Effects of Infertility Insurance Mandates on Fertility[⊗]

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Abstract

Infertility currently affects over 6 million individuals in the United States. While most health insurance plans nationwide do not cover infertility diagnoses or treatments, to date fifteen states have enacted some form of infertility insurance mandate. In this paper, I use data from the Vital Statistics Detail Natality Data and Census population estimates to examine whether these state-level mandates were successful in increasing fertility rates. Using a difference-in-differences approach, I exploit variation in the enactment of mandates both across states and over time, and identify control groups that should not have been affected by infertility coverage. My results suggest that the mandates significantly increase first birth rates for women over 35, and these results are robust to a number of specification tests.

JEL codes: I3, J1

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I. Introduction

The American Society of Reproductive Medicine (ASRM) has defined infertility to be a disease of the reproductive system. Like other diseases, it imposes significant costs on women and families. The psychological effects of infertility have been compared to the effects of other diseases such as cancer and heart disease (e.g. Fidler and Bernstein, 1999), and the financial costs of treatment can be quite large. These costs are currently borne by a large number of individuals, as infertility affects over 6 million individuals, and one in ten couples cannot conceive without medical assistance. However, only 25 percent of all health plan sponsors provide coverage for infertility services.

The ASRM has stated, "The desire to have children and be parents is one of the most fundamental aspects of being human. People should not be denied insurance coverage for medically appropriate treatment to fulfill this goal."[1] In response to a perceived need for coverage, legislation was introduced at the federal level in 2003 that would require health plans to provide infertility benefits.[2] As the fraction of the population affected by infertility continues to rise, there are likely to be continued efforts to mandate coverage. Understanding the costs and benefits of these policies thus becomes increasingly important.

As of 2003, fifteen states have enacted some form of infertility insurance mandate. I use Vital Statistics Detail Natality Data and Census population estimates to examine whether these state-level mandates were successful in increasing fertility rates. Using a difference-in-differences approach, I exploit variation in the enactment of mandates both across states and over time, and identify control groups that should not have been affected by infertility coverage. My

[1] www.asrm.org/Patients/faqs.htm

[2] The Family Building Act of 2003 (HR 3014) would require insurance coverage of infertility treatment (including up to four *in vitro* fertilization (IVF) attempts) by all group health plans that also require obstetrical benefits.

results suggest that the mandates significantly increase first birth rates for women over 35, and these results are robust to a number of specification tests.

II. Background Information

A. Incidence of Infertility/Impaired Fecundity

There are a variety of problems associated with defining infertility as well as with obtaining standardized measures of its incidence that can be followed over time. Demographers using the National Survey of Family Growth have used two criteria to classify whether women are having difficulties in childbearing. *Infertility* only applies to married or cohabiting women, and is defined as the condition of being unable to conceive after 12 or more consecutive months of unprotected intercourse. *Impaired fecundity*, however, applies to women of any marital or cohabiting status, and is defined as having problems with conceiving or carrying a pregnancy to term, as well as being unable to conceive after 3 years of unprotected intercourse (Chandra and Stephen, 1998).[3,4]

Overall, the proportion of women reporting impaired fecundity has risen only 2 percentage points between 1982 and 1995, from 8% to 10%. However, due to increasing numbers of women between the ages of 15-44, there has actually been a dramatic increase in the number of women reporting infecundity, from 4.6 million to 6.2 million.[5] This increase has occurred across almost all subgroups of women, including along the dimensions of marital status, income, education, race, and ethnicity (Chandra and Stephen, 1998). The one dimension on which fertility-impaired women differ from the general population of women is age -- 43% are aged 35-44, as compared with 36% of the general population (Stephen and Chandra, 2000)

[3] Both conditions only apply to those women who are not surgically sterile.
[4] However, the ASRM does not, in official documents, make this distinction.
[5] One reason given for this increase is delay of childbearing to later ages that are associated with decreased fertility. Another possibility is that an increase in attention paid to infertility by the media may have increased women's awareness of potential fertility problems, leading to an increase in self-reports.

Treatments for infertility can be extremely expensive. Most instances of impaired fecundity are treated by "conventional" methods such as drug treatment or surgical repair of reproductive organs. Some of the less invasive therapies such as hormone therapy can range from $200-$3,000 per cycle. Tubal surgery can range from $10,000-$15,000, requires a hospital stay and poses a high risk of complication (Resolve, 2003). In vitro fertilization (IVF) accounts for approximately five percent of all infertility treatments, and the average cost of an IVF cycle in the United States is $12,400 (ASRM, 2003).

Despite the large and growing share of the population that faces infertility problems, and despite the large financial costs of treatment, health care coverage of treatment is limited. Nationwide, only 25% of health care plans cover infertility treatment, and coverage varies significantly by state.[6] Of the 6.2 million women with impaired fecundity in 1995, 2.7 million (44%) had ever sought treatment. Of that group, 700,000 women had sought treatment within the past year. However, as a result of the high (and often uninsured) costs associated with treatment, medical assistance for infertility is sought primarily by women and couples that are white, college-educated, and affluent. Women with private health insurance coverage were 50% more likely to have received services, as were women with income more than 300% of the poverty line (Stephen and Chandra, 2000). This is the case even though increases in infertility over time have occurred across all race, ethnicity, income, and education groups (see Chandra and Stephen (1998) and Stephen and Chandra (2000)). It is widely believed that there is an unmet need for infertility services, especially among those with lower incomes and lower levels of education (Chandra & Mosher 1994).

[6] As a comparison, in 2002 78% of covered workers had coverage for oral contraceptives (Kaiser Foundation, 2002), and a study of health plans found that 57% covered colonoscopy (Klabunde et al., 2004).

B. State Mandates

The first state-level infertility insurance mandate was enacted by West Virginia in 1977. Since that time, fourteen other states have passed mandates, and additional states have ongoing legislative advocacy efforts in this area. Of the traditional economic justifications for mandated benefits (e.g. Summers, 1989; Gruber, 1994)), the best efficiency argument is that asymmetric information between the patient and insurer will lead to an adverse selection problem so that benefits will not be provided by the private market (e.g. Rothschild and Stiglitz, 1976).

In addition, two externality arguments can be made for mandated infertility coverage. Both deal with multiple births, which are costly to society and are generally paid for by higher health insurance premiums for everyone. First, if fertility drugs and IVF are substitutes, and if cheaper fertility drugs increase the incidence of multiple births, then subsidizing IVF might reduce the number of multiple births. Second, since IVF is so expensive, if a couple chooses to undergo this treatment and bears the full cost, there is a great deal of pressure for a successful cycle. This could lead to more embryos being transplanted per cycle, which increases the probability of multiple births. Studies (Jain et al. (2002), Reynolds et al. (2003), and Hamilton and McManus (2005)) find evidence that the presence of an IVF mandate reduces the number of embryos transplanted per cycle.

The mandates that have been passed vary along several dimensions. A mandate "to cover" requires that health insurance companies provide coverage of infertility treatment as a benefit included in every policy. A mandate "to offer" requires that health insurance companies make available for purchase a policy which offers coverage of infertility treatment. In addition, some mandates cover all health plans, while others either exclude health maintenance organizations (HMOs) or only cover HMOs. Finally some mandates exclude coverage of IVF,

which is one of the most expensive treatments available for infertility. Table 1 provides a list of the states with mandates currently in place, the date the mandates were enacted, whether the provisions are mandates to offer or mandates to cover, whether the mandates cover IVF, and how the mandates treat HMOs. Detailed information on these mandates, including any further restrictions placed on coverage, can be found in Appendix A.[7] As of 2000, these mandates were in place in only thirteen states. However, as is illustrated in Table 2, these mandates affect an increasing share of the population over time. In 1985, less than one percent of all live births in the US occurred in mandate states. By 1990, 30% of births were in mandate states, and this percentage rose to 46% by 1995.

By reducing the price of infertility treatment, we might expect to see an increase in utilization of treatments. This could be true if the mandate expands access to individuals who previously could not afford treatment, or if individuals who were previously receiving treatment now choose to consume higher quantities (or a higher quality) of treatment. However, it is also possible that these mandates have no effect on access or on treatment consumed, but simply provide windfall gains to those individuals who would have purchased treatment in the absence of insurance coverage. Finally, mandates may also have dynamic effects on the timing of births. Individuals could seek treatment earlier, which is beneficial from a medical perspective. Alternatively, individuals could further delay childbearing, with the knowledge that they will ultimately be covered.

To date only a few studies have looked at the effects of these mandates. Jain et al. (2002) and Reynolds et al. (2003) use clinic data from 1998 and find that states with required coverage for IVF have the highest rates of IVF utilization. Hamilton and McManus (2005) develop a

[7] Many mandates restrict treatment to individuals on the basis of marital status. In addition, several states also restrict treatment on the basis of age.

model of the market for IVF and use data from clinics at the Metropolitan Statistical Area level to test the model's predictions. Using data from 1995-2000, they confirm the findings of Jain et al. (2002) and Reynolds et al. (2003) that a mandate increases IVF utilization rates. They also find that clinics are attracted to areas where women are more educated and wealthier, but find no evidence that clinics are attracted to places where mandates are in effect. While these studies are an important contribution to our understanding of the effects of these mandates, they have several shortcomings. First, they focus exclusively on IVF, even though IVF comprises only about 5% of all infertility treatments. In addition, the studies are cross-sectional and cannot control for unobservable differences in patients or clinics that may be state-specific. It is therefore impossible to tell if, for example, higher rates of utilization in Massachusetts are caused by the mandate, or if Massachusetts had higher rates of utilization prior to the mandate.

Two additional studies exploit both state-level variation and variation over time to look at the effects of the mandates. Buckles (2005) uses Vital Statistics Detail Natality Data and finds that mandates that cover IVF are associated with a higher age at first birth.[8] Bitler (2005) uses the mandates to examine the effects of assisted reproductive technologies on infant health outcomes. She finds small negative effects of these technologies on length of gestation, birth weight, and Apgar scores.

In this paper, I use a difference-in-differences approach where I exploit variation in the enactment of mandates both across states and over time to determine whether these mandates have been successful in increasing first birth rates. By analyzing birth rates rather than IVF utilization, I can estimate the total effects of the mandates on fertility, which will include increases resulting from all types of infertility treatments.

III. Data

[8] Buckles also looks at impacts of the mandates on economic variables such as labor force participation and wages.

Information on births comes from Vital Statistics Detail Natality Data, gathered by the National Center for Health Statistics. This information is based on birth certificate data, and includes specific information about the timing, parity (whether it was a first or subsequent birth), and plurality (whether it was a single, twin, triplet, or higher order birth) of each birth. These data also include demographic information on the mother, including age, race, ethnicity, marital status, and educational attainment. Geographic information about the mother's state of residence is also provided. Beginning in 1985 the data cover every birth in the United States. The counts of births by state, year, race, and five-year age cohort are used to generate birth rates.[9]

The denominators for birth rates must come from another data source, since the birth certificates only provide information on those women who actually give birth. Population estimates are available for black and non-black women by age and state through the Census Bureau, and can be used to calculate birth rates. Ideally, the denominator would include only those women who have not yet had a first birth. However, the Census data do not allow for further breakouts. Birth counts by parity of the mother can be calculated, but denominators with counts of women by the number of children they have already borne cannot be generated. Other control variables, collected by state and by year, come from a variety of publicly available sources. Summary statistics for the data set, which covers the years 1985-1999, can be found in Appendix B.[10]

IV. Model Specification

I estimate the following model:

[9] Five year cohorts are used up to the age of 49 (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49). The maximum age reported by the Vital Statistics Data was 49 through 1996, and in 1997 births to women up to the age of 54 were also reported. I omit births to women 50 and older to maintain consistency across years.

[10] The last mandate passed during this sample period was Ohio, in 1991. All results are robust to analyzing the shorter period of years from 1985-1993.

$$\ln(fstbthrt)_{ajt} = \alpha + \beta Z_{jt} + \gamma Mand_{j(t-2)} + \theta(Mand_{j(t-2)} \times 35Plus) + \sum_a \delta_a A_a + \sum_j \delta_j S_j + \sum_t \delta_t T_t + \sum_{a*t} \delta_{at}(A_a \times T_t) + \varepsilon \quad (1)$$

where the dependent variable is the log first birth rate for age cohort *a* in state *j* and year *t*.[11] The first birth rate is equal to the number of first births within an age cohort-race-state-year cell, divided by the number of women in that same age cohort-race-state-year cell. I focus on first birth rates, because treatments are more likely to be sought by women who have not already borne children.

The independent variable of primary interest, *Mand*, is an indicator for whether a state had an infertility insurance mandate in place in a given year. In the specification, a mandate is not allowed to affect fertility rates in the year it is enacted, but can instead affect fertility rates with a two year lag. This is to account for two factors: 1) infertility treatments often do not result in an immediate conception; and 2) even if a conception occurs immediately, there is still a necessary nine-month waiting period before those new conceptions can affect fertility rates.[12] If the mandates have been successful at increasing access to infertility treatments, and if these treatments have been successful, then the estimated coefficient on this variable is expected to be positive.

[11] Other papers examining fertility often use the log birth rate as the dependent variable (for example, see Klerman (1999), and Dee (2001)), despite an ongoing debate in the literature about whether this practice is appropriate (e.g. Manning and Mullahy (2001). One specific concern with the log specification used here is the presence of some age cohort-race-state-year cells with zero births. In the main regression results presented here, I set zero cells to an arbitrarily small number before taking logs. However, I have run two tests to check the sensitivity of my results. I first eliminate the oldest cohort, where most of the zero cells occur. Results are qualitatively similar, but slightly smaller in magnitude. Second, I employ a technique developed by Papke and Wooldridge (1996) that explicitly accounts for both the fractional nature of the dependent variable and the presence of zero values. Again, results are similar in magnitude and statistical significance to those presented here.

[12] If a one-year lag structure is used, results are qualitatively similar but the magnitude of the estimated coefficients is slightly smaller.

However, it is possible that there exist systematic differences in first birth rates across states that are correlated with, but not caused by the state-level mandates. If this unobserved heterogeneity exists, one way to estimate the effects of the mandates accurately is to identify a treatment group for whom the mandates should have a direct effect, and a control group for whom they should not. This approach allows for estimation of the parameter of interest without bias. To this end, I use age cohort as a way of distinguishing a treatment group and a control group. The probability that a woman experiences infertility is extremely low for young women, and increases with age. Those women most likely to be affected by the mandates are those who have delayed childbearing, and specifically those women 35 and older.[13] As such, I interact the mandate with an identifier for whether the birth rates are for age cohorts 35 and older. The estimated coefficient γ will pick up any unobserved heterogeneity in birth rates that is correlated with the state mandates. The effect of the mandates on the treatment group of older women, θ, will then be estimated without bias.

One potential concern with this approach is the possibility that women under 35 may be a contaminated control group. This could happen for two reasons that would affect my results in opposing directions. First, younger women might also be receiving infertility treatments. Alternatively, it is possible that younger women may be more likely to delay childbearing if they know infertility treatment is covered by their insurance. An alternative way to think of the methodological approach is to interpret γ as the estimated effect of the mandates on all women, and θ as the additional effect on older women. The estimate of γ would be positive if the first effect dominated, and negative if the second effect was larger. As another robustness check, I

[13] The American Society for Reproductive Medicine identifies 35 as an important turning point in the risk of infertility problems. Their *Patient's Fact Sheet on the Prediction of Fertility Potential in Older Female Patients* states that "approximately one-third of couples in which the female partner is age 35 or older will have problems with fertility."

estimate all regressions omitting the portion of the control group most likely to be receiving infertility treatment – women 30-34. All results are robust to this alternate specification.

The *Z* vector controls for variables that will vary across states and over time that might also affect birth rates. These include variables that reflect economic conditions, including the state unemployment rate, log median usual weekly earnings, log tenth percentile weekly usual earnings, and female labor force participation rates.[14] A variable describing whether parental involvement is required for minors to obtain an abortion is also included.[15] The *Z* vector also includes the log maximum level of state welfare benefits available to a family of three.[16] The specification also includes state fixed effects (S_j) to control for any time-invariant unobserved state characteristics that may influence age-specific birth rates, year fixed effects (T_t) to control for national trends in birth rates over time, and age fixed effects (A_a), as well as a complete set of age-year interactions to allow for differential trends in birth rates by age over time.[17] The error term is represented by ε. Difference-in-differences estimation can lead to artificially low standard error estimates if the outcomes and the policy changes of interest are serially correlated (Bertrand et al., 2002). I calculate White robust standard errors clustered by state to correct for this potential problem. Regressions are weighted by the population counts in each cell.

V. Results

A. Main Results

[14] Dehejia and Lleras-Muney (2004) find that parental characteristics vary systematically depending on the unemployment rate at the time of a baby's conception.
[15] Fertility regressions also often include restrictions on Medicaid funding of abortions. I do not control for these policies here, since few states changed these policies over my sample period (see Levine, 2002).
[16] These values are for the Aid to Families with Dependent Children program through 1996, and for the Temporary Assistance for Needy Families program from 1997 through 1999.
[17] First birth rates for older women have been increasing over time, as an increasing number of women delay their first births until older ages. The mean age at first birth for women in the United States has risen from 21.4 years in 1970 to almost 25 years in 2000 (Mathews and Hamilton, 2002).

Results from the estimation of equation (1) can be found in Column 1 of Table 3.[18] First birth rates vary significantly by age in a nonlinear fashion. Compared to the omitted category of women age 15-19, women in their early twenties are most likely to have a first birth. After age 25, first birth rates decline with age. State level welfare generosity and parental involvement restrictions on abortion have no significant effects on births.[19]

Having a mandate in effect in a state has no significant effect on birth rates. The estimated coefficient is –0.05 and is not statistically different from zero. However, the presence of a mandate *does* significantly increase birth rates for women over 35. The estimated coefficient implies that the presence of a mandate increases birth rates for women over 35 by 32%, and this effect is statistically significant at the five-percent level. In 1999, Vital Statistics Detail Natality data report 104,455 first births to women over the age of 35 (with a first birth rate for this group of 0.0034). A 32% increase would imply an additional 34,787 births to this group of women.[20] As an additional sensitivity test, I re-estimate the specification in Column 1 with additional controls for state-specific linear time trends. These do not change the magnitude nor the statistical significance of the mandate variables, suggesting that once age-year interactions are added, there are no additional state-specific trends over time that are correlated with the mandates.

One argument for expanding coverage made by proponents of mandates is that there are currently large differences in access to treatment. White, married women with high levels of income are most likely to seek and to receive treatment for infertility (e.g. Stephen and Chandra, 2000). While I cannot test for effects by marital status or income with these data, I can test

[18] The results in Table 3 are similar to results in an earlier, preliminary paper (Schmidt, 2005).
[19] Levine (2002) finds that parental involvement laws decrease abortion rates for younger teens but have no significant effects on births.
[20] As a comparison, reports from the Center for Disease Control imply that roughly 11,000 live births to women over 25 resulted from IVF cycles that began in 1998. Many of these births would have occurred in 1999.

whether the mandates are having differential effects on birth rates by race. I re-estimate the model separately by the race of the mother. These results, presented in Columns 2 and 3 of Table 3, suggest that the effects of the mandates on the full sample are entirely driven by results for white women. There are no significant effects of the mandates on the first birth rates of African American women, either for the entire population or for the subgroup of women over 35, and the point estimates are much smaller than for white women.

While Table 3 shows that the mandates have a very large, positive, significant effect on first birth rates for women between the ages of 35-49, there is likely to be a great deal of heterogeneity within this group. In particular, demand for infertility services may increase with the age of the mother, leading to larger effects of the mandates at older ages. To test this, I allow the effect of the mandates to vary by age cohort. These results are presented in Table 4. There are no significant effects of the mandates for women under 34. However, the coefficients on the mandate-age interactions are positive and significant for each age group beginning with the 35-39 year olds, and as would be expected, the effects increase in magnitude and statistical significance with age. The results suggest a 12% increase in first births among women aged 35-39, and a 32% increase for women 40-49. Due to the smaller coefficient for women 35-39 (who account for most of the births to older women), back-of-the-envelope calculations based on these coefficient estimates suggest a smaller effect of the mandates. These estimated coefficients would imply an additional 11,696 births to women 35-39, and an additional 5,659 births to women 40-49, or a total effect that is roughly half the magnitude of the impact suggested by Table 3.

B. Robustness Tests

The enactment of state mandates will generally only help those individuals who already have access to health insurance. In Panel A of Table 5, I interact the mandate variables with the share of the women 15-44 with private health insurance.[21] The estimated coefficients on the control variables in the regression are similar to those presented in Column 1 of Table 3, so only the estimates of the mandate coefficients are presented here. The share of individuals with private insurance has a negative and significant effect on birth rates, but this is likely capturing omitted variables such as income that are correlated with both the likelihood of having private insurance and with fertility. The mandate interacted with private health insurance has no significant effect on first birth rates, but the coefficient on the three-way interaction between the presence of a mandate, the share of women with health insurance, and whether or not the age group is 35 and older is positive and statistically significant at the five-percent level.

In addition, even among those firms that provide their employee with health insurance, not all are subject to the mandates. First, the smallest firms are generally exempt from the mandates. Second, under the Employer Retirement Income Security Act of 1974 (ERISA), firms that self-insure are exempt from the mandates. It has been argued that the passage of mandates could induce firms to self-insure in order to avoid compliance (e.g. Jensen et al. (1995)). Ideally, I would have information on the share of employees by state and year in firms that self insure. However, these data are not available.[22] It has been shown that the primary determinant of self-insurance by firms is firm size, with large firms being significantly more likely to self-insure (Park, 2000). In panel B of Table 5, I interact the mandate variables with variables that indicate

[21] These data come from the March Current Population Survey.

[22] Park (2000) provides data on the share of employees in firms that self-insure by state for 1993. While there is a great deal of variation by state, the average self-insurance rate for the mandate states in 1993 is 47.9%, compared with the average self-insurance rate for the non-mandate states of 48.8%. (These figures exclude Hawaii, which has an employer mandate for health insurance coverage that predates ERISA, and is therefore not subject to ERISA preemption).

the share of women who work (or who have a spouse that work) in firms of a particular size. (Categories are less than 25 employees, 25-99 employees, and more than 100 employees.)[23] While none of the interactions between the firm size variables and the mandate variables are statistically different from zero, the point estimates suggest that all of the action on mandates for women over the age of 35 is in the mid-size firms (this coefficient is extremely large and is close to achieving statistical significance at the 10 percent level), which is consistent with employees in both the smallest and the largest firms having less access. The total effect of the mandates (summing the coefficients across firm size) is still zero for the overall population, and is still positive and statistically significant for women over the age of 35.

In Panel C of Table 5, I allow mandates covering all health plans to affect births differently than mandates that either exclude HMOs or that only cover HMOs, by replacing the dummy variable for mandate with the share of the population that is covered by the mandate. For states with no mandate, this variable is equal to zero; for states with a mandate covering all health plans, it is equal to one; for states with mandates only covering HMOs, it is equal to the HMO penetration rate; and for states with mandates excluding HMOs, and it is equal to one minus the HMO penetration rate.[24] The main results presented above are robust to this alternate specification. The share of the population covered by the mandate has no significant effect on overall first birth rates, but has a positive and significant effect for women over 35.

It is also possible that the effect of the mandates on first birth rates varies depending on the type of mandate enacted. In particular, one might expect a "mandate to cover" to affect births differently than a "mandate to offer", or a mandate that includes IVF to affect births differently than one that excludes IVF. In Table 6, I break out the mandates by type. Column 1

[23] These data are generated from the March Current Population Survey.
[24] HMO penetration rates come from Interstudy, various years.

presents the main results from Table 3. Column 2 shows results from a specification separating mandates to cover from mandates to offer. The estimated coefficient on the mandate to cover variables implies a 34 percent increase in first birth rates for women over the age of 35, statistically significant at the five-percent level. The point estimate on the mandate to offer variable for women over 35 is slightly smaller, at 0.29, and is not statistically different from zero. However, these coefficients are not statistically different from each other.

In Column 3, I break out mandates that cover IVF versus those that exclude IVF. These results are surprising, in that mandates in those states that exclude IVF coverage have a much larger effect on first birth rates than mandates in states that cover IVF. However, the states that exclude IVF are California, Montana, New York, Ohio, and West Virginia. One might expect that this group, dominated in population by California and New York, is not a representative group of states. In the next three columns, I test to see whether these results are primarily driven by the two large states. Column 4 presents results which omit California from the sample, while Column 5 presents results omitting New York. Column 6 presents results that omit both states. The effect of mandates to cover remains fairly stable at approximately a 15-16 percent increase across these specifications (although this effect is not precisely estimated). However, omitting California and New York from the sample completely removes any estimated effect of the mandates that exclude IVF, suggesting that the results in Column 3 are completely driven by these large states.

As a final robustness check, I re-estimate the model using log second and higher parity birth rates as the dependent variable. If infertility treatments are more likely to be sought by women who have not already given birth, the effects of mandates on higher parity birth rates should be smaller. Results in Table 7 confirm this. The estimated coefficient on mandates for

women over 35 falls from 0.32 for first birth rates to 0.20 for second and higher birth rates, and is no longer statistically different from zero.

VI. Conclusion

For a woman or couple faced with fertility problems, a conception and birth is the ultimate goal. From this perspective, it appears as if the state-level infertility insurance mandates have been a success, as I find that the mandates significantly increase first birth rates among women over 35. The estimated effects increase with age, and are robust to a wide variety of specification tests. Despite the rhetoric of increased access that has surrounded the enactment of mandates, the mandates have had no effect on the first birth rates of African American women.

As demographic changes and continued trends in delay of childbearing cause infertility to become an increasingly common medical problem, advocacy groups are likely to continue to pressure policymakers to enact mandated benefits at both the state and federal levels. Insurance providers are likely to continue to resist these pressures. A full evaluation of the effects of these mandated benefits is essential to informing this policy debate.

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Table 1
State Mandated Infertility Insurance

State	Year Enacted	Mandate to Cover/Mandate to Offer	*In Vitro* Fertilization Coverage?	HMO Treatment
Arkansas	1987*	Cover	Yes	HMOs excluded
California	1989*	Offer	No	All plans covered
Connecticut	1989	Offer	Yes	HMOs excluded
Hawaii	1987	Cover	Yes	All plans covered
Illinois	1991	Cover	Yes	All plans covered
Louisiana	2001	Cover	No	All plans covered
Maryland	1985	Cover	Yes	All plans covered
Massachusetts	1987	Cover	Yes	All plans covered
Montana	1987	Cover	No	HMOs only
New Jersey	2001	Cover	Yes	All plans covered
New York	1990*	Cover	No	HMOs excluded
Ohio	1991	Cover	No	HMOs only
Rhode Island	1989	Cover	Yes	All plans covered
Texas	1987	Offer	Yes	All plans covered
West Virginia	1977*	Cover	No	HMOs only

Sources: Resolve (www.resolve.org) and state laws (see Appendix A). *Arkansas, California, New York, and West Virginia first passed mandates in the years shown. These mandates were subsequently revised, but remained in place.

Table 2
Live Births in Mandate States

	1985	1990	1995
Live births in mandate states	25,259	1,258,990	1,782,930
Live births in US	3,765,064	4,162,917	3,903,012
Births in mandate states as a percentage of total births	0.67%	30.24%	45.68%

Source: National Center for Health Statistics, *Vital Statistics of the United States, Volume I (Natality)*, various years. Births are considered to be in mandate states if a mandate was in place in the *previous* calendar year.

Table 3
Effects of Mandates on First Birth Rates

	Pooled Sample		White and Other		Black	
Mandate	-0.0518		-0.0549		-0.0226	
	(0.0693)		(0.0779)		(0.0290)	
Mandate * 35Plus	0.3160	**	0.3519	**	0.0330	
	(0.1426)		(0.1539)		(0.0891)	
Black	-0.0862	**	--		--	
	(0.0376)					
Age 20-24	0.3438	***	0.4489	***	-0.2468	***
	(0.0272)		(0.0286)		(0.0382)	
Age 25-29	0.0262		0.2026	***	-1.0250	***
	(0.0651)		(0.0713)		(0.0662)	
Age 30-34	-0.8292	***	-0.6385	***	-2.0026	***
	(0.0833)		(0.0868)		(0.0864)	
Age 35-39	-2.2046	***	-2.0448	***	-3.1939	***
	(0.1082)		(0.1099)		(0.1154)	
Age 40-44	-4.3824	***	-4.2462	***	-5.1933	***
	(0.1416)		(0.1427)		(0.1573)	
Age 45-49	-7.4025	***	-7.4088	***	-7.0873	***
	(0.1917)		(0.2164)		(0.1865)	
Log median weekly earnings	0.1572		0.1938		0.4098	
	(0.2016)		(0.2201)		(0.3132)	
Log 10^{th} percentile weekly earnings	0.0649		0.1051		-0.2911	*
	(0.1079)		(0.1361)		(0.1578)	
Unemployment rate	0.0186	**	0.0237	**	-0.0187	**
	(0.0086)		(0.0104)		(0.0074)	
Female labor force participation rate	-0.0007		-0.0011		-0.0055	
	(0.0049)		(0.0058)		(0.0072)	
Log maximum AFDC/TANF benefit	-0.1049		-0.1339		0.0655	
	(0.0972)		(0.1148)		(0.1412)	
Parental involvement abortion restrictions	0.0061		0.0176		-0.0586	*
	(0.0277)		(0.0311)		(0.0302)	

Notes: Dependent variable is the log of the first birth rate in a state-year-race-age cohort cell. All regressions include state fixed effects, year fixed effects, and a full set of age-year interactions. White robust standard errors clustered by state in parentheses. Regressions are weighted by cell-level population counts. Levels of statistical significance: *** denotes significance at the one-percent level; ** at the five-percent level; and * at the ten-percent level.

Table 4
Age Specific Mandate Effects

Mandate * Under 30	-0.0785	
	(0.0899)	
Mandate * Age 30-34	0.0165	
	(0.0641)	
Mandate * Age 35-39	0.1274	**
	(0.0541)	
Mandate * Age 40-49	0.3230	***
	(0.1034)	

Notes: Dependent variable is the log of the first birth rate in a state-year-race-age cohort cell. All regressions include state fixed effects, year fixed effects, and a full set of age-year interactions. White robust standard errors clustered by state in parentheses. Regressions are weighted by cell-level population counts. Levels of statistical significance: *** denotes significance at the one-percent level; ** at the five-percent level; and * at the ten-percent level

Table 5
Effects of Mandates on First Birth Rates, Sensitivity Analyses

A. Private Health Insurance		
Mandate * share with private health insurance	-0.0524	
	(0.0908)	
Mandate * share with private health insurance * 35Plus	0.4417	**
	(0.1906)	
Share with private health insurance	-0.8077	***
	(0.2470)	
B. Firm Size		
Mandate * share in firms with less than 24 emp	0.4317	
	(0.8278)	
Mandate * share in firms with less than 24 emp * 35Plus	-0.0299	
	(2.0263)	
Mandate * share in firms with 25-99 emp	-1.2948	
	(2.1493)	
Mandate * share in firms with 25-99 * 35Plus	6.3961	
	(3.9634)	
Mandate * share in firms with 100+ emp	-0.0065	
	(0.2319)	
Mandate * share in firms with 100+ emp * 35Plus	-0.5895	
	(0.4102)	
Share in firms with less than 24 emp	-0.5130	***
	(0.1913)	
Share in firms with 25-99 emp	-0.1698	
	(0.2970)	
Share in firms with 100+ emp	-0.5888	***
	(0.1637)	
Test if sum of (Mandate * firm size * 35Plus) interactions = 0		
F(1, 31959)	8.06	***
Test if sum of (Mandate * firm size) interactions = 0		
F(1, 31959)	0.52	
C. Share of population covered by mandate (due to variation in treatment of HMOs)		
Share covered by mandate	-0.2421	
	(0.2134)	
Share covered by mandate * Plus35	0.5590	**
	(0.2251)	
HMO penetration rate	0.3992	
	(0.2823)	

Notes: Dependent variable is the log of the first birth rate in a state-year-race-age cohort cell. White robust standard errors clustered by state in parentheses. Regressions include state and year fixed effects, as well as age*year interactions. Regressions are weighted by cell-level population counts. Levels of statistical significance: *** denotes significance at the one-percent level; ** at the five-percent level; and * at the ten-percent level.

Table 6
Effects of Mandates on First Birth Rates, Sensitivity Analyses

	Original Specification	Cover vs Offer	IVF vs Non-IVF	IVF (omitting CA)	IVF (omitting NY)	IVF (omitting CA & NY)
Mandate * 35Plus	0.3160 **	--	--	--	--	--
	(0.1426)					
Mandate to cover * 35Plus	--	0.3428 **	--	--	--	--
		(0.1454)				
Mandate to offer * 35Plus	--	0.2881	--	--	--	--
		(0.2420)				
Mandate covers IVF * 35Plus	--	--	0.1564	0.1634	0.1686	0.1781
			(0.1663)	(0.1665)	(0.1657)	(0.1656)
Mandate excludes IVF * 35Plus	--	--	0.4713 ***	0.3589	0.3937 **	-0.0770
			(0.1318)	(0.2519)	(0.1816)	(0.7861)

Notes: Dependent variable is the log of the first birth rate in a state-year-race-age cohort cell. White robust standard errors clustered by state in parentheses. Regressions include state and year fixed effects, as well as age*year interactions. Regressions are weighted by cell-level population counts. Levels of statistical significance: *** denotes significance at the one-percent level; ** at the five-percent level; and * at the ten-percent level.

Table 7
Second and Higher Birth Rates as dependent variable

Mandate	-0.0727
	(0.0584)
Mandate * Plus35	0.1999
	(0.1278)

Notes: Dependent variable is the log of the higher order birth rate (second births and higher) in a state-year-race-age cohort cell. All regressions include state fixed effects, year fixed effects, and a full set of age-year interactions. White robust standard errors clustered by state in parentheses. Regressions are weighted by cell-level population counts. Levels of statistical significance: *** denotes significance at the one-percent level; ** at the five-percent level; and * at the ten-percent level

Appendix A: State Laws Regarding Insurance Coverage of Infertility Treatment

Arkansas

The current law, enacted in 1991, requires all insurance policies which provide pregnancy-related benefits to provide coverage for in vitro fertilization. To qualify:

- The patient must be the policyholder or the spouse of the policyholder and must be a covered dependent under that policy.
- The patient must have her oocytes fertilized by her spouse's sperm.
- The patient and her spouse must have a history of unexplained infertility for at least two years, or must have one or more of the following medical conditions:
    1. Endometriosis
    2. Exposure in utero to Diethylstillbestrol (DES)
    3. Blockage or removal of one or both fallopian tubes, not as a result of voluntary sterilization.
    4. Abnormal male factors.
- The patient must have been unable to obtain successful pregnancy through other less costly infertility treatments for which coverage is available under the policy.
- The in vitro procedure must be performed at a medical facility licensed by the Arkansas Department of Health and meeting the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society

These qualifications indicate that the woman must be married to receive coverage; however, no other restrictions exist regarding the age of the patient, the maximum firm size that may omit coverage, or exceptions for religious organizations.

The law has existed in this form since 1991, but some coverage for in vitro fertilization was first required of health insurance companies in 1987. The 1991 law revised the 1987 one by setting maximum and minimum benefit levels and establishing the above standards for determining whether a policy or certificate must include coverage.
(www.accessarkansas.org/insurance/rulesandregs/legal_rnr01.html)

California

California's 1989 law mandates that all insurers covering hospital, medical or surgical expenses on a group basis offer coverage of infertility treatment, *excluding* in vitro fertilization. Infertility is defined as either the presence of a demonstrated medical condition recognized by a licensed physician, or as the inability to conceive a pregnancy or carry a pregnancy to term after at least a year of regular unprotected sexual intercourse. Covered treatment includes diagnosis, medication, surgery, and gamete intrafallopian transfer (GIFT). No restrictions exist as to the age or marital status of the patient, or the size of the firm or group offering the policy. Religious organizations whose religious or ethical principles disagree with this policy are exempt from having to offer coverage.

(California Insurance Code section 10119.6)

Connecticut

According to 1989 law, all group insurers must offer an insurance plan that covers the "medically necessary" expenses of the diagnosis and treatment of infertility, including in vitro fertilization procedures. "Infertility" is defined as the inability to conceive or to retain a pregnancy during a one year period. "Medically necessary" is not defined, nor are there any other restrictions or exemptions.
(Connecticut General Statutes Annotated, section 38a-536)

Hawaii

In 1987, Hawaii passed a law requiring all individual and group health insurance policies which provide pregnancy-related benefits to provide a one-time only benefit for all outpatient expenses arising from in vitro fertilization. To qualify:

- The patient must be the policyholder or the spouse of the policyholder and must be a covered dependent under that policy.
- The patient must have her oocytes fertilized by her spouse's sperm, where "spouse" is defined as the person who is lawfully married to the patient under the laws of the state.
- The patient and her spouse must have a history of unexplained infertility for at least five years, or must have one or more of the following medical conditions:
    1. Endometriosis
    2. Exposure in utero to Diethylstillbestrol (DES)
    3. Blockage or removal of one or both fallopian tubes, not as a result of voluntary sterilization.
    4. Abnormal male factors.
- The patient must have been unable to obtain successful pregnancy through other less costly infertility treatments for which coverage is available under the policy.
- The in vitro procedure must be performed at a medical facility meeting the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society.

No restrictions exist for age of the patient or firm size, and no exemptions are made for religious organizations.
(Hawaii Revised Statutes, §431:10A-116.5)

Illinois

Illinois law requires that all group insurers providing coverage for more than 25 employees after 1991 must cover the diagnosis and treatment of infertility, including in vitro fertilization, uterine

embryo lavage, embryo transfer, artificial insemination, gamete intrafallopian tube transfer, zygote intrafallopian tube transfer, and low ovum tube transfer. To qualify:

- The patient must be unable to conceive or sustain a pregnancy after one year of unprotected sexual intercourse.
- The patient must be unable to obtain successful pregnancy through other less costly infertility treatments for which coverage is available under the policy.
- The patient must have undergone fewer than four oocyte retrievals, unless a live birth has resulted from a completed oocyte retrieval, in which case she is entitled to two more covered retrievals.
- The procedure must be performed at a medical facility meeting the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society.

No other restrictions exist; however, the insurer does not have to pay for:

- The reversal of voluntary sterilization.
- Costs rendered to a surrogate for purposes of childbirth
- The cryopreservation and storage of sperm, eggs, and embryos.
- Non-medical costs of a sperm or egg donor, including travel costs.
- Experimental treatments.

Furthermore, religious organizations which find these policies to be at odds with their moral and ethical teachings are exempt from providing coverage.
(www.ins.state.il.us/HealthInsurance/infert.htm)

Maryland

As of 1985, Maryland requires that insurers of individuals and groups, including HMO's, must provide coverage of in vitro fertilization to the same extent as pregnancy-related services are provided. To qualify:

- The patient must be the policyholder or the spouse of the policyholder and must be a covered dependent under that policy.
- The patient must have her oocytes fertilized by her spouse's sperm.
- The patient and her spouse must have a history of unexplained infertility for at least two years, or must have one or more of the following medical conditions:
    1. Endometriosis
    2. Exposure in utero to Diethylstillbestrol (DES)
    3. Blockage or removal of one or both fallopian tubes, not as a result of voluntary sterilization.
    4. Abnormal male factors.
- The patient must have been unable to obtain successful pregnancy through other less costly infertility treatments for which coverage is available under the policy.

- The in vitro procedure must be performed at a medical facility meeting the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society.

Benefits may not exceed a maximum lifetime benefit of $100,100. Women must be married, but no further restrictions apply. Religious organizations are exempt from providing coverage if it conflicts with their moral beliefs. Firms with 50 or fewer employees are also exempt as of 1994. (Maryland Insurance Article §15-810)

Massachusetts

1987 Massachusetts law requires all insurers and HMO's to cover benefits for required infertility procedures, including artificial insemination, in vitro fertilization, gamete intrafallopian transfer, sperm or egg procurement, processing, and storage, intracytoplasmic sperm injection, and zygote intrafallopian transfer. The insurer must also cover prescription drugs relating to infertility. Insurers are not required to cover experimental procedures, surrogacy, reversal of voluntary sterilization, or cryopreservation of eggs. Patients must hold the insurance policy themselves, or must be the spouse or dependent of the insured person. Infertility is defined as the inability to conceive or carry a pregnancy to term during the period of one year. No other requirements or exemptions apply.
(Annotated Laws of Massachusetts 211 CMR: Division of Insurance 37.00)

Montana

Montana's laws require HMO's to cover infertility treatment, but specifically excludes artificial insemination and infertility treatment from coverage mandated for other insurance companies. No mention is made of what infertility is, nor what is covered by the HMO's. No other requirements or exemptions apply.
(Montana Code Annotated, §33-22-1521, §33-31-102)

New Jersey

New Jersey's law was not enacted until 2001. However, it mandates that all insurers covering groups of 50 or more must cover the diagnosis and treatment of infertility. This includes artificial insemination, assisted hatching, diagnostic tests, fresh and frozen embryo transfer, up to four completed egg retrievals, GIFT and ZIFT, in vitro fertilization, medications, ovulation induction, and surgery. Insurers do not have to pay for reversal of voluntary sterilization, surrogacy cryopreservation of eggs, sperm, or embryos, non-medical costs of the egg or sperm donor, experimental treatments, or ovulation or sperm testing kits. They also do not have to pay for IVF, GIFT, or ZIFT for women who are 46 years of age or older. Employers with religious objections are exempt from offering coverage. A patient is considered infertile if she a) is under age 35 and is unable to conceive after two years of unprotected sexual intercourse; b)is over age 35 and is unable to conceive after one year of unprotected sexual intercourse; or c) is medically

sterile. Patients must use all reasonable, less expensive treatments before turning to IVF, GIFT, or ZIFT, and all such procedures must be performed in a medical facility meeting the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society. No other requirements or exemptions apply.
(www.state.nj.us/dobi/pn02_260.htm, New Jersey P.L. 2001, c. 236 §11:4-54)

New York

As of 1990, group insurers in New York are required to provide coverage of infertility treatments, including diagnostic tests and pharmaceuticals, for all infertile women between ages 21 and 44 who have been covered under the policy for at least a year. Insurers are not required to cover in vitro fertilization, gamete intrafallopian transfer, zygote intrafallopian transfer, reversal of voluntary sterilization, sex change procedures, cloning, or experimental procedures. "Infertility" must be determined in accordance with the standards of the American College of Obstetrics and Gynecologists and the American Society for Reproductive Medicine. No other requirements or exemptions apply.

In 2002 the state of NY passed a revised law, which clarified the 1990 law and appropriated $10 million to a pilot project to help pay for in vitro procedures for a small number of people who received care from those facilities that were to be the beneficiaries of grants awarded through the program.

(New York Consolidated Laws, Insurance, Section 3221(k)(6), Section 4303(s).)

Ohio

Under a 1991 law, Ohio includes coverage for infertility services as part of its basic health care services, and, as such, covers the medically necessary diagnosis and correction of problems causing infertility. There is no specific law covering in vitro fertilization, gamete intrafallopian transfer, or zygote intrafallopian transfer; however, the Superintendent of Insurance stated in 1997 that IVF, GIFT and ZIFT were not essential for the protection of an individual's health and were therefore not subject to mandated insurance coverage. Ohio has no definition of infertility, nor does it detail any other specific requirements or exemptions.
(www.ins.state.oh.us/Legal/Bulletins/97-1.htm)

Rhode Island

Rhode Island (1989) requires that all insurers which cover pregnancy-related benefits also cover the diagnosis and treatment of infertility, where "infertility" is defined as "the condition of an otherwise healthy married individual who is unable to conceive or produce conception during a period of one year." It further stipulates that the patient co-payment may not exceed 20%. There are no other requirements or exemptions.
(Rhode Island General Laws, §27-18-30)

Texas

1987 Texas law requires group and private insurers to offer coverage for outpatient expenses arising from in vitro fertilization procedures. To qualify:

- The patient must be the policyholder or the spouse of the policyholder and must be a covered dependent under that policy.
- The patient must have her oocytes fertilized by her spouse's sperm.
- The patient and her spouse must have a history of unexplained infertility for at least five years, or must have one or more of the following medical conditions:
    1. Endometriosis
    2. Exposure in utero to Diethylstillbestrol (DES)
    3. Blockage or removal of one or both fallopian tubes, not as a result of voluntary sterilization.
    4. Abnormal male factors.
- The patient must have been unable to obtain successful pregnancy through other less costly infertility treatments for which coverage is available under the policy.
- The in vitro procedure must be performed at a medical facility that meets the standards set by either the American College of Obstetricians and Gynecologists or the American Fertility Society

Religious organizations whose moral code conflicts with this policy are exempt from offering coverage. No other restrictions or exemptions exist.
(Texas Insurance Statutes, Art. 3.51-6, Section 3A)

West Virginia

Since 1977, West Virginia has required HMO's to cover infertility services as part of "Basic Health Care Services." The 1977 law did not specify which services were covered, which women were covered, or whether any organizations were exempt from providing coverage. That 1977 law was amended in 2001, and mandated HMO's to cover infertility treatment only as a "preventative service" benefit (thus excluding in vitro fertilization).
(West Virginia Code §33-25A-2).

Appendix B: Summary Statistics

Variable	Mean
First birth rate	0.0231
	(0.0240)
Log median weekly earnings	5.9156
	(0.1399)
Log 10^{th} percentile weekly earnings	4.7808
	(0.1922)
Unemployment rate	5.7129
	(1.7799)
Female labor force participation rate	59.274
	(4.739)
Maximum AFDC/TANF benefit	460.184
	(180.274)
Parental involvement abortion restrictions	0.4706
Share with private health insurance	0.6591
	(0.2006)
Share in firms with less than 25 emp	0.1315
	(0.1122)
Share in firms with 25-99 emp	0.0758
	(0.0711)
Share in firms with 100+ emp	0.3834
	(0.2093)
HMO penetration rate	0.1388
	(0.1241)
Number of state-year-age-race cells	32130

Notes: Standard deviations in parentheses. Observations are state/year/5-year age cohort/race cells.