cycle and carried into Trump's presidency. After the American Health Care Act (AHCA), introduced by House Republicans to replace the ACA, failed in March 2017, Trump's administration changed strategy, citing the need to protect religious liberty to issue executive orders limiting insurance coverage of contraceptives. Two interim rules were announced in October 2017 (82 FR 47792, 2017;

[1] There are two main exceptions to the ACA contraceptive mandate. First are grandfathered insurance plans, meaning insurance plans that started no later than March 2010 and have continued since that time without substantial benefit changes (Marketplace options for grandfathered health insurance plans, 2020). The second exception is that certain religious employers are able to request exemption from the contraceptive mandate. However, substantial decreases in the total amount paid for contraceptives since the implementation of the ACA contraceptive mandate have been documented, with the percent of women paying zero dollars out of pocket for OCPs increased from 15 percent to 67 percent between 2012 and 2014 (Sonfield, et al., 2014).

82 FR 47838, 2017) followed by final rules in November 2018 (83 FR 57536, 2018; 83 FR 57592, 2018) that relaxed the criteria for gaining religious or moral exemption to providing insurance coverage of contraceptives. The Supreme Court ruled on July 8, 2020 that the Trump administration has the legal authority to issue the final rules, which effectively reduce the amount of contraceptive coverage initially mandated by the ACA (Little Sisters of the Poor v. Pennsylvania, 2020).

The effect of the ACA contraceptive mandate on women's health outcomes would be crucial information to have in current and future policy discussions surrounding contraceptive coverage. It is especially important to determine the effect of the ACA contraceptive mandate requiring zero out-of-pocket costs specifically since economists argue that a zero price of any good decreases the good's perceived value by the consumer. Thus, a zero copayment for contraceptives could lead to higher "sales," but lower rates of adherence (e.g., women could receive automatic shipments of free contraceptives, but not bother to use them).

The effect of the ACA contraceptive mandate on fertility and abortion rates is further complicated because 30 states had already implemented some form of contraceptive mandate when the ACA contraceptive mandate went into full effect in January 2013 (Mulligan, 2015). These state mandates, however, did not have the same reach as the ACA contraceptive mandate for many reasons. First, they only affected women with private insurance. Second, they did not apply to women with employers who self-insured, and this accounts for approximately 60 percent of individuals who secure health insurance through their employer (Guttmacher Institute, 2020). Third they only required contraceptive coverage if the insurance company offered other prescription coverage. Finally, many state mandates still required women to pay a copayment for contraception. In contrast, the ACA expanded the number of women with insurance. This is especially relevant because women with insurance are 30 percent more likely to use prescription contraceptives (Culwell & Feinglass, 2007a). The ACA also required insurance coverage of contraceptives *and* reduced the copayments to $0 for most plans. The greatest absolute decrease in contraceptive costs were for LARCs, which have relatively high upfront costs. Because the ACA expanded the number of people covered and reduced the costs of contraceptives beyond the state mandate, it is reasonable to hypothesize that the introduction of the ACA contraceptive mandate led to modest reductions in fertility in states that had a state contraceptive mandate in place prior to 2013, and larger reductions in fertility in states without a mandate in place before the ACA.

Present scholarship has not yet sufficiently investigated how the ACA contraceptive mandate impacted rates of unintended pregnancies and abortions, the end goals of contraceptive health policy. As I will discuss in Chapter 2, past scholars have primarily investigated the impact of healthcare policy at the state level pre-ACA, where policies sufficiently differed from the ACA as to not be representative, or because scholars have studied other factors related to reproductive health, such as contraceptive usage rates, but not the direct impact of the ACA on unintended pregnancy rates.

This dissertation will improve our understanding of the ACA contraceptive mandate's impact on fertility and abortion rates by estimating the effect of the ACA mandate on all 50 states while also taking into account the 30 state mandates previously in place. Additionally, this work will include stratified models run across multiple subpopulations to help identify effects specific to different segments of the population. This research will be of special importance in advancing our understanding of healthcare policy's effect on historically underinsured and understudied populations, especially low-income and minority women.

In a political climate where the future of the ACA contraceptive mandate is uncertain, it behooves us to fully comprehend the effects of the law on reproductive health in order to present policymakers with a clear-eyed view of how their decisions will impact the Nation's progress to its stated goals for women's health.

1.2 Research Aims

There are two specific aims of this research:

1. Estimate the effect of the ACA contraceptive mandate on *fertility* rates in the US during the 2007 to 2017 period and determine whether this effect differs by age group and race or ethnicity.
2. Estimate the effect of the ACA contraceptive mandate on *abortion* rates in the US during the 2008 to 2016 period and determine whether this effect differs by age group and race or ethnicity.

2.0 Literature Review and Conceptual Framework

2.1 Legislative History of Contraceptives

Because a large part of this study requires interpreting changes in mandates and regulations, a brief legislative history surrounding prescription contraceptives in the US follows.

For nearly 100 years, any medicine or device intended to be used for contraception and even information about contraception were technically banned in the US under both federal and state laws. The 1873 Comstock Act banned the interstate shipping of contraceptives or information about contraceptives and, following the passing of this law, 45 states implemented similar bans of contraceptives within the states. Although inconsistently enforced for the next nine decades, contraceptives first became legal for married couples in the US through the 1965 Supreme Court decision in Griswold v. Connecticut. This was followed by the 1972 Supreme Court decision in Eisenstadt v. Baird, which extended this right to privacy to non-married individuals. Finally, the 1973 decision in Roe v. Wade legalized abortion. Since these three Supreme Court decisions, much of the legislative and legal debate surrounding contraceptives has involved insurance coverage.

By the late 1990s, several women's health advocates, lobbyists, and politicians were trying to gather support for federal legislation involving insurance coverage of contraceptives. The federal legislation first proposed in 1997 was called the Equity in Prescription Insurance and Contraceptive Coverage Act (EPICC). To promote EPICC, members of Congress cited Griswold v. Connecticut, which stated that "Congress should take further steps to ensure that all women have universal access to affordable contraception" (1965). Up until this point, Title X funding, which was established in 1970 to increase access to contraceptives for low-income women, was the only federal policy concerning contraceptive coverage. EPICC was introduced in Congress in 1997, 1999, 2001, 2003, 2005 and 2007 (Kuhn, 2007). After EPICC died in committee the first time it was introduced in 1997, many states in favor of EPICC began adopting state-wide contraceptive mandates, the first being Maryland in 1998 (Kuhn, 2007). See Section 2.1.1 for a more complete discussion of the state-specific mandates.

During the time period when EPICC was being introduced, the Equal Employment Opportunity Commission (EEOC, 2000) and the court decision in Erickson v. Bartell Drug Co. (Saubermann, 2002) found that it was discriminatory for an employer to not include prescription coverage of contraceptives if the health insurance plan covered other prescription drugs. Although many state mandates cited these decisions, the state mandates were limited and weak and many felt there was a need for a law at the federal level to require insurance coverage of contraceptives (Kuhn, 2007). For example, many states' laws had a "conscience" opt-out clause, which EPICC did not have. These were viewed as a political advantage of state mandates but also led to weaker improvements in contraceptive access (Kuhn, 2007).

However, several critics of EPICC feared potentially negative, unintended consequences if EPICC passed. Some critics believed that it would not reduce unintended pregnancies in the US because (1) it failed to address non-contraceptive determinants of unintended pregnancy (such as social or psychosocial determinants), and (2) it would be directed at women with health insurance, and thus would not address those without insurance, in turn widening inequities between insured and uninsured (Kuhn, 2007).

Furthermore, critics worried that because EPICC would only extend coverage to people who already have private insurance, EPICC's political constituency, who tended to be wealthier and more educated, would lose interest in improving contraceptive access for all women, particularly those not covered by their own private insurance. There was also some concern that insurance companies might react by dropping all prescription coverage, thereby evading the mandate, conditional on insurance coverage of prescriptions, to cover contraceptives. Critics also believed that previous laws regarding contraceptive coverage upon which EPICC relied, including Title VII and the Pregnancy Discrimination Act, were not sufficient to enforce mandated coverage of prescription contraceptives in all insurance plans (Kuhn, 2007).

Research during the years that EPICC was being proposed supported some of these concerns. Culwell and Feinglass utilized data from the National Survey of Family Growth (NSFG) to study the change in prescription contraceptive use between 1995 and 2002 based on insurance status (Culwell & Feinglass, 2007b). They utilized logistic regression to estimate the likelihood of self-reported use of a prescription-contraceptive and examined differential effects of private insurance, public insurance, or no insurance coverage. The authors controlled for various demographic factors and found that although overall prescription contraceptive use increased by three percent between 1995 and 2002, the change in the likelihood of prescription contraceptive use was only significant among women who had private insurance coverage, with the likelihood increasing by 5.5 percent (Culwell & Feinglass, 2007b). This provided evidence to support those who were concerned that EPICC would only impact those with private insurance coverage.

Despite the obvious limitations of state mandates, their effectiveness among women with private health insurance led to greater support for contraceptive mandates in later legislation. The effect of this support was seen when President Obama signed the ACA in March 2010, which included a preventive health services mandate (Patient Protection and Affordable Care Act, 2010). The ACA stated that “preventive health services” would be determined by recommendations from the Institute of Medicine (IOM). In January 2012, Kathleen Sebelius, then Secretary of the Department of Health and Human Services, announced that the definition of women’s preventive health services would include required coverage of all FDA-approved contraception (Preventive care benefits for women, 2020). The US Supreme Court upheld the ACA in June 2012 (Guttmacher Institute, 2015).

Although the contraceptive mandate officially began on August 1, 2012, the mandate only applied to new insurance plans, which means that this requirement did not take effect for most plans until January 1, 2013 (Guttmacher Institute, 2015). The mandate includes religious exemptions as well as potential accommodations for entities not wanting to provide contraceptive coverage but who do not qualify as a religious organization. When the ACA contraceptive mandate went into effect, 30 states had mandates requiring that insurance companies cover all FDA-approved contraceptives if the insurance plan had any prescription coverage. However, some states’ mandates allowed exemptions for religious or moral reasons, limiting the reach of the mandates (Guttmacher Institute, 2015).

Although the contraceptive mandate in the ACA may be viewed by some as a large step forward for women’s reproductive health, it remains highly controversial and contested. Many political constituencies regularly seek to remove or weaken the mandate (Charo, 2012; Guttmacher Institute, 2015). The June 2014 Supreme Court decision on Burwell v. Hobby Lobby Stores, Inc. ruled in favor of Hobby Lobby, stating that for-profit corporations that are "closely held" may be exempt from the contraceptive mandate if providing contraceptives, or even specific types of contraceptives, would conflict with the owners' religious beliefs (Charo, 2014). The Court cited the Religious Freedom Restoration Act (RFRA) in their decision, stating that forcing these types of corporations to follow the mandate would violate RFRA by imposing a "substantial burden" on the owners' exercise of personal religious freedom. The Court stated that there existed a less restrictive option for providing contraceptive coverage to women at no cost—employees work directly with the insurance company to get coverage (which is reimbursed by the federal government) and the employer is completely absent from the discussion, a means made available to religious non-profit organizations—and that this option should be made available to "closely held" for-profit corporations with similar religious beliefs (Charo, 2014).

In the November 2016 election, Donald Trump won the presidency and Republicans maintained a majority in both the House of Representatives and the Senate. Throughout the election and immediately after, the topic of "repealing and replacing" or "repairing" the ACA increased in popularity (Kaplan & Pear, 2017).

On March 8, 2017, House Republicans first introduced into committee H.R. 1628, the American Health Care Act of 2017 (AHCA), which was designed to replace the ACA (AHCA, 2017). The AHCA would have impacted reproductive health through various changes in provisions, including changing required pharmaceutical coverage and decreasing the number of people with insurance coverage by an estimated 14 million. When evaluating the impact of the AHCA on reproductive health, the Congressional Budget Office (CBO) estimated that Medicaid expenditures would increase under the AHCA due to covering “several thousand” more unplanned births due to decreased contraceptive access (CBO, 2017). Although the bill was able to get through two committees relatively quickly and move to the House floor on March 20, 2017, it was withdrawn by Speaker Paul Ryan on March 24, 2017 prior to a vote because of insufficient support for the bill to pass (Pear, Kaplan, & Haberman, 2017). Despite this defeat, both Speaker Ryan and President Trump pledged to continue fighting for healthcare reform, though not immediately (Pear, Kaplan, & Haberman, 2017).

Starting in May 2017, Trump signaled his intention to move his agenda forward via executive orders and interim final rules by issuing an executive order concerning the protection of religious liberty (Trump, 2017). In this executive order, Trump directed the Secretaries of three government departments—Health and Human Services, Labor, and the Treasury—to consider modifying regulations surrounding the ACA’s mandates to more expansively address religious-based or conscience-based objections, meaning employer’s objections to insurance coverage of contraceptives. In October 2017, the three above-mentioned Departments announced two interim final rules that broadened the criteria for moral and religious exemptions to insuring contraceptives (82 FR 47792, 2017; 82 FR 47838, 2017). Over 100,000 public comment submissions were made on the two interim rules before the December 2017 comment deadline and three lawsuits were filed against the interim final rules (U.S. Department of Health and Human Services, 2018). On November 7, 2018, two final rules were announced with some modifications

(83 FR 57536, 2018; 83 FR 57592, 2018). CMS-994-F2 allows religious exemptions for individuals or entities that object to mandated services based on “sincerely held religious beliefs.” This final rule still maintained the accommodation set up through the ACA where an institution or employer could remove itself from all discussions of contraceptive coverage but still allow its employees to directly secure contraceptive coverage from the insurance company. However, the final rule changed this accommodation to optional and voluntary, eliminating contraceptive coverage for some women (83 FR 57536, 2018). CMS-9925-F allows moral exemptions to nonprofits, small or closely-held businesses, educational institutions, and individuals who have non-religious but moral convictions opposing contraceptives. This rule gives these groups the same exemptions as religious entities, including the voluntary accommodation. These exemptions do not apply to publicly traded businesses or government agencies (83 FR 57592, 2018).

Multiple lawsuits blocked these two final rules from being in effect until the Supreme Court issued its ruling on *Trump v. Pennsylvania* (2020) and *Little Sisters of the Poor v. Pennsylvania* (2020). On July 8, 2020, the Supreme Court issued a 7-2 decision on both cases, stating that the Trump administration had the legal authority to issue the two final rules (Little Sisters of the Poor v. Pennsylvania, 2020). However, this ruling does not preclude future administrations from changing these exemptions and the Supreme Court returned the case back to lower federal courts where it will likely be argued whether the new rules are “arbitrary and capricious” in a way that violates the Administrative Procedure Act (Little Sisters of the Poor v. Pennsylvania, 2020).

The fate of contraceptive mandates is far from certain for all or subsets of the US population. The Supreme Court has to date offered no ruling that would definitively settle the issue, and the partisan divide over the ACA's mandates for contraceptive coverage will likely persist into the future. Legislation surrounding contraceptives and contraceptive coverage in the United States remains strongly contested and very likely to continue evolving over the foreseeable future. The need for carefully executed studies of policy impact will endure.

2.1.1 State-Specific Mandates

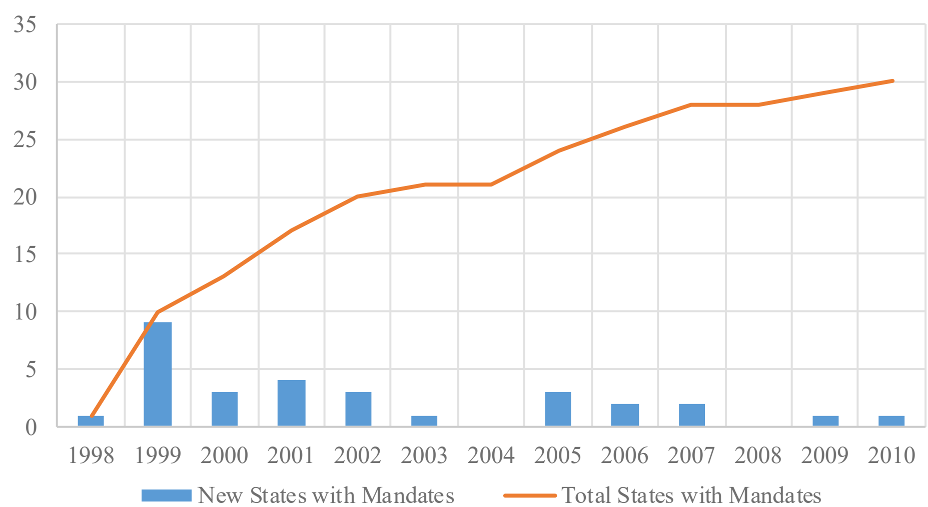
Because state-specific mandates were in place in the majority of states and because these mandates will be incorporated into this analysis, this section further discusses the specifics of the state mandates. As mentioned previously, by the time the ACA contraceptive mandate officially started on August 1, 2012, 30 states had some form of contraceptive mandate. No additional states have since added a state-specific contraceptive mandate. Twenty-eight of the 30 states had mandates created by legislative acts. The remaining two states—Michigan and Montana—had their mandates created via attorney general ruling, both in 2006. All 30 mandates require insurance coverage of all FDA-approved prescription contraceptives if the health insurance plan offers any coverage of other prescription medications. Twenty-one of the 30 state mandates include a religious exemption to the required contraceptive coverage.

Mandates were put in place over a 13-year period, starting with Maryland in 1998 and ending with Colorado in 2010. Figure 1 graphs the new state mandates and cumulative state mandates over time, showing that over half of the mandates were enacted between 1998 and 2001. The state mandates were in place for at least a couple years and in some cases over a decade before the ACA contraceptive mandate went into effect. This simplifies the analysis because no state mandate came into effect after the

ACA contraceptive mandate, so these different types of mandates are chronologically distinct and the effects of each are more distinguishable.

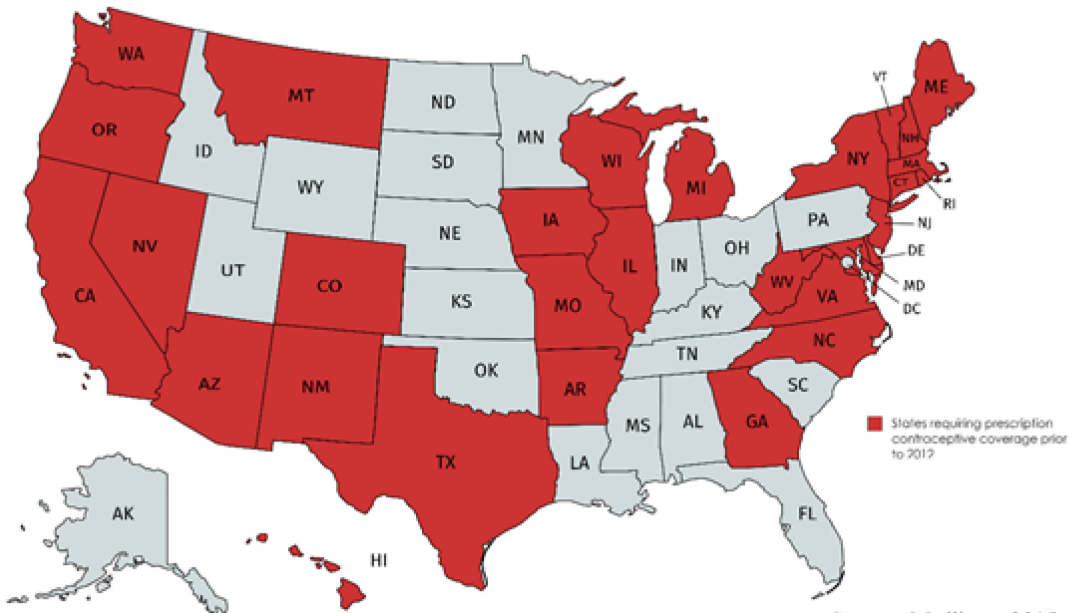
There appear to be some geographic patterns in terms of the states with contraceptive mandates. Figure 2 maps the states with contraceptive mandates in red, showing the greatest concentration of states with mandates to be in the West, Southwest, Mid-Atlantic, New England, and central Midwest regions. These geographic patterns give further support to the idea that a state mandate is less a random event, but instead an event driven by specific characteristics of each state and shared in common among states within a given region. A full list of the states and years of contraceptive mandate enactment are in Appendix Table 1.

Figure 1: New States and Total States with Contraceptive Mandates in the US, 1998-2010



Source: Mulligan, 2015.

Figure 2: States with a Contraceptive Mandate, 2012

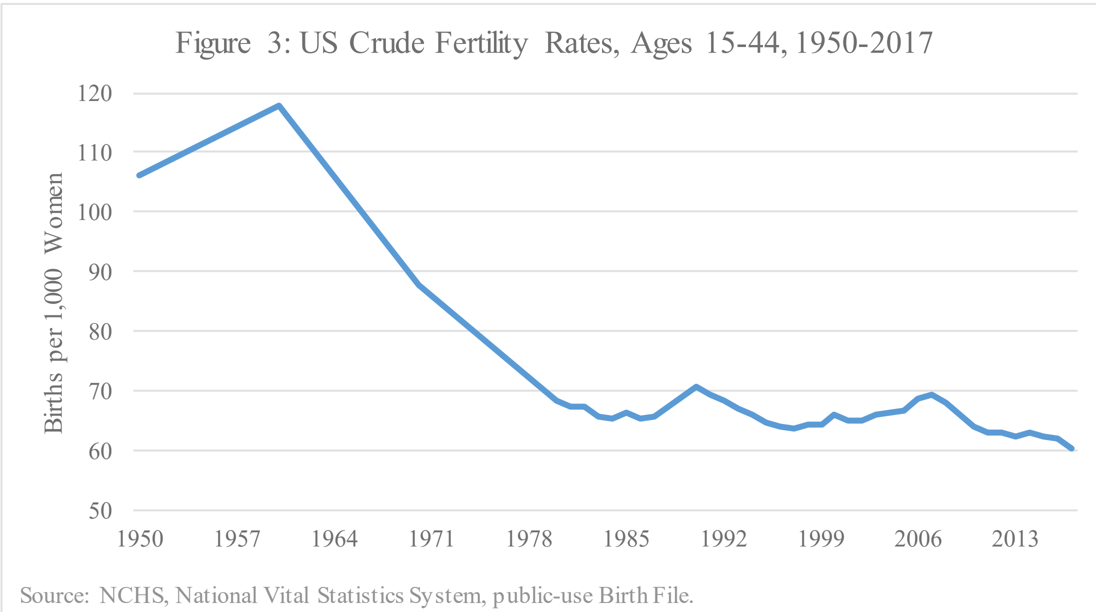


Source: Mulligan, 2015.

As a result, it seems reasonable to assume that the enactment of a state-specific contraceptive mandate was not randomly distributed across all states. Instead, it seems highly likely that the states that implemented contraceptive mandates prior to the ACA contraceptive mandate may be systematically different from the states that did not have a mandate. These factors will be taken into account in the development of the methodology for this analysis.

2.2 Fertility Rates and Trends in the United States

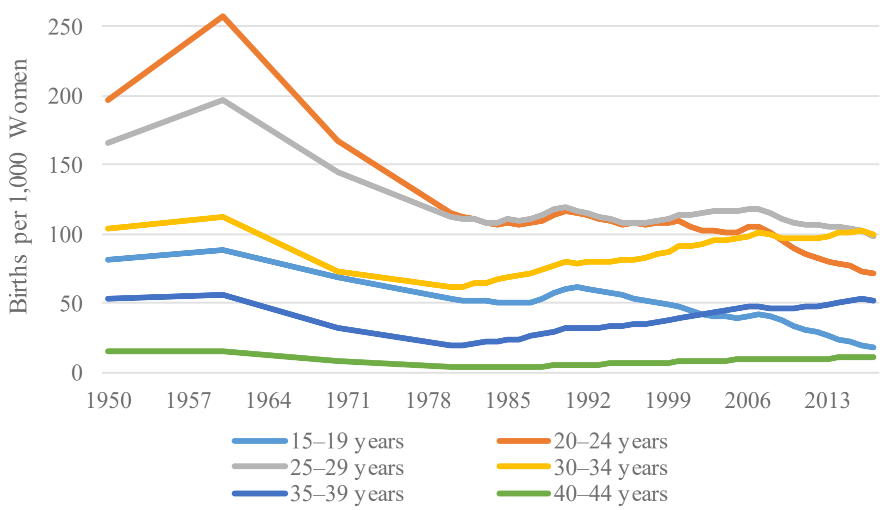
Understanding the trends in US fertility rates provides important context to understanding the impact of the ACA contraceptive mandate on fertility rates. Figure 3 shows the US crude fertility rates (births per thousand women ages 15 to 44) from 1950 to 2017 for the population as a whole, showing a rise through 1960 (generally attributed to the post-war baby boom) followed by a general decline in the years afterward. The decline in the 1960s and 1970s is generally attributed to the increasing availability of prescription contraceptives. The fluctuations seen since the 1980s can largely be explained by changes in the economy, where increasing economic uncertainty decreases the birthrate. The Great Recession started the most recent declining trend in fertility rates, with the last several years having the lowest US fertility rates on record.



Looking at the trends in fertility rates by age group reveals more complex trends and is essential in understanding the differential impact of the ACA contraceptive mandate on different age groups. Figure 4 shows the age-specific fertility rates for the same time period as Figure 3, showing the general increase in average mother's age. The same peak in fertility rates is seen in 1960 for all age groups, but is most pronounced for the 20 to 24 and 25 to 29 age groups. Although the age-specific fertility rates were very different for the 15 to 19 and 20 to 24 age groups from 1950 through 1980, after 1980 they decreased in roughly the same parallel pattern through 2017, both ending much lower than the 1950 starting point. The age-specific fertility rate trend lines for the 30 to

34 and 35 to 39 age groups were roughly parallel during the entire 1950 to 2017 time period. Both groups had a general decline through 1980 followed by a general increase to roughly the same fertility rates in 2017 as in 1950. The 40 to 44 group had the least pronounced change over the time period and ended with fertility rates in 2017 at roughly two thirds of the 1950 fertility rates. Finally, the 25 to 29 age group started with lower fertility rates than the 20 to 24 group through 1980. From 1980 to 2000, these two age groups had almost identical age-specific fertility rates. In the following 17 years, the age-specific fertility rates for the 25 to 29 group remained roughly constant while the rates for the 20 to 24 group dropped. It was not until 2017 that the age-specific fertility rates for women ages 30 to 34 became the highest of all of the age groups.

Figure 4: US Age-Specific Fertility Rates, 1950-2017

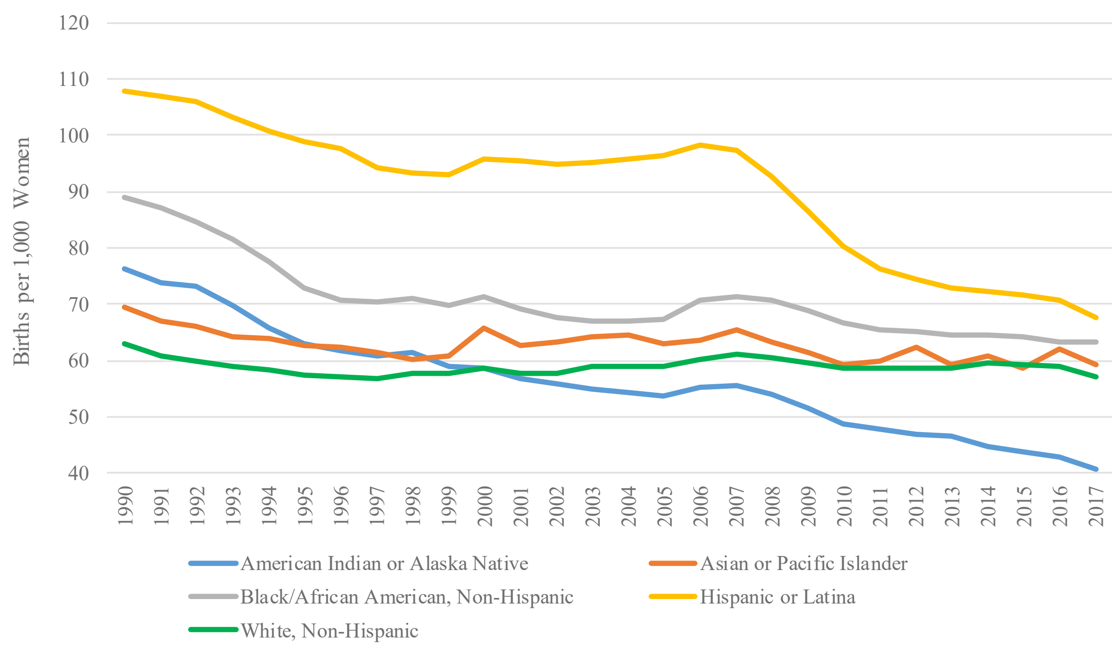


Source: NCHS, National Vital Statistics System, public-use Birth File.

Just as it was important to understand trends by age group, looking at trends in crude fertility rates by race or ethnicity helps to provide greater context for understanding the impact of the ACA contraceptive mandate on subpopulations. The Hispanic population has had the highest fertility rate for the entire 1990 to 2017 time period even with a rapid drop in fertility rates starting in 2008. The non-Hispanic Black/African American and American Indian or Alaska Native populations had roughly parallel fertility rates through the early 2000s, but the fertility rate for American Indian or Alaska Native populations has decreased faster than all other racial subgroups, with an approximate 50 percent decrease in the fertility rate between 1990 and 2017. The non-Hispanic White and Asian or Pacific Islanders have had the closest fertility rates during this period, with the rates becoming even closer after 2009.

The fertility rates for the entire US have been generally declining since 1960. However, there is considerable variation when looking at fertility rate trends among subpopulations. This research uses these variations as a context for understanding the ACA contraceptive mandate and as evidence to support running individual regressions by subpopulation.

Figure 5: US Crude Fertility Rates by Race or Ethnicity, Ages 15-44, 1990-2017



Source: NCHS, National Vital Statistics System, public-use Birth File.

2.3 Unintended Pregnancy Rates, Trends, and Consequences

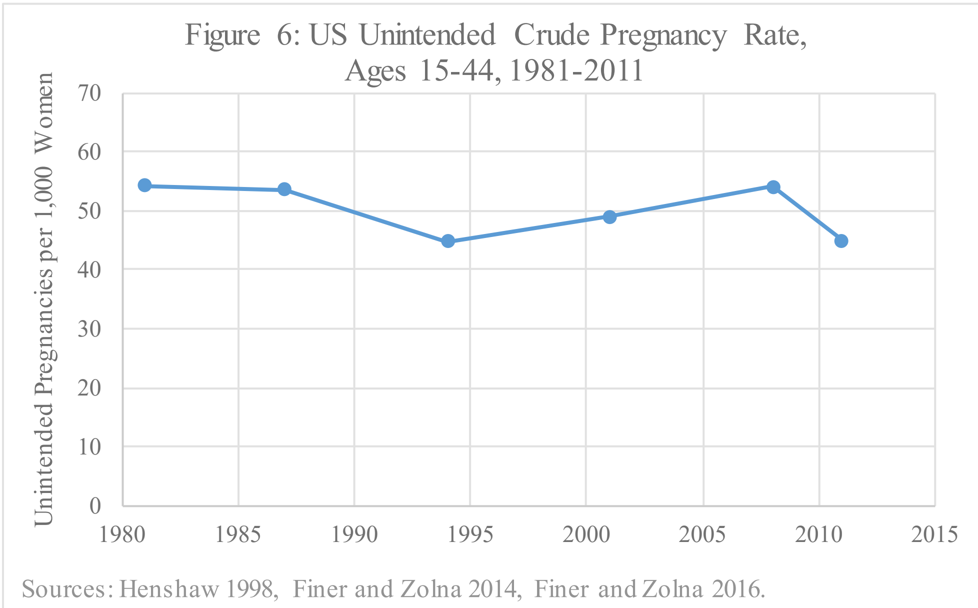
Since the purpose of a contraceptive mandate is to help decrease unintended pregnancies, it is important to understand the prevalence and trends for unintended pregnancy in the US. Unintended pregnancy generally occurs under one of three conditions: 1. contraceptive failure, 2. incorrect or inconsistent use of contraceptives, or 3. no contraceptive use (Black, Gupta, Rassi, & Kubba, 2010). A contraceptive mandate would likely not influence the first condition (unless the mandate induces switching to a method with higher efficacy), but may influence the second and third conditions by increasing affordable access to contraceptives. Contraceptive failure will be discussed more in Section 2.4.

The unintended pregnancy rate in the US is generally decreasing, though remains much higher than most Western countries. Measuring and reporting unintended pregnancy is difficult and, in the United States, not undertaken annually, making it difficult to determine granular trends across time. Many studies document the difficulty of obtaining valid measures of pregnancy intention (Joyce, Kaestner, & Korenman, 2002; Rackin & Morgan, 2018). Post-pregnancy measures of intention are subject to revision bias and prospective measures are seldom available, so these data should be interpreted with caution. Figure 6 combines data from three different studies to show estimates in the US unintended pregnancy rate between 1981 and 2011. The first paper by Henshaw reported estimates for 1981, 1987, and 1994 (Henshaw, 1998).[2] The other two papers were both written by Finer and Zolna and reported estimates for 2001 and 2008 in the first article and 2008 and 2011 in the second article (Finer & Zolna, 2014; Finer & Zolna, 2016).[3] It could be that the different groups of authors used slightly different methods, so the estimates after 2001 may not be methodologically comparable to the prior trends shown in Figure 6. The unintended pregnancy rate in 2008 was nearly the same rate as in 1981, but otherwise there appears to be a general decline in the unintended pregnancy rate over time. Although there has not yet been a full update with the 2013-2015 data, one study using NSFG data found an estimated 15 percent decrease in the unintended pregnancy rate overall between the pre-mandate (2008-2010) and post-mandate (2013-

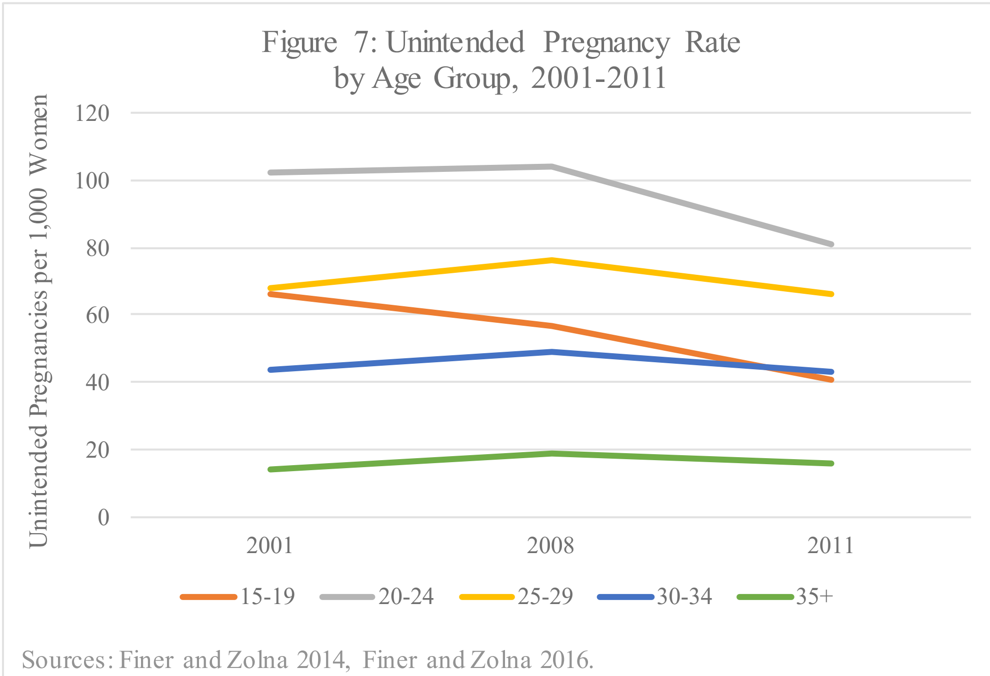
[2] The NSFG data used by Henshaw categorized a birth as unplanned (i.e., unintended) if the woman indicated she was using contraceptives when she became pregnant and that the pregnancy occurred either earlier than wanted or that she did not want to become pregnant ever again. A birth was categorized as intended if the woman had not been using contraception and that she did not care whether she became pregnant.

[3] Both papers by Finer and Zolna also used NSFG data to categorize retrospective pregnancy intention. They follow the same definitions as Henshaw except they do not include contraceptive use or non-use in their categorization of pregnancies.

2015) time periods. Women with government-sponsored insurance had an even higher estimated decrease in the unintended pregnancy rate of 37 percent (MacCallum-Bridges & Margerison, 2020).

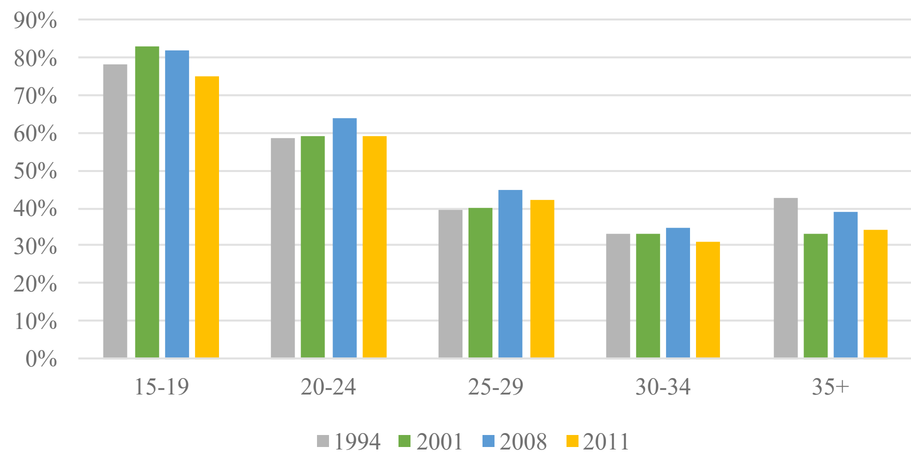


As with the fertility rate data, it is important to understand how unintended pregnancy varies by subpopulation, especially given that fertility rates vary considerably by subpopulation. Figure 7 breaks out the aggregate unintended pregnancy rate from Figure 6 by age group for 2001-2011. There is considerable variation in the unintended pregnancy rate across age, with the highest rate consistently for women ages 20 to 24 and the lowest consistently for women over 35. The greatest decrease in the unintended pregnancy rates in this time period were for women ages 20 to 24 and 15 to 19, though all age groups experienced a decrease between 2008 and 2011. Because of this, it seems reasonable to hypothesize that the younger age groups would experience the greatest decrease in fertility rate due to the ACA contraceptive mandate. The ACA has a provision that that allows some young adults up to age 26 to remain on their parent's health insurance plans at no additional cost, which may increase the effect of the ACA contraceptive mandate on this age group even more.



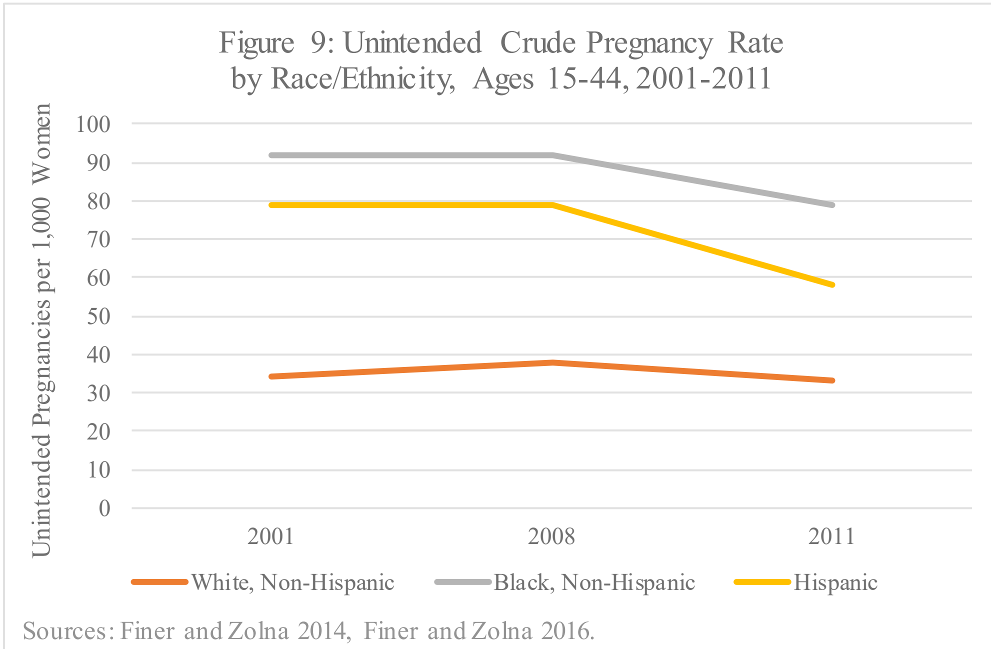
It is important to distinguish the difference between the unintended pregnancy rate and the percent of pregnancies that are unintended. Figure 8 reports the percent of pregnancies in the US that were unintended by age group between 1994 and 2011, with the highest percent for women ages 15 to 19 and the lowest for ages 30 to 34. There is a general decrease in the percent of pregnancies that were unintended with increasing time and increasing age, but there is variation in that trend across age groups. A quick comparison of Figures 7 and 8 may seem paradoxical because women age 20 to 24 had the highest unintended pregnancy rate in Figure 7, but the second highest percent of pregnancies that are unintended in Figure 8. This is because pregnant women ages 20 to 24 are less likely to have an unintended pregnancy than teenagers (reflected in Figure 8), but they are much more likely to get pregnant at all (Figure 4), therefore having a much higher overall unintended pregnancy rate per thousand women. Assuming a utilitarian objective of reducing the total number of unintended pregnancies, then efforts should be focused on subpopulations with the highest rates rather than the highest percent of pregnancies that are unintended.

Figure 8: Percent of All Pregnancies that were Unintended by Age Group, 1994-2011



Sources: Henshaw 1998, Finer and Zolna 2014, Finer and Zolna 2016.

As with age, racial or ethnic differences in the unintended pregnancy rate will likely affect the impact of the ACA contraceptive mandate on those subpopulations. Figure 9 breaks down the aggregate unintended crude pregnancy rate from Figure 6 by racial or ethnic category from 2001 to 2011. The non-Hispanic White population had the lowest unintended pregnancy rates throughout the time period and the least amount of decline between 2008 and 2011. The non-Hispanic Black population had the highest unintended pregnancy rate and a moderate decline between 2008 and 2011. Although the unintended pregnancy rate for the Hispanic population started out parallel to that of non-Hispanic Blacks between 2001 and 2008, this population experienced a sharper decline between 2008 and 2011. Combining results from Figure 7 and Figure 9, it seems likely that younger minority subpopulations stand to gain the most in terms of unintended pregnancies avoided due to the ACA contraceptive mandate.



All this said, however, the causes of unintended pregnancy include more than just contraceptive access. Other factors like discontinuation, improper use, and non-use could dampen the effect of the ACA contraceptive mandate on fertility rates. Research on the causes for the high unintended pregnancy rates have proposed several explanations briefly discussed earlier in this Section. Although the sperm meets egg story of conception is simple, the pathways to an unintended pregnancy are complex and variable. Models of the pathways can also be complex and varied.

Bounded rationality models invoke agents who undertake constant weighing of costs and benefits of continuing to use the contraceptive method, perceived fertility, and perceived ability to access abortion in the event of an unplanned pregnancy (Black et al., 2010; Forrest & Frost, 1996; Jaccard, Helbig, Wan, Gutman, & Kritz-Silverstein, 1990; Miller, 1986). Other models of bounded rationality temper rationality with high levels of ambivalence toward pregnancy obscuring the agent's certainty that there are stable benefits from pregnancy avoidance (Brückner, Martin, & Bearman, 2004; Layte, McGee, Rundle, & Leigh, 2007). Another theory suggests that the planned versus unplanned dichotomy is unrealistic and that pregnancy intentions fall along a spectrum rather than being easily dichotomized (Augustine, Nelson, & Edin, 2009). A related study concluded that the traditionally-used measure of pregnancy intention may overstate unintended pregnancy rates because current assumptions in the measurement constructs do not reflect current reproductive practices and attitudes (Mumford, Sapra, King, Louis, & Buck Louis, 2016). These theories and proposed models of contraceptive use behavior play a role in the relationship between contraceptive price and contraceptive use and will be discussed further in Section 3.1.

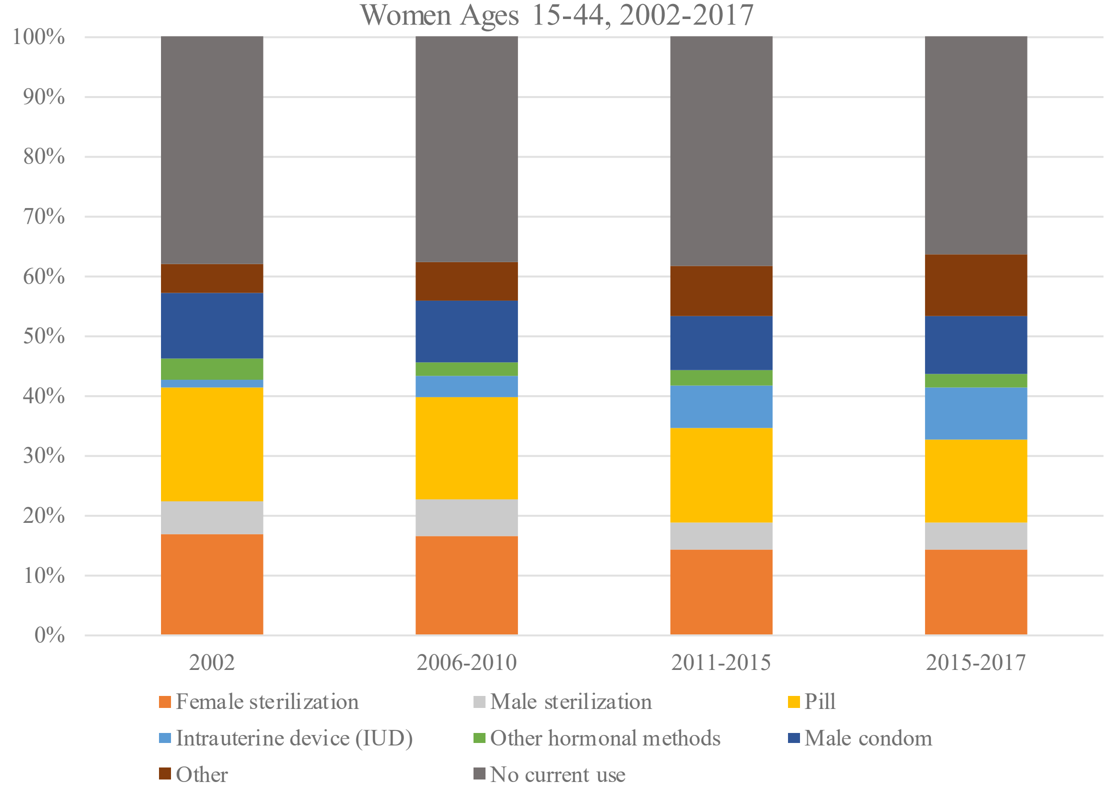
2.4 Contraceptive Use, Trends, and Failure Rates

Since contraceptive method use rates prior to the ACA contraceptive mandate affect our ability to detect the impact of the mandate[4], awareness of pre-mandate trends in contraceptive use is necessary to appropriately model the mandate's effect on the fertility and abortion rates. Figure 10 shows the breakdown of contraceptive method use for 2002 through 2017. Similar to the unintended pregnancy data, contraceptive use data are also derived from surveys. Data are not reported annually, which makes trends more difficult to discern, but still provide some helpful context. The percent of women using any form of contraceptives remained relatively constant from 2002 through 2017, though the contraceptive method mix changed. The percent of women using the pill or male or

[4] For example, if some sub-groups already have very high rates of contraceptive use, ceiling effects would dampen the visible impact of the ACA. Similarly, if sub-groups have high rates of surgical sterilization, effects would be dampened, etc.

female sterilization decreased while the percent using IUDs increased. In spite of these changes, overall use rates of the pill alone or sterilization alone are still higher than IUD use rates. Since IUDs have a higher typical-use effectiveness rate, one would expect fewer unplanned pregnancies due to contraceptive failure in populations with higher IUD use as well as overall fewer unplanned pregnancies, *ceteris paribus*.

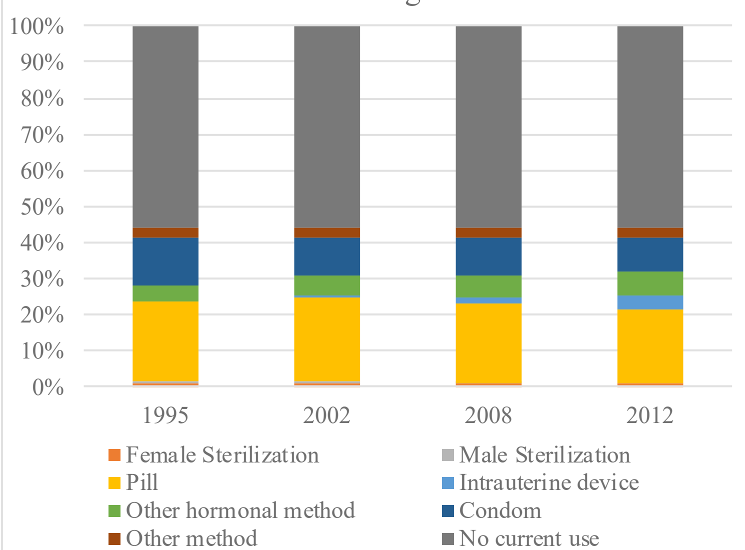
Figure 10: US Contraceptive Use and Method, Women Ages 15-44, 2002-2017



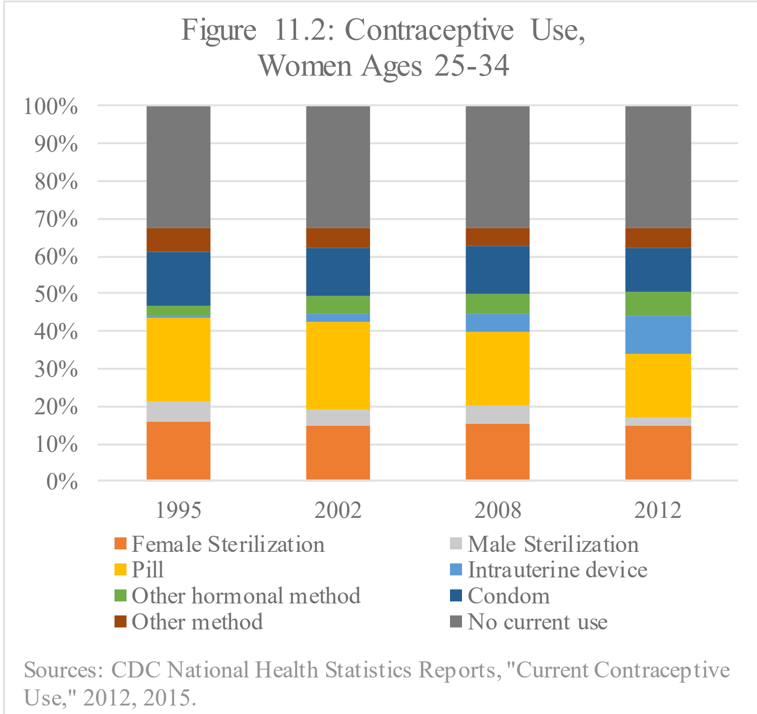
Source: National Center for Health Statistics, Key Statistics from the National Survey of Family Growth.

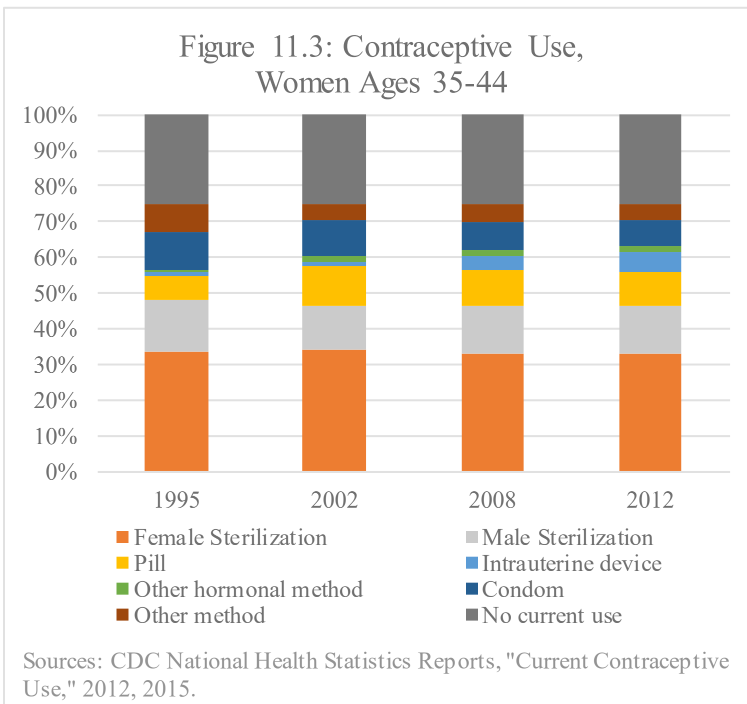
As was also the case with fertility and unintended pregnancy rates, it is important to understand how contraceptive use varies by subpopulation because that will influence how the ACA contraceptive mandate impacts outcomes. The three panels of Figure 11 show contraceptive use by three different age categories to highlight differences in use by age. Any contraceptive use increases with age, with approximately 50 percent, 66 percent, and 75 percent of women using any contraceptive in the three age groups from youngest to oldest, respectively. The percent using either female or male sterilization is the most different across ages, with less than two percent use among those ages 15 to 24 and nearly 50 percent for women ages 35 to 44. Because the ACA contraceptive mandate will have no effect on those in partnerships using permanent sterilization, it is reasonable to hypothesize that the contraceptive mandate would have a smaller estimated impact on older populations. Condoms or other non-hormonal methods, which have higher failure rates than any hormonal contraceptive method, are used more often in younger age groups. Among people already using contraception, the ACA contraceptive mandate would have the largest effect in terms of avoiding unintended pregnancies in populations that switch from no hormonal method to any hormonal method.

Figure 11.1: Contraceptive Use, Women Ages 15-24



Sources: CDC National Health Statistics Reports, "Current Contraceptive Use," 2012, 2015.

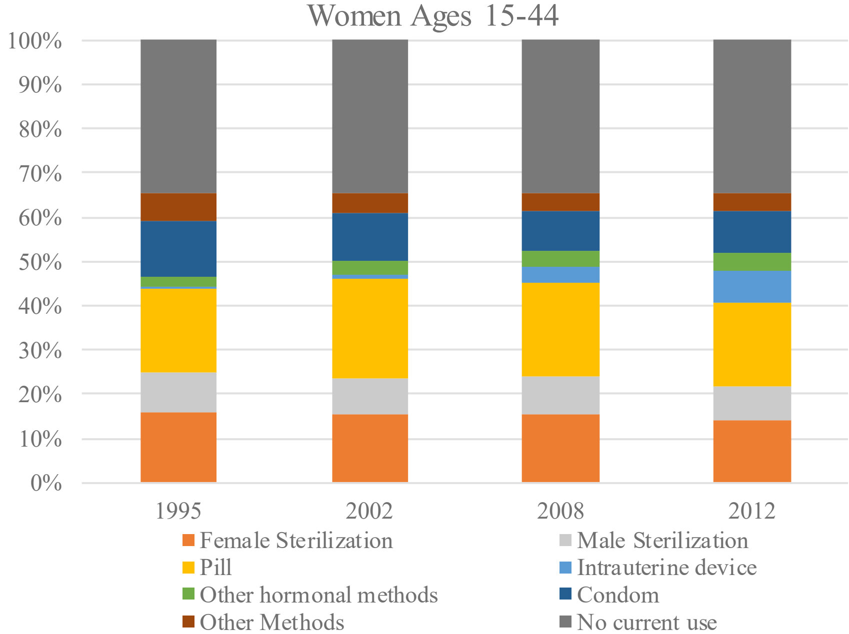




Variation in contraceptive use across race or ethnic groups can also help predict the impact of the ACA contraceptive mandate. The three panels of Figure 12 show contraceptive use by three racial or ethnic categories: non-Hispanic White, non-Hispanic

Black, and Hispanic. The three categories all have roughly 25 percent using either male or female sterilization. The non-Hispanic White population has the highest pill or IUD use and the highest overall use of any contraceptive. The ACA contraceptive mandate would likely have the least impact on this population of the three subgroups. Non-Hispanic Blacks and Hispanics have about the same total percent of sterilization plus hormonal contraceptive use—just above 40 percent—though Hispanics use condoms and other methods at higher rates than non-Hispanic Blacks. Again, this provides more evidence that minority populations are likely to have a relatively higher estimated impact of the ACA contraceptive mandate.

Figure 12.1: Non-Hispanic White Contraceptive Use, Women Ages 15-44



Sources: CDC National Health Statistics Reports, "Current Contraceptive Use," 2012, 2015.

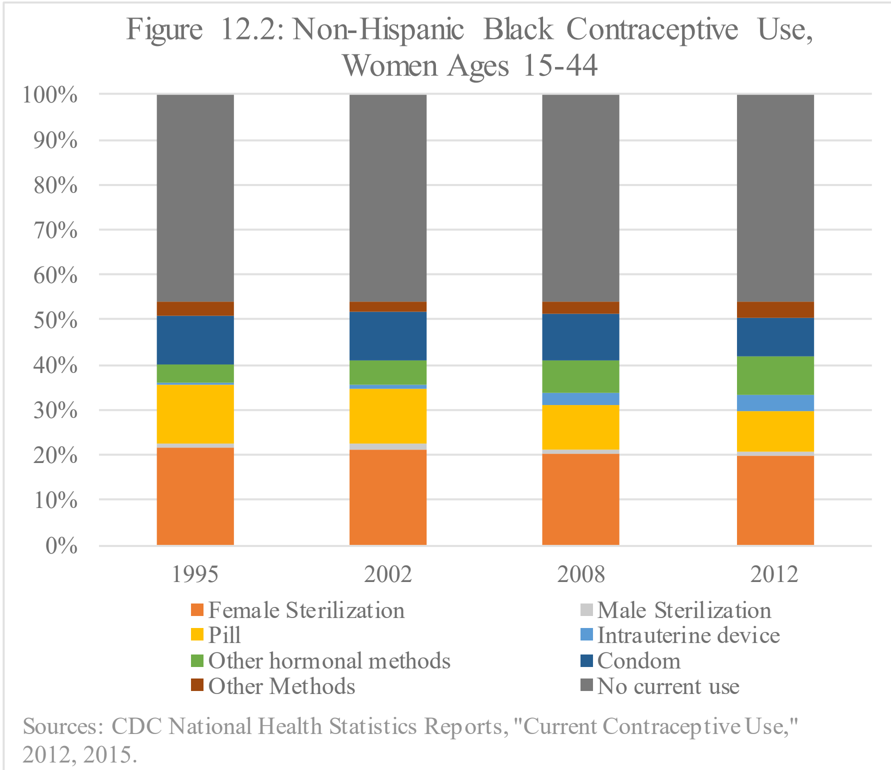


Figure 12.2: Non-Hispanic Black Contraceptive Use, Women Ages 15-44
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1995
2002
2008
2012
Female Sterilization
Male Sterilization
Pill
Intrauterine device
Other hormonal methods
Condom
Other Methods
No current use
Sources: CDC National Health Statistics Reports, "Current Contraceptive Use," 2012, 2015.

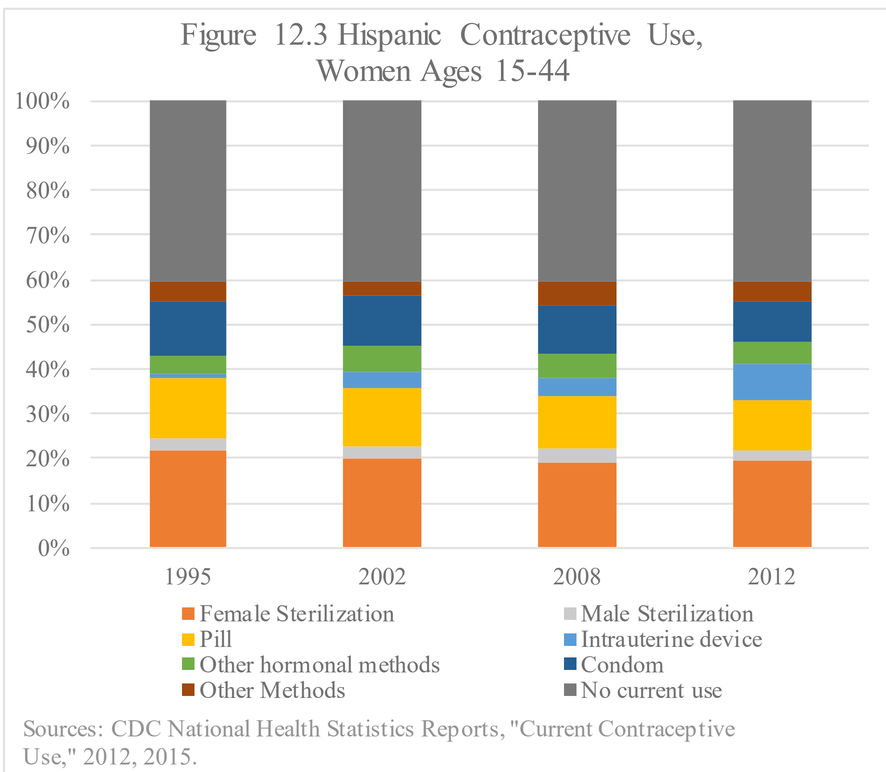


Figure 12.3 Hispanic Contraceptive Use, Women Ages 15-44
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1995
2002
2008
2012
Female Sterilization
Male Sterilization
Pill
Intrauterine device
Other hormonal methods
Condom
Other Methods
No current use
Sources: CDC National Health Statistics Reports, "Current Contraceptive Use," 2012, 2015.

In addition to age and racial or ethnic differences in contraceptive use, there is also evidence of differences in failure rates across subpopulations. There is a great amount of literature on the failure rates of various contraceptives. These studies obtain their data from one of two major categories: clinical trials or surveys. There are various benefits and drawbacks from both types of data. For example, clinical trials gather data prospectively and perhaps may be able to better monitor adherence. These results, then, would be more likely to show the failure rates during perfect use, or the contraception's efficacy. Survey data, then, are useful to show the contraception's effectiveness, or the failure rates during typical use. However, survey data are most often gathered retrospectively, and there are often issues of over-reporting of contraceptive adherence (Trussell, 2008). Thus, it is helpful to use information from both types of studies or systematic reviews of a large number of studies to obtain a more complete picture of various contraceptive methods' failure rates.

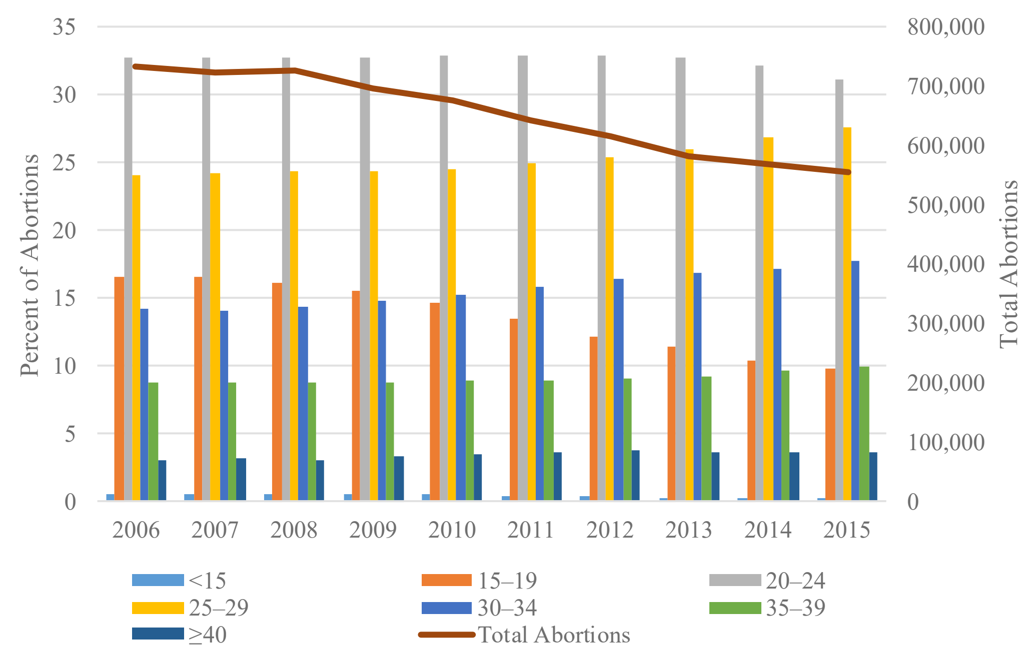
There are multiple demographic factors (e.g. age, socioeconomic status (SES), ethnicity) and behavioral factors (e.g. ambivalence, accuracy of information, or access to services) that impact the actual effectiveness of a specific category of contraception for the median woman in each sub-demographic (Black et al., 2010). However, on average, studies have found that contraceptive effectiveness generally follows this ranking in descending order: sterilization, LARCs with hormonal components (e.g. Mirena, implants), copper IUDs, SARCs (e.g. injectables, OCPs, patch, ring), barrier methods (e.g. condom, diaphragm), and natural methods (e.g. rhythm) (Black et al., 2010; Kost, Singh, Vaughan, Trussell, & Bankole, 2008; Mansour, Inki, & Gemzell-Danielsson, 2010; Trussell, 2008; Trussell, 2011). Often also documented in these studies are the one year continuation rates of each contraceptive method.

Even if women have greater access to contraceptives because of the ACA contraceptive mandate, that does not necessarily translate into a direct reduction in the fertility and abortion rates because of the intervening impact of contraceptive failure or misuse, with typical-use failure rates varying across contraceptive methods. Understanding the impact of the ACA contraceptive mandate on a subpopulation's fertility rates is especially complex if contraceptive failure rates vary significantly across subpopulations. Decisions regarding contraceptive use are complicated and the pathways that help calculate the likelihood that a specific individual's contraception will fail are also complex and intertwined with socioeconomic status. Although the ACA mandate is a clear policy, the effect of the same policy will be very different for subpopulations.

2.5 Abortion Use and Trends

Similar to the discussion of fertility rates in Section 2.2, trends in abortion rates provide necessary context to understanding the impact of the ACA contraceptive mandate on abortion. Figure 13 includes both the total count of abortions and the percent of abortions by age group for 2006 through 2015. These data include recorded abortions voluntarily reported by states. The count of abortions has decreased approximately 24 percent during this ten year period. Women between ages 25 and 34 are contributing an increasing proportion of the abortions over this time period. Abortions by women ages 20 to 24 account for a somewhat smaller proportion of total abortions while women ages 15 to 19 contribute a much smaller proportion of abortions across this timeframe.

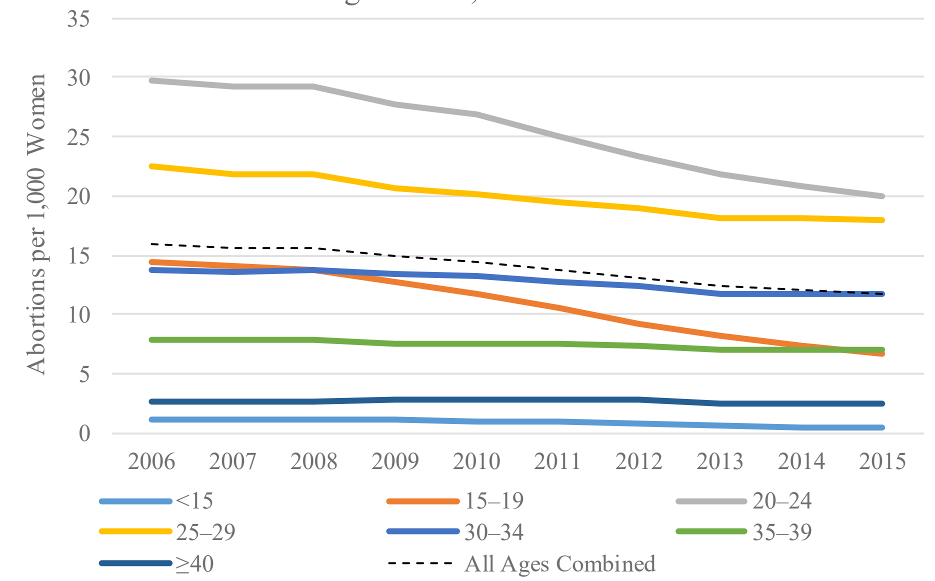
Figure 13: Total Abortions and Percent of Abortions by Age Group, Ages 11-44, 2006-2015



Source: CDC Abortion Surveillance Reports, 2008-2016

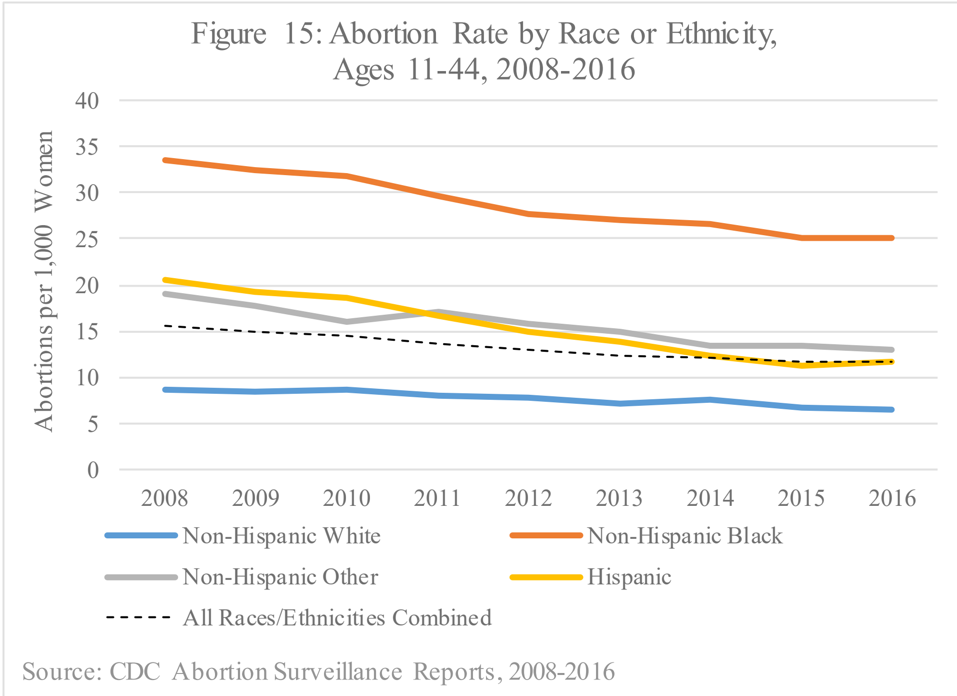
To further understand the interaction between age and abortion use across time, Figure 14 plots the abortion rate by age group for this same ten year period. The population-level abortion rate is also plotted with the dashed black line, which shows a declining trend in abortion rates nationwide during the study period. Women ages 20 to 24 have the highest rate throughout the ten year period. Women ages 15 to 19 and 20 to 24 have roughly parallel trends and decrease the most of all of the age groups. Women ages 25 to 29 and 30 to 34 have a moderate and roughly parallel decline. The three remaining age groups—less than 15, 35 to 39, and over 40—have little change in abortion rate during this period. These data support the hypothesis that the ACA contraceptive mandate will have the greatest impact on the abortion rate for women between 20 and 24.

Figure 14: Abortion Rate by Age Group, Ages 11-44, 2006-2015



Source: CDC Abortion Surveillance Reports, 2008-2016

Finally, abortion rates by race or ethnicity help provide context to anticipating and understanding the impact of the ACA contraceptive mandate on each subpopulation. Non-Hispanic Blacks have the highest abortion rates and non-Hispanic White have the lowest rates. The Hispanic and non-Hispanic Other subpopulations have the most similar rates and are also closest to the average abortion rate for all races and ethnicities combined. The Hispanic subpopulation had a 43.2 percent decrease in abortion rates during this time, which is the greatest decrease of the racial or ethnic groups. The other three racial groups had decreases ranging between 24.1 and 31.5 percent. Because the non-Hispanic White population has the lowest abortion rates, it is reasonable to hypothesize that the ACA contraceptive mandate will have a relatively smaller impact on that group.



2.6 Non-Cost Barriers to Contraceptive Use

Although cost is an important barrier to contraceptive use, there are still additional non-cost barriers to all forms of contraceptives and perhaps further barriers to more effective LARCs.

One study attempting to find the role of cost in limiting contraceptive access used focus group discussions and interviews with 45 low-income women in Boston between March 2007 and January 2009 (Dennis & Grossman, 2012). Authors worked to identify all barriers to prescription contraceptives and to gauge interest in obtaining contraceptives over-the-counter in the future. The women who participated cited several issues with current means of obtaining prescription contraceptives, including costs for copays and clinic visits, required clinic visits, limits on the number of packs that could be obtained at a time, and, for the 47 percent of the women who had insurance, limits on when the purchase for the next month could be made. Some women admitted that they had switched from their preferred and more effective method to condoms because they could obtain them either at a lower cost or for free.

Most of the women interviewed seem to support over-the-counter contraceptives, but raised concerns about costs and patient safety. Although most women felt cost and time pressures from required clinic visits, they seemed to think that it helped improve safety, particularly for women starting to use contraceptives or for women with other medical conditions. Authors cited additional concerns for women on Medicaid who currently pay zero copayments for contraceptives, but who might face costs for contraceptives if they became available over-the-counter (Dennis & Grossman, 2012).

This article supports the idea that, even in a state that has insurance mandates requiring prescription contraceptive coverage, not all low-income women have ready access to contraceptives, particularly the most effective contraceptives that may be more expensive. These findings are also significant to note because even if cost barriers are eliminated by enforcing zero copayments for contraceptives, there are still barriers in the form of office visits, limits on the numbers of packs that can be purchased at a time, and the time window for when additional packs can be purchased. Inasmuch as women in the study who were on Medicaid and had zero copayments for contraceptives still cited these barriers as significant, it would be worthwhile to pursue means to reduce these barriers.

Another important barrier to contraceptives is the time involved in obtaining prescriptions, particularly when they must be obtained monthly, as is the case with SARCs. For example, Foster, et al. found that receiving a one-year supply of OCPs was associated with a 30 percent reduction in the odds of an unplanned pregnancy and 46 percent reduction in the odds of an abortion when compared to receiving either one month or three months of OCPs (Foster, Hulett, Bradsberry, Darney, & Policar, 2011). Even if monetary costs go to zero, the rate of unplanned pregnancies may not change if time costs are not also changed or if obtaining contraceptives (especially OCPs) does not become more convenient.

Beyond these general factors applicable across all contraceptive types, there could be additional unique barriers when considering the shift from SARCs to LARCs. Xu, et al. conducted a study with NSFG data from 2006 to 2008 to identify the determinants of IUD use (Xu et al., 2011). The authors found that, when compared to women using injectables, IUD users were more likely to be older, to be married, to have at least one child, to have a higher income, and for the respondent's mother to have a higher education. The authors conclude that IUD users are different from women using SARCs and other LARCs.

These results suggest that changing the price of IUDs alone may not result in a greater number of women using IUDs. That said, there may be alternate explanations for why these data seem to suggest IUD cost does not impact use rates. For example, Xu, et al. states that as of 2005 the practice guidelines and FDA recommendations no longer state that nulliparous women should not use an IUD. Perhaps this change in guidelines will influence clinicians' recommendations and uptake among women previously not using the IUD. The authors also state that the trend for wealthier women to use the IUD at higher rates could be an example of wealthier individuals taking advantage of new technologies sooner, so as the IUD becomes more common, other income groups may begin taking advantage of IUDs at higher rates.

As we see from Xu, et al., it is not clear whether LARCs, particularly IUDs, are used frequently in younger populations. However, a study by Rosenstock, et al. shows that younger populations, including teenagers, have LARC continuation rates as high as older populations (Rosenstock, Peipert, Madden, Zhao, & Secura, 2012). Furthermore, younger populations were more likely to be dissatisfied with SARCs. This study suggests that providing LARCs to younger populations could be successful not only in terms of continuation, but also in terms of increasing satisfaction. Ayadi, et al. also found that increasing the provision of prescription contraceptives at zero cost among low-income teenagers in Florida and Georgia increased contraceptive use and reduced teen pregnancies (Ayadi, Kuo, Adams, & Gavin, 2012).

In sum, these studies show that even if all monetary costs related to contraceptives were removed, contraceptive use may not increase as much as expected due to other barriers. It is still unknown whether mandating zero copayments will be a large enough incentive for women to overcome other remaining barriers and increase utilization, or if removing cost barriers will only have a minor effect on overall utilization (while potentially shifting the utilization toward more effective but more expensive LARCs).

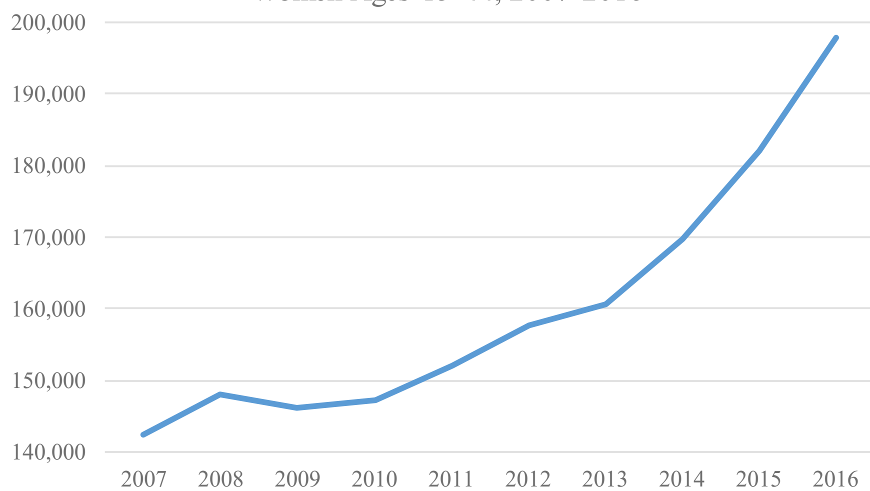
2.7 Other Fertility Impacts of the ACA

The ACA contraceptive mandate is just one small part of the ACA, which had a major impact on health insurance availability and healthcare costs. Several aspects of the ACA affected the reality of having a potential future child. The ACA increased the availability and quality of health insurance and at times at lower premiums. Having good and affordable health insurance would make quality health care both during pregnancy and for the potential child more realistic, and would likely lead to better health outcomes.

Some aspects of the ACA, such as requiring zero-cost preventive care and regular immunizations, would make the expected healthcare costs of an additional child lower than before the ACA. It would not be surprising, then, if as the expected total cost of a child decreased, the demand for that good increased.

One potential though less direct impact of the ACA on fertility was via increased infertility coverage and increased use of Artificial Reproductive Technology (ART). As part of the ACA, states were required to create state-specific Essential Health Benefits (EHB) benchmark plans to list out specific types of coverage that must be included in health insurance policies offered on the state's Marketplace. Twenty-four states included infertility coverage in their EHB benchmark plans for the 2014 to 2016 time period (see Appendix Table 2 for list of States). Some, but not all, of these states had state-level legislation already in place that required insurance plans to have some form of infertility coverage. Although EHBs are only enforced for individually-purchased plans and employer group coverage, many self-insured employers may feel pressure to cover the same list of mandated benefits in their state's EHBs in order to offer competitive benefits. It seems likely, then, that a substantial proportion of women in at least 24 states experienced a dramatic price decrease in infertility services at the same time the ACA contraceptive mandate came into effect. Figure 16, which shows the count of ART cycles per year, shows an average two percent increase per year from 2007 through 2013, then increases of 5.6 percent, 7.4 percent, and 8.6 percent for each year between 2014 and 2016, respectively. This seemingly changed rate could be due to any number of factors outside of better insurance coverage for infertility benefits, but it seems non-trivial to suddenly have the option of pursuing a treatment for hundreds of dollars that would have formerly cost tens of thousands of dollars. Although the CDC's 2018 Fertility Clinic Success Rates Report cites 1.9 percent as the proportion of US-born infants who are conceived via ART each year, these births are disproportionately to older mothers. The absolute effect of better infertility insurance coverage may not be playing a substantial role on changing fertility rates overall, but may have a more pronounced effect among older age groups.

Figure 16: Number of ART Cycles per Year, Women Ages 15-44, 2007-2016



Source: "2016 Assisted Reproductive Technology National Summary Report." CDC, National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health.

2.8 Research on the Effect of the Contraceptive Mandate

Current literature has not drawn a definitive conclusion about how the ACA contraceptive mandate has impacted fertility and abortion rates. Literature has either focused on the impact of state-specific mandates implemented prior to the ACA contraceptive mandate (and occasionally as a means of estimating the impact of the then-future ACA) or has studied the ACA's impact on some other reproductive health factor, such as contraceptive usage rates, but not its direct impact on fertility or abortion rates.

In general, the literature antedating the ACA intended to estimate the possible impact of the forthcoming ACA contraceptive mandate based on state mandate results. These papers use a variety of methods (difference in difference, fixed effects) and data sources (Pregnancy Risk Assessment Monitoring System (PRAMS), Behavioral Risk Factor Surveillance System (BRFSS), National Longitudinal Survey of Youth (NLSY), Centers for Disease Control and Prevention (CDC), US Census) to study a wide range of outcome variables (contraceptive use, unintended births, birth rate, fertility rate, abortion rate, STD rates). The main findings are mixed, but generally show a small decrease in the birth rate and unintended birth rate for some sub-populations (Atkins & Bradford, 2014; Dills & Grecu, 2017; Gius, 2013; Johnston & Adams, 2017; Magnusson et al., 2012; Mulligan, 2015). These papers, however, only examined the effect of weaker state contraceptive mandates that themselves only impacted a small subset of the population. This is especially important because state mandates only impacted those with private insurance (especially pre-ACA, a generally older, whiter, and wealthier population), and we would expect a universal contraceptive mandate to have the greatest impact on the subsets of the population with the highest rates of unintended pregnancy (younger, non-white populations). As a result, these studies likely underestimated the overall potential impact of the ACA because state mandates generally did not impact the populations we would expect the ACA's mandate to most impact. Seven articles representing this category of research are discussed in further detail.

The most common statistical method used is difference in difference (DID), utilized by five of the seven papers, which compares the difference in outcome variables for states with and without a contraceptive mandate in place. Dills and Grecu used US

Natality data from 1996 to 2009 to look at the DID effects of state mandates on birth rates as well as other measures of parental involvement, such as prenatal care and involvement in “risky” behaviors during pregnancy. Their regression models included county-level fixed effects. They found a statistically significant four percent decline in the birth rate for Hispanic women under 19 years old. Since only a third of Hispanic women were covered by the state mandates, the authors estimated a “treatment-on-the-treated” effect of a 12 percent decline for this subpopulation. No other subpopulations had statistically significant effects. These upward-adjusted estimates may still be an underestimate, as the ACA contraceptive mandate also includes a zero copay for contraceptives not found in the state mandates on which Dills and Grecu based their model.

Atkins and Bradford used BRFSS survey data between 1998 and 2010 in logit regression models to estimate the impact of state mandates on contraceptive use. They found that insured women in a state with a mandate were five percent more likely to use an “effective” method of contraception—which they defined as permanent sterilization, any FDA-approved prescription contraception, or condoms—and four percent more likely to use OCPs. Atkins and Bradford also found that there was no impact of the state mandates on women without insurance. As discussed earlier in Sections 2.2 and 2.4, self-reported increases in contraceptive use may be inaccurate and do not necessarily imply a corresponding decrease in the fertility rate. However, since increased contraceptive use is necessary to reduce unintended pregnancies, all else equal, it is relevant to the likely outcome of our study’s hypothesis that the more limited state mandates had a positive effect on contraceptive use.

Johnston and Adams used PRAMS data from 1997 to 2012 to estimate the probability of an unintended birth among privately insured women living in states with contraceptive mandates. The authors studied unintended birth as a whole, but also broke the unintended births into mistimed versus unwanted births. The authors found that the state mandates decreased the probability of unintended births overall and mistimed births specifically among women with private health insurance by 1.58 percent and 1.37 percent, respectively, in the second year after implementation. There was not a statistically significant effect on the unintended subcategory of unwanted births, suggesting that women who categorically do not want pregnancy regardless of timing may be less sensitive to cost. Surprisingly, the authors also found that women *without* private health insurance had a 1.57 percent and 1.97 percent decreased probability of unintended births in the first and second years after implementation, respectively. However, this drop in unintended births was attributed mostly to a statistically significant 1.21 percent decreased probability of an unwanted birth by the second year after implementation. In response to these results, the authors hypothesized that there could be spillover effects from the state mandates onto women without private health insurance. Other possible hypotheses include the fact that their models exclude variables that could account for differing economic and labor markets across states and time as well as abortion access, and, as discussed in Section 2.3, the possibility of bias when retrospectively self-reporting pregnancy intention post-birth.

The paper by Gius used fixed effects regression to model the DID effect of state mandates on abortion, birth, and sexually-transmitted disease (STD) rates between 1996 and 2006. Gius found no effect of the state mandates except for a statistically significant decrease in the crude fertility rate of 0.443 births per 1,000 women. Although Gius included variables for the percent of the state that is White/Caucasian as well as the percent falling in certain age categories, all the regressions were done on the US population as a whole and not by subpopulation. This is a major limitation of this paper since the unintended pregnancy rates described in Section 2.3 – and thus the expected impact of a contraceptive mandate – vary significantly by racial/ethnic and age subpopulation.

The paper by Mulligan utilized fixed effects to estimate the DID impact of state mandates on abortion and birth rates and contraception use. Results showed a statistically significant impact on abortions, estimating a three percent decrease in the abortion rate. Mulligan used this figure to estimate that the ACA contraceptive mandate would avoid approximately 25,000 abortions in the first year of implementation in the 20 states without state mandates prior to the ACA. Mulligan also found a statistically significant 2.1 percent increased likelihood of contraceptive use, but no significant impact on the birth rate. Unlike Gius, Mulligan was able to include three age categories—teens, 20-29, and 30-39—but like Gius also did not run any separate regressions by racial or ethnic subcategories. Although it seems reasonable to use the state mandates' results to prospectively estimate the lower bounds of the possible impact of the ACA contraceptive mandate, the state mandates sufficiently differ from the ACA contraceptive mandate to suggest a need for retrospective analysis now that longitudinal data are available.

Magnusson, et al. used NSFG data gathered between 2006 and 2008 in multilevel logistic regression models to estimate the adjusted odds ratio (aOR) of consistent contraceptive use among women with private insurance in states with full, partial, or no contraceptive mandates. The authors found a statistically significant aOR of 1.64 (95% CI: 1.08-2.5) of consistent contraceptive use for women with private insurance in states with full mandates. As stated previously, self-reported contraceptive use has flaws and does not necessarily imply a decrease in unintended births. Additionally, this paper seemed to ignore the timing of when specific states' mandates went into effect, which seems important since six of the 23 states' mandates were enacted between 2005 and 2007, just before or during the time period examined in this paper.

Although quite different from the previous six studies described, Burlone, et al. is included because it utilized available data to conduct an economic evaluation. This study used a decision-analytic model and TreeAge software to model the impact of increased contraceptive coverage proposed under the ACA contraceptive mandate. The authors compared the then-current status of women in Oregon versus the predicted reality under the ACA contraceptive mandate. The authors found that the ACA mandate would save healthcare costs, decrease the fertility rate, and increase quality adjusted life years (QALYs) via avoiding unintended pregnancies. These results are not as broadly generalizable as the population in Oregon is not representative of the entire US population, and as a result this article is the most geographically limited of the category. However, this article helps to provide additional evidence of the expected effects of the ACA contraceptive mandate, even if the results are limited to a narrow subpopulation.

The papers in this pre-ACA first category of research have substantial limitations, especially now that more data are available. That said, these papers still provide a helpful framework and lower bound for research conducted post-ACA implementation.

Among the research conducted post-ACA, no studies have examined the effect of the implementation of the ACA contraceptive mandate on fertility rates or abortion rates, instead examining the effects on other outcomes, such as price, LARC utilization, pill sales and discontinuation (Arora & Desai, 2015; Bearak & Jones, 2017; Bullinger & Simon, 2019; Carlin, Fertig, & Dowd, 2016; Law et al., 2016; Pace, Dusetzina, & Keating, 2016a; Pace, Dusetzina, & Keating, 2016b). However, because avoidance of unintended pregnancy constitutes the main cost savings of a contraceptive, and contraceptive sales and reported use do not equate to efficient prevention of unwanted pregnancy (especially as contraceptives can be used for things other than pregnancy prevention such as acne or period symptom management), it is still important to look at the ultimate impact of contraception mandates on fertility rates. Nine studies are included for further discussion.

Two of the papers use a pre-post design, which is a relatively weaker method comparing two cross-sectional measurements before and after the policy change. Arora and Desai used NSFG data from 2011 to 2013 to estimate the impact of the ACA contraceptive mandate on utilization and costs of reproductive preventive health (2015). Although they included a variety of demographic variables in their models, they did not run regressions by subpopulation. They found that the proportion of women using contraceptives did not significantly change between 2011 and 2013. Bearak and Jones used survey data from 2012 and 2015 in two cross-sectional studies to determine the impact of the ACA contraceptive mandate on contraceptive use (2017). Although they found no change in use among sexually active women, use of the pill increased from 21 percent to 40 percent among women ages 18 to 24 who had not had sex within the last month. Even so, most of the women in this second category listed pregnancy prevention as one of the reasons for starting contraceptives, suggesting a potential impact on unintended pregnancy.

Two papers had such narrow topics that the results only speak to one part of the effects of the ACA contraceptive mandate. Pace et al. (2016b) utilized claims data in a retrospective cohort study between 2010 and 2013 on the impact of the ACA on LARC use. They found that the percent of total pharmaceutical claims with zero copayment for IUDs and implants increased from 36.6 percent to 87.6 percent and from 9.3 percent to 80.5 percent, respectively, between 2010 and 2013. Although Pace et al. also found an increase of LARC uptake over time, this increase was not statistically significant. Law et al. also used claims data from 2011 to 2013 to estimate the impact of the ACA on out-of-pocket costs for contraceptives (2016). The authors found that costs decreased 70 percent, but did not find a statistically significant change in contraceptive use. Both these papers are not only limited by their narrow topics, they also did not account for the effect of state mandates on ACA effects.

Pace, et al. (2016a) used prescription claims data for women with employer-sponsored insurance between 2010 and 2013 to estimate the impact of the ACA on contraceptive cost sharing, discontinuation, and nonadherence. The authors utilized multivariate logistic regression and found a statistically significant decrease in cost sharing post-ACA. Higher cost-sharing was associated with higher discontinuation rates, and discontinuation and nonadherence had a significant but small decrease post-ACA. As mentioned previously, one limitation of using claims data as a proxy for use—especially when copayments are at or near zero—is that automatic shipment of zero-cost contraceptives does not imply continued or consistent use.

Of the nine post-ACA studies included in this analysis, Canestaro, et al. is unique in that it provides a cost-effectiveness analysis of the ACA employer mandate to cover contraceptives (Canestaro, Vodicka, Downing, & Trussell, 2016). Specifically, this study utilized a decision model to estimate the cost-effectiveness of insurance companies *electively* choosing to cover contraception under employer-sponsored insurance. This paper was written as a response to the expanded exemptions for mandated insurance coverage of contraceptives. The study utilized parameters from NSFG survey data to estimate the age, marital status, sexual activity, and contraceptive method use of the women in the model. The authors found that providing no contraceptive coverage resulted in a statistically significant increase in the number of unintended pregnancies, unintended births, and abortions. Total costs to the insurance company were also higher when providing no contraceptive coverage. The greatest effect was found on women between 20 and 29 years old. Although this article implies that even the more restrictive ACA contraceptive mandate is cost-effective for the country as a whole, it is still crucial to have analysis done on the data containing the real-life effects of the ACA. However, this article only models the hypothetical impact based on survey data and fails to utilize real data from the time period when the ACA contraceptive mandate was in effect.

Finally, three papers utilized DID methods to look at the effects of the ACA on reproductive health, with two papers looking at contraceptive use and the third looking at fertility rates. Carlin, et al. utilized claims data for women in the Midwest with employer-sponsored health insurance between 2008 and 2014 (2016). The treatment group included women with insurance coverage that eliminated contraceptive copayments, and the control group included women with insurance coverage that still required some non-zero contraceptive copayment. The authors found that decreasing the copayment led to a statistically significant 2.3 percent increase in contraceptive use with an increased likelihood of using LARCs. This paper is not only limited in terms of geography and generalizability to the US, but also because contraceptive claims do not equate to contraceptive use or a reduction in unintended pregnancies. Trudeau and Conway used data from the Current Population Survey (CPS) and BRFSS to examine the impact of both the ACA contraceptive mandate and the ACA young adult-dependent coverage mandate on young adults between 18 and 26 years old (Trudeau & Conway, 2018). The authors found a small decrease in fertility due to the contraceptive mandate in only some models. Although this study combines two policies that very much affected young adult health concurrently in a compelling model, its conclusions even for this age subgroup are limited because this study does not run the models by demographic subpopulations. Finally, Bullinger and Simon used prescription claims data between 2008 and 2014 to compare the sales of specific contraceptive methods pre- and post-ACA in states that did versus did not have a state contraceptive mandate prior to the ACA (2019). The authors found that the ACA increased sales of prescription contraceptives generally and a statistically significant increase in injectable contraceptives, but found no impact on other forms of prescription contraceptives (e.g. IUD, implant, pill, etc.) in states that did not have a state contraceptive mandate relative to states that did have a mandate. The main limitation of this paper is that its methodology assumes (1) that each state's adoption of a contraceptive mandate was completely random and (2) that the effect of the state mandate is the same as the ACA contraceptive mandate.

Although substantial research has been done on various aspects of state-specific contraceptive mandates as well as the ACA contraceptive mandate, present research has not yet definitively understood the impact of the ACA contraceptive mandate on fertility and abortion rates.

2.9 Conceptual Framework

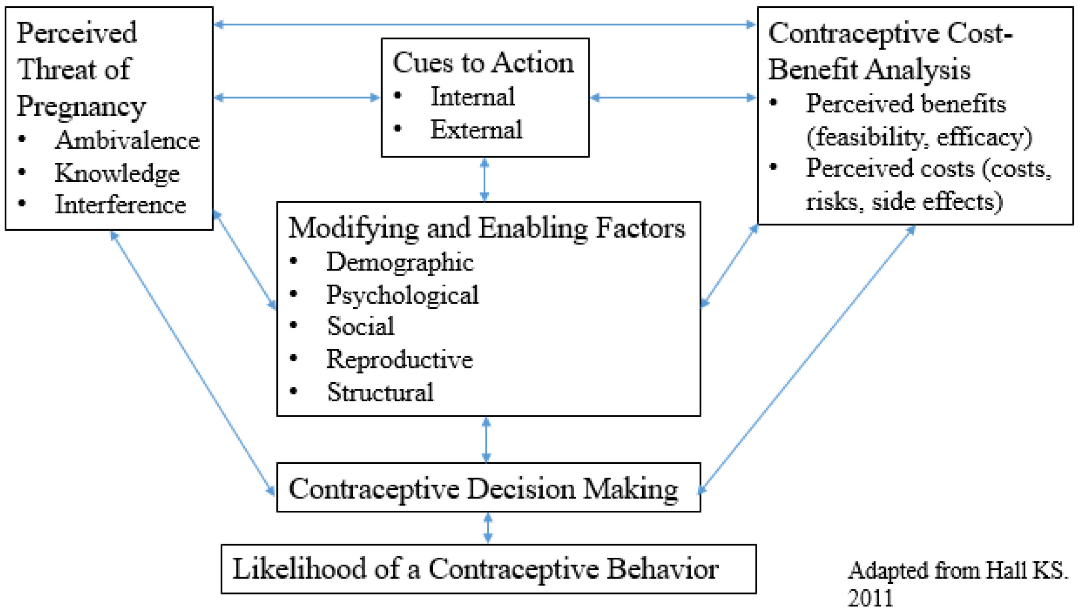
The broader conceptual framework for this research question includes a discussion of how individuals and couples decide whether to use contraceptives at all and, if so, how and when to use contraceptives for both the spacing (the individual or couple wants another child, but not now) and limiting (the individual or couple does not want another child) of children. Because this analysis ultimately looks at the effects of contraceptive use in terms of changes in the fertility and abortion rates, it will be impossible to identify whether changes in these rates are occurring because of preferences for spacing or limiting.

The conceptual framework for this research will examine three main components: 1. The general contraceptive decision-making framework; 2. The demand and supply for contraceptives in general; and 3. The individual model of selecting a contraceptive method based on perceived effectiveness as well as cost to the individual.

2.9.1 General Contraceptive Decision-Making Framework

The below visual flowchart (Figure 17) shows the pathways of different variables that influence contraceptive decision-making and contraceptive use and is an adaptation of the framework presented by Hall. This chart lays out four categories of variables that are intertwined and influence how the other categories ultimately lead to contraceptive decisions: perceived threat of pregnancy, cues to action, contraceptive cost-benefit analysis, and modifying and enabling factors.

Figure 17: Conceptual Framework of Contraceptive Decision Making



The perceived threat of pregnancy includes factors that identify the perceived likelihood of getting pregnant and the magnitude of a pregnancy's impact at that point in life. A woman may not have the knowledge to know what her risks of pregnancy are. Lack of sex education or awareness of one's fertility may inaccurately lead some women to assume that their activities are not putting them at risk for pregnancy. The perceived threat would be affected by the ambivalence the woman felt toward pregnancy in her life in general and at the more specific time of the contraceptive decision. If a woman knew she likely wanted to have kids at some point, but maybe not right now, she may be less likely to choose effective contraception than a woman who never wanted to have any children.

The cues to action may be internal or external and would operate to alert the woman to the threat of pregnancy. Internal cues could include menarche for very young women or delayed or missed periods in menstruating women. External cues could include anything absorbed from another person or entity, such as friends or the media, which would alert the woman to a risk of an unplanned pregnancy.

The contraceptive cost-benefit analysis is discussed at greater length in Sections 2.9.2 and 2.9.3, and weighs the perceived benefits of contraceptive use (such as increased likelihood of avoiding unplanned pregnancy) with the perceived costs. Costs are not limited to the financial costs, but also include social costs, time costs of obtaining contraceptives, and the risk of any side effects.

Finally, the modifying and enabling factors influence the ways in which each woman interacts with the other categories of variables, including demographic, psychological, social, reproductive, and structural variables. A woman with higher socioeconomic status and more ready access to healthcare and transportation may have had more thorough sex education (increasing her perceived threat of pregnancy), had more exposure to contraceptive options from her physician in annual exams (increasing cues to action), and may have better health insurance coverage and more income to cover contraceptive costs (affecting the cost-benefit analysis).

All four of these categories of variables work together to ultimately lead to a decision about contraceptive method use. This “decision” can even be the subconscious choice to delay by taking no action, for example, in the case where the perceived threat is low and there are insufficient cues to action. Once this decision has been made, it affects the likelihood of using contraceptives in a way that can reduce the risk of unwanted pregnancy.

From a policy perspective, addressing any of the first three categories of variables—perceived threat of pregnancy, cues to action, and cost-benefit analysis—while being aware of the modifying and enabling factors that put certain subpopulations at greatest risk could offer potential policy avenues for decreasing unplanned pregnancy. Since the categories of variables are all intertwined, thought must be given about how intervention in one area affects the entire experience of the individual.

2.9.2 General Economics of Contraceptives

Economics as a science attempts to make sense of human behavior. In economics, the discussion of consumer behavior frequently starts with defining a utility function, or mathematical representation of the estimate of happiness or satisfaction that one derives from consuming different goods. A more detailed discussion on the development and structure of the utility function is available in Section 8.1.1.

Economics assumes that people make utility-maximizing consumption decisions based on their utility functions, budget constraints, and prices *in that moment*. Any change in any of those three factors could affect purchase decisions. For example, a substantial increase in income could increase the total quantity of goods consumed. Likewise, evolving preferences could alter one's utility function and shift consumption.

The economics of consumer behavior focuses mainly, though, on the effects of price changes on quantities of goods purchased. The price elasticity of demand is the standard measure of the impact of a price change on the quantity purchased of a particular good. If a good is defined as a normal good (e.g. shoes), when the price goes up, the expected quantity demanded (or purchased) decreases. Conversely, if the price goes down, the expected quantity demanded increases. This is illustrated in the following linearization of the demand equation:

[Eq 1]

$$Q = \beta_0 + \beta_1 P$$

where Q represents the quantity demanded, P represents the price, and β_1 represents the impact on quantity purchased when the price increases (or decreases) by one unit. Frequently, β_1 is negative because one would expect an inverse relationship between price and quantity demanded. When looking at the effect of a change in price on the change in quantity, the above formula eventually yields the following equation for the price elasticity of demand, ε, where:

[Eq 2]

$$\varepsilon = -\frac{\Delta Q/Q}{\Delta P/P}$$

If the demand curve is a linear function, then the elasticity will be dependent upon the starting prices and quantities because it utilizes the percent change. Thus, the elasticity will be higher at higher starting prices and will not be constant across the function. To account for this, it is common practice to take the natural log of the above demand equation so the estimated elasticity is constant across all prices and quantities, yielding the following equation:

[Eq 3]

$$\ln Q = \beta_0 + \beta_1 \ln P$$

A good is defined as having elastic demand if the elasticity is greater than one and inelastic if the elasticity is less than one. Elastic demand means that a unit change in price has a greater than unit change in quantity (e.g. increasing the price by one percent will lead to a decrease in quantity that is greater than one percent). This frequently happens when there are substitutes for the specific good.

Because there are many contraceptive methods available, one might expect that demand for a specific contraceptive could be relatively elastic. However, the costs associated with switching contraceptive methods could make the demand seem more inelastic. Previous estimates of the price elasticity of contraceptives have largely determined that it is inelastic (Janowitz & Bratt, 1996; Lewis, 1986). Further discussion of how this equation will be utilized in this research can be found in Section 4 below.

In order for economic models to work exactly as predicted, it is assumed that the consumers have full information and are able to make rational, utility-maximizing decisions. These two assumptions possibly never reflect reality, but these two assumptions are especially unrealistic when it comes to contraceptive purchase decisions for the following reasons.

As is the case with most goods, when comparing various contraceptive methods, the consumer must evaluate multiple variables, such as cost (including both monetary and time costs), quality (including perceived effectiveness and risk of side effects), and ease of use. This decision is further complicated with contraceptive purchases because all contraceptives are not used for the same time period. Some are used in a single act of sexual intercourse (e.g. male condoms) while others can be used for up to ten years (e.g. copper IUD). This complicates the purchase decision because women are faced with options that are much more like a consumable good ranging to those more like a durable good.

For example, in addition to having higher effectiveness than SARCs, choosing to purchase an IUD has major time benefits, both in the form of lower time costs associated with compliance (e.g. avoiding taking a pill each day or scheduling and attending regular appointments for injectables, etc.) and lower time costs associated with making contraceptive decisions in the future.

The drawbacks of using an IUD, though, could include the uncertainty that a woman would have about whether that particular method will work for them specifically, whether she will want to continue using contraceptives during the lifespan of the IUD (versus wanting to try to have a/another child), and whether newer and potentially preferable methods would become available in the lifespan of the IUD. As is the case with most durable goods, historically there has been a relatively high upfront cost for an IUD, which adds financial risk to a complicated decision.

Another important component to the contraceptive method decision is the availability and accuracy of information about contraceptive alternatives. This includes information about pricing, side-effects, and effectiveness and could come from many sources, including physicians, pharmaceutical companies via advertising, partners, peers, or community resources. Since economics often assumes perfect information, it is important to note that the absence of perfect information in this case, particularly information about effectiveness and relative prices, could lead to unexpected purchase decisions.

For these reasons, it is unclear how much price alone will impact contraceptive use in the US, because the prices will change in an ever-changing world of availability, information, and common practices surrounding contraceptives. The violation of these assumptions will affect the results and could lead to different effects across time. For example, common beliefs about IUD safety for nulliparous women has been changing slowly over the last decade (Luchowski et al., 2014), so the likelihood of a physician suggesting use of an IUD in nulliparous women would likely increase with time, and, thus, likely increase IUD use among this population (Fleming, Sokoloff, & Raine, 2010) independent of IUD pricing.

This study will not attempt to attribute portions of changes in fertility or abortion rates to either changes in pricing, information, or common practices. However, it is imperative that these other forces are acknowledged and kept in mind when interpreting results.

To more closely examine the impact of these and other variables on contraceptive purchase decisions, the model of the decision at the individual level will now be explored.

2.9.3 Individual Model for Contraceptive Decision Making

When an individual is deciding whether to prevent a pregnancy, they are essentially weighing the total costs versus the total benefits of having a pregnancy. The total benefits of having a pregnancy when a child is wanted are high and somewhat difficult to quantify, including evolutionary-driven delight at seeing one's offspring, the desire to raise a child with a partner, social approval, and the increased chance of companionship and caregiving later in life. Since this research question assumes that the total benefits of pregnancy are less than the total costs at least at the point in time when the woman chooses to use contraceptives, quantifying the benefits of having a child will largely be ignored in the model.

The expected total costs (TC) of having an unplanned pregnancy are more easily defined, since most of the costs are either already defined explicitly in dollar amounts or easily quantified, and are divided into three categories: lost wages, costs of childrearing, and the additional less tangible costs associated with the burden of having an unplanned pregnancy. The lost wages (LW) due to an unplanned birth are not limited to just pregnancy and postpartum recovery. Lost wages are a discounted sum of reduced earnings into the future as shown below:

[Eq 4]

$$LW = \sum_{t}^{18} \beta^t \left(Wage_t - Wage_{pp,t}\right) * \left(Labor\ Supply_t - Labor\ Supply_{pp,t}\right)$$

where β is a discount rate between 0 and 1, $Wage_t$ and $Labor\ Supply_t$ represent the wages and labor supply at time t of the woman if she had no pregnancies, and $Wage_{pp,t}$ and $Labor\ Supply_{pp,t}$ represent the wages and labor supply post-pregnancy at time t. The loss of wages could extend well beyond the postpartum recovery in some situations where women delay returning to work or work fewer hours for many years after the birth of a child. Although relatively smaller in magnitude, there could also be LW when choosing abortion after an unplanned pregnancy if unpaid time off work was needed for the abortion procedure or recovery.

Total childrearing expenses are defined as the additional monetary costs of caring for a baby (CB). Overall basic living costs—including housing, medical care, food, clothing, and childcare—are higher for women who choose childbirth. Some of the costs are likely to be shared with the child's father if the woman is married or can establish the paternity of her partner. The costs of caring for a baby are a discounted sum of the difference in these basic living costs for the woman with and without a child. This sum would be added across the entire woman's life and the sign of CB may change in later years due to remittances. CB is defined as the following:

[Eq 5]

$$CB_i = \sum_{t}^{death} \beta^t \{ (H_{pp,t} + M_{pp,t} + F_{pp,t} + C_{pp,t} + CC_{pp,t}) - (H_t + M_t + F_t + C_t) \}$$

where β is again a discount rate between zero and one, the subscripts "pp,t" and "t" refer to time t post-pregnancy and time t without a pregnancy, respectively, H represents housing costs, M represents medical care costs, F represents food costs, C represents clothing costs, and CC represents childcare costs, which is only positive when the woman has a child.

The third category includes the less tangible costs of the additional disutility of having an unwanted baby (DB), which could include emotional distress, cultural stigma, or negative impacts on family or other relationships. When a child is unwanted, it would be expected that this last category of costs would have considerable variability across women, and could be particularly high in some situations. Finally, for women who abort, there are the costs of the abortion procedure, lost wages due to time off for the procedure and recovery, and any additional emotional disutility from having an abortion, represented in the model as a single "Abortion Cost" for simplicity. These components yield an equation for the expected total costs of getting pregnant at time i to be:

[Eq 6]

$$\mathrm{E[TC_i]} = [\mathrm{Pr(Abortion)\ x\ Abortion\ Cost}] + [(1 - \mathrm{Pr(Abortion)})\ (\mathrm{LW_i} + \mathrm{CB}_i + \mathrm{DB}_i)]$$

The expected cost, then, of an unplanned pregnancy in a one year time period would be TC_i multiplied by the probability of pregnancy (PRP) in that same time period. When using no contraceptive method, the typical woman faces an 85 percent chance of pregnancy in one year. If using the Mirena IUD, the typical woman faces a 0.2 percent chance of pregnancy in the same time period (Trussell, 2001). Thus, if a woman recognizes that she would have high total costs of an unplanned pregnancy, she should also recognize that her expected costs—meaning what her costs should be if she were the average woman—would be highly dependent upon the efficacy and effectiveness of the contraceptive method used, if any.

Assuming that women want to minimize the net cost of avoiding unintended pregnancy, their goal is to minimize the following:

[Eq 7]

$$\text{Minimize Net Cost} = C_{ij} + TC_i \times PRP_{ij}$$

where C_{ij} represents the discounted cost in period i of contraceptive j, TC_i represents the discounted total costs of the unplanned pregnancy in period i, and PRP_{ij} represents the probability of a pregnancy with contraceptive method j in period i[5]. Although PRP_{ij} is typically reported in terms of the probability of pregnancy in a year with contraceptive

[5] There are many factors aside from contraceptive use that affect PRP. In his seminal paper, Bongaarts identified the proximate determinants of fertility through which SES and environmental variables impact the fertility rate on a population level. Some of the proximate determinants Bongaarts discussed include: involuntary sterility, fecundity, breastfeeding, mean age at marriage, and contraception use and effectiveness. The individual model developed in Section 2.9.3 ignores the factors beyond contraceptive use and effectiveness in order to simplify the model. Additionally, the data used in this analysis are state-level data based on millions of women. With this many women represented in the data, individual proximate determinants average out to constants and the ACA contraceptive mandate's effect on Cij can be considered ceteris paribus in the sample. Finally, the statistical methods used assume that nothing happens concurrent with the ACA contraceptive mandate that would impact the proximate determinants of fertility as a population level, such as sudden changes in breastfeeding norms or widespread sudden menopause. See Bongaarts, 1987.

method j, PRP_{ij} can be calibrated to any time horizon. For example, a woman wanting to make her contraceptive method decision each month would calibrate the annual PRP_{ij} into the monthly risk of pregnancy with method j. Alternately, a woman who knew that she wanted to delay childbearing for a minimum of five years could calibrate the annual PRP_{ij} into a five-year measure to more accurately model the long-term costs of LARCs. If PRP_{ij} were calibrated to any time period i other than one year, C_{ij} would also need to be adjusted to the total discounted costs of method j over the selected time period.

If, for example, a woman was comparing using the lowest price modern contraceptive method to using no method, she would apply the following inequality.

[Eq 8]

$$C_{\mathrm{Lowest\ Price\ Contraception}_i} \leq TC_i \times (PRP_{\mathrm{None}} - PRP_{\mathrm{Any}})_i$$

which shows that a woman's utility will be greater using any contraceptive method as long as $C_{\mathrm{Lowest\ Price\ Contraception}_i}$ is less than or equal to the difference in expected costs of the unplanned pregnancy when using no method versus any method.

This same evaluation could theoretically be done to compare any two contraceptive methods. Table 1 lists the PRP, one-year effectiveness, retail costs, expected lifetime cost of childbearing (PRP*lifetime cost of childbearing), and Incremental Cost-Effectiveness Ratios (ICER) for seven different contraceptive choices. If a person did not want to ever have another pregnancy, each year they should be willing to pay some amount for contraceptives up to the total cost of raising a child multiplied by their risk of having an unintended pregnancy in that year, calculated in Table 1 as PRP*Lifetime Cost of Childbearing. If the increase in retail cost from switching to a more effective contraceptive method is less than the decrease in expected lifetime costs of childbearing, then switching to that contraceptive method is considered cost effective. Applying this definition, each contraceptive method listed in Table 1 is cost-effective. ICERs measure the change in cost divided by the change in estimated effect when switching between possible interventions. Specifically in this case, the ICER measures the dollars paid per percent increase in one-year effectiveness resulting from switching to a more effective contraceptive method. As is seen in Table 1, the lowest ICER is for the switch from unprotected sex to a male condom, which decreases the expected costs of raising an unwanted child by $156,519 when spending $120 per year on condoms, yielding an ICER of 1.79, or spending $1.79 for each additional percent of one-year effectiveness. If switching from male condoms to an oral contraceptive, one would pay an additional $554 to decrease the expected cost of raising an unwanted child by an additional $21,025. Although it still is rational to spend the additional $554 to save $21,025 in expected costs, it is a relatively less cost-effective switch than switching from nothing to condoms.

With the high US unintended pregnancy rate, the greatest impact that the ACA could have on unintended pregnancy (and, thus, on fertility and abortion rates), would be from switching women from no contraceptive to *any* contraceptive method or from reducing discontinuation or brand switching among methods. Although there would be a lower unintended pregnancy rate if everyone who currently was using oral contraceptives switched to an IUD, the additional costs would be much more effectively spent by getting more women on any contraceptive. A recent study found that reducing unintended pregnancies is most effectively achieved by decreasing method failure rather than switching from SARCs to LARCS, for example (Diamond-Smith, Moreau, & Bishai, 2014). Although it is interesting to know whether zero cost contraceptives shift prior users of oral contraceptives to IUDs, it has less aggregate importance related to the unintended pregnancy rate. Thus, the focus of this analysis is on how the ACA contraceptive mandate impacts fertility rate rather than how it optimizes contraceptive method mix.

Table 1: Illustrative Costs, Probabilities, and ICERs for the Rational Choice Model

Method	PRP[1]	One-Year Effectiveness	Retail Cost for One Year (Cij)[2]	PRP*Lifetime Cost of Childbearing[3]	ICER
Perfect Abstinence	0%	0%	$0	$0	
Unprotected Sex	85%	15%	$0	$198,569	-
Male Condom[4]	18%	82%	$120	$42,050	1.79
Oral Contraceptive Pill	9%	91%	$674	$21,025	61.59
Injectable	6%	94%	$551	$14,017	(41.14)
Mirena IUD	0.2%	99.8%	$850	$467	51.53
Implanon	0.05%	99.95%	$961	$117	738.40

Notes and Sources:

[1] Source: Trussell J. Contraceptive Efficacy. In Hatcher RA, Trussell J, Nelson AL, Cates W, Kowal D, Policar M. *Contraceptive Technology: Twentieth Revised Edition.* New York, NY: Ardent Media, 2011.

[2] Source for all methods except male condoms: Trussell, J., Lalla, A. M., Doan, Q. V., Reyes, E., Pinto, L., & Gricar, J. (2009). Cost effectiveness of contraceptives in the United States. Contraception, 79(1), 5–14.

[3] Estimated lifetime cost was set at $233,610, per Lino, M., Kuczynski, K., Rodriguez, N., Schap, T. (2017). *Expenditures on Children by Families, 2015.* Miscellaneous Publication No. 1528-2015. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. Available at: https://fns-prod.azureedge.net/sites/default/files/crc2015_March2017.pdf

[4] Assumes $2 per condom and 5 condoms per month, based on "Condoms." Available at https://www.plannedparenthood.org/learn/birth-control/condom.

The rational choice model predicts that women's demand for contraception should not be very price sensitive because the gains to contraceptive use (in the form of decreasing the expected cost of raising a child) far exceed the full contraceptive costs even if the products are not insured (see Table 1). Indeed, the rational model predicts that unintended pregnancy would be a rare event in a highly-rational population with high awareness about the availability of contraception and super-human impulse control. What's more, it seems especially surprising that the unintended pregnancy rate is so high in the US because only 12 percent of private-sector employees in the US have paid family leave (U.S. Department of Labor, 2012), so the expected lost income[6] during a brief maternity leave alone would far outweigh the cost of even many IUD insertions and removals each year.

Obviously, reality is right and the model is wrong—the goal of this exercise in theorizing is to establish the details about why the rational choice model fails. Ultimately, the theory that price matters in contraceptive decision-making presumes 100% rational calculation whereas real people have bounded rationality due to imperfect information and non-rational motivations rooted in feelings, social status, identity formation. Some coital acts occur after executive function has been impaired by alcohol or other substances. The nature of the violations to the rational choice model may or may not make a focus on price-barriers the obvious policy solution to unintended pregnancy.

Other explanations for model failure might include imperfect information about prices and an individual's specific PRP. For example, a recent study found that 49 percent of women ages 15 to 24 who reported an unintended birth in a 2002 NSFG survey reported that they had not been using contraceptives because they did not believe that they could get pregnant, thus making contraceptives unnecessary (Chandra, et al., 2012). Polis and Zabin found that although 19 percent of women and 13 percent of men believed it likely that they were infertile, some demographics had relatively higher odds of perceived infertility, including Hispanic women and men and women who received public assistance in the prior twelve months (2012). Furthermore, health insurance complicates the information about prices and both women and their physicians may not know what the prices of various methods will be. Additionally, although there is good

[6] US median income per month is estimated at $5000 (Guzman, 2019).

information about efficacy and decent information about effectiveness, the information about the effectiveness of a specific method for a specific individual is less known.

For example, a woman may perceive that she would be an ideal patient and assume that she would adhere perfectly to the method's protocol, and, thus, assume that her probability of pregnancy using any method would be much closer to the perfect-use rate (efficacy) rather than the typical-use rate (effectiveness). This potentially false assumption could negatively impact her ability to optimize contraceptive method choice. There is a chance that a highly-capable perfectionist with a deflated view of her capabilities may choose a method that is more effective than is warranted from an economic standpoint. For example, switching from an IUD to an implant shows a hugely inefficient ICER in Table 1. However, if the goal is to avoid unplanned pregnancies, then there should be less concern about these types of individuals and more concern about the confident and optimistic yet highly undisciplined women who would more likely overestimate their ability to strictly adhere to method protocol.

Finally, one other aspect of human behavior—risk homeostasis—could be impacting how representative the rational model is of reality. It could be that women, on average, are very tolerant of their pre-ACA contraceptive mandate level of unintended pregnancy risk. Thus, with the increase in contraception (and decreased overall risk of pregnancy, all else equal), the theory of risk homeostasis argues that people would alter their behavior when switching to more effective methods of contraception to maintain their risk level. In the case of fertility and increased contraceptive use, the altered behavior would be increasing coital frequency (Bell & Bishai, 2017). If this theory proved accurate in this population, then contraceptive use could increase while having zero effect on fertility. Since legal coitus is a voluntary act, more legal coitus increases the population well-being. Thus, even if the ACA contraceptive mandate does not change the overall fertility rates, the increased contraceptive prevalence indicate higher social welfare through the increased coitus.

3.0 Study Design

This is a retrospective longitudinal data analysis of US fertility rates from 2007 to 2017 and US abortion rates from 2008 to 2016. The time periods were selected due to data constraints and to ensure adequate capture of pre- and post-ACA contraceptive mandate trends in fertility and abortion rates.

3.1 Study Population

This research includes all women who at any point between 2007 and 2017 (Aim 1) or 2008 and 2016 (Aim 2) were of reproductive age (defined as ages 15 to 44 for Aim 1 and 11 to 44 for Aim 2) and lived in the United States. The study is based on vital records data for all births occurring inside the US regardless of mother's citizenship. Although residents of all states are eligible to be included in this study, not all states report abortion data to the CDC each year, so some abortions will not be captured in this analysis.

3.2 Data Sources

3.21 Fertility Data

The CDC Natality Data, which were accessed via CDC Wonder, were used for Aim 1. These data include counts of all live births in the US. This analysis is limited to 2007 through 2017 because of data availability at the time of the analysis. Although other data sources for live births had data available through 2018, they did not have the same breakdown of live birth counts or fertility rates by age of the mother, state, and race or ethnicity. Because significant variation in fertility rates is expected by demographic subcategories, preference was given for greater data specificity over additional years of longitudinal data pre-ACA contraceptive mandate implementation.

3.22 Abortion Data

The primary data for Aim 2 come from the annual Abortion Surveillance reports published by the CDC for the years between 2008 and 2016. There is roughly a three-year lag in data availability, so the data used reflect the most recent data available. These data include the counts of all reported legal abortions by the age of the woman, state, and race or ethnicity. There are 47 “reporting areas” included in the Abortion Surveillance reports for the study period, which include 46 states and DC.

There are a couple limitations to these data. First, four states—California, Florida, Maryland, and New Hampshire—do not ever report abortion data during the study period and not all states report each year, so some abortion data are not captured. Second, not all the abortion data that are reported include all of the demographic information to further categorize the counts, such as age of the mother. Finally, the data that are further broken down by demographic categories are reported by the state where the abortion occurred instead of by the woman’s state of residence.

The final limitation is the most problematic for this analysis. Ideally, data by the state of residence would be strongly preferred because a person’s circumstances that result in abortion happen in the state where they live, not the state where the abortion takes place. It is the state-level mandate and the state-level variables that most impact the effect of the ACA contraceptive mandate in the state. States neighboring other states with relatively restrictive abortion laws will have data for a large number of abortions that their demographics and state policies did not create. Conversely, states with relatively restrictive abortion laws will not record the full abortion outcome for their policies, culture, and demographics. The most recent Abortion Surveillance Report published by the CDC states that 12.4 percent of all abortions reported to the CDC do not include information about maternal residence. Furthermore, there is substantial variation in the percent of abortions obtained by out-of-state residents in each state—ranging from 0.6 percent in Alaska to 49.8 percent in Kansas. These limitations and the methods used to mitigate them are discussed in greater detail in Sections 4.2 and 5.1.

Additionally, data on the number of operating abortion facilities by state and year were provided by The Guttmacher Institute. For the three years in the 2008 to 2016 time period for which these data were not available—2009, 2012, and 2015—the mean of the number of facilities in the state from the year before and after the missing year was used. These data were used as a proxy for overall abortion access within states during the study period.

3.23 Census Data

Total resident counts by state, age of the woman, and race or ethnicity were obtained from US Census data. These counts were used for the population weights in the weighted regressions and to calculate the age-specific abortion rates by demographic subcategory. These data came from intercensal population estimates from 2007 through 2017 and were accessed via the US Census Population Estimates API.

The American FactFinder tool from the US Census was utilized to obtain intercensal estimates of state-level demographic variables. These data were used as controls in the regressions. A full list of the variables obtained is included in Section 3.3.

3.3 Study Variables

3.3.1 Outcome Variables

The outcome variables are either the fertility rate for Aim 1 or the abortion rate for Aim 2, meaning the number of live births or abortions per 1,000 women in the designated aggregation level. For example, the most basic regressions will have the fertility rate or abortion rate by state and year, which can be interpreted as the number of live births or abortions per 1,000 women of reproductive age in each state in each year. Regressions that are broken down by age categories will include age-specific fertility rates (ASFR) and age-specific abortion rates (ASAR).

3.3.2 Binary Variables

Each analytical file will include three binary or dummy variables. The first indicates whether the ACA contraceptive mandate is in effect (2013+). The second indicates whether a state mandate was in effect that year, which varies for each of the 30 states. The final dummy variable is a multiplied product (or "interaction term") of the previous two (and equals 1 if it is a year post-ACA contraceptive mandate in a state with a pre-ACA mandate). The final effect of the ACA contraceptive mandate in states with state-specific mandates would be the sum of the estimated coefficients for the first and third binary variables.

Unlike policies that have a clear start date of impact, such as speed limit laws, the contraceptive mandate had a more staggered starting impact on individuals since it was implemented via insurance coverage, with different policies adopting the change at different times. To account for this, various assumptions about the timing of implementation and effects were used in the series of regressions. A more detailed discussion of these assumptions about effect coding is included in Section 4.2.4.

3.3.3 Demographic Variables

Ten demographic variables aggregated at the state-year level are included in the model. These variables are utilized because they are likely to be associated with the fertility and abortion rates in each state and help explain differences between states in the outcome variables. The demographic variables fall into three categories described below in Table 2. An additional demographic variable measuring the annual ratio of open abortion clinics per 100,000 women between ages 15 and 44 was used in the abortion analyses. Because demographic data were not consistently available by demographic subgroup, the state means for the demographic variables were used as proxies for the subgroups' true demographic variable values. Investigation of data that were available by subgroup showed variation in subgroups' correlation with the state means (see Appendix Table 3).

Table 2: Demographic Variable Definitions

Category	Variable	Definition
Insurance Data	Employer-based health insurance	Percent of the state population ages 18 to 64 years with employer-based health insurance
	Medicaid coverage*	Percent of the state population ages 18 to 64 years with Medicaid coverage
Household Data	Household income	State median household income
	Family size	State mean family size
Population Data	Unemployment rate	State unemployment rate
	Percent Non-Hispanic White	Percent of all state population that is Non-Hispanic White/Caucasian
	Percent married	Percent of women ages 15 and older who are currently married
	Percent born to unwed mothers	Percent of all babies born each year to unmarried mothers
	High school graduate	Percent of the state population ages 25 and over with a high school degree or higher
	College graduate	Percent of the state population ages 25 and over with a bachelor's degree or higher

*The data categorization utilized by the US Census changed in 2017 to include ages 19 to 64.

4.0 Methods

4.1 Data Processing

The data described in Section 3.2 were downloaded from publicly available websites or extracted from published publicly available reports. Analytical files were created for each outcome (fertility rates and abortion rates) and for each level of aggregation. There was a total of six analytical files for Aim 1 and four for Aim 2, described in Table 2 below. The analytical files do not have identical aggregation levels because the abortion data were more limited than the fertility data.

The first analytical file for abortion rates is categorized by the woman's state of residence. The remaining three analytical files for the abortion rate are categorized by the state of abortion occurrence. It would have been preferred to have data by the state of residence to better control for state-level factors influencing the abortion rate. Since state data are not available by age category or race/ethnicity, the first two analytical files—both with all ages and all races/ethnicities—are used to better understand the difference in results when looking at abortions by state of residence versus state of occurrence.

Table 3: Analytical Files Created

Outcome	Age	Race	Ethnicity	Regression Models†
Fertility Rate	All	All	All	2
	All	By race	All	4
	All	All	By ethnicity	2
	By age category	All	All	6
	By age category	By race	All	24
	By age category	All	By ethnicity	12
Abortion Rate*	All	All	All	2
	All	All	All	2
	By age category	All	All	6
	All	By race	By ethnicity	4

†The analytical files for all ages and all races/ethnicities have two regressions per file: one with only the ACA contraceptive mandate variable and one with all three policy variables.

*The first set of abortion regressions for all populations combined is for abortions by the woman's state of residence. The remaining three sets of regressions are for abortions by the state of occurrence.

Once these ten files were created, the three binary variables described in Section 3.3.2 were merged onto each dataset by state and year. The data for the ten demographic variables described in Section 3.3.3 were combined into a single file by state and year and similarly merged onto each analytical dataset. Finally, the population weights were calculated. The population weights were defined as the mean population across the entire time period for that aggregation level. For example, the mean annual number of Black/African American women between ages 20 and 24 living in Nebraska between 2007 and 2017 would be used to form the population weight utilized in the fifth analytical file for the Aim 1 fertility rate analysis.

Table 4 below reports the descriptive statistics of the variables used in this analysis. Summary statistics were calculated from the data utilized in the regression models with demographic variables and all demographic subpopulations combined. Each variable represents the state-wide value; there are no breakdowns by demographic subcategory in this table. The reported mean represents the unweighted average of each variable for the listed number of state-years. Four states—California, Florida, Maryland, and New Hampshire—do not report abortion data. Additionally, the abortion data are not available for as many years. Thus, there are fewer states and state-years in the abortion analysis. Other than having a slightly lower average median household income in the abortion analysis, the demographic variable means and standard deviations are largely unchanged.

Table 4: Descriptive Statistics of Data Used for Fertility and Abortion Analyses

	Fertility Analysis		**Abortion Analysis**	
Counts				
States*	51		47	
State-Years	408		327	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Crude Fertility Rate (births per 1,000 women)	63.23	6.75	-	-
Abortion Rate (abortions per 1,000 women)	-	-	10.10	3.89
Unemployment Rate	7.7%	1.9%	7.9%	1.9%
Median Household Income	$54,325	$9,119	$52,961	$8,393
Percent with Medicaid	12.4%	4.7%	12.1%	4.6%
Percent Married	50.2%	4.3%	50.5%	4.1%
Median Family Size	3.18	0.17	3.17	0.16
Percent with High School Degree	87.8%	3.2%	87.6%	3.2%
Percent with College Degree	28.9%	6.0%	28.3%	5.6%
Percent with Employer-Based Health Insurance	61.7%	5.3%	61.6%	5.0%
Percent Non-Hispanic White	69.5%	16.4%	70.7%	15.6%
Percent of Infants Born to Unwed Mothers	35.3%	6.8%	35.5%	6.8%
Abortion Clinics per 100,000 Women	-	-	1.26	0.99

*The fertility analysis includes all 50 states plus DC. The abortion analysis includes 47 "reporting areas," with data representing 46 states (California, Florida, Maryland, and New Hampshire omitted) plus DC.

Note: Results are based off data utilized in regressions that include demographic variables and all women. Mean and standard deviation are unweighted calculations for the state-years reported.

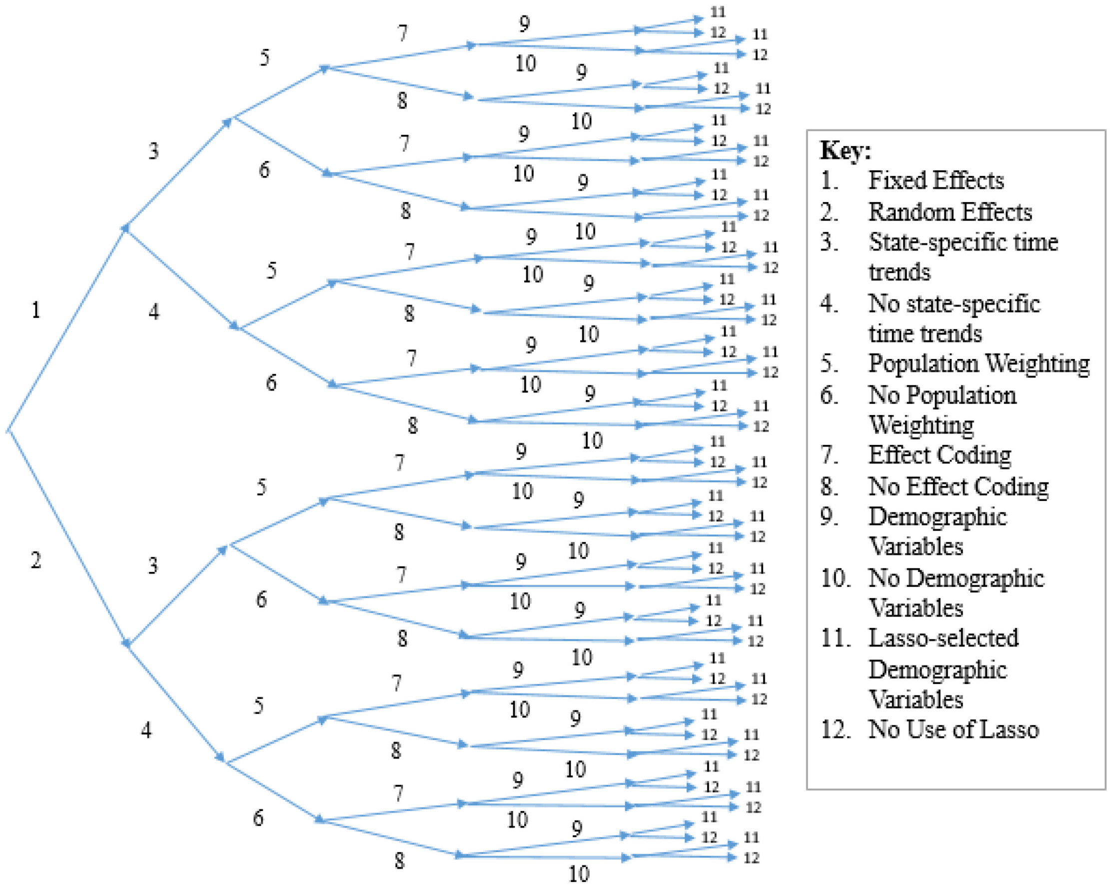
4.1.1 Demographic Variable Exploratory Analysis

As part of the data processing, an exploratory analysis of the demographic variables was conducted to better understand these variables and their relationship to the two outcomes—fertility and abortion rates. Boxplots were created first for each demographic variable to identify any outliers and confirm outlier data accuracy in source materials. Locally Weighted Scatterplot Smoothing (LOWESS) was then run for the demographic variables with each of the two outcomes to observe the relationships between variables.

4.2 Regression Model Methodology

The final regression model was determined through strategic and systematic testing of six regression model characteristics. The order in which these analyses were conducted is outlined in Figure 18 and the following subsections walk through the methodology for each decision point.

Figure 18: Decision Tree For Modeling Design Selection



4.2.1 Fixed Effects versus Random Effects

The analytical datasets created as described in Section 4.1 were first used to run fixed effects regressions with the following regression equation:

[Eq 9]

$$FR_{s,t} = \beta_0 + \beta_1 SPM_{s,t} + \beta_2 ACA_{s,t} + \beta_3 SPM * ACA_{s,t} + X'_{s,t}\pi + Year'\delta + \theta_s + \theta_t + \varepsilon_{s,t}$$

where $FR_{s,t}$ represents the fertility rate (or abortion rate) in state *s* at time *t*, $SPM_{s,t}$ represents the dummy variable for state policy mandate, $ACA_{s,t}$ represents the dummy variable for ACA, $X'_{s,t}$ represents a matrix of state-level demographic variables, $Year'$ represents a matrix of dummy variables for each year, and θ_s and θ_t represent the state and year fixed effects. It is expected that the coefficient estimating the impact of the

ACA contraceptive mandate (β_2) will be larger in magnitude and have a greater statistical significance than the coefficient estimating the impact of the state contraceptive mandates (β_1). The third coefficient (the "interaction term," or β_3) is expected to be the smallest in magnitude because women in states with state contraceptive mandates would experience relatively smaller additional benefits from the ACA contraceptive mandate than women in states without state contraceptive mandates.

The decision between fixed effects and random effects models comes into play because of the potential for what is referred to as "omitted variable bias" in panel data. In most regressions, there are variables that are correlated with the outcome variable that are not included in the model. Typically, this happens because the variables are difficult to measure or are not available at the level of specificity required to be useful.

For example, an individual's decision about their own fertility or abortion use is likely influenced by their perceived level of community support or disapproval over their potential choices. The perceived support or disapproval could be influenced by religious or cultural differences. Perceived support or disapproval, religious or political views, and cultural differences vary regionally. Although these data could be carefully collected through well-articulated surveys and aggregated up to mean perceptions at the state level, that is infeasible for this analysis. However, because these mean perceptions and mean religious or cultural views and expectations are correlated with states, a random effects model may yield biased estimates of regression coefficients due to absorbing some of the effect of the omitted variables.

The actual impact of the omitted variables on the outcome is irrelevant as fixed effects models assume that the impact is constant across time. Fixed effects models remove or control for the effect of the omitted variables that remain constant over time, or at least that can be assumed to remain constant over the time period of the analysis. For example, the cultural views toward fertility and abortion have certainly evolved over the last 100 years in the United States, but the changes within each state have been more constant over the time period in this analysis. When using fixed effects, the changes in the outcome variable are more likely to be accurately attributed to the changes in the observed predictors.

Using fixed effects models is not without its drawbacks. Fixed effects models only utilize the variation within the entities—in this case, the states—and ignores the variation across states. Fixed effects models also cannot estimate the effects of variables that do not change over time. Additionally, by assuming omitted variables are time-invariant, fixed effects models cannot estimate the impact of these omitted variables, but specification tests can detect whether collectively, the omitted variables were biasing estimates that did control for fixed effects. Finally, although fixed effects models yield less biased estimates, this comes at the cost of larger standard errors and the potential for type 2 error if sample sizes are limited.

Given our theory of how local culture affects outcome variables, it seems likely that the fixed effects model would be preferred over random effects. However, to ensure that this is a correct assumption, a Hausman Test was conducted to verify the fixed effects versus random effects model.

4.2.2 State Fixed Effects versus State-Specific Time Trends

The fixed effects model at the state-year level is estimating a difference in difference model with the state mandates and ACA contraceptive mandate. Even though the individual state y-intercepts for fertility rate and abortion rate trend lines would vary, this model assumes that each state will have parallel time trend in fertility rates across time. If this is a valid assumption, then the fixed effects model at the state-year level is sufficient. If, however, the trend lines are divergent across states, then it is more appropriate to also include state-specific time trends into the model to allow the flexibility for each state to have a different time trend. The decision about whether to include state-specific time trends involves balancing out the tradeoff between increasing the model's accuracy and attenuating the statistical power of the model. There are relatively few observations when utilizing state-level data, so adding in state-specific trend lines for all 50 states can quickly weaken the model's power. One avenue for compromise is to include state-specific trend lines only for states that appear to not have a roughly parallel time trend to the mean time trend for all states.

To determine which states warrant the inclusion of state-specific trend lines, a visual inspection was done of all states' trend lines compared to the mean time trend of all states. Any states identified as not having a roughly parallel time trend would be added to the regression model as a state-specific time trend. Models that were run with state fixed effects were compared with models run with both state fixed effects plus state-specific time trends for states with non-parallel trends. Differences in the adjusted R-squared statistics between the two modeling options were investigated to help determine whether adding state-specific time trends leads to a better model fit. Ratios of the estimated parameters of interest were graphed to understand how robust the results are to the decision surrounding state-specific trends.

4.2.3 Population Weights

Because there are arguments for and against using population weights in the regression models, all regressions are run with and without population weights. When using fixed effects, each state is treated as an individual unit, so this analysis has a maximum of 51 analytical units (50 states plus DC) in the fertility analysis and 47 analytical units (46 states plus DC) in the abortion analysis. If the regression is not population-weighted, each of the 51 analytical units is treated as equally important compared to every other state in the regression, regardless of the relative population of each state. These unweighted regressions have results that are generalizable to states. Unweighted estimates presume that each state is the unit that is being given a policy treatment and that each state's response to the treatment is of equal interest regardless of its population. Conveniently for a state policy maker, unweighted estimates are the mean effect on state-level fertility and abortion rates with the implementation of the ACA contraceptive mandate.

If, however, the goal is to understand what happened on a population level or for any external applications, population weights are preferred as unweighted regression estimates may be biased. From our theoretical perspective, the ACA mandates and state policies were policy treatments applied to 60 million American women who happened to be residing in 51 different locations. When population weights are used, each birth or abortion has equal importance in the regression regardless of the state where the event occurred. This necessarily means that states with larger populations, such as California and New York, would have their fertility or abortion rates weighted more heavily in the regression than outcome data from Wyoming, for example. It makes sense that if one wants to understand how an entire country's population will respond to any future policies, then states with more people have to be weighted more. The estimates from the population-weighted models estimate the response to the policy on a population level.

However, one must be cautious when interpreting and applying results from a population-weighted regression. The linear model assumes that there are homogenous error terms across the data points. Because states with a larger population have a larger sample size, their estimates of statewide fertility and abortion rates could have a smaller standard error than states with a smaller population and smaller sample size. Thus, if the assumption of homogenous error terms is violated and the states with higher populations are weighted more heavily in the model, the estimated coefficients could have estimated error terms that would be underestimated when applying results to smaller states. Adding the vce(robust) command in Stata helps to correct the heteroscedasticity of the error terms.

To test the impact of utilizing population weights, the ten most populous states were iteratively removed from the model that utilized population weights. This was done to understand how excluding the most populous states impacted the significance and magnitude of the parameter of interest. Understanding each large state's potential impact on the outcome provides guidance on when and how to use models with versus without population weights.

4.2.4 Effect Coding

As mentioned in Section 3.2.3, a contraceptive mandate behaves differently than how we might normally think about laws. When they go into effect, most laws pose a penalty on violators that applies to everyone equally at the exact time the new law goes into effect. In contrast, the contraceptive mandate required insurance companies to change their policies to cover prescription contraceptives starting after August 1, 2012. Although most private health insurance policies in the US start on January 1 of each year, because health insurance is often secured via employment, most people who started new health insurance coverage after August 1, 2012 would have a policy that would have to comply with the contraceptive mandate. This led to some people having full coverage of prescription contraceptives months before most people's new health insurance policies started on January 1, 2013.

Even if the health insurance coverage of everyone in the US changed on the same day, the effect of the policy still would not be on the same day for everyone because people need to see a physician to get prescriptions for contraceptives. Observable changes in births would then occur nine months later. This delay in the time to get an appointment and fill prescriptions and then get pregnant and then give birth leads to even greater differences in the date when the contraceptive mandate would begin having effects on fertility and abortion rates.

Because of these two effects, using a strict binary categorization would lead to biased estimated effects of the contraceptive mandates, and would underestimate the true impact of the policy change. Even if data were available for each individual's insurance coverage's adoption of the contraceptive mandate, the regression's calculated coefficient would still underestimate the impact of the policy change because of the delay from the date of policy change to the date that new contraceptives are acquired and being used.

Effect coding is a strategy used when weights other than a binary zero or one value are used with categorical variables. The contraceptive mandate is an ideal scenario to utilize effect coding to help account for the phase-in aspect of the mandate's effects. This analysis uses effect coding in slightly different ways for the fertility and abortion analyses because a contraceptive mandate would impact each outcome on a different timeline. One would expect the earliest impact on fertility rates to be roughly nine months from the start of the contraceptive mandate, whereas the impact on abortions could start much sooner. Because of this difference, a "transition year" was defined to be the year in which it would be expected that the mandate would start impacting the specific outcome. Years after the transition year are modeled to have the full effect of the contraceptive mandate.

Four different methods of effect coding were utilized in the series of regressions to test for impact for the both the fertility and abortion analyses. Details of each are listed below in Tables 5.1 and 5.2. Comparisons of the magnitude and statistical significance of all estimated coefficients were made to determine the best model of effect coding for this analysis.

Table 5.1: Effect Coding Methods for Fertility Analyses

Method Label	ACA Mandate Values 2013	ACA Mandate Values 2014	Method Description
2013=0.35	0.35	1	The value of 0.35 was used because only the final three months of births in 2013 would be a result of pregnancies after the full mandate was in effect on 1/1/2013. The additional 0.1 is to cover the much smaller percent of people for whom the ACA mandate applied to their insurance plans starting in mid-2012. The 0.1 is likely larger than is needed, but that is done intentionally so the estimated effect is more likely to be underestimated than overestimated.
2013=0.5	0.5	1	This is more of a standard effect code when implementing mid-year. This would likely overattribute birth rate changes to the ACA.
2013=1	1	1	This assumes that the full effect is seen starting as soon as the day the policy is in "full force." This unrealistically assumes that greater contraceptive access could retroactively help to avoid unintended pregnancies that had already occurred.
2013=0	0	1	This assumes that an insignificant number of potential pregnancies were impacted prior to the second quarter of 2013 (as people are realizing their expanded insurance coverage, getting in to see a doctor, and filling Rx and starting contraceptives).

Table 5.2: Effect Coding Methods for Abortion Analyses

Method Label	ACA Mandate Values 2013	ACA Mandate Values 2014	Method Description
2013=0.75	0.75	1	Because it takes several weeks from unprotected sex to a positive pregnancy test, and then typically at least a couple more weeks until a woman could obtain an abortion, this method assumes that even if women had contraceptive access nearly immediately after the mandate went into effect, the would not be decrease in the abortion rate for at least the first couple months of the year.
2013=0.5	0.5	1	Similar to the 2013=0.75 effect coding, this method takes the delays to positive pregnancy test and abortion procedure into account, but also assumes that there is at least a couple month lag before women are able to start new contraceptives after the mandate goes into effect. This would delay the impact of the contraceptive mandate on the abortion rate until roughly half way through the first year.
2013=1	1	1	This assumes that the full effect is seen starting as soon as the day the policy is in "full force." This unrealistically assumes that greater contraceptive access could retroactively help to avoid unintended pregnancies that had already occurred and, thus, immediately start avoiding abortions.
2013=0	0	1	This assumes that an insignificant number of potential pregnancies were avoided during the majority of 2013 as people are realizing their expanded insurance coverage, getting doctor's appointments, filling Rx, and starting contraceptives.

4.2.5 Demographic Variables

The ten demographic variables listed in Table 2 were added to the model to help better control for time-varying factors that impact either the fertility or abortion rates directly or impact how the ACA contraceptive mandate would impact the outcomes. In some of the scatterplots of the dependent variable and each demographic variable, the relationship between the two variables changed across the range of the demographic variable. Partitioning the demographic variables into segments allowed for a more flexible specification so these changing relationships could be better captured. The effects of partitioning the demographic variables were tested by halves, quartiles, and quintiles.

4.2.6 Lasso-Selected Demographic Variables

Similar to the concerns about adding in superfluous state-specific time trends at the expense of the model's power, there is also concern about overfitting the model with too many demographic variables to the detriment of the model's overall power. Conversely, there is also concern about omitted variable bias, when an important independent variable is left out of the model, leading to biased estimates. To help find the optimal demographic variable list for each of the regression subgroups, the lasso2 command in Stata was used to select the demographic variables for each regression. The Extended Bayesian Information Criteria (EBIC) was used as this method levies an additional penalty on the overall number of parameters, which decreases the likelihood of overselection. The lasso2 command utilizes an algorithm to iteratively add and drop variables to select the value of lambda that minimizes the EBIC. Any variables added prior to the algorithm identifying the minimum EBIC are included in the model.

As is also the case with prior tests for model selection, the adjusted R-squared and estimated coefficients for the parameter of interest were compared to determine whether the full list of demographic variables or the lasso-selected demographic variables lead to the best model for the data.

5.0 Fertility Results and Discussion

5.1 Fertility Results

The regressions for the fertility analyses were run on the subpopulations outlined in Table 2, using a series of slightly differing models outlined in Figure 18 (to, among other things, test for robustness). The results of these multiple regression models are detailed in the following subsections.

5.1.1 Fixed Effects versus Random Effects

The first set of regressions modeling the impact of the ACA contraceptive mandate on fertility rates were done to determine whether to used fixed effects or random effects in the subsequent models. To do this, Equation 9 was used, exclusive of demographic variables. Each of the 50 regressions was modeled with both fixed effects and random effects separately, and the results were used to conduct a Hausman test.

The full fixed effects regression results are available in Appendix Tables 4.1 to 4.4. The first three rows of the regression results tables include the binary variables for the state mandates, the ACA contraceptive mandate, and the interaction of the two mandates. Following these binary variables are the individual year binary variables and the ten demographic variables, when included in later models. In these and all other Tables and Figures, the following abbreviations are used: “Black/AA” represents Black or African American, “White” represents White or Caucasian, “AIAN” represents American Indian or Alaskan Native, “API” represents Asian or Pacific Islander,” and “Hisp” and “Non-Hisp” represent Hispanic and Non-Hispanic.

A subset of the Hausman test results, including the Hausman Test chi-square, degrees of freedom, and corresponding p-value, are reported in Table 6. Again, if the

Hausman Test statistic is significant, this indicates that the fixed effects models should be used as they yield unbiased estimates. If the Hausman Test statistic is insignificant, random effects models are preferred as they are more efficient. Five of the fourteen regressions in Table 6 have a Hausman Test statistic that is significant at the alpha=0.05 level and an additional four that are significant at the alpha=0.10 level. Because of the mixed results, and because fixed effects better fits with the theory behind the model of fertility rates, it was decided to use fixed effects to minimize the risk of estimation bias and to maintain method consistency across the 50 regression subpopulations.

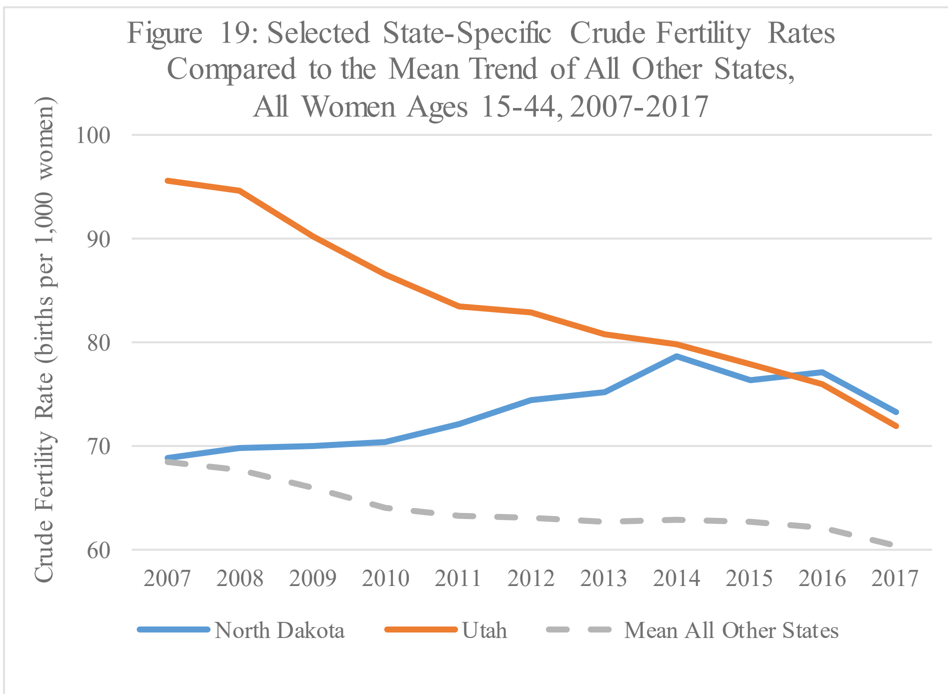
Table 6: Selected Fertility Analysis Hausman Test Results

		Hausman Test Results		
Regression Category	**Subcategory**	**Chi-Square**	**DOF**	**P-Value**
All Data	ACA Only	--		
	All Variables	8.25	2	0.0161*
By Race	Black/AA	7.36	2	0.0252*
	White	0.92	2	0.6302
	AIAN	6.54	3	0.0880
	API	2.48	2	0.2895
By Ethnicity	Hispanic	5.68	2	0.0584
	Non-Hispanic	15.59	2	0.0004*
By Age Group of Mother	15-19	5.33	2	0.0695
	20-24	8.04	2	0.0179*
	25-29	6.21	2	0.0448*
	30-34	0.99	2	0.6089
	35-39	5.17	2	0.0753
	40-44	3.28	2	0.1940

*P-value indicates fixed effects is optimal at the alpha=0.05 level.

5.1.2 State Fixed Effects versus State-Specific Time Trends

As discussed in Section 4.2.2, state fixed effects assumes that states have roughly parallel time trends, so testing was done to determine whether any states required state-specific time trends in addition to state fixed effects. Two states—North Dakota and Utah—were determined to have sufficiently unique time trends to justify testing the inclusion of their state-specific time trends in the regression models. These states' fertility time trend lines are graphed in Figure 19, as well as a reference line for the mean fertility time trend of the remaining states. The full graph of all states' fertility time trend lines is available in Appendix Figure 1. North Dakota was the only state with a generally increasing fertility rate during the time period. Although Utah's trend line is not as dramatically different from the mean as North Dakota's, the slope of the decline is much steeper given the much higher starting mean fertility rate. Thus, to ensure the best possible modeling of fertility rates, both states' time trends were included in the testing of state-specific time trends.

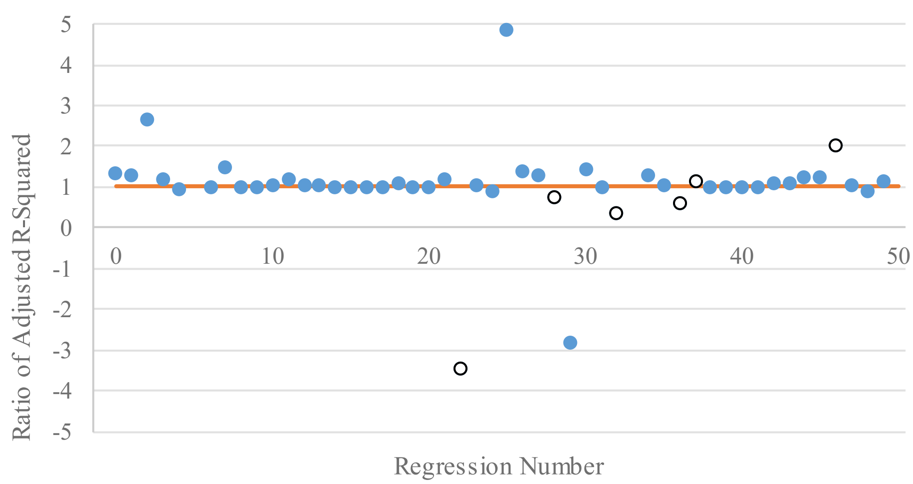


After these two states were identified, state-specific time trend parameters were included in the fixed effects regression model described in Section 5.1.1. The regression results are reported in Appendix Tables 5.1 to 5.4. To better visualize the impact of the inclusion of these two states' time trends on the overall model's goodness of fit, Figure 20 graphs the ratio of the adjusted R-squared for models with versus without the two state-specific time trend parameters. For this and all other graphs of ratios, the solid blue circle indicates that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. The ratio is otherwise marked with a white circle outlined in black if either one or both estimated coefficients in the ratio were not statistically significant. Of the 50 regression models, 38 models have a higher adjusted R-squared when including the state-specific time parameters. An additional four models have an adjusted R-squared ratio between 0.9 and 1.0, indicating that the adjusted R-squared with state-specific time trends is within ten percent of those in models without state-specific time trends. Of the remaining eight models with adjusted R-squared ratios less than 0.9, four of them are for American Indian or Alaskan Native women in the four age groups between 25 and 44 years old.

Two ratios are not in the range of the graph: regression six (Asian or Pacific Islander women of all ages, ratio: -140.97) and regression 34 (Asian or Pacific Islander women ages 35 to 39, ratio: 32.83). For this and future graphs of the ratio of adjusted R-squared values, any negative ratio indicates that one of the two adjusted R-squared values was less than zero, indicating a likely over-parameterized model. Figure 21 similarly graphs the ratio of the estimated ACA contraceptive mandate coefficients in models with versus without state-specific trend lines. Thirty-nine of the 50 ratios indicate that the estimated coefficients are within ten percent of each other and that the estimated coefficients are generally robust with the inclusion of state-specific time trends. Two groups are the most sensitive to the inclusion of state-specific time trends: American Indian or Alaskan Native women ages 35 to 39 (with the lowest ratio at 0.18) and Black or African American women ages 25 to 29 (with the highest ratio at 5.85). If these subgroups became the primary interest of further analysis, it may be better to pursue models without state-specific trends.

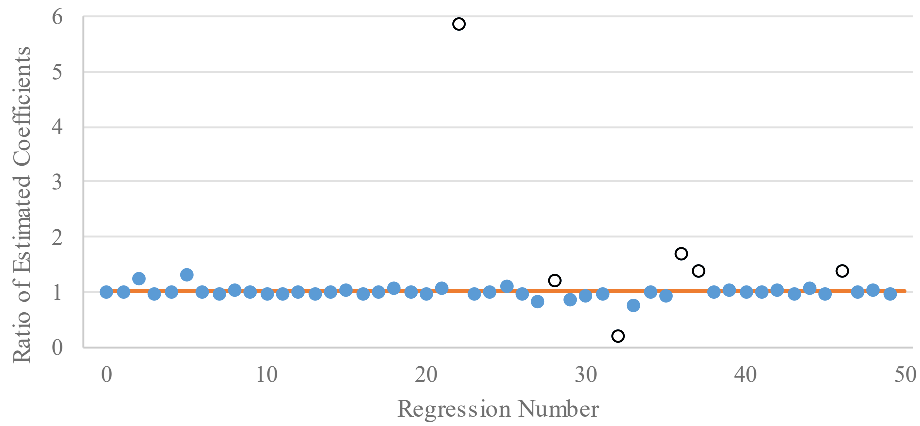
Overall, since the adjusted R-squared value generally increases when adding in the selected state-specific time trends (see Figure 20), it was decided to include the time trends for Utah and North Dakota in the final model. Although there are some differences in the estimated parameters between the two models with and without state-specific time trends, the results are generally consistent and robust to either model specification (see Figure 21).

Figure 20: Fertility Analysis Ratio of Adjusted R-Squared with and without State-Specific Trends



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 21: Fertility Analysis Ratio of Estimated ACA Mandate Coefficients with and without State-Specific Trends



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

5.1.3 Population Weighting

Whether to use population weighting was tested by running a series of regressions in which the top ten most populous states were iteratively excluded from the analysis. As explained in Section 4.2.3, because the goal of this research was to better understand how the ACA contraceptive mandate impacted fertility rates on a population level, it is assumed that population weights are the preferred method. However, when using population weights, there is the risk that one or more larger states unintentionally drive the overall result.

To test for this, Table 7 shows the estimated coefficients and p-values for the ACA contraceptive mandate effect while iteratively dropping the top ten most populous states from the analysis. This table only reports a subset of the fifty total regressions. Omitting the states never resulted in an estimated coefficient with a changed sign or changed statistical significance from the reference regression results. However, omitting either California or Texas led to a 14 and 10 percent reduction in the estimated parameter of interest, respectively, for the regression model using all data for all ages and all races or ethnicities combined. Although there are not substantial differences for most subgroups, models with or without population weights should be used in the appropriate settings discussed in Section 4.2.3 because some minor differences in estimates persist.

Table 7: Fertility Analysis Test Results for Using Population Weighting

	All Data	Black/AA Only	White Only	15-19yo Only	20-24yo Only	25-29yo Only	30-34yo Only	35-39yo Only
No Omitted States (Reference)	-5.923 (0.00)	-8.255 (0.00)	-7.678 (0.00)	-22.62 (0.00)	-28.38 (0.00)	-14.75 (0.00)	7.635 (0.00)	8.695 (0.00)
Omit California	-5.076 (0.00)	-8.312 (0.00)	-7.151 (0.00)	-22.46 (0.00)	-27.75 (0.00)	-13.90 (0.00)	7.941 (0.00)	8.666 (0.00)
Omit Texas	-5.348 (0.00)	-8.260 (0.00)	-7.225 (0.00)	-22.08 (0.00)	-27.87 (0.00)	-14.40 (0.00)	7.918 (0.00)	8.784 (0.00)
Omit New York	-6.097 (0.00)	-7.945 (0.00)	-7.972 (0.00)	-22.81 (0.00)	-28.47 (0.00)	-14.78 (0.00)	7.680 (0.00)	8.510 (0.00)
Omit Florida	-6.017 (0.00)	-7.833 (0.00)	-7.668 (0.00)	-22.19 (0.00)	-27.57 (0.00)	-13.93 (0.00)	8.006 (0.00)	8.560 (0.00)
Omit Illinois	-5.808 (0.00)	-8.252 (0.00)	-7.681 (0.00)	-22.62 (0.00)	-28.20 (0.00)	-14.61 (0.00)	7.689 (0.00)	8.770 (0.00)
Omit Pennsylvania	-6.150 (0.00)	-7.796 (0.00)	-8.174 (0.00)	-23.44 (0.00)	-29.42 (0.00)	-14.42 (0.00)	8.087 (0.00)	8.762 (0.00)
Omit Ohio	-6.117 (0.00)	-8.495 (0.00)	-7.944 (0.00)	-23.00 (0.00)	-28.96 (0.00)	-15.14 (0.00)	7.441 (0.00)	8.766 (0.00)
Omit Georgia	-5.802 (0.00)	-8.130 (0.00)	-7.589 (0.00)	-22.52 (0.00)	-28.40 (0.00)	-14.87 (0.00)	7.628 (0.00)	8.689 (0.00)
Omit Michigan	-6.022 (0.00)	-8.467 (0.00)	-7.765 (0.00)	-22.61 (0.00)	-28.26 (0.00)	-14.76 (0.00)	7.627 (0.00)	8.738 (0.00)
Omit North Carolina	-5.935 (0.00)	-8.444 (0.00)	-7.641 (0.00)	-22.61 (0.00)	-28.44 (0.00)	-14.90 (0.00)	7.582 (0.00)	8.673 (0.00)

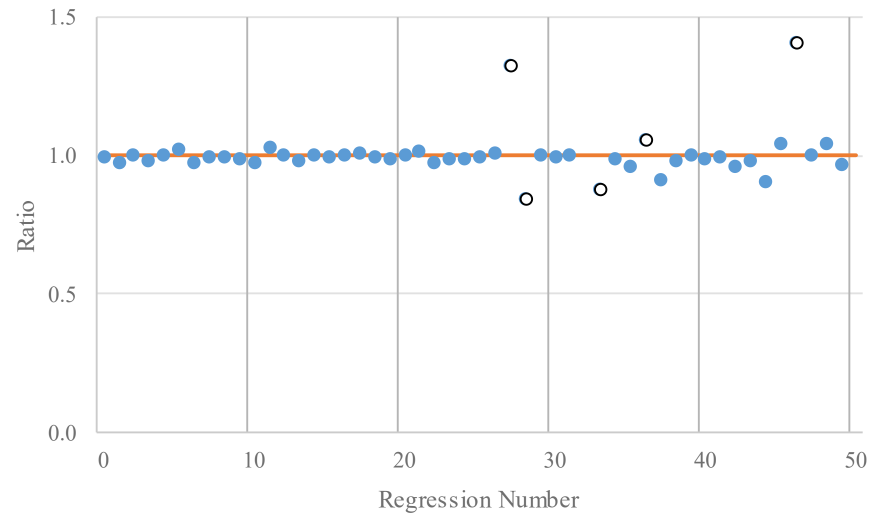
Note: All models used the three binary variables for state mandate, ACA mandate, and state*ACA mandate; fixed effects, and population weighting.

5.1.4 Effect Coding

The methodology for effect coding outlined in Section 4.2.4 resulted in three different tests partially reported in Table 8 below: Panel 1 with estimated coefficient comparisons; Panel 2 testing for the correct sign of the estimated coefficient; and Panel 3 calculating ratios of the estimated coefficients for different effect coding methods. The full results of this analysis from all fifty regressions are included in Appendix Tables 6.1 through 6.4.

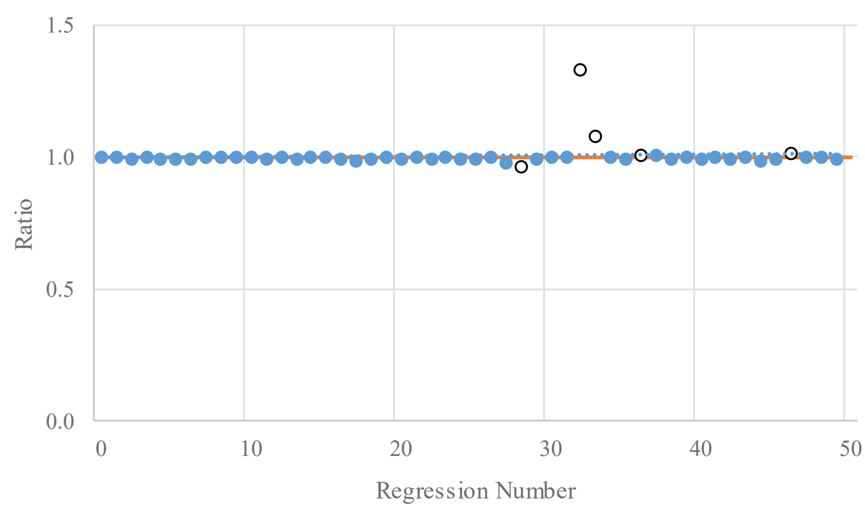
Figures 22.1 through 22.3 below plot the ratios calculated in Panel 3 for all fifty regressions in each figure. The vertical axis has the same scale for all three figures to ease comparison across figures. Since the effect coding method of 2013=0.35 was selected for the final analysis, it is used as the comparison point for each of the three ratios. Figures 22.1 to 22.3 indicate that with few exceptions the results are robust to the various choices of effect coding and the choice to use the 2013=0.35 method was not biasing the results. One subgroup—American Indian or Alaskan Native women ages 35 to 39, represented by regression 33—has a ratio in Figure 22.1 that does not fit on the scale of -1.97, which is the only ratio of the fifty regressions under three different effect coding comparisons that is below zero. The other two ratios for this subgroup in Figures 22.2 and 22.3 are 1.33 and 0.75, suggesting that this subgroup is more sensitive to effect coding. However, all four estimated coefficients for this subgroup are relatively small and statistically insignificant. The other two subgroups that are relatively more impacted by effect coding choice are regression model 28 (White women ages 30 to 34) and 47 (Hispanic women ages 35 to 39). The full regression results utilizing the 2013=0.35 effect coding method are included in Appendix Tables 7.1-7.4.

Figure 22.1: Ratios of Effect Coding Estimated Coefficients: (2013=0.35)/(2013=1)

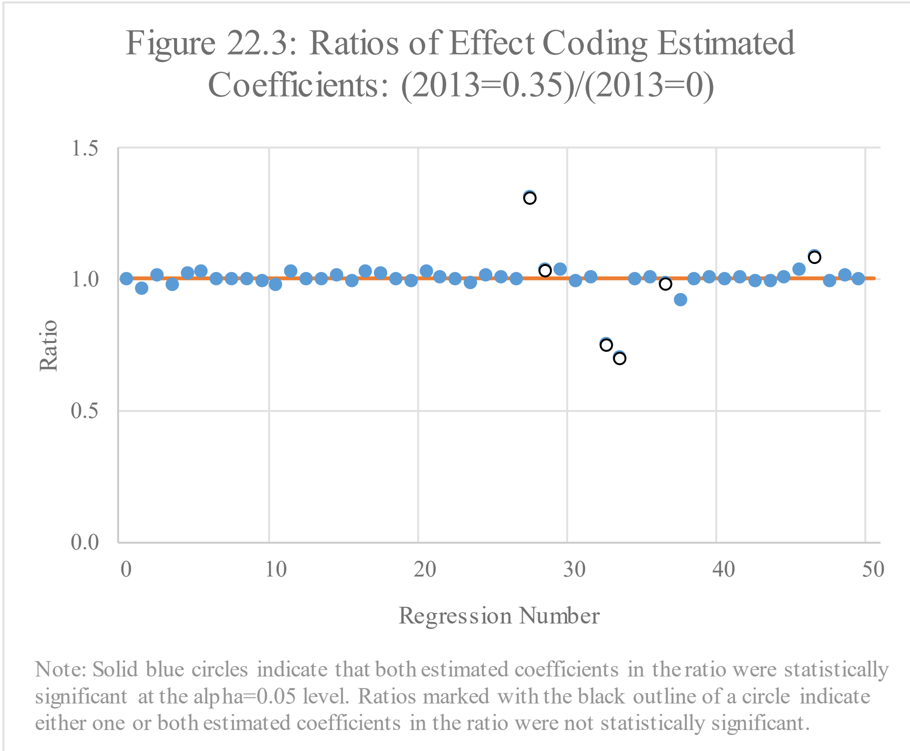


Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 22.2: Ratios of Effect Coding Estimated Coefficients: (2013=0.35)/(2013=0.5)



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.



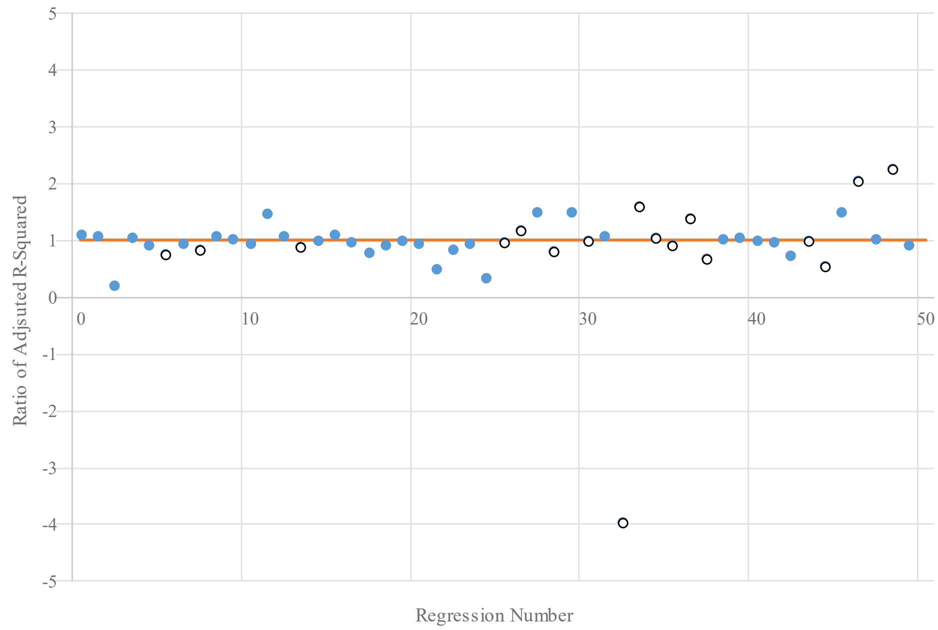
5.1.5 Demographic Variables

Following the addition of the effect coding method of 2013=0.35, the full list of demographic variables in Table 2 was added to the regressions to understand how the demographic variables help model the impact of the ACA contraceptive mandate on the fertility rates. The full regression results are available in Appendix Tables 8.1 to 8.4.

To better visualize the impact of the inclusion of demographic variables on the goodness of fit and the estimated parameters of interest, Figures 23 and 24 plot the ratios of the adjusted R-squared and the estimated coefficients with and without demographic variables, respectively. These ratios are calculated from the output in Appendix Tables 7.1 to 7.4 and Appendix Tables 8.1 to 8.4. These plots are similar to the state-specific time trend analyses presented in Figures 20 and 21 in Section 5.1.2. The vertical axis in Figure 23 has the same scale as Figure 20 to ease comparison of goodness of fit impacts across the various tests for model specification. Twenty-four of the 50 regressions have a higher adjusted R-squared value for the models that included demographic variables. An additional fourteen regressions have adjusted R-squared values within ten percent of the models without demographic variables. American Indian or Alaskan Native women ages 35 to 39 were most sensitive to the inclusion of demographic variables, with an adjusted R-squared ratio of -3.96, the only ratio less than zero. However, the estimated ACA contraceptive mandate coefficients are statistically insignificant for this subgroup both in the models with and without demographic variables, suggesting that this relatively extreme ratio is less concerning.

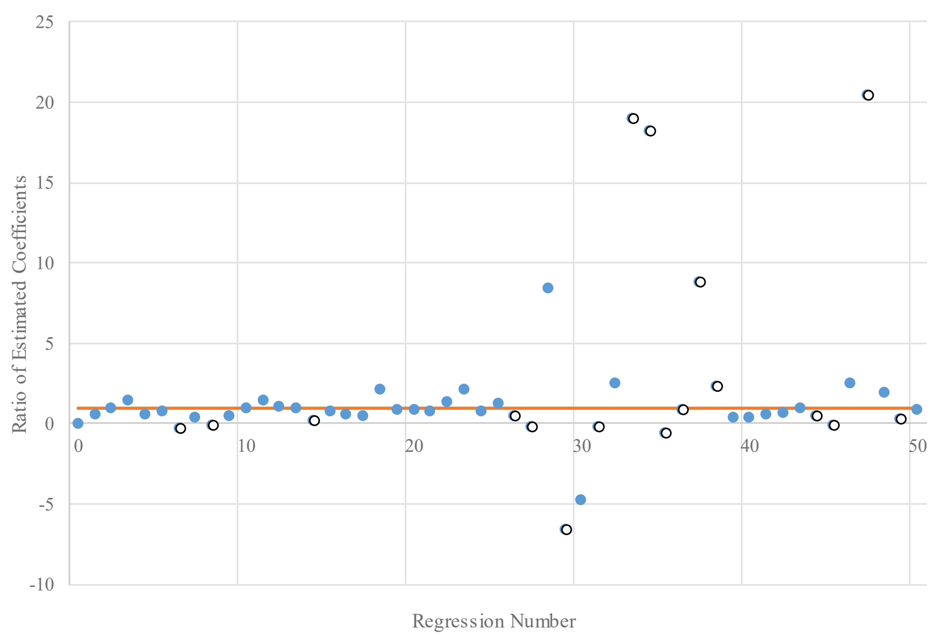
Figure 24 shows a relatively greater impact on the estimated coefficients with the addition of demographic variables than the impact adding selected state-specific time trends shown in Figure 21. Thirty-one of the 50 regressions had a smaller estimated coefficient with the demographic variables than without. This suggests that the models may generally overstate the effect of the ACA contraceptive mandate when the demographic variables are not included. The ratios are generally the most extreme for regression models 27 through 38, representing women ages 30 to 44 by race, indicating that these groups are the most sensitive to the inclusion of demographic variables. Three of the seven most extreme values are for subpopulations whose regressions in models both with and without demographic variables yield statistically insignificant coefficients (all American Indian or Alaskan Native, ages 30 to 44). Two of the seven most extreme values had insignificant coefficients for models without demographic variables, but significant coefficients when the demographic variables were included (Asian or Pacific Islander and Hispanic women, both ages 35 to 39).

Figure 23: Ratios of Fertility ACA Mandate Adjusted R-Squared with and without Demographic Variables



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 24: Ratios of Fertility ACA Mandate Estimated Coefficients with and without Demographic Variables



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

5.1.6 Selecting Demographic Variables with Lasso

Although the list of ten demographic variables were selected based on a literature review and supporting theory, as explained in Section 4.2.6, lasso2 was used in Stata to select the ideal demographic variable list for each of the fifty regressions. Each of these regressions was run with the model characteristics selected from the analyses in Sections 5.1.1 through 5.1.4: fixed effects, selected state-specific time trends, population weighting, and effect coding. The full lasso regression results are below in Tables 9.1 to 9.4. Similar to Figures 20 and 23, Figure 25 plots the ratios of the adjusted R-squared value in models with the full demographic variable list versus lasso-selected demographic variables. As well, similar to Figures 21 and 24, Figure 26 plots the ratio of the estimated ACA contraceptive mandate coefficients for the full demographic variable models versus lasso-selected demographic variable models.

In line with patterns seen in Figure 23, the ratios of adjusted R-squared values in Figure 25 have the greatest variation for the regressions for the relatively older age groups with data by both age group and race (regressions 22 through 38, women ages 25 to 44) or age group and ethnicity (regressions 45 to 50, women ages 30 to 44). Exactly half of the 50 regressions have higher adjusted R-squared values with the full demographic variable models and 32 of the 50 regressions have adjusted R-squared values within ten percent of the values with full demographic variables versus lasso-selected demographic variables. Thus, for most regressions there is not a substantial impact on overall goodness of fit when choosing whether to use lasso. Since the lasso procedure removed nearly all or all of the demographic variables from the regressions by age plus race or ethnicity for the relatively older age groups, it is not surprising that the ratios are the highest for the same subpopulations in Figure 26 as in Figure 24: American Indian or Alaskan Native ages 30 to 44 (regression numbers 29, 33 and 37) and Hispanic women ages 35 to 39 (regression number 47). Regression 33, which represents American Indian or Alaskan Native ages 35 to 39, has a ratio of -392.67, far beyond the scale of Figure 26. Again, because most of these regression subpopulations have insignificant estimated coefficients, the extreme ratios are less concerning.

To increase the ease of comparison of the ACA contraceptive mandate estimated effect both within the set of 50 regressions and between methods utilizing all demographic variables versus lasso-selected demographic variables, Figures 27.1 through 27.4 below graph the estimated parameters along with the 95 percent confidence intervals for the fifty regressions in both modeling choices side-by-side (where part A graphs results for all demographic variables and part B graphs results for lasso-selected demographic variables). Estimated parameters for which the 95 percent confidence intervals do not cross zero are statistically significant at the alpha=0.05 level.

Table 9.1: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Effect Coding of 2013=0.35, and Lasso-Selected Variables

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Variable	ACA Only	All Variables	Black/AA	White	AIAN	API	Hisp	Non-Hisp	15-19	20-24	25-29	30-34	35-39	40-44
State Mandate in Effect		-3.062*	0.0577	-4.234**	-3.706*	-3.014	-4.867**	-3.598**	-4.816*	-2.758	-1.533	-1.984	-0.485	-0.419**
		(1.718)	(1.650)	(1.959)	(2.085)	(6.847)	(2.396)	(1.778)	(2.728)	(1.945)	(4.244)	(3.713)	(0.326)	(0.181)
ACA Mandate in Effect	-0.983	-1.008	-8.267***	-3.459***	-17.53***	-3.283***	-27.55***	-3.153***	-6.708***	-27.48***	-21.38***	8.264***	6.745***	1.854***
	(1.080)	(1.054)	(0.472)	(0.630)	(1.046)	(0.817)	(1.165)	(0.459)	(1.135)	(1.502)	(1.785)	(0.935)	(0.385)	(0.0819)
State Mandate * ACA Mandate		-0.731***	1.732***	-1.400***	5.495***	1.577**	-3.196***	-0.171	0.106	-2.536***	-1.334***	-2.879***	0.00140	0.310***
		(0.183)	(0.384)	(0.223)	(0.857)	(0.731)	(0.998)	(0.174)	(0.277)	(0.437)	(0.450)	(0.393)	(0.188)	(0.0668)
2008 Dummy			-1.118***		-0.977		-4.938***						0.853***	0.314***
			(0.401)		(0.845)		(0.816)						(0.230)	(0.0679)
2009 Dummy			-2.999***		-2.951***		-11.17***						0.190	0.519***
			(0.401)		(0.846)		(0.816)						(0.257)	(0.0692)
2010 Dummy			-5.491***		-5.664***		-17.51***			-6.813***			0.0993	0.717***
			(0.401)		(0.850)		(0.818)			(0.442)			(0.288)	(0.0714)
2011 Dummy	0.249	0.125	-6.310***	-0.458**	-6.438***	0.527	-21.47***	0.0345	-0.839***	-11.99***	-2.725***	0.641*	1.482***	0.816***
	(0.243)	(0.239)	(0.402)	(0.223)	(0.854)	(0.472)	(0.821)	(0.179)	(0.306)	(0.553)	(0.418)	(0.343)	(0.317)	(0.0708)
2012 Dummy	0.769**	0.521	-6.725***	-0.557*	-7.268***	2.733***	-23.30***	0.244	-0.740	-14.85***	-5.158***	1.463***	2.653***	0.897***
	(0.389)	(0.384)	(0.402)	(0.299)	(0.854)	(0.474)	(0.821)	(0.235)	(0.452)	(0.694)	(0.535)	(0.356)	(0.335)	(0.0716)
2013 Dummy	0.932***	0.818***	-4.654***	0.739**	-3.085***	0.331	-14.27***	1.248***	-0.0545	-7.492***	0.0103	0.0975	1.272***	0.251***
	(0.288)	(0.282)	(0.353)	(0.334)	(0.746)	(0.422)	(0.719)	(0.263)	(0.418)	(0.435)	(0.371)	(0.328)	(0.246)	(0.0633)
2014 Dummy	2.483***	2.636***	-0.197	4.344***	4.177***	2.283***	4.611***	3.708***	3.436***	9.356***	13.86***	-1.222*	-1.428***	-0.935***
	(0.565)	(0.552)	(0.400)	(0.440)	(0.842)	(0.505)	(0.815)	(0.330)	(0.629)	(0.602)	(0.948)	(0.689)	(0.198)	(0.0699)
2015 Dummy	2.063***	2.198***	-0.831**	4.062***	3.167***	-0.694	4.172***	2.771***	2.369***	6.799***	11.06***	-0.705	-0.602***	-0.568***
	(0.417)	(0.408)	(0.400)	(0.317)	(0.842)	(0.469)	(0.815)	(0.245)	(0.449)	(0.491)	(0.689)	(0.613)	(0.197)	(0.0695)
2016 Dummy	1.582***	1.668***	0.228	2.370***	2.003**	2.712***	3.017***	1.815***	0.956***	3.333***	6.780***	1.168***	0.339*	-0.170**
	(0.252)	(0.246)	(0.400)	(0.221)	(0.842)	(0.470)	(0.815)	(0.176)	(0.298)	(0.414)	(0.474)	(0.450)	(0.197)	(0.0684)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate	-0.792***	-0.695***		-0.732***				-0.441***	-1.010***					
	(0.112)	(0.112)		(0.138)				(0.0998)	(0.161)					
Median Household Income	-0.000407***	-0.000330***										-0.000724***		
	(7.95e-05)	(7.98e-05)										(0.000124)		
Percent with Medicaid	-0.174***	-0.152***		-0.161***		0.314***			-0.115***		-0.524***			
	(0.0256)	(0.0254)		(0.0299)		(0.0757)			(0.0380)		(0.0616)			
Percent Married	0.909***	0.763***							1.131***					
	(0.260)	(0.257)							(0.283)					
Median Family Size	-2.351	-3.828*		-7.929***						-7.270*				
	(2.126)	(2.102)		(2.536)						(3.743)				
Percent with High School Degree	0.871***	0.742***		0.679***				0.279*	-2.155***	1.320***	4.765***			
	(0.187)	(0.185)		(0.201)				(0.156)	(0.295)	(0.346)	(0.474)			
Percent with College Degree														
Percent with Employer-Based Health Insurance	-0.473***	-0.424***		-0.652***					-1.035***		-0.135	0.671***		
	(0.0542)	(0.0541)		(0.0664)					(0.0845)		(0.131)	(0.112)		
Percent Non-Hispanic White	-0.160	-0.181							-0.0978	-0.136	-1.460***	-0.348	0.0780*	
	(0.156)	(0.155)							(0.135)	(0.160)	(0.229)	(0.214)	(0.0415)	
Percent of Babies Born to Unwed Mothers				-0.00213					0.0541					-0.0325***
				(0.0283)					(0.0359)					(0.00857)
Constant	19.29	37.77*	71.83***	81.57***	57.07***	58.42***	101.7***	41.90***	237.4***	18.24	-197.0***	116.3***	41.60***	10.93***
	(20.13)	(20.07)	(1.076)	(18.79)	(1.485)	(5.848)	(1.987)	(13.51)	(28.90)	(30.03)	(36.01)	(15.37)	(2.636)	(0.314)
Observations	408	408	561	408	559	408	561	408	408	459	408	408	663	561
R-squared	0.773	0.786	0.669	0.781	0.541	0.323	0.856	0.615	0.965	0.949	0.815	0.745	0.870	0.787
Number of States	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Adjusted R-squared	0.718	0.733	0.612	0.728	0.484	0.189	0.838	0.529	0.956	0.938	0.772	0.686	0.850	0.755

Standard errors in parentheses. Full reression results available upon request.

*** p<0.01, ** p<0.05, * p<0.1

Table 9.2: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Effect Coding of 2013=0.35, and Lasso-Selected Variables

	By Age Group and Race											
	15-19				20-24				25-29			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	-5.405***	-5.242*	-11.61***	-6.804***	-6.887**	-2.159	-7.512	-6.341**	-0.701	-1.024	-6.159	3.739
	(2.047)	(2.705)	(3.342)	(1.688)	(3.163)	(2.091)	(5.060)	(2.664)	(15.91)	(1.484)	(4.099)	(3.165)
ACA Mandate in Effect	-36.69***	-11.65***	-32.32***	-10.28***	-38.16***	-27.46***	-50.97***	-19.79***	-4.242***	-18.73***	-20.33***	-17.51***
	(0.603)	(2.186)	(1.685)	(0.808)	(0.910)	(1.281)	(2.533)	(1.245)	(1.181)	(0.722)	(2.060)	(1.459)
State Mandate * ACA Mandate	5.284***	-1.131***	10.13***	2.989***	0.526	-3.780***	17.14***	2.622**	-2.685***	-4.851***	2.332	0.503
	(0.490)	(0.302)	(1.380)	(0.700)	(0.739)	(0.498)	(2.075)	(1.068)	(0.896)	(0.589)	(1.689)	(1.260)
2008 Dummy	-1.926***		-1.140	-0.769	-3.852***		-2.036	-2.595***		-3.218***	-2.732	-2.838***
	(0.514)		(1.358)	(0.547)	(0.778)		(2.052)	(0.863)		(0.595)	(1.664)	(0.991)
2009 Dummy	-5.598***		-3.740***	-1.960***	-9.192***		-7.810***	-6.541***		-7.015***	-6.288***	-4.959***
	(0.514)		(1.360)	(0.547)	(0.779)		(2.055)	(0.865)		(0.596)	(1.667)	(0.992)
2010 Dummy	-10.91***		-8.117***	-3.456***	-16.11***	-7.016***	-12.11***	-10.21***		-9.955***	-11.31***	-8.188***
	(0.515)		(1.371)	(0.550)	(0.780)	(0.483)	(2.066)	(0.868)		(0.599)	(1.675)	(0.996)
2011 Dummy	-14.70***	-0.973**	-10.47***	-4.138***	-22.41***	-12.48***	-16.41***	-11.04***	-0.0996	-11.54***	-10.45***	-6.034***
	(0.516)	(0.426)	(1.381)	(0.552)	(0.781)	(0.551)	(2.074)	(0.870)	(0.804)	(0.601)	(1.682)	(0.998)
2012 Dummy	-17.96***	-1.512**	-11.49***	-4.620***	-25.62***	-15.36***	-21.57***	-11.51***	-0.454	-12.54***	-12.26***	-3.988***
	(0.516)	(0.720)	(1.375)	(0.552)	(0.781)	(0.636)	(2.074)	(0.870)	(0.805)	(0.601)	(1.682)	(0.998)
2013 Dummy	-11.24***	0.231	-6.608***	-2.839***	-15.72***	-7.639***	-10.56***	-7.685***	3.249***	-5.527***	-4.193***	-4.214***
	(0.453)	(0.466)	(1.204)	(0.482)	(0.685)	(0.439)	(1.812)	(0.761)	(0.758)	(0.525)	(1.470)	(0.873)
2014 Dummy	6.396***	6.601***	5.988***	1.155**	6.000***	10.12***	9.368***	2.107**	6.020***	9.130***	7.315***	7.399***
	(0.514)	(1.067)	(1.370)	(0.546)	(0.778)	(0.589)	(2.048)	(0.861)	(0.954)	(0.594)	(1.661)	(0.988)
2015 Dummy	3.292***	4.189***	4.079***	0.376	3.541***	7.712***	6.719***	0.243	2.845***	8.097***	5.500***	1.448
	(0.514)	(0.745)	(1.374)	(0.547)	(0.778)	(0.518)	(2.047)	(0.861)	(0.865)	(0.594)	(1.660)	(0.988)
2016 Dummy	1.540***	1.556***	1.845	0.704	1.515*	3.648***	3.188	1.848**	3.138***	4.279***	3.874**	7.082***
	(0.514)	(0.428)	(1.371)	(0.547)	(0.778)	(0.467)	(2.048)	(0.861)	(0.824)	(0.594)	(1.660)	(0.988)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate		-1.036***										
		(0.187)										
Median Household Income		-0.000928***										
		(0.000140)										
Percent with Medicaid		-0.147***										
		(0.0458)										
Percent Married		1.414***										
		(0.414)										
Median Family Size		-0.973				-6.014						
		(3.676)				(4.335)						
Percent with High School Degree		-2.122***				1.741***						
		(0.279)				(0.386)						
Percent with College Degree		4.433***										
		(0.531)										
Percent with Employer-Based Health Insurance		-1.061***							2.514***			
		(0.102)							(0.275)			
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers		0.0580										
		(0.0376)										
Constant	65.48***	143.4***	55.60***	20.10***	138.8***	-32.04	108.7***	58.21***	-46.58**	122.5***	90.75***	96.50***
	(1.320)	(34.67)	(2.334)	(1.408)	(2.026)	(34.59)	(3.586)	(2.194)	(19.17)	(1.016)	(2.920)	(2.641)
Observations	553	408	474	466	561	459	508	561	408	561	513	561
R-squared	0.958	0.956	0.711	0.575	0.922	0.932	0.678	0.662	0.248	0.828	0.327	0.526
Number of States	51	51	46	47	51	51	49	51	51	51	50	51
Adjusted R-squared	0.953	0.945	0.663	0.514	0.913	0.920	0.635	0.620	0.0811	0.803	0.236	0.466

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Table 9.3: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Effect Coding of 2013=0.35, and Lasso-Selected Variables

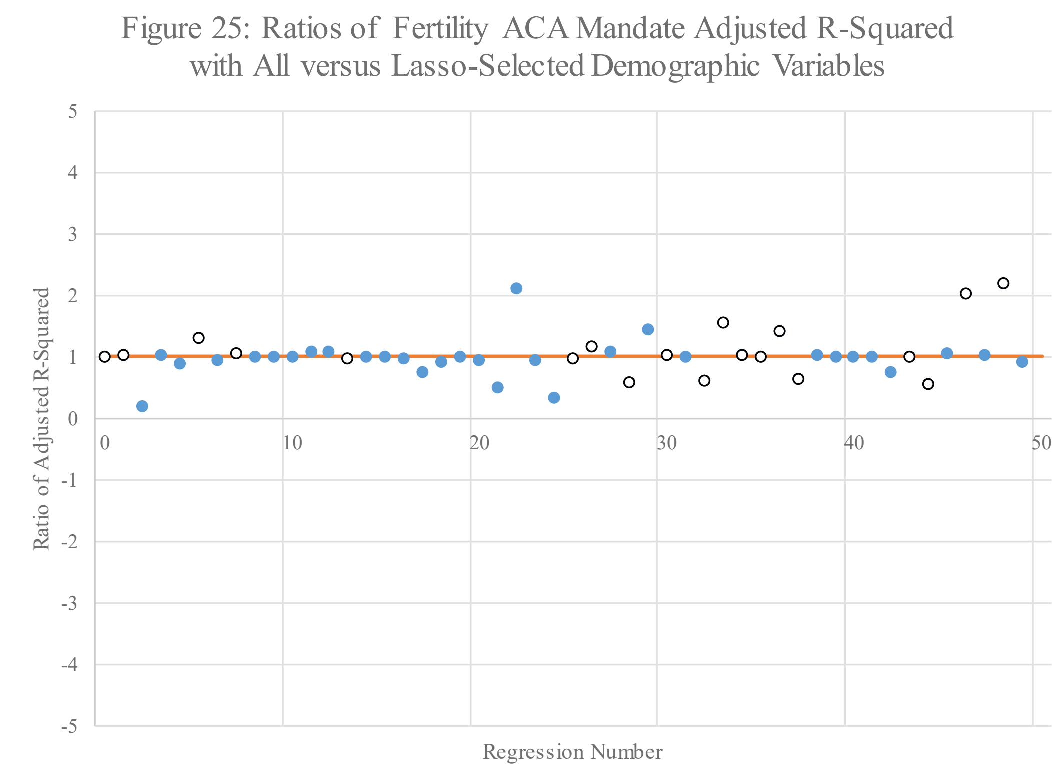
	By Age Group and Race											
	30-34				35-39				40-44			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	6.613**	-2.589	0.222	3.621	2.889	-3.134*	1.794	-4.455*	-0.102	-1.423*	1.007	-1.562*
	(2.953)	(3.533)	(3.296)	(3.178)	(7.471)	(1.672)	(1.918)	(2.417)	(0.698)	(0.793)	(0.778)	(0.880)
ACA Mandate in Effect	11.70***	4.068**	-1.647	-4.593***	12.15***	5.125***	0.0152	0.977	3.250***	1.441***	0.618	1.140***
	(0.846)	(1.641)	(1.667)	(1.447)	(0.536)	(0.692)	(0.988)	(1.090)	(0.191)	(0.510)	(0.459)	(0.397)
State Mandate * ACA Mandate	-1.291*	-3.585***	-1.474	1.452	0.366	-0.431**	1.215	5.066***	0.414***	0.253***	-0.108	1.500***
	(0.688)	(0.391)	(1.367)	(1.254)	(0.412)	(0.181)	(0.808)	(0.947)	(0.155)	(0.0866)	(0.389)	(0.346)
2008 Dummy	-0.132		-0.789	-3.964***			-1.041	-0.727	0.121		0.0807	0.522**
	(0.718)		(1.343)	(0.974)			(0.791)	(0.725)	(0.160)		(0.355)	(0.260)
2009 Dummy	-1.503**		-1.316	-6.503***			-1.440*	-1.818**	0.282*		0.223	0.740***
	(0.718)		(1.344)	(0.975)			(0.791)	(0.726)	(0.160)		(0.356)	(0.261)
2010 Dummy	-1.956***		-3.685***	-8.064***			-1.601**	-2.791***	0.585***		0.0645	0.929***
	(0.719)		(1.351)	(0.979)			(0.796)	(0.728)	(0.161)		(0.363)	(0.262)
2011 Dummy	-0.971	0.113	-4.845***	-6.727***	1.716***	1.251***	-0.960	-1.415*	0.773***	0.141	0.358	1.107***
	(0.720)	(0.368)	(1.357)	(0.981)	(0.367)	(0.171)	(0.800)	(0.730)	(0.161)	(0.0987)	(0.356)	(0.262)
2012 Dummy	-0.00703	-0.0645	-2.581*	-0.287	2.993***	1.974***	-0.880	2.603***	1.031***	0.157	0.284	1.942***
	(0.720)	(0.445)	(1.358)	(0.981)	(0.369)	(0.203)	(0.799)	(0.730)	(0.161)	(0.155)	(0.358)	(0.262)
2013 Dummy	-1.628**	0.181	-1.144	-5.896***	-0.0206	1.276***	0.189	-0.691	0.137	-0.358***	0.0514	1.096***
	(0.632)	(0.340)	(1.186)	(0.858)	(0.325)	(0.147)	(0.696)	(0.639)	(0.141)	(0.0891)	(0.311)	(0.229)
2014 Dummy	-6.695***	1.182	2.503*	2.986***	-5.470***	-0.419	-1.001	-1.865**	-2.006***	-1.149***	-0.212	-0.407
	(0.717)	(0.965)	(1.340)	(0.971)	(0.397)	(0.400)	(0.784)	(0.723)	(0.160)	(0.245)	(0.346)	(0.259)
2015 Dummy	-5.161***	1.473**	1.747	-1.003	-4.200***	0.462	0.101	-3.144***	-1.491***	-0.662***	0.101	-0.574**
	(0.717)	(0.741)	(1.340)	(0.971)	(0.386)	(0.319)	(0.784)	(0.723)	(0.160)	(0.174)	(0.350)	(0.259)
2016 Dummy	-1.120	1.696***	2.094	6.472***	-1.045***	0.592***	0.437	0.934	-0.579***	-0.267**	0.0762	0.0298
	(0.717)	(0.497)	(1.340)	(0.971)	(0.373)	(0.221)	(0.783)	(0.723)	(0.160)	(0.107)	(0.344)	(0.259)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate												
Median Household Income		-0.000940***				-0.000137*						
		(0.000158)				(7.40e-05)						
Percent with Medicaid					-0.357***							
					(0.0684)							
Percent Married										-0.0545		
										(0.101)		
Median Family Size										0.0962		
										(0.994)		
Percent with High School Degree										-0.256***		
										(0.0836)		
Percent with College Degree		1.396**				0.435				0.0204		
		(0.594)				(0.266)				(0.129)		
Percent with Employer-Based Health Insurance		0.636***								-0.0748***		
		(0.121)								(0.0269)		
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers					-0.0206					-0.0128		
					(0.0625)					(0.0114)		
Constant	70.87***	74.98***	52.43***	118.6***	39.06***	43.68***	23.05***	69.35***	8.721***	39.55***	4.834***	15.49***
	(1.932)	(17.39)	(2.357)	(2.663)	(5.543)	(6.168)	(1.385)	(2.038)	(0.466)	(9.892)	(0.598)	(0.748)
Observations	555	408	504	561	394	408	469	560	484	408	218	495
R-squared	0.620	0.677	0.058	0.368	0.838	0.900	0.087	0.435	0.710	0.617	0.058	0.333
Number of States	51	51	49	51	51	51	46	51	49	51	31	49
Adjusted R-squared	0.572	0.602	-0.0696	0.275	0.800	0.877	-0.0393	0.352	0.669	0.525	-0.168	0.241

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

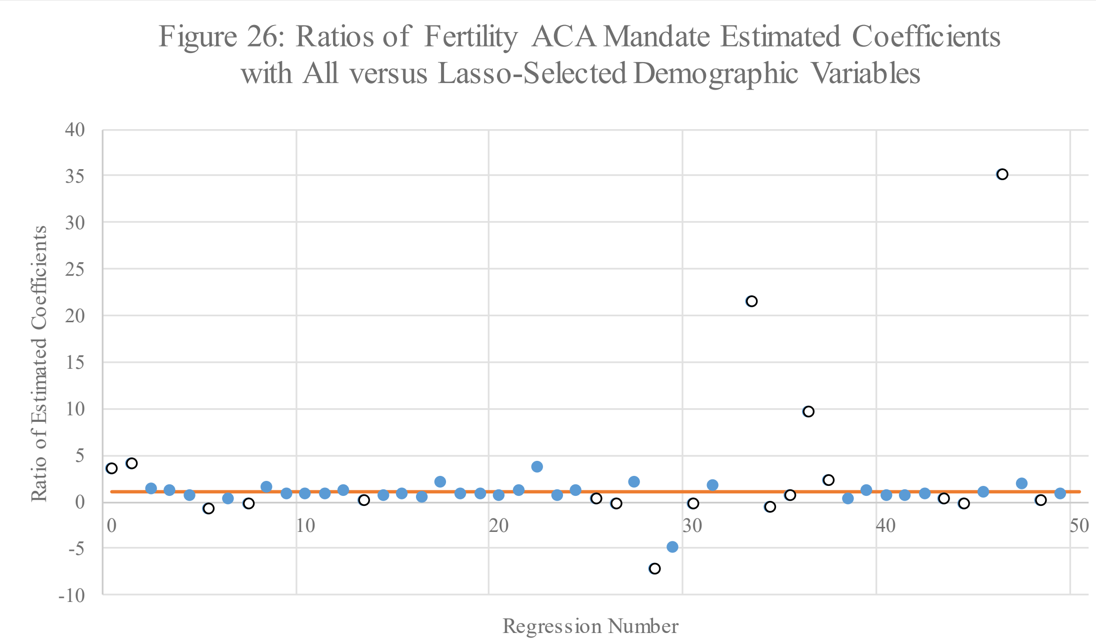
Table 9.4: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Effect Coding of 2013=0.35, and Lasso-Selected Variables

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Variable	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
State Mandate in Effect	-11.64***	-0.181	-3.183	-5.642	1.308	-2.534*	-2.365	-1.450	-2.374*	-1.200**	0.242	-0.539***
	(2.793)	(2.544)	(4.444)	(3.947)	(3.531)	(1.331)	(2.336)	(4.178)	(1.367)	(0.556)	(0.541)	(0.197)
ACA Mandate in Effect	-45.37***	-6.155***	-45.41***	-21.47***	-30.56***	-13.74***	-8.459***	9.740***	0.228	5.172***	1.793***	1.645***
	(1.404)	(0.674)	(2.874)	(1.030)	(1.724)	(0.607)	(1.137)	(1.009)	(0.656)	(0.252)	(0.253)	(0.0893)
State Mandate * ACA Mandate	-2.132*	1.394***	-6.095***	-1.135***	-8.100***	-2.635***	-4.066***	-2.937***	-0.752	0.479**	-0.631***	0.378***
	(1.209)	(0.237)	(1.263)	(0.374)	(1.477)	(0.494)	(0.972)	(0.410)	(0.560)	(0.205)	(0.216)	(0.0726)
2008 Dummy	-5.071***				-7.283***	-2.186***	-3.194***		-0.998**	-0.780***	0.180	0.273***
	(0.967)				(1.208)	(0.510)	(0.801)		(0.463)	(0.212)	(0.179)	(0.0753)
2009 Dummy	-11.98***				-15.30***	-4.630***	-7.792***		-2.539***	-1.334***	0.0865	0.505***
	(0.968)				(1.209)	(0.511)	(0.802)		(0.463)	(0.212)	(0.179)	(0.0768)
2010 Dummy	-19.91***		-14.27***		-24.22***	-6.279***	-11.93***		-3.226***	-1.404***	-0.171	0.765***
	(0.970)		(1.023)		(1.212)	(0.513)	(0.804)		(0.464)	(0.213)	(0.180)	(0.0791)
2011 Dummy	-26.10***	-0.680***	-24.98***	-4.310***	-28.20***	-6.576***	-13.30***	1.182***	-3.632***	0.254	-0.0910	0.854***
	(0.973)	(0.246)	(1.121)	(0.359)	(1.216)	(0.514)	(0.806)	(0.383)	(0.465)	(0.214)	(0.180)	(0.0784)
2012 Dummy	-29.39***	-0.877***	-29.88***	-6.947***	-29.78***	-7.021***	-14.15***	2.333***	-3.427***	1.507***	0.0439	0.884***
	(0.973)	(0.326)	(1.296)	(0.422)	(1.216)	(0.514)	(0.806)	(0.398)	(0.465)	(0.214)	(0.180)	(0.0794)
2013 Dummy	-17.62***	-0.440	-16.98***	-1.834***	-17.16***	-2.444***	-9.508***	0.744**	-2.447***	0.597***	-0.271*	0.272***
	(0.853)	(0.353)	(0.875)	(0.300)	(1.065)	(0.450)	(0.706)	(0.364)	(0.408)	(0.187)	(0.158)	(0.0700)
2014 Dummy	9.295***	1.919***	12.61***	9.919***	6.740***	8.058***	-0.0733	-1.445*	-1.034**	-1.284***	-0.958***	-0.822***
	(0.967)	(0.461)	(1.287)	(0.494)	(1.208)	(0.509)	(0.801)	(0.758)	(0.463)	(0.212)	(0.179)	(0.0773)
2015 Dummy	6.133***	1.015***	9.586***	6.769***	7.531***	5.998***	2.096***	-1.470**	-0.139	-0.585***	-0.472***	-0.540***
	(0.967)	(0.339)	(1.113)	(0.399)	(1.208)	(0.509)	(0.801)	(0.672)	(0.463)	(0.212)	(0.179)	(0.0769)
2016 Dummy	3.055***	0.0887	5.351***	2.980***	5.752***	3.668***	2.773***	0.606	1.140**	0.119	0.0779	-0.233***
	(0.967)	(0.243)	(0.973)	(0.342)	(1.208)	(0.509)	(0.801)	(0.497)	(0.463)	(0.212)	(0.179)	(0.0758)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate		-0.455***										
		(0.140)										
Median Household Income								-0.000941***				
								(0.000139)				
Percent with Medicaid		0.0564		0.250***								
		(0.0351)		(0.0540)								
Percent Married												
Median Family Size			12.42	-3.694								
			(9.633)	(4.010)								
Percent with High School Degree		-3.211***	1.355	1.881***								
		(0.218)	(0.920)	(0.339)								
Percent with College Degree												
Percent with Employer-Based Health Insurance		-0.395***						0.978***				
		(0.0753)						(0.126)				
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers		0.00943										-0.0330***
		(0.0307)										(0.00924)
Constant	85.56***	329.1***	-11.45	-66.53**	148.3***	111.2***	110.3***	87.33***	56.92***	46.22***	12.96***	10.28***
	(2.338)	(18.78)	(80.36)	(32.02)	(2.927)	(0.876)	(1.929)	(11.60)	(1.128)	(0.369)	(0.446)	(0.338)
Observations	552	408	459	408	561	561	561	408	559	561	499	561
R-squared	0.920	0.960	0.915	0.929	0.788	0.766	0.576	0.732	0.315	0.872	0.300	0.704
Number of States	51	51	51	51	51	51	51	51	51	51	48	51
Adjusted R-squared	0.910	0.951	0.899	0.915	0.762	0.726	0.514	0.671	0.214	0.856	0.206	0.660

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

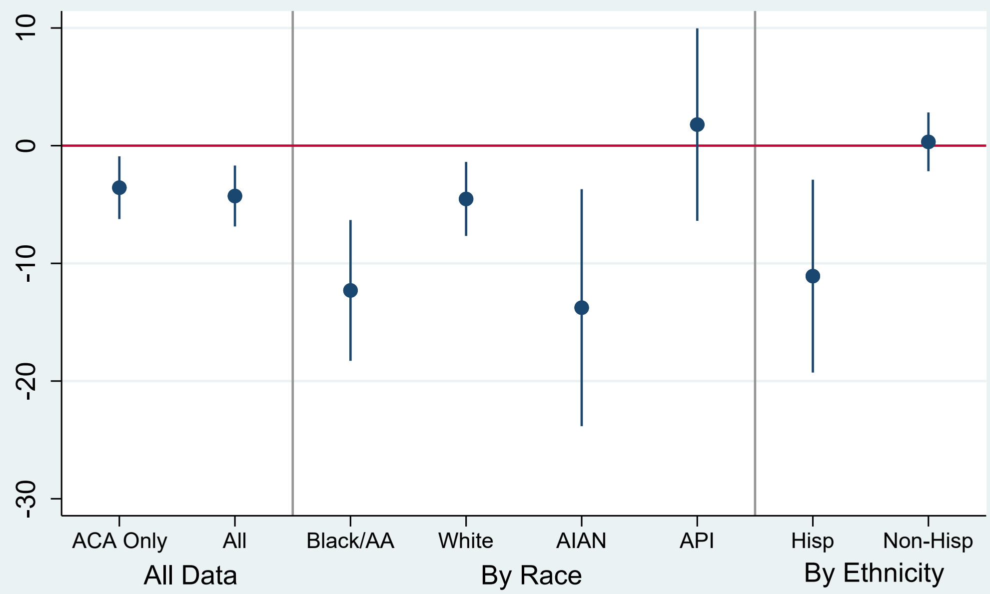


Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.



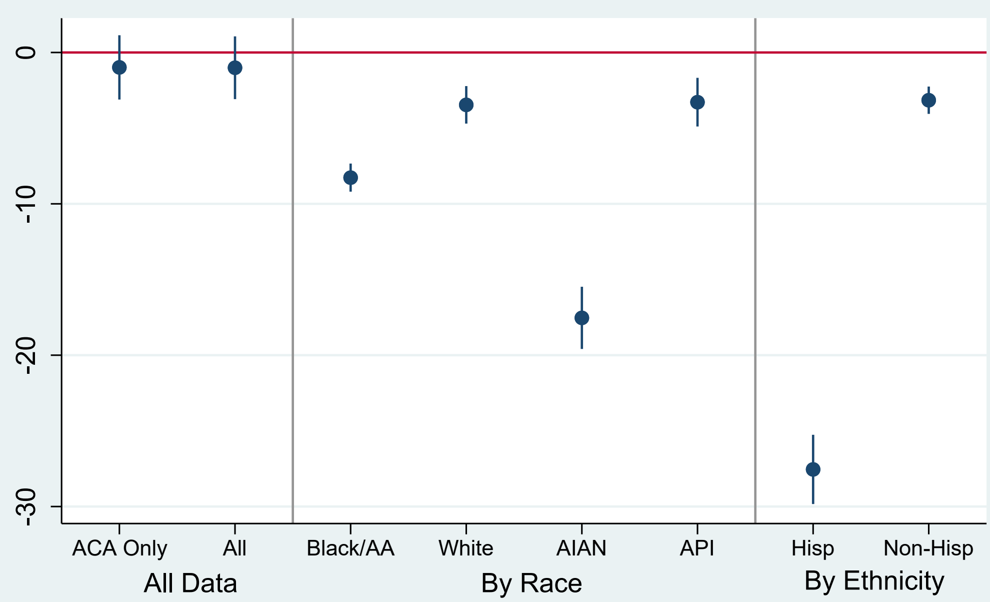
Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 27.1a: Fertility ACA Mandate Regression Coefficients:*
All Demographic Variables, All Ages, By Race or Ethnicity



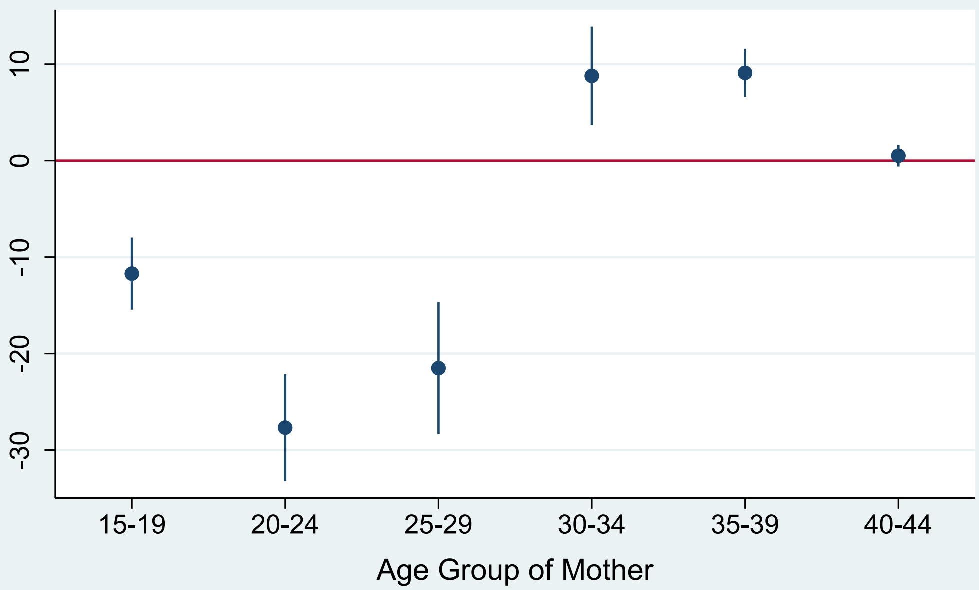
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and demographic variables

Figure 27.1b: Fertility ACA Mandate Regression Coefficients:*
Lasso-Selected Variables, All Ages, By Race or Ethnicity



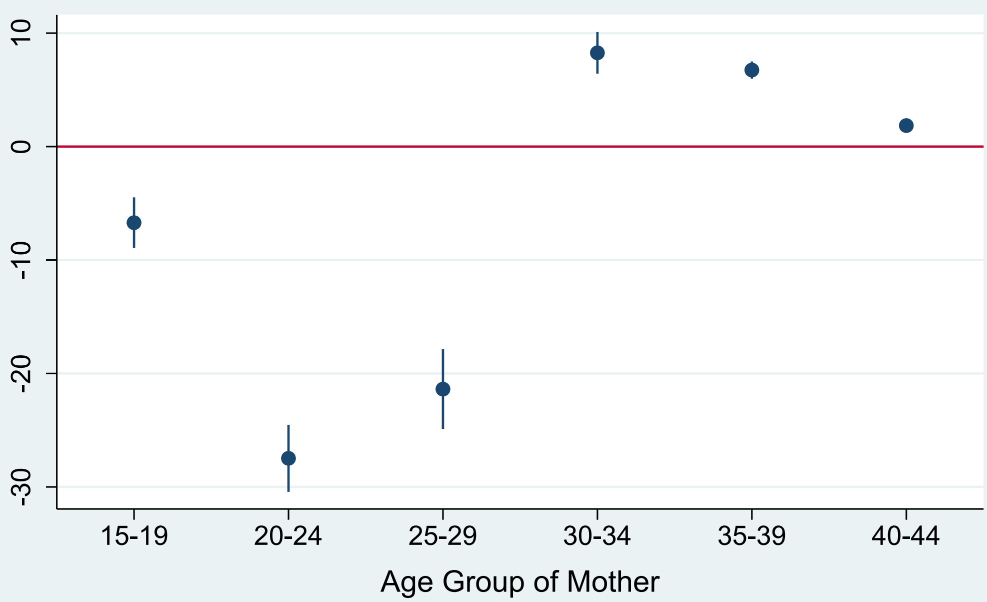
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and lasso-selected demographic variables

Figure 27.2a: Fertility ACA Mandate Regression Coefficients:*
All Demographic Variables, By Age Group of Mother



*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and demographic variables

Figure 27.2b: Fertility ACA Mandate Regression Coefficients:*
Lasso-Selected Variables, By Age Group of Mother



*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and lasso-selected demographic variables

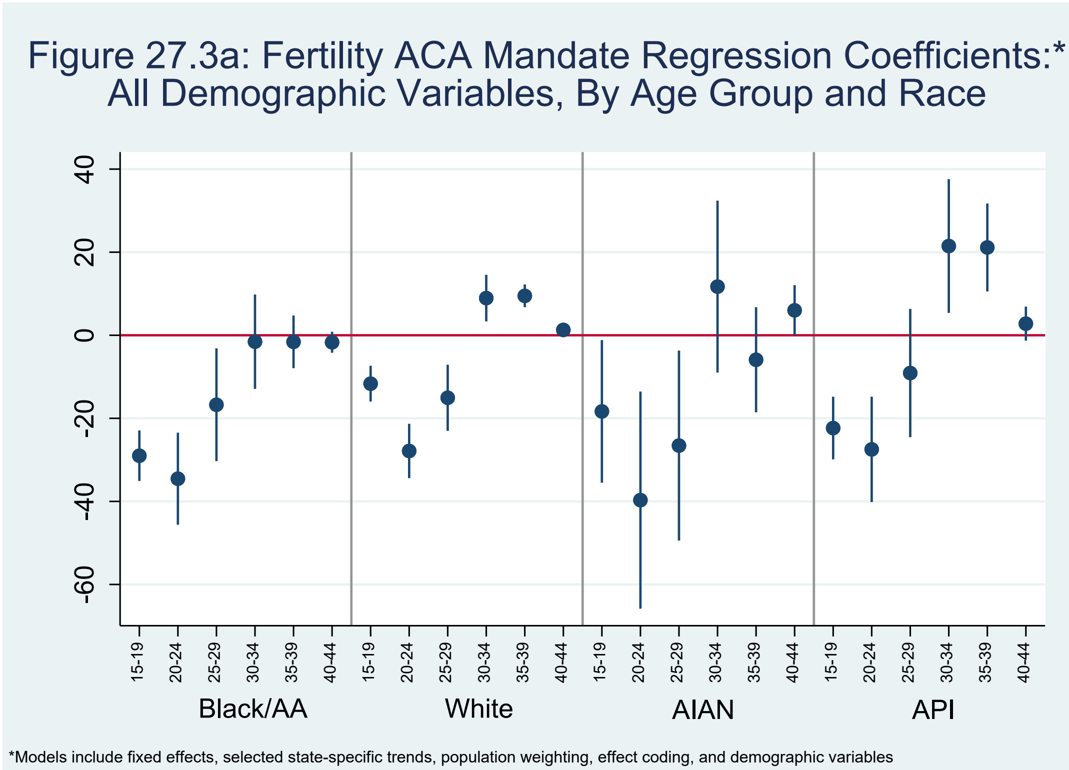


Figure 27.3a: Fertility ACA Mandate Regression Coefficients:*
All Demographic Variables, By Age Group and Race
40
20
0
-20
-40
-60
15-19
20-24
25-29
30-34
35-39
40-44
Black/AA
White
AIAN
API
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and demographic variables

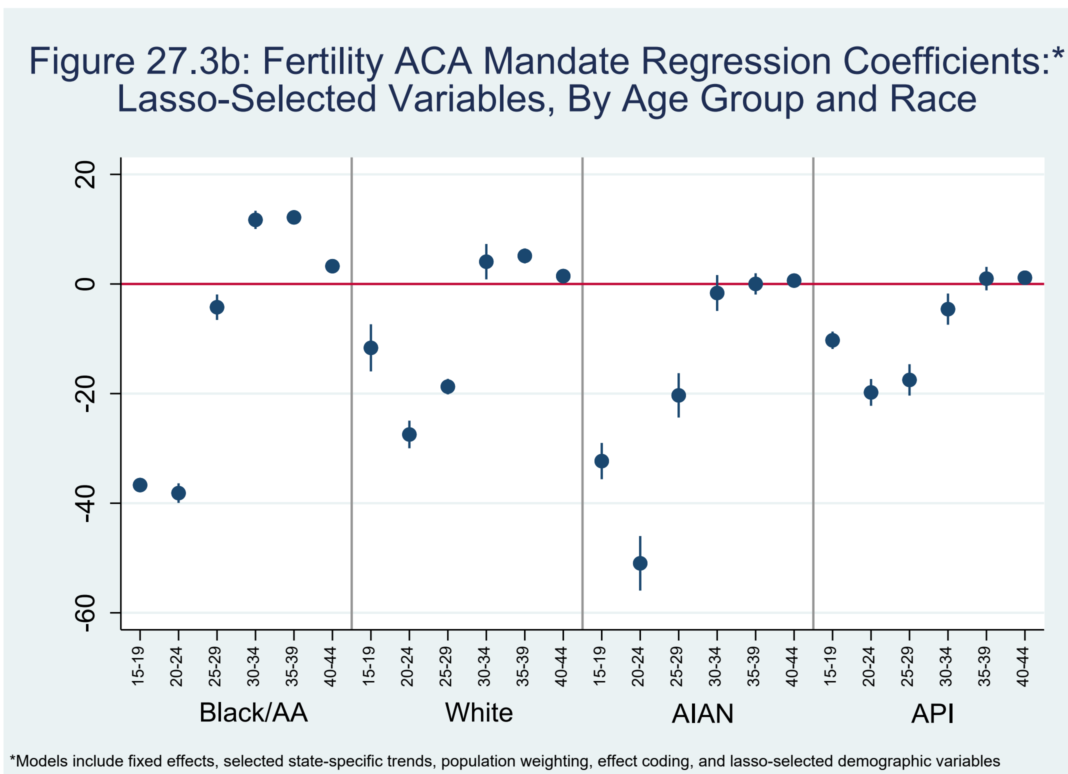


Figure 27.3b: Fertility ACA Mandate Regression Coefficients:*
Lasso-Selected Variables, By Age Group and Race
20
0
-20
-40
-60
15-19
20-24
25-29
30-34
35-39
40-44
Black/AA
White
AIAN
API
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and lasso-selected demographic variables

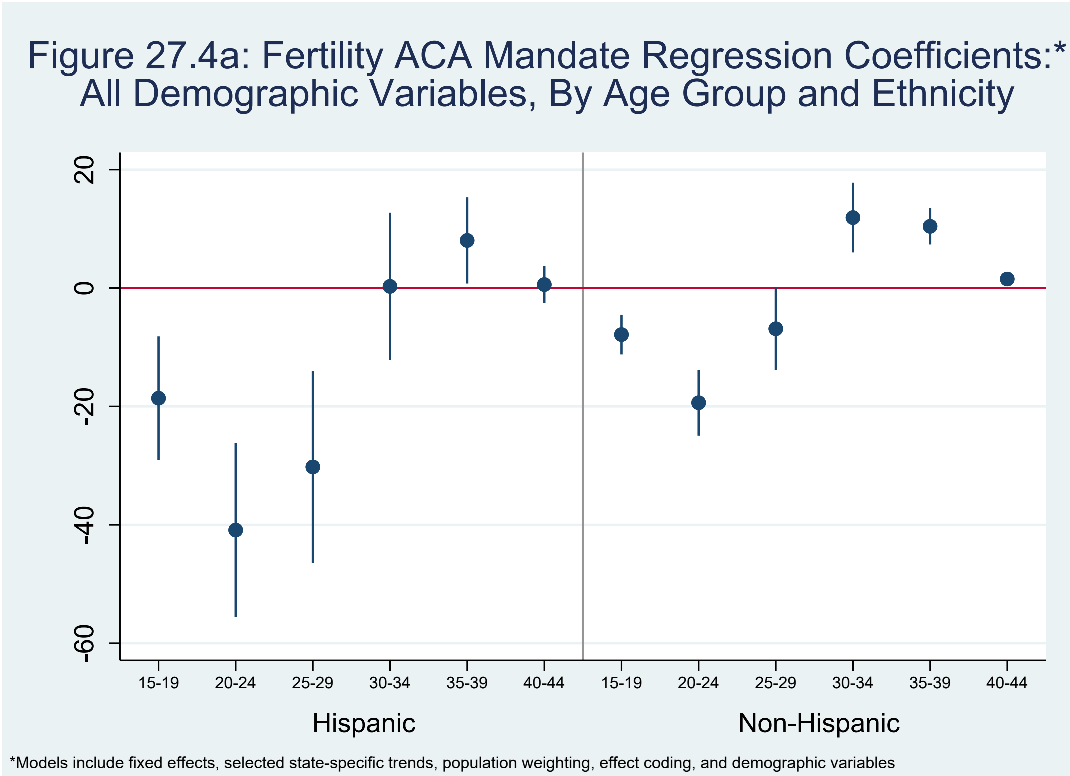


Figure 27.4a: Fertility ACA Mandate Regression Coefficients:*
All Demographic Variables, By Age Group and Ethnicity
20
0
-20
-40
-60
15-19
20-24
25-29
30-34
35-39
40-44
15-19
20-24
25-29
30-34
35-39
40-44
Hispanic
Non-Hispanic
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and demographic variables

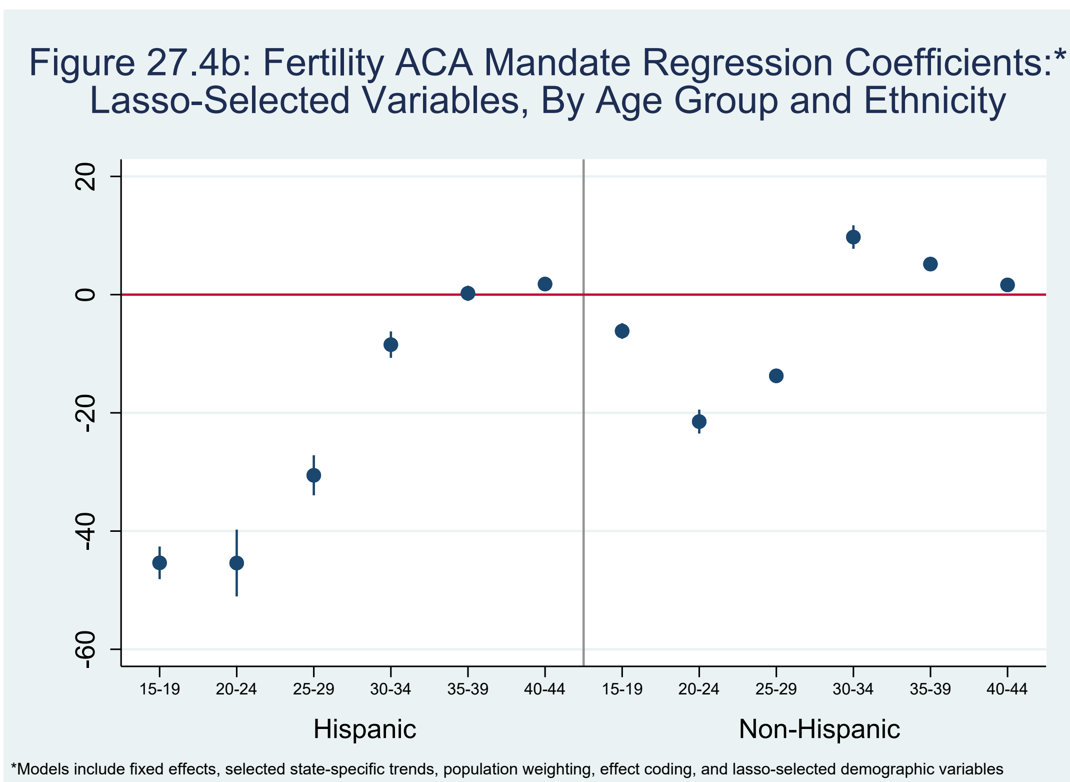


Figure 27.4b: Fertility ACA Mandate Regression Coefficients:*
Lasso-Selected Variables, By Age Group and Ethnicity
20
0
-20
-40
-60
15-19
20-24
25-29
30-34
35-39
40-44
15-19
20-24
25-29
30-34
35-39
40-44
Hispanic
Non-Hispanic
*Models include fixed effects, selected state-specific trends, population weighting, effect coding, and lasso-selected demographic variables

5.2 Fertility Discussion

This section will first discuss the testing that was done to determine the final model before discussing the details of the final model's results.

5.2.1 Discussion of Final Model Determination

Six separate tests were done to decide on the final model: fixed effects versus random effects, state fixed effects only versus including selected state-specific time trends, population weighting, effect coding, demographic variable inclusion, and selecting demographic variables with the lasso2 command in Stata.

The Hausman test results reported in Table 6 were utilized to determine to use fixed effects for all 50 regression subpopulations. This was decided because a majority of regressions had statistically significant Hausman Test statistics and because of the ability to minimize bias with fixed effects.

Since the adjusted R-squared value generally increased when adding in the selected state-specific time trends (see Figure 20), it was decided to include the time trends for Utah and North Dakota in the final model. The results are generally consistent and robust to either including or excluding the state-specific time trends (see Figure 21).

The estimated coefficients obtained when iteratively dropping the ten largest states reported in Table 7 showed the effects of population weighting when excluding California or Texas. Although population weights were used for the main model in this analysis, models with or without population weights should be used in the appropriate settings discussed in Section 4.2.3.

Effect coding was next explored as a means to potentially more accurately model the timing of the impact of the ACA contraceptive mandate. Of the effect coding method options listed in Table 5.1, coding 2013 with a value of one seemed to be the most inaccurate option given the realities of the timeline of the likely policy impacts. Waiting to estimate the policy impact until the next full year, in which case 2013 would be coded as zero and 2014 as one, seemed the next least ideal option. Thus, some value between zero and one seemed to be the best option, with testing done to ensure that theory of what *should* be the best way to model the impact of the ACA mandate lined up with reality.

Graphs of the ratios of different effect coding methods' estimated coefficients in Figures 22.1 to 22.3 show the impact of choosing a specific value for effect coding the ACA contraceptive mandate. Since the theory best supports a value of 2013=0.35, that set of regressions is the comparison point for the ratios. Figure 22.1 contrasts the 2013=0.35 with what seems the least logical choice from a theoretical standpoint, where 2013=1 (meaning that the full impact on the fertility rate started immediately on January 1, 2013). These ratios have the widest range of any of the ratios in Figures 22.1 to 22.3. Figure 22.3, which compares the baseline with 2013=0 (which represents the full impact of the ACA contraceptive mandate happening on January 1, 2014), unsurprisingly has a narrower range of ratios. Finally, comparing the baseline with 2013=0.5 in Figure 22.2 shows that the exact fraction used has little sizable impact for most of the regressions. In all three figures, regression 33 (American Indian or Alaskan Native ages 35 to 39) has the most variation in ratios. Three other subpopulations have more extreme ratios in the figures: regression 28 (White women ages 30 to 34), regression 34 (Asian or Pacific Islander women ages 35 to 39), and regression 47 (Hispanic women ages 35 to 39). It could be that the large differences in these specific subpopulations indicate a differential impact in the start of the effect of the ACA contraceptive mandate. However, since none of the estimated coefficients for these racial/ethnic age groups are statistically significant in any of the effect coding models, it seems less important that the ratios are relatively high for these groups. Furthermore, for most subgroups, there are not substantial differences between the effect coding methods, indicating that this decision does not bias the final results. Since the effect coding method of 2013=0.35 seems to make the most sense when considering when and how the policy was implemented, it was selected for modeling the specific timing of the ACA contraceptive mandate.

Demographic variables were next included in the model to help differentiate the impact of the ACA contraceptive mandate from other characteristics impacting the fertility rate during the same time period. Results were evaluated based on comparisons between adjusted R-squared values (Figure 23) and the estimated coefficients (Figure 24) in the models with and without demographic variables. As described in Section 5.1.5, when including demographic variables in the regression models, most of the 50 regressions either had a higher adjusted R-squared value when including demographic variables in the model (n=24) or had an adjusted R-squared value within ten percent of the adjusted R-squared value of models excluding demographic variables (n=14). The most sensitive subpopulation to the inclusion of demographic variables—American Indian or Alaskan Native women ages 35 to 39—was deemed less of a concern because of the statistically insignificant estimated coefficients under both model assumptions. Thus, it seems that the overall fit was either improved or minimally decreased with the inclusion of demographic variables.

The impact of including the demographic variables on the estimated coefficient is shown in Figure 24 with the ratios of estimated ACA mandate coefficients with and without demographic variables. Most of the ratios are fairly close to one, with 26 of the 50 ratios between 0.5 and 1.5, indicating a difference of less than 50 percent between the estimated coefficients with and without demographic variables. The ratios are much larger in absolute value for a few of the subpopulations, including White women ages 30 to 34 (regression 28), American Indian or Alaskan Native women ages 35 to 44 (regressions 33 and 37), Asian or Pacific Islander women ages 35 to 39, and Hispanic women ages 35 to 39. This suggests a differential impact of the demographic variables for different subpopulations and potential confounding. Additionally, because 31 of the 50 ratios are less than one, which happens when the estimated coefficient for the regressions *with* demographic variables is less than the coefficient for regressions *without* the demographic variables, this suggests that models that exclude the demographic variables may be overestimating the effect of the ACA contraceptive mandate on the fertility rate. Thus, to decrease the bias in the estimated coefficients, demographic variables should be included.

Although the demographic variables were selected based on a literature review and theory surrounding fertility choices, there can be concern about overfitting a model, especially as additional extraneous variables reduce the statistical power of a model, which is of greater concern in models with relatively fewer observations. Because of the sample size in this analysis, introducing ten demographic variables can significantly decrease the power of the analysis and increase confidence intervals. To address this issue, the lasso2 Stata command was used to select the optimal set of demographic variables for each of the 50 regressions. As discussed in Section 5.1.6, 32 of the 50 regressions have adjusted R-squared values within ten percent of the values when comparing models with all versus lasso-selected demographic variables and exactly half of the 50 regressions have a higher adjusted R-squared with the full demographic variables (see Figure 25). Thus, for most regressions there is not a substantial impact on overall goodness of fit when choosing whether to use lasso. Although there are some regressions in Figure 26 that are outliers in the ratio of estimated coefficients, most of the subpopulations have insignificant estimated parameters for the ACA contraceptive mandate variable, which makes these more extreme ratios less concerning.

Since the differences in adjusted R-squared values between models with the full demographic variables and models with lasso-selected demographic variables did not clearly indicate which modeling specification would be preferred for all 50 regression models, Figure 27 was included to help highlight the differences in estimated parameters for the 50 regressions under the two different model specifications. It is clear when comparing panel A and panel B that the lasso2 command did exactly what was intended, which was to select the most important demographic variables to limit the effect on power. This led to much more precise estimates in panel B and much broader 95% confidence intervals in panel A. The coefficient estimates are generally robust with either the full demographic variables or lasso-selected demographic variables and follow roughly the same general patterns and relationships when comparing races, ethnicities, age groups, or a combination of race/ethnicity and age groups. Some exceptions include that the coefficients for the two regressions for “All Data” become insignificant but remain negative and the coefficients for Asian or Pacific Islanders and non-Hispanic women become significant and negative. There are the least changes for White women, whether for all ages combined or by age group when comparing the two modeling choices.

The adjusted R-squared doesn’t make a clear case for either the full demographic variable model or lasso-selected models for all regressions as a whole. However, the much greater precision gained via utilizing lasso2 to select demographic variables makes the models with lasso-selected demographic variables slightly more preferable to models with the full demographic variables when considering the entire set of 50 regressions together. When looking at an individual subpopulation, it would make sense to consider both modeling choices and compare adjusted R-squared values for that specific subpopulation. Further discussion of the exact estimates in the final model follows in Section 5.2.2.

5.2.2 Discussion of Final Model Results and Trends

The final model results generally show a statistically significant reduction in fertility rate due to the ACA contraceptive mandate. Many of the 50 regressions also show a statistically significant effect of the state-specific contraceptive mandates, though smaller in magnitude than the estimated effect of the ACA contraceptive mandate. This is what was expected, as the state-specific mandates did not impact as many people or reduce the copayments for contraceptives to zero. Because there is variation in results by sub-population, these results will be discussed individually.

The first two regressions in Table 9.1 were run with all of the data aggregated to show the average effects of the ACA contraceptive mandate on the entire population. The first regression only has the ACA contraceptive mandate binary variable and the second regression includes all three policy binary variables to estimate the impact of state-specific mandates, the ACA contraceptive mandate, and the interaction of the two. In the lasso-selected models, both of these regressions have insignificant estimated coefficients for the ACA contraceptive mandate. However, both of these regressions have a higher adjusted R-squared in the model with the full demographic variables, where both regressions have a statistically significant estimated coefficient for the ACA contraceptive mandate (see Appendix Table 8.1). The first model estimates a decrease in the fertility rate of 3.569 births per thousand women (95% CI [-6.23, -0.90], 2012 US mean: 63.0 births per 1,000 women). The second regression includes all three policy binary variables to estimate the impact of state-specific mandates, the ACA contraceptive mandate, and the interaction of the two. All three policy binary variables have a negative coefficient and are statistically significant, showing the greatest decrease for the ACA contraceptive mandate: -4.277 births per 1,000 women (95% CI [-6.86, -0.22], 2012 US mean: 63.0 births per 1,000 women). It is important to separate these two regressions to verify that the effect attributed to the ACA mandate is not simply coming from the state-specific mandates. It is interesting to note that adding in the state-specific mandates actually increases the absolute value of the impact of the ACA mandate, with states with mandates experiencing an additional decrease in fertility of 0.844 births per 1,000 women (95% CI [-1.20, -0.49]). These two estimated impacts on the fertility rate translate to a nationwide estimate of roughly 299,179 births averted annually. The presence of significant interaction effects in Appendix Table 8.1 implies that the model with all three policy variables is better at appropriately allocating effects than the model with the ACA policy variable alone. These two models show a roughly five percent reduction in the crude fertility rate from 2012 base levels due to the ACA contraceptive mandate, which confirms what previous related studies have generally found, which is the ACA contraceptive mandate decreasing the fertility rate by a small but statistically significant amount.

The first regression sub-population groups were done by four racial categories: Black/African American, White/Caucasian, American Indian/Alaskan Native, and Asian or Pacific Islander (see Table 9.1). All four groups had a statistically significant estimated coefficient for the ACA contraceptive mandate in the lasso-selected models. All four groups also had statistically significant estimates of the interaction term between the state mandates and ACA mandate, but the coefficient was negative for only White women. The coefficient was the largest in absolute value for the American Indian/Alaskan Native population, with an estimated decrease of 17.93 births per 1,000 women (95% CI [-19.59, -15.48], 2012 US mean: 47.0) overall. The interaction term between the ACA contraceptive mandate and the state-specific mandates estimated that states with mandates had an additional relative *increase* in the fertility rate of 5.49 births per 1,000 women (95% CI [3.81, 7.18]) when the ACA contraceptive mandate went into effect. The White subpopulation had the smallest estimated decrease of 3.46 births per 1,000 women (95% CI [-4.70, -2.22], 2012 US mean: 58.6) overall and an additional decrease in states with contraceptive mandates of 1.40 births per 1,000 women (95% CI [-1.84, -0.96]). The 95 percent confidence intervals are much wider for the American Indian/Alaskan Native and the Asian or Pacific Islander subpopulations, which is a trend seen with these two races in all of the regressions by subpopulations, though much more apparent in the regressions with the full demographic variable list rather than the lasso-selected models. It is important to note that these subcategories are only by race and not also by ethnicity, so, for example, the "White" category includes both White Hispanic and White Non-Hispanic women. This somewhat complicates the interpretation of the variables, but a further breakdown of the data by both race and ethnicity were not available. The results of this subpopulation's regressions provide greater context for later regressions by race and age category.

The second subpopulation of regressions is run by Hispanic and Non-Hispanic ethnicity (see Table 9.1). Similar to the discussion of race categories, these categories are only by ethnicity, so the Hispanic population is largely comprised of women in the White/Caucasian racial category with an additional small group from the Black/African American racial category. Non-Hispanic, however, includes people from all four of the race categories as long as they do not report having Hispanic ethnicity. Seeing the range of results in the prior subpopulation by race illuminates the difficulty in making the comparisons between Hispanic and Non-Hispanic when the data are also not further categorized by race. That said, there was a statistically significant decrease in the fertility rate for Hispanics of 27.55 births per 1,000 women (95% CI [-29.84, -25.26], 2012 US mean: 74.4) overall with an additional decrease in states with mandates of 3.20 births per 1,000 women (95% CI [-5.16, -1.24]). The estimated effect was statistically significant but much smaller for Non-Hispanics: -3.15 births per 1,000 women (95% CI [-4.06, -2.25]). Since the Hispanic population is largely White, when combining the results by race with the results by ethnicity, it seems likely that the reduction in fertility due to the ACA contraceptive mandate for Non-Hispanic Whites is likely less than the estimated coefficient reported for Whites as an entire racial group.

The third subpopulation of regressions was done by five-year age categories from 15 through 44 (see Table 9.1). In these lasso-selected regressions, the estimated coefficient for the ACA contraceptive mandate was statistically significant at the alpha=0.01 level for all six age categories. Ages 15 through 29 show an estimated decrease in the fertility rate while ages 30 to 44 show an estimated increase in the fertility rate. This same trend is repeated throughout later regressions for younger versus older age groups. The greatest estimated decrease in the fertility rate is for women between 20 and 24 years old, with the model estimating a decline in 27.48 births per 1,000 women (95% CI [-30.44, -24.53], 2012 US mean: 83.1) overall and an additional decrease of 2.54 births per 1,000 women (95% CI [-3.39, -1.68]) in states with mandates. The estimated decrease for 25 to 29-year-olds is slightly smaller at 21.38 births per 1,000 women (95% CI [-24.89, -17.86], 2012 US mean: 106.5) overall plus an additional decrease of 1.33 births per 1,000 women (95% CI [-2.22, -0.45]) in states with mandates, which is roughly three times the estimated decrease of 6.71 births per 1,000 women between ages 15 and 19 (95% CI [-8.94, -4.48], 2012 US mean: 29.4). It may initially seem counterintuitive that the ACA contraceptive mandate would have the smallest effect on women between 15 and 19 when such a large proportion of those births are unintended. The estimated coefficients are measuring the change in the fertility rate and not the percent reduction in unintended pregnancies. Although a lower percent of pregnancies in ages 20 to 24 are unintended, there is a much higher overall birthrate, and thus a higher absolute unintended pregnancy rate, for women ages 20 to 24 (see Figures 7 and 8).

The fourth subpopulation groupings are by the four race categories and the six mother’s age categories, resulting in a total of 24 regressions in Tables 9.2 and 9.3. For the Black/African American population, the youngest three age groups have a statistically significant decrease in fertility due to the ACA contraceptive mandate while the oldest three age groups have a statistically insignificant decrease in the lasso-selected models. However, all but the 20-24 age group regressions have higher adjusted R-squared values in the models with full demographic variables where all six age groups have a negative estimated coefficient, though only the youngest three age groups are statistically significant (see Appendix Tables 8.2 and 8.3). Unlike the results by age group only where the highest decreases in fertility were in the 20 to 24 and then 25 to 29 age groups, for the Black/African American group, 15 to 19 has the second largest decrease in fertility closely after the 20 to 24 age group, at -36.69 births per 1,000 women (95% CI [-37.87, -35.51], 2012 US mean: 44.0) overall. The ACA/state policy interaction term estimated an additional *increase* in fertility post-ACA contraceptive mandate implementation of 5.28 births per 1,000 women (95% CI [4.32, 6.25]) in states with mandates. Finally, the Black-African American population between ages 20 and 24 had the second largest estimated decrease in fertility of all of the 24 race-age group subcategories, at 38.16 births per 1,000 women (95% CI [-39.95, -36.37], 2012 US mean: 108.7).

Similar to the discussion of prior results, interpreting the results for the White race category are slightly more complex because it includes both White Hispanic women and Non-Hispanic White women. As seen in Figures 27.3a and 27.3b, White women have the least differences between the models with full demographic variables and lasso-selected demographic variables. In this race category, the three youngest age groups show a statistically significant estimated decrease in the fertility rate and ages 30 to 44 have a statistically significant estimated *increase* in the fertility rate (see Tables 9.2 and 9.3).

The relative patterns of the estimated coefficients of the three younger age groups follow the same relationship seen in the regressions only by age group, with the largest estimated decrease of 27.46 births per thousand White women ages 20 to 24 (95% CI [-29.98, -24.94], 2012 US mean: 80.8) overall plus an additional decrease of 3.78 births per 1,000 women (95% CI [-4.76, -2.80]) in states with mandates. Following this age group is ages 25 to 29 with the second highest decrease, then ages 15 to 19.

The results for the American Indian/Alaskan Native women by age group have the widest confidence intervals of the four races, and are much wider than the confidence intervals for Black/African American and White women, especially in the models with the full demographic variables (see Figures 27.3a and 27.3b). This is not surprising because the American Indian/Alaskan Native population is relatively much smaller and there are not data for all states for all years for each of this race's age group categories (see Tables 9.2 and 9.3 for the count of states included for each age category). Four of the six age groups have an estimated negative coefficient for the ACA contraceptive mandate variable, but only three of the four are statistically significant at the alpha=0.05 level—women ages 15 to 29. The estimated decrease for women ages 20 to 24 is the highest of all of the 24 race-age category combinations, with an estimated 50.97 fewer births per 1,000 American Indian/Alaskan Native women (95% CI [-55.95, -45.99], 2012 US mean: 81.7) overall plus an estimated *increase* in the fertility rate by 17.14 births per 1,000 women (95% CI [13.06, 21.22]) in states with mandates.

The final race category includes Asian or Pacific Islander women. This group's ACA mandate coefficients had statistically significant decreases in fertility rates for ages 15 to 34 and a statistically significant *increase* in fertility rates for ages 40 to 44. The

Asian or Pacific Islander group is the only racial category that had a statistically significant estimated decrease for women ages 30 to 34: -4.59 births per 1,000 women (95% CI [-7.44, -1.75], 2012 US mean: 121.3). Similar to the White population, the Asian or Pacific Islander population had the second largest estimated fertility decrease in ages 25 to 29 instead of 15 to 19. For reasons likely similar to those discussed with the American Indian/Alaskan Native population, the confidence intervals for the Asian or Pacific Islander women are relatively large, especially when looking at results from models with the full demographic variables (see Figures 27.3a and 27.3b).

The final regression subpopulation groups are by ethnicity and age group (see Table 9.4). Hispanic women had a statistically significant estimated decrease in fertility for women ages 15 through 34. The estimated decrease for ages 20 to 24 was the second largest estimated decrease in fertility of the 50 regressions, at 45.41 births per 1,000 women (95% CI [-51.06, -39.76], 2012 US mean: 111.5) overall plus an additional estimated decrease of 6.10 births per 1,000 women (95% CI [-8.58, -3.61]) in states with a mandate. The estimated decrease for women ages 15 to 19 was next highest, at 45.37 births per 1,000 women (95% CI [-48.13, -42.62], 2012 US mean: 46.3). The estimated decrease for Hispanic women ages 25 to 29 was roughly two thirds that of women ages 15 to 24: -30.56 (95% CI [-33.95, -27.18], 2012 US mean: 119.6) overall plus an additional -8.1 births per 1,000 women (95% CI [-11.0, -5.20]) in states with a mandate. The estimated coefficient for the two older age categories implies an increase in fertility, but only the coefficient for ages 40 to 44 is statistically significant. Non-Hispanic women had a statistically significant estimated decrease in fertility rates for the three youngest age groups, but the magnitude is much smaller than for Hispanic women of the same ages. Non-Hispanic women ages 30 to 44 had a statistically significant estimated increase in fertility. Again, the Non-Hispanic category is not the same as Non-Hispanic White, so should be interpreted accordingly.

Overall, the results were consistent in showing the biggest estimated reductions in fertility in specific segments of the population: those that were younger and those in a racial or ethnic minority. This is not surprising, because, as discussed in Section 2.3, these are the segments of the population that have the highest rates of unintended pregnancies. Assuming that a policy change that increases contraceptive availability and use would result in a decrease in unplanned pregnancies, different effects should be expected in across segments with differing unplanned pregnancy rates.

Previous studies have largely found a small or insignificant effect of the ACA contraceptive mandate on fertility rates roughly similar to the modest approximate 5 percent decrease in the first two regressions with all data combined across age categories, race and ethnicity. When the data are not broken down further by age, race, and ethnicity, it is impossible to isolate the segments of the population that are at greatest risk for unplanned pregnancy. The 48 regressions that follow the initial two regressions in this analysis highlight the importance of determining the effect of contraceptive policies on more specific subgroups than the US population as a whole, where, for example, the ACA contraceptive mandate was estimated to have decreased fertility rates for women ages 20 to 25 by 33.1 percent and 37.0 percent for Hispanic women.

Perhaps most surprising in this analysis were the statistically significant estimated *increases* in fertility rates for the older age groups. These findings were fairly consistent when looking at only age groups, age groups plus race, and age groups plus ethnicity. It seems somewhat counterintuitive that a contraceptive policy that expands access and affordability would increase the fertility rates for certain populations. However, as mentioned in Section 2.7, the ACA contraceptive mandate was only one part of the ACA, which had a major impact on health insurance availability and healthcare costs.

One potential explanation for the increases in fertility rates among older age groups is the increased access to ART via the state EHBs discussed in Section 2.7. To test this hypothesis, the regressions by age group were run separately for states with and without ART required coverage in their EHB benchmark plans (see Appendix Table 2). The two groups of states had different estimated effects of the ACA contraceptive mandate on fertility rates, especially on older age groups. However, the women in states *with* EHBs requiring ART coverage had a *lower* estimated impact of the ACA on fertility rates (see Appendix Figures 2.1 to 2.3), which is the opposite of what was expected. It could be that women in states without EHBs requiring ART coverage are only seeing the cost of having a child at any age decrease with the increased health insurance coverage and decreased healthcare costs, which is resulting in increased demand for an additional child. Conversely, women in states with EHBs requiring ART coverage could be intentionally choosing to delay having children because they know that infertility services will be much more affordable if they need them later due to their lower fertility at older ages due to a delay in childbearing. It is clear that there is some difference between these two groups of states that is likely not limited to only the differences in state EHB requirements. Further investigation may help elucidate the differing experiences of these two groups of older women.

5.2.3 Strengths

The final set of regression models generally pass various checks of robustness and the findings do not contradict prior literature and theory while filling a substantial research gap in the knowledge about the effect of the ACA contraceptive mandate on fertility rates.

This work is the first to look at the effect of the ACA contraceptive mandate by all of the various subpopulation categories. This is crucial because of the wide range of differences in unplanned pregnancies and pre-ACA contraceptive access and use by these age, race, and ethnicity subcategories.

This work is also the first to include binary variables for the effect of state-specific contraceptive mandates in addition to the effect of the ACA contraceptive mandate. Including the state-specific policy variables allows the model to more accurately attribute each policy's impact.

5.2.4 Limitations

The main limitations to this analysis are due to data availability. The fertility data were at most broken down by either race plus age or ethnicity plus age. Fertility data by race *and* ethnicity or race *and* ethnicity *and* age are not reported consistently in every state in the US. Having those data would help to better understand the impact of the ACA contraceptive mandate on all subpopulations, but would be especially useful in understanding the impact for Non-Hispanic White women.

Additionally, the fertility data and the demographic variables are all at the state level. It is expected that there would be substantial fluctuation in fertility preferences and trends as well as demographic makeup within each state across rural versus urban areas.

However, all of the required data for this analysis are not available at a geography smaller than the state level for all states in the US and across all years.

As well, it is likely that some of the demographic variables are confounded with the ACA. Decisions regarding fertility are highly complex and are influenced by individual family norms, local culture, both current and expected household income, desired family size, etc. It is likely that there are variables not included in this model that may be better at capturing these factors, especially for certain subpopulations, like Asians or Pacific Islanders, whose lasso regressions omitted most demographic variables.

Additionally, the data utilized in this analysis cannot be used to separate out unintended from intended fertility. It is expected that the reductions in fertility due to the ACA contraceptive mandate would largely impact unintended fertility, but that cannot be separately measured and analyzed with these data.

The final main limitation is that economic fluctuations affect fertility preferences in general and the Great Recession has had a unique impact on fertility rates. Fertility trends are strongly linked with economic indicators (Schneider, 2015) and the typical rebound in fertility rates post-recession has still yet to materialize after the Great Recession (Schneider, 2015; Seltzer, 2019; Buckles, et al., 2020). This is especially complicated in this analysis because the unemployment rates vary across states and vary even more across counties within states, with greater unemployment in geographic areas that historically have had more jobs in the manufacturing industries (Seltzer, 2019). This analysis included two demographic variables that should help to model this relationship—the unemployment rate and median household income—but the Great Recession may have permanently altered fertility preferences and confidence in the ability to afford additional children, which is not fully captured in this analysis (Hartnett & Gemmill, 2020). Even with these variables included in the models, there may be some residual confounding affecting the results.

5.2.5 Policy Implications

This analysis shows that the ACA contraceptive mandate was generally effective at reducing the fertility rate, with greater effectiveness for specific subpopulations previously at higher risk for unintended pregnancy. Historically, there has been uncertainty about the mandate's effectiveness because of the multiple steps between issuing a mandate and reducing the fertility rate, including getting a doctor's appointment, obtaining a prescription for contraceptives, picking up the contraceptives, and using the contraceptives correctly and consistently. This analysis shows that the ACA contraceptive mandate ultimately has the intended effect of the policy.

Assuming that the estimated decrease in fertility rate due to the ACA contraceptive mandate was largely from decreasing unintended pregnancies (Buckles, et al., 2019), and assuming that helping women avoid unintended pregnancies is a goal worth pursuing, the ACA contraceptive mandate or a similar policy should continue. If resources were limited, and if and this were in a single-payor system of insurance, for example, priority for free contraceptives should be given to women between ages 15 and 29 and to women belonging to minority racial and ethnic groups.

Even if the federal or state governments choose to discontinue the ACA contraceptive mandate or similar state-specific mandates, private insurance companies should explore following a similar policy in their own insurance benefit plans to help reduce unintended pregnancies among their population of insured women. This would likely save insurance companies the costs of prenatal and postpartum care for unintended pregnancies avoided via greater contraceptive access.

Relevant government agencies could pursue related research to further clarify these findings for greater policy guidance. This research could attempt to locate data on a more granular level than the state level, add in contraceptive method mix data, or add in data over a longer time period to see if trends persist.

6.0 Abortion Results and Discussion

This chapter has two main sections: the abortion analysis results (6.1) and discussion (6.2). The results section will report the testing done to determine the final model and include details of the final model's results. The discussion section will cover both the final model selection and interpretations from the final model.

6.1 Abortion Results

The regressions for the abortion analyses were run on the subpopulations listed in Table 3 and in the order indicated in the decision tree in Figure 18. The results of these multiple regression models are detailed in the following subsections.

6.1.1 Fixed Effects versus Random Effects

The first models were designed to determine whether to used fixed effects or random effects in the subsequent models. These regressions utilized Equation 9 but omitted the demographic variables. Each of the fifteen regressions was modeled with both fixed effects and random effects, and the results were used to conduct a Hausman Test. The full regression results for the fixed effects and random effects regressions are available in Appendix Tables 9 and 10, respectively. The Hausman Test chi-square, degrees of freedom, and corresponding p-values are listed in Table 10 by the regression category and subcategory. Again, if the Hausman Test statistic is significant, fixed effects models are preferred in order to obtain unbiased estimates. If the statistic is insignificant, however, there is no difference between the estimates under fixed effects or random effects, so random effects should be used as they yield more efficient estimates.

As per Table 10, Hausman Tests statistics for models with data on residence, state of occurrence, and age were somewhat mixed. Four of the fifteen abortion regressions in

Table 10 had a p-value less than 0.05 and an additional three regressions had a p-value between 0.05 and 0.1. All seven of these models were regressions with either full data or data by age group. None of the four regressions with race or ethnicity had significant or borderline significant Hausman test results. However, it was decided to use fixed effects for all models to ensure unbiased estimates and to use consistent methodology across all fifteen regression subcategories. As seen in Appendix Tables 9 and 10, the differences in estimated coefficients and standard errors are minor for most of the regressions except for the four regressions for which the Hausman Test indicated that fixed effects must be used. Although using fixed effects will potentially come at a cost of some efficiency for some models, it seems reasonable to move forward using only fixed effects to ensure unbiased estimates of all models. This is especially the case as the results are generally robust to either decision.

Table 10: Abortion Analysis Hausman Test Results

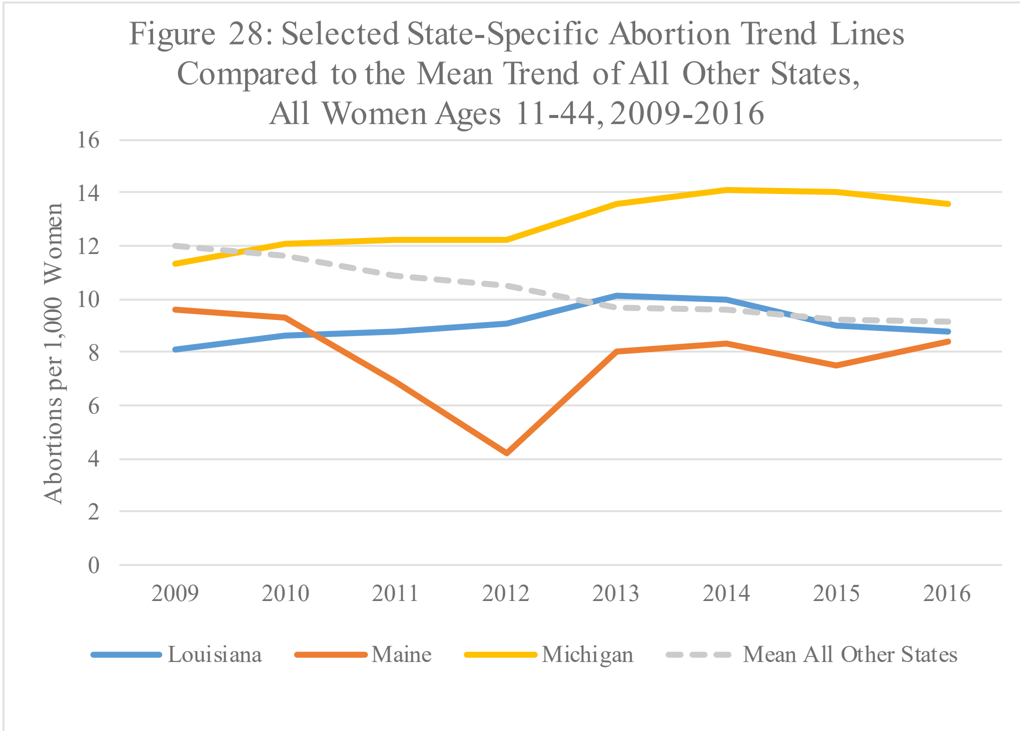
		Hausman Test Results		
Regression Category	**Subcategory**	**Chi-Square**	**DOF**	**P-Value**
By Woman's Residence	ACA Only	4.08	2	0.1300
	All Variables	13.74	4	0.0082**
By State of Occurrence	ACA Only	4.00	2	0.1356
	All Variables	8.99	4	0.0614*
By Age Group of Mother	11-14	25.00	10	0.0054**
	15-19	20.26	7	0.0050**
	20-24	13.12	7	0.0692*
	25-29	11.98	7	0.1012
	30-34	12.66	7	0.0809*
	35-39	14.38	7	0.0448**
	40-44	15.24	10	0.1236
By Race/Ethnicity	NH White	14.23	10	0.1628
	NH Black	8.60	10	0.5705
	NH Other	10.26	10	0.4178
	Hispanic	12.72	10	0.2396

**P-value indicates fixed effects is optimal at the alpha=0.05 level.
*P-value indicates fixed effects is optimal at the alpha=0.1 level.

6.1.2 State Fixed Effects versus State-Specific Time Trends

As discussed in Section 4.2.2, states that did not have roughly parallel abortion trend lines were identified to test for the potential inclusion of state-specific time trends. Three states—Louisiana, Maine, and Michigan—were determined to have sufficiently non-parallel trend lines to justify testing their state-specific time trends. These three states' abortion trend lines are graphed in Figure 28, along with the reference line showing the mean abortion trend line for all other states combined. The full graph of all states' abortion trend lines is included in Appendix Figure 3.

Michigan was the only state with a steadily-increasing trend in abortions over nearly the entire time period. Louisiana only had a slight increase between 2009 and 2016, but the atypical inverted shallow-U shape made it seem reasonable to include a time trend for Louisiana. Maine had a net decrease over the 2009-2016 period, but was included because of the sharp decline between 2010 and 2012 which was followed by a sharp rise between 2012 and 2013. Although it was not noted in the data source, this could be due to data reporting differences or a data reporting error, or it could be accurate. However, the pattern is substantially different from other states to justify considering a time-trend for Maine along with Louisiana and Maine.



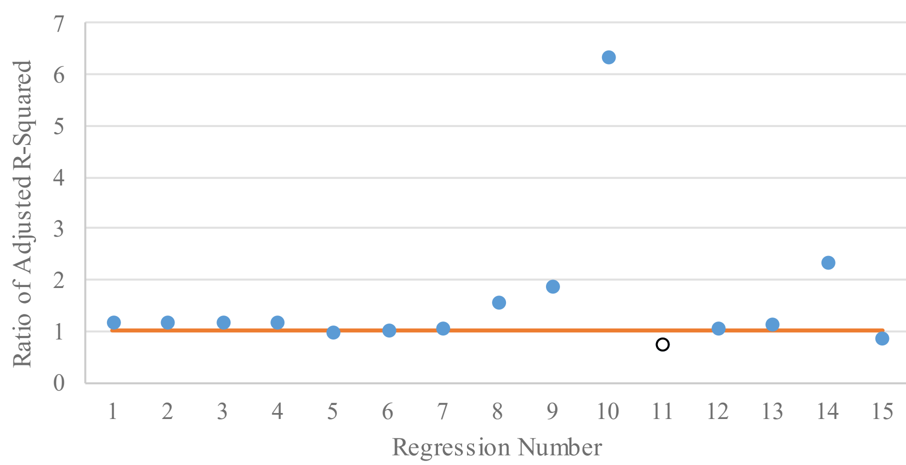
After identifying these three states, the fixed effects regression model described in Section 6.1.1 was modified to include these state-specific time trends. The full regression results are available in Appendix Table 11. To better understand the impact of the inclusion of state-specific time trends on the regressions' goodness of fit, Figure 29 graphs the ratio of the adjusted R-squared for models with and without the state-specific time trends. Figure 30 similarly graphs the ratio of the estimated ACA mandate coefficients for models with and without the state-specific time trends for each of the fifteen abortion regressions to show the change in the estimated impact of the ACA mandate on abortion rates. Again, ratios are graphed in a solid blue circle when both models' estimates are statistically significant for the regression subpopulation. When one or both models' estimates are insignificant, the ratio is graphed with a black-outlined white circle.

When adding additional variables for the three states' time trends, the adjusted R-squared increased for eleven of the fifteen models, showing that including these state-specific time trends allowed for better overall modeling of the abortion rates. Regression ten—which is the model for women ages 35 to 39—shows a very high ratio because the initial adjusted R-squared without state time trends was only 0.0225, so increasing the adjusted R-squared to 0.142 manifested as a massive jump. Regressions five (women ages 11 to 14) and six (women ages 15 to 19) had ratios just barely less than one (0.974 and 0.997, respectively), indicating a slight model preference for excluding state-specific trends for these subpopulations. Regressions eleven (women ages 40 to 44, which is statistically insignificant) and fifteen (Hispanic women) had the lowest ratios (0.739 and 0.856, respectively), indicating that the additional variables did not improve the model for these two subpopulations.

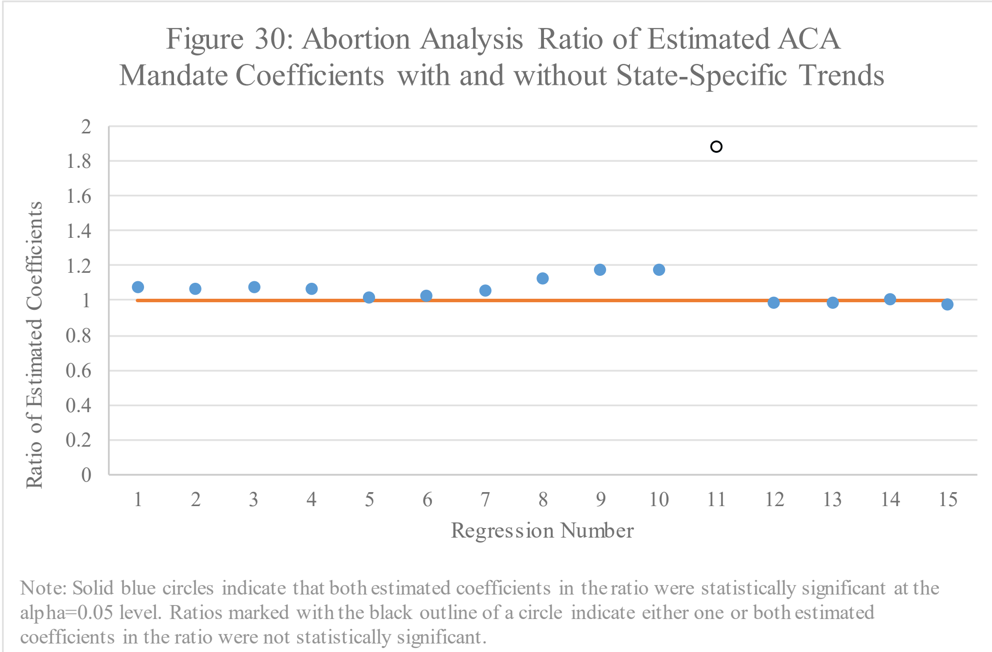
In Figure 30, fourteen of the fifteen regressions have a ratio of the estimated coefficients between 0.98 and 1.17, showing a very modest effect on the ACA mandate estimated coefficient when including state-specific time trends. Given that the state-specific trends that were included were for states with non-parallel abortion time trends, it is not surprising that the inclusion of these specific states' trends would increase the estimated impact of the ACA contraception mandate. It is interesting that the ratios show higher estimated coefficients with state-specific trends included for all the regressions except for the four regressions by race or ethnic subcategory. These ratios were all between 0.98 and 1.0, however, so the estimates are not significantly lower when including state-specific time trends. The ratio standing out the most is for regression eleven (women ages 40 to 44), which shows the highest increase in the estimated coefficient under the state-specific time trends model. However, this coefficient's estimates were both relatively small (from -0.07 to -0.12) and were statistically insignificant under both models, making this ratio of little concern.

Combining results from Figure 29 and Figure 30, it seems reasonable to include the time trends for these three states in the final model. Their inclusion increased the adjusted R-squared, indicating better fit. Additionally, the estimated coefficients between the two models were relatively similar, indicating the robustness of the model regardless of the choice made about selected state-specific time trends.

Figure 29: Abortion Analysis Ratio of Adjusted R-Squared with and without State-Specific Trends



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.



6.1.3 Population Weights

Whether to use population weighting was tested by running a series of regressions in which the most populous states were iteratively excluded from the analysis. Since the different regression subpopulations do not all include the same states due to differences in data availability across states, twelve total states were iteratively excluded from the analysis to ensure that each of the fifteen regressions had a minimum of ten states dropped from the analysis. The estimated coefficient and corresponding p-value for the ACA mandate parameter are included for all fifteen abortion regressions in Table 11 below. I find that omitting large states had minimal impact on results so population weighting can be implemented with minimal impact on effect size. Population weighted results measure the treatment effect for one individual. Unweighted results measure the treatment effect for one state and would be relevant to state legislation. Table 11 suggests that by and large, these results are similar. However, as discussed in Section 4.2.3, future research or policy questions may indicate a preference for weighting or not weighting.

Table 11: Abortion Analysis Test Results for Using Population Weighting

Variable	By Residence ACA Only	By Residence All	By Occurrence ACA Only	By Occurrence All	By Age Group of Mother 11-14	15-19	20-24	25-29	30-34	35-39	40-44	By Race/Ethnicity NH White	NH Black	NH Other	Hispanic
No Omitted States (Reference)	-3.852 (0)	-3.127 (0)	-4.088 (0)	-3.795 (0)	-0.270 (0)	-6.366 (0)	-8.623 (0)	-3.327 (0)	-1.716 (0)	-0.711 (0)	-0.057 (0.510)	-2.246 (0)	-5.159 (0)	-2.160 (0)	-3.567 (0)
Omit Texas	-3.579 (0)	-3.079 (0)	-3.795 (0)	-3.744 (0)	-0.275 (0)	-6.411 (0)	-8.374 (0)	-3.145 (0)	-1.624 (0)	-0.637 (0)	-0.027 (0.721)	-2.156 (0)	-4.668 (0)	-2.059 (0.001)	-2.973 (0.003)
Omit New York	-3.437 (0)	-2.981 (0)	-3.698 (0)	-3.649 (0)	-0.260 (0)	-6.094 (0)	-8.256 (0)	-3.067 (0)	-1.546 (0)	-0.665 (0)	-0.046 (0.603)	-2.224 (0)	-5.744 (0)	-1.959 (0.001)	-3.794 (0)
Omit Illinois	-3.888 (0)	-3.149 (0)	-4.160 (0)	-3.816 (0)	-0.269 (0)	-6.348 (0)	-8.676 (0)	-3.343 (0)	-1.740 (0)	-0.717 (0)	-0.072 (0.413)	**	**	**	**
Omit Pennsylvania	-3.865 (0)	-3.037 (0)	-4.136 (0)	-3.853 (0)	-0.257 (0)	-6.074 (0)	-8.478 (0)	-3.531 (0)	-1.789 (0)	-0.801 (0)	-0.087 (0.350)	**	**	**	**
Omit Ohio	-3.892 (0)	-3.079 (0)	-4.110 (0)	-3.769 (0)	-0.265 (0)	-6.177 (0)	-8.385 (0)	-3.195 (0)	-1.631 (0)	-0.712 (0)	-0.042 (0.651)	-2.092 (0)	-4.612 (0)	-2.913 (0)	-3.405 (0)
Omit Georgia	-3.945 (0)	-3.187 (0)	-4.197 (0)	-3.855 (0)	-0.274 (0)	-6.380 (0)	-8.709 (0)	-3.421 (0)	-1.782 (0)	-0.763 (0)	-0.061 (0.485)	-2.268 (0)	-5.147 (0)	-2.131 (0.001)	-3.717 (0)
Omit North Carolina	-3.890 (0)	-3.140 (0)	-4.122 (0)	-3.807 (0)	-0.272 (0)	-6.361 (0)	-8.648 (0)	-3.373 (0)	-1.761 (0)	-0.730 (0)	-0.070 (0.417)	-2.273 (0)	-5.302 (0)	-2.185 (0)	-3.594 (0)
Omit Michigan	-4.043 (0)	-3.150 (0)	-4.286 (0)	-3.818 (0)	-0.270 (0)	-6.364 (0)	-8.632 (0)	-3.360 (0)	-1.702 (0)	-0.697 (0)	-0.059 (0.477)	-2.218 (0)	-4.960 (0)	-2.159 (0)	-3.533 (0)
Omit New Jersey	-3.894 (0)	-3.163 (0)	-4.156 (0)	-3.845 (0)	-0.272 (0)	-6.378 (0)	-8.704 (0)	-3.368 (0)	-1.778 (0)	-0.745 (0)	-0.067 (0.436)	-2.141 (0)	-5.784 (0)	-2.155 (0)	-3.439 (0)
Omit Virginia	-3.722 (0)	-3.071 (0)	-3.975 (0)	-3.752 (0)	-0.268 (0)	-6.360 (0)	-8.538 (0)	-3.231 (0)	-1.680 (0)	-0.687 (0)	-0.055 (0.527)	-2.238 (0)	-4.837 (0)	-2.096 (0.001)	-3.559 (0)
Omit Arizona	-3.996 (0)	-3.196 (0)	-4.229 (0)	-3.864 (0)	-0.271 (0)	-6.422 (0)	-8.754 (0)	-3.446 (0)	-1.798 (0)	-0.750 (0)	-0.069 (0.411)	-2.314 (0)	-5.219 (0)	-2.239 (0)	-3.845 (0)
Omit Indiana	-3.896 (0)	-3.180 (0)	-4.115 (0)	-3.839 (0)	-0.277 (0)	-6.501 (0)	-8.724 (0)	-3.319 (0)	-1.685 (0)	-0.695 (0)	-0.048 (0.591)	-2.310 (0)	-5.317 (0)	-2.484 (0)	-3.686 (0)

Note: All models except the two labeled "ACA Only" used the same covariates: the three binary variables for state mandate, ACA mandate, and state*ACA mandate and year.
**Indicates that the regression model did not include data from the state omitted.

6.1.4 Effect Coding

Following the methodology outlined in Section 4.2.4, three different tests were conducted to determine appropriate use of effect coding in the abortion analyses. These three tests' results for all fifteen regressions are included in the three panels of Table 12 below. Panel 1 reports the estimated coefficients for each of the four effect coding methods, Panel 2 tests whether the estimated coefficient has the correct sign, and Panel 3 reports ratios of estimated coefficients for different effect coding methods. Figures 31.1 through 31.3 graph the ratios listed in Panel 3 to better visualize the differences in the effect coding methods. The vertical axis has the same scale for all three figures to ease comparison across figures. As the effect coding method of 2013=0.75 was selected for the final analysis, it is used as the comparison point for each of the three ratios. The full regression results with effect coding of 2013=0.75 are available in Appendix Table 12.

These analyses show that the results were generally robust regardless of the effect coding method used, as evidenced by the relatively small ratios of estimated coefficients presented in Figures 31.1 through 31.3. Figure 31.1 shows the biggest range of ratios because the effect coding method of 2013=0 implies that there is no impact of the ACA mandate on abortions for a full year after the January 1, 2013 full implementation date. Similar to the results with the state-specific time trends, the largest exception was for women ages 40 to 44. Again, the estimated coefficient for this subpopulation is very small and statistically insignificant in each of the four methods of effect coding, so small changes in the estimated coefficient lead to much larger changes in the ratio. Regression thirteen (representing Black/African American women) is the next most sensitive to the effect coding method used, but even in the most extreme comparison between effect coding methods in Figure 31.1, the estimated coefficients for regression thirteen only differ by approximately ten percent. Because results are generally robust regardless of the effect coding method used, the effect coding of 2013=0.75 was selected for the final model because it seems the most accurate reflection of when the ACA contraceptive mandate was likely to first start impacting the abortion rates.

Table 12: Abortion Analysis Effect Coding Method Comparison

Panel 1: Estimated Coefficient Results

	By State of Residence		By State of Occurrence		By Age Group of Mother							By Race or Ethnicity			
Effect Coding Method	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
2013=0	-4.170***	-3.449***	-4.419***	-4.136***	-0.277***	-6.690***	-9.373***	-4.016***	-2.122***	-0.893***	-0.137	-2.279***	-5.509***	-2.114***	-3.515***
	(0.211)	(0.251)	(0.226)	(0.269)	(0.0221)	(0.394)	(0.569)	(0.454)	(0.270)	(0.151)	(0.0861)	(0.216)	(0.900)	(0.606)	(0.901)
2013=0.5	-4.170***	-3.346***	-4.419***	-4.048***	-0.272***	-6.535***	-9.111***	-3.822***	-2.002***	-0.855***	-0.112	-2.238***	-5.144***	-2.135***	-3.459***
	(0.211)	(0.252)	(0.226)	(0.270)	(0.0223)	(0.395)	(0.569)	(0.456)	(0.272)	(0.152)	(0.0868)	(0.217)	(0.906)	(0.611)	(0.915)
2013=0.75	-4.170***	-3.366***	-4.419***	-4.039***	-0.272***	-6.556***	-9.109***	-3.785***	-1.975***	-0.848***	-0.104	-2.218***	-4.960***	-2.159***	-3.533***
	(0.211)	(0.249)	(0.226)	(0.267)	(0.0220)	(0.391)	(0.562)	(0.450)	(0.268)	(0.151)	(0.0857)	(0.215)	(0.896)	(0.604)	(0.899)
2013=1	-4.170***	-3.426***	-4.419***	-4.053***	-0.273***	-6.631***	-9.185***	-3.791***	-1.974***	-0.850***	-0.101	-2.202***	-4.811***	-2.187***	-3.654***
	(0.211)	(0.245)	(0.226)	(0.263)	(0.0216)	(0.384)	(0.552)	(0.442)	(0.263)	(0.148)	(0.0841)	(0.213)	(0.882)	(0.592)	(0.873)

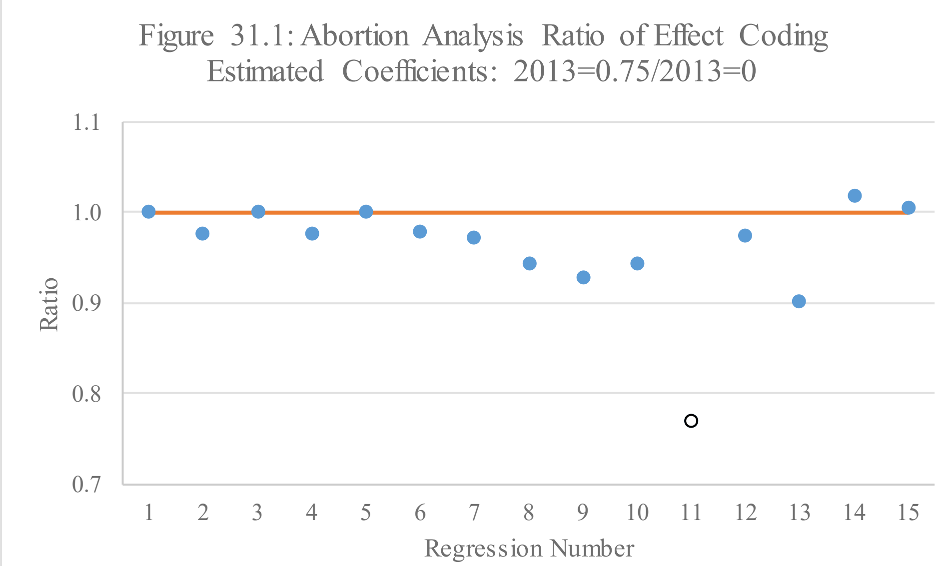
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel 2: Test for Correct Sign of Estimated Coefficient

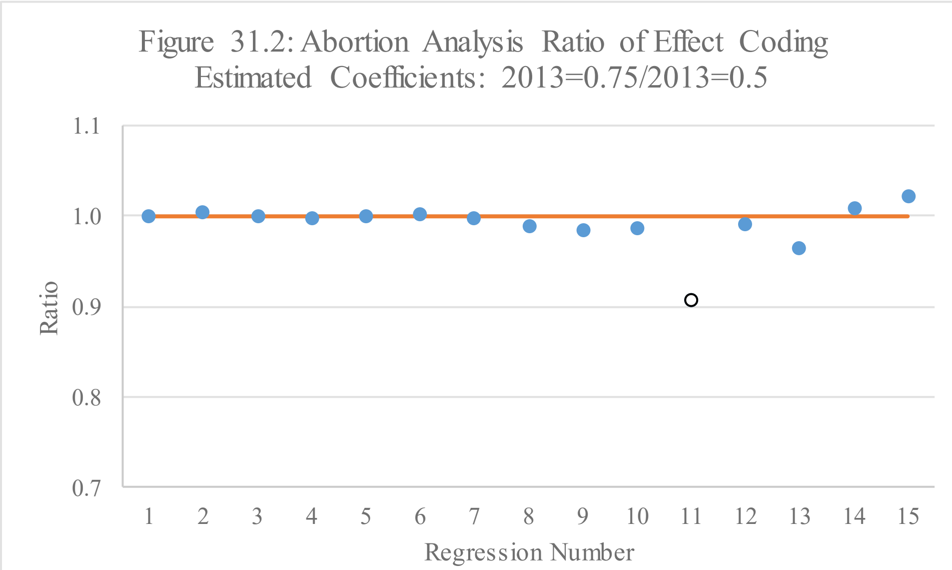
	By State of Residence		By State of Occurrence		By Age Group of Mother							By Race or Ethnicity			
Effect Coding Method	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
2013=0	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=0.5	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=0.75	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=1	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel 3: Ratios of Estimated Coefficients

	By State of Residence		By State of Occurrence		By Age Group of Mother							By Race or Ethnicity			
Ratio	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
2013=0.75/2013=0	1.000	0.977	1.000	0.976	1.000	0.979	0.971	0.943	0.929	0.944	0.769	0.974	0.902	1.019	1.006
2013=0.75/2013=0.5	1.000	1.006	1.000	0.998	1.000	1.003	0.999	0.990	0.985	0.988	0.909	0.991	0.965	1.009	1.023
2013=0.75/2013=1	1.000	0.982	1.000	0.995	1.000	0.988	0.991	0.997	1.000	0.988	1.000	1.005	1.031	0.986	0.967

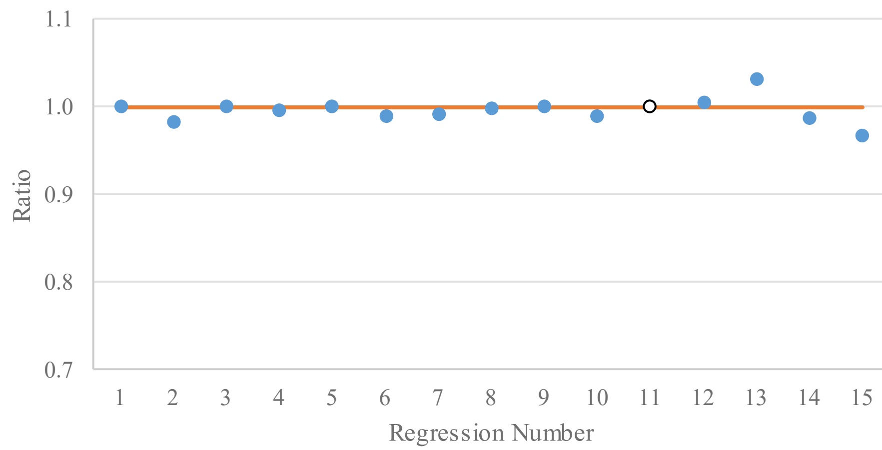


Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 31.3: Abortion Analysis Ratio of Effect Coding Estimated Coefficients: 2013=0.75/2013=1



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

6.1.5 Demographic Variables

The full Equation 9 was used to run fixed effects regressions with selected state-specific trends, population weights, effect coding of 2013=0.75 and the ten demographic variables outlined in Table 2 plus the number of abortion clinics per 100,000 women in each state. As discussed in Section 4.1.1, four of the demographic variables—percent with high school degrees, percent with college degrees, median household income, and mean family size—were divided into quartiles to allow for a more flexible specification of the models, as the relationship between these variables and the abortion rates differed across the range of the demographic variable.

The results for the fifteen regressions are reported in Table 13. Again, the estimated coefficient for the variable "ACA Mandate in Effect" is the effect of the ACA mandate on abortion rates in states without contraceptive mandates. The sum of the estimated coefficients for "ACA Mandate in Effect" and "State Mandate * ACA Mandate" is the estimated total effect of the ACA mandate in states *with* contraceptive mandates. To better understand the relative sizes and significance of the ACA mandate parameter of interest, the main coefficient estimates and confidence intervals for each of the fifteen regressions are graphed in Figure 32.

Finally, Figures 33 and 34 graph the ratios of the adjusted R-squared and ACA mandate estimated coefficients with and without the demographic variables (with data from Table 13 and Appendix Table 12, respectively) to understand the impact of including the demographic variables on the main parameter of interest.

In Figure 33, twelve of the fifteen regressions have higher adjusted R-squared values when including demographic variables and the other three ratios indicate an adjusted R-squared within two, three, and ten percent for regressions numbered three, four, and eight, respectively. The very slightly lower R-squared is less concerning in regressions three and four, which represent the two regressions by state of occurrence. As a reminder, the demographic variables are state-level and the abortion data for these two regressions are for state of abortion occurrence instead of state of the woman's residence. This slight difference could make the addition of the demographic variables slightly less powerful than in regressions one and two, which are the same regressions but with abortion data by state of the woman's residence. Thus, it seems that including the demographic variables slightly increases the models' overall goodness of fit for the abortion analysis with data by state of residence but slightly decreases the goodness of fit for data by state of occurrence as the power lost due to increased variables outweighs the gain in additional information.

It is unclear why there is a roughly ten percent decrease in the adjusted R-squared value for regression eight, which represents women ages 25 to 29. The number of statistically significant demographic variables and their estimated values are within the range of the other fourteen regressions. Additionally, the sample size for this subgroup is the same for other age groups between 15 and 39, so it is not due to a dramatically lower sample size with power that is easily affected by the number of variables in the model. It seems that, for whatever reason, the demographic variables are less able to model the abortion rate for this age group.

Despite the results for these three regressions, for most regressions, adding in additional demographic variables yields a better model of abortion rates, as seen by increased adjusted R-squared values. For this reason, the full list of demographic variables were included in the final model.

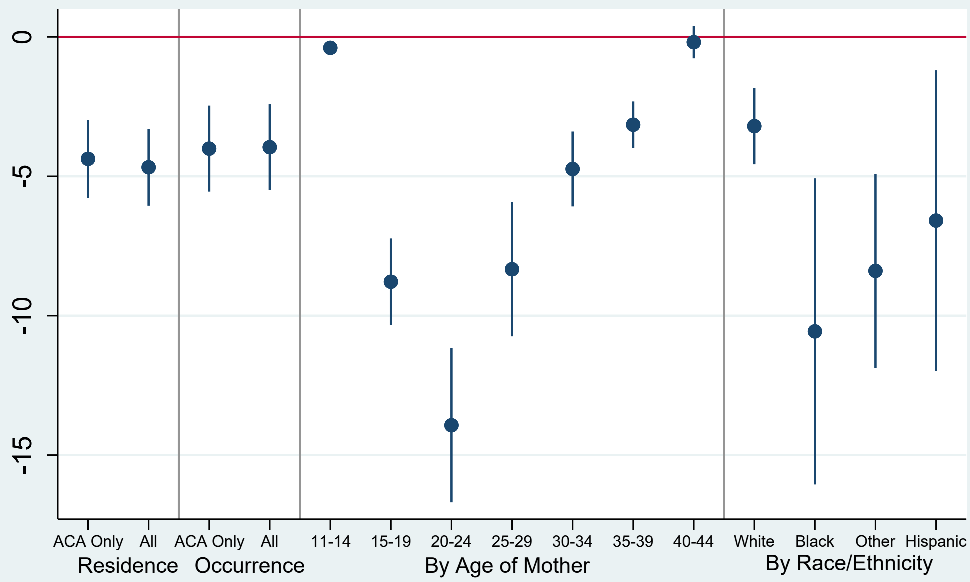
Similar to Figure 30, Figure 34 graphs the ratios of the estimated ACA mandate coefficients for the models with and without demographic variables (with data from Table 13 and Appendix Table 12). Thirteen of the fifteen ratios are greater than one, indicating that the model with demographic variables has higher estimated ACA mandate coefficients for all models except for regressions three and four, which are again the two regressions with data by state of abortion occurrence. These two regressions also had a lower adjusted R-squared value with the addition of the demographic variables, so it seems that the demographic variables are not as good at modeling the abortion rates by state of occurrence. Regressions 10 (women ages 35 to 39) and 14 (non-Hispanic other) have the greatest increases in the estimated coefficient with the addition of demographic variables, indicating that these subpopulations are the most sensitive to the inclusion or exclusion of demographic variables.

Table 13: Abortion Analysis with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding of 2013=0.75, and all Demographic Variables

	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
State Mandate in Effect		-0.148		-0.0424	-0.0338	0.224	-0.00326	1.439	0.973	0.262	-0.0347	0.482	0.346	-2.358	-0.288
		(0.827)		(0.983)	(0.0650)	(1.092)	(1.937)	(1.590)	(0.947)	(0.517)	(0.336)	(0.699)	(5.677)	(1.994)	(2.096)
ACA Mandate in Effect	-4.375***	-4.677***	-4.007***	-3.955***	-0.392***	-8.782***	-13.93***	-8.335***	-4.737***	-3.151***	-0.191	-3.201***	-10.56***	-8.393***	-6.589**
	(0.712)	(0.699)	(0.783)	(0.781)	(0.0593)	(0.788)	(1.402)	(1.221)	(0.682)	(0.424)	(0.294)	(0.693)	(2.775)	(1.759)	(2.725)
State Mandate * ACA Mandate		-0.877***		-0.471*	-0.0120	-1.133***	-2.029***	-0.871**	-0.640**	-0.312**	-0.0840	-0.414*	-0.810	0.143	0.215
		(0.239)		(0.249)	(0.0180)	(0.285)	(0.508)	(0.441)	(0.268)	(0.143)	(0.107)	(0.235)	(0.986)	(0.697)	(0.979)
2011 Dummy	-0.425**	-0.705***	-0.609**	-0.724***	-0.0632***	-1.516***	-2.388***	-1.476***	-1.044***	-0.591***	-0.125	-0.686***	-3.170***	-0.784	0.356
	(0.215)	(0.224)	(0.242)	(0.250)	(0.0193)	(0.282)	(0.497)	(0.422)	(0.250)	(0.151)	(0.0916)	(0.241)	(1.017)	(0.655)	(0.876)
2012 Dummy	-0.871***	-1.406***	-1.365***	-1.571***	-0.111***	-3.349***	-4.994***	-3.008***	-2.038***	-1.109***	-0.246	-1.313***	-6.550***	-2.227**	1.624
	(0.330)	(0.353)	(0.368)	(0.383)	(0.0324)	(0.448)	(0.792)	(0.671)	(0.398)	(0.238)	(0.150)	(0.383)	(1.590)	(1.031)	(1.531)
2013 Dummy	1.906***	1.812***	0.998**	0.911*	0.129***	2.565***	4.418***	2.235***	0.764	0.794***	-0.399**	0.462	-0.708	3.024***	7.385***
	(0.446)	(0.436)	(0.490)	(0.491)	(0.0347)	(0.547)	(0.973)	(0.855)	(0.495)	(0.277)	(0.192)	(0.424)	(1.771)	(1.114)	(1.562)
2014 Dummy	2.123***	2.137***	1.289***	1.231***	0.147***	3.196***	5.695***	3.317***	1.387***	1.317***	-0.189	0.992**	0.571	2.803***	6.433***
	(0.414)	(0.404)	(0.453)	(0.453)	(0.0326)	(0.503)	(0.892)	(0.787)	(0.450)	(0.257)	(0.180)	(0.393)	(1.626)	(1.042)	(1.470)
2015 Dummy	0.965***	0.949***	0.534**	0.492*	0.0543***	1.334***	2.314***	1.305***	0.590**	0.490***	-0.158	0.425*	-0.469	1.224**	2.032***
	(0.245)	(0.239)	(0.269)	(0.269)	(0.0186)	(0.293)	(0.521)	(0.456)	(0.262)	(0.146)	(0.102)	(0.225)	(0.956)	(0.586)	(0.730)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Percent with Employer-Based Health Insurance	0.0619	0.0769	0.174*	0.199**	0.0238***	0.429***	0.609***	0.127	-0.0340	0.0117	-0.0823***	0.0610	0.763*	-0.575**	0.401
	(0.0818)	(0.0800)	(0.0944)	(0.0950)	(0.00622)	(0.0973)	(0.175)	(0.154)	(0.0881)	(0.0534)	(0.0310)	(0.101)	(0.439)	(0.281)	(0.396)
Percent with High School Degree--2nd Quartile	-0.676***	-0.448**	-0.590**	-0.424	-0.112***	-1.608***	-0.593	-0.0329	-0.156	-0.136	-0.0683	0.562***	-0.111	0.175	-2.474***
	(0.216)	(0.220)	(0.243)	(0.258)	(0.0171)	(0.289)	(0.485)	(0.437)	(0.252)	(0.136)	(0.0877)	(0.201)	(0.732)	(0.547)	(0.717)
Percent with High School Degree--3rd Quartile	-0.513	-0.254	-0.218	-0.0298	-0.116***	-1.749***	0.195	0.969	0.180	0.0685	0.0278	0.679*	-2.190	0.863	-2.346*
	(0.344)	(0.343)	(0.397)	(0.408)	(0.0268)	(0.447)	(0.775)	(0.678)	(0.399)	(0.217)	(0.138)	(0.362)	(1.434)	(0.966)	(1.329)
Percent with High School Degree--4th Quartile	-0.0983	0.425	0.209	0.536	-0.133***	-1.378**	0.768	1.355	0.802	0.211	0.208	0.627	-1.476	0.273	-1.477
	(0.496)	(0.506)	(0.573)	(0.598)	(0.0385)	(0.620)	(1.106)	(0.943)	(0.559)	(0.309)	(0.198)	(0.525)	(3.599)	(1.399)	(1.850)
Percent with College Degree--2nd Quartile	-0.0411	-0.350	-0.219	-0.396	-0.00861	-0.147	-1.090	-0.940	-0.217	0.0240	0.00926	-0.521*	-2.211*	0.604	1.109
	(0.331)	(0.334)	(0.394)	(0.405)	(0.0259)	(0.421)	(0.740)	(0.636)	(0.377)	(0.207)	(0.134)	(0.281)	(1.134)	(0.983)	(1.502)
Percent with College Degree--3rd Quartile	0.655	0.228	0.478	0.255	0.00734	-0.379	-1.579*	-1.487*	-0.425	0.0570	0.0190	-0.709*	-5.446***	-0.248	3.626**
	(0.411)	(0.418)	(0.481)	(0.495)	(0.0328)	(0.534)	(0.948)	(0.817)	(0.483)	(0.264)	(0.171)	(0.376)	(1.470)	(1.188)	(1.701)
Percent with College Degree--4th Quartile	0.566	0.325	0.808	0.662	0.00217	-0.243	0.670	0.505	0.758	0.929**	0.303	-0.365	-8.325**	1.191	4.746**
	(0.538)	(0.531)	(0.625)	(0.630)	(0.0435)	(0.700)	(1.246)	(1.078)	(0.632)	(0.359)	(0.225)	(0.551)	(4.086)	(1.545)	(2.371)
Median Family Size--2nd Quartile	0.247	0.319	0.454	0.485	0.0266	0.672**	0.548	0.346	0.315	0.194	0.0461	0.248	2.336**	0.0152	0.981
	(0.257)	(0.252)	(0.302)	(0.302)	(0.0189)	(0.306)	(0.547)	(0.472)	(0.278)	(0.157)	(0.0995)	(0.183)	(1.079)	(0.573)	(1.073)
Median Family Size--3rd Quartile	0.701**	0.721**	0.758*	0.771*	0.0740***	0.975**	1.241*	0.736	0.465	0.103	0.0693	0.141	2.522*	0.00151	3.235**
	(0.334)	(0.329)	(0.391)	(0.392)	(0.0252)	(0.410)	(0.729)	(0.625)	(0.370)	(0.204)	(0.131)	(0.286)	(1.334)	(0.921)	(1.455)
Median Family Size--4th Quartile	0.273	0.299	0.168	0.144	0.0336	0.422	1.867*	1.076	0.847*	0.603**	0.281	0.476	-1.613	3.145**	3.034
	(0.420)	(0.411)	(0.469)	(0.470)	(0.0353)	(0.568)	(1.011)	(0.860)	(0.510)	(0.282)	(0.182)	(0.445)	(1.826)	(1.248)	(1.846)
Percent Married	-0.693**	-0.855***	-0.783***	-0.751**	-0.0232	-1.608***	-2.028***	-1.521***	-1.126***	-0.576***	-0.253**	-0.680**	-3.434**	-2.975***	1.323
	(0.279)	(0.276)	(0.296)	(0.296)	(0.0213)	(0.339)	(0.597)	(0.503)	(0.305)	(0.170)	(0.114)	(0.339)	(1.330)	(0.862)	(1.313)
Percent with Medicaid	0.0579	0.0639*	0.130***	0.140***	0.00714**	0.0362	0.297***	0.186***	0.0961**	0.0832***	0.0106	0.0212	0.185	0.0470	0.194
	(0.0377)	(0.0370)	(0.0434)	(0.0437)	(0.00287)	(0.0476)	(0.0850)	(0.0710)	(0.0425)	(0.0235)	(0.0150)	(0.0348)	(0.202)	(0.112)	(0.168)
Unemployment Rate	-0.806***	-0.639***	-0.257	-0.150	-0.0167	-0.486*	-0.684	-0.372	-0.174	-0.243**	0.0733	-0.0519	0.566	-1.084**	-3.159***
	(0.186)	(0.187)	(0.194)	(0.201)	(0.0160)	(0.248)	(0.441)	(0.379)	(0.225)	(0.123)	(0.0814)	(0.189)	(0.795)	(0.526)	(0.755)
Median Household Income--2nd Quartile	0.366	0.384	0.423	0.527	0.0522**	0.796*	3.220***	2.683***	1.621***	1.032***	0.342**	0.140	-2.194	-1.137	1.825
	(0.388)	(0.378)	(0.349)	(0.352)	(0.0259)	(0.414)	(0.732)	(0.638)	(0.378)	(0.205)	(0.136)	(0.318)	(1.362)	(1.102)	(1.877)
Median Household Income--3rd Quartile	-0.530	-0.505	-0.407	-0.284	0.0624*	0.851	2.946***	2.632***	1.706***	1.162***	0.287	0.468	-1.406	-0.879	3.766*
	(0.475)	(0.464)	(0.469)	(0.472)	(0.0336)	(0.542)	(0.970)	(0.831)	(0.497)	(0.270)	(0.176)	(0.420)	(1.752)	(1.353)	(2.207)
Median Household Income--4th Quartile	-1.366**	-1.400**	-1.304**	-1.217**	0.0294	-0.614	2.048*	1.814*	1.556***	1.308***	0.343	0.884*	-5.207**	-0.565	4.886**
	(0.569)	(0.556)	(0.595)	(0.595)	(0.0406)	(0.645)	(1.147)	(0.979)	(0.589)	(0.328)	(0.208)	(0.509)	(2.197)	(1.542)	(2.396)
Percent of Babies Born to Unwed Mothers	-0.00249	-0.00207	-0.0123	-0.0137	-0.00259	0.00177	-0.00520	0.0125	0.00822	-0.00104	-0.00399	-0.0273	-0.207*	-0.120*	0.00204
	(0.0267)	(0.0261)	(0.0309)	(0.0308)	(0.00214)	(0.0338)	(0.0603)	(0.0519)	(0.0307)	(0.0168)	(0.0111)	(0.0247)	(0.122)	(0.0713)	(0.105)
Percent Non-Hispanic White	0.245	0.0168	0.635***	0.536**											
	(0.197)	(0.202)	(0.226)	(0.232)											
Abortion Clinics per 100,000 Women	0.192	0.0623	0.708**	0.667**	-0.0390*	-0.323	-0.463	1.251**	0.596*	0.437**	0.455***	1.521***	1.894	-1.123	2.593**
	(0.268)	(0.265)	(0.319)	(0.320)	(0.0225)	(0.339)	(0.628)	(0.521)	(0.306)	(0.177)	(0.124)	(0.294)	(1.241)	(0.703)	(1.030)
Percent Non-Hispanic White by Age Group					-0.0216*	-0.0966	-0.0570	-0.658***	-0.391**	-0.221***	0.104**				
					(0.0112)	(0.140)	(0.199)	(0.209)	(0.158)	(0.0774)	(0.0412)				
Constant	34.18*	55.95***	1.529	4.103	1.641	77.40***	97.00**	127.1***	94.06***	49.50***	12.23*	37.42*	159.3*	212.0***	-66.20
	(18.67)	(19.16)	(18.95)	(18.94)	(1.366)	(21.14)	(37.58)	(31.56)	(19.09)	(10.14)	(6.822)	(20.83)	(84.07)	(53.04)	(77.72)
Observations	327	327	328	328	285	316	316	316	316	316	286	196	196	195	195
R-squared	0.759	0.772	0.731	0.735	0.798	0.876	0.803	0.560	0.578	0.567	0.457	0.696	0.662	0.446	0.682
Number of states	47	47	47	47	46	46	46	46	46	46	46	36	36	36	36
Adjusted R-squared	0.669	0.684	0.630	0.632	0.710	0.827	0.726	0.387	0.411	0.397	0.219	0.540	0.489	0.160	0.519

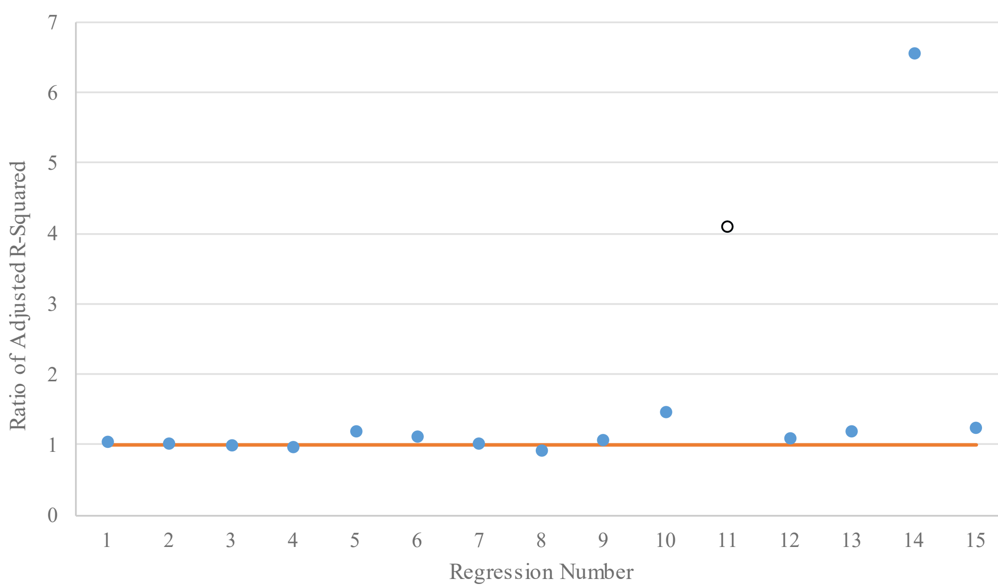
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 32: Abortion ACA Mandate Regression Coefficients:*
Results Including All Demographic Variables

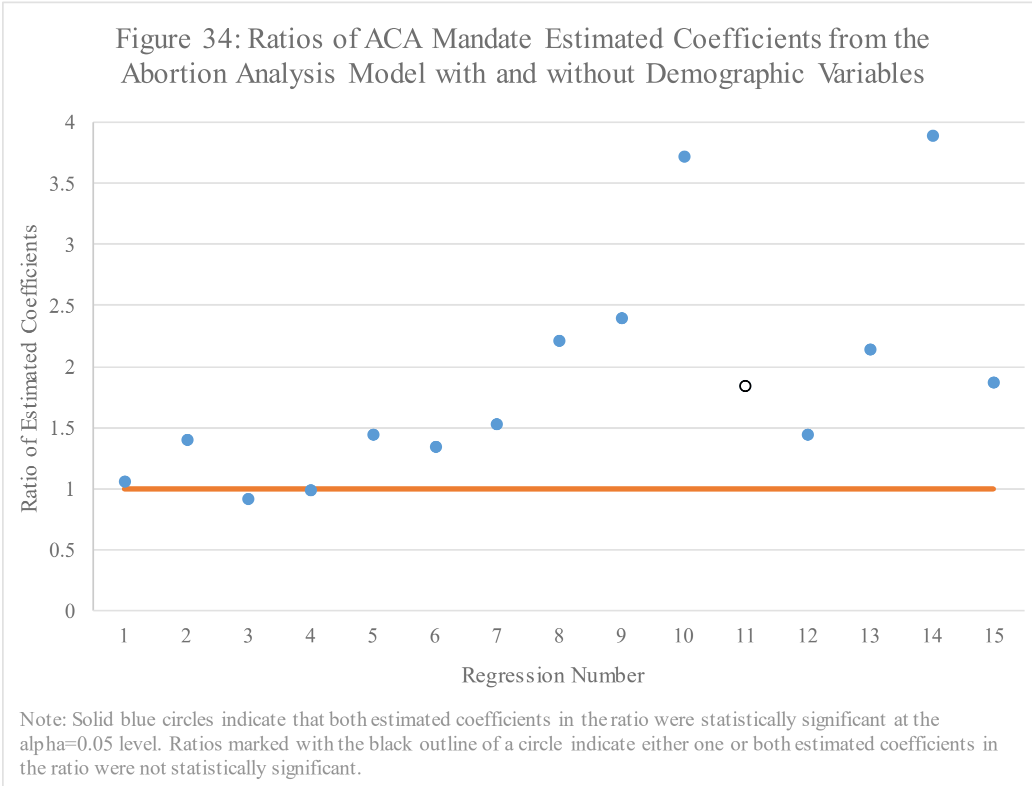


*Models include fixed effects, selected state-specific trends, population weights, and effect coding of 2013=0.75.

Figure 33: Ratios of Adjusted R-Squared Values from the Abortion Analysis Model with and without Demographic Variables



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.



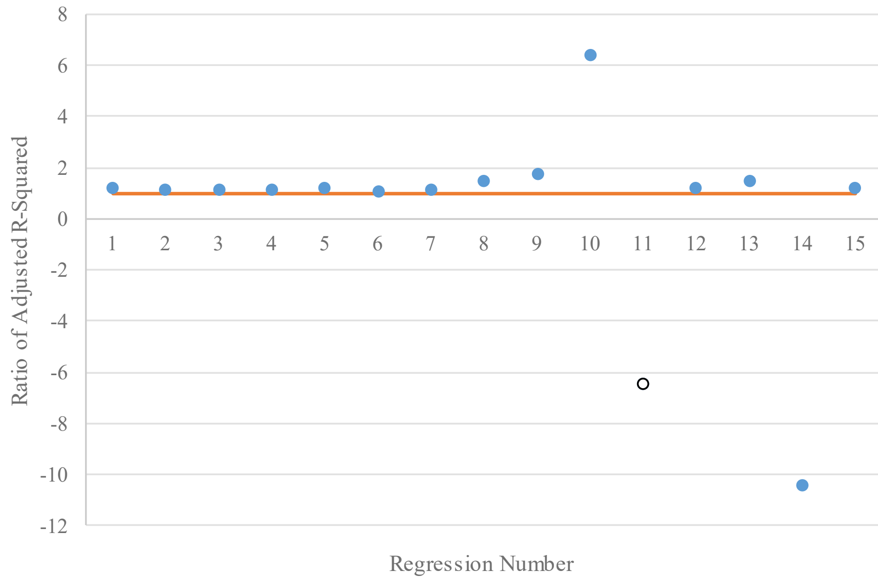
6.1.6 Lasso-Selected Demographic Variables

The full demographic variable list included in the regressions in Section 6.1.5 was informed by literature and supporting theory. However, as discussed in Section 4.2.5, the lasso2 procedure was used in Stata to select the demographic variables for each of the fifteen regressions to avoid overspecification and to find the best fit for each subpopulation. The full regression results are available in Appendix Table 13. Similar to Figures in the previous section, Figure 35 graphs the ratio of adjusted R-squared values and Figure 36 graphs the ratios of the ACA mandate estimated coefficients for models with all demographic variables versus only the lasso-selected demographic variables (coefficients from Table 13 and Appendix Table 13, respectively).

Surprisingly, as seen in Figure 35, the adjusted R-squared value was lower in all fifteen regressions with lasso-selected demographic variables (Appendix Table 13) compared to the regressions with the full list of demographic variables (Table 13). Two regressions (women ages 40 to 44 and "non-Hispanic other") have a negative ratio because the adjusted R-squared value changes from a positive value with all demographic variables to a small negative value with lasso-selected variables (see Appendix Table 13). Because the adjusted R-squared indicates that there is a better overall model fit when including the full list of demographic variables, the model using the full list of demographic variables (presented in Section 6.2.5 with results in Table 13) was determined to be the best fit for modeling the impact of the ACA contraceptive mandate on abortion rates. Since the lasso2 command removed nearly all or all of the demographic variables for most of the fifteen regressions, and consistently removed more demographic variables in the smaller population subgroup regressions, this could suggest that the demographic variables used are not capturing their relationship with the abortion rate as well for some subgroups.

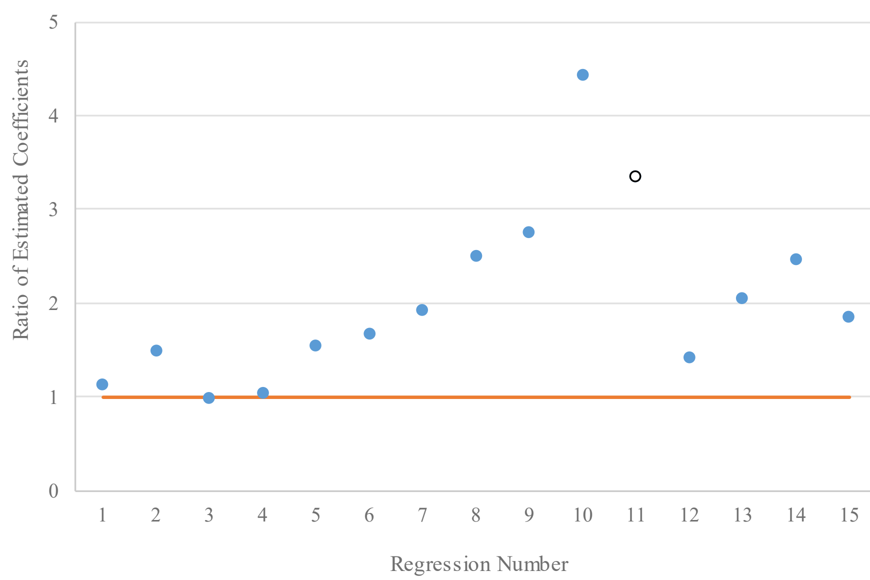
Figure 36 shows that the estimated ACA mandate coefficient was higher for all but regression three (all women by state of abortion occurrence), which is just two percent smaller with lasso-selected demographic variables. Regression 10 (women ages 35 to 39) has the highest ratio of estimated coefficients with the full demographic variables versus lasso-selected variables. This is not surprising given the high ratio observed for this same subgroup in Figure 34, which compares estimated coefficients with and without demographic variables and the lasso2 command removed all demographic variables for this subgroup. This provides further evidence that the demographic variables are especially not as good at modeling the relationship with abortion rates for this subgroup.

Figure 35: Ratios of Adjusted R-Squared Values from the Abortion Analysis Model with All versus Lasso-Selected Demographic Variables



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

Figure 36: Ratios of ACA Mandate Estimated Coefficients from the Abortion Analysis Model with All versus Lasso-Selected Demographic Variables



Note: Solid blue circles indicate that both estimated coefficients in the ratio were statistically significant at the alpha=0.05 level. Ratios marked with the black outline of a circle indicate either one or both estimated coefficients in the ratio were not statistically significant.

6.2 Abortion Discussion

This section will first discuss the selection of the final model before discussing the details of the final model's results, strengths and limitations, and policy implications.

6.2.1 Discussion of Final Model Determination

As outlined in Figure 18, a series of six tests were done to determine the final model. This discussion will go through each test in the order it was done.

The Hausman Test results reported in Table 10 indicated that fixed effects must be used for seven of the fifteen test statistics in order to avoid estimation bias. Thus, fixed effects were used for all models to ensure unbiased estimates and for consistency across regression subcategories.

After it was determined to use fixed effects for all models, whether to include state-specific time trends was then investigated. Figure 29 reports the ratio of adjusted R-squared values for regressions with and without the state-specific trend lines to evaluate the relative goodness of fit across the two methods. As part of the state-specific trend analysis, Figure 30 was included to graph the impact on the ACA contraception mandate parameter via a ratio between the estimated coefficients with and without state-specific trends included in the model. These results supported including the time trends for these three states in the final model. Including these state trend lines increased the adjusted R-squared without negatively affecting the statistical power of the model. Additionally, estimated coefficients between the two models were relatively similar, indicating the robustness of the model regardless whether state time trends were included.

In order to determine the impact of population weighting, the most populous states were iteratively dropped from the regressions. These results are reported in Table

11, which show minimal impact from omitting large states. However, as explained in Section 4.2.3, there may be some policy questions where not using population weighting would be preferred, so this decision about population weighting should be dependent upon the policy or research question.

The analysis that tested various effect coding methods, reported in Table 12, Figures 31.1 to 31.3, and Appendix Table 12, showed that the results were generally robust regardless of the effect coding method used. Thus, the effect coding method of 2013=0.75 was selected for the final model because it seemed to be the most accurate reflection of when the ACA contraceptive mandate most likely began to impact abortion rates.

After the first four modeling decisions were made, the eleven demographic variables were added to the model. Because this model is the final model selected, the discussion of the specific results presented in Table 13 and Figure 32 will occur in Section 6.1.2. The adjusted R-squared values are equal or greater in the model with demographic variables (Table 13) than without (Appendix Table 12) in all but three regressions—regressions three and four (the two regressions with all women by state of abortion occurrence) and regression eight (women ages 25 to 29). For most regressions, adding in additional demographic variables yields a better model of abortion rates, as seen by increased adjusted R-squared values. For this reason, the full list of demographic variables were included in the final model.

Finally, the lasso2 procedure was used to determine whether the models would better fit when the demographic variables were specifically selected for each subpopulation. The adjusted R-squared value was lower for all fifteen regressions with lasso-selected demographic variables (see Appendix Table 13) compared to the regressions with the full demographic variables (see Table 13). Thus, the models with the full demographic variable list were selected as the final model.

6.2.2 Discussion of Final Model Results and Trends

The final model results presented in Table 13 generally show a statistically significant reduction in the abortion rate for fourteen of the fifteen regression subpopulations. None of the regressions yielded statistically significant coefficients for the state-specific mandates, though eight of the thirteen models with the interaction term for the ACA mandate and state-specific mandates had statistically significant estimated reductions in the abortion rate. As the results vary by subpopulation, the specific results will be discussed individually.

The first two regressions are the only regressions run on abortion rates by the woman's state of residence, while all others are based on abortion rates by the state of abortion occurrence. The first regression—which only has one policy variable representing the ACA mandate—shows an estimated decrease in the abortion rate of 4.375 abortions per 1,000 women (95% CI [-5.777, -2.974]). The second regression includes all three policy variables and estimates a decrease in the abortion rate of 4.677 abortions per 1,000 women (95% CI [-6.055, -3.299]) and an additional decrease of 0.877 abortions per 1,000 women (95% CI [-1.347, -0.406]) for states with a state-specific contraceptive mandate. As a reference point, the US 2012 abortion rate was 12.6 abortions per 1,000 women (see Table 4). These two estimated coefficients combined translate to a nationwide estimate of roughly 325,219 abortions averted annually.

The next two regressions follow the same model as the first two regressions but are run on abortion data reported by state of abortion occurrence. It would be ideal to have all data by the woman's state of residence, but since those data are not available, these first four regressions are included to show estimated differences in results when using the two types of abortion data. The estimated effect of the ACA mandate is smaller but still statistically significant for both models, with a decrease of 4.007 abortions per 1,000 women (95% CI [-5.550, -2.465]) for the ACA-only model and -3.955 abortions per 1,000 women (95% CI [-5.494, -2.417]) for the model with all three policy variables. The ACA-state policy interaction term for regression four was statistically insignificant.

The third category of regressions includes seven regressions by the age category of the mother. All age categories except for women ages 40 to 44 have statistically significant estimated effects of the ACA contraceptive mandate on the abortion rate. The greatest estimated decrease is for women ages 20 to 24—13.93 abortions per 1,000 women (95% CI [-16.695, -11.168], 2012 US mean: 23.3 abortions per 1,000 women, see Table 4)—and the smallest estimated decrease is for women ages 11 to 14—0.392 abortions per 1,000 women (95% CI [-0.509, -0.275], 2012 US mean: 0.8 abortions per 1,000 women, see Table 4). All age categories except for the youngest (11 to 14) and oldest (40 to 44) have statistically significant ACA-state policy interaction terms showing an additional decrease in the abortion rate for states with contraceptive mandates ranging from 0.312 abortions per 1,000 women ages 35 to 39 (95% CI [-0.593, -0.031]) to 2.029 abortions per 1,000 women ages 20 to 24 (95% CI [-3.029, -1.029]). These results make sense as the age groups with the highest abortion rates shown in Figure 14 have the highest estimated ACA contraceptive mandate decrease on the abortion rates.

The final category of regressions includes four race/ethnicity subcategories, all of which have a statistically significant estimated decrease in the abortion rate. None of these subcategories have a statistically significant ACA-state policy interaction term. The estimated decrease is the largest for non-Hispanic Black women at 10.56 abortions per 1,000 women (95% CI [-16.054, -5.073], 2012 US mean: 27.8 abortions per 1,000 women, see Table 4). This is roughly three times the estimated decrease for non-Hispanic White women, which is 3.201 abortions per 1,000 women (95% CI [-4.571, -1.831], 2012 US mean: 7.7 abortions per 1,000 women). The estimated decrease for Hispanic women falls between that of non-Hispanic White and non-Hispanic Black women, at 6.589 abortions per 1,000 women (95% CI [-11.980, 01.198], 2012 US mean: 15.0 abortions per 1,000 women). It makes sense that non-Hispanic Black women had the highest estimated impact of the ACA contraceptive mandate on abortion rates because, as shown in Figure 15, non-Hispanic Black women have the highest abortion rates of the four racial/ethnic subcategories.

There is a range of estimated impacts of the demographic variables across the fifteen abortion regressions. Some demographic variables behave exactly as the literature would have predicted. For example, data and published literature show that married women are less likely to have abortions, and the fifteen regressions are nearly unanimous on an inverse relationship between the percent married and the abortion rate. The four demographic variables parsed into quartiles have regression estimates for the second through fourth quartile, with the first quartile of each variable used as the reference. Thus, it makes sense, for example, that states with the percent of population with a high school degree in the second quartile would have a lower expected abortion rate than states in the first quartile of high school degrees, as evidenced by six of the seven regressions with statistically significant second quartile high school degrees showing a negative impact of the ACA contraceptive mandate on the abortion rate. However, interpreting variables parsed into quartiles (such as the high school degree variable just discussed) can feel somewhat confusing because a predominantly inverse relationship can change to an insignificant or direct relationship in the higher quartiles, or vice versa. Because of this confusion, it is important to remember that this flexible modeling was used precisely so that the changing relationship between the demographic variable and the abortion rate could be more accurately captured by the model. For example, states with the lowest quartile of median household income may be, on average, less able to afford abortions than higher quartiles. However, the highest quartile, though more likely to be able to afford abortion, may also be more able to afford contraceptives that would have avoided the unintended pregnancy that led to the abortion. These effects, in short, must be interpreted with care. Finally, it is important to remember that the demographic variables are based on state-level data, so the estimated coefficients for demographic variables for subpopulations should be interpreted cautiously.

Perhaps most surprising in the abortion analysis is the relative size of the estimated effects to the country-wide mean abortion rates in 2012. The final model with the full list of demographic variables estimates an average 45.8 percent decrease in the 2012 abortion rates due to the ACA contraceptive mandate (range: 31.3 percent to 95.4 percent). Even when looking at the more modest estimates from the models with lasso-selected variables, the mean estimated effect is a 26.5 percent decrease in the abortion rate (range: 9.7 percent to 57.1 percent).

Though relatively large, this range seems less concerning given evidence in the literature on similar policy interventions and contraceptive use and unintended pregnancy post-ACA implementation. A previous study on the effect of free contraceptives in the Contraceptive CHOICE Project in St. Louis found a greater than 75 percent decrease in the abortion rate attributable to the provision of free contraceptives in their study population (McNicholas, Madden, Secura, & Peipert, 2014). Additionally, although most studies have found relatively modest estimated increases in contraceptive use post-ACA implementation (Kim & Look, 2018; Snyder, et al., 2018), one study that stratified results into groups by sexual activity found that OCP use doubled (21 percent to 40 percent) for women ages 18 to 24 who had not had sex in the previous month (Bearak & Jones, 2017). This is an age group with relatively high rates of unintended pregnancy and relatively high abortion rates. If these women were not having frequent sex, they may underestimate their risk of pregnancy and choose to not use consistent prescription contraceptives, especially if affording birth control would be difficult. However, this means that this group of women is at higher risk of unintended pregnancy when they *do* have sex because they are limited to barrier methods or emergency contraceptives. Furthermore, infrequent sex is less predictable, meaning that women in this demographic may be less consistently prepared in the moment to prevent pregnancy via barrier methods. Doubling the rate of consistent OCP use in this population could very likely have a large impact on the unintended pregnancy rates and abortion rates of this subgroup.

Additionally, as mentioned in Section 2.3, a recent study found the unintended pregnancy rate decreased post-ACA implementation by 15 percent overall and 37 percent among women with government-sponsored health insurance (MacCallum-Bridges & Margerison, 2020). If these estimated decreases in the unintended pregnancy rate prove accurate, they would give greater credibility to the estimated decrease in abortion rates due to the ACA.

It seems reasonable to conclude that the ACA contraceptive mandate had a significant impact on abortion rates. It is absolutely true that the ACA contraceptive mandate massively shifted contraceptive costs from individuals to insurance companies and the government, but the ACA contraceptive mandate did not address many of the other barriers generally associated with contraceptive access, such as awareness of individual pregnancy risk, contraceptive knowledge, or more convenient physical access to contraceptives. It seems, then, that if the ACA contraceptive mandate were combined with any other efforts to address barriers to contraception, the impact on the abortion rate could be even greater.

6.2.3 Strengths

This work is the first study that utilizes abortion data to model the effect of both the ACA and state-specific contraceptive mandates on abortion rates. These models generally pass checks for robustness and fill a substantial research gap on the effect of the ACA contraceptive mandate on abortion rates. Breaking out the results into various subpopulations greatly increases the specificity of the results, as pre- and post-ACA unintended pregnancy rates and abortion rates varied greatly by subpopulation.

Similar to the fertility analysis, this work is the first to include binary variables for the effect of state-specific contraceptive mandates and the ACA contraceptive mandate in the same model, which allows for more accurate estimation of each policy's impact on the abortion rate.

6.2.4 Limitations

The main limitations are due to available data and the changing political and economic climate during the study period.

The abortion data that are available are far from perfect. Not all states report any data, and not all states report all data by subcategories. Furthermore, the abortion data are not broken down into as many subpopulations as other data on reproduction. For example, there is no simultaneous breakdown of age with race or ethnicity, so there is no way to estimate the isolated effect of the ACA contraceptive mandate on the subpopulations likely to be impacted the most by this policy (younger and racial/ethnic minority). Finally, the majority of the abortion data are reported by the state of abortion occurrence instead of the state of the mother's residence, which limits the ability to accurately attribute state-level effects to state abortion rates.

The relative lack of specificity of the demographic data also limits this analysis. As discussed in Section 5.2.4, because the demographic data are not available for all the subpopulations at the state level, the state level means for the total state population are used for all state subpopulations. Although this has less of an effect on subpopulations that are in the majority (in most states, White) as their subpopulation's demographic data are more strongly correlated with state-level demographic data, it potentially has a much larger effect on estimates involving minority subpopulations.

Finally, the political and economic circumstances themselves were changing at the same time the ACA contraceptive mandate went into effect. This study period was a time when there was rapid growth in the number of laws restricting abortions and shutting down abortion facilities, which affected abortion access. Additionally, economic fluctuations affect fertility preferences and some areas of the US saw a stark increase in the unemployment rate in this time period. Although the models include variables to try to account for these forces—the number of abortion clinics per 100,000 women as well as the state unemployment rate and state mean household income—these variables may not sufficiently capture the larger changes occurring during the time period. This is especially the case because many of the most dramatic changes in unemployment, for example, occurred in specific cities that had previously been dominated by the manufacturing industry. Thus, the state-level averages would dramatically understate the effect of the economy on women who live in geographic areas with relatively much higher unemployment than the state average.

6.2.5 Policy Implications

There are three main policy implications of this research: 1. Fund contraceptive coverage; 2. Provide funding to improve the abortion data reported to the CDC; and 3. Enable continued research on this topic.

This research provides evidence that there should be bipartisan support for funding contraceptive coverage because the ACA contraceptive mandate was estimated to have caused statistically significant reductions in abortion rates for all subpopulations except for women ages 40 to 44. Even if the federal government strikes down the ACA contraceptive mandate entirely or continues to weaken it through broadening the exceptions for employer-based health insurance policies, state policies—including their EHBs—should be enacted to continue full coverage of contraceptives. Even if state governments do not take this action, insurance companies should choose to fully cover contraceptives to avoid the costs of unintended pregnancy and abortion. Although only five states—California, Maine, New York, Oregon, and Washington—now require all insurance plans sold on the Marketplace that cover any maternity care to also include abortion coverage, an additional twelve states plus DC offer at least one plan on the Marketplace that includes abortion coverage (Salganicoff, 2019). Even if the costs of both contraceptives and abortion procedures and the morality of abortion were not at play, having multiple abortions may cause negative health effects in terms of future pre-term birth, which can have life-long effects on the child (National Academies of Sciences, 2018). Reducing the abortion rate via increasing contraceptive use could save money and improve population health outcomes.

Second, funding should be allocated to continue the Abortion Surveillance reports and work to improve the abortion data quality. There is so much that is still unknown because of the limitations of the data currently included in the Abortion Surveillance reports. For example, it would be helpful to gather more data by the state of the woman's residence rather than just the state of occurrence to better understand what local laws are affecting choice and to have a better idea of the demographics of who is getting abortions. It would be helpful to gather more racial and ethnicity information, and especially helpful to gather and report data by age group plus race and ethnicity. These additional data would allow for much more detailed findings. Although states may be reluctant to add more required data to the reporting, these data will help states better serve their populations and help women have better health outcomes.

Finally, funding either via HHS, the CDC, post-docs, or training grants should be made available to fund further research on this topic. It would be especially helpful to be able to include more specific demographic data to use in the regressions by subpopulation. Including geospatial data to estimate the mean distance or traveling time to the nearest abortion facility may also be a variable worth including.

Prioritizing contraceptive coverage and further research on this topic will increase the likelihood of finally reaching the goal of reducing unintended pregnancy in the US.

7.0 Conclusion

This dissertation addressed two specific research aims estimating the effect of the ACA contraceptive mandate on (1) fertility rates and (2) abortion rates in the US. Various tests led to final models with fixed effects, selected state-specific time trends, population weights, effect coding, and either full demographic variable inclusion or lasso-selected demographic variables.

In general, both the fertility and abortion findings were robust to model specification selection. The main findings for all women generally confirm prior studies' results with small but statistically significant decreases in the fertility and abortion rates due to the ACA contraceptive mandate. In addition to modeling data from the time period pre- and post-ACA implementation, this work adds to the research literature by including the effects of the prior state-specific contraceptive mandates as well as the many additional regression models by demographic subpopulation. It is the results for these subpopulations that provide crucial information for future policy specificity.

This work found a larger estimated impact on abortion rates (mean of 26.5 percent) than fertility rates (mean of 6.8 to 8.1 percent). This non-linear relationship between the decreased fertility rates and decreased abortion rates implies that the ACA contraceptive mandate did not randomly prevent pregnancies but instead focused on certain demographics that were more prone to unintended pregnancy and abortion. It seems reasonable, then, to conclude that the ACA contraceptive mandate shifted some women who had previously relied on abortion if they got pregnant to using contraceptives to prevent pregnancy or that the ACA prevented unintended pregnancies that otherwise would have ended in abortion.

It is crucial to understand the impact the ACA contraceptive mandate is estimated to have had on fertility rates and abortion rates. In addition to cost-savings, there are gains in health and utility in avoiding unintended pregnancy. Furthermore, if society as a whole would like to reduce abortion rates, access to contraceptives must be prioritized. This is especially the case if relatively more vulnerable populations experience a disproportionate share of unintended pregnancies and abortions. In light of this dissertation's findings, the federal government and the Supreme Court should carefully consider what exceptions should be allowed to the contraceptive mandate. If future funding of a contraceptive mandate is limited, priority should be given to continuing funding for providing contraceptives for younger minority women, as they saw the biggest decreases in fertility and abortion rates.

The ACA contraceptive mandate only focused on one of many barriers to contraceptive use: the cost to the individual. It was not combined with outreach, information campaigns, or transportation to doctor's appointments. However, it had a substantial impact on fertility and abortion rates. Further public health work and additional research should be pursued to see if other interventions done in conjunction with the contraceptive mandate could improve outcomes even more.

The COVID-19 pandemic is currently impacting reproductive health. One study conducted in May 2020 found that at this earlier stage of the pandemic, women were reporting increased barriers to in-person physician appointments for contraceptives (Lindberg, et al., 2020). However, the current COVID-19 pandemic has the *potential* to improve women's future access to contraceptives via the much greater prevalence and insurance reimbursement of telemedicine. This increased access to physicians (and, thus, to prescription contraceptives) has the potential to further reduce physical barriers to physicians, including transportation access and associated time costs. If continued after the pandemic, telemedicine has the potential to improve reproductive health long-term for many women, including those who have less flexible employment that make attending appointments in-person more difficult. To fully take advantage of this opportunity, additional work needs to be done to ensure that the most vulnerable populations are aware of this option and have the necessary internet connection for telemedicine appointments.

There are many exciting avenues for improving reproductive healthcare both now and long-term. Investing in women's health has been shown to deliver positive returns (Karpilow, et al., 2013), and should inspire us to move forward with boldness in identifying and funding these and other high-return investments in reproductive health.

8.0 References

8.1 Appendix

8.1.1 Utility Function Discussion

In a world where there is only one good, x, the utility function is simply the product of the average utility gained per item and the number of items consumed:

$$Utility_x = \overline{utility}_x * \ quantity_x$$

In a world where there are only two goods, x and y, the total utility would be a sum of the utility gained by the individual from consuming the quantity purchased of each good:

$$Total\ Utility = (\overline{utility}_x * \ quantity_x) + (\overline{utility}_y * \ quantity_y)$$

The aggregate utility of a group of individuals or society as a whole would simply be the sum of the n individual's utility functions:

$$Total\ Utility_{society} = \sum_{i=1}^{n} Total\ Utility_i$$

Discussion of consumer behavior gets interesting because resources are finite, so individuals must make decisions to maximize their utility given their income or budget constraints and the prices of each good, such that

$$Income \ \geq \ (Price_x * \ Quantity_x) + (Price_y * \ Quantity_y)$$

When individuals encounter purchasing decisions, they generally do so in a setting where prices are exogenous, meaning that they are price takers instead of price setters. Therefore, maximizing individual utility subject to a budget constraint involves 1.

The amount of utility the individual derives from each good (which is entirely controlled by the individual), 2. The individual income (which is generally assumed to be fixed in the short-run), and 3. The prices of each good (which are most often beyond the individual's control).

8.1.2 Additional Appendix Tables and Figures

Appendix Table 1: State-Specific Contraceptive Mandates

State	Year Enacted	Religious Exemption	Via Leglislation
Arizona	2002	Yes	Yes
Arkansas	2005	Yes	Yes
California	1999	Yes	Yes
Colorado	2010	No	Yes
Connecticut	1999	Yes	Yes
Delaware	2000	Yes	Yes
Georgia	1999	No	Yes
Hawaii	1999	Yes	Yes
Illinois	2003	Yes	Yes
Iowa	2000	No	Yes
Maine	1999	Yes	Yes
Maryland	1998	Yes	Yes
Massachusetts	2002	Yes	Yes
Michigan*	2006	Yes	No
Missouri	2001	Yes	Yes
Montana*	2006	No	No
Nevada	1999	Yes	Yes
New Hampshire	1999	No	Yes
New Jersey	2005	Yes	Yes
New Mexico	2001	Yes	Yes
New York	2002	Yes	Yes
North Carolina	1999	Yes	Yes
Oregon	2007	Yes	Yes
Rhode Island	2000	Yes	Yes
Texas	2001	Yes	Yes
Vermont	1999	No	Yes
Virginia	2001	No	Yes
Washington	2007	No	Yes
West Virginia	2005	Yes	Yes
Wisconsin	2009	No	Yes

*Note: Michigan and Montana both had state contraceptive mandates enacted via attorney general decision rather than via legislation.

Appendix Table 2: State EHB Benchmark Plans and Infertility Coverage Laws

State	EHB Benchmark Plan Requires Infertility Coverage	State Law Requires Infertility Coverage	State Law Requires Infertility Coverage to be Offered
Alabama	Yes		
Arkansas	Yes	Yes	
California			Yes
Connecticut	Yes	Yes	
Delaware		Yes	
Georgia	Yes		
Hawaii	Yes	Yes	
Illinois	Yes	Yes	
Iowa	Yes		
Kansas	Yes		
Louisiana		Yes	
Maryland	Yes	Yes	
Massachusetts	Yes	Yes	
Michigan	Yes		
Montana	Yes	Yes	
Nevada	Yes		
New Jersey	Yes	Yes	
New Mexico	Yes		
New York	Yes	Yes	
North Carolina	Yes		
Ohio		Yes	
Rhode Island	Yes	Yes	
South Dakota	Yes		
Tennessee	Yes		
Texas	Yes		Yes
Virginia	Yes		
West Virginia	Yes	Yes	
Wyoming	Yes		

Source: Centers for Medicare and Medicaid Services. "Plan Year 2014-2016 Essential Health Benefits Benchmark Plans." Available at: https://www.cms.gov/CCIIO/Resources/Data-Resources/2014-2016-EHB-BenchmarkPlans

Appendix Table 3: Correlation of Statewide Demographic Variables with Subgroups

Variable	Subgroup	Correlation	States	Years
Percent with High School Education or Higher	NH White	0.6068	51	2011-2016
	NH Black	0.2062	49	2011-2016
	NH Asian	0.0115	51	2011-2016
	Hispanic	0.4144	51	2011-2016
Percent with BS degree or Higher	NH White	0.8963	51	2011-2016
	NH Black	0.5826	48	2011-2016
	NH Asian	0.4074	51	2011-2016
	Hispanic	0.5129	51	2011-2016

Appendix Table 4.1: Fertility Regression Results with Fixed Effects

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Variable	ACA Only	All Variables	Black/AA	White	AIAN	API	Hisp	Non-Hisp	15-19	20-24	25-29	30-34	35-39	40-44
State Mandate in Effect		0.337	0.930	-1.257	-2.206	-0.926	-1.792	-0.369	0.748	1.097	-1.097	1.086*	-0.314	-0.0126
		(0.513)	(2.282)	(1.044)	(3.252)	(2.815)	(3.516)	(0.837)	(0.664)	(0.939)	(0.784)	(0.653)	(0.311)	(0.128)
ACA Mandate in Effect	-4.212***	-3.452***	-5.068***	-7.790***	-17.13***	-4.585***	-31.21***	-5.850***	-20.95***	-28.10***	-14.24***	8.989***	8.565***	2.615***
	(0.455)	(0.500)	(0.973)	(0.445)	(1.396)	(1.200)	(1.498)	(0.357)	(0.648)	(0.917)	(0.765)	(0.638)	(0.304)	(0.125)
State Mandate * ACA Mandate		-1.392***	-0.555	-0.900***	4.434***	-1.599*	1.537	0.499*	0.440	-2.131***	-3.596***	-4.317***	-0.195	0.0651
		(0.359)	(0.755)	(0.345)	(1.078)	(0.931)	(1.163)	(0.277)	(0.465)	(0.659)	(0.550)	(0.458)	(0.218)	(0.0897)
2008 Dummy	3.179***	3.133***	-0.939	-0.726*	-2.232*	-1.447	-5.482***	-0.370	0.165	0.869	-0.966	3.968***	3.284***	1.009***
	(0.455)	(0.457)	(0.865)	(0.395)	(1.244)	(1.067)	(1.332)	(0.317)	(0.591)	(0.837)	(0.698)	(0.582)	(0.277)	(0.114)
2009 Dummy	1.382***	1.329***	-3.286***	-2.590***	-4.190***	-2.761**	-12.98***	-1.503***	-2.032***	-4.521***	-4.948***	2.291***	2.691***	1.218***
	(0.455)	(0.458)	(0.866)	(0.396)	(1.240)	(1.068)	(1.334)	(0.318)	(0.593)	(0.840)	(0.701)	(0.584)	(0.278)	(0.114)
2010 Dummy	-0.470	-0.529	-3.906***	-4.265***	-7.469***	-4.757***	-19.81***	-2.628***	-5.708***	-10.16***	-7.817***	2.023***	2.476***	1.404***
	(0.455)	(0.460)	(0.869)	(0.398)	(1.245)	(1.072)	(1.339)	(0.319)	(0.596)	(0.843)	(0.704)	(0.586)	(0.279)	(0.115)
2011 Dummy	-1.220***	-1.279***	-5.972***	-5.042***	-8.771***	-3.864***	-24.74***	-2.980***	-8.454***	-14.48***	-8.551***	1.775***	3.776***	1.512***
	(0.455)	(0.460)	(0.869)	(0.398)	(1.245)	(1.072)	(1.339)	(0.319)	(0.596)	(0.843)	(0.704)	(0.586)	(0.279)	(0.115)
2012 Dummy	-1.421***	-1.480***	-7.312***	-5.312***	-8.359***	-2.377**	-26.62***	-3.056***	-10.20***	-17.10***	-9.028***	2.729***	4.863***	1.569***
	(0.455)	(0.460)	(0.869)	(0.398)	(1.245)	(1.072)	(1.339)	(0.319)	(0.596)	(0.843)	(0.704)	(0.586)	(0.279)	(0.115)
2013 Dummy	2.345***	2.345***	-1.708**	2.749***	5.700***	0.952	1.358	2.293***	7.545***	9.764***	7.307***	-3.058***	-2.646***	-1.063***
	(0.455)	(0.451)	(0.865)	(0.395)	(1.232)	(1.067)	(1.332)	(0.317)	(0.584)	(0.827)	(0.690)	(0.575)	(0.274)	(0.113)
2014 Dummy	2.704***	2.704***	-1.767**	3.377***	3.721***	1.306	1.618	2.742***	5.255***	8.120***	7.583***	-0.138	-1.365***	-0.915***
	(0.455)	(0.451)	(0.865)	(0.395)	(1.232)	(1.067)	(1.332)	(0.317)	(0.584)	(0.827)	(0.690)	(0.575)	(0.274)	(0.113)
2015 Dummy	2.394***	2.394***	-1.610*	3.226***	2.570**	-0.523	2.234*	2.306***	3.464***	5.832***	6.473***	0.638	-0.0698	-0.623***
	(0.455)	(0.451)	(0.865)	(0.395)	(1.232)	(1.067)	(1.332)	(0.317)	(0.584)	(0.827)	(0.690)	(0.575)	(0.274)	(0.113)
2016 Dummy	1.763***	1.763***	-0.321	1.985***	0.704	2.583**	2.330*	1.679***	1.531***	2.700***	4.184***	1.867***	0.537**	-0.147
	(0.455)	(0.451)	(0.865)	(0.395)	(1.232)	(1.067)	(1.332)	(0.317)	(0.584)	(0.827)	(0.690)	(0.575)	(0.274)	(0.113)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	65.10***	64.96***	75.41***	68.85***	58.38***	67.37***	106.1***	64.61***	39.50***	102.5***	121.0***	92.86***	40.92***	7.903***
	(0.322)	(0.383)	(1.394)	(0.638)	(1.995)	(1.720)	(2.148)	(0.511)	(0.495)	(0.701)	(0.585)	(0.487)	(0.232)	(0.0955)
Observations	765	765	561	561	559	561	561	561	765	765	765	765	765	765
R-squared	0.508	0.519	0.259	0.607	0.374	0.109	0.715	0.498	0.880	0.888	0.748	0.485	0.791	0.658
Number of States	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Adjusted R-squared	0.463	0.473	0.167	0.558	0.296	-0.00144	0.679	0.436	0.869	0.877	0.724	0.436	0.772	0.625

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4.2: Fertility Regression Results with Fixed Effects

	By Age Group and Race											
	15-19				20-24				25-29			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	-5.498**	-1.120	-9.935**	-5.992***	-2.930	-1.169	-2.465	-4.540	7.311	-3.469**	2.047	2.359
	(2.568)	(1.399)	(4.322)	(1.888)	(4.933)	(1.999)	(6.897)	(4.176)	(5.820)	(1.676)	(6.263)	(5.874)
ACA Mandate in Effect	-34.63***	-19.06***	-31.79***	-11.00***	-34.27***	-31.38***	-51.03***	-16.69***	-0.343	-18.27***	-24.02***	-13.53***
	(1.102)	(0.596)	(1.978)	(0.874)	(2.103)	(0.852)	(3.059)	(1.780)	(2.481)	(0.714)	(2.769)	(2.504)
State Mandate * ACA Mandate	5.015***	-0.585	7.509***	2.833***	-0.159	-1.911***	11.70***	0.103	-6.803***	-3.103***	1.017	-2.732
	(0.856)	(0.463)	(1.546)	(0.687)	(1.632)	(0.661)	(2.382)	(1.381)	(1.925)	(0.554)	(2.156)	(1.943)
2008 Dummy	-2.303**	-0.862	-2.125	-0.653	-3.688**	-2.866***	-2.917	-1.688	0.974	-2.933***	-6.562***	-3.163
	(0.973)	(0.530)	(1.736)	(0.766)	(1.869)	(0.757)	(2.744)	(1.582)	(2.205)	(0.635)	(2.484)	(2.226)
2009 Dummy	-6.040***	-2.899***	-6.476***	-1.871**	-7.791***	-8.468***	-10.15***	-5.987***	-4.909**	-7.137***	-7.767***	-3.980*
	(0.980)	(0.531)	(1.738)	(0.763)	(1.871)	(0.758)	(2.748)	(1.584)	(2.208)	(0.636)	(2.487)	(2.229)
2010 Dummy	-11.06***	-6.217***	-8.671***	-3.726***	-13.16***	-13.85***	-17.37***	-9.100***	-3.024	-9.665***	-16.53***	-7.950***
	(0.978)	(0.533)	(1.758)	(0.784)	(1.879)	(0.761)	(2.760)	(1.591)	(2.217)	(0.638)	(2.489)	(2.237)
2011 Dummy	-14.94***	-8.774***	-12.44***	-4.511***	-22.38***	-18.33***	-22.97***	-9.387***	-5.102**	-10.76***	-14.84***	-3.447
	(0.978)	(0.533)	(1.782)	(0.785)	(1.879)	(0.761)	(2.760)	(1.591)	(2.217)	(0.638)	(2.480)	(2.237)
2012 Dummy	-17.08***	-10.15***	-12.49***	-5.376***	-28.09***	-20.79***	-27.92***	-9.306***	-4.456**	-11.46***	-14.28***	-4.433**
	(0.984)	(0.533)	(1.770)	(0.790)	(1.879)	(0.761)	(2.753)	(1.591)	(2.217)	(0.638)	(2.489)	(2.237)
2013 Dummy	8.950***	6.865***	10.74***	2.791***	4.571**	9.357***	13.39***	5.887***	1.137	8.646***	10.78***	7.280***
	(0.988)	(0.530)	(1.790)	(0.788)	(1.869)	(0.757)	(2.744)	(1.582)	(2.205)	(0.635)	(2.475)	(2.226)
2014 Dummy	6.541***	5.157***	7.054***	2.357***	1.665	8.433***	8.369***	2.083	0.573	8.979***	10.03***	8.720***
	(0.984)	(0.530)	(1.814)	(0.785)	(1.869)	(0.757)	(2.761)	(1.582)	(2.205)	(0.635)	(2.499)	(2.226)
2015 Dummy	3.307***	3.521***	5.220***	1.050	0.456	6.303***	5.317*	0.432	-1.241	8.235***	5.957**	2.853
	(0.988)	(0.530)	(1.816)	(0.802)	(1.869)	(0.757)	(2.736)	(1.582)	(2.205)	(0.635)	(2.484)	(2.226)
2016 Dummy	1.360	1.489***	1.595	1.157	-0.857	2.825***	1.253	2.371	1.528	4.548***	2.873	8.069***
	(0.994)	(0.530)	(1.800)	(0.800)	(1.869)	(0.757)	(2.761)	(1.582)	(2.205)	(0.635)	(2.484)	(2.226)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	62.78***	37.20***	56.81***	22.79***	135.8***	102.7***	115.4***	61.41***	111.6***	125.4***	94.59***	107.6***
	(1.559)	(0.855)	(2.514)	(1.135)	(3.014)	(1.221)	(4.086)	(2.551)	(3.556)	(1.024)	(3.732)	(3.589)
Observations	553	561	474	466	561	561	508	561	561	561	513	561
R-squared	0.848	0.869	0.591	0.481	0.673	0.890	0.604	0.337	0.056	0.757	0.239	0.133
Number of States	51	51	46	47	51	51	49	51	51	51	50	51
Adjusted R-squared	0.829	0.852	0.535	0.407	0.633	0.876	0.551	0.254	-0.0613	0.727	0.136	0.0247

Standard errors in parentheses. Full reression results available upon request.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4.3: Fertility Regression Results with Fixed Effects

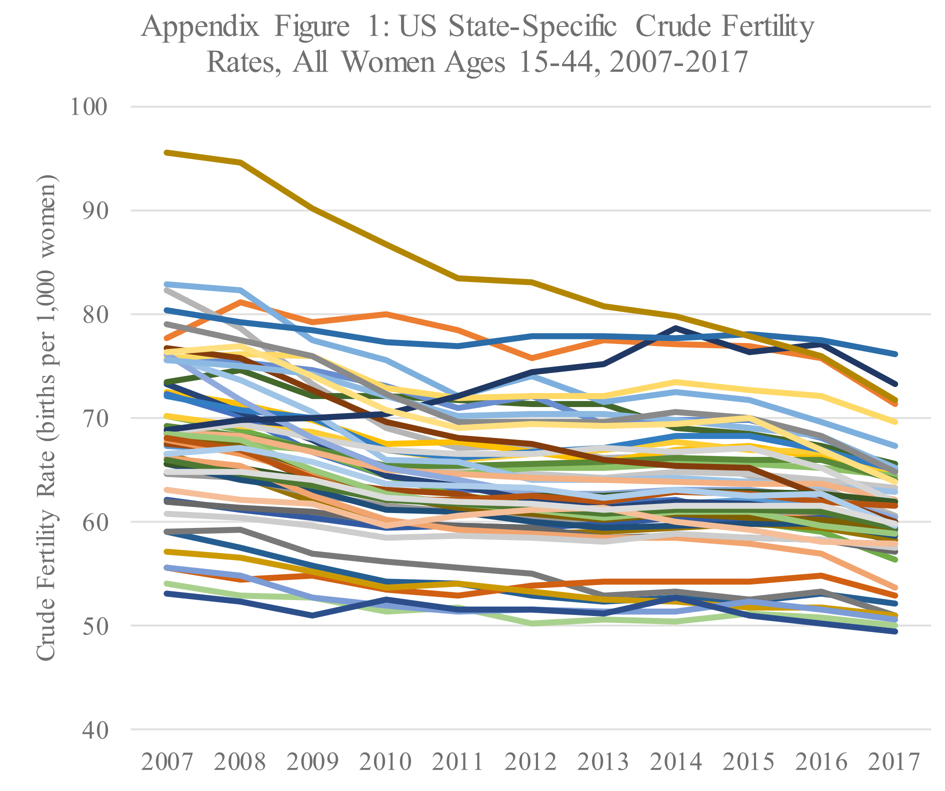
	By Age Group and Race											
	30-34				35-39				40-44			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	4.447	-0.558	2.210	0.744	0.598	-1.090	0.679	-2.089	-0.459	-0.316	0.821	0.110
	(4.642)	(1.517)	(5.188)	(5.434)	(2.823)	(0.897)	(2.953)	(4.032)	(1.068)	(0.364)	(0.809)	(1.315)
ACA Mandate in Effect	17.50***	2.044***	-3.640	7.079***	13.49***	2.651***	1.035	6.288***	4.132***	1.132***	0.359	0.447
	(1.998)	(0.647)	(2.309)	(2.316)	(1.237)	(0.382)	(1.373)	(1.719)	(0.491)	(0.155)	(0.545)	(0.600)
State Mandate * ACA Mandate	-3.143**	-3.244***	0.432	-2.414	-0.875	0.580*	1.047	-1.019	0.0236	0.381***	0.127	0.364
	(1.544)	(0.502)	(1.802)	(1.798)	(0.955)	(0.297)	(1.059)	(1.335)	(0.389)	(0.120)	(0.453)	(0.466)
2008 Dummy	0.416	-0.604	0.823	-0.390	-0.0175	-0.721**	-0.838	0.0215	0.113	0.140	-0.132	0.0334
	(1.785)	(0.575)	(2.076)	(2.059)	(1.102)	(0.340)	(1.246)	(1.536)	(0.440)	(0.138)	(0.493)	(0.536)
2009 Dummy	-1.140	-2.328***	0.112	-0.909	0.766	-1.700***	-1.438	-0.379	0.904**	0.359***	0.237	0.462
	(1.788)	(0.575)	(2.067)	(2.062)	(1.098)	(0.340)	(1.242)	(1.529)	(0.441)	(0.138)	(0.500)	(0.540)
2010 Dummy	1.553	-2.717***	-3.348	-1.180	1.270	-1.882***	-1.931	-2.495	0.749*	0.520***	-0.0874	0.436
	(1.777)	(0.578)	(2.076)	(2.070)	(1.102)	(0.342)	(1.247)	(1.536)	(0.440)	(0.139)	(0.515)	(0.542)
2011 Dummy	2.004	-2.930***	-6.706***	-0.471	3.084***	-0.631*	-0.734	-0.896	1.113**	0.624***	0.366	0.729
	(1.777)	(0.578)	(2.076)	(2.070)	(1.109)	(0.342)	(1.247)	(1.536)	(0.440)	(0.139)	(0.486)	(0.537)
2012 Dummy	1.416	-2.441***	-3.052	3.472*	3.027***	0.211	-0.749	3.371**	1.223***	0.596***	0.435	1.383**
	(1.777)	(0.578)	(2.089)	(2.070)	(1.102)	(0.342)	(1.243)	(1.536)	(0.440)	(0.139)	(0.495)	(0.537)
2013 Dummy	-9.713***	-1.768***	1.357	-5.884***	-8.229***	-1.705***	-0.304	-5.191***	-2.377***	-0.854***	-0.191	0.328
	(1.768)	(0.575)	(2.076)	(2.059)	(1.090)	(0.340)	(1.207)	(1.527)	(0.431)	(0.138)	(0.467)	(0.526)
2014 Dummy	-7.812***	1.095*	4.052*	-1.527	-5.035***	-0.353	0.222	-3.842**	-2.372***	-0.723***	-0.127	-0.246
	(1.768)	(0.575)	(2.076)	(2.059)	(1.087)	(0.340)	(1.206)	(1.527)	(0.428)	(0.138)	(0.467)	(0.519)
2015 Dummy	-5.298***	1.965***	2.074	-3.709*	-3.215***	0.928***	-0.912	-2.126	-1.794***	-0.385***	0.305	-0.553
	(1.768)	(0.575)	(2.086)	(2.059)	(1.087)	(0.340)	(1.207)	(1.527)	(0.425)	(0.138)	(0.476)	(0.527)
2016 Dummy	-1.534	2.145***	2.517	3.308	-0.465	0.944***	-1.555	0.268	-0.947**	-0.0818	0.212	0.357
	(1.768)	(0.575)	(2.086)	(2.059)	(1.090)	(0.340)	(1.202)	(1.527)	(0.422)	(0.138)	(0.454)	(0.521)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	78.39***	101.4***	56.58***	114.2***	39.96***	46.63***	26.31***	62.54***	10.54***	9.054***	6.381***	14.49***
	(2.841)	(0.927)	(3.076)	(3.320)	(1.734)	(0.548)	(1.741)	(2.467)	(0.676)	(0.223)	(0.571)	(0.815)
Observations	555	561	504	561	539	561	469	560	484	561	218	495
R-squared	0.319	0.350	0.051	0.096	0.460	0.618	0.051	0.116	0.286	0.282	0.051	0.032
Number of States	51	51	49	51	51	51	46	51	49	51	31	49
Adjusted R-squared	0.234	0.269	-0.0774	-0.0166	0.389	0.571	-0.0803	0.00600	0.185	0.193	-0.176	-0.101

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4.4: Fertility Regression Results with Fixed Effects

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Variable	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
State Mandate in Effect	-6.320	1.175	0.838	-0.0831	0.932	-2.767	-2.827	-0.635	-1.423	-1.286*	0.326	-0.430
	(3.882)	(1.145)	(6.820)	(1.698)	(5.496)	(1.736)	(4.173)	(1.544)	(2.468)	(0.688)	(0.880)	(0.288)
ACA Mandate in Effect	-53.98***	-19.84***	-70.87***	-28.75***	-24.05***	-14.64***	-4.638***	5.222***	1.732	4.650***	2.432***	1.586***
	(1.664)	(0.488)	(2.907)	(0.724)	(2.342)	(0.740)	(1.779)	(0.658)	(1.052)	(0.293)	(0.400)	(0.123)
State Mandate * ACA Mandate	5.371***	2.694***	0.960	0.613	-4.618**	-2.406***	-0.490	-2.814***	-1.127	0.460**	-0.548*	0.165*
	(1.293)	(0.379)	(2.256)	(0.562)	(1.818)	(0.574)	(1.380)	(0.511)	(0.817)	(0.227)	(0.309)	(0.0953)
2008 Dummy	-5.956***	-0.562	-10.40***	-1.845***	-5.676***	-2.299***	-3.375**	-0.324	-1.480	-0.731***	0.155	0.190*
	(1.485)	(0.434)	(2.584)	(0.643)	(2.082)	(0.658)	(1.581)	(0.585)	(0.940)	(0.260)	(0.358)	(0.109)
2009 Dummy	-15.58***	-2.139***	-27.25***	-5.899***	-13.39***	-5.470***	-7.464***	-1.240**	-2.736***	-1.146***	0.295	0.400***
	(1.483)	(0.435)	(2.587)	(0.644)	(2.085)	(0.658)	(1.583)	(0.586)	(0.941)	(0.261)	(0.360)	(0.109)
2010 Dummy	-24.66***	-5.046***	-42.81***	-10.22***	-23.51***	-7.164***	-11.24***	-0.754	-2.577***	-1.268***	-0.260	0.636***
	(1.493)	(0.436)	(2.598)	(0.647)	(2.093)	(0.661)	(1.589)	(0.588)	(0.940)	(0.262)	(0.361)	(0.110)
2011 Dummy	-32.43***	-7.247***	-53.60***	-13.85***	-27.35***	-7.468***	-12.39***	-0.951	-3.137***	0.213	-0.149	0.724***
	(1.493)	(0.436)	(2.598)	(0.647)	(2.093)	(0.661)	(1.589)	(0.588)	(0.940)	(0.262)	(0.362)	(0.110)
2012 Dummy	-35.34***	-8.805***	-58.43***	-16.25***	-28.26***	-7.975***	-13.32***	0.134	-3.071***	1.368***	0.233	0.726***
	(1.489)	(0.436)	(2.598)	(0.647)	(2.093)	(0.661)	(1.589)	(0.588)	(0.940)	(0.262)	(0.363)	(0.110)
2013 Dummy	10.21***	6.832***	7.002***	9.976***	-1.104	8.068***	-8.351***	-2.597***	-4.537***	-2.509***	-1.690***	-0.941***
	(1.485)	(0.434)	(2.584)	(0.643)	(2.082)	(0.658)	(1.581)	(0.585)	(0.935)	(0.260)	(0.350)	(0.109)
2014 Dummy	6.399***	4.796***	5.256**	8.331***	-0.157	8.369***	-4.926***	0.319	-2.053**	-1.323***	-1.342***	-0.796***
	(1.485)	(0.434)	(2.584)	(0.643)	(2.082)	(0.658)	(1.581)	(0.585)	(0.935)	(0.260)	(0.351)	(0.109)
2015 Dummy	4.788***	3.141***	4.568*	5.886***	3.362	6.687***	-1.284	0.747	-0.925	-0.0792	-1.044***	-0.576***
	(1.485)	(0.434)	(2.584)	(0.643)	(2.082)	(0.658)	(1.581)	(0.585)	(0.935)	(0.260)	(0.346)	(0.109)
2016 Dummy	3.029**	1.317***	3.132	2.739***	4.719**	4.109***	0.875	1.967***	0.880	0.406	-0.0202	-0.204*
	(1.485)	(0.434)	(2.584)	(0.643)	(2.082)	(0.658)	(1.581)	(0.585)	(0.935)	(0.260)	(0.348)	(0.109)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	87.28***	34.26***	174.1***	96.42***	150.2***	117.9***	108.8***	96.33***	56.35***	44.24***	13.71***	8.531***
	(2.350)	(0.700)	(4.166)	(1.037)	(3.357)	(1.060)	(2.549)	(0.943)	(1.504)	(0.420)	(0.535)	(0.176)
Observations	552	561	561	561	561	561	561	561	559	561	499	561
R-squared	0.853	0.902	0.783	0.897	0.472	0.641	0.249	0.434	0.143	0.794	0.208	0.460
Number of States	51	51	51	51	51	51	51	51	51	51	48	51
Adjusted R-squared	0.834	0.890	0.756	0.884	0.406	0.596	0.156	0.364	0.0354	0.768	0.101	0.393

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1



Source: NCHS, National Vital Statistics System, public-use Birth File.

Appendix Table 5.1: Fertility Regression Results with Fixed Effects and Selected State-Specific Trends

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Variable	ACA Only	All Variables	Black/AA	White	AIAN	API	Hisp	Non-Hisp	15-19	20-24	25-29	30-34	35-39	40-44
State Mandate in Effect		0.410	1.207	-1.236	-2.168	-0.897	-1.771	-0.358	0.898	1.135	-1.296*	1.222**	-0.288	-0.0191
		(0.438)	(1.864)	(0.910)	(3.299)	(2.512)	(3.512)	(0.666)	(0.649)	(0.883)	(0.737)	(0.604)	(0.299)	(0.124)
ACA Mandate in Effect	-4.234***	-3.451***	-6.325***	-7.610***	-16.87***	-5.949***	-31.48***	-5.663***	-21.67***	-28.01***	-13.52***	8.563***	8.555***	2.552***
	(0.397)	(0.439)	(0.819)	(0.400)	(1.460)	(1.104)	(1.543)	(0.293)	(0.651)	(0.885)	(0.739)	(0.606)	(0.300)	(0.125)
State Mandate * ACA Mandate		-1.401***	0.567	-1.023***	4.294***	-0.320	1.727	0.377*	1.012**	-2.146***	-3.902***	-4.044***	-0.140	0.122
		(0.315)	(0.635)	(0.310)	(1.127)	(0.856)	(1.196)	(0.227)	(0.468)	(0.636)	(0.531)	(0.435)	(0.216)	(0.0895)
2008 Dummy	3.063***	3.005***	-0.948	-0.764**	-2.225*	-1.360	-5.579***	-0.384	0.0169	0.847	-0.869	3.884***	3.284***	1.004***
	(0.397)	(0.397)	(0.720)	(0.352)	(1.287)	(0.971)	(1.357)	(0.257)	(0.589)	(0.801)	(0.669)	(0.548)	(0.272)	(0.113)
2009 Dummy	1.279***	1.212***	-3.206***	-2.620***	-4.245***	-2.752***	-13.12***	-1.516***	-2.200***	-4.505***	-4.657***	2.106***	2.610***	1.216***
	(0.397)	(0.399)	(0.721)	(0.352)	(1.283)	(0.972)	(1.359)	(0.258)	(0.591)	(0.804)	(0.671)	(0.550)	(0.273)	(0.113)
2010 Dummy	-0.581	-0.656	-4.327***	-4.303***	-7.377***	-4.788***	-20.03***	-2.650***	-5.974***	-10.14***	-7.578***	1.792***	2.470***	1.416***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2011 Dummy	-1.334***	-1.409***	-6.449***	-5.077***	-8.901***	-3.753***	-24.64***	-3.008***	-8.721***	-14.51***	-8.329***	1.550***	3.708***	1.512***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2012 Dummy	-1.581***	-1.656***	-7.661***	-5.392***	-8.495***	-2.466**	-26.75***	-3.076***	-10.51***	-17.18***	-8.938***	2.396***	4.812***	1.611***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2013 Dummy	2.220***	2.220***	-1.513**	2.605***	5.350***	1.215	1.327	2.173***	7.582***	9.712***	6.848***	-3.019***	-2.732***	-1.022***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2014 Dummy	2.540***	2.540***	-1.792**	3.209***	3.471***	1.399	1.674	2.585***	5.225***	7.993***	7.071***	-0.173	-1.480***	-0.886***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2015 Dummy	2.307***	2.307***	-1.957***	3.153***	2.465*	-0.444	2.226	2.245***	3.433***	5.835***	5.997***	0.722	-0.110	-0.602***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2016 Dummy	1.671***	1.671***	-0.492	1.896***	0.602	2.637***	2.281*	1.610***	1.501**	2.644***	3.858***	1.876***	0.476*	-0.171
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	65.10***	64.93***	75.25***	68.84***	58.36***	67.35***	106.1***	64.60***	39.44***	102.4***	121.1***	92.80***	40.91***	7.905***
	(0.275)	(0.326)	(1.139)	(0.556)	(2.023)	(1.535)	(2.145)	(0.407)	(0.484)	(0.658)	(0.549)	(0.450)	(0.223)	(0.0925)
Observations	765	765	561	561	559	561	561	561	765	765	765	765	765	765
R-squared	0.655	0.665	0.526	0.714	0.383	0.320	0.727	0.695	0.891	0.905	0.787	0.579	0.815	0.692
Number of States	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Adjusted R-squared	0.608	0.618	0.445	0.664	0.276	0.203	0.680	0.643	0.875	0.892	0.757	0.520	0.789	0.649

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5.2: Fertility Regression Results with Fixed Effects and Selected State-Specific Trends

	By Age Group and Race											
	15-19				20-24				25-29			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	-5.247**	-1.046	-9.832**	-6.045***	-2.653	-1.128	-2.457	-4.685	8.338*	-3.534**	1.685	2.724
	(2.480)	(1.384)	(4.315)	(1.900)	(4.576)	(1.900)	(6.977)	(4.026)	(5.019)	(1.606)	(6.328)	(5.584)
ACA Mandate in Effect	-35.04***	-19.42***	-31.02***	-10.80***	-36.63***	-31.27***	-49.71***	-17.79***	-1.995	-17.83***	-23.75***	-14.79***
	(1.097)	(0.608)	(2.044)	(0.909)	(2.010)	(0.835)	(3.195)	(1.769)	(2.205)	(0.705)	(2.889)	(2.453)
State Mandate * ACA Mandate	5.505***	-0.276	6.706***	2.670***	2.034	-2.049***	10.84***	1.020	-5.954***	-3.071***	1.187	-1.546
	(0.851)	(0.471)	(1.591)	(0.707)	(1.559)	(0.647)	(2.482)	(1.371)	(1.710)	(0.547)	(2.243)	(1.902)
2008 Dummy	-2.089**	-0.855	-2.320	-0.655	-3.416*	-2.951***	-2.890	-1.954	0.112	-2.856***	-6.616**	-3.120
	(0.958)	(0.535)	(1.771)	(0.783)	(1.768)	(0.734)	(2.836)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2009 Dummy	-5.656***	-2.946***	-6.392***	-1.791**	-7.690***	-8.536***	-10.31***	-5.933***	-4.770**	-6.887***	-7.566***	-4.426**
	(0.965)	(0.535)	(1.774)	(0.780)	(1.770)	(0.735)	(2.841)	(1.557)	(1.942)	(0.621)	(2.567)	(2.160)
2010 Dummy	-11.55***	-6.329***	-8.710***	-3.662***	-13.13***	-13.93***	-16.92***	-8.875***	-5.236***	-9.431***	-16.02***	-8.621***
	(0.963)	(0.538)	(1.795)	(0.802)	(1.778)	(0.738)	(2.854)	(1.564)	(1.950)	(0.624)	(2.569)	(2.169)
2011 Dummy	-14.83***	-8.866***	-12.96***	-4.416***	-22.97***	-18.41***	-23.31***	-9.339***	-7.077***	-10.57***	-14.28***	-4.036*
	(0.963)	(0.538)	(1.821)	(0.803)	(1.778)	(0.738)	(2.854)	(1.564)	(1.950)	(0.624)	(2.560)	(2.169)
2012 Dummy	-17.46***	-10.28***	-12.66***	-5.291***	-28.37***	-20.95***	-28.05***	-9.289***	-6.076***	-11.43***	-13.76***	-4.845**
	(0.969)	(0.538)	(1.808)	(0.808)	(1.778)	(0.738)	(2.846)	(1.564)	(1.950)	(0.624)	(2.569)	(2.169)
2013 Dummy	9.080***	6.884***	10.34***	2.740***	4.534**	9.280***	12.71***	5.896***	1.347	8.177***	10.44***	7.447***
	(0.974)	(0.535)	(1.830)	(0.806)	(1.768)	(0.734)	(2.836)	(1.555)	(1.939)	(0.620)	(2.554)	(2.157)
2014 Dummy	6.450***	5.110***	6.994***	2.262***	1.932	8.294***	7.388***	2.502	0.247	8.499***	9.711***	8.325***
	(0.969)	(0.535)	(1.856)	(0.810)	(1.768)	(0.734)	(2.854)	(1.555)	(1.939)	(0.620)	(2.580)	(2.157)
2015 Dummy	2.999***	3.483***	5.207***	1.146	0.474	6.302***	4.922*	0.657	-2.424	7.812***	5.773**	2.353
	(0.974)	(0.535)	(1.857)	(0.821)	(1.768)	(0.734)	(2.828)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2016 Dummy	1.041	1.467***	1.510	1.307	-0.689	2.764***	0.816	2.730*	1.257	4.221***	3.030	7.391***
	(0.979)	(0.535)	(1.840)	(0.826)	(1.768)	(0.734)	(2.854)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	62.65***	37.16***	56.76***	22.79***	135.6***	102.7***	115.3***	61.49***	111.1***	125.5***	94.79***	107.4***
	(1.506)	(0.845)	(2.509)	(1.143)	(2.795)	(1.160)	(4.132)	(2.459)	(3.066)	(0.981)	(3.770)	(3.411)
Observations	553	561	474	466	561	561	508	561	561	561	513	561
R-squared	0.865	0.877	0.612	0.491	0.731	0.905	0.613	0.409	0.327	0.786	0.259	0.248
Number of States	51	51	46	47	51	51	49	51	51	51	50	51
Adjusted R-squared	0.841	0.856	0.537	0.399	0.684	0.888	0.541	0.308	0.212	0.749	0.120	0.120

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5.3: Fertility Regression Results with Fixed Effects and Selected State-Specific Trends

	By Age Group and Race											
	30-34				35-39				40-44			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	4.460	-0.413	2.371	0.503	0.887	-1.047	1.044	-2.081	-0.438	-0.328	0.857	0.0744
	(4.375)	(1.430)	(5.144)	(5.265)	(2.396)	(0.894)	(2.884)	(3.625)	(1.032)	(0.362)	(0.786)	(1.322)
ACA Mandate in Effect	16.66***	1.688***	-4.353*	5.993***	12.65***	2.583***	0.191	4.811***	4.084***	1.043***	0.611	0.624
	(1.942)	(0.628)	(2.365)	(2.313)	(1.084)	(0.393)	(1.389)	(1.593)	(0.485)	(0.159)	(0.561)	(0.615)
State Mandate * ACA Mandate	-2.133	-3.081***	0.976	-1.588	-0.108	0.598*	1.637	0.744	0.121	0.453***	-0.0211	0.351
	(1.499)	(0.487)	(1.840)	(1.793)	(0.837)	(0.305)	(1.067)	(1.236)	(0.382)	(0.123)	(0.459)	(0.476)
2008 Dummy	0.310	-0.677	1.282	0.103	0.445	-0.803**	-0.789	0.0589	0.0645	0.125	-0.0344	0.0355
	(1.717)	(0.553)	(2.104)	(2.034)	(0.955)	(0.345)	(1.247)	(1.408)	(0.427)	(0.140)	(0.496)	(0.545)
2009 Dummy	-1.567	-2.443***	-0.181	-1.349	0.897	-1.875***	-1.854	-0.0398	0.927**	0.353**	0.278	0.497
	(1.719)	(0.553)	(2.094)	(2.037)	(0.951)	(0.346)	(1.242)	(1.402)	(0.431)	(0.140)	(0.495)	(0.549)
2010 Dummy	2.013	-2.934***	-3.644*	-0.796	0.838	-1.971***	-1.985	-2.517*	0.687	0.521***	-0.0513	0.508
	(1.709)	(0.556)	(2.104)	(2.045)	(0.955)	(0.347)	(1.248)	(1.408)	(0.430)	(0.141)	(0.510)	(0.552)
2011 Dummy	1.417	-3.171***	-6.281***	0.650	3.275***	-0.773**	-1.563	-0.682	0.996**	0.619***	0.488	0.822
	(1.709)	(0.556)	(2.104)	(2.045)	(0.961)	(0.347)	(1.248)	(1.408)	(0.430)	(0.141)	(0.491)	(0.547)
2012 Dummy	1.249	-2.757***	-3.319	3.657*	2.655***	0.0995	-1.515	3.261**	1.244***	0.631***	0.281	1.390**
	(1.709)	(0.556)	(2.117)	(2.045)	(0.955)	(0.347)	(1.244)	(1.408)	(0.430)	(0.141)	(0.500)	(0.547)
2013 Dummy	-9.921***	-1.724***	1.426	-4.914**	-7.643***	-1.788***	-0.903	-4.981***	-2.322***	-0.815***	-0.264	0.219
	(1.699)	(0.553)	(2.104)	(2.034)	(0.944)	(0.345)	(1.206)	(1.400)	(0.423)	(0.140)	(0.463)	(0.536)
2014 Dummy	-8.482***	1.062*	4.463**	-0.683	-4.763***	-0.466	0.356	-4.529***	-2.563***	-0.688***	-0.233	-0.487
	(1.699)	(0.553)	(2.104)	(2.034)	(0.941)	(0.345)	(1.205)	(1.400)	(0.420)	(0.140)	(0.457)	(0.534)
2015 Dummy	-5.810***	2.079***	2.364	-3.330	-3.451***	0.918***	-0.942	-2.617*	-1.799***	-0.360**	0.328	-0.703
	(1.699)	(0.553)	(2.115)	(2.034)	(0.941)	(0.345)	(1.206)	(1.400)	(0.420)	(0.140)	(0.475)	(0.538)
2016 Dummy	-1.675	2.160***	2.573	3.902*	-0.814	0.891**	-1.540	0.186	-1.209***	-0.0884	-0.0506	0.212
	(1.699)	(0.553)	(2.115)	(2.034)	(0.944)	(0.345)	(1.201)	(1.400)	(0.417)	(0.140)	(0.456)	(0.536)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	78.38***	101.4***	56.50***	114.3***	39.81***	46.60***	26.15***	62.53***	10.53***	9.061***	6.327***	14.49***
	(2.677)	(0.874)	(3.049)	(3.216)	(1.471)	(0.546)	(1.700)	(2.218)	(0.653)	(0.221)	(0.556)	(0.820)
Observations	555	561	504	561	539	561	469	560	484	561	218	495
R-squared	0.421	0.445	0.110	0.186	0.628	0.636	0.140	0.315	0.351	0.319	0.149	0.049
Number of States	51	51	49	51	51	51	46	51	49	51	31	49
Adjusted R-squared	0.320	0.350	-0.0578	0.0467	0.561	0.574	-0.0289	0.197	0.239	0.202	-0.106	-0.113

Standard errors in parentheses. Full reression results available upon request.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5.4: Fertility Regression Results with Fixed Effects and Selected State-Specific Trends

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Variable	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
State Mandate in Effect	-6.309	1.256	0.971	-0.0790	1.214	-2.874*	-2.927	-0.527	-1.443	-1.232*	0.291	-0.441
	(3.890)	(1.117)	(6.792)	(1.608)	(5.368)	(1.631)	(4.088)	(1.446)	(2.422)	(0.654)	(0.885)	(0.274)
ACA Mandate in Effect	-54.25***	-20.40***	-71.11***	-28.62***	-25.07***	-13.93***	-4.914***	5.001***	2.363**	4.594***	2.497***	1.535***
	(1.719)	(0.491)	(2.984)	(0.706)	(2.358)	(0.717)	(1.796)	(0.635)	(1.064)	(0.287)	(0.410)	(0.120)
State Mandate * ACA Mandate	5.545***	3.212***	1.143	0.479	-4.322**	-2.588***	-0.00323	-2.770***	-1.581*	0.457**	-0.604*	0.215**
	(1.333)	(0.380)	(2.314)	(0.548)	(1.828)	(0.556)	(1.393)	(0.492)	(0.826)	(0.223)	(0.315)	(0.0934)
2008 Dummy	-6.255***	-0.530	-10.12***	-1.888***	-6.776***	-2.171***	-3.271**	-0.366	-1.199	-0.792***	0.170	0.187*
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.941)	(0.253)	(0.365)	(0.106)
2009 Dummy	-15.80***	-2.137***	-27.32***	-5.927***	-14.03***	-5.165***	-7.645***	-1.362**	-2.496***	-1.312***	0.333	0.402***
	(1.516)	(0.432)	(2.628)	(0.622)	(2.077)	(0.631)	(1.582)	(0.559)	(0.942)	(0.253)	(0.366)	(0.106)
2010 Dummy	-24.82***	-5.145***	-43.29***	-10.21***	-24.95***	-6.883***	-10.73***	-0.961*	-2.313**	-1.358***	-0.220	0.643***
	(1.526)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.367)	(0.107)
2011 Dummy	-32.55***	-7.341***	-53.24***	-13.90***	-28.11***	-7.221***	-12.35***	-1.118**	-2.737***	0.0417	-0.0756	0.719***
	(1.526)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.368)	(0.107)
2012 Dummy	-35.56***	-8.928***	-58.53***	-16.30***	-29.00***	-7.782***	-13.31***	-0.0634	-3.199***	1.269***	0.307	0.773***
	(1.522)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.369)	(0.107)
2013 Dummy	9.945***	6.883***	6.976***	9.964***	-1.312	7.637***	-8.242***	-2.541***	-4.541***	-2.583***	-1.658***	-0.903***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.356)	(0.106)
2014 Dummy	6.441***	4.765***	5.376**	8.217***	-0.0867	7.866***	-5.351***	0.337	-1.882**	-1.422***	-1.320***	-0.769***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.357)	(0.106)
2015 Dummy	4.843***	3.115***	4.703*	5.928***	3.413	6.244***	-1.770	0.893	-1.021	-0.0767	-0.985***	-0.557***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.352)	(0.106)
2016 Dummy	2.836*	1.295***	3.173	2.713***	4.482**	3.843***	1.042	2.010***	0.804	0.377	0.0215	-0.238**
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.353)	(0.106)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	87.28***	34.22***	174.1***	96.42***	150.1***	118.0***	108.8***	96.27***	56.36***	44.21***	13.72***	8.537***
	(2.355)	(0.682)	(4.149)	(0.982)	(3.279)	(0.996)	(2.497)	(0.883)	(1.476)	(0.400)	(0.538)	(0.167)
Observations	552	561	561	561	561	561	561	561	559	561	499	561
R-squared	0.858	0.911	0.794	0.911	0.517	0.696	0.309	0.525	0.208	0.821	0.217	0.531
Number of States	51	51	51	51	51	51	51	51	51	51	48	51
Adjusted R-squared	0.834	0.896	0.759	0.896	0.434	0.644	0.190	0.443	0.0720	0.791	0.0915	0.451

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 6.1: Fertility Analysis Effect Coding Method Comparison

Panel 1: Estimated Coefficient Results

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Effect Coding Method	**ACA Only**	**All Variables**	**Black/AA**	**White**	**AIAN**	**API**	**Hisp**	**Non-Hisp**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**
2013=0.35	-5.923***	-4.081***	-8.272***	-7.554***	-17.47***	-8.979***	-27.08***	-4.914***	-22.61***	-28.15***	-14.49***	7.887***	8.704***	2.591***
	(0.382)	(0.430)	(0.472)	(0.432)	(1.087)	(0.817)	(1.193)	(0.243)	(0.646)	(0.850)	(0.717)	(0.527)	(0.251)	(0.0909)
2013=0.5	-5.923***	-4.061***	-8.300***	-7.527***	-17.56***	-8.999***	-27.15***	-4.917***	-22.60***	-28.14***	-14.46***	7.899***	8.700***	2.597***
	(0.382)	(0.428)	(0.471)	(0.431)	(1.084)	(0.816)	(1.193)	(0.243)	(0.645)	(0.847)	(0.714)	(0.524)	(0.250)	(0.0908)
2013=1	-5.923***	-4.189***	-8.255***	-7.678***	-17.39***	-8.745***	-27.67***	-4.927***	-22.62***	-28.38***	-14.75***	7.635***	8.695***	2.638***
	(0.382)	(0.420)	(0.463)	(0.423)	(1.060)	(0.790)	(1.160)	(0.239)	(0.633)	(0.832)	(0.701)	(0.516)	(0.246)	(0.0895)
2013=0	-5.923***	-4.236***	-8.142***	-7.744***	-17.04***	-8.757***	-27.13***	-4.908***	-22.66***	-28.37***	-14.77***	7.678***	8.717***	2.594***
	(0.382)	(0.432)	(0.470)	(0.432)	(1.083)	(0.806)	(1.176)	(0.241)	(0.644)	(0.851)	(0.722)	(0.531)	(0.250)	(0.0906)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel 2: Test for Correct Sign of Estimated Coefficient

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Effect Coding Method	**ACA Only**	**All Variables**	**Black/AA**	**White**	**AIAN**	**API**	**Hisp**	**Non-Hisp**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**
2013=0.35	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
2013=0.5	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
2013=1	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
2013=0	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			

Panel 3: Ratios of Estimated Coefficients

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Ratio	**ACA Only**	**All Variables**	**Black/AA**	**White**	**AIAN**	**API**	**Hisp**	**Non-Hisp**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**
(2013=0.35)/(2013=1)	1.000	0.976	1.002	0.984	1.006	1.026	0.978	0.998	1.000	0.993	0.980	1.033	1.001	0.982
(2013=0.35)/(2013=0.5)	1.000	1.005	0.996	1.004	0.994	0.998	0.996	1.000	1.000	1.000	1.000	0.998	1.000	0.998
(2013=0.35)/(2013=0)	1.000	0.965	1.016	0.975	1.024	1.025	0.996	1.002	1.000	0.993	0.980	1.027	0.999	0.999

Appendix Table 6.2: Fertility Analysis Effect Coding Method Comparison

Panel 1: Estimated Coefficient Results

	By Age Group and Race											
	15-19				20-24				25-29			
Effect Coding Method	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**
2013=0.35	-36.73***	-19.64***	-32.82***	-10.29***	-38.28***	-31.64***	-50.37***	-19.71***	-7.812***	-18.75***	-20.32***	-17.18***
	(0.613)	(0.672)	(1.736)	(0.837)	(0.919)	(0.830)	(2.632)	(1.268)	(1.102)	(0.725)	(2.126)	(1.482)
2013=0.5	-36.79***	-19.62***	-32.99***	-10.33***	-38.33***	-31.61***	-50.66***	-19.67***	-7.825***	-18.71***	-20.41***	-17.22***
	(0.610)	(0.672)	(1.729)	(0.836)	(0.919)	(0.829)	(2.621)	(1.267)	(1.102)	(0.723)	(2.125)	(1.481)
2013=1	-36.60***	-19.73***	-32.68***	-10.18***	-38.43***	-31.89***	-50.19***	-19.33***	-7.973***	-18.94***	-20.51***	-17.29***
	(0.600)	(0.659)	(1.688)	(0.808)	(0.904)	(0.816)	(2.557)	(1.229)	(1.084)	(0.711)	(2.078)	(1.432)
2013=0	-36.39***	-19.80***	-31.99***	-10.05***	-38.15***	-31.91***	-48.98***	-19.68***	-7.844***	-19.05***	-20.02***	-17.08***
	(0.619)	(0.668)	(1.738)	(0.826)	(0.913)	(0.827)	(2.636)	(1.249)	(1.094)	(0.725)	(2.106)	(1.459)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel 2: Test for Correct Sign of Estimated Coefficient

	By Age Group and Race											
	15-19				20-24				25-29			
Effect Coding Method	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**
2013=0.35	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=0.5	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=1	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2013=0	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel 3: Ratios of Estimated Coefficients

	By Age Group and Race											
	15-19				20-24				25-29			
Ratio	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**	**Black/AA**	**White**	**AIAN**	**API**
(2013=0.35)/(2013=1)	1.003	0.995	1.006	1.010	0.995	0.994	1.004	1.021	0.980	0.989	0.990	0.994
(2013=0.35)/(2013=0.5)	1.000	1.000	0.997	0.990	0.997	1.000	0.994	1.005	0.999	1.000	0.995	0.994
(2013=0.35)/(2013=0)	1.011	0.990	1.028	1.020	1.003	0.991	1.029	1.005	0.996	0.984	1.015	1.006

Appendix Table 6.3: Fertility Analysis Effect Coding Method Comparison

Panel 1: Estimated Coefficient Results

	By Age Group and Race											
	30-34				35-39				40-44			
Effect Coding Method	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
2013=0.35	11.70***	1.087**	-1.845	-4.511***	10.62***	3.680***	-0.248	1.056	3.246***	1.419***	0.715	1.134***
	(0.856)	(0.537)	(1.685)	(1.476)	(0.460)	(0.235)	(0.988)	(1.113)	(0.192)	(0.0930)	(0.467)	(0.406)
2013=0.5	11.70***	1.111**	-1.901	-4.539***	10.61***	3.681***	-0.182	0.974	3.248***	1.430***	0.708	1.125***
	(0.856)	(0.535)	(1.684)	(1.474)	(0.459)	(0.235)	(0.988)	(1.111)	(0.192)	(0.0931)	(0.467)	(0.405)
2013=1	11.58***	0.819	-2.176	-4.489***	10.62***	3.653***	0.122	1.197	3.283***	1.478***	0.675	1.238***
	(0.842)	(0.529)	(1.649)	(1.426)	(0.451)	(0.231)	(0.968)	(1.073)	(0.189)	(0.0918)	(0.457)	(0.392)
2013=0	11.67***	0.828	-1.787	-4.376***	10.67***	3.659***	-0.328	1.500	3.260***	1.408***	0.726	1.234***
	(0.850)	(0.539)	(1.667)	(1.453)	(0.456)	(0.234)	(0.976)	(1.100)	(0.190)	(0.0920)	(0.460)	(0.400)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel 2: Test for Correct Sign of Estimated Coefficient

	By Age Group and Race											
	30-34				35-39				40-44			
Effect Coding Method	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
2013=0.35			YES	YES			YES					
2013=0.5			YES	YES			YES					
2013=1			YES	YES								
2013=0			YES	YES			YES					

Panel 3: Ratios of Estimated Coefficients

	By Age Group and Race											
	30-34				35-39				40-44			
Ratio	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
(2013=0.35)/(2013=1)	1.010	1.327	0.848	1.007	1.000	1.007	-1.967	0.882	0.989	0.960	1.059	0.916
(2013=0.35)/(2013=0.5)	1.000	0.978	0.968	0.996	1.001	1.000	1.333	1.084	0.999	0.992	1.010	1.008
(2013=0.35)/(2013=0)	1.003	1.313	1.034	1.032	0.995	1.006	0.750	0.704	0.996	1.008	0.985	0.919

Appendix Table 6.4: Fertility Analysis Effect Coding Method Comparison

Panel 1: Estimated Coefficient Results

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Effect Coding Method	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
2013=0.35	-44.79***	-20.06***	-66.15***	-27.20***	-30.14***	-13.76***	-8.156***	4.589***	0.363	5.267***	1.822***	1.644***
	(1.445)	(0.476)	(2.205)	(0.545)	(1.775)	(0.605)	(1.158)	(0.567)	(0.666)	(0.251)	(0.257)	(0.0915)
2013=0.5	-44.86***	-20.08***	-66.22***	-27.24***	-30.27***	-13.75***	-8.272***	4.601***	0.356	5.253***	1.817***	1.651***
	(1.444)	(0.475)	(2.204)	(0.545)	(1.775)	(0.605)	(1.159)	(0.566)	(0.666)	(0.251)	(0.257)	(0.0915)
2013=1	-45.33***	-19.93***	-66.96***	-27.34***	-31.39***	-13.92***	-8.998***	4.396***	0.257	5.240***	1.745***	1.697***
	(1.400)	(0.468)	(2.139)	(0.536)	(1.732)	(0.596)	(1.130)	(0.558)	(0.646)	(0.246)	(0.250)	(0.0905)
2013=0	-44.78***	-19.90***	-66.30***	-27.13***	-30.30***	-13.88***	-8.129***	4.426***	0.334	5.313***	1.799***	1.643***
	(1.422)	(0.475)	(2.173)	(0.541)	(1.748)	(0.602)	(1.140)	(0.565)	(0.657)	(0.249)	(0.254)	(0.0906)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel 2: Test for Correct Sign of Estimated Coefficient

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Effect Coding Method	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
2013=0.35	YES	YES	YES	YES	YES	YES	YES					
2013=0.5	YES	YES	YES	YES	YES	YES	YES					
2013=1	YES	YES	YES	YES	YES	YES	YES					
2013=0	YES	YES	YES	YES	YES	YES	YES					

Panel 3: Ratios of Estimated Coefficients

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Ratio	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
(2013=0.35)/(2013=1)	0.987	1.005	0.988	0.996	0.962	0.986	0.907	1.044	1.412	1.005	1.044	0.969
(2013=0.35)/(2013=0.5)	0.998	1.000	0.998	1.000	0.997	1.000	0.985	0.997	1.020	1.003	1.003	0.996
(2013=0.35)/(2013=0)	1.000	1.005	0.997	1.004	0.993	0.993	1.004	1.037	1.087	0.991	1.013	1.001

Appendix Table 7.1: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends and Effect Coding of 2013=0.35

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Variable	**ACA Only**	**All Variables**	**Black/AA**	**White**	**AIAN**	**API**	**Hisp**	**Non-Hisp**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**
State Mandate in Effect		0.410	1.207	-1.236	-2.168	-0.897	-1.771	-0.358	0.898	1.135	-1.296*	1.222**	-0.288	-0.0191
		(0.438)	(1.864)	(0.910)	(3.299)	(2.512)	(3.512)	(0.666)	(0.649)	(0.883)	(0.737)	(0.604)	(0.299)	(0.124)
ACA Mandate in Effect	-4.234***	-3.451***	-6.325***	-7.610***	-16.87***	-5.949***	-31.48***	-5.663***	-21.67***	-28.01***	-13.52***	8.563***	8.555***	2.552***
	(0.397)	(0.439)	(0.819)	(0.400)	(1.460)	(1.104)	(1.543)	(0.293)	(0.651)	(0.885)	(0.739)	(0.606)	(0.300)	(0.125)
State Mandate * ACA Mandate		-1.401***	0.567	-1.023***	4.294***	-0.320	1.727	0.377*	1.012**	-2.146***	-3.902***	-4.044***	-0.140	0.122
		(0.315)	(0.635)	(0.310)	(1.127)	(0.856)	(1.196)	(0.227)	(0.468)	(0.636)	(0.531)	(0.435)	(0.216)	(0.0895)
2008 Dummy	3.063***	3.005***	-0.948	-0.764**	-2.225*	-1.360	-5.579***	-0.384	0.0169	0.847	-0.869	3.884***	3.284***	1.004***
	(0.397)	(0.397)	(0.720)	(0.352)	(1.287)	(0.971)	(1.357)	(0.257)	(0.589)	(0.801)	(0.669)	(0.548)	(0.272)	(0.113)
2009 Dummy	1.279***	1.212***	-3.206***	-2.620***	-4.245***	-2.752***	-13.12***	-1.516***	-2.200***	-4.505***	-4.657***	2.106***	2.610***	1.216***
	(0.397)	(0.399)	(0.721)	(0.352)	(1.283)	(0.972)	(1.359)	(0.258)	(0.591)	(0.804)	(0.671)	(0.550)	(0.273)	(0.113)
2010 Dummy	-0.581	-0.656	-4.327***	-4.303***	-7.377***	-4.788***	-20.03***	-2.650***	-5.974***	-10.14***	-7.578***	1.792***	2.470***	1.416***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2011 Dummy	-1.334***	-1.409***	-6.449***	-5.077***	-8.901***	-3.753***	-24.64***	-3.008***	-8.721***	-14.51***	-8.329***	1.550***	3.708***	1.512***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2012 Dummy	-1.581***	-1.656***	-7.661***	-5.392***	-8.495***	-2.466**	-26.75***	-3.076***	-10.51***	-17.18***	-8.938***	2.396***	4.812***	1.611***
	(0.397)	(0.400)	(0.724)	(0.354)	(1.289)	(0.976)	(1.364)	(0.259)	(0.594)	(0.807)	(0.674)	(0.552)	(0.274)	(0.114)
2013 Dummy	2.220***	2.220***	-1.513**	2.605***	5.350***	1.215	1.327	2.173***	7.582***	9.712***	6.848***	-3.019***	-2.732***	-1.022***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2014 Dummy	2.540***	2.540***	-1.792**	3.209***	3.471***	1.399	1.674	2.585***	5.225***	7.993***	7.071***	-0.173	-1.480***	-0.886***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2015 Dummy	2.307***	2.307***	-1.957***	3.153***	2.465*	-0.444	2.226	2.245***	3.433***	5.835***	5.997***	0.722	-0.110	-0.602***
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2016 Dummy	1.671***	1.671***	-0.492	1.896***	0.602	2.637***	2.281*	1.610***	1.501**	2.644***	3.858***	1.876***	0.476*	-0.171
	(0.397)	(0.392)	(0.720)	(0.352)	(1.274)	(0.971)	(1.357)	(0.257)	(0.582)	(0.791)	(0.660)	(0.541)	(0.268)	(0.111)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	65.10***	64.93***	75.25***	68.84***	58.36***	67.35***	106.1***	64.60***	39.44***	102.4***	121.1***	92.80***	40.91***	7.905***
	(0.275)	(0.326)	(1.139)	(0.556)	(2.023)	(1.535)	(2.145)	(0.407)	(0.484)	(0.658)	(0.549)	(0.450)	(0.223)	(0.0925)
Observations	765	765	561	561	559	561	561	561	765	765	765	765	765	765
R-squared	0.655	0.665	0.526	0.714	0.383	0.320	0.727	0.695	0.891	0.905	0.787	0.579	0.815	0.692
Number of States	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Adjusted R-squared	0.608	0.618	0.445	0.664	0.276	0.203	0.680	0.643	0.875	0.892	0.757	0.520	0.789	0.649

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 7.2: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends and Effect Coding of 2013=0.35

	By Age Group and Race											
	15-19				20-24				25-29			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	-5.247**	-1.046	-9.832**	-6.045***	-2.653	-1.128	-2.457	-4.685	8.338*	-3.534**	1.685	2.724
	(2.480)	(1.384)	(4.315)	(1.900)	(4.576)	(1.900)	(6.977)	(4.026)	(5.019)	(1.606)	(6.328)	(5.584)
ACA Mandate in Effect	-35.04***	-19.42***	-31.02***	-10.80***	-36.63***	-31.27***	-49.71***	-17.79***	-1.995	-17.83***	-23.75***	-14.79***
	(1.097)	(0.608)	(2.044)	(0.909)	(2.010)	(0.835)	(3.195)	(1.769)	(2.205)	(0.705)	(2.889)	(2.453)
State Mandate * ACA Mandate	5.505***	-0.276	6.706***	2.670***	2.034	-2.049***	10.84***	1.020	-5.954***	-3.071***	1.187	-1.546
	(0.851)	(0.471)	(1.591)	(0.707)	(1.559)	(0.647)	(2.482)	(1.371)	(1.710)	(0.547)	(2.243)	(1.902)
2008 Dummy	-2.089**	-0.855	-2.320	-0.655	-3.416*	-2.951***	-2.890	-1.954	0.112	-2.856***	-6.616**	-3.120
	(0.958)	(0.535)	(1.771)	(0.783)	(1.768)	(0.734)	(2.836)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2009 Dummy	-5.656***	-2.946***	-6.392***	-1.791**	-7.690***	-8.536***	-10.31***	-5.933***	-4.770**	-6.887***	-7.566***	-4.426**
	(0.965)	(0.535)	(1.774)	(0.780)	(1.770)	(0.735)	(2.841)	(1.557)	(1.942)	(0.621)	(2.567)	(2.160)
2010 Dummy	-11.55***	-6.329***	-8.710***	-3.662***	-13.13***	-13.93***	-16.92***	-8.875***	-5.236***	-9.431***	-16.02***	-8.621***
	(0.963)	(0.538)	(1.795)	(0.802)	(1.778)	(0.738)	(2.854)	(1.564)	(1.950)	(0.624)	(2.569)	(2.169)
2011 Dummy	-14.83***	-8.866***	-12.96***	-4.416***	-22.97***	-18.41***	-23.31***	-9.339***	-7.077***	-10.57***	-14.28***	-4.036*
	(0.963)	(0.538)	(1.821)	(0.803)	(1.778)	(0.738)	(2.854)	(1.564)	(1.950)	(0.624)	(2.560)	(2.169)
2012 Dummy	-17.46***	-10.28***	-12.66***	-5.291***	-28.37***	-20.95***	-28.05***	-9.289***	-6.076***	-11.43***	-13.76***	-4.845**
	(0.969)	(0.538)	(1.808)	(0.808)	(1.778)	(0.738)	(2.846)	(1.564)	(1.950)	(0.624)	(2.569)	(2.169)
2013 Dummy	9.080***	6.884***	10.34***	2.740***	4.534**	9.280***	12.71***	5.896***	1.347	8.177***	10.44***	7.447***
	(0.974)	(0.535)	(1.830)	(0.806)	(1.768)	(0.734)	(2.836)	(1.555)	(1.939)	(0.620)	(2.554)	(2.157)
2014 Dummy	6.450***	5.110***	6.994***	2.262***	1.932	8.294***	7.388***	2.502	0.247	8.499***	9.711***	8.325***
	(0.969)	(0.535)	(1.856)	(0.810)	(1.768)	(0.734)	(2.854)	(1.555)	(1.939)	(0.620)	(2.580)	(2.157)
2015 Dummy	2.999***	3.483***	5.207***	1.146	0.474	6.302***	4.922*	0.657	-2.424	7.812***	5.773**	2.353
	(0.974)	(0.535)	(1.857)	(0.821)	(1.768)	(0.734)	(2.828)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2016 Dummy	1.041	1.467***	1.510	1.307	-0.689	2.764***	0.816	2.730*	1.257	4.221***	3.030	7.391***
	(0.979)	(0.535)	(1.840)	(0.826)	(1.768)	(0.734)	(2.854)	(1.555)	(1.939)	(0.620)	(2.563)	(2.157)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	62.65***	37.16***	56.76***	22.79***	135.6***	102.7***	115.3***	61.49***	111.1***	125.5***	94.79***	107.4***
	(1.506)	(0.845)	(2.509)	(1.143)	(2.795)	(1.160)	(4.132)	(2.459)	(3.066)	(0.981)	(3.770)	(3.411)
Observations	553	561	474	466	561	561	508	561	561	561	513	561
R-squared	0.865	0.877	0.612	0.491	0.731	0.905	0.613	0.409	0.327	0.786	0.259	0.248
Number of States	51	51	46	47	51	51	49	51	51	51	50	51
Adjusted R-squared	0.841	0.856	0.537	0.399	0.684	0.888	0.541	0.308	0.212	0.749	0.120	0.120

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 7.3: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends and Effect Coding of 2013=0.35

	By Age Group and Race											
	30-34				35-39				40-44			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	4.460	-0.413	2.371	0.503	0.887	-1.047	1.044	-2.081	-0.438	-0.328	0.857	0.0744
	(4.375)	(1.430)	(5.144)	(5.265)	(2.396)	(0.894)	(2.884)	(3.625)	(1.032)	(0.362)	(0.786)	(1.322)
ACA Mandate in Effect	16.66***	1.688***	-4.353*	5.993***	12.65***	2.583***	0.191	4.811***	4.084***	1.043***	0.611	0.624
	(1.942)	(0.628)	(2.365)	(2.313)	(1.084)	(0.393)	(1.389)	(1.593)	(0.485)	(0.159)	(0.561)	(0.615)
State Mandate * ACA Mandate	-2.133	-3.081***	0.976	-1.588	-0.108	0.598*	1.637	0.744	0.121	0.453***	-0.0211	0.351
	(1.499)	(0.487)	(1.840)	(1.793)	(0.837)	(0.305)	(1.067)	(1.236)	(0.382)	(0.123)	(0.459)	(0.476)
2008 Dummy	0.310	-0.677	1.282	0.103	0.445	-0.803**	-0.789	0.0589	0.0645	0.125	-0.0344	0.0355
	(1.717)	(0.553)	(2.104)	(2.034)	(0.955)	(0.345)	(1.247)	(1.408)	(0.427)	(0.140)	(0.496)	(0.545)
2009 Dummy	-1.567	-2.443***	-0.181	-1.349	0.897	-1.875***	-1.854	-0.0398	0.927**	0.353**	0.278	0.497
	(1.719)	(0.553)	(2.094)	(2.037)	(0.951)	(0.346)	(1.242)	(1.402)	(0.431)	(0.140)	(0.495)	(0.549)
2010 Dummy	2.013	-2.934***	-3.644*	-0.796	0.838	-1.971***	-1.985	-2.517*	0.687	0.521***	-0.0513	0.508
	(1.709)	(0.556)	(2.104)	(2.045)	(0.955)	(0.347)	(1.248)	(1.408)	(0.430)	(0.141)	(0.510)	(0.552)
2011 Dummy	1.417	-3.171***	-6.281***	0.650	3.275***	-0.773**	-1.563	-0.682	0.996**	0.619***	0.488	0.822
	(1.709)	(0.556)	(2.104)	(2.045)	(0.961)	(0.347)	(1.248)	(1.408)	(0.430)	(0.141)	(0.491)	(0.547)
2012 Dummy	1.249	-2.757***	-3.319	3.657*	2.655***	0.0995	-1.515	3.261**	1.244***	0.631***	0.281	1.390**
	(1.709)	(0.556)	(2.117)	(2.045)	(0.955)	(0.347)	(1.244)	(1.408)	(0.430)	(0.141)	(0.500)	(0.547)
2013 Dummy	-9.921***	-1.724***	1.426	-4.914**	-7.643***	-1.788***	-0.903	-4.981***	-2.322***	-0.815***	-0.264	0.219
	(1.699)	(0.553)	(2.104)	(2.034)	(0.944)	(0.345)	(1.206)	(1.400)	(0.423)	(0.140)	(0.463)	(0.536)
2014 Dummy	-8.482***	1.062*	4.463**	-0.683	-4.763***	-0.466	0.356	-4.529***	-2.563***	-0.688***	-0.233	-0.487
	(1.699)	(0.553)	(2.104)	(2.034)	(0.941)	(0.345)	(1.205)	(1.400)	(0.420)	(0.140)	(0.457)	(0.534)
2015 Dummy	-5.810***	2.079***	2.364	-3.330	-3.451***	0.918***	-0.942	-2.617*	-1.799***	-0.360**	0.328	-0.703
	(1.699)	(0.553)	(2.115)	(2.034)	(0.941)	(0.345)	(1.206)	(1.400)	(0.420)	(0.140)	(0.475)	(0.538)
2016 Dummy	-1.675	2.160***	2.573	3.902*	-0.814	0.891**	-1.540	0.186	-1.209***	-0.0884	-0.0506	0.212
	(1.699)	(0.553)	(2.115)	(2.034)	(0.944)	(0.345)	(1.201)	(1.400)	(0.417)	(0.140)	(0.456)	(0.536)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	78.38***	101.4***	56.50***	114.3***	39.81***	46.60***	26.15***	62.53***	10.53***	9.061***	6.327***	14.49***
	(2.677)	(0.874)	(3.049)	(3.216)	(1.471)	(0.546)	(1.700)	(2.218)	(0.653)	(0.221)	(0.556)	(0.820)
Observations	555	561	504	561	539	561	469	560	484	561	218	495
R-squared	0.421	0.445	0.110	0.186	0.628	0.636	0.140	0.315	0.351	0.319	0.149	0.049
Number of States	51	51	49	51	51	51	46	51	49	51	31	49
Adjusted R-squared	0.320	0.350	-0.0578	0.0467	0.561	0.574	-0.0289	0.197	0.239	0.202	-0.106	-0.113

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 7.4: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends and Effect Coding of 2013=0.35

	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Variable	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
State Mandate in Effect	-6.309	1.256	0.971	-0.0790	1.214	-2.874*	-2.927	-0.527	-1.443	-1.232*	0.291	-0.441
	(3.890)	(1.117)	(6.792)	(1.608)	(5.368)	(1.631)	(4.088)	(1.446)	(2.422)	(0.654)	(0.885)	(0.274)
ACA Mandate in Effect	-54.25***	-20.40***	-71.11***	-28.62***	-25.07***	-13.93***	-4.914***	5.001***	2.363**	4.594***	2.497***	1.535***
	(1.719)	(0.491)	(2.984)	(0.706)	(2.358)	(0.717)	(1.796)	(0.635)	(1.064)	(0.287)	(0.410)	(0.120)
State Mandate * ACA Mandate	5.545***	3.212***	1.143	0.479	-4.322**	-2.588***	-0.00323	-2.770***	-1.581*	0.457**	-0.604*	0.215**
	(1.333)	(0.380)	(2.314)	(0.548)	(1.828)	(0.556)	(1.393)	(0.492)	(0.826)	(0.223)	(0.315)	(0.0934)
2008 Dummy	-6.255***	-0.530	-10.12***	-1.888***	-6.776***	-2.171***	-3.271**	-0.366	-1.199	-0.792***	0.170	0.187*
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.941)	(0.253)	(0.365)	(0.106)
2009 Dummy	-15.80***	-2.137***	-27.32***	-5.927***	-14.03***	-5.165***	-7.645***	-1.362**	-2.496***	-1.312***	0.333	0.402***
	(1.516)	(0.432)	(2.628)	(0.622)	(2.077)	(0.631)	(1.582)	(0.559)	(0.942)	(0.253)	(0.366)	(0.106)
2010 Dummy	-24.82***	-5.145***	-43.29***	-10.21***	-24.95***	-6.883***	-10.73***	-0.961*	-2.313**	-1.358***	-0.220	0.643***
	(1.526)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.367)	(0.107)
2011 Dummy	-32.55***	-7.341***	-53.24***	-13.90***	-28.11***	-7.221***	-12.35***	-1.118**	-2.737***	0.0417	-0.0756	0.719***
	(1.526)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.368)	(0.107)
2012 Dummy	-35.56***	-8.928***	-58.53***	-16.30***	-29.00***	-7.782***	-13.31***	-0.0634	-3.199***	1.269***	0.307	0.773***
	(1.522)	(0.434)	(2.638)	(0.625)	(2.085)	(0.634)	(1.588)	(0.562)	(0.941)	(0.254)	(0.369)	(0.107)
2013 Dummy	9.945***	6.883***	6.976***	9.964***	-1.312	7.637***	-8.242***	-2.541***	-4.541***	-2.583***	-1.658***	-0.903***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.356)	(0.106)
2014 Dummy	6.441***	4.765***	5.376**	8.217***	-0.0867	7.866***	-5.351***	0.337	-1.882**	-1.422***	-1.320***	-0.769***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.357)	(0.106)
2015 Dummy	4.843***	3.115***	4.703*	5.928***	3.413	6.244***	-1.770	0.893	-1.021	-0.0767	-0.985***	-0.557***
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.352)	(0.106)
2016 Dummy	2.836*	1.295***	3.173	2.713***	4.482**	3.843***	1.042	2.010***	0.804	0.377	0.0215	-0.238**
	(1.518)	(0.431)	(2.624)	(0.621)	(2.074)	(0.630)	(1.579)	(0.559)	(0.935)	(0.253)	(0.353)	(0.106)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Constant	87.28***	34.22***	174.1***	96.42***	150.1***	118.0***	108.8***	96.27***	56.36***	44.21***	13.72***	8.537***
	(2.355)	(0.682)	(4.149)	(0.982)	(3.279)	(0.996)	(2.497)	(0.883)	(1.476)	(0.400)	(0.538)	(0.167)
Observations	552	561	561	561	561	561	561	561	559	561	499	561
R-squared	0.858	0.911	0.794	0.911	0.517	0.696	0.309	0.525	0.208	0.821	0.217	0.531
Number of States	51	51	51	51	51	51	51	51	51	51	48	51
Adjusted R-squared	0.834	0.896	0.759	0.896	0.434	0.644	0.190	0.443	0.0720	0.791	0.0915	0.451

Standard errors in parentheses. Full reression results available upon request.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 8.1: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding, and Demographic Variables

	All Data		By Race				By Ethnicity		By Age Group of Mother					
Variable	**ACA Only**	**All Variables**	**Black/AA**	**White**	**AIAN**	**API**	**Hisp**	**Non-Hisp**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**
State Mandate in Effect		-3.540**	-3.395	-3.978**	7.683	-0.277	-8.320**	-2.604	-5.140**	-7.095*	-0.757	0.851	-2.591	-1.472**
		(1.687)	(6.814)	(1.935)	(6.304)	(6.678)	(4.186)	(1.756)	(2.562)	(3.814)	(4.306)	(3.397)	(1.672)	(0.721)
ACA Mandate in Effect	-3.569***	-4.277***	-12.30***	-4.526***	-13.77***	1.792	-11.08***	0.324	-11.71***	-27.67***	-21.51***	8.783***	9.100***	0.505
	(1.355)	(1.316)	(3.041)	(1.599)	(5.118)	(4.157)	(4.164)	(1.269)	(1.899)	(2.820)	(3.478)	(2.596)	(1.270)	(0.571)
State Mandate * ACA Mandate		-0.844***	0.801*	-1.384***	2.871***	1.311*	-1.994***	-0.115	-0.0913	-2.033***	-1.161**	-1.485***	0.0336	0.142*
		(0.181)	(0.431)	(0.224)	(0.946)	(0.761)	(0.673)	(0.179)	(0.269)	(0.404)	(0.474)	(0.400)	(0.186)	(0.0799)
2011 Dummy	-0.0360	-0.253	-1.906***	-0.392	-1.530	0.562	-4.099***	0.675***	-1.228***	-5.731***	-2.515***	1.435***	2.003***	0.0319
	(0.258)	(0.252)	(0.611)	(0.314)	(1.091)	(0.859)	(0.793)	(0.254)	(0.373)	(0.560)	(0.665)	(0.517)	(0.252)	(0.109)
2012 Dummy	0.150	-0.300	-3.382***	-0.621	-2.638	2.547*	-6.071***	1.333***	-1.886***	-9.318***	-4.995***	2.758***	3.696***	0.0343
	(0.433)	(0.427)	(1.036)	(0.530)	(1.826)	(1.427)	(1.388)	(0.425)	(0.628)	(0.943)	(1.126)	(0.870)	(0.424)	(0.186)
2013 Dummy	0.848***	0.692**	-0.391	0.735**	0.610	-1.736*	-3.354***	1.412***	-0.340	-3.062***	-0.00423	1.112*	1.861***	-0.221*
	(0.286)	(0.278)	(0.683)	(0.347)	(1.124)	(1.026)	(0.892)	(0.281)	(0.410)	(0.627)	(0.730)	(0.578)	(0.286)	(0.119)
2014 Dummy	3.607***	4.075***	5.415***	4.690***	6.513***	-2.306	4.839**	2.051***	5.414***	12.56***	13.65***	-0.684	-2.097***	-0.590**
	(0.667)	(0.651)	(1.460)	(0.779)	(2.437)	(2.056)	(1.973)	(0.622)	(0.931)	(1.369)	(1.698)	(1.264)	(0.622)	(0.281)
2015 Dummy	2.711***	3.034***	3.087***	3.984***	5.380***	-4.367***	4.621***	1.469***	3.224***	8.685***	10.55***	-0.0783	-1.213***	-0.365*
	(0.464)	(0.452)	(1.021)	(0.544)	(1.728)	(1.460)	(1.332)	(0.438)	(0.652)	(0.959)	(1.176)	(0.885)	(0.435)	(0.196)
2016 Dummy	1.856***	2.024***	2.219***	2.206***	3.587***	0.749	3.189***	1.140***	1.194***	4.085***	6.331***	1.637***	0.0310	-0.101
	(0.265)	(0.258)	(0.584)	(0.313)	(1.018)	(0.846)	(0.741)	(0.254)	(0.375)	(0.553)	(0.668)	(0.511)	(0.251)	(0.111)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate	-0.740***	-0.613***	-0.417	-0.708***	0.829*	0.984**	-0.807**	-0.392***	-0.787***	-0.379	-0.217	-0.568**	-0.202*	0.000140
	(0.112)	(0.112)	(0.263)	(0.139)	(0.499)	(0.419)	(0.369)	(0.112)	(0.164)	(0.249)	(0.293)	(0.232)	(0.114)	(0.0476)
Median Household Income	-0.000516***	-0.000456***	0.000413*	-0.000415***	-0.000178	-0.000797***	0.000266	-0.000379***	-0.000596***	-0.000275	-0.000351	-0.00102***	-0.000347***	-6.95e-06
	(8.60e-05)	(8.41e-05)	(0.000212)	(0.000103)	(0.000325)	(0.000265)	(0.000238)	(8.56e-05)	(0.000124)	(0.000187)	(0.000216)	(0.000171)	(8.26e-05)	(3.53e-05)
Percent with Medicaid	-0.141***	-0.107***	-0.0968	-0.136***	-0.0112	0.315***	-0.313***	-0.0147	-0.0347	0.0387	-0.525***	-0.258***	-0.0230	0.0142
	(0.0274)	(0.0273)	(0.0758)	(0.0337)	(0.117)	(0.0964)	(0.0886)	(0.0279)	(0.0407)	(0.0632)	(0.0720)	(0.0564)	(0.0283)	(0.0118)
Percent Married	0.773***	0.569**	-1.532**	0.255	3.221***	1.553*	-2.005***	0.841***	1.136***	0.0438	-0.337	1.293**	1.106***	0.0657
	(0.261)	(0.256)	(0.597)	(0.304)	(0.918)	(0.805)	(0.708)	(0.249)	(0.374)	(0.555)	(0.630)	(0.515)	(0.261)	(0.108)
Median Family Size	-0.818	-2.093	3.431	-4.207	-11.15	12.94*	1.107	-0.360	2.113	-3.268	2.152	-6.297	2.575	1.477
	(2.160)	(2.102)	(4.789)	(2.673)	(7.927)	(7.171)	(6.958)	(2.098)	(3.159)	(4.683)	(5.530)	(4.338)	(2.131)	(0.912)
Percent with High School Degree	0.735***	0.547***	0.454	0.432**	3.665***	1.179*	-0.234	0.198	-2.701***	2.415***	4.685***	2.202***	0.145	-0.131
	(0.191)	(0.188)	(0.433)	(0.206)	(0.812)	(0.707)	(0.621)	(0.166)	(0.288)	(0.389)	(0.497)	(0.365)	(0.169)	(0.0798)
Percent with College Degree	0.961***	1.222***	0.682	1.380***	1.657	-0.0691	-0.584	0.196	3.070***	1.515**	0.380	-0.445	0.175	0.198
	(0.308)	(0.302)	(0.682)	(0.386)	(1.166)	(1.011)	(1.019)	(0.301)	(0.453)	(0.673)	(0.783)	(0.621)	(0.307)	(0.130)
Percent with Employer-Based Health Insurance	-0.385***	-0.304***	0.518***	-0.547***	0.415	0.583***	-0.948***	0.0484	-0.759***	-0.358**	-0.187	0.355***	0.0819	-0.0380
	(0.0606)	(0.0607)	(0.157)	(0.0755)	(0.260)	(0.201)	(0.189)	(0.0620)	(0.0915)	(0.150)	(0.161)	(0.126)	(0.0672)	(0.0260)
Percent Non-Hispanic White	-0.173	-0.198							-0.0794	-0.498***	-1.548***	-0.850***	-0.134	-0.112***
	(0.155)	(0.152)							(0.128)	(0.166)	(0.238)	(0.210)	(0.0888)	(0.0279)
Percent of Babies Born to Unwed Mothers	0.00504	0.0104	0.0601	0.00672	0.0875	-0.0792	0.00682	-0.00717	0.0765**	0.0551	-0.000632	-0.0639	0.000690	-0.0151
	(0.0235)	(0.0227)	(0.0593)	(0.0279)	(0.0849)	(0.0845)	(0.0778)	(0.0226)	(0.0336)	(0.0509)	(0.0596)	(0.0473)	(0.0229)	(0.00972)
Constant	6.307	23.92	27.19	53.71**	-467.0***	-157.0**	270.3***	17.99	201.9***	-78.69*	-162.8***	-32.60	-10.90	18.73**
	(20.37)	(19.96)	(45.02)	(25.17)	(85.50)	(78.69)	(66.93)	(20.10)	(30.87)	(44.31)	(52.94)	(41.28)	(20.16)	(9.021)
Observations	408	408	408	408	408	408	408	408	408	408	408	408	408	408
R-squared	0.780	0.796	0.296	0.794	0.547	0.399	0.829	0.643	0.970	0.946	0.819	0.797	0.934	0.791
Number of States	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Adjusted R-squared	0.725	0.744	0.119	0.743	0.432	0.247	0.785	0.553	0.962	0.933	0.773	0.745	0.917	0.737

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 8.2: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding, and Demographic Variables

	By Age Group and Race											
	15-19				20-24				25-29			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	-4.402	-5.242*	-9.456	-10.66*	-29.04**	-7.127*	26.86*	0.223	4.050	-4.639	7.080	6.609
	(6.877)	(2.705)	(10.51)	(6.029)	(12.64)	(4.122)	(16.00)	(10.67)	(15.20)	(4.834)	(13.99)	(12.58)
ACA Mandate in Effect	-29.00***	-11.65***	-18.34**	-22.34***	-34.53***	-27.86***	-39.69***	-27.47***	-16.73**	-15.05***	-26.56**	-9.098
	(3.094)	(2.186)	(8.717)	(3.829)	(5.633)	(3.327)	(13.28)	(6.448)	(6.905)	(4.047)	(11.62)	(7.851)
State Mandate * ACA Mandate	2.836***	-1.131***	6.891***	1.804**	-0.173	-2.966***	9.916***	1.171	-0.380	-1.425**	-1.125	0.660
	(0.438)	(0.302)	(1.619)	(0.697)	(0.797)	(0.466)	(2.430)	(1.161)	(0.975)	(0.574)	(2.118)	(1.424)
2011 Dummy	-5.048***	-0.973**	-1.817	-3.468***	-7.729***	-6.120***	-6.827**	-4.384***	-1.999	-2.275***	-4.218*	2.110
	(0.621)	(0.426)	(1.847)	(0.785)	(1.132)	(0.654)	(2.808)	(1.335)	(1.387)	(0.801)	(2.471)	(1.632)
2012 Dummy	-9.058***	-1.512**	-1.862	-6.900***	-12.22***	-9.884***	-13.06***	-8.217***	-4.276*	-4.172***	-10.09**	3.241
	(1.053)	(0.720)	(3.103)	(1.298)	(1.917)	(1.103)	(4.716)	(2.212)	(2.353)	(1.351)	(4.156)	(2.716)
2013 Dummy	-4.881***	0.231	-0.325	-3.352***	-4.295***	-3.302***	-5.251*	-4.299***	1.277	-0.194	-1.891	-1.120
	(0.694)	(0.466)	(1.850)	(0.938)	(1.264)	(0.720)	(2.848)	(1.584)	(1.551)	(0.889)	(2.526)	(1.951)
2014 Dummy	7.925***	6.601***	5.735	6.279***	13.14***	13.21***	10.62*	7.895**	10.11***	10.83***	13.65**	4.986
	(1.491)	(1.067)	(4.128)	(1.926)	(2.709)	(1.621)	(6.303)	(3.191)	(3.308)	(1.966)	(5.501)	(3.859)
2015 Dummy	4.368***	4.189***	4.803	2.999**	8.342***	9.579***	8.715*	3.206	5.728**	9.944***	11.55***	-1.006
	(1.045)	(0.745)	(2.928)	(1.381)	(1.897)	(1.133)	(4.471)	(2.272)	(2.312)	(1.371)	(3.905)	(2.733)
2016 Dummy	1.874***	1.556***	2.976*	1.637**	3.768***	4.387***	4.927*	2.946**	4.519***	5.391***	8.104***	5.543***
	(0.598)	(0.428)	(1.716)	(0.800)	(1.085)	(0.652)	(2.622)	(1.323)	(1.320)	(0.788)	(2.289)	(1.584)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate	0.0822	-1.036***	0.820	0.648*	-1.125**	-0.303	2.802**	0.893	-0.392	-0.312	3.456***	0.496
	(0.266)	(0.187)	(0.833)	(0.383)	(0.485)	(0.288)	(1.275)	(0.645)	(0.598)	(0.356)	(1.133)	(0.799)
Median Household Income	0.000761***	-0.000928***	-0.000337	-0.000398	0.000727*	-0.000204	-0.000819	-0.000230	2.01e-05	0.000208	0.00102	-0.00128**
	(0.000217)	(0.000140)	(0.000549)	(0.000245)	(0.000395)	(0.000216)	(0.000837)	(0.000417)	(0.000479)	(0.000261)	(0.000729)	(0.000501)
Percent with Medicaid	0.205***	-0.147***	0.0103	0.296***	0.0831	0.00993	0.0348	0.443***	-0.357**	-0.583***	-0.0700	-0.126
	(0.0767)	(0.0458)	(0.201)	(0.0891)	(0.140)	(0.0703)	(0.301)	(0.149)	(0.171)	(0.0859)	(0.264)	(0.183)
Percent Married	-2.178***	1.414***	5.482***	-2.004***	-2.291**	-0.816	7.139***	-2.249*	-1.046	-1.151	1.603	1.760
	(0.609)	(0.414)	(1.535)	(0.754)	(1.106)	(0.635)	(2.342)	(1.260)	(1.350)	(0.773)	(2.050)	(1.520)
Median Family Size	15.54***	-0.973	-13.62	9.583	7.106	-6.255	-25.16	15.33	1.059	-8.771	-30.96*	5.673
	(4.931)	(3.676)	(13.27)	(6.815)	(8.835)	(5.559)	(20.36)	(11.04)	(10.74)	(6.693)	(17.78)	(13.30)
Percent with High School Degree	-1.737***	-2.122***	4.746***	1.624**	2.698***	2.362***	8.281***	2.305**	4.980***	2.020***	6.230***	5.340***
	(0.437)	(0.279)	(1.387)	(0.664)	(0.796)	(0.429)	(2.083)	(1.087)	(0.978)	(0.526)	(1.818)	(1.328)
Percent with College Degree	-0.215	4.433***	0.638	3.864***	-1.560	1.831**	4.391	3.221**	-0.268	-0.0111	2.602	0.413
	(0.697)	(0.531)	(1.986)	(0.947)	(1.265)	(0.806)	(3.024)	(1.573)	(1.547)	(0.975)	(2.641)	(1.904)
Percent with Employer-Based Health Insurance	0.0653	-1.061***	0.140	-0.206	0.0625	-0.346**	0.507	0.00707	1.654***	-0.637***	1.172**	-0.0200
	(0.161)	(0.102)	(0.444)	(0.186)	(0.292)	(0.157)	(0.663)	(0.312)	(0.355)	(0.193)	(0.580)	(0.377)
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers	0.155**	0.0580	0.0887	-0.00376	0.133	0.0311	0.193	-0.0311	0.100	-0.0228	0.149	-0.0763
	(0.0604)	(0.0376)	(0.140)	(0.0788)	(0.110)	(0.0581)	(0.215)	(0.130)	(0.134)	(0.0716)	(0.189)	(0.159)
Constant	214.0***	143.4***	-613.2***	-135.4*	5.947	-64.56	-1,053***	-183.1	-360.8***	66.90	-664.8***	-410.6***
	(46.19)	(34.67)	(146.1)	(77.63)	(83.02)	(52.37)	(220.2)	(121.7)	(101.3)	(63.21)	(193.0)	(146.0)
Observations	401	408	338	332	408	408	368	408	408	408	374	408
R-squared	0.963	0.956	0.718	0.517	0.862	0.929	0.681	0.446	0.339	0.796	0.279	0.561
Number of States	51	51	45	44	51	51	47	51	51	51	50	51
Adjusted R-squared	0.954	0.945	0.637	0.387	0.827	0.911	0.595	0.306	0.172	0.745	0.0784	0.450

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 8.3: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding, and Demographic Variables

	By Age Group and Race											
	30-34				35-39				40-44			
Variable	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API	Black/AA	White	AIAN	API
State Mandate in Effect	15.73	-0.776	12.79	6.640	-0.443	-2.228	1.998	0.890	-3.924	-1.436*		0.993
	(12.78)	(3.387)	(12.52)	(13.07)	(7.296)	(1.658)	(7.539)	(8.514)	(2.962)	(0.805)		(3.290)
ACA Mandate in Effect	-1.543	8.942***	11.71	21.48***	-1.584	9.486***	-5.893	21.13***	-1.691	1.285*	5.996*	2.794
	(5.773)	(2.853)	(10.51)	(8.186)	(3.225)	(1.388)	(6.429)	(5.382)	(1.283)	(0.665)	(3.066)	(2.084)
State Mandate * ACA Mandate	-1.314	-2.788***	-2.801	2.239	-0.113	-0.164	0.163	1.336	-0.0550	0.255***	0.643	0.302
	(0.821)	(0.404)	(1.911)	(1.489)	(0.460)	(0.195)	(1.169)	(0.991)	(0.183)	(0.0919)	(0.664)	(0.390)
2011 Dummy	-0.785	1.324**	1.025	3.865**	-0.528	2.163***	-0.397	3.087***	-0.517**	0.155	0.996	0.0418
	(1.162)	(0.565)	(2.232)	(1.692)	(0.647)	(0.273)	(1.359)	(1.108)	(0.257)	(0.130)	(0.639)	(0.429)
2012 Dummy	-1.632	2.155**	4.682	11.13***	-1.179	3.748***	-0.744	8.250***	-0.732*	0.173	1.720	0.933
	(1.971)	(0.952)	(3.754)	(2.817)	(1.099)	(0.461)	(2.289)	(1.845)	(0.437)	(0.219)	(1.095)	(0.714)
2013 Dummy	0.332	1.496**	3.084	-3.567*	-0.699	2.122***	2.194	-0.213	-0.186	-0.304**	0.0996	0.0674
	(1.303)	(0.626)	(2.283)	(2.018)	(0.725)	(0.302)	(1.386)	(1.323)	(0.288)	(0.143)	(0.644)	(0.515)
2014 Dummy	1.419	0.00852	0.235	-9.885**	0.733	-1.826***	4.154	-11.48***	0.378	-1.048***	-2.930**	-1.804*
	(2.766)	(1.388)	(4.995)	(4.027)	(1.546)	(0.677)	(3.060)	(2.658)	(0.614)	(0.325)	(1.453)	(1.033)
2015 Dummy	0.568	1.027	0.474	-11.83***	0.0863	-0.463	3.830*	-11.51***	0.304	-0.629***	-1.687	-1.641**
	(1.935)	(0.969)	(3.547)	(2.850)	(1.082)	(0.473)	(2.173)	(1.883)	(0.430)	(0.227)	(1.036)	(0.734)
2016 Dummy	1.962*	1.625***	1.755	0.217	1.070*	0.146	2.499**	-3.767***	0.310	-0.265**	-0.724	-0.521
	(1.105)	(0.557)	(2.078)	(1.649)	(0.618)	(0.272)	(1.267)	(1.089)	(0.246)	(0.130)	(0.602)	(0.424)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate	-0.153	-0.809***	0.434	0.697	0.247	-0.372***	-0.0524	1.667***	-0.101	-0.0228	-0.0598	0.364*
	(0.503)	(0.251)	(1.023)	(0.825)	(0.279)	(0.121)	(0.620)	(0.540)	(0.111)	(0.0570)	(0.306)	(0.210)
Median Household Income	0.000511	-0.000773***	-0.000782	-0.00274***	0.000646***	-0.000253***	0.000324	-0.00176***	0.000384***	-2.95e-05	-9.38e-05	3.26e-05
	(0.000401)	(0.000185)	(0.000664)	(0.000520)	(0.000224)	(8.95e-05)	(0.000406)	(0.000341)	(8.93e-05)	(4.27e-05)	(0.000212)	(0.000132)
Percent with Medicaid	-0.259*	-0.218***	-0.0813	-0.124	-0.152*	-0.0689**	0.202	0.530***	-0.000422	0.0105	-0.116	0.153***
	(0.144)	(0.0604)	(0.240)	(0.190)	(0.0811)	(0.0292)	(0.148)	(0.124)	(0.0325)	(0.0139)	(0.0721)	(0.0484)
Percent Married	-2.160*	0.463	4.511**	3.262**	-2.125***	0.773***	0.645	4.753***	-1.095***	-0.0390	0.792	0.395
	(1.131)	(0.546)	(1.876)	(1.579)	(0.633)	(0.264)	(1.154)	(1.037)	(0.252)	(0.126)	(0.540)	(0.402)
Median Family Size	-1.286	-12.41***	2.691	19.30	2.779	0.948	-2.529	17.19*	4.339**	0.610	1.393	1.995
	(9.044)	(4.760)	(16.46)	(13.98)	(5.099)	(2.334)	(10.28)	(9.355)	(2.038)	(1.113)	(5.006)	(3.678)
Percent with High School Degree	0.525	1.451***	0.435	2.619*	-0.0891	0.0661	1.772*	-1.032	-0.784***	-0.265***	-0.273	0.210
	(0.821)	(0.369)	(1.640)	(1.380)	(0.462)	(0.178)	(1.029)	(0.913)	(0.185)	(0.0847)	(0.566)	(0.361)
Percent with College Degree	1.331	-1.071	1.053	-0.422	1.488**	-0.279	0.586	0.977	0.620**	0.109	-0.878	-0.874*
	(1.292)	(0.689)	(2.379)	(1.981)	(0.722)	(0.335)	(1.449)	(1.308)	(0.288)	(0.160)	(0.702)	(0.507)
Percent with Employer-Based Health Insurance	1.371***	0.188	0.870*	0.364	0.476***	-0.196***	0.423	1.311***	0.0401	-0.0677**	-0.0337	0.152
	(0.297)	(0.136)	(0.526)	(0.394)	(0.166)	(0.0658)	(0.324)	(0.261)	(0.0660)	(0.0311)	(0.160)	(0.102)
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers	-0.00488	-0.0210	-0.0626	-0.334**	0.0168	0.0121	-0.0144	-0.0558	0.0196	-0.0126	0.104**	-0.0685
	(0.113)	(0.0504)	(0.174)	(0.166)	(0.0629)	(0.0243)	(0.107)	(0.110)	(0.0250)	(0.0115)	(0.0507)	(0.0430)
Constant	-9.208	62.86	-276.4	-187.4	37.92	35.84	-212.8*	-171.3*	79.44***	36.65***	12.78	-17.16
	(85.11)	(44.92)	(175.2)	(151.8)	(47.93)	(21.90)	(108.6)	(101.5)	(19.12)	(10.46)	(57.66)	(40.16)
Observations	407	408	367	408	394	408	344	408	356	408	164	364
R-squared	0.731	0.716	0.188	0.517	0.850	0.906	0.203	0.639	0.756	0.618	0.157	0.329
Number of States	51	51	49	51	51	51	45	51	49	51	31	49
Adjusted R-squared	0.663	0.644	-0.0395	0.396	0.811	0.882	-0.0243	0.548	0.691	0.522	-0.238	0.154

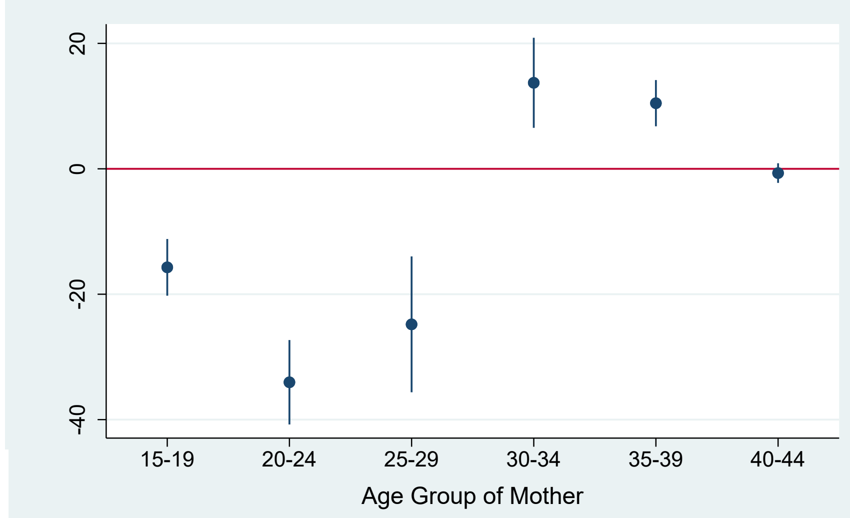
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 8.4: Fertility Regression Results with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding, and Demographic Variables

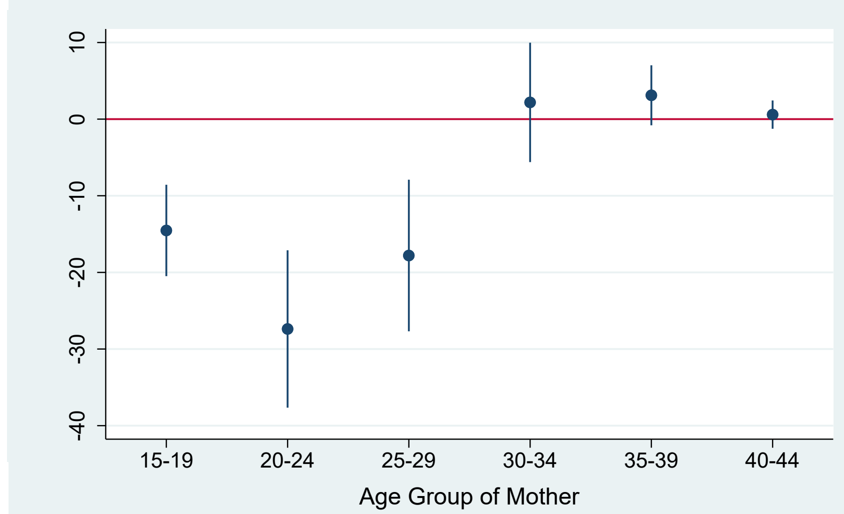
	By Age Group and Ethnicity											
	15-19		20-24		25-29		30-34		35-39		40-44	
Variable	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp	Hisp	Non-Hisp
State Mandate in Effect	-16.81***	-0.598	-12.09	-4.962	1.017	-3.711	-9.345	0.416	-6.012	-2.217	-1.331	-1.838**
	(5.277)	(2.462)	(7.582)	(4.035)	(8.350)	(4.821)	(6.409)	(4.045)	(3.719)	(2.112)	(1.561)	(0.817)
ACA Mandate in Effect	-18.61***	-7.865***	-40.89***	-19.38***	-30.22***	-6.877*	0.274	11.90***	8.038**	10.42***	0.587	1.525**
	(5.307)	(1.704)	(7.479)	(2.827)	(8.256)	(3.546)	(6.332)	(2.996)	(3.702)	(1.556)	(1.573)	(0.597)
State Mandate * ACA Mandate	-2.531***	1.247***	-4.040***	-1.107***	-3.358**	-0.905*	-1.177	-2.069***	0.355	0.0164	-0.305	0.245***
	(0.869)	(0.236)	(1.217)	(0.398)	(1.340)	(0.505)	(1.025)	(0.428)	(0.595)	(0.221)	(0.249)	(0.0839)
2011 Dummy	-3.967***	-0.798**	-11.51***	-3.925***	-8.126***	0.203	-0.821	1.898***	0.0359	2.402***	0.174	0.149
	(1.010)	(0.339)	(1.426)	(0.567)	(1.583)	(0.714)	(1.214)	(0.603)	(0.704)	(0.311)	(0.295)	(0.119)
2012 Dummy	-5.707***	-1.042*	-17.64***	-6.267***	-14.32***	-0.114	-2.032	3.686***	0.619	4.278***	0.249	0.264
	(1.772)	(0.567)	(2.495)	(0.946)	(2.764)	(1.194)	(2.120)	(1.008)	(1.232)	(0.521)	(0.519)	(0.199)
2013 Dummy	-2.666**	-0.104	-8.126***	-1.627***	-6.945***	1.611**	-1.989	1.619**	-1.217	2.115***	0.0404	-0.206
	(1.134)	(0.371)	(1.602)	(0.623)	(1.787)	(0.793)	(1.371)	(0.670)	(0.791)	(0.345)	(0.329)	(0.131)
2014 Dummy	7.648***	3.176***	16.75***	9.003***	13.32***	7.680***	0.956	-1.688	-3.838**	-2.623***	-0.0195	-1.119***
	(2.517)	(0.837)	(3.546)	(1.384)	(3.909)	(1.730)	(3.002)	(1.464)	(1.754)	(0.763)	(0.743)	(0.293)
2015 Dummy	3.792**	1.953***	12.66***	6.048***	13.39***	5.982***	3.067	-1.357	-1.587	-1.720***	0.248	-0.780***
	(1.700)	(0.592)	(2.396)	(0.977)	(2.642)	(1.218)	(2.030)	(1.032)	(1.184)	(0.538)	(0.500)	(0.207)
2016 Dummy	1.259	0.662*	6.801***	2.592***	8.789***	3.853***	3.105***	0.827	0.543	-0.521*	0.424	-0.388***
	(0.947)	(0.342)	(1.335)	(0.566)	(1.472)	(0.705)	(1.131)	(0.598)	(0.657)	(0.311)	(0.276)	(0.119)
2017 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-
Unemployment Rate	-1.474***	-0.267*	-1.122*	-0.0276	-0.294	-0.308	-0.940*	-0.541**	0.0408	-0.137	-0.0974	-0.0180
	(0.473)	(0.148)	(0.666)	(0.248)	(0.740)	(0.316)	(0.566)	(0.268)	(0.326)	(0.138)	(0.135)	(0.0523)
Median Household Income	-0.00103***	-8.20e-05	0.000301	-0.000169	0.000898*	-0.000504**	-0.000451	-0.000996***	4.20e-05	-0.000362***	-8.93e-05	1.46e-05
	(0.000305)	(0.000115)	(0.000430)	(0.000192)	(0.000474)	(0.000239)	(0.000363)	(0.000202)	(0.000210)	(0.000105)	(8.79e-05)	(3.99e-05)
Percent with Medicaid	0.0978	0.0863**	-0.444***	0.241***	-1.008***	-0.503***	-0.567***	-0.216***	-0.258***	-0.00266	-0.0441	0.0236*
	(0.113)	(0.0374)	(0.159)	(0.0623)	(0.176)	(0.0781)	(0.135)	(0.0658)	(0.0788)	(0.0340)	(0.0332)	(0.0130)
Percent Married	0.649	0.897***	-3.675***	0.497	-6.963***	1.425**	-0.962	0.891	0.701	0.786**	0.227	-0.0635
	(0.901)	(0.334)	(1.272)	(0.557)	(1.413)	(0.697)	(1.086)	(0.590)	(0.629)	(0.306)	(0.264)	(0.116)
Median Family Size	10.21	2.182	4.157	-2.049	-24.19*	-1.479	-11.33	-5.152	-2.455	4.905*	-2.173	2.104**
	(9.003)	(2.818)	(12.53)	(4.646)	(13.72)	(5.791)	(10.57)	(4.944)	(6.170)	(2.596)	(2.591)	(0.995)
Percent with High School Degree	-1.673**	-3.283***	2.327**	1.781***	5.139***	3.153***	1.616*	1.716***	0.851	-0.124	-0.0829	-0.250***
	(0.790)	(0.221)	(1.113)	(0.370)	(1.232)	(0.468)	(0.946)	(0.395)	(0.554)	(0.204)	(0.236)	(0.0779)
Percent with College Degree	2.009	1.278***	0.0866	0.00487	-0.213	-0.366	1.272	-1.201*	-0.727	-0.0984	1.204***	-0.0893
	(1.307)	(0.403)	(1.837)	(0.670)	(2.014)	(0.839)	(1.543)	(0.711)	(0.904)	(0.370)	(0.385)	(0.142)
Percent with Employer-Based Health Insurance	-1.059***	-0.204**	-0.651*	0.0651	-1.539***	-0.113	-1.113***	0.644***	-0.823***	0.205***	-0.293***	-0.0228
	(0.241)	(0.0828)	(0.338)	(0.139)	(0.375)	(0.174)	(0.289)	(0.147)	(0.168)	(0.0761)	(0.0703)	(0.0289)
Percent Non-Hispanic White												
Percent of Babies Born to Unwed Mothers	0.164*	0.0375	0.0934	0.0570	-0.0887	0.00376	-0.0666	-0.0691	-0.0104	-0.00780	-0.00629	-0.0201*
	(0.0986)	(0.0298)	(0.139)	(0.0502)	(0.155)	(0.0637)	(0.119)	(0.0538)	(0.0693)	(0.0278)	(0.0294)	(0.0105)
Constant	206.5**	237.5***	143.1	-85.94*	190.0	-179.8***	123.3	-23.60	26.35	11.07	5.263	32.20***
	(86.00)	(27.09)	(120.2)	(44.54)	(132.1)	(55.59)	(101.6)	(47.45)	(59.49)	(24.80)	(25.23)	(9.505)
Observations	401	408	408	408	408	408	408	408	408	408	366	408
R-squared	0.945	0.964	0.912	0.931	0.649	0.774	0.426	0.759	0.549	0.906	0.558	0.679
Number of States	51	51	51	51	51	51	51	51	51	51	48	51
Adjusted R-squared	0.930	0.955	0.890	0.913	0.561	0.717	0.282	0.698	0.436	0.882	0.450	0.598

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

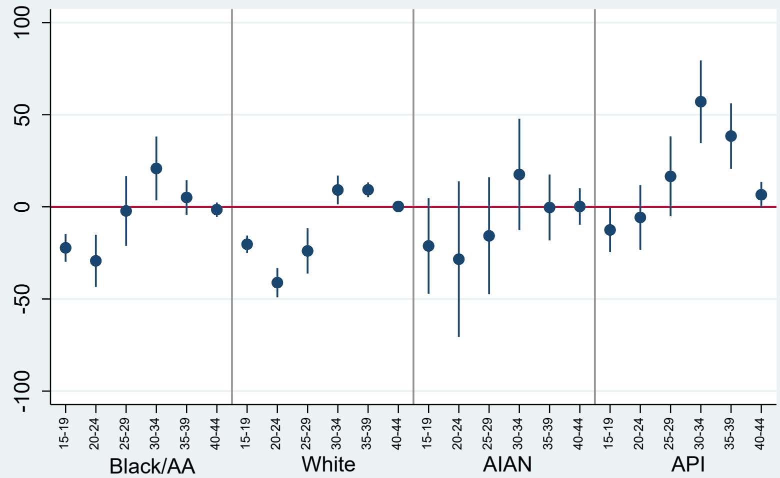
Appendix Figure 2.1a: ACA Estimated Coefficients, States without EHB ART Requirement, By Age Group of Mother



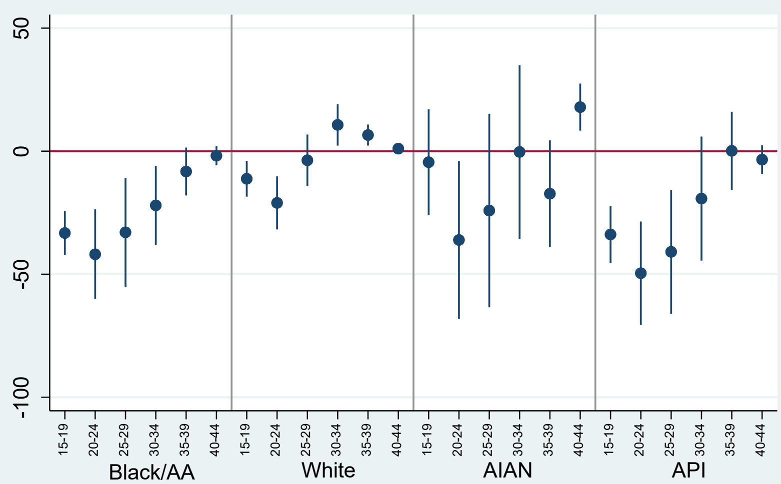
Appendix Figure 2.1b: ACA Estimated Coefficients, States with EHB ART Requirement, By Age Group of Mother

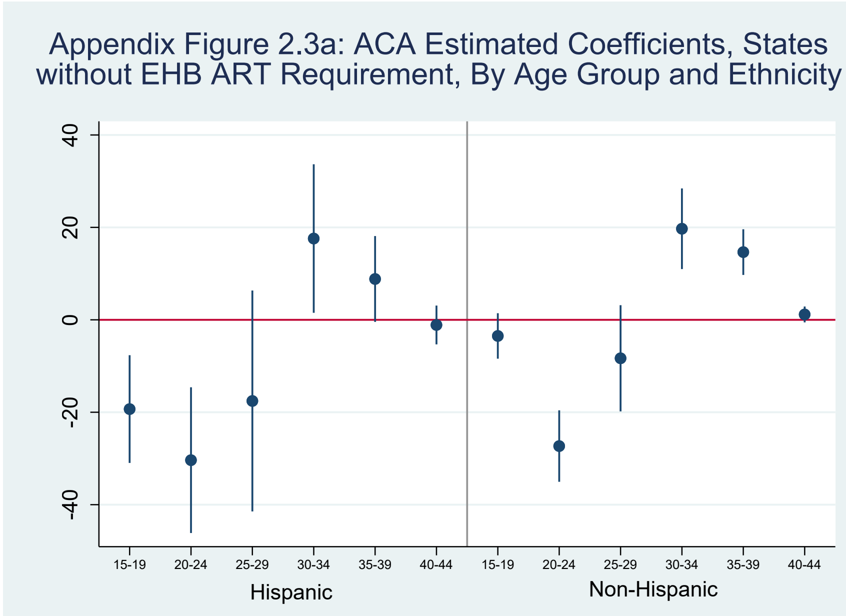


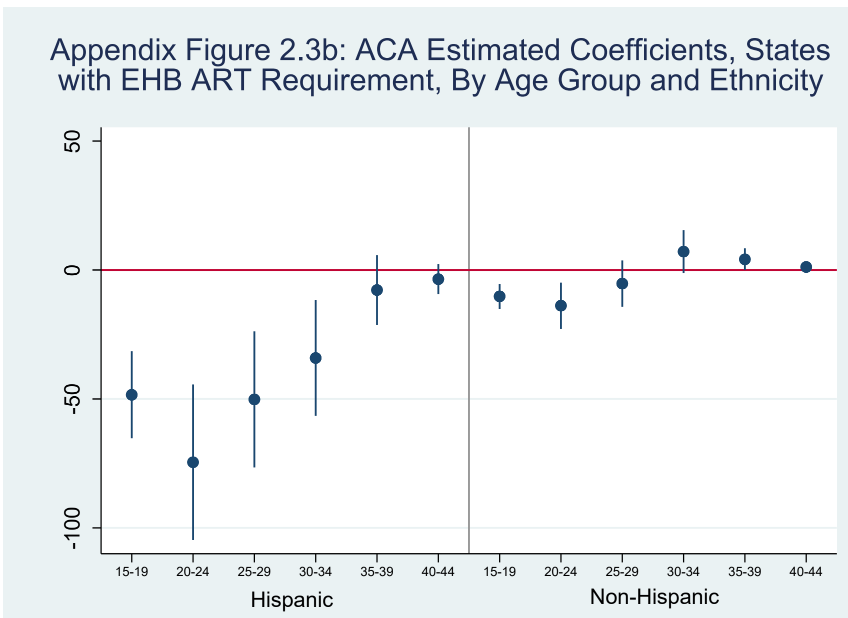
Appendix Figure 2.2a: ACA Estimated Coefficients, States without EHB ART Requirement, By Age Group and Race



Appendix Figure 2.2b: ACA Estimated Coefficients, States with EHB ART Requirement, By Age Group and Race




Appendix Figure 2.3a: ACA Estimated Coefficients, States without EHB ART Requirement, By Age Group and Ethnicity
40
20
0
-20
-40
15-19
20-24
25-29
30-34
35-39
40-44
15-19
20-24
25-29
30-34
35-39
40-44
Hispanic
Non-Hispanic


Appendix Figure 2.3b: ACA Estimated Coefficients, States with EHB ART Requirement, By Age Group and Ethnicity
50
0
-50
-100
15-19
20-24
25-29
30-34
35-39
40-44
15-19
20-24
25-29
30-34
35-39
40-44
Hispanic
Non-Hispanic

Appendix Table 9: Abortion Analysis with Fixed Effects

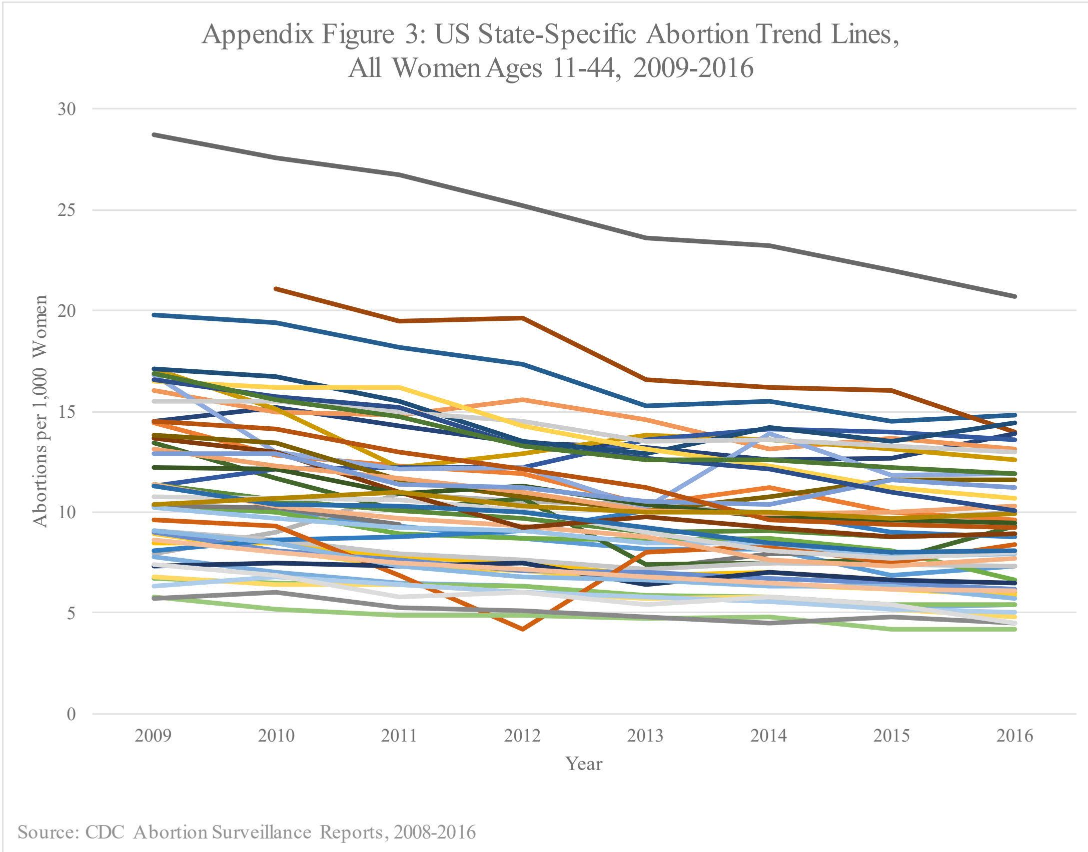
	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
State Mandate in Effect		0.630		0.666	0.0521	0.985	1.463	0.812	0.508	0.0603	-0.0855	-0.00640	-0.380	-2.692	0.462
		(0.586)		(0.699)	(0.0490)	(0.838)	(1.364)	(1.082)	(0.627)	(0.395)	(0.197)	(0.637)	(2.389)	(1.759)	(2.079)
ACA Mandate in Effect	-3.566***	-3.055***	-3.627***	-3.344***	-0.249***	-5.772***	-7.594***	-3.007***	-1.517***	-0.810***	-0.0656	-2.022***	-6.052***	-2.698***	-3.331***
	(0.228)	(0.260)	(0.268)	(0.310)	(0.0238)	(0.379)	(0.616)	(0.489)	(0.283)	(0.179)	(0.0955)	(0.260)	(0.975)	(0.718)	(0.849)
State Mandate * ACA Mandate		-0.925***		-0.535**	-0.0367*	-1.594***	-2.414***	-0.751*	-0.252	-0.0278	-0.0453	0.00583	0.905	0.954	-0.996
		(0.227)		(0.271)	(0.0207)	(0.331)	(0.539)	(0.428)	(0.248)	(0.156)	(0.0830)	(0.239)	(0.898)	(0.663)	(0.784)
2009 Dummy	-0.743***	-0.739***	-0.661**	-0.658**	-0.0390**	-1.015***	-1.524***	-0.726*	-0.393	-0.138	0.0507	-0.263	-0.945	-0.0238	-0.502
	(0.228)	(0.224)	(0.268)	(0.267)	(0.0194)	(0.326)	(0.530)	(0.420)	(0.244)	(0.154)	(0.0782)	(0.232)	(0.869)	(0.640)	(0.757)
2010 Dummy	-1.196***	-1.209***	-1.068***	-1.082***	-0.0615***	-1.782***	-2.285***	-1.258***	-0.478**	-0.184	0.0996	-0.348	-1.002	0.283	-0.750
	(0.227)	(0.223)	(0.266)	(0.266)	(0.0195)	(0.324)	(0.527)	(0.418)	(0.242)	(0.153)	(0.0786)	(0.238)	(0.892)	(0.657)	(0.776)
2011 Dummy	-1.919***	-1.946***	-1.779***	-1.807***	-0.108***	-3.042***	-4.013***	-2.165***	-1.082***	-0.422***	0.0924	-0.858***	-3.681***	0.218	-1.911**
	(0.227)	(0.224)	(0.266)	(0.267)	(0.0196)	(0.326)	(0.530)	(0.420)	(0.244)	(0.153)	(0.0787)	(0.238)	(0.894)	(0.666)	(0.787)
2012 Dummy	-2.410***	-2.441***	-2.351***	-2.379***	-0.158***	-4.202***	-5.194***	-2.536***	-1.345***	-0.499***	0.106	-1.125***	-4.616***	-0.609	-1.983**
	(0.228)	(0.225)	(0.266)	(0.267)	(0.0198)	(0.328)	(0.533)	(0.423)	(0.245)	(0.154)	(0.0796)	(0.239)	(0.895)	(0.659)	(0.779)
2013 Dummy	-0.306	-0.318	-0.230	-0.241	-0.00747	-0.145	0.0496	-0.630*	-0.482**	-0.150	-0.0376	-0.147	-1.255	0.715	-0.909
	(0.206)	(0.202)	(0.241)	(0.240)	(0.0183)	(0.291)	(0.474)	(0.376)	(0.218)	(0.137)	(0.0735)	(0.207)	(0.775)	(0.571)	(0.675)
2014 Dummy	0.528**	0.521**	0.625**	0.621**	0.0197	0.931***	2.073***	0.550	0.0706	0.251	0.0683	0.484**	-0.484	0.641	0.0985
	(0.228)	(0.224)	(0.268)	(0.267)	(0.0209)	(0.326)	(0.530)	(0.420)	(0.244)	(0.153)	(0.0835)	(0.225)	(0.845)	(0.622)	(0.736)
2015 Dummy	0.138	0.132	0.0359	0.0318	0.00308	0.0928	0.492	-0.143	-0.139	0.0223	-0.0165	-0.0266	-0.682	0.179	-0.824
	(0.228)	(0.224)	(0.268)	(0.267)	(0.0207)	(0.323)	(0.526)	(0.417)	(0.242)	(0.152)	(0.0824)	(0.225)	(0.842)	(0.620)	(0.733)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	12.72***	12.39***	13.26***	12.91***	0.413***	11.80***	24.37***	17.90***	11.23***	6.591***	2.352***	7.425***	24.32***	10.31***	10.60***
	(0.161)	(0.350)	(0.188)	(0.417)	(0.0303)	(0.507)	(0.825)	(0.654)	(0.379)	(0.239)	(0.122)	(0.355)	(1.331)	(0.977)	(1.156)
Observations	420	420	421	421	371	406	406	406	406	406	372	251	251	250	250
R-squared	0.574	0.593	0.514	0.520	0.575	0.729	0.627	0.298	0.257	0.155	0.062	0.455	0.376	0.170	0.280
Number of states	47	47	47	47	46	46	46	46	46	46	46	37	37	37	37
Adjusted R-squared	0.510	0.530	0.442	0.446	0.501	0.687	0.569	0.188	0.140	0.0225	-0.101	0.332	0.236	-0.0177	0.116

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 10: Abortion Analysis with Random Effects

	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	**ACA Only**	**All Variables**	**ACA Only**	**All Variables**	**11-14**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**NH White**	**NH Black**	**NH Other**	**Hispanic**
State Mandate in Effect		1.534***		1.302**	0.0471	2.064***	3.333***	2.251**	1.253**	0.562	0.216	1.026**	1.257	-0.793	2.651**
		(0.517)		(0.625)	(0.0344)	(0.659)	(1.189)	(0.950)	(0.569)	(0.355)	(0.168)	(0.502)	(1.969)	(1.054)	(1.306)
ACA Mandate in Effect	-3.566***	-3.104***	-3.628***	-3.381***	-0.251***	-5.842***	-7.705***	-3.090***	-1.560***	-0.839***	-0.0896	-2.045***	-6.054***	-2.815***	-3.357***
	(0.229)	(0.263)	(0.269)	(0.311)	(0.0242)	(0.384)	(0.620)	(0.491)	(0.285)	(0.180)	(0.0960)	(0.262)	(0.971)	(0.716)	(0.851)
State Mandate * ACA Mandate		-0.906***		-0.521*	-0.0359*	-1.568***	-2.369***	-0.717*	-0.235	-0.0160	-0.0363	0.0489	0.922	0.964	-0.993
		(0.230)		(0.272)	(0.0211)	(0.337)	(0.543)	(0.430)	(0.250)	(0.158)	(0.0836)	(0.241)	(0.894)	(0.660)	(0.784)
2009 Dummy	-0.745***	-0.740***	-0.663**	-0.660**	-0.0398**	-1.018***	-1.527***	-0.728*	-0.394	-0.138	0.0494	-0.269	-0.938	0.0152	-0.444
	(0.229)	(0.227)	(0.269)	(0.269)	(0.0199)	(0.331)	(0.534)	(0.423)	(0.245)	(0.155)	(0.0788)	(0.234)	(0.866)	(0.641)	(0.761)
2010 Dummy	-1.196***	-1.228***	-1.068***	-1.096***	-0.0625***	-1.804***	-2.325***	-1.289***	-0.494**	-0.195	0.0898	-0.348	-1.012	0.226	-0.714
	(0.228)	(0.225)	(0.267)	(0.267)	(0.0200)	(0.329)	(0.531)	(0.421)	(0.244)	(0.154)	(0.0792)	(0.240)	(0.888)	(0.655)	(0.778)
2011 Dummy	-1.919***	-1.984***	-1.779***	-1.834***	-0.108***	-3.089***	-4.095***	-2.228***	-1.114***	-0.444***	0.0779	-0.899***	-3.707***	0.123	-1.961**
	(0.228)	(0.226)	(0.267)	(0.268)	(0.0199)	(0.330)	(0.533)	(0.422)	(0.245)	(0.155)	(0.0792)	(0.240)	(0.890)	(0.664)	(0.789)
2012 Dummy	-2.409***	-2.479***	-2.351***	-2.406***	-0.158***	-4.255***	-5.278***	-2.599***	-1.378***	-0.522***	0.0905	-1.166***	-4.640***	-0.728	-2.032***
	(0.229)	(0.228)	(0.267)	(0.268)	(0.0201)	(0.333)	(0.537)	(0.425)	(0.247)	(0.156)	(0.0801)	(0.240)	(0.891)	(0.658)	(0.781)
2013 Dummy	-0.307	-0.328	-0.230	-0.246	-0.00564	-0.151	0.0315	-0.645*	-0.490**	-0.154	-0.0375	-0.176	-1.291*	0.704	-0.938
	(0.206)	(0.204)	(0.242)	(0.242)	(0.0187)	(0.296)	(0.478)	(0.378)	(0.219)	(0.139)	(0.0740)	(0.208)	(0.771)	(0.569)	(0.676)
2014 Dummy	0.527**	0.521**	0.626**	0.622**	0.0218	0.939***	2.075***	0.550	0.0712	0.251	0.0722	0.461**	-0.520	0.666	0.101
	(0.229)	(0.227)	(0.269)	(0.269)	(0.0213)	(0.331)	(0.534)	(0.423)	(0.245)	(0.155)	(0.0841)	(0.227)	(0.841)	(0.620)	(0.737)
2015 Dummy	0.138	0.132	0.0367	0.0331	0.00387	0.100	0.495	-0.142	-0.138	0.0234	-0.0136	-0.0500	-0.742	0.194	-0.881
	(0.229)	(0.227)	(0.269)	(0.269)	(0.0211)	(0.329)	(0.531)	(0.420)	(0.244)	(0.154)	(0.0831)	(0.226)	(0.838)	(0.618)	(0.735)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	12.73***	11.91***	13.29***	12.60***	0.417***	11.27***	23.43***	17.17***	10.86***	6.347***	2.161***	7.128***	23.49***	9.593***	9.842***
	(0.580)	(0.591)	(0.710)	(0.753)	(0.0320)	(0.646)	(1.345)	(1.095)	(0.711)	(0.429)	(0.183)	(0.490)	(2.049)	(0.927)	(1.155)
Observations	420	420	421	421	371	406	406	406	406	406	372	251	251	250	250
Number of states	47	47	47	47	46	46	46	46	46	46	46	37	37	37	37

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1


Appendix Figure 3: US State-Specific Abortion Trend Lines,
All Women Ages 11-44, 2009-2016
30
25
20
15
10
5
0
Abortions per 1,000 Women
2009
2010
2011
2012
2013
2014
2015
2016
Year
Source: CDC Abortion Surveillance Reports, 2008-2016

Appendix Table 11: Abortion Analysis with Fixed Effects and State-Specific Trends for Louisiana, Maine, and Michigan

	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
State Mandate in Effect		0.837		0.884	0.0610	1.162	1.841	1.132	0.719	0.180	-0.0438	0.0164	-0.265	-2.676	0.505
		(0.532)		(0.653)	(0.0497)	(0.843)	(1.321)	(1.013)	(0.584)	(0.371)	(0.195)	(0.634)	(2.341)	(1.779)	(2.100)
ACA Mandate in Effect	-3.826***	-3.250***	-3.910***	-3.565***	-0.252***	-5.940***	-7.979***	-3.389***	-1.779***	-0.951***	-0.122	-2.001***	-5.935***	-2.698***	-3.260***
	(0.217)	(0.243)	(0.259)	(0.298)	(0.0249)	(0.392)	(0.615)	(0.471)	(0.272)	(0.173)	(0.0978)	(0.260)	(0.960)	(0.730)	(0.861)
State Mandate * ACA Mandate		-1.065***		-0.669**	-0.0435**	-1.688***	-2.581***	-0.841**	-0.306	-0.0522	-0.0573	-0.0964	0.404	0.857	-1.159
		(0.212)		(0.260)	(0.0216)	(0.344)	(0.539)	(0.413)	(0.238)	(0.151)	(0.0848)	(0.241)	(0.890)	(0.678)	(0.801)
2009 Dummy	-0.764***	-0.758***	-0.682***	-0.678***	-0.0399*	-1.034***	-1.539***	-0.740*	-0.352	-0.118	0.0392	-0.257	-0.906	-0.0266	-0.513
	(0.217)	(0.210)	(0.259)	(0.257)	(0.0204)	(0.338)	(0.530)	(0.406)	(0.235)	(0.149)	(0.0801)	(0.232)	(0.855)	(0.650)	(0.767)
2010 Dummy	-1.273***	-1.292***	-1.150***	-1.170***	-0.0689***	-1.853***	-2.384***	-1.355***	-0.535**	-0.206	0.0704	-0.346	-1.005	0.296	-0.724
	(0.215)	(0.209)	(0.258)	(0.256)	(0.0205)	(0.336)	(0.527)	(0.404)	(0.233)	(0.148)	(0.0806)	(0.238)	(0.879)	(0.668)	(0.788)
2011 Dummy	-1.998***	-2.036***	-1.864***	-1.904***	-0.118***	-3.131***	-4.146***	-2.266***	-1.135***	-0.457***	0.0777	-0.792***	-3.347***	0.315	-1.820**
	(0.215)	(0.210)	(0.258)	(0.257)	(0.0206)	(0.338)	(0.530)	(0.406)	(0.234)	(0.149)	(0.0807)	(0.239)	(0.883)	(0.679)	(0.802)
2012 Dummy	-2.465***	-2.509***	-2.407***	-2.447***	-0.166***	-4.342***	-5.462***	-2.776***	-1.486***	-0.564***	0.0736	-1.083***	-4.416***	-0.608	-1.896**
	(0.217)	(0.211)	(0.258)	(0.257)	(0.0207)	(0.338)	(0.530)	(0.406)	(0.234)	(0.149)	(0.0811)	(0.239)	(0.884)	(0.672)	(0.793)
2013 Dummy	-0.349*	-0.364*	-0.261	-0.275	-0.0110	-0.181	-0.0130	-0.674*	-0.471**	-0.155	-0.0528	-0.134	-1.219	0.769	-0.920
	(0.195)	(0.189)	(0.233)	(0.232)	(0.0191)	(0.302)	(0.474)	(0.363)	(0.210)	(0.133)	(0.0748)	(0.209)	(0.773)	(0.587)	(0.693)
2014 Dummy	0.530**	0.522**	0.631**	0.625**	0.0186	0.931***	2.062***	0.542	0.0919	0.266*	0.0714	0.493**	-0.484	0.684	0.0578
	(0.217)	(0.210)	(0.259)	(0.257)	(0.0217)	(0.338)	(0.530)	(0.406)	(0.234)	(0.149)	(0.0853)	(0.228)	(0.843)	(0.641)	(0.756)
2015 Dummy	0.158	0.149	0.0441	0.0386	-0.00257	0.0987	0.498	-0.141	-0.0845	0.00105	-0.0217	-0.0347	-0.707	0.188	-0.893
	(0.217)	(0.210)	(0.259)	(0.257)	(0.0216)	(0.336)	(0.527)	(0.404)	(0.233)	(0.148)	(0.0848)	(0.227)	(0.840)	(0.638)	(0.754)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	12.72***	12.27***	13.26***	12.79***	0.409***	11.70***	24.16***	17.73***	11.11***	6.525***	2.330***	7.435***	24.37***	10.34***	10.58***
	(0.147)	(0.317)	(0.176)	(0.389)	(0.0307)	(0.509)	(0.798)	(0.612)	(0.353)	(0.224)	(0.121)	(0.354)	(1.307)	(0.990)	(1.169)
Observations	420	420	421	421	371	406	406	406	406	406	372	251	251	250	250
R-squared	0.664	0.688	0.601	0.610	0.592	0.746	0.675	0.428	0.400	0.307	0.146	0.477	0.419	0.177	0.287
Number of states	47	47	47	47	46	46	46	46	46	46	46	37	37	37	37
Adjusted R-squared	0.587	0.615	0.510	0.518	0.488	0.685	0.597	0.291	0.257	0.142	-0.0746	0.339	0.266	-0.0409	0.0993

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 12: Abortion Analysis with Fixed Effects, Selected State-Specific Trends, Population Weights, and Effect Coding of 2013=0.75

	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	**ACA Only**	**All Variables**	**ACA Only**	**All Variables**	**11-14**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**NH White**	**NH Black**	**NH Other**	**Hispanic**
State Mandate in Effect		1.070**		1.192**	0.0658	1.598**	2.400**	1.455	0.926*	0.163	-0.0303	0.0380	0.311	-2.590*	1.135
		(0.509)		(0.586)	(0.0441)	(0.805)	(1.159)	(0.911)	(0.537)	(0.304)	(0.171)	(0.504)	(4.047)	(1.324)	(1.308)
ACA Mandate in Effect	-4.170***	-3.366***	-4.419***	-4.039***	-0.272***	-6.556***	-9.109***	-3.785***	-1.975***	-0.848***	-0.104	-2.218***	-4.960***	-2.159***	-3.533***
	(0.211)	(0.249)	(0.226)	(0.267)	(0.0220)	(0.391)	(0.562)	(0.450)	(0.268)	(0.151)	(0.0857)	(0.215)	(0.896)	(0.604)	(0.899)
State Mandate * ACA Mandate		-1.254***		-0.681***	-0.0338*	-1.709***	-2.291***	-1.091***	-0.615***	-0.211	-0.0942	-0.0459	-0.176	-0.203	-1.364*
		(0.216)		(0.232)	(0.0191)	(0.340)	(0.490)	(0.393)	(0.234)	(0.131)	(0.0745)	(0.191)	(0.784)	(0.530)	(0.816)
2009 Dummy	-0.626***	-0.625***	-0.727***	-0.726***	-0.0383**	-1.108***	-1.733***	-1.085***	-0.445**	-0.191	0.0795	-0.329*	0.417	-0.593	-0.296
	(0.211)	(0.201)	(0.226)	(0.223)	(0.0176)	(0.316)	(0.456)	(0.361)	(0.215)	(0.121)	(0.0679)	(0.187)	(0.756)	(0.473)	(0.554)
2010 Dummy	-1.167***	-1.193***	-1.341***	-1.367***	-0.0742***	-2.179***	-2.817***	-1.706***	-0.652***	-0.227*	0.118*	-0.569***	-0.689	-0.783	-0.276
	(0.211)	(0.201)	(0.226)	(0.223)	(0.0176)	(0.316)	(0.456)	(0.362)	(0.215)	(0.121)	(0.0680)	(0.192)	(0.760)	(0.484)	(0.570)
2011 Dummy	-1.981***	-2.030***	-2.050***	-2.101***	-0.132***	-3.505***	-4.639***	-2.605***	-1.169***	-0.375***	0.144**	-0.941***	-2.816***	-0.305	-1.911***
	(0.211)	(0.202)	(0.226)	(0.224)	(0.0177)	(0.318)	(0.458)	(0.364)	(0.216)	(0.121)	(0.0683)	(0.191)	(0.758)	(0.489)	(0.574)
2012 Dummy	-2.572***	-2.623***	-2.725***	-2.777***	-0.166***	-4.797***	-6.298***	-3.267***	-1.546***	-0.533***	0.0984	-1.250***	-4.393***	-1.079**	-3.166***
	(0.211)	(0.202)	(0.226)	(0.224)	(0.0177)	(0.318)	(0.458)	(0.364)	(0.216)	(0.121)	(0.0684)	(0.189)	(0.749)	(0.484)	(0.569)
2013 Dummy	-0.178	-0.192	-0.231	-0.244	0.000541	-0.0401	0.0393	-0.763**	-0.388**	-0.206*	-0.0382	-0.142	-1.854***	0.653	-0.537
	(0.190)	(0.181)	(0.204)	(0.201)	(0.0159)	(0.285)	(0.410)	(0.326)	(0.194)	(0.109)	(0.0616)	(0.172)	(0.685)	(0.416)	(0.513)
2014 Dummy	0.521**	0.520**	0.528**	0.527**	0.0265	0.883***	2.005***	0.521	0.210	0.264**	0.0932	0.474**	-1.333*	0.276	-0.273
	(0.211)	(0.201)	(0.226)	(0.223)	(0.0184)	(0.328)	(0.472)	(0.375)	(0.223)	(0.125)	(0.0710)	(0.185)	(0.730)	(0.445)	(0.543)
2015 Dummy	0.197	0.195	0.237	0.236	0.00518	0.393	0.787*	0.0266	0.0410	0.0447	-0.0204	0.166	-1.010	0.0647	-0.307
	(0.211)	(0.201)	(0.226)	(0.223)	(0.0177)	(0.316)	(0.455)	(0.361)	(0.215)	(0.120)	(0.0685)	(0.191)	(0.772)	(0.464)	(0.564)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant	14.73***	14.04***	15.71***	15.00***	0.424***	12.70***	27.50***	20.74***	13.08***	7.638***	2.664***	7.662***	26.58***	12.90***	13.14***
	(0.144)	(0.352)	(0.155)	(0.381)	(0.0305)	(0.551)	(0.790)	(0.630)	(0.373)	(0.212)	(0.120)	(0.312)	(2.669)	(1.005)	(1.147)
Observations	420	420	421	421	371	406	406	406	406	406	372	251	251	250	250
R-squared	0.717	0.745	0.708	0.718	0.684	0.796	0.770	0.537	0.505	0.413	0.247	0.600	0.537	0.228	0.542
Number of sta	47	47	47	47	46	46	46	46	46	46	46	37	37	37	37
Adjusted R-squared	0.652	0.684	0.641	0.651	0.604	0.748	0.715	0.427	0.387	0.273	0.0535	0.495	0.416	0.0244	0.422

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 13: Abortion Analysis with Fixed Effects, Selected State-Specific Trends, Population Weights, Effect Coding of 2013=0.75, and Lasso-Selected Demographic Variables

	By Residence		By Occurrence		By Age Group of Mother							By Race/Ethnicity			
Variable	ACA Only	All Variables	ACA Only	All Variables	11-14	15-19	20-24	25-29	30-34	35-39	40-44	NH White	NH Black	NH Other	Hispanic
State Mandate in Effect		0.805		0.913	0.0242	1.321	1.432	1.034	0.698	0.0297	-0.0805	0.00602	0.188	-2.792*	1.133
		(0.587)		(0.661)	(0.0718)	(1.174)	(2.174)	(1.032)	(0.600)	(0.345)	(0.179)	(0.524)	(4.336)	(1.503)	(1.295)
ACA Mandate in Effect	-3.861***	-3.125***	-4.088***	-3.795***	-0.253***	-5.257***	-7.231***	-3.327***	-1.716***	-0.711***	-0.0573	-2.246***	-5.159***	-3.409***	-3.567***
	(0.232)	(0.279)	(0.246)	(0.294)	(0.0200)	(0.322)	(0.593)	(0.495)	(0.291)	(0.166)	(0.0868)	(0.222)	(0.953)	(1.253)	(0.889)
State Mandate * ACA Mandate		-1.134***		-0.518**	-0.0200	-0.896***	-1.237**	-0.955**	-0.561**	-0.167	-0.0690	0.122	0.492	-0.269	-1.316
		(0.242)		(0.255)	(0.0166)	(0.261)	(0.486)	(0.431)	(0.253)	(0.145)	(0.0755)	(0.196)	(0.831)	(0.567)	(0.807)
2011 Dummy	-1.856***	-1.891***	-1.930***	-1.967***	-0.0536***	-1.144***	-1.586***	-2.421***	-1.108***	-0.333**	0.160**	-1.055***	-3.347***	-0.139	-1.966***
	(0.232)	(0.226)	(0.246)	(0.246)	(0.0136)	(0.212)	(0.399)	(0.400)	(0.234)	(0.133)	(0.0691)	(0.196)	(0.803)	(0.489)	(0.566)
2012 Dummy	-2.407***	-2.443***	-2.579***	-2.615***	-0.0944***	-2.544***	-3.301***	-2.985***	-1.415***	-0.472***	0.127*	-1.314***	-4.655***	-1.221*	-3.197***
	(0.232)	(0.227)	(0.246)	(0.246)	(0.0137)	(0.215)	(0.401)	(0.400)	(0.235)	(0.134)	(0.0693)	(0.194)	(0.794)	(0.637)	(0.562)
2013 Dummy	-0.127	-0.137	-0.194	-0.203	0.0577***	1.120***	1.532***	-0.725**	-0.374*	-0.183	-0.0167	-0.175	-1.877***	1.051**	-0.544
	(0.209)	(0.203)	(0.222)	(0.221)	(0.0143)	(0.225)	(0.422)	(0.358)	(0.210)	(0.120)	(0.0624)	(0.172)	(0.711)	(0.449)	(0.503)
2014 Dummy	0.533**	0.532**	0.539**	0.539**	0.0650***	1.562***	2.750***	0.545	0.230	0.278**	0.0964	0.451**	-1.302*	0.697	-0.246
	(0.232)	(0.225)	(0.246)	(0.245)	(0.0157)	(0.245)	(0.458)	(0.411)	(0.241)	(0.137)	(0.0718)	(0.186)	(0.758)	(0.519)	(0.532)
2015 Dummy	0.205	0.203	0.237	0.236	0.0221	0.521**	0.994**	0.0416	0.0302	0.0710	-0.0138	0.171	-0.911	0.252	-0.277
	(0.232)	(0.225)	(0.246)	(0.245)	(0.0139)	(0.216)	(0.405)	(0.397)	(0.233)	(0.133)	(0.0693)	(0.191)	(0.798)	(0.461)	(0.552)
2016 Dummy (omitted)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Percent with Employer-Based Health Insurance					0.0268***	0.560***	0.632***								
					(0.00525)	(0.0823)	(0.155)								
Percent with High School Degree--3rd Quartile						-0.247									
						(0.201)									
Percent Married														-1.004	
														(0.612)	
Median Household Income--4th Quartile						-2.038***	-1.631***								
						(0.311)	(0.578)								
2009	-0.630***	-0.630***	-0.722***	-0.722***				-1.086***	-0.484**	-0.205	0.0827	-0.331*	0.413		-0.297
	(0.232)	(0.225)	(0.246)	(0.245)				(0.397)	(0.233)	(0.133)	(0.0687)	(0.195)	(0.810)		(0.548)
2010	-1.098***	-1.116***	-1.260***	-1.279***				-1.596***	-0.609***	-0.193	0.139**	-0.570***	-0.691	-0.111	-0.280
	(0.232)	(0.225)	(0.246)	(0.245)				(0.398)	(0.233)	(0.133)	(0.0688)	(0.199)	(0.815)	(0.453)	(0.564)
Constant	14.73***	14.21***	15.71***	15.17***	-1.251***	-23.01***	-12.79	21.01***	13.23***	7.724***	2.697***	7.636***	26.51***	63.92**	13.14***
	(0.163)	(0.406)	(0.174)	(0.430)	(0.322)	(5.051)	(9.464)	(0.713)	(0.417)	(0.240)	(0.125)	(0.324)	(2.858)	(31.42)	(1.135)
Observations	420	420	421	421	285	316	316	406	406	406	372	251	251	223	250
R-squared	0.620	0.643	0.607	0.613	0.673	0.820	0.684	0.363	0.336	0.189	0.119	0.553	0.453	0.195	0.538
Number of states	47	47	47	47	46	46	46	46	46	46	46	37	37	37	37
Adjusted R-squared	0.554	0.579	0.549	0.554	0.596	0.781	0.617	0.263	0.232	0.0617	-0.0340	0.452	0.329	-0.0154	0.433

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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9.0 Curriculum Vitae

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Education

The Johns Hopkins Bloomberg School of Public Health **Baltimore, MD**
Ph.D. in Public Health, Department of Population, Family and Reproductive Health Expected December 2020
Certificate in Public Health Economics

- GPA: 3.87/4.0. Completing methods requirements in both health economics and reproductive health.
- Recipient of the Robertson Award for 75% tuition funding for 2011-2016. One recipient in the department. Based on academic achievement and work experience.
- Recipient of the Kann Trowbridge Fund ($10,000) for academic year 2013-2014 and 2017-2018. One recipient in the department. Based on short essay, academic and research achievement, involvement in the department, and commitment to family planning and reproductive health research.
- Family Planning Fellow for academic year 2014-2015 and 2018-2019. Based on short essay, academic achievement, involvement in the department, and commitment to family planning research.
- Winner of the best student abstract for the JHSPH Research Day in 2013. One recipient in the department. Based on extended abstract and presentation on student research.

The Johns Hopkins University **Baltimore, MD**
Master of Arts in Public Policy August 2009-May 2011
Certificates in Health Policy and Health Disparities
GPA: 4.0/4.0. Recipient of the highest merit-based scholarship in the department from Johns Hopkins, based on academic achievement, essay, work history, and test scores.

Brigham Young University **Provo, UT**
Bachelor of Arts in Economics September 2000-April 2006
Minor in Business Management

- Financed education with scholarships and part-time work.
- Gordon B. Hinckley Presidential Scholar (4-year scholarship): BYU's most prestigious merit-based scholarship, awarded to the top 50 entering freshmen for academics, leadership and extracurricular activities.
- Robert C. Byrd Scholar (4-year scholarship): Awarded by Colorado Department of Education for academic achievement, extracurricular activities, essay.

Work Experience

The Jacob France Institute **Baltimore, MD**
Research Economist, Associate Director of Workforce July 2016-Present
Associate Director of the largest practice at The Jacob France Institute, with annual revenues near $2 million. Manages clients, budgets, and major research projects evaluating health and social policies and programs, workforce evaluations and non-profit training programs. Sole author and analytical lead of multiple major reports per year. Also worked for the Institute during master's program from January-September 2011 on a HRSA-funded project to conduct literature reviews and quantitative analysis to build supply and demand models for health care workers in Washington, DC.

McKinsey & Company **Philadelphia, PA**
Insight Healthcare Program Participant June 26-29, 2014
One of 40 participants selected from over 1,000 PhD and MD student applicants for a mini-internship with McKinsey & Company, one of the leading management consulting firms in the world. Workshops and training focused on consulting work in the healthcare industry and how to make academic research more applicable to a worldwide audience.

The Johns Hopkins Bloomberg School of Public Health **Baltimore, MD**
Research Assistant September 2011-January 2017
Working with Dr. David Bishai and two others in an international team to determine the impact of child wantedness on child survival and education levels in Bangladesh. Performing instrumental variable regression analysis of longitudinal data in Stata. Helping draft articles, including first-authored articles. Also working with Dr. Antonio Trujillo on a USAID-funded project to build a series of models estimating the impact of interventions on chronic conditions in women of childbearing age. Leading the development of the model estimating the impact of tobacco taxes and diabetes education on mortality and morbidity while coordinating work with entire team.

The Johns Hopkins Bloomberg School of Public Health **Baltimore, MD**
Teaching Assistant January 2012-January 2017
Helping prepare course materials, leading discussion sections, and grading assignments for graduate-level health economics and economic evaluation courses and an undergraduate medical sociology course. Working in a team of professors and other teaching assistants to evaluate course content and progress.

Charles River Associates **Boston, MA & Washington, DC**
Associate, Competition Practice August 2006-January 2013
Helped plan and carry out data analysis on a variety of projects, including merger review, litigation, damages estimates, and labor cases. Assisted in writing and editing expert reports and preparing experts for trial. Worked on projects in several industries, including health care and labor. Participated in hiring, training, and mentoring new staff. Worked full-time through September 2009 and as an independent contractor during graduate school through January 2013.

U.S. Government Accountability Office **Washington, DC**
Summer Graduate Intern, Strategic Issues May-August 2010
Helped plan and strategize research project reviewing the funding of Presidential Libraries. Reviewed documents and drafted summaries of each Presidential Library. Created database of relevant financial and descriptive information.

Church of Jesus Christ of Latter-Day Saints **Hamburg, Germany**
Volunteer Representative January 2004-July 2005
Planned and led volunteer work in congregations, including community seminars and service projects. Translated from German to English at meetings. Assisted women's organizations in service projects, such as literacy and education.

Center for the Study of Elections and Democracy **Provo, UT**
Research Assistant/Data Analyst January 2003-December 2003
Managed national data collection and performed data analysis on campaign finance reform for Dr. David Magleby, which was used in publications and as evidence for the national BCRA case. Involved in writing and editing books.

Brigham Young University, Department of Economics **Provo, UT**
Teaching Assistant for Economics 110 and Economics 388 August 2002-December 2003
Assisted Professor Kearl and Professor McDonald, head of Economics Department, in teaching introductory economics and advanced econometrics courses. Prepared and conducted weekly review sessions and taught various topics.

Selected Presentations and Publications

Zhang, T, Christiansen, S. (2019). SNAP, UI, and Employment Interactions in Maryland, 2009-2015. In O'Leary C.J., Stevens, D., Wandner, S.A, Wiseman, M. (Eds.), *Strengths of the Social Safety Net in the Great Recession: Supplemental Nutrition Assistance and Unemployment Insurance* (pp. 243-280). Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

"Causal Impact of Being an Unwanted Child on Survival in Matlab, Bangladesh." Population Association of America May 2012 Annual Meeting, San Francisco, CA. Presented by Dr. David Bishai. Research done with David Bishai, Abdur Razzaque, and Michelle Hindin.

Bishai, D., Razzaque, A., Christiansen, S., Mustafa, A. H., & Hindin, M. (January 01, 2015). Selection bias in the link between child wantedness and child survival: theory and data from Matlab, Bangladesh. *Demography, 52,* 1, 61-82.

"Do unwanted children get less schooling? Using the Matlab, Bangladesh quasi-randomized trial to control for selection bias." Population Association of America May 2014 Annual Meeting, Boston, MA. Poster presentation.

Additional Information

- Highly skilled in SAS, Stata, Excel, and Microsoft Office Suite. Proficient in SQL, ArcGIS, and R.