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Effects of Infertility Insurance Mandates on Fertility[⊗]

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I. Introduction

Infertility is a disease that imposes health-related and financial costs on women and families. It currently 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 any coverage for infertility services. In response to the perceived need for coverage, legislation was introduced at the federal level in 2003 that would require health plans to provide infertility benefits.[1] As the fraction of the population affected by infertility continues to rise, there are likely to be continued efforts to legislate mandated coverage. Understanding the implications of coverage expansion thus becomes increasingly important. As of 2003, fifteen states have enacted some form of infertility insurance mandate. The experiences of these states provide useful information on how expanding coverage affects access to services and birthrates, as well as on how the costs of coverage are distributed across individuals and society.

My goal in this paper is to improve our understanding of the benefit of mandated infertility insurance coverage by examining the impact of state mandates on birth rates. I use fertility rates by age cohort, race and state generated from Vital Statistics Detail Natality Data and Census Population estimates to examine whether these mandates were successful in increasing fertility rates among those women most likely to be affected. 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 have been successful in increasing the number of women who are able to give birth.

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

II. Background Information

Infertility is considered by medical organizations to be a disease of the reproductive system (American Society of Reproductive Medicine (ASRM), 2003). As such, it imposes costs on women and families that are both health-related and economic. In this section, I discuss the incidence of infertility, the costs associated with it, and insurance coverage of treatment.

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. (Chandra et al, 2003). 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 (IF),* 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).[2] However, the ASRM does not, in official documents, make this distinction. For simplicity, I refer to impaired fecundity and infertility interchangeably.

Overall, the proportion of women reporting IF 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 fairly dramatic increase in the number of women reporting infecundity, from 4.6 million to 6.2 million. This increase has occurred across almost all subgroups of women, including along the dimensions of marital status, income, education,

[2] Both conditions only apply to those women who are not surgically sterile.

race, and ethnicity (Chandra and Stephen, 1998). Because of this, the population of fertility impaired women is similar to the general population of women, except that they are older -- 43% are aged 35-44, as compared with 36% of the general population (Stephen and Chandra, 2000)

Like other diseases, infertility imposes large physical and psychological costs on individuals and families. The psychological effects of infertility have been compared to the effects of other diseases such as cancer and heart disease (Fidler and Bernstein, 1999). In addition to the physical nature of the disease of infertility, and the psychological costs of the disease, there are also nonnegligable financial costs. 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). Assisted Reproductive Technology (ART) refers to all fertility treatments in which both eggs and sperm are handled. The most common type of ART is *in vitro* fertilization (IVF), which comprises 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.[3] 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

[3] 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).

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).

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. State mandates fall into one of two categories. 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 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, and whether the mandates cover IVF. Detailed information on these mandates, including any further restrictions placed on coverage, can be found in Appendix A. Many mandates restrict treatment to individuals on the basis of marital status. In addition, several states also restrict treatment on the basis of age. As of 2000, these mandates only

affected thirteen states. However, as is illustrated in Table 2, a number of large states are affected. 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.

Despite the increasing prevalence of infertility, the significant disparities in access to treatment, and the ongoing efforts to legislate coverage expansions, to date only a few studies have looked at the effects of these mandates. Jain et al. (2002) use clinic data from 1998 and find that states with required coverage for IVF have the highest rates of IVF utilization, and the lowest number of embryos transferred per cycle.[4] Reynolds et al. (2003) find that the states with mandated insurance coverage of IVF have lower numbers of embryos transferred than states without coverage, as well as a lower proportion of multiple births resulting from IVF. Hamilton and McManus (2004) develop a model of the market for ART 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 and reduces the number of embryos transferred. 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. These three studies focus exclusively on IVF and ignore other types of fertility treatments that may be covered by the mandates. In addition, the studies are generally cross-sectional analyses that cannot control for unobservable differences in patients or clinics that may be state-specific. Finally, they all

[4] Individuals with insurance coverage for IVF are thought to be likely to transplant fewer embryos in a given cycle, since the pressure for a successful procedure on the first try is lower. Fewer embryos leads to lower incidence of multiple births, which is important from a public health standpoint.

look at a period of time during which no changes in mandated coverage were legislated, so they cannot exploit variation within a state over time as the mandate is enacted.[5]

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 birth rates for those women most likely to need infertility treatment.

III. Data

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, and limited demographic information on the father. 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 count of births by state, year, race, and five-year age cohort are used to generate birth rates.[6]

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 from 1981-2000 through

[5] Bitler (2004) does not analyze the effects of the state mandates, but instead uses variation generated by those mandates between 1981 and 2000 to examine the effects of ART on infant health outcomes. She finds evidence that living in a state with a mandate, which is likely to improve access to ART, leads to a small but significant decrease in gestation, with larger effects for older women.

[6] Five year cohorts are used up to the age of 44 (15-19, 20-24, 25-29, 30-34, 35-39, 40-44). Due to smaller numbers of births in older ages, births to women 45-54 are grouped together.

the Census Bureau, and can be used to calculate birth rates. However, they do not allow for further breakouts. For example, birth counts by parity or by marital status 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. State level unemployment rates and female labor force participation rates are published by the Bureau of Labor Statistics. Data on the distribution of usual weekly earnings (median and tenth percentile) have been generated from the CPS Outgoing Rotation Group Data. Data on abortion policies (e.g. whether Medicaid funds abortions in the state; whether parental involvement is required for minors to obtain an abortion) have been collected from a variety of public sources. The maximum level of state welfare benefits available to a family of three come from various editions of the U.S. House of Representatives Green Book.[7]

IV. Model Specification and Empirical Results

As shown in Table 1, the mandates were enacted in different states in different years. I use a difference-in-differences approach where I am able to exploit variation in mandates both across states and over time, as well as identify control groups that should not have been affected by infertility coverage.

Using birth rates generated from Vital Statistics Detail Natality data and Census population counts, I estimate the following model:

$$\ln(fstbthrt)_{ajt} = \alpha + \beta Z_{jt} + \sum_{k=1}^{2} \gamma Mand_{j(t-k)} + \sum_{k=1}^{2} \theta (Mand_{j(t-k)} \times Over35) + \sum_{j} \delta_j S_j + \sum_{t} \delta_t T_t + \varepsilon_i \quad (1)$$

[7] Summary statistics for the data set can be found in Appendix B, and a full description of the data used in the analysis can be found in Appendix C.

where the dependent variable is the log first birth rate for a given age cohort in state *j* and year *t*. 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 *Z* vector controls for variables that will vary across states and over time that might also affect birth rates.[8] 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. Variables describing state-level abortion policies are also included, such as whether Medicaid funds abortions in the state, and whether parental involvement is required for minors to obtain an abortion. These policies have been found in previous research to affect birth rates (e.g. Blank, London, and George (1996); Levine, Trainor, and Zimmerman (1996); and Klerman (1999)). Finally, the *Z* vector also includes the log maximum level of state welfare benefits available to a family of three.[9] 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 effects. The error term is represented by ε. I calculate White robust standard errors clustered by state, as suggested by Bertrand et al (2002).[10] Regressions are weighted by the population counts in each cell.[11]

The independent variable of interest is the policy variable *Mand*. This variable equals one if a state had either a mandate to cover or a mandate to offer infertility insurance. Mandates

[8] I am grateful to Rebecca Blank for providing much of the state-level data.
[9] 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 2001.
[10] Difference-in-differences estimation can lead to artifically low standard error estimates if the outcomes and the policy changes of interest are serially correlated. This approach corrects for this potential problem.
[11] The results are robust to running unweighted regressions.

are allowed to affect fertility rates with a two-year lag structure, such that mandates in year *t-1* and in year *t-2* are allowed to affect fertility rates in year *t*. 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. 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.

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.[12] 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. The use of the log first birth rate as the dependent variable

[12] The age of 35 appears to be an important turning point in the risk of infertility problems. The government publication *Infertility: Medical and Social Choices* states that "the probability of infertility increases somewhat after age 30 and significantly more after age 35." In addition, the American Society for Reproductive Medicine identifies 35 as a turning point. 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." Finally, Resolve (the national support group for those faced with infertility) says "Most physicians advise you not to be concerned unless you have been trying to conceive for at least one year and are under 35. If you are over 35 and have been trying for six months, you should consult a physician."

means that the estimated coefficient θ can be interpreted as the percentage change in the first birth rate of older women with respect to the implementation of a mandate.

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 results in opposing directions. First, the 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 estimate all regressions omitting the portion of the control group most likely to be receiving infertility treatment – those women 30-34. All results presented below are robust to this alternate specification.

Results from the estimation of equation (1) can be found in Column 1 of Table 3. The age pattern of births is nonlinear. Compared to the omitted category of women ages 15-19, women in their early twenties are the most likely to bear children. After age 25, first birth rates decline with age. The coefficient on black is negative and significant, suggesting that after controlling for a variety of other factors that affect birth rates, black women are less likely to have a first birth.

The one year lag mandate variable has no significant effects. The two year lag, however, is significant at the one-percent level. The estimate of γ shows that in fact there is some correlation between birth rates and the mandates, as overall first birth rates in states with mandates are lower than those without. However, the interaction between the mandate and the

indicator for *Over 35* is positive and strongly significant, suggesting that the presence of a mandate is associated with fertility rates for women over the age of 35 that are 42 percent higher than in states without mandates.

One potential concern with these results is that first birth rates for older women have been increasing over time, as an increasing number of women delay their first births until older ages.[13] Since the mandates are also positively correlated with time, it is possible that the effect of the mandates on the treatment group may simply be picking up increases in birth rates among older women. To allow for this possibility, I re-estimate equation (1) controlling for a set of interactions between age cohort and year. The results from this regression are presented in Column 2 of Table 3. It is clear that the original estimates of the effects of mandates in Column 1 were spuriously picking up changes in age-specific trends. The estimate of γ becomes much smaller and is no longer statistically different from zero. The estimate of θ, the effect of the mandate on older women, falls in magnitude. However, there is still a positive significant effect of the mandates, suggesting that the mandates increased birth rates for women over the age of 35 by 18 percent. As an additional sensitivity test, I re-estimate the specification in Column 2 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.[14]

It is 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 including IVF to affect births differently than a

[13] 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).
[14] These results are available from the author.

mandate excluding IVF coverage. In Table 4, I break out the mandates by type. Panel A shows results from a specification separating mandates to cover from mandates to offer. The estimated coefficients on the control variables in the regression are similar to those presented in Column 2 of Table 3, so only the estimates of the mandate coefficients are presented here. The two year lags on both types of mandates are positive and significant for women over 35, and there is no statistical evidence that a mandate to cover affects first birth rates differently than a mandate to offer.

Panel B of Table 4 shows results separating mandates with and without required IVF coverage. For the mandates with IVF, the pattern of coefficients is similar to that of the single mandate variable. The two year lag is positive and significant for women over 35, and no other mandate variables are statistically different from zero. For mandates without IVF coverage, the coefficient on the two year lag is positive and statistically significant, and is not statistically different from the coefficient on the corresponding variable with IVF coverage. However, there is also a positive and statistically significant effect of the one-year lag on women over 35. These differential lag effects of mandates with and without IVF are worth further exploration

One argument from a policy standpoint for expanding coverage for infertility treatment is that there are currently large differentials in terms of who has access to treatment. White, married women with higher levels of income are most likely to seek and to receive treatment for infertility (e.g. Stephen and Chandra, 2000). To test whether the mandates are having differential effects on birth rates by race, I re-estimate the main specification (including age-year interactions) separately by the race of the mother (separating black women from white and other). These results are presented in Table 5. The two year lag on the mandate variable is positive and significant for women over the age of 35. It suggests that a mandate increases first

birth rates for older white women by 17%, and for older black women by 32%. However, these percentage changes are on different bases, as first birth rates for women over 35 differ by race. In 1999, the average first birth rate across states for white/other women 35 and older was 0.0032, while the corresponding rate for black women was lower at 0.0022.

V. Conclusions and Directions for Future Work

For a woman or couple faced with fertility problems, a healthy 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 increase first birth rates among women over 35 by 18% percent. The effects are similar for the different types of mandates (mandates to cover vs. mandates to offer and mandates including or excluding IVF coverage), and the effects are larger in percentage terms for black women (albeit from a smaller base rate).

However, this analysis leaves several important questions unanswered. In ongoing work, I am working on addressing the following questions. First, have the mandates been successful at increasing births for those groups who have traditionally had less access to treatment? This requires individual data that allows breakdowns along dimensions of race, ethnicity, education, and income. Second, what is the intermediate mechanism through which the mandates are increasing birth rates? Are they increasing particular types of treatments? This is essential for determining the costs of the mandates. Finally, who bears the cost of these state mandates? How do they affect the labor market? Do they reduce labor demand like a tax, leading to a reduction in employment? Or do they also increase labor supply, offsetting the negative effects of reduced labor demand on employment through reduced wages?

As infertility becomes 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 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?
Arkansas	1987*	Cover	Yes
California	1989*	Offer	No
Connecticut	1989	Offer	Yes
Hawaii	1987	Cover	Yes
Illinois	1991	Cover	Yes
Louisiana	2001	Cover	No
Maryland	1985	Cover	Yes
Massachusetts	1987	Cover	Yes
Montana	1987	Cover	No
New Jersey	2001	Cover	Yes
New York	1990*	Cover	No
Ohio	1991	Cover	No
Rhode Island	1989	Cover	Yes
Texas	1987	Offer	Yes
West Virginia	1977*	Cover	No

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

	Column 1		Column 2	
Black	-0.0876	**	-0.0877	**
	(0.0378)		(0.0375)	
Age 20-24	0.2733	***	0.3438	***
	(0.0232)		(0.0272)	
Age 25-29	0.0340		0.0264	
	(0.0576)		(0.0651)	
Age 30-34	-0.6811	***	-0.8290	***
	(0.0732)		(0.0833)	
Age 35-39	-1.9902	***	-2.2045	***
	(0.0733)		(0.1082)	
Age 40-44	-3.8463	***	-4.3822	***
	(0.0828)		(0.1416)	
Age 45-54	-7.4122	***	-7.4024	***
	(0.0862)		(0.1918)	
Log median weekly earnings	0.1608		0.1610	
	(0.1950)		(0.1967)	
Log 10^{th} percentile weekly earnings	0.0268		0.0280	
	(0.1037)		(0.1026)	
Unemployment rate	0.0168	**	0.0162	*
	(0.0084)		(0.0083)	
Female labor force participation rate	-0.0011		-0.0012	
	(0.0047)		(0.0048)	
Log maximum AFDC/TANF benefit	-0.0632		-0.0676	
	(0.0901)		(0.0887)	
State in compliance with Hyde amendment	0.0902	***	0.0887	***
	(0.0220)		(0.0218)	
State funds abortions beyond Hyde requirements	0.1132	***	0.1133	***
	(0.0254)		(0.0255)	
Parental involvement abortion restrictions	0.0081		0.0077	
	(0.0257)		(0.0254)	
Mandate (t-1) γ_{t-1}	0.0233		-0.0208	
	(0.0445)		(0.0460)	
Mandate(t-1)*Over35 θ_{t-1}	0.0355		0.1371	
	(0.1057)		(0.1082)	
Mandate (t-2) γ_{t-2}	-0.1394	***	-0.0280	
	(0.0344)		(0.0422)	
Mandate(t-2)*Over35 θ_{t-2}	0.4220	***	0.1832	***
	(0.0355)		(0.0529)	
State fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Age*year interactions	No		Yes	

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 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
Effects of Mandates on First Birth Rates, by Type of Mandate

A. Mandate to cover vs. mandate to offer		
Mandate to cover (t-1)	-0.0384	
	(0.0815)	
Mandate to cover (t-1)*Over35	0.1471	
	(0.1399)	
Mandate to cover (t-2)	-0.0236	
	(0.0203)	
Mandate to cover (t-2)*Over35	0.2004	***
	(0.0404)	
Mandate to offer (t-1)	0.0007	
	(0.0502)	
Mandate to offer (t-1)*Over35	0.1244	
	(0.2054)	
Mandate to offer (t-2)	-0.0367	
	(0.0621)	
Mandate to offer (t-2)*Over35	0.1680	**
	(0.0716)	
Test equality of coefficients: mandate to cover and to offer (2 year lag interacted with *Over 35*)		
F(1, 31958)	0.20	
B. Mandate covering IVF vs. mandate not covering IVF		
Mandate with IVF (t-1)	0.0361	
	(0.0505)	
Mandate with IVF (t-1)*Over35	-0.0520	
	(0.1382)	
Mandate with IVF (t-2)	0.0004	
	(0.0332)	
Mandate with IVF (t-2)*Over35	0.2140	***
	(0.0636)	
Mandate without IVF (t-1)	-0.0611	
	(0.0672)	
Mandate without IVF (t-1)*Over35	0.2734	**
	(0.1242)	
Mandate without IVF (t-2)	-0.0736	**
	(0.0311)	
Mandate without IVF (t-2)*Over35	0.2032	***
	(0.0496)	
Test equality of coefficients: mandate with IVF and without IVF (2 year lag interacted with *Over 35*)		
F(1, 31958)	0.03	

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 5: Effects of Mandates on First Birth Rates, By Race

	White and Other		Black	
Age 20-24	0.4489	***	-0.2467	***
	(0.0286)		(0.0383)	
Age 25-29	0.2028	***	-1.025	***
	(0.0713)		(0.0663)	
Age 30-34	-0.6383	***	-2.0032	***
	(0.0867)		(0.0864)	
Age 35-39	-2.0447	***	-3.1947	***
	(0.1099)		(0.1152)	
Age 40-44	-4.246	***	-5.1944	***
	(0.1426)		(0.1571)	
Age 45-54	-7.4088	***	-7.0881	***
	(0.2165)		(0.1867)	
Log median weekly earnings	0.2111		0.2599	
	(0.2164)		(0.3014)	
Log 10^{th} percentile weekly earnings	0.0594		-0.2773	*
	(0.1278)		(0.1610)	
Unemployment rate	0.0204	**	-0.0152	**
	(0.0099)		(0.0076)	
Female labor force participation rate	-0.0017		-0.0038	
	(0.0057)		(0.0075)	
Log maximum AFDC/TANF benefit	-0.0977		0.1081	
	(0.1023)		(0.1568)	
State in compliance with Hyde amendment	0.1008	***	0.0130	
	(0.0280)		(0.0190)	
State funds abortions beyond Hyde requirements	0.1259	***	0.0127	
	(0.0321)		(0.0320)	
Parental involvement abortion restrictions	0.0180		-0.0562	*
	(0.0279)		(0.0320)	
Mandate (t-1) γ_{t-1}	-0.0189		-0.0305	
	(0.0494)		(0.0377)	
Mandate(t-1)*Over35 θ_{t-1}	0.1877		-0.2872	***
	(0.1187)		(0.1042)	
Mandate (t-2) γ_{t-2}	-0.0268		-0.0326	
	(0.0389)		(0.0219)	
Mandate(t-2)*Over35 θ_{t-2}	0.1694	***	0.3161	***
	(0.0593)		(0.0576)	
State fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Age*year interactions	Yes		Yes	

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. 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	5.9157
	(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)
State in compliance with Hyde amendment	0.642
State funds abortions beyond Hyde requirements	0.298
Parental involvement abortion restrictions	0.471
Number of state-year-age-race cells	32130

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

Appendix C: Data Sources

Birth Data

- *Birth counts by age cohort, race, year, state, parity, and plurality*: Generated from the Vital Statistics Detail Natality Data.

Census Data

- Counts of black and non-black women in seven age cohorts for each state, from 1981-2000, are available through the Census Dept. web site, **www.census.gov**.

State-Level Economic Indicators[15]

- *State level unemployment rates*: Available annually from 1973-2002 from the Bureau of Labor Statistics web site, **www.bls.gov**. 1973-78 data come from Blank (1997).
- *Maximum AFDC/TANF benefits for a family of 3 in 2001 dollars*: Data available by state and year for 1974-2001. 1974-96 data are from *Characteristics of State AFDC Plans,* various years. 1981-2001 data are from various editions of *The Green Book* (U.S. House of Representatives). Data were converted to 2001 dollars from their sources by hand.
- *10^{th} percentile usual weekly earnings and median usual weekly earnings*: Data were calculated from the Current Population Survey Outgoing Rotation Group (ORG), for 1979 on. Values for 1977 and 1978 data are calculated from the March Current Population Survey.
- *Female labor force participation rates per state per year*: Published in the *Geographic Profile of Employment and Unemployment*, Bureau of Labor Statistics. Also available from the Bureau of Labor Statistics web page, **www.bls.gov**.

Abortion Data

- *Indicator variable for whether a state complies with the Hyde Amendment; indicator variable for whether a state funds Medicaid abortions more than is required by the Hyde Amendment*: Coded from a variety of sources in different years, specifically Gold and Guardado (1988), Daley and Gold (1991), Daley and Gold (1993), Gold et al. (1996), as well as fact sheets from the Center for Reproductive Rights, the National Abortion Rights Action League (NARAL), and the Alan Guttmacher Institute. Where data were missing, individual states' legislatures were consulted.
- *Indicator variable for whether a state requires parental consent or notification for a minor to receive an abortion*: Coded from a variety of sources, specifically fact sheets from the Center for Reproductive Rights, the National Abortion Rights Action League (NARAL), and the Alan Guttmacher Institute. Where data were missing, individual states' legislaturs were consulted.

[15] I am grateful to Rebecca Blank for providing these data.