Effects of Infertility Insurance Mandates on Fertility[⊗]

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February 2005

[⊗] Alex Bal, Julia Brown, Katherine McGrath, and Abigail Wattley provided excellent research assistance. I am grateful to Marianne Bitler, Rebecca Blank, Bill Gentry, Emma Hutchinson, Matt Kotchen, David Loughran, Mindy Marks, Jessica Reyes, Purvi Sevak, Lara Shore-Sheppard, Tara Watson, and seminar participants at Williams College and at the University of North Carolina at Greensboro for useful comments and conversations. I would also like to thank Marianne Bitler, Rebecca Blank, and Tara Watson for providing me with data. All errors or omissions are my own. Contact information: Department of Economics, Fernald House, Williams College, Williamstown, MA 01267, email: lschmidt@williams.edu.

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. Anne T. Fidler and Judith 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. The step is to examine the effects that these mandates have on fertility. 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

[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.

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.

In this paper, I ask the first order question of whether the mandated insurance coverage of infertility treatment has affected birth rates. As of 2003, fifteen states have enacted some form of infertility insurance mandate. 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.

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] 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 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.[4] 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)

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). 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

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

[4] 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.

significantly by state.[5] 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).

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. The push for these mandates is notable, particularly since the traditional economic justifications for mandated benefits (paternalism, negative externalities from lack of treatment (e.g. Summers, 1989; Gruber, 1994)) do not apply in this case.[6] The best efficiency argument is that asymmetric information between the patient and

[5] 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).

[6] 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.

insurer will lead to an adverse selection problem so that benefits will not be provided by the private market (e.g. Michael Rothschild and Joseph E. Stiglitz, 1976).

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.

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) 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 model of the market for IVF and

[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.

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. [8]

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. Finally, they all 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.

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] 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 assisted reproductive technologies on infant health outcomes. She finds evidence that living in a state with a mandate, which is likely to improve access to assisted reproductive technologies, leads to a small but significant decrease in gestation, with larger effects for older women.

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. 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. 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. The data set covers the years 1985-1999.[10]

IV. Model Specification and Empirical Results

I estimate the following model:

[9] 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.

[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.

$$\ln(fstbthrt)_{ajt} = \alpha + \beta Z_{jt} + \gamma Mand_{j(t-2)} + \theta(Mand_{j(t-2)} \times Over35) + \sum_a \delta_a A_a + \sum_j \delta_j S_j + \sum_t \delta_t T_t + \sum_{a*t} \delta_{at}(A_a \times T_t) + \varepsilon \quad (1)$$

where the dependent variable is the log first birth rate for age cohort *a* in state *j* and year *t*. 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.[11] 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

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

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

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. 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)). The *Z* vector also includes the log

[12] 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."

[13] 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 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.

maximum level of state welfare benefits available to a family of three.[14] 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.[15] 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.

Results from the estimation of equation (1) can be found in Column 1 of Table 3. 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.

Having a mandate in effect in a state has no significant effect on birth rates. The estimated coefficient is –0.06 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 114,409 first births to women over the age of 35 (with a first birth rate

[14] 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.

[15] 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).

for this group of 0.0028). A 32% increase would imply an additional 36,780 births to this group of women.[16]

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 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.

While Table 3 shows that the mandates have a large, positive, significant effect on first birth rates for women between the ages of 35-54, thre 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 interact the mandate variable with dummies for each age cohort above the age of 30. 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.

V. Robustness Tests

[16] 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.

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.[17] 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.[18] 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 (e.g. Park (2000)). In panel B of Table 5, I interact the mandate variables with variables that

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

[18] 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). In addition, Park reports that the rates of self-insurance were increasing until the mid-1990s, which should lead to a reduction in the number of women in firms subject to the mandates, which should bias my results towards zero.

indicate 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.)[19] 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, 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.

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 covering all health plans to affect births differently than a mandate that either excludes HMOs or that only covers HMOs. In Table 6, I break out the mandates by type. Panel A 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, there is no statistical evidence that a mandate to cover affects first birth rates differently than a mandate to offer.

In Panel B of Table 4, I replace 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

[19] These data are generated from the March Current Population Survey.

mandates excluding HMOs, and it is equal to one minus the HMO penetration rate.[20] The main results presented in Table 3 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.

In Panel C, I break out mandates that cover IVF versus those that do not cover IVF. These results are surprising, in that mandates in those states that exclude IVF coverage have a much larger and stronger 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. One possibility is that there is endogeneity in the enactment of mandates. Perhaps in these large states there was lobbying due to an increase in infertility among a particular group. If there was large unmet demand in some states, it might lead to an overstatement of effects. One way of addressing this potential endogeneity is to control for a full set of interactions (i.e. age-state and state-year in addition to age-year). There could be changes over time in state-specific patterns in first birth rates that are correlated with the mandates that are driving these results. Alternatively, there could be different patterns of childbearing by age in some of these states that are driving results.

To test this, in Table 7, I reestimate the main specification with controls for a full set of interactions. In Column 1, I provide the main set of results from Column 1 of Table 3 for comparison. In Column 2, I present results from the main specification but control for all of the interactions. With the full set of interactions included, there is now a positive and significant effect of the mandates on all women of 7%. The coefficient on women over 35 falls, but is still positive and significant, and the overall effect of mandates on women over 35 is still over 30%.

[20] HMO penetration rates come from Interstudy, various years.

In Column 3, I provide the results from the IVF versus non-IVF specification from Table 6. In Column 4, I present results from this same specification with controls for a full set of interactions. In this specification, there appears to be a positive and significant effect of the mandates that cover IVF on women over 35, but no net effect of the mandates that exclude IVF coverage on older women, since the two mandate variables are of similar magnitudes but offsetting signs.

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 8 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. Conclusions and Directions for Future Work

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 increase first birth rates among women over 35 by 32% percent. These 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.

However, this analysis is only the first step in a full analysis of the costs and benefits of these policies. In ongoing work, I am addressing the following questions. First, do the mandates increase consumption of particular *types* of treatment? Are these treatments high or low cost? This is essential for determining the costs of the mandates. Second, 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 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 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	-0.0577		-0.0606		-0.0249	
	(0.0681)		(0.0763)		(0.0298)	
Mandate * Over 35	0.3164	**	0.3519	**	0.0365	
	(0.1429)		(0.1540)		(0.0908)	
Black	-0.0876	**	--		--	
	(0.0375)					
Age 20-24	0.3438	***	0.4489	***	-0.2468	***
	(0.0272)		(0.0286)		(0.0382)	
Age 25-29	0.0263		0.2027	***	-1.0249	***
	(0.0651)		(0.0713)		(0.0662)	
Age 30-34	-0.8290	***	-0.6383	***	-2.0025	***
	(0.0834)		(0.0868)		(0.0864)	
Age 35-39	-2.2045	***	-2.0450	***	-3.1939	***
	(0.1082)		(0.1099)		(0.1154)	
Age 40-44	-4.3822	***	-4.2461	***	-5.1934	***
	(0.1416)		(0.1427)		(0.1574)	
Age 45-54	-7.4023	***	-7.4087	***	-7.0874	***
	(0.1918)		(0.2164)		(0.1865)	
Log median weekly earnings	0.1337		0.1669		0.3714	
	(0.1969)		(0.2152)		(0.3179)	
Log 10^{th} percentile weekly earnings	0.0382		0.0773		-0.2965	*
	(0.1078)		(0.1352)		(0.1605)	
Unemployment rate	0.0171	**	0.0220	**	-0.0183	**
	(0.0081)		(0.0097)		(0.0076)	
Female labor force participation rate	-0.0012		-0.0017		-0.0049	
	(0.0049)		(0.0058)		(0.0074)	
Log maximum AFDC/TANF benefit	-0.0621		-0.0891		0.0814	
	(0.0898)		(0.1035)		(0.1490)	
State in compliance with Hyde amendment	0.0888	***	0.1012	***	0.0135	
	(0.0218)		(0.0281)		(0.0198)	
State funds abortions beyond Hyde req	0.1151	***	0.1289	***	0.0059	
	(0.0255)		(0.0324)		(0.0310)	
Parental involvement abortion restrictions	0.0087		0.0197		-0.0584	*
	(0.0260)		(0.0287)		(0.0312)	

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	-0.0844	
	(0.0889)	
Mandate * Age 30-34	0.0107	
	(0.0633)	
Mandate * Age 35-39	0.1216	**
	(0.0540)	
Mandate * Age 40-44	0.2426	***
	(0.0809)	
Mandate * Age 45-54	0.3669	***
	(0.1275)	

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	-0.0594	
	(0.0894)	
Mandate * share with private health insurance * Over35	0.4423	**
	(0.1910)	
Share with private health insurance	-0.8047	***
	(0.2483)	
B. Firm Size		
Mandate * share in firms with less than 25 emp	0.3951	
	(0.8189)	
Mandate * share in firms with less than 25 emp * Over35	-0.0280	
	(2.0385)	
Mandate * share in firms with 25-99 emp	-1.2478	
	(2.1361)	
Mandate * share in firms with 25-99 * Over35	6.4534	
	(3.9848)	
Mandate * share in firms with 100+ emp	-0.0137	
	(0.2331)	
Mandate * share in firms with 100+ emp * Over35	-0.6012	
	(0.4122)	
Share in firms with less than 25 emp	-0.4998	***
	(0.1841)	
Share in firms with 25-99 emp	-0.1804	
	(0.2957)	
Share in firms with 100+ emp	-0.5783	***
	(0.1615)	
Test if sum of (Mandate * firm size * Over 35) interactions = 0		
F(1, 31957)	8.08	***
Test if sum of (Mandate * firm size) interactions = 0		
F(1, 31957)	0.53	

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

A. Mandate to cover versus mandate to offer		
Mandate to cover	-0.0680	
	(0.0759)	
Mandate to cover * Over35	0.3440	**
	(0.1462)	
Mandate to offer	-0.0499	
	(0.1141)	
Mandate to offer * Over 35	0.2880	
	(0.2423)	
Test equality of coefficients: mandate to cover * Over35 and mandate to offer * Over 35		
F(1, 31962)	0.04	
B. Share of population covered by mandate (due to variation in treatment of HMOs)		
Share covered by mandate	-0.2438	
	(0.2286)	
Share covered by mandate * Over35	0.5605	**
	(0.2286)	
HMO penetration rate	0.3992	
	(0.2842)	
C. IVF versus non-IVF mandate		
Mandate covers IVF	0.0296	
	(0.0717)	
Mandate covers IVF * Over35	0.1561	
	(0.1666)	
Mandate excludes IVF	-0.1436	**
	(0.0662)	
Mandate excludes IVF * Over 35	0.4724	***
	(0.1318)	

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
Full Set of Interactions

	Main Results		With full set of interactions		IVF vs nonIVF		With full set of interactions	
Mandate	-0.0577		0.0722	***	--		--	
	(0.0681)		(0.0205)					
Mandate * Over 35	0.3164	**	0.2455	***	--		--	
	(0.1429)		(0.0486)					
Mandate covers IVF	--		--		0.0296		-0.0021	
					(0.0717)		(0.0254)	
Mandate covers IVF * Over35	--		--		0.1561		0.2168	***
					(0.1666)		(0.0590)	
Mandate excludes IVF	--		--		-0.1436	**	-0.2733	***
					(0.0662)		(0.0230)	
Mandate excludes IVF * Over 35	--		--		0.4724	***	0.2646	***
					(0.1318)		(0.0520)	
Age X Year Interactions	X		X		X		X	
Age X State Interactions			X				X	
State X Year Interactions			X				X	

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 8
Second and Higher Birth Rates as dependent variable

Mandate	-0.0692
	(0.0575)
Mandate * Over 35	0.2011
	(0.1284)

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	5.9157
	(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

- *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' legislatures were consulted.