The Impact of Ultrasound Laws on the Demand for Abortions by Young Women

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The purpose of the present study is to determine if laws requiring ultrasounds have any effect on abortion. Using individual-level data from the NLSY and a sample selection model, results suggest that ultrasound requirement laws have a negative effect on the abortion decision of a young woman. In addition to the ultrasound requirement laws, other important determinants of the decision to abort were marital status, the presence of other children, and urban residence.

INTRODUCTION

Abortion has been one of the most divisive issues in American politics ever since the *Roe v. Wade* decision was handed down by the U. S. Supreme Court in 1973. Ever since this landmark case upheld the right of a woman to have an abortion, various attempts have been made to weaken the ruling. One of the more recent attempts to restrict access to abortions is the requirement that all women who want to obtain an abortion must first have an ultrasound of the fetus. Anecdotal evidence suggests that women who view an ultrasound image of their fetus may be less likely to abort it than women who do not see an ultrasound. In a 2002 article published in the *Massachusetts News*, the director of an abortion clinic noted that, before ultrasounds were available, about 40-50 percent of their clients decided to keep their babies; after the clinic started offering ultrasounds, this percentage increased to over 75 percent. Given this evidence, more and more pro-life legislators are sponsoring bills that, in some way, would require an abortion patient to view an ultrasound of her fetus before proceeding with the procedure. According to the National Right to Life Committee, the first ultrasound laws were passed in 1996; by 2009, nineteen states had some form of an ultrasound requirement law. Although not all of these laws actually require a woman seeking an abortion to first get an ultrasound, they do give a pregnant woman the right and/or the opportunity to view an ultrasound of the fetus.

Pro-choice groups do not support these ultrasound requirement laws. They believe that the use of ultrasound images to convince a woman to reverse their decision to abort is very intrusive and is probably unconstitutional. Although supporters of these laws claim that these ultrasounds are necessary as a check on fetal development, pro-choice groups believe that they are medically unnecessary. These groups contend that ultrasound requirement laws are another way in which pro-life groups are attempting to place further restrictions on a woman's right to choose.

Regarding a possible correlation between ultrasounds and abortions, it is important to note that abortion rates started to decline at about the same time that ultrasounds started to be used widely as a diagnostic tool for pregnancies. The abortion rate, which is the number of abortions per 1,000 women aged 15-44, was at 16.3 in 1973. It rose to a high of 29.3 in 1981 and then it started to fall; by the year

2000, the abortion rate had fallen to 21.3, what it was in 1975. In 2006, it was 19.4 (Allan Guttmacher Institute, 1992; 2003).

At about the same time that abortion rates were starting to fall, usage rates for diagnostic ultrasounds for pregnancies began to increase. By the mid-1990s, the average number of ultrasounds per low-risk pregnancy was 1.3; by 2005, that rate had increased to 2.1. Although this increase in the use of ultrasounds may not be statistically correlated with the decline in the abortion rate observed over the same time period, this is nonetheless compelling anecdotal evidence that viewing an ultrasound may have a negative effect on a woman's decision about whether or not abort a fetus.

Finally, ultrasounds not only became more common, but they also became much better. New 3-D ultrasound technology, which has become more prevalent since 2000, allows parents to see a 3-D image of their fetus, giving it very lifelike features. This is a vast improvement over earlier ultrasound technology which was only two dimensional and had low picture quality. Hence, it is possible that not only the quantity but also the quality of ultrasounds has enabled women contemplating abortion to more clearly see their fetuses, thus possibly convincing some of them to change their minds about the procedure.

The purpose of the present study is to determine if ultrasound requirement laws have any effect on the individual-level decision about whether or not to abort a fetus. Given this is a relatively new legal restriction on abortion, the present study is one of the first few to examine this important issue. Gius (2010) also looked at ultrasound requirement laws but only used state-level data. The present study uses individual-level data, which is much more appropriate for the analysis of such an individual-level decision as an abortion.

LITERATURE REVIEW

There has been a great deal of research done on the demand for abortions, and several studies have been conducted on the impact of legal restrictions and/or provider availability on abortion demand. As noted above, since only one prior study specifically looked at the effect of ultrasound laws on the demand for abortions, the present study will examine research done on various other types of legal restrictions on abortions.

Leibowitz, Eisen, and Chow (1986) used individual-level data on teenage women living in California in 1972-1974 in order to determine the factors that affect the birth decision. Specifically, the authors assumed that pregnant teenage women have three choices: bear the child without marrying; marry in order to legitimize the birth; or abort the fetus. Using a conditional logit function, the authors employed explanatory variables that attempt to capture the costs and benefits associated with each of the possible choices. Examples of such variables included value of time, public assistance, and ethnicity. Results indicated that teenagers who were enrolled in school, those not on public assistance, and those who were not Mexican-Americans were more likely to choose abortion. The application of this study's results is somewhat limited since it looks at a very select sample from one state and one very short time period.

Powell-Griner and Trent (1987) employed individual-level data from the National Center for Health Statistics in order to determine the effects of various socioeconomic determinants on the demand for abortion. Using the explanatory variables race, marital status, age, residence status, educational attainment, and previous live birth, the authors found that unmarried, white, urban, educated women were more likely to choose abortion than others.

Garbacz (1990), using state-level data, attempted to determine if passage of the Hyde Amendment, which eliminated federal funding of abortions through Medicaid, had any statistically-significant impact on abortions. Specifically, some states replaced the lost federal funds with their own; the author attempted to determine if this state funding had any effect on the demand for abortions. Using the state abortion rate as the dependent variable, the author found that abortion is price inelastic, hence public policy targeting the price of abortions may have a limited effect on the overall demand for abortions. Regarding the role of Medicaid funding in the demand for abortions, this study found that the results were very sensitive to the construct of the demand model; if a variable designating the urban nature of a state is included in the

regression model, the variable denoting Medicaid funding becomes insignificant.

King, Myers, and Byrne (1991) published a short note on the economic determinants of teenage abortion. Using data from the National Longitudinal Survey of Youth (NLSY), the authors found that white, higher income women who were enrolled in college were more likely to have an abortion than other women.

Gohman and Ohsfeldt (1993) used state-level data pooled over the years 1982, 1984, 1985, and 1987 in order to determine income and price elasticities for abortion and the effect of state-level restrictions on access to abortion services. Using a fixed-effects model, the authors found that the demand for abortions is price inelastic, and abortion is a normal good. In addition, it was found that state regulations restricting access to abortions increased the price of abortions and hence reduced to a rather limited degree the overall demand for abortions.

Gober (1994) used state-level data to determine the effect of legal restrictions and various socioeconomic variables on the overall level of abortions. Using a path model, the author found that legal restrictions had a significant impact of the state-level abortion rates.

Haas-Wlison (1996) examined the role of state-level parental consent and notification laws on the demand for abortions by minors. Using state-level data for the period 1978-1990 and various socioeconomic statistics, the author found that the parental involvement laws caused abortions by minors to fall by 13 to 25 percent. In addition, state restrictions on the use of Medicaid to pay for abortion reduced abortion demand by 9 to 17 percent.

Meier, Haider-Markel, Stanislawski, and McFarlane (1996) employed state-level data for the years 1982 to 1992 in order to determine if state-level restrictions had any statistically-significant impact on the demand for abortion services. Using a variety of socioeconomic variables and dummy variables for 23 different laws that were passed by various states attempting to restrict access to abortion services, the authors found that none of the laws had a statistically-significant impact on the abortion rate in any state that had adopted the laws.

Brown and Jewell (1996) and Brown, Jewell, and Rous (2001) both used the same data set in order to determine if provider availability had any effect on the demand for abortion. Using individual-level data from Texas for 1993, the authors found in both studies that women who had to travel large distance to reach an abortion provider were much less likely to have an abortion than others.

Matthews, Ribar, and Wilhelm (1997) used state-level data for the years 1978-1988 in order to determine if access to abortion providers had any effect on abortion demand. Their results indicated that access was an important determinant of abortion demand and may have accounted for one-quarter of the five percent decline in abortion rates between 1982 and 1992.

Ellertson (1997) examined the impact of parental involvement laws on the demand for abortions by minors in three states. Using individual-level data from Minnesota, Missouri, and Indiana, the authors found that the parental involvement laws did cause a statistically-significant drop in state abortion rates.

New (2004), in a Heritage Foundation report, analyzed the effect of state abortion restrictions on the demand for abortions during the 1990's. Using state-level data for the years 1990 to 1999, the author found that parental involvement laws had no statistically-significant effect on abortion rates, while informed consent laws, Medicaid funding restrictions, and partial-birth abortion bans all had statistically-significant and negative effects on abortion rates.

Gius (2007) used NLSY data to determine the effect of the availability of abortion providers and legal restrictions on the demand for abortions by young women. Using data from 1980-1983 and 1998-2000, the author found that legal restrictions had no statistically- significant effects on abortion demand but that the number of abortion providers and various socioeconomic characteristics of the young women were significant.

Finally, Gius (2010) used state-level data to determine if laws requiring ultrasounds prior to an abortion being performed have any effect on the demand for abortions. Using a difference-in-differences approach, results suggested that ultrasound laws have no statistically-significant effects on state-level abortion rates. Results indicated that the fears of pro-choice groups that such laws would greatly reduce the demand for abortions are not support by the empirical evidence. The study also showed that states

with Republican governors, more abortion providers, and younger populations had, on average, higher abortion rates.

In reviewing this literature, several important points emerge. First, white, educated, urban women almost always have a higher demand for abortions than other women. Second, access to abortion providers is very important; the further a woman is from a provider, the less likely she will have an abortion. Third, the evidence on the effect of restrictive laws on abortion demand is mixed. Finally, most abortion studies use state-level as opposed to individual-level data. The present study will incorporate several of the aspects of previous studies and will use individual-level data in order to determine if ultrasound requirement laws have any statistically-significant effects on abortion demand. The present study will attempt to improve upon this earlier research by using individual-level data and by utilizing a statistical technique not previously used in this type of analysis.

EMPIRICAL TECHNIQUE

An important issue in estimating the determinants of abortion at the individual level is that a woman must first become pregnant in order to make the decision to abort or not. Not all women have to make that decision; only those who are pregnant have to choose whether or not to get an abortion. Hence, a potential sample selection problem exists. In order to correct for this sample selection problem, a two-stage procedure is employed. In the first stage, a probit regression is estimated where the dependent variable equals one if the individual is pregnant and zero otherwise; the explanatory variables in that regression consist of demographic and socioeconomic factors that may be related to being pregnant. Only those individuals for whom the dependent variable equals one in the first stage regression are then included in the sample for estimating the second stage regression. In the second stage, a binary model of abortion is estimated. This empirical technique is Heckman's two step estimation method. The use of this technique results in consistent estimators for the parameters.

The first-stage (pregnancy) regression estimated in the present study is as follows:

$$Y = a_0 + a_1 AGE + a_2\ GRADE + a_3\ BIOCH + a_4\ NONBIO + a_5\ BLACK + a_6\ HISPANIC + a_7\ URBAN + a_8\ MARRIED + a_9\ DIVORCE + a_{10}\ BLGRADE + a_{11}\ HSGRADE \quad (1)$$

The second stage (abortion) regression estimated in the present study is as follows:

$$Z = a_0 + a_1 AGE + a_2\ GRADE + a_3\ BIOCH + a_4\ NONBIO + a_5\ BLACK + a_6\ HISPANIC + a_7\ URBAN + a_8\ MARRIED + a_9\ DIVORCE + a_{10}\ BLGRADE + a_{11}\ HSGRADE + a_{12}\ CATHOLIC + a_{13}\ BAPTIST + a_{14}\ NOGOD + a_{15}\ ULTRA \quad (2)$$

where Y takes a value of one if the woman was pregnant and zero otherwise; Z takes a value of one if the woman had an abortion and zero otherwise AGE is age of respondent in years (Brown and Jewell, 1996; Brown, Jewell, and Rous, 2001; King, Myers, and Byrne, 1991; Leibowitz, Eisen, and Chow, 1986; New, 2004; Powell-Griner and Trent, 1987); GRADE is the number of years of education respondent has completed; BIOCH is the number of biological children the respondent already has; NONBIO is the number of non-biological children the respondent has; BLACK takes a value of one if woman is African-American and zero otherwise; HISPANIC takes a value of one if woman is Hispanic and zero (Brown and Jewell, 1996; Brown, Jewell, and Rous, 2001; Garbacz, 1990; Gober, 1994; King, Myers, and Byrne, 1991; Leibowitz, Eisen, and Chow, 1986; Meier, et al., 1996; New, 2004; Powell-Griner and Trent; 1987); URBAN takes a value of one if person lives in an urban area and zero otherwise (Brown, Jewell, and Rous, 2001; Garbacz, 1990; Gober, 1994; Meier, et al., 1996; Powell-Griner and Trent, 1987); MARRIED equals one if respondent is married and zero otherwise; DIVORCE equals one if respondent is divorced and zero otherwise; BLGRADE is an interaction term between BLACK and GRADE; HSGRADE is an interaction term between HISPANIC and GRADE; CATHOLIC takes a value of one if

person is Catholic and zero otherwise (Brown and Jewell, 1996; Brown, Jewell, and Rous, 2001; Gober, 1994; King, Myers, and Byrne, 1991; Leibowitz, Eisen, and Chow, 1986); BAPTIST takes a value of one if person is a Baptist and zero otherwise; NOGOD takes a values of one if woman is an atheist or agnostic; and ULTRA equals one if state has a law requiring ultrasounds for potential abortion patients. Prior research that utilized similar explanatory variables is noted in parentheses after the relevant variable. Only those cases for which Y equals one in equation (1) are used in estimating equation (2).

It is assumed that AGE, URBAN, CATHOLIC, BAPTIST, NOGOD, MARRIED and DIVORCED are all proxies that capture a woman's preference regarding pregnancy and/or abortion. Older women are assumed to want children more than younger women. Urban women are assumed to have less of a desire for children than rural women. It is assumed that women raised as Catholics or Baptists are much less likely to abort a fetus since they derive greater utility from having a child.

GRADE, HISPANIC, and BLACK are all indicative of the opportunity cost of having another child. Given that women with more years of education are likely to earn more income, women with more education would have greater opportunity costs for having a child and hence are less likely to become pregnant and are more likely to abort their fetuses. In addition, African-American women are assumed to have fewer economic opportunities and hence are less likely to abort their fetuses.

Regarding the costs of having an abortion, it is assumed that if there are laws that impede the abortion process, then the overall cost of having an abortion is perceived to be greater, and fewer women will have abortions; hence ULTRA should be negatively related to the decision to abort.

DATA AND RESULTS

Individual-level data was obtained from the National Longitudinal survey of Youth (NLSY). The NLSY was constructed to be a nationally representative sample of the civilian non-institutionalized population at the time of the initial survey in 1979. A second survey with a different cohort was started in 1997. The 1979 NLSY consisted of 12,686 young men and women who were between the ages of 14 and 22 when they were first surveyed in 1979. The 1997 NLSY consisted of 8,984 men and women between the ages of 12 and 16. Interviews with NLSY respondents are conducted annually, and retention rates have been relatively high, averaging over 90%. Each age-sex cohort is represented by a multi-stage probability sample drawn by the Bureau of the Census from a list of sampling areas that had been constructed for the Monthly Labor Survey. The NLSY employed extensive household interviews in the selected sampling areas in order to obtain as random and as representative a sample as possible. In the present study, the Geocode version of the 1997 NLSY was used; this version contains data on the respondent's state of residence, which is required in order to match the respondent with the proper state-level data on legal restrictions.

Data on legal restrictions was obtained from three sources: a paper written for the Heritage Foundation (New, 1994), an article that appeared in *Women's Rights Law Reporter*, and data obtained from the National Right to Life Committee. There are several problems regarding the incorporation of legal restrictions into a quantitative regression equation. First, state laws typically vary, so an informed consent law in one state may not be exactly like an informed consent statute in another state. Second, there is the issue of the degree to which the statute is being enforced by the state. Some statutes are ignored or overlooked by busy, disinterested prosecutors. For the purposes of the present study, it is assumed that all state statutes are identical and that all states enforce their abortion statutes. Table 1 lists the states that have ultrasound laws and the years in which they became effective.

Data was collected for four years: 2005-2008. The sample size for the pregnancy regression (equation (1)) was 11,127. The sample size for the abortion regression (equation (2)) was 1,700. It is important to note that women who were pregnant but reported miscarriages or stillbirths were excluded from both samples. This exclusion was necessary in order to truly capture the determinants of the abortion decision; it is assumed that women who had a miscarriage did not have a choice.

TABLE 1
EFFECTIVE DATES FOR STATES WITH ULTRASOUND LAWS

Alabama (2002)	Michigan (2006)
Arizona (1999)	Mississippi (2007)
Arkansas (2003)	Ohio (2008)
Florida (2005)	Oklahoma (2006)
Georgia (2007)	South Carolina (1996)
Idaho (2007)	South Dakota (2008)
Indiana (2005)	Utah (1996)
Louisiana (1999)	Wisconsin (1998)

Descriptive statistics for the pregnancy sample are presented on Table 2, and descriptive statistics for the abortion sample are presented on Table 3. These statistics indicate that on average 15.3 percent of women were pregnant during the period in question. For the abortion data set, 7.65 percent of pregnancies were aborted.

TABLE 2
DESCRIPTIVE STATISTICS
ALL WOMEN

Variable	**Mean**	**Standard Deviation**
Pregnant (Y)	0.1527	0.359
AGE	24.4	1.81
GRADE	13.44	2.58
BIOCH	0.796	1.06
NONBIO	0.043	0.281
BLACK	0.281	0.449
HISPANIC	0.207	0.405
URBAN	0.813	0.389
MARRIED	0.269	0.443
DIVORCE	0.0411	0.225

TABLE 3
DESCRIPTIVE STATISTICS
ALL PREGNANT WOMEN

Variable	Mean	Standard Deviation
Abortion (Z)	0.0765	0.265
AGE	24.44	1.79
GRADE	12.59	2.40
BIOCH	1.56	0.447
NONBIO	0.0535	0.281
BLACK	0.297	0.457
HISPANIC	0.235	0.424
URBAN	0.782	0.412
MARRIED	0.447	0.497
DIVORCE	0.0529	0.224
CATHOLIC	0.205	0.404
BAPTIST	0.255	0.436
NOGOD	0.15	0.357
ULTRA	0.242	0.428

Results for the first stage regression (equation (1)) are presented on Table 4. Results for the second stage regression (equation (2)) are presented on Table 5. In interpreting the logistic regression results, it is important to note that odds ratios are interpreted in comparison to the omitted dummy variable category. So, for example, on Table 5, the odds ratio of 0.037 for MARRIED, a dichotomous variable, implies that the odds of a married woman choosing an abortion are only 3.7% of the odds for an abortion by a single woman. For continuous variables, such as BIOCH, the odds ratio of 0.304 suggests that for each biological child that a woman has, the odds of having an abortion decrease by almost 70 percent.

Regarding the variable of interest in the present study, ULTRA is significant and negative with an odds ratio of 0.254, which implies that the odds of a woman having an abortion who lives in a state with an ultrasound law are only 25.4 percent of the odds for a woman having an abortion who lives in a state without such a law. These results suggest that ultrasound requirement laws had a statistically significant and negative effect on the number of abortions demanded by young women during the period 2005-2008. These results contradict the findings of some earlier research on the effects of legal restrictions on abortion (Gius, 2010). One possible reason for this difference in results is that individual-level data and a sample selection model were both used in the present study. Earlier studies typically used state-level data, which also did not allow for the use of a sample selection model.

TABLE 4
FIRST-STAGE PROBIT REGRESSION RESULTS
DEPENDENT VARIABLE – PREGNANCY

Variable	Coefficient	Standard Deviation	Test Statistic
Constant	0.277	0.235	1.177
AGE	-0.056	0.009	-6.307***
GRADE	-0.0324	0.0093	-3.492***
BIOCH	0.381	0.0161	23.618***
NONBIO	0.108	0.0519	2.072***
BLACK	-0.572	0.196	-2.919***
HISPANIC	-0.871	0.21	-4.149***
URBAN	-0.0421	0.0395	-1.067
MARRIED	0.434	0.0357	12.165***
DIVORCE	0.127	0.075	1.698*
BLGRADE	0.0453	0.0147	3.08***
HSGRADE	0.0676	0.0162	4.168***

Note:
Significant at 10 percent level = *
Significant at 5 percent level = **
Significant at 1 percent level = ***

TABLE 5
SECOND-STAGE LOGISTIC REGRESSION RESULTS
DEPENDENT VARIABLE – ABORTION

Variable	Coefficient	Odds Ratio	Test Statistic
Constant	-1.66		-1.083
AGE	0.0272		0.440
GRADE	-0.0745		-1.108
BIOCH	-0.517	0.304	-4.878***
NONBIO	-0.612		-0.988
BLACK	-0.737		-0.664
HISPANIC	-3.044	0.00093	-1.805*
URBAN	0.709	5.11	2.001**
MARRIED	-1.432	0.037	-5.258***
DIVORCE	-0.467		-0.909
BLGRADE	0.081		0.943
HSGRADE	0.246	1.76	1.852*
CATHOLIC	0.0708		0.227
BAPTIST	-0.393		-1.378
NOGOD	0.447	2.79	1.659*
ULTRA	-0.595	0.254	-1.977**

Note:
Significant at 10 percent level = *
Significant at 5 percent level = **
Significant at 1 percent level = ***

Regarding the effects of other explanatory variables on abortion, the number of biological children, Hispanic, urban residence, married, the interaction between Hispanic and educational attainment, and atheists are all statistically significant. In terms of odds ratios, the odds of an urban woman having an abortion are 411 percent greater than those of a rural woman. The odds of an atheist obtaining an abortion are 179 percent higher than a non-atheist.

In order to test the above results, equation (2) is estimated using a logistic regression, with no correction for sample selection. The results are presented on Table 6 and are very similar to those of the sample selection model. Once again, the odds of a woman having an abortion in a state with an ultrasound law are only 25% of the odds of a woman having an abortion who lives in a state without such a law. The negative effect of this law on a young woman's demand for abortion is rather significant and robust.

TABLE 6
LOGISTIC REGRESSION RESULTS

Variable	Coefficient	Odds Ratio	Test Statistic
Constant	-1.668		-1.113
AGE	0.027		0.495
GRADE	-0.0736		-1.105
BIOCH	-0.514	0.306	-4.808***
NONBIO	-0.6229		-1.412
BLACK	-0.710		-0.589
HISPANIC	-3.032	0.00093	-2.06**
URBAN	0.707	5.09	2.18**
MARRIED	-1.432	0.037	-5.399****
DIVORCE	-0.477		-1.041
BLGRADE	0.0785		0.837
HSGRADE	0.244	1.75	2.156**
CATHOLIC	0.0688		0.23
BAPTIST	-0.4004		-1.445
NOGOD	0.442	2.77	1.701*
ULTRA	-0.599	0.252	-2.139**

Note:
Significant at 10 percent level = *
Significant at 5 percent level = **
Significant at 1 percent level = ***

CONCLUDING REMARKS

The purpose of the present study was to determine if ultrasound requirement laws had any effect on the individual decision about whether or not to have an abortion. Using individual-level data from the NLSY and state-level data on ultrasound laws, results of the present study suggest that ultrasound laws had a very significant and negative effect on the abortion decision. The primary motivation for the present study was to determine if the anecdotal evidence on ultrasound laws was true: did giving women the opportunity to view their unborn fetus reduce the probability that they would have an abortion? Most pro-life groups believe that is the case. Most pro-choice groups also believe it to be true, although they believe that these laws are unconstitutional. Results of the present study suggest, however, that both groups are correct; ultrasound requirement laws reduce the odds of a woman having an abortion quite substantially.

It is important to note, however, that every state that has an ultrasound requirement law has an abortion rate that is lower than the national average. For the year 2006, the national rate was 15.9 abortions per 1,000 women. The highest abortion rate for the group of states that have an ultrasound law was 14.2 (South Carolina). Hence, the ultrasound law dummy variable may be capturing other aspects of a state's population that may signal a certain attitude with regards to abortion. It may be that women in a particular state may demand fewer abortions, with or without an ultrasound requirement law. This is a topic that should be addressed in future research.

**This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

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