ABSTRACT

A Synthetic Control Model to Estimate the Effect of Colorado's Family Planning Initiative on Abortions

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In 2009, the Colorado Family Planning Initiative provided IUDs at no cost for low-income women. The lowering of the price of an IUD could have the possible substitution effect of decreasing the number of abortions. Even though abortions decreased in Colorado after the initiative, we find no evidence of a causal relationship.

A Synthetic Control Model to Estimate the Effect of Colorado's Family Planning Initiative on Abortions

by

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A Thesis

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TABLE OF CONTENTS

LIST OF FIGURES v

LIST OF TABLES vi

ACKNOWLEDGMENTS vii

1 Introduction 1

1.1 Long-Acting Reversible Contraceptives 1

1.2 Colorado's Family Planning Initiative 1

1.3 States with Comparable Funding for Contraceptives 3

2 Background 4

2.1 Review of Prior Contraception/Abortion Literature 4

2.2 Hypothesized Outcomes from Akerlof's Model 5

3 Methodology 7

3.1 Data Description 7

3.2 Method 10

4 Results 12

4.1 AGI Synthetic Control Estimates using 50 States as a Donor Pool . . 12

4.2 AGI Synthetic Control Estimates using 29 States as a Donor Pool . . 16

4.3 CDC Synthetic Control Estimates using 25 States as a Donor Pool . . 19

5 Discussion 25

5.1 Conclusion 25

5.2 Policy Implications 25

BIBLIOGRAPHY 26

LIST OF FIGURES

3.1 Number of Abortions per Year in Colorado, AGI Data 7

3.2 Number of Abortions per Year in Colorado, CDC Data 8

3.3 Abortion Rates for Colorado & the Rest of the US, AGI Data 9

3.4 Abortion Rates for Colorado & the Rest of the US, CDC Data 9

4.1 Trends in Abortions per Woman of Childbearing Age - 50 states . . . 12

4.2 Per woman of childbearing age abortion gap - 50 states 14

4.3 Post/pre RMSPE histogram - 50 states 14

4.4 Gap in Colorado and placebo gaps - 50 states 15

4.5 Gap in Colorado and placebo gaps, removing outliers - 50 states . . . 16

4.6 Trends in Abortions per Woman of Childbearing Age - 29 states . . . 17

4.7 Gap between CO and Synthetic CO - 29 states 18

4.8 Post/pre RMSPE histogram - 29 states 18

4.9 Gap between CO and placebo gaps - 29 states 19

4.10 Gap between CO and placebo gaps, removing outlier - 29 states . . . 20

4.11 Placebo gaps, pre-CFPI RMSPE less than twice CO's - 29 states . . . 20

4.12 Trends in Proportion of Abortions to Women Ages 15 to 19 - 25 states 21

4.13 Abortion Proportion Gap - 25 states 22

4.14 Post/pre RMSPE ratio histogram - 25 states 22

4.15 Gap in Colorado and placebo gaps - 25 states 23

4.16 Gap in Colorado and placebo gaps, removing outliers - 25 states . . . 23

LIST OF TABLES

4.1 Colorado Synthetic Control Weights, 50 states - AGI 13

4.2 Actual Versus Synthetic Colorado Characteristics, 50 states - AGI . . 15

4.3 Colorado Synthetic Control Weights, 29 states - AGI 16

4.4 Actual Versus Synthetic Colorado Characteristics, 29 states - AGI . . 19

4.5 Colorado Synthetic Control Weights, 25 states - CDC data 21

4.6 Actual Versus Synthetic Colorado Characteristics, 25 states - CDC . 24

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CHAPTER ONE

Introduction

1.1 Long-Acting Reversible Contraceptives

Long-Acting Reversible Contraceptives (LARCs) are a class of contraceptive that last a long time and require no regular effort on the part of the user to work. Injections, IUDs, and implants are all types of LARCs. Because they do not require extra effort from the user after implantation, they have higher effective rates. The amount of time that an IUD is good for depends on the device - the range is 3 to 10 years. Gynecologists now recommend IUDs as the preferred method of contraception for young women (including adolescents). Because they are a one-time upfront cost, there may be a barrier for these young women to acquire a LARC - even though the cost in the long-run is cheaper than other, more popular methods (like the pill, for example) [6]. Another barrier is the lack of information and knowledge about LARCs in the general population - perhaps women don't choose to use a LARC because they're not familiar with them. Teen or young motherhood (and usually also single motherhood) are accompanied by a multitude of unfavorable outcomes for both the young mother and her child. If getting a LARC for these at-risk women would help them delay parenthood for a few years, they may have other opportunities that would not have been available to them as single mothers. Unmarried women under 25 who have less than a high school education and their children are at particular risk of economic insecurity and poor health, educational, and developmental outcomes throughout their lives [11].

1.2 Colorado's Family Planning Initiative

Colorado's Family Planning Initiative (CFPI) is a privately-funded measure whose primary functions were to provide LARCs at no cost to clients at Title X-funded clinics, and to provide training for providers and staff regarding the provision of LARC methods at 28 Title X-funded agencies. All other contraceptives at the Title X-funded clinics were offered on a sliding-fee scale for individuals above 100% of the federal poverty level (anyone at or below 100% of the federal poverty level pay nothing, according to Title X guidelines, regardless of their chosen method). The CFPI was implemented on the county-level in Colorado and reached 95% of the population, including 95% of the low-income population. The Initiative began in January 2009. Because it took time to train staff and train providers, it took about 1.5 years for the CFPI to become fully effective. Even so, the statistics about the abortion rate and birth rate of teens in Colorado changed immediately. They fell every year since the Initiative began. Due to the statistically significant drop in teen births and teen abortions in Colorado, it is logical to ask – did the lowered costs of IUDs by the CFPI *cause* the decrease in abortions?

The CFPI monitored caseloads and clients' LARC use over two years, and their analysis suggests that "programs that increase LARC use among young, low-income women may contribute to declines in fertility rates, abortion rates and births among high-risk women" [13].

> The abortion rate for 15-19-year-olds in the CFPI group was 11 abortions per 1,000 women in 2008, before the initiative began. In 2011, the third year of the initiative, it had fallen to 7, a statistically significant decline of 34%. The comparable rates in the non-CFPI group were 14 and 10 abortions, respectively, representing a significant decline of 29%. The rates for women aged 20-24 in the CFPI group were 22 and 18 abortions per 1,000 in 2008 and 2011, respectively, representing a statistically significant decline of 18%. Rates for 20-24-year-olds in non-CFPI counties were essentially stable, at 26 and 28 abortions per 1,000 in 2008 and 2011... Still, Colorado's teen birth rate seems to be declining much more quickly than its peers' rates. Between 2008 and 2012, the state went from the 29th lowest teen birth rate in the nation to the 19th lowest [13].

1.3 States with Comparable Funding for Contraceptives

Yearly, the Alan Guttmacher Institute creates a document called "State Policies in Brief" in which it lists Medicaid Family Planning Eligibility Expansions. Using the "State Policies in Brief" for years 2009-2011, we found which states had close to comparable funding to the CFPI. Since clients at or below 100% of the federal poverty level at Title X-funded clinics pay nothing for their choice of contraception, and 91% of clients had incomes at or below 250% of the federal poverty level [17], we deduce that the people who are provided LARCs at no cost are people below 250% of the poverty level.

Using the AGI analysis of state funding for contraceptives each year, we found that the following states provide funding comparable to 200% of the federal poverty level at some time during the 2009-2011 post-treatment period: Arkansas (200%), California (200%), Georgia (200%), Illinois (200%), Iowa (200%), Louisiana (200%), Michigan (185%), Minnesota (185%), Missouri (185%), New Mexico (185%), New York (200%), North Carolina (185%), Oklahoma (185%), Oregon (185%), Pennsylvania (185%), South Carolina (185%), Texas (185%), Virginia (200%), Washington (200%), Wisconsin (300%). Some states provided education and training as part of their services; others didn't. Because of the ambiguity, we decided to run two different analyses: one in which all 50 states compose a donor pool for control units; the other in which we remove the states described above from the donor pool.

CHAPTER TWO

Background

2.1 Review of Prior Contraception/Abortion Literature

A foundational principle in economics is the one of supply and demand and the substitution effect. When a good decreases in price, the demand increases. If IUDs decrease in price, the demand should increase. Moreover, because some view abortions as a form of contraception (as insurance against having a child), this suggests that the relative cost of an abortion should increase under CFPI. Thus, in theory, some individuals are substituting an IUD for an abortion, and we could expect fewer abortions.

According to Levine's model, there are two models for women in a market with contraception. Contraception is a technology - and, as with any technology, people either decide to use it or forgo it. So we have one category of women who will adapt to the technology and use contraception; meanwhile we have the other category of women who will not. There are many possible reasons for a woman to not use contraception - in any case, we can say that these women view using contraception or abstaining from sexual activity as costly [14]. As abortion is more accessible (hence less costly), Levine suggests that abortion may be substituted for contraception.

Levine shows two possible scenarios: the first is where cost of abortion is greater than the cost of birth for an individual; the second is where cost of abortion is less than the cost of birth. Levine goes on to say:

> ...a woman will choose a level of contraception intensity that maximizes her expected utility at the point where the marginal cost of contraception just equals either the cost of the birth or the cost of abortion, whichever is lower. It is the lower cost that is relevant because once it is clear that an unintentional pregnancy will

> result in, say, a birth, the cost of abortion becomes irrelevant in the decision-making process [14].

Because abortion can be viewed as a form of insurance against an unwanted birth, "women will evaluate the cost of 'purchasing' this form of insurance relative to the cost of the loss" [14]. Since both abortions and contraception prevent births, there is a population for which these are substitute goods. Thus, when the price of contraception goes down, the relative price of an abortion goes up. Moreover, "an improvement in contraceptive technology that reduces the marginal cost of contraception will increase the level of contraceptive intensity, reducing the likelihood of a pregnancy" [14].

2.2 Hypothesized Outcomes from Akerlof's Model

Based on Akerlof, Yellen, and Katz's (1996) model, we could expect two possible outcomes regarding abortions from lowering the price of an IUD. First, we could expect that the number of abortions would decrease, because lowering the price of an IUD is raising the relative price of an abortion. On the other hand, we could expect a perverse outcome in which lowering the price of an IUD increases abortions.

> Before the technology shock abstinence would be the norm for all women. After the technology shock those women who would use contraception or would be wiling to obtain an abortion in the event of pregnancy or both engage in premarital sexual activity. However, those women who are not willing to use contraception or obtain an abortion will also engage in sexual activity, since they correctly fear that if they abstain their partners would seek satisfaction elsewhere. The advent of contraception and abortion used by others may result in an unwanted increase in sexual participation for those who reject the new technology" [2].

Levine's model suggests that the demand for abortion should fall as the relative price of an abortion rises due to subsidized LARC. This would show up in our analysis as a reduction in the number of abortions for the affected group relative to counterfactual. On the other hand, Akerlof's model suggests a perverse outcome could occur if there are women who are opposed to adopting LARC. Insofar as Akerlof's conjecture is correct – that contraception technology alters sexual markets and induces some women to select into sexual relationships who would not have otherwise – then LARC contraception could lead to increases in unwanted births among the group of women least likely to adopt LARC. If this leads to more unwanted births, then hypothetically, LARC may lead to an increase in abortion demand.

CHAPTER THREE

Methodology

3.1 Data Description

We gathered data from the Alan Guttmacher Institute (AGI), the Centers for Disease Control and Prevention (CDC), National Cancer Institute (via the SEER U.S. Population Data), and the Current Population Survey (CPS). From the AGI, we gathered number of abortions available per state per year (1973-2011). From

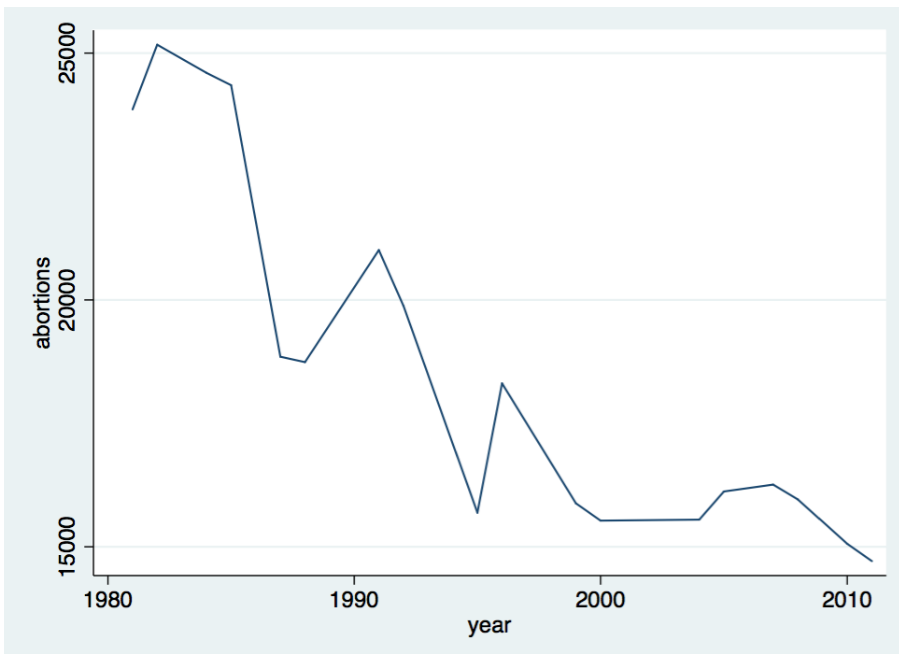

Figure 3.1. Number of Abortions per Year in Colorado, AGI Data

the CDC, we gathered the following for every state-year beginning in 1990: total abortions; number abortions per age group (younger than 15, ages 15-19, age 20-24, age 25-29, age 30-34, age 35-39, age 40 or older), number of abortions performed various weeks of gestation (these data categories changed, so we condensed the data to be gestation less than 8 weeks, gestation 9 to 15 weeks, and gestation of 16 or more weeks); number of abortions to married women, and number of abortions to unmarried women; number of live births before this abortion; number of prior abortions. From the SEER data, we have population data per age group and race

Figure 3.2. Number of Abortions per Year in Colorado, CDC Data

(not ethnicity). From the CPS data, we collected total income, highest education level, employment status, whether they are single, divorced, or single. From the CPS data, we generated variables “poor” and “very poor”. “Very poor” is defined to be the proportion of individuals with income at or below the 10th percentile (CPI adjusted to be in 2011$); “poor” on the other hand is the proportion of individuals with income between the 10th and 25th percentiles (CPI adjusted to be in 2011$). States California, Florida, and New Hampshire were missing completely from the CDC data – so these states are eliminated altogether from analysis.

We acquired abortion data from both the CDC and the AGI. These two agencies collect data on abortions from each state differently, and have very different numbers. The AGI collects abortion data by surveying providers directly [3] whereas the CDC collects data “through a voluntary federal-state partnership in which states are responsible for collecting and managing data” [15]. As a result, states ultimately

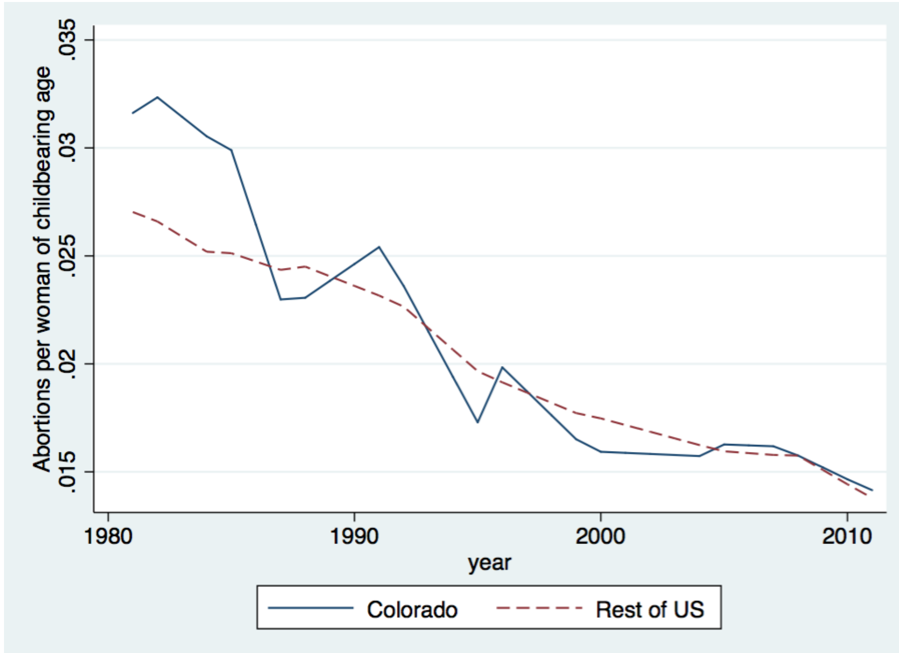

Figure 3.3. Abortion Rates for Colorado and the Rest of the U.S., AGI Data

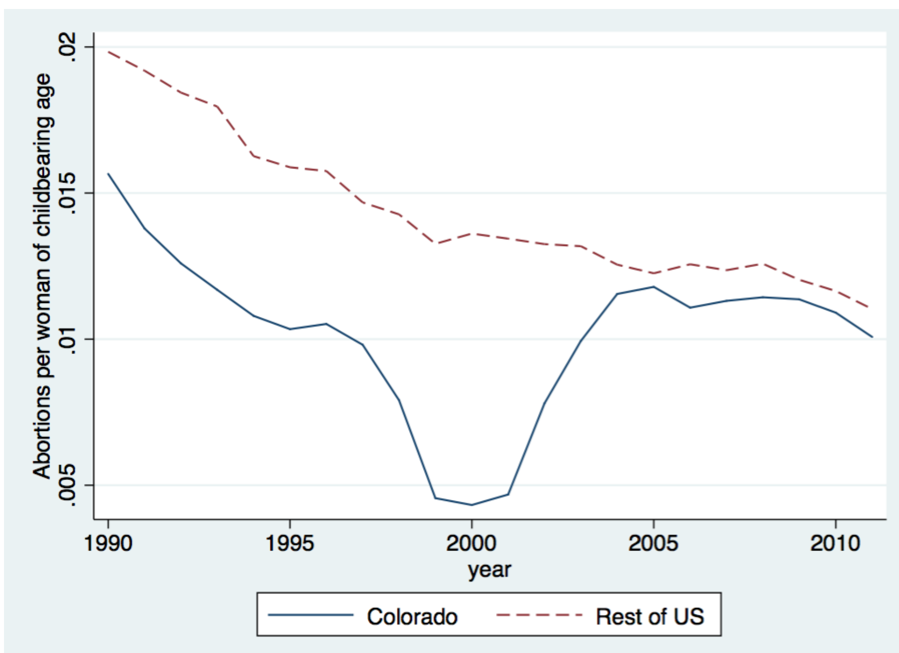

Figure 3.4. Abortion Rates for Colorado and the Rest of the U.S., CDC Data

determine the quality and availability of national, government-generated abortion data" [15]. Figure 3.1 shows the number of abortions per year in Colorado using the AGI data; Figure 3.2 shows the number of abortions per year in Colorado using

CDC data. Figures 3.3 and 3.4 display the trends in abortion rates per woman of childbearing age (ages 15-44) in Colorado and the rest of the U.S., using the AGI data, and the CDC data, respectively.

3.2 Method

Analyzing the effect of the CFPI is a Comparative Case study because it compares the evolution of an aggregate outcome for the unit affected by the intervention to the evolution of the same aggregate for some control group. In our comparative case study, the unit of analysis - Colorado - is an aggregate entity, and there is no suitable single comparison group. Synthetic Control generates a comparison unit by selecting the weighted average of all potential comparison units that best resembles the characteristics.

We observe Colorado and J-many states that comprise a donor pool of potential controls during a pretreatment period of T years, giving us a total of $J+1$ units. We use k covariates that are relevant to our outcome of interest to match on during the pretreatment period and find the best combination of untreated units that resembles the treated unit Colorado. Each state in the donor pool has a nonnegative weight assigned to it such that the sum of all of these weights is 1 (if the weight for a state is 0, that means the state is not included in Synthetic Colorado). Moreover, if X_{jm} is the value of the mth covariate for state j, the weights are chosen to minimize $\displaystyle\sum_{m=1}^{k} v_m(X_{1m} - \sum_{j=2}^{J+1} w_j X_{jm})^2$, where v_m is a weight that reflects the relative importance that we assign to the mth variable when we measure the discrepancy between the treated unit (unit 1) and the synthetic control ($\sum_{j=2}^{J+1} w_j X_{jm}$) for each covariate m. Moreover, if Y_{jt} is the value of the outcome for unit j at time t in the post-treatment period, the synthetic control estimator of the effect of the treatment is given by the comparison between the outcome for the treated unit and the outcome for the synthetic control at that period. That is, $\displaystyle Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$ [1].

Abadie, Diamond, Hainmueller argue that if the number of pre-intervention periods in the data is large, matching on pre-intervention outcomes allows to control for heterogeneous responses to multiple unobserved factors. Because we are synthesizing a counterfactual, only units that are alike in both observed and unobserved determinants of the outcome variable, as well as in the predictors of the outcome variable, should produce similar trajectories of the outcome variable over extended periods of time [1].

To determine statistical significance of our results, we conduct a series of placebo tests where we iteratively assign the treatment to states other than Colorado. This generates a distribution of placebo effects. We also compare the gap, the root mean squared prediction error (RMSPE), for Colorado to the distribution of placebo gaps, where

$$RMSPE = (\frac{1}{T - T_0} \sum_{t=T_0+1}^{T} (Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt})^2)^{1/2}$$

We also calculate a ratio of the post-treatment to the pretreatment RMSPE to calculate a P-value for Colorado – to determine if our results are statistically significant compared to the distribution of placebos.

CHAPTER FOUR

Results

4.1 AGI Synthetic Control Estimates using 50 States as a Donor Pool

Our analysis of abortions uses the Alan Guttmacher abortion data, and we go back to 1981 because the more pretreatment periods we have, the more accurate our matching will be. The synthetic control model selects states that are most similar to abortion rates and other covariates of interest before 2009. After matching on the pretreatment period, we can infer if any decline in abortion rates is due to the treatment of the CFPI.

Because the AGI is missing data for some years, we interpolate the missing

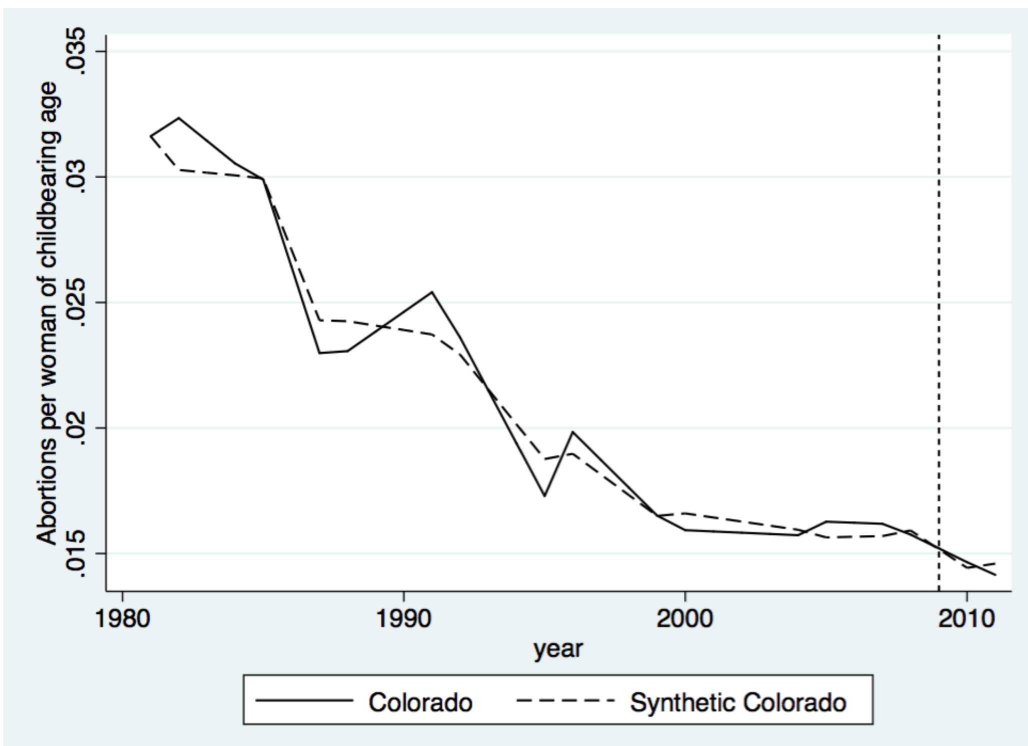

Figure 4.1: Trends in Abortions per Woman of Childbearing Age: CO and synthetic CO - 50 states donor pool, AGI data

data values using a straight line to approximate the missing abortion data. The actual and synthetic characteristics from our model are in Table 4.2. The states which make up synthetic Colorado is a weighted average of District of Columbia (.02), Georgia (.133), Hawaii (.03), Kansas (.109), Nevada (.033), New Hampshire (.501), Rhode Island (.004), South Dakota (.015), and Washington (.156), shown in Table 4.1.

Figure 4.1 shows both the synthetic Colorado and Colorado trend before and after the treatment year (2009). The model fits fairly well on the pretreatment period of 1981-2008, and we see no difference in the post-treatment period. Because there is no gap in the post-treatment period, there appears to be no evidence of a causal effect. In Figure 4.2, we can see where our model of synthetic Colorado fits

Table 4.1. Colorado Synthetic Control Weights, 50 states - AGI

State name	Estimated Weight
District of Columbia	.02
Georgia	.133
Hawaii	.03
Kansas	.109
Nevada	.033
New Hampshire	.501
Rhode Island	.004
South Dakota	.015
Washington	.156

well and where it does not. Because the gaps in pretreatment estimation are large relative to the gaps in post-treatment estimation, the decline in the post-treatment period does not say much. The post/pre RMSPE ratio for Colorado is $\frac{40}{51} = 0.784$

As recommended by Abadie et al. (2010), we ran a series of placebo tests to test the statistical significance of our results. This placebo test is done by assigning treated status to all of the states in the control donor pool, one by one, finding their synthetic model, and then finding the 'gaps'. Figure 4.4 shows these gaps for all states in the control pool. The state that is the outlier here is California, so we remove it in Figure 4.5. Figure 4.5 illustrates that we are not seeing anything statistically significant from our synthetic control model estimation. The histogram showing the distribution of the ratio of post-RMSPE/pre-RMSPE for all states is in Figure 4.3. Where Colorado lies in the histogram is noted.

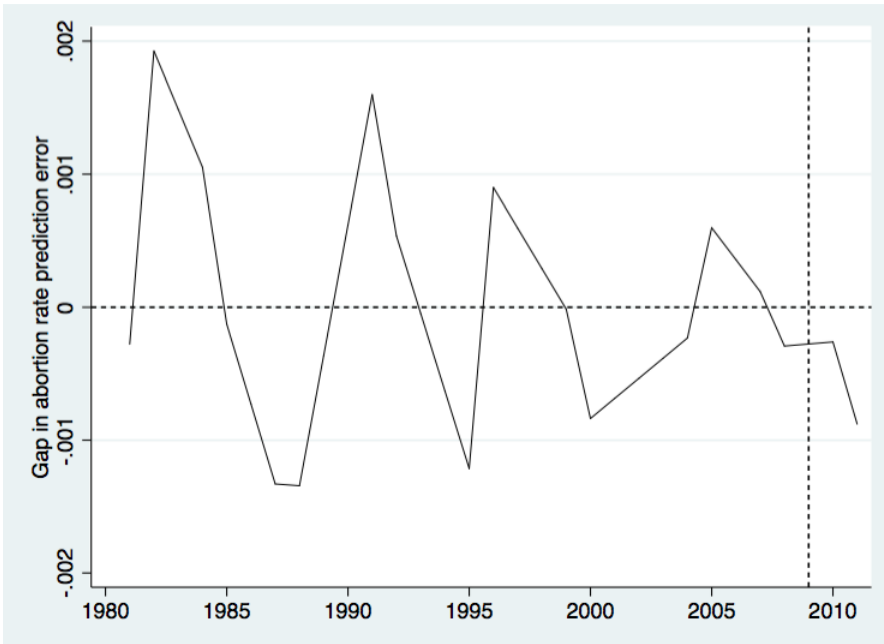

Figure 4.2: Per woman of childbearing age abortion gap between CO and synthetic CO - 50 states donor pool, AGI data

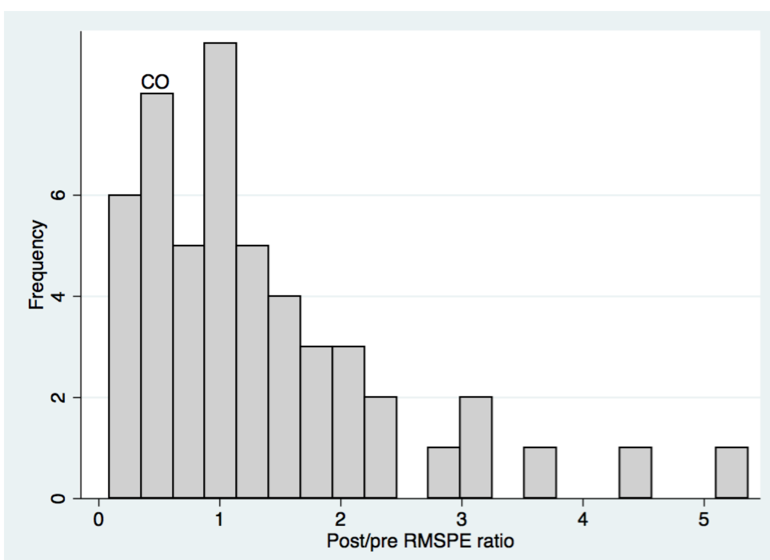

Figure 4.3. Post/pre RMSPE histogram - 50 states donor pool, AGI data

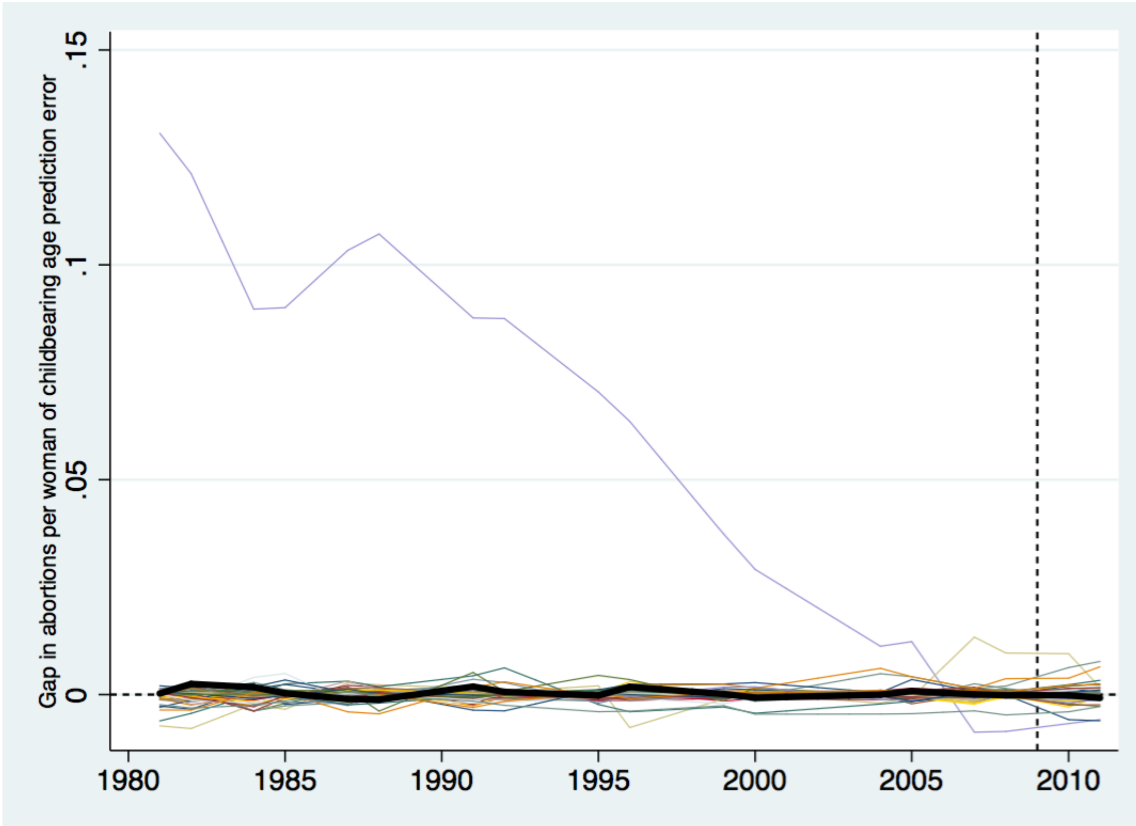

Figure 4.4: Per woman of childbearing age abortion gap in Colorado and placebo gaps in all states - 50 states donor pool, AGI data

Table 4.2. Actual Versus Synthetic Colorado Characteristics, 50 states - AGI

Variable names	Colorado	Synthetic Colorado
Abortions per Woman (1981)	.0316184	.0316173
Abortions per Woman (1985)	.0298957	.0299392
Abortions per Woman (1988)	.0230616	.0242524
Abortions per Woman (1992)	.0236032	.0229211
Abortions per Woman (1995)	.0172896	.0187632
Abortions per Woman (1999)	.0165088	.016499
Abortions per Woman (2004)	.0157292	.0159458
Abortions per Woman (2008)	.0157557	.0159194
Proportion of Ages 15 to 19	.1439371	.1570628
Proportion of Ages 20 to 24	.1588557	.1579591
Proportion of Very Poor	.0731408	.0714987
Proportion of White Females	.4479808	.4335932
Proportion with less than a HS Diploma	.2050961	.2220045

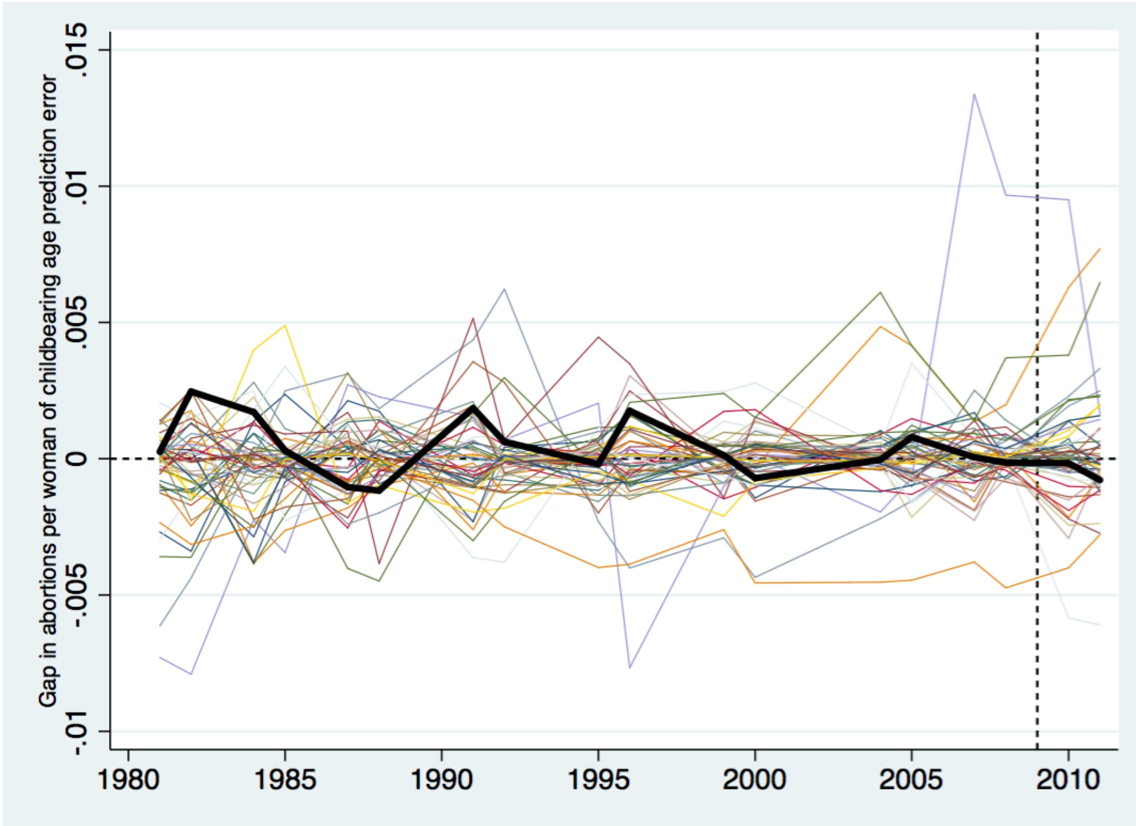

Figure 4.5: Per woman of childbearing age abortion gap in Colorado and placebo gaps in all states, having removed California (outlier) - 50 states, AGI data

4.2 AGI Synthetic Control Estimates using 29 States as a Donor Pool

This analysis is the same as the above, save that we have 29 states that compose our donor pool of possible control units. The actual and synthetic characteristics from our model are in Table 4.4. The states that make up synthetic Colorado is

Table 4.3. Colorado Synthetic Control Weights, 29 states - AGI

State name	Estimated Weight
District of Columbia	.023
Hawaii	.076
Kansas	.249
Maine	.033
Nevada	.045
New Hampshire	.574

a weighted average of District of Columbia (.023), Hawaii (0.076), Kansas (0.249), Maine (0.033), Nevada (0.045), and New Hampshire (0.574), seen in Table 4.3. Figure 4.6 shows Colorado and synthetic Colorado trends before and after the treatment year (2009).

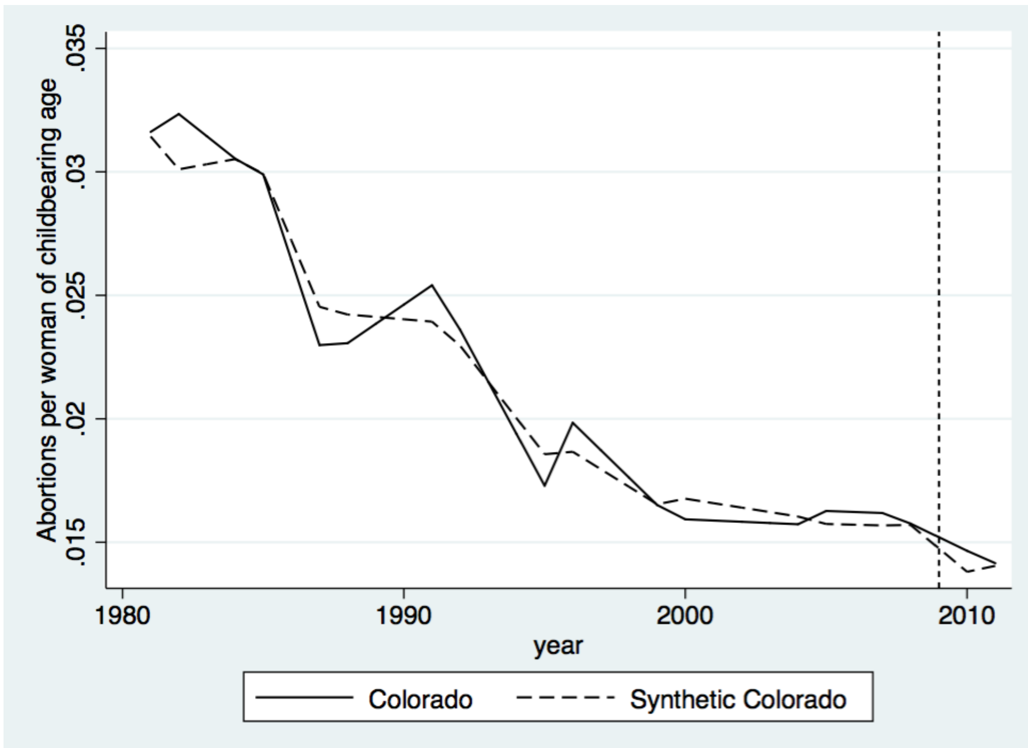

Figure 4.6: Trends in Abortions per Woman of Childbearing Age: CO and synthetic CO - 29 control states, AGI data

The model fits fits fairly well in the pretreatment period, and does not appear to diverge significantly in the post-treatment period. The gaps between Colorado and synthetic Colorado are shown in Figure 4.7. To determine the statistical significance, we ran the placebo tests and found that, of all 30 states included in our analysis, Colorado ranked 20th in the post/pre RMSPE ratio. Thus, the probability of obtaining a post/pre RMSPE ratio as large as Colorado's is $\frac{20}{30} = 0.667$. Figure 4.9 shows these gaps for all states in the donor pool; Figure 4.10 removes the outlier, and Figure 4.11 discards all states with pre-treatment RMSPE 2 times higher than Colorado's. Here we can see that Colorado's trend is not statistically significant with

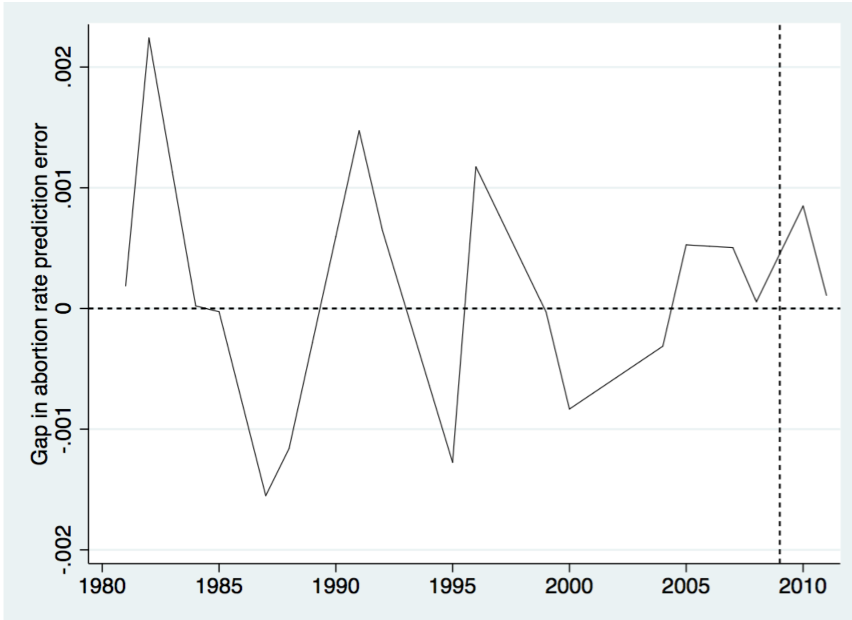

Figure 4.7: Per woman of childbearing age abortion gap between CO and synthetic CO - 29 control states, AGI data

respect to the other states. The histogram displaying the distribution of post/pre RMSPE ratios for all states is given in Figure 4.8.

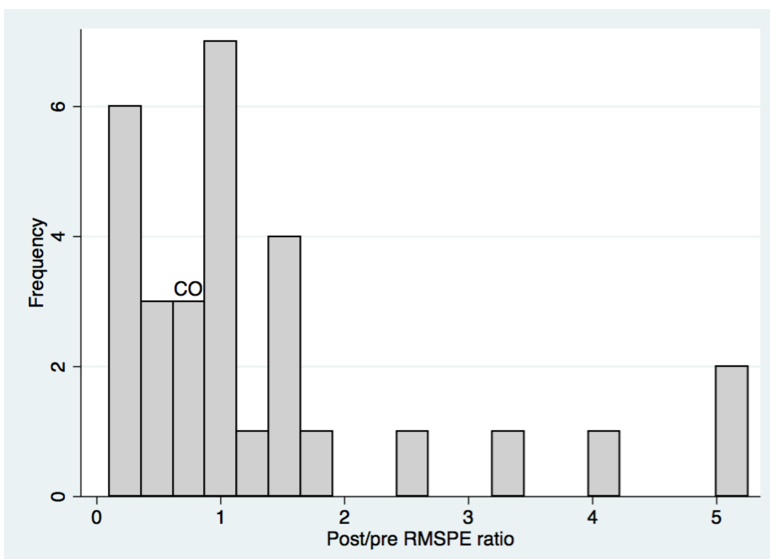

Figure 4.8: Per woman of childbearing age abortion gap between CO and synthetic CO - 29 control states, AGI data

Table 4.4. Actual Versus Synthetic Colorado Characteristics, 29 states - AGI

Variable names	Colorado	Synthetic Colorado
Abortions per Woman (1981)	.0316184	.0314319
Abortions per Woman (1985)	.0298957	.0299234
Abortions per Woman (1988)	.0230616	.0242215
Abortions per Woman (1992)	.0236032	.0229598
Abortions per Woman (1995)	.0172896	.0185649
Abortions per Woman (1999)	.0165088	.016538
Abortions per Woman (2004)	.0157292	.0160419
Abortions per Woman (2008)	.0157557	.0157003
Proportion of Ages 15 to 19	.1439371	.1591901
Proportion of Ages 20 to 24	.1588557	.1586461
Proportion of Very Poor	.0731408	.067395
Proportion of White Females	.4479808	.4387646
Proportion with less than a HS Diploma	.2050961	.2245584

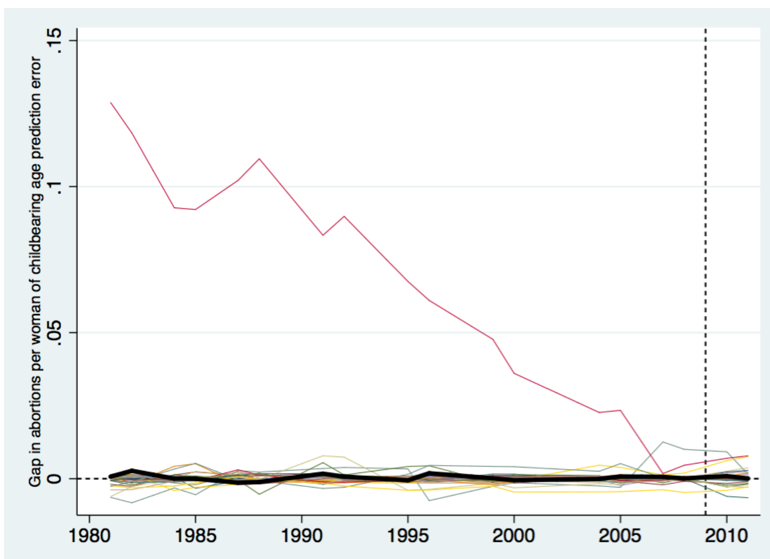

Figure 4.9: Per woman of childbearing age abortion gap between CO and synthetic CO - 29 control states, AGI data

4.3 CDC Synthetic Control Estimates using 25 States as a Donor Pool

In this analysis, we excluded all states that had comparable funding to the CFPI, and also removed additional states that were not present in the CDC's abortion data, leaving 25 states as a donor pool for control units. Because each state has

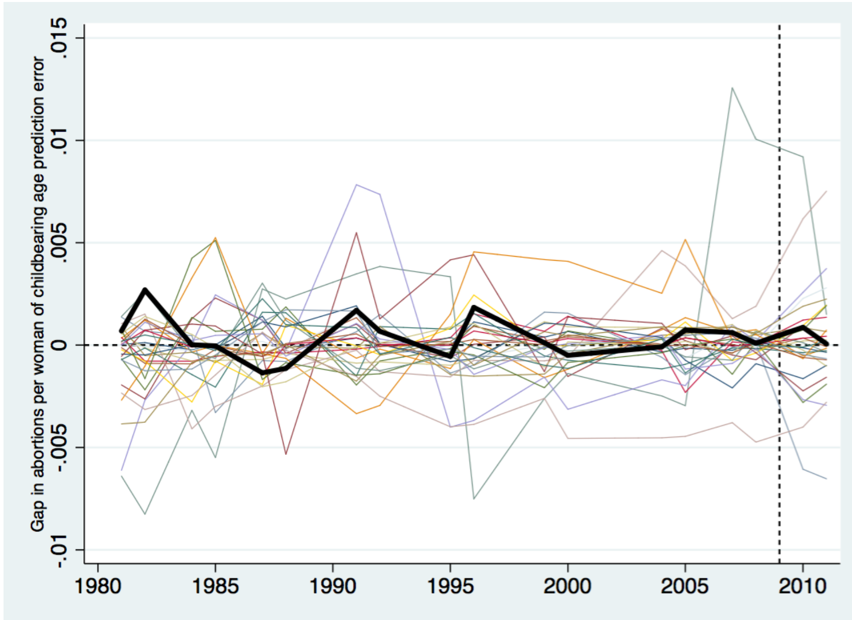

Figure 4.10: Per woman of childbearing age abortion gap between CO and synthetic CO - 29 control states, removed outlier of D.C., AGI data

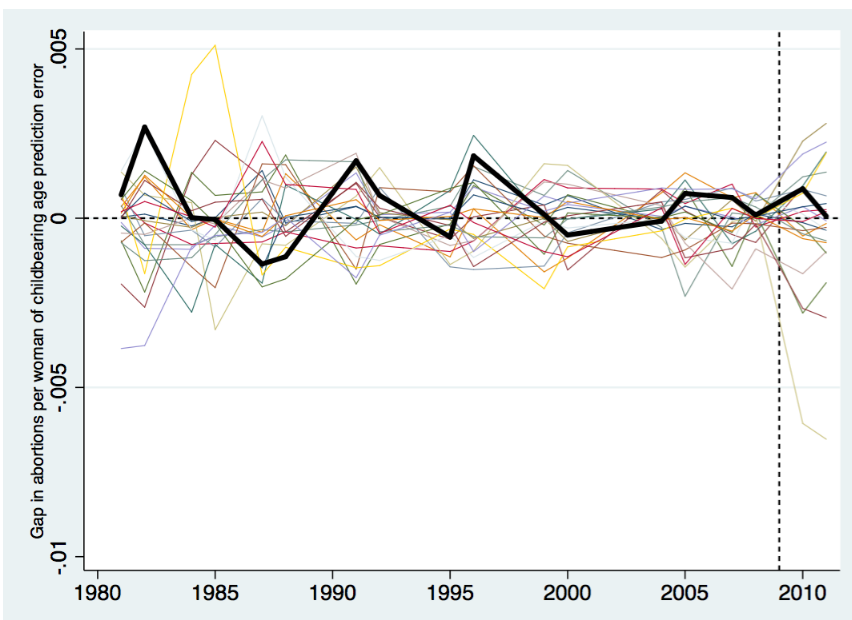

Figure 4.11: Per woman of childbearing age gaps in Colorado and placebo gaps in all 29 control states (discards states with pre-CFPI RMSPE 2 times higher than CO's, AGI data

its own laws and procedures for collecting abortion data, there is reason to believe that there is heterogeneity in reporting data from each state. To address this, we decided to examine disaggregate outcomes as a share of total abortions. Because young, low-income women are most likely to benefit from the lowering of the cost of an IUD, we focused our analysis on outcomes where women are young. In particular, this model has the outcome of proportion of abortions to women ages 15 to 19. The trend for Colorado and synthetic Colorado is shown in Figure 4.12. Synthetic Colorado is composed of a weighted average of Connecticut (0.113), Hawaii (0.345), Kansas (0.227), Maryland (0.057), Nebraska (0.141), Nevada (0.001), and South Dakota (0.116), as seen in Table 4.5.

Table 4.5. Colorado Synthetic Control Weights, 25 control states - CDC data

State name	Estimated Weight
Connecticut	.113
Hawaii	.345
Kansas	.227
Maryland	.057
Nebraska	.141
Nevada	.001
South Dakota	.116

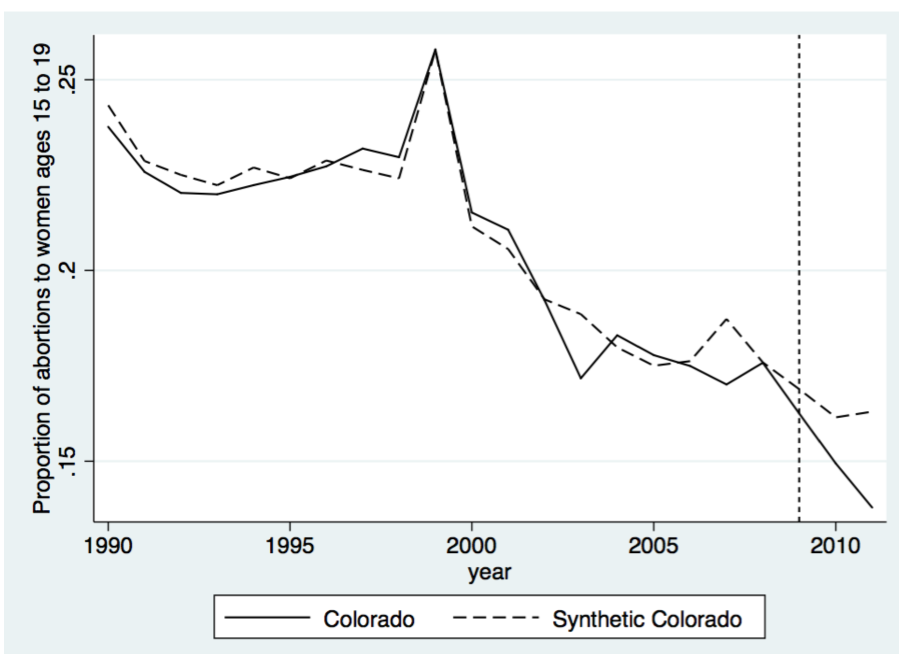

Figure 4.12: Proportion of Abortions to Women Ages 15 to 19, 25 control states - CDC data

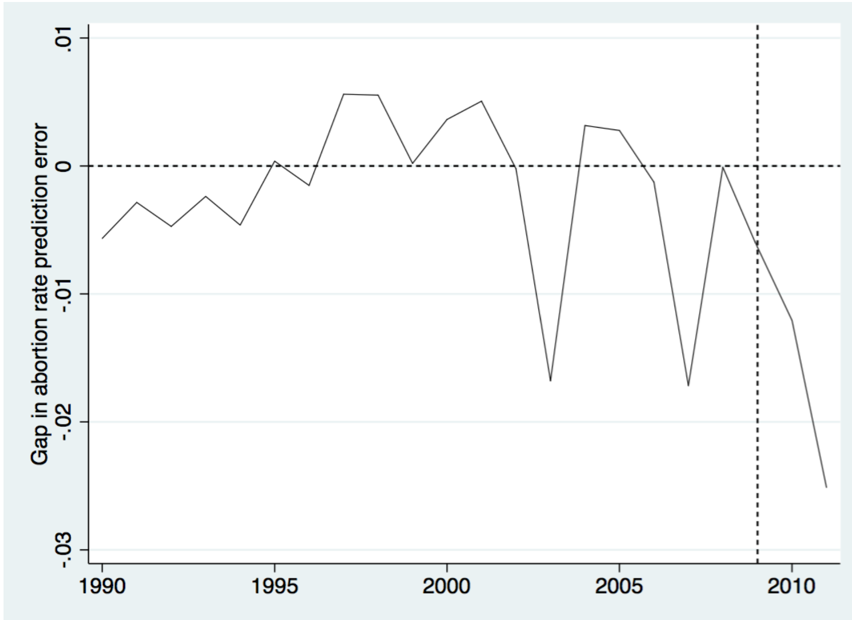

Figure 4.13. Gap in Abortion Proportion Predicted Error, 25 control states - CDC data

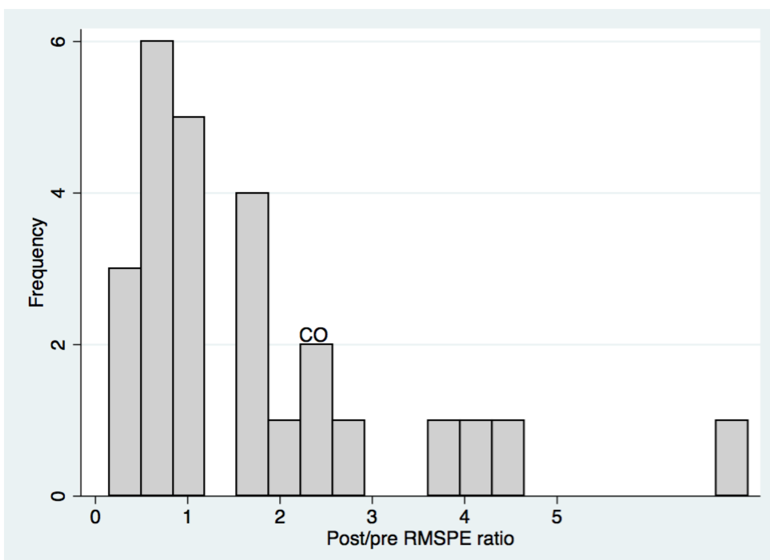

Figure 4.14. Histogram of post/pre RMSPE ratio, 25 control states - CDC data

The characteristics for the matching are shown in Table 4.6. This model has the most divergence between Colorado and the counterfactual, but notice that the divergence begins in the pre-treatment period, which is very clear in Figure 4.13, which shows the gap in predicted error. The placebo test shows that of all 26

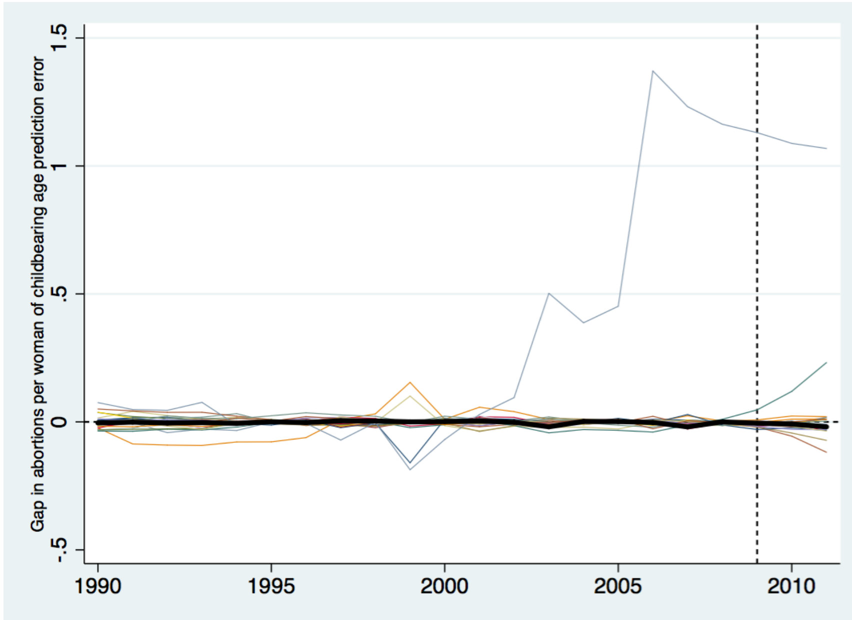

Figure 4.15. Placebo gaps in all 25 control states, along with CO - CDC data

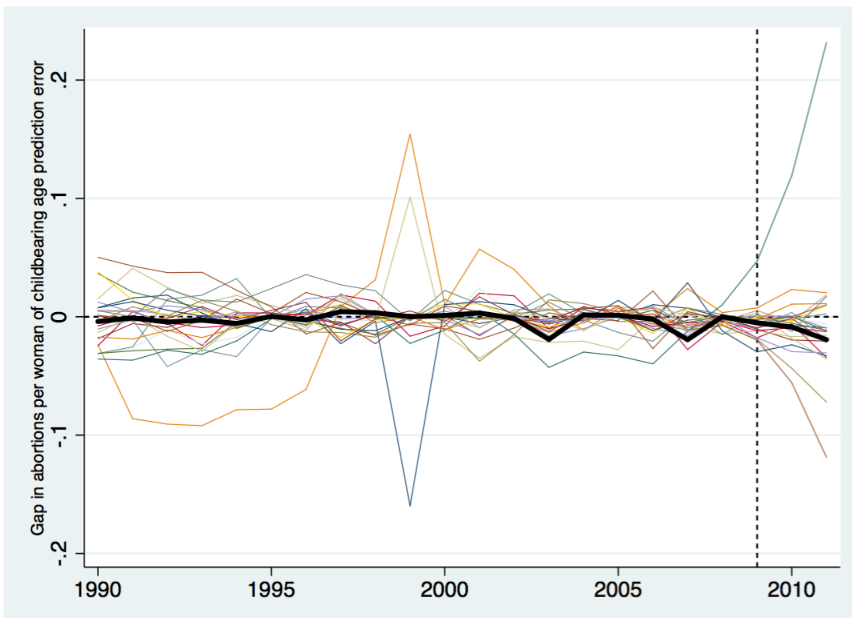

Figure 4.16. Placebo gaps in all 15 control states excluding Wyoming - CDC data

states included in our analysis, Colorado ranked 20th in the post/pre RMSPE ratio. Thus, the probability of obtaining a post/pre RMSPE ratio as large as Colorado's is $\frac{7}{26} = 0.269$, which is not statistically significant. Figure 4.15 shows the placebo gaps in all 25 states in our donor pool; Figure 4.16 removes the outlier of Wyoming; the black line for where Colorado is the treated unit is essentially in the middle of the pack. There seems to be some evidence for a decrease in the abortion proportion for women ages 15 to 19, but it does not appear to be caused by the CFPI. The histogram of the distribution of post/pre RMSPE ratios is given in Figure 4.14.

Table 4.6. Actual Versus Synthetic Colorado Characteristics, 25 control states - CDC

Variable names	Colorado	Synthetic Colorado
Proportion of Abortions age 15 to 19 (1995)	.2245311	.2241558
Proportion of Abortions age 15 to 19 (1999)	.2579247	.257725
Proportion of Abortions age 15 to 19 (2000)	.2151839	.2115503
Proportion of Abortions age 15 to 19 (2002)	.1922135	.1924303
Proportion of Abortions age 15 to 19 (2005)	.1777949	.1750225
Proportion of Abortions age 15 to 19 (2008)	.1758052	.1759058
Very poor	.0655586	.0655379
Poor	.1145694	.1192389

CHAPTER FIVE

Discussion

5.1 Conclusion

We find no effect of the decrease of the price of an IUD on the number of abortions. From 2008-2011, there have been unprecedented drops in the abortion rates (and numbers) nationally [12], and no one seems to know what the cause is. There is some research suggesting that the MTV show *16 and Pregnant* may have some contribution here. Likely there are several contributing factors for the decline in abortions. Due to this national trend, we cannot confidently say that the decrease in abortions after 2009 is caused by the CFPI. One limitation of our data is that we only have three years post-treatment; perhaps further analysis could be done when more years of abortion data become available. Another area worth researching would be analyzing the effect of the CFPI on births. Another possible interpretation of our results is that it is possible for the two theoretical possibilities to be mixed (for abortions to increase in one subgroup, and for abortions to decrease in another subgroup), thus yielding no net effect.

5.2 Policy Implications

Since the analysis suggests that the CFPI lowering the price of an IUD did not cause the decrease in abortions in Colorado, perhaps we should be hesitant to support funding to make IUDs free, because it seems to make no difference.

BIBLIOGRAPHY

[1] A. Abadie, A. Diamond, and J. Hainmueller, Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Program, *Journal of the American Statistical Association* **105**(490) (2010), 493–505.

[2] G. Akerlof, J. Yellen, and M. Katz, An Analysis of Out-of-Wedlock Childbearing in the United States, *The Quarterly Journal of Economics* **111**(2) (1996), 277–317.

[3] D. Allen, H. Atrash, and R. Rochat, Legal abortions in Tennessee 1974-1978. *Journal of the Tennessee Medical Association* **73**(12) (1980), 855–863.

[4] A. Anderson, C. Dehlendorf, K. Gbenedio, M. Tharayil, J. Steinauer, A. Wittman, Counseling about IUDs: A Mixed-Methods Analysis. *Perspectives on Sexual and Reproductive Health*, **46**(3) (2014), 133–140.

[5] C. Chuang, and C. Weisman, Making the Most of the Affordable Care Act's Contraceptive Coverage Mandate for Privately-Insured Women. *Women's Health Issues*, (2014).

[6] K. Cleland, J. Peipert, S. Spear, J. Trussell, and C. Westhoff, Family Planning as a Cost-Saving Preventive Health Service *The New England Journal of Medicine*, **37**, (2011).

[7] J. Donohue, and S. Levitt, Measurement Error, Legalized Abortion, and the Decline in Crime: A Response to Foote and Goetz.

[8] M. Eeckhaut, J. Gipson, M. Sweeney, Who Is Using Long-Acting Reversible Contraceptive Methods? Findings from Nine Low-Fertility Countries. *Perspectives on Sexual and Reproductive Health*, **46**(3), (2014), 149–155.

[9] K. Ethier, L. Frohwirth, J. Jerman, M. Kavanaugh, and R. Popkin, *Journal of Pediatric & Adolescent Gynecology*, **26**, (2013), 86–95.

[10] C. Harper, W. Shields, and J. Speidel, The Potential of Long-Acting Reversible Contraception to Decrease Unintended Pregnancy. *Contraception* **78**, (2008), 197–200.

[11] R. Haveman, K. Pence, and B. Wolfe, Intergenerational Effects of Nonmarital and Early Childbearing. *Out of Wedlock: Causes and Consequences of Nonmarital Fertility*. Russell Sage, New York, 2001.

[12] R. Jones and J. Jerman, Abortion Incidence and Service Availability In the United States, 2011, *Perspectives on Sexual and Reproductive Health*, **46**(1), (2014).

[13] G. Klinger, S. Ricketts, and R. Schwalberg, Game Change in Colorado: Widespread Use of Long-Acting Reversible Contraceptives and Rapid Decline in Births Among Young, Low-Income Women, *Perspectives on Sexual and Reproductive Health*, **46**(3), (2014).

[14] P. Levine, *Sex and Consequences: Abortion, Public Policy, and the Economics of Fertility*, Princeton, New Jersey, 2004.

[15] R. Saul, Abortion Reporting in the United States: An Examination of the Federal-State Partnership. *Family Planning Perspectives*, **30**(5), (1998).

[16] L. Wang, *Long-acting Reversible Contraceptives Under the ACA: How to Help Patients Get Coverage* Medscape. Retrieved from http://www.medscape.com/viewarticle/821561_2, (2014).

[17] Title X Family Planning http://www.hhs.gov/opa/title-x-family-planning/