State-level Abortion Restrictions and Its Association with Abortion Rates and Cross-state Movement in the United States, 2017 - 2019

Abstract

Before the U.S. Supreme Court overturned Roe v. Wade, even though abortion was made legal, most states implemented regulations leading to barriers to care. This study aims to investigate the association of abortion policy with the abortion rate and cross-state movement to obtain abortion care from 2017 to 2019 in the United States. We implement multiple linear regression models using publicly available data. Through our analysis, we provide evidence that a highly restrictive state legislative climate is associated with a lower abortion rate and a high percentage of cross-state movement for abortion. It also suggests that high costs of medication abortion, less access to abortion facilities, low gestational limit for procedural abortion, and high percentage of poverty are confounding factors that may drive the abortion rate and cross-state movement.

I. Background and Significance

Before U.S. Supreme Court decided to overrule Roe v. Wade (1973) which guaranteed a constitutional right to abortion services, even though abortion was made legal, most states implemented regulations promoting abortion scarcity and leading to barriers to care in recent decades (Wolfe & van der Meulen Rodgers, 2021). For instance, the "Targeted Regulation of Abortion Providers (TRAP)" laws put stringent and unnecessary requirements on abortion providers (Austin & Harper, 2018). In 2017, 89% of counties in the United States had no abortion providers within their borders. People were forced to travel more than 100 miles to receive abortion services as of 2018 in 27 cities (Smith et al., 2022).

Previous studies assessed the impact of such restrictions on abortions outcome. For instance, Ellertson (1997) found a decrease in the in-state abortion rate and delay in abortions when parental involvement laws took effect. Addante et al. (2021) investigated that states with more restrictive abortions have higher maternal mortality than states with moderate or protective abortions from 1995 to 2017. However, most articles evaluated policy effects from 2006 or earlier, possibly prior to the recent surge in regulation enactment (Austin & Harper, 2018). It's helpful to re-evaluate in light of recent policy changes, therefore our study examines the association of abortion policy with the abortion rate and cross-state movement to obtain abortion care from 2017 to 2019 in the United States. We hypothesize that a more restrictive abortion policy is associated with a decrease in the abortion rate, but an increase in traveling across states for abortion care.

II. Statistical Methodology

We rely on data from the Centers for Disease Control and Prevention (CDC)'s Annual Abortion Surveillance report from 2017 to 2019 (Centers for Disease Control and Prevention, 2022), for the outcome variables — abortion rate and percentage of cross-state leaving for abortion. They compile information from reporting areas to produce national estimates of legally induced abortions. We use the total number of abortions by state of residence, adjusted by the number of women of reproductive age (15-49 years), to calculate abortion rate. We then use the number of abortions that occurred in the same states of residence and clinical services to calculate percentage of leaving. Four states (California, the District of Columbia, Maryland, New Hampshire, and Wyoming) either do not report to the CDC, or do not conform to reporting requirements, therefore are not included in the analysis.

We also collect the state abortion policy index from the Alan Guttmacher Institute (AGI) (Guttmacher Institute, 2022), as our main variable of interest. States are scored based on whether they have policies in effect in any of six categories of abortion restrictions and any of six categories of measures that protect or expand abortion rights and access, in effect as of December 30, 2020. Each state is given a score of 1 for every protective measure in effect and a score of -1 for every abortion restriction in effect. A state with a score of either +6 or -6 has either all of the protective measures or all of the abortion restrictions in effect.

Other risk factors are collected from the Abortion Facility Database Project 2017 - 2021 (Schroeder et al., 2022), conducted at the University of California San Francisco. Data is offered by publicly advertising abortion facilities across the United States. It mainly provides the number of women of reproductive age per facility, gestational limit, and median cost of abortion services from 2017 to 2019. Furthermore, another risk factor, percentage of poverty, is collected from the U.S. Census Bureau. The data includes the percentage of poverty on a 2-year average, which is based on Current Population Survey and 1960 to 2021 Annual Social and Economic Supplements (U.S. Census Bureau, 2021). For each year, we use the 2-year percentage of poverty from the corresponding year and the last year. For instance, the percentage of poverty in 2019 is the average percentage of poverty in 2018 - 2019.

For the data analysis, we first conduct missing value evaluation based on the pattern of missingness. Variables with a large portion of missingness (i.e. larger than 50%) are discarded, and variables without any specific pattern of missingness are imputed with mean. Then, we conduct exploratory data analysis and visualization, in order to describe the characteristics of each variable and the relationship between variables.

We implement multiple linear regression (MLR) for each outcome variable, with adequate variable transformation if needed. For each regression, we conduct model selection with Akaike information criterion (AIC) by removing variables without statistical evidence of significance and adding new interaction terms. Then, Variance inflation factor (VIF) is checked for multicollinearity with the selected variables. After building the model, model assumptions (linearity, constant variance, normality, independence) and evaluation metrics (R-squared, Adjusted R-squared, AIC, BIC) are assessed for model accuracy. Regression coefficient with a p-value less than 0.05 is considered to be significant.

III. Results

For missing value evaluation, one variable (cost of abortions in second trimester) is discarded due to a large percentage of missingness, and two variables (cost of medication abortions, cost of abortions in the first trimester) are imputed with mean for the corresponding state. After data cleaning, only states with a policy index from -6 to 4 are included. Figure 1 shows a moderate and strong right-skewed distribution in the abortion rate and percentage of leaving respectively. The correlation plot (Figure 2) indicates four pairs of potential interactive variables, with correlation coefficients larger or less than +/- 0.8. Among the two outcome variables, the cost of medication abortion has a strong negative correlation with abortion rate.

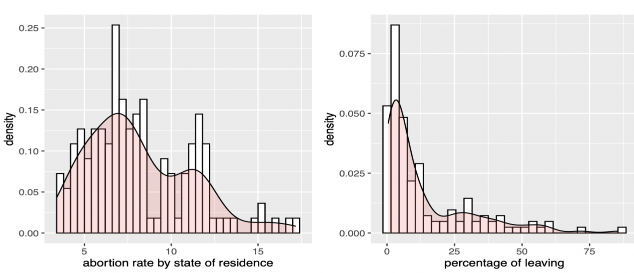

Figure 1 Histograms for Outcome Variables

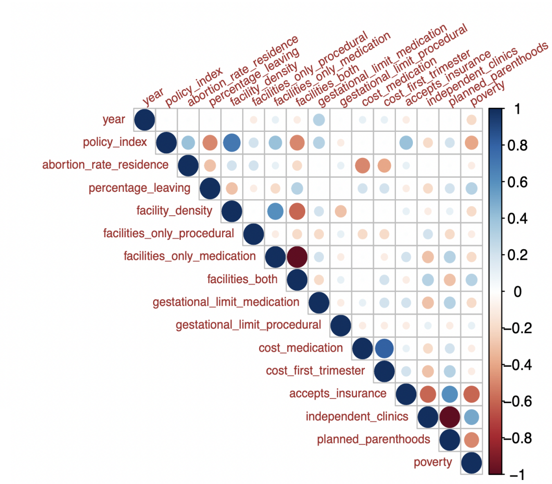

Figure 2 Correlogram

We implement two MLRs for abortion rate and log-transformed percentage of leaving. To avoid possible errors in log transformation with 0s, we add a small positive constant 0.0000001 to the percentage of leaving before the log transformation. After model selection with AIC, according to the residual plots, both regressions meet the assumption of linearity, constant variance, and normality. Both models are nicely fitted with data with acceptable R-squared values (R-squared and adjusted R-squared > 0.45). However, some outliers with high leverage are still identified. Full model output and visualization of the model assessment for both regressions are available in the Appendix.

In the first regression model, we find a positive correlation between abortion rate and policy index (estimate = 0.63096, p-value = 0.00000). Specifically, there is an 0.63096 unit increase in abortion rate for every one unit increase in policy index, holding all other variables constant. This association should be corrected by the facility density, as we found that the interaction between policy index and facility density is statistically significant (estimate = -0.33830, p-value = 0.00087). This indicates that each additional unit of facility density decreases the effect of policy index on abortion rate by 0.33830, holding all other variables constant. Moreover, cost of medication abortion is negatively correlated with abortion rate (estimate: -0.01261, p-value = 0.00000), and percentage of poverty is positively correlated with abortion rate (estimate: 0.16797, p-value = 0.03097).

In the second regression model, we find a negative correlation between log-transformed percentage of leaving and policy index (estimate = -0.18268, p-value = 0.00003). Specifically, there is a 16.69% decrease in percentage of leaving for every one unit increase in policy index, holding all other variables constant. We also find that for every unit increase in facility density and gestational limit for procedural abortion, the percentage of leaving decreases by 41.59% (estimate = -0.53778, p-value = 0.00192) and 8.91% (estimate = -0.09338, p-value = 0.00194) respectively, holding all other variables constant. Similarly to the first model, we find that for every unit increase in percentage of poverty, percentage of leaving increases by 8.95%, holding all other variables constant (estimate = 0.08578, p-value = 0.01814). Furthermore, we include the interaction between percentage of independent clinics and percentage of planned parenthood (estimate = -0.00041, p-value = 0.00005). We find that each additional unit of percentage of independent clinics decreases the effect of the percentage of planned parenthood on the percentage of leaving by 0.04%.

IV. Discussion

A rising amount of data demonstrates that stringent state laws may be an obstacle for individuals seeking an abortion. This study presents data from a linear regression analysis indicating that a more restricted state legislative climate is associated with a lower abortion rate. This implies that people are less likely to perform abortions in states with stricter abortion policies. Possible explanations may be the external constraints that prevent individuals from obtaining an abortion, or it may be due to personal willingness. In our study, we find that higher costs for medication abortion and less access to abortion facilities can be the contributing factors.

Our results also suggest that individuals in states with stricter abortion regulations are more likely to leave their state to have an abortion. Abortion patients may leave their state for care for a variety of reasons, including state restrictions related to gestational limits, waiting periods, and locations of clinics (Smith, 2022). Our finding suggests that gestational limit for procedural abortion and limited access to abortion facilities are two of the factors related to patients leaving their state for abortion.

In our study, one of the most alarming findings is that higher poverty rate is associated with higher abortion rate. This is similar to findings in previous studies, which show the substantial disparities in abortion rates in the US, with low-income women having higher abortion rates than affluent women. Possible explanations might be the differences in the effective use of contraception influencing disparities in unintended pregnancy; lack of sexual initiation among adolescents live; and differences in access to, quality of, and acceptability of family planning (Dehlendorf et al., 2013).

However, our study has several limitations. First, the assumption of independence is violated in our study due to repeated measures, in which each state provides more than one data point. Second, we use the abortion policy index referring to laws in effect as of December 30, 2020, due to the unavailability of information regarding abortion policy index between 2017 and 2019. However, it is reasonable to use the policy index for 2020, considering that state abortion laws are unlikely to undergo significant changes over one or two years. Based on a comparison with the abortion policy score in 2017 presented by Smith (2022), the majority of states scored the same.

In conclusion, this study provides evidence that a highly restrictive abortion legislative climate is associated with a lower abortion rate and a high percentage of cross-state movement for abortion. It also suggests that high costs of medication abortion, less access to abortion facilities, low gestational limit for procedural abortion, and high percentage of poverty are confounding factors that may drive the abortion rate and cross-state movement. We conclude that restrictive policies may pose a barrier to patients accessing abortion care.

V. References

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Appendix

APPENDIX 1: Multiple Linear Regression for Abortion Rate

We assume the linear relationship between abortion rate and explanatory variables from Figure 3. Full model coefficients are as follows:

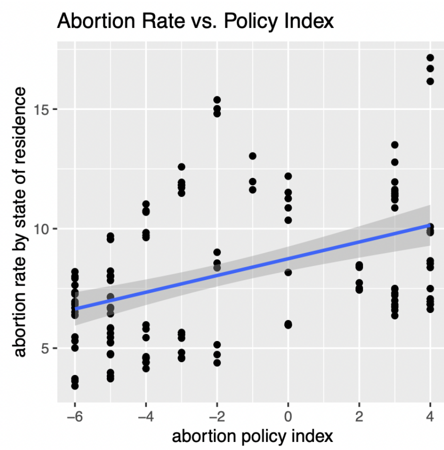

Figure 3 Scatterplot between Abortion Rate and Policy Index

Table 1 Regression Model Accuracy Metrics

r.squared	adj.r.squared	AIC	BIC
0.48615	0.45848	619.5718	645.9171

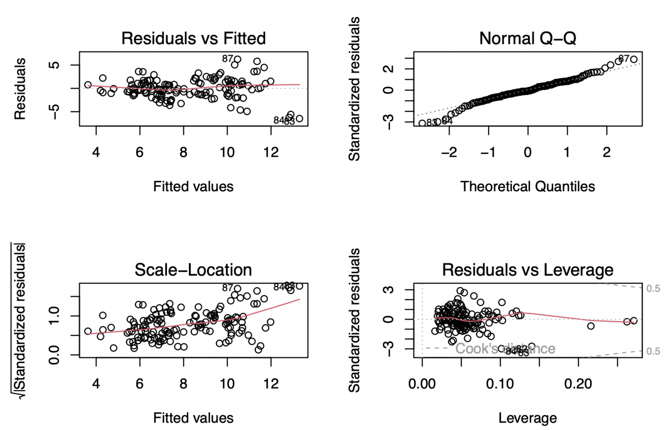

Figure 4 Residual Plots of Regression Model for Abortion Rate

Table 2 Regression Results for Abortion Rate

term	estimate	std.error	statistic	p.value
(Intercept)	-792.27006	482.71784	-1.64127	0.10316
year	0.39883	0.23918	1.66748	0.09783
policy_index	0.63096	0.08475	7.44528	0.00000
facility_density	0.75553	0.39711	1.90257	0.05931
gestational_limit_procedural	0.08267	0.07066	1.16991	0.24418
cost_medication	-0.01261	0.00177	-7.10950	0.00000
poverty	0.16797	0.07701	2.18121	0.03097
policy_index:facility_density	-0.33830	0.09923	-3.40918	0.00087

APPENDIX 2: Multiple Linear Regression for Percentage of Leaving

We confirm the normality of log-transformed percentage of leaving and assume the linear relationship between log-transformed percentage of leaving and explanatory variables from Figure 5. Full model coefficients are as follows:

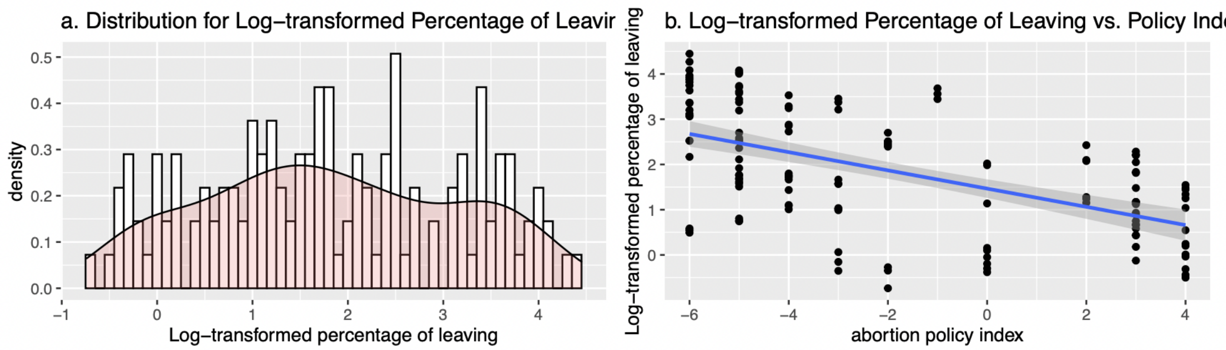

Figure 5 Histogram and Scatter Plot of Log-transformed Percentage of Leaving

Table 3 Regression Model Accuracy Metrics

r.squared	adj.r.squared	AIC	BIC
0.55486	0.52356	378.118	410.3177

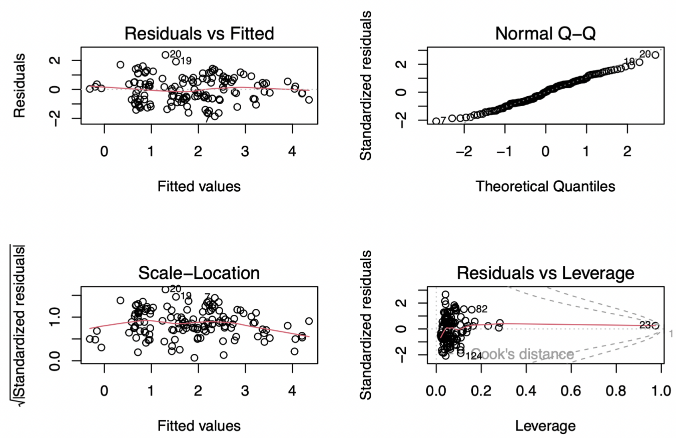

Figure 6 Residual Plots of Regression Model for Percentage of Leaving

Table 4 Regression Results for Percentage of Leaving

term	estimate	std.error	statistic	p.value
(Intercept)	20.26750	15.53629	1.30453	0.19439
policy_index	-0.18268	0.04245	-4.30385	0.00003
facility_density	-0.53778	0.16975	-3.16799	0.00192
gestational_limit_procedural	-0.09338	0.02951	-3.16471	0.00194
accepts_insurance	0.00699	0.00364	1.92028	0.05705
independent_clinics	-0.17980	0.15587	-1.15348	0.25086
planned_parenthoods	-0.16889	0.15602	-1.08249	0.28107
poverty	0.08578	0.03584	2.39347	0.01814
policy_index:facility_density	0.08619	0.04586	1.87925	0.06248
independent_clinics:planned_parenthoods	-0.00041	0.00010	-4.19394	0.00005