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IMPACT OF ABORTION ACCESS ON GENDER EQUALITY AND WOMEN'S CHOICES

A thesis submitted in partial fulfilment of the requirements for the degree of Bachelor of Economics at the School of Economics, Business, Accounting and Actuarial Science of the University of São Paulo.

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São Paulo

November 2022

Acknowledgements

I am deeply indebted to my parents for supporting my undergraduate study emotionally and financially. My mom, as a PhD supervisor and researcher herself, inspired me greatly in doing scientific research and writing academic papers. My dad enlightened me to study Economics with his knowledge of the financial markets.

To my grandfather, who bravely fought against cancer. Regretfully, I could not spend his last days together because of travel restrictions. His decease has caused me great pain and reminds me to cherish every moment.

I could not have undertaken this journey without my tutor, Professor Fernando Postali, for all the support over these three years and the instruction for completing my Scientific Initiation project. He has always been responsive to helping me with problems during the course.

Many thanks to the supervisor of my final thesis, Professor Paula Pereda, for her invaluable patience and opinion throughout the development of the work.

I appreciate my friends and colleagues for the good moments together and the company so that I am not feeling alone.

I'd also like to recognize the Brazilian government and the University of São Paulo for offering me this unforgettable opportunity to study a subject I am always enthusiastic about.

The three years were intense and demanding. Although I have struggled along the road, happiness was still the main theme of the time. I've enjoyed the challenges I've faced thus far, and I'm looking forward to starting a new chapter of my life.

"The Master said, 'A virtuous man has neither anxiety nor fear.'
'Being without anxiety or fear!', said Sze-ma New, 'Does this constitute what we call a virtuous man?'
The Master said, 'If you look inside yourself and find no faults, what is there to be anxious about, what is there to fear?'"
(The Analects of Confucius, Book XII, Chapter IV)

Abstract

Abortion is a method of terminating pregnancies used by millions of women worldwide. Therefore, it is viewed as a public health issue. Abortion occurs in one-fourth of all pregnancies worldwide each year. One of the most divisive topics in the world is access to abortion, and there are many misconceptions regarding the effects of limiting access. In many countries, legalizing abortion has directly contributed to a drop in birth rate, especially among young, single, and coloured women. Women who were denied an abortion have a considerable increase in financial hardship in the years following the encounter. Social science researchers must broaden their understanding of the economic effects of abortion services and legislation as barriers to accessing abortion grow and existing inequities spread. We collected yearly data from 194 countries between 1996 and 2015. To investigate the association between abortion flexibility and other socioeconomic indicators, several models were built. The present study provides global empirical evidence for the notion that restricting access to abortion has a detrimental effect on women's educational achievement and labour force participation. In order to contribute literature to the pertinent issue, the study also addresses the case of Brazilian society.

Keywords: Abortion access; Gender inequality; Health; Legislative reform

JEL Classification: C23, I14, J13, J16, K38

Resumo

O aborto é um método de interrupção de gravidez utilizado por milhões mulheres no mundo todo e, por isso, é visto como uma questão de saúde pública. Todo ano, um quarto das gravidezes são interrompidas pelo aborto. Um dos tópicos mais divisivos sobre esse tema é o acesso ao aborto, existindo inúmeros equívocos em relação aos efeitos da sua limitação. Em muitos países, a legalização do aborto contribuiu diretamente com a queda da taxa de natalidade, especialmente entre mulheres jovens, solteiras e negras. As mulheres ao qual o aborto foi negado, têm um aumento considerável nas dificuldades financeiras nos anos seguintes. Os cientistas sociais devem ampliar a compreensão dos efeitos econômicos dos serviços e da legislação do aborto à medida que as barreiras do acesso ao aborto crescem e as desigualdades existentes aumentam. Coletamos dados anuais de 194 países entre 1996 e 2015. Para investigar a associação entre a flexibilidade do aborto e outros indicadores socioeconômicos, vários modelos foram construídos. O presente estudo fornece evidências empíricas globais para a noção de que restringir o acesso ao aborto tem um efeito negativo no desempenho educacional e na participação da força de trabalho das mulheres. A fim de contribuir com literatura para o tema pertinente, o trabalho também aborda o caso da sociedade brasileira.

Palavras-chave: Acesso ao aborto; Desigualdade de gênero; Saúde; Reforma legislativa

Código JEL: C23, I14, J13, J16, K38

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1. Introduction

Abortion is a method used to terminate pregnancies worldwide that millions of women consider as a basic healthcare need. One-quarter of pregnancies in the world end up to abortion every year (Bearak et al., 2020). However, women in some countries cannot have access to safe and legal abortions. For, example, in 2021, 24 countries out of 195 have prohibited abortion in any situation. Some countries have more flexible legislation, but a gestational limitation, which stipulates that an embryo may only be terminated before it reaches a certain developmental stage, is present in nearly every country where abortion is legal. In 46 countries, abortion is allowed if the pregnancy is a result of rape; in 34 countries, incest is a legitimate reason for getting an abortion; and in 45 countries, legal abortion occurs if the fetus has a serious anomaly (Singh et al., 2018). In Brazil, abortion is only permitted in situations of rape, incest, saving a woman's life, and, as of 2012, anencephaly, a severe disease in which newborns are delivered without sections of their brain or skull (Malta et al., 2019). Abortion access is one of the most controversial issues in the world, and the debate is filled with misunderstandings about the consequences of restrictive access (Kapur, 2022).

Apart from the obvious health consequences, a safe abortion access has significant economic implications. One of the most often reported motives for abortion is financial and socioeconomic difficulty (Biggs et al., 2013). Previous studies have linked abortion use to economic consequences including women's educational achievement and employment status (Fergusson et al., 2007). Abortion and equality are frequently associated. Courts and legal experts have emphasized the relevance of abortion and a woman's capacity to determine whether and when she has children to her full and equal participation in society (Metzger, 2007).

The main focus of this work is to systematically investigate the impact of abortion laws worldwide on the achievement of SDG 5 of gender equality. Existing studies have an emphasis on the negative economic effects on women, yet they seldom reach the concept of gender equality. The present study also aims to call attention to the subordinate situation of women deepened by restrictive abortion access.

The fundamental idea is to use an empirical econometric technique to assess the impact of these laws on a series of gender-related socio-economic indicators, including female labour participation, education completion and fertility. The following natural hypotheses will be tested: more restrictive abortion access policies i) increase the gender gap, ii) decrease female labour participation, iii) decrease female educational achievement, and iv) increase fertility.

We collected yearly data from 194 countries between 1996 and 2015. Several models were constructed to examine the relationship between the primary explanatory variable (abortion flexibility score) and outcome variables (female labour participation rate, primary completion rate, total fertility rate and gender development index), before and after the inclusion of control variables (Gross Domestic Product per capita, health expenditure per capita and life expectancy). Based on the distribution of the variable, the abortion flexibility score is incorporated in the models as a categorical variable with levels from 0 to 7, as well as a binary variable of above 3 or not.

The results suggest that a more flexible abortion policy has led to a smaller gender gap, higher female labour participation rate and higher primary education completion rate in the countries studied. Thus, it appears that flexible abortion policies are important to achieve gender equality by improving the educational completion and labour participation of women.

Additionally, we discover that, from global evidence, more flexible abortion policies have resulted in a decline in the fertility of women. This finding suggests that abortion policies can be an effective demographic tool for controlling population growth.

The present study provides global empirical evidence and consolidates the previous findings that restrictive abortion access has a direct negative impact on women's educational achievement and labour participation. The study values by connecting abortion access to the issue of gender equality, which deepens the interaction between abortion access and gender equality to help understand that abortion access is beyond merely a religious issue. The study also discusses the case of Brazilian society to add literature to the relevant topic.

The next section reviews the literature relating to the topic. The third section presents the decision-making process of an unwanted pregnancy. The fourth section shows the selection and description of indicators included in the models. The fifth section includes the theoretical background, with a description of the fixed effects model (FE);

presents the methodological procedures and statistical tools used in the study. In the sixth section, we show the analysis of results, highlighting the negative impacts of restrictive abortion access to gender equality in the global view. In the seventh section, we discuss the context of abortion access in Brazil, as well as social and legal practices. Finally, we present concluding remarks, including limitations and suggestions for future work.

2. Literature Review

Abortion is one of the most prevalent gynaecological procedures globally, ending around one-fourth of all pregnancies. In spite of the high rate of abortion in the world, there is a lack of a synthesis of the known economic effects of abortion care and legislation (Moore et al., 2021). The connection between women's abortion access and economic effects has been discussed in several papers. Moore et al. (2021) consolidated the research on the economics of abortion at the microeconomic, mesoeconomic, and macroeconomic levels using data from a thorough scoping review. Miller et al. (2020) assess the financial consequences of being denied an abortion owing to gestational restrictions. For women who had pregnancies just above and below a gestational age restriction allowing for the desired abortion, the financial consequences after 10 years were compared. Before the abortion encounter, the outcome trajectories of the two groups of women are comparable. Women who were denied an abortion have a significant rise in financial discomfort after the encounter that lasts for several years. They also discovered some indications of a temporary decrease in credit availability. Their findings indicate significant economic and financial effects of restricting women's access to abortion. The paper by Bernstein and Jones (2019) examines the research that is currently available about the financial impacts of abortion access. The study demonstrates the link between abortion availability and a number of economic outcomes, including women's educational attainment, labour force participation, and other socioeconomic indicators for the next generation of men and women, by combining high-quality research that estimates causal impacts.

Abortion legalization in many countries is directly related to a decline in birth rate, particularly in the group of young, single, and coloured women (Gruber et al., 1999). According to existing evidence, the legalization of abortion caused a long-lasting drop in fertility rates, with women having fewer children throughout their lifetimes (Ananat et al., 2004). Although an extensive study has been conducted on the impact of restrictive laws and legalized abortion on birth rates, there have been few papers on other impacts of these policies. Policies that make abortion illegal may affect public spending positively due to an increase in high-cost emergency department visits. There are significant detrimental effects on women's health when access to safe abortion is restricted. These restrictions compel women to seek out unsafe abortion providers, endangering their lives and health (Roeder, 2021). There are also increased costs from the criminal justice system, as women might judicialize the right to get an abortion. In Brazil, people who have unlawful abortions face up to three years in jail under the 1940 Penal Code, while those who perform abortions face up to four years (Brazil, 1940).

Diniz et al. (2017) provide the findings of the 2016 Brazilian National Abortion Survey (PNA 2016) and contrast them with the results of the 2010 PNA on the demographics of the respondents and the prevalence of abortion. The PNA is based on a random sample of Brazilian women aged 18 to 39 who were interviewed face-to-face and through vote boxes in metropolitan areas. According to the findings, abortion is a frequent and ongoing occurrence across women of all socioeconomic classes, racial groupings, educational backgrounds, and religious affiliations: in 2016, over 1 in 5 women had at least one abortion by the time they were 40. There were about 416,000 abortions in 2015, according to women. However, there is socioeconomic heterogeneity, with abortions occurring more frequently among women with lower levels of education, women who are Black, Brown, and Indigenous, as well as women who reside in the North, North-eastern, and Central-western parts of the country. According to the PNA 2010, half of all women who chose to have an abortion did so by using medicine and almost half of them were hospitalized. Domingues et al. (2020) conducted their study intending to update information on unsafe abortion in Brazil. They conducted a comprehensive evaluation of 50 papers and found that women who failed to induce an abortion were more likely to have postpartum depression and common mental illnesses during pregnancy. According to research, abortion is often utilized in Brazil, particularly by women who are more socially vulnerable and live in less developed areas. The decrease in hospitalizations for complications and the decline in abortion-related morbidity are likely because of access to safer procedures. However, the majority of women still use alternative contraceptives, and there are still a lot of hospitalizations related to complications from abortion.

Brazil is the largest and most populated country in Latin America and the Caribbean. The region has one of the strictest abortion legislations in the world and accounts for a high rate of abortion: 44 in every 1000 women, compared to an incidence of 17 in the United States and Canada (Sedgh et al., 2016). A necessity for both public health and human rights is to end the underlying epidemic of unsafe abortion. Like other more obvious global health crises, this epidemic poses a risk to women all across the underdeveloped world. Every year, around 19 to 20 million abortions are performed by people without medical abilities, which increases the risks of the procedure (Grimes et al., 2006).

The scoping review by Rodgers et al., (2021), summarizes the research on the effects of abortion-related services and regulations on macroeconomic outcomes (that is, for societies and nation-states). According to research, post-abortion care services may account for a sizable amount of national health spending. Abortion costs are rarely covered by the public sector, and most of the costs are borne by the individual. Evidence also suggests that easing restrictions on abortion can benefit women's employment opportunities and educational levels, and that access to abortion services can benefit the human capital of children. The political economy around abortion policy is still complex and divisive, nevertheless.

Ananat et al. (2009) offer a framework for comprehending selection mechanisms and make use of that framework to solve the shortcomings of earlier methodological methods as well as to offer proof of the long-term influence on cohort characteristics. Their findings suggest that legalization led to lower-cost abortion, which changed young adult outcomes through selection. In particular, it lowered the probability of becoming a single parent, decreased welfare use, and raised the likelihood of graduating from college.

The demand for abortions is estimated in the research of Medoff (1988) using an economic model of fertility control. The findings demonstrate that the basic rule of demand still applies to abortions, with a price elasticity of demand of 0.81. Abortions are considered a regular good with a demand elasticity of income of 0.79. The demand for abortions is also inversely correlated with women's labour force involvement and marriage status. It was discovered that the demand for abortions was not statistically significantly affected by women's poverty, education, or affiliation with the Catholic Church.

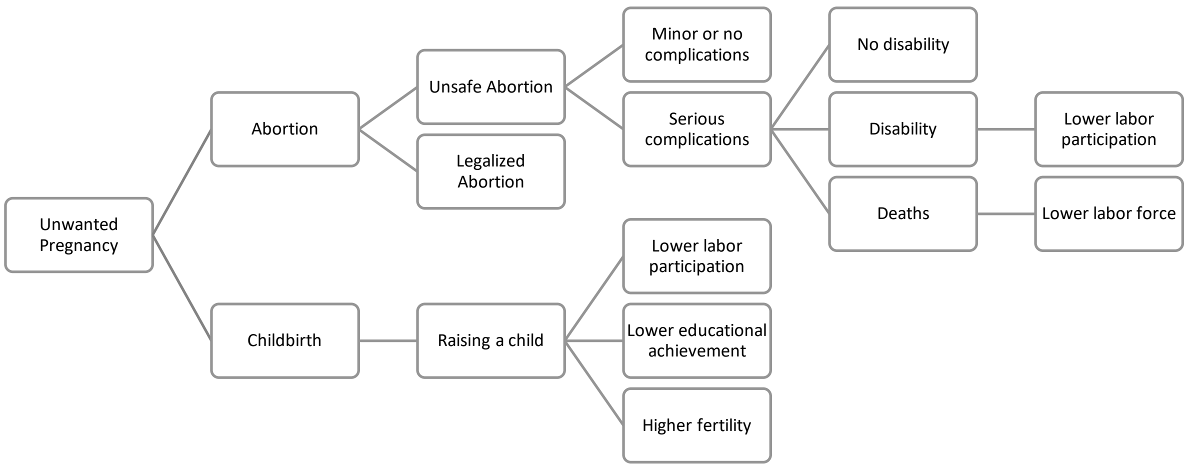
The scoping review by Coast et al. (2021) reveals a number of gaps in our knowledge of the economics of abortion and the supporting research. The economics that surrounds medical abortion is closely related to its self-use. Our understanding of the microeconomic effects of abortion, particularly the indirect economic cost of abortion-related care and its longer-term economic effects, still has many gaps. They didn’t find enough evidence to understand how pregnancy's supportability, wantedness, planning, or ambivalence interact with microeconomic advantages and values. Also, how economic considerations interact with ideas of abortion risk and treatment quality is open for discussion, even though they are conceptually distinct from delays and connected to them in terms of health consequences.

The problems of a system in which pregnant women must travel abroad to get an abortion or acquire abortion drugs online have been emphasized by COVID-19 (Caruana-Finkel, 2020). The COVID-19 pandemic had an impact on health systems, which complicated matters further by limiting women's access to the necessary abortions through mandatory national lockdowns and travel restrictions. People have been debating various governments' decisions in a contentious manner. Organizations advocating for abortion access and pro-life organizations discussed the consequences of various policies. However, temporary measures in some countries increased access to abortion beyond what it had been before the outbreak, allowing women to take care of their bodies and health in the privacy of their own homes (Bojovic et al., 2021).

3. Decisions of an Unwanted Pregnancy

Figure 3.1 constructs pathways for evaluating the impacts of an unwanted pregnancy. Women will have two choices when occurring an unexpected pregnancy - getting an abortion or not. In the following, we analyse the outcomes of both choices.

Figure 3.1: Impact Pathways



The first case is where the woman decides to get an abortion. In the scenario in which abortion is legalized, in others words, when there is safe access to abortion for women, there would be no major impacts for women. When legalized abortion access is limited, women will have to seek unsafe procedures. Serious complications may occur in a proportion of women who have unsafe abortions; some of these women will go to the professional health system for treatment, but many will do so outside of it. Both will cause a financial cost to women to varying degrees. Three outcomes are conceivable for women who have complications: survival without long-term effects, survival with long-term effects including recurrent pelvic infections, sub-fecundity, infertility, or death. Each consequence has an indirect cost as a result of decreased productivity.

If the woman decides to keep the fetus until delivery, there will be a positive impact on fertility and population. In some countries, women usually spend more time raising a child than men, which may have negative impacts on labour participation and the career outcomes of women.

The emphasis in this framework and the paper is to explain the trajectory of negative impacts of restrictive abortion access on women, although how to value these impacts, is a problem that is still debatable. Quantifying social and psychological costs is challenging, yet they exist. The stigmatization that women who have had abortions face is a true consequence in some countries. Other post-abortion psychological traumas may enforce enormous losses on the women, which may be difficult to measure. While acknowledging the complexity and diversity of potential economic effects, the purpose of this study is on assessing one component – inferior labour and educational outcomes, and a larger gender gap resulting from restrictive abortion access.

4. Data

The research sample includes all the World Health Organization (WHO) member countries where data were available. The UN Population Division Database was used to obtain data on abortion policies, total fertility rate and female labour participation rate collected from the World Bank database, and the WHO Global Health Expenditure Database was used to collect health expenditure data. All data were aggregated by country and year. Total fertility rate data were available for 194 countries between 1996 and 2015. Female labour participation rate data were available for 186 countries, and data on abortion laws were available for 182 countries within the same range of time. The final dataset includes 171 countries with data on both abortion policies and total fertility rates between 1996 and 2015. 168 countries are included with data on both abortion policies and female labour participation rates. Data extraction was done by the author in September 2022. Table 4.1 contains information on the definition and source of the primary explanatory, dependent, and control variables.

Table 4.1: Sources and descriptions of data

Variable	**Description**	**Source**
	Dependent Variables	
Female Primary Completion rate (*primary*)	Refer to the "dependent variables".	UNESCO Institute for Statistics (2022)
Female Labor Participation Rate (*labor*)		International Labor Organization, ILOSTAT database (2021)
Total Fertility Rate (*fertility*)		World Bank Open Data (2022a)
Gender Development Index (*GDI*)		United Nations Development Programme (2022)
	Primary Explanatory Variable	
Abortion flexibility (*abortion*)	Refer to the "primary explanatory variable".	UN Population Division Database (2020)

Control Variables		
Health Expenditure per capita (*health*)	The total of public and private health spending represented as a proportion of the population is known as health expenditure per capita. Although it does not involve the supply of water and sanitation, it does include the provision of health care (both preventative and curative), reproductive planning activities, nutrition programs, and health-related disaster help. Data is presented in current US dollars.	World Health Organization Global Health Expenditure database (2022)
GDP per capita (*GDP*)	By dividing the gross domestic output by the midyear population, the GDP per capita is determined. GDP is determined as the total of all resident producers' gross value added, plus any applicable product taxes, minus any subsidies not reflected in the product value. It is calculated without taking into account the degradation and depletion of natural resources or the decline of manufactured assets. Data is presented in current US dollars.	World Bank Open Data (2022b)
Life expectancy at birth (*life*)	The number of years a newborn child would live, if the mortality rates at the time of birth remained constant throughout its life, is known as life expectancy at birth. It illustrates the death pattern that prevails across all age groups in a given year and represents the population's overall mortality rate.	World Bank Open Data (2022c)

Notes: Symbols are presented in parentheses.

Primary explanatory variable

Each country's abortion flexibility policy each year is the primary explanatory variable of interest. Yearly data on abortion policies are available in the United Nations Population Division database. It contains information on abortion policies around the world from 1996 to 2015. We categorized the abortion policies using the UN population policy database's definitions. The database (United Nations, 2020) classifies reasons for which women have access to legal abortion as:

1) To save the life of a woman (life grounds)
2) To preserve the physical health of a woman (narrow health grounds)
3) To preserve the mental health of a woman (broad health grounds)
4) In case of rape or incest (juridical grounds)
5) In case of fetal impairment (fetal defect)
6) For economic or social reasons (social grounds)
7) On request (permitted on all grounds)

The number of reasons for abortion in each country from 1996 to 2015 is counted to get an abortion flexibility score varying from 0 to 7. When abortion is not permissible for any reason, a flexibility score of 0 is distributed. Whereas abortion is legal for any of the reasons listed above, a flexibility score of 7 is assigned. Appendix A contains a detailed classification and observation of each flexibility score.

Dependent variables

We choose the following indicators that can reflect the labour and educational situation of females in each country.

The Female Labour Participation Rate is the percentage of women aged 15 and older who are employed. By dividing the whole female population of working age by the female labour force, the female labour force participation rate is calculated. People who are of working age are those who are 15 to 64 years old. Abortion and the availability of female labour are directly related: Abortion (and other forms of contraception) are accessible, which lowers fertility and increases female labour force participation. Recent studies have discovered a link between female participation and the number of children living in the family that is negative (International Labour Organization, 2021).

The Female Primary Completion Rate, also known as the gross intake ratio to the last grade of primary education, is calculated by dividing the population at the theoretical entrance age for the last grade of primary education by the number of new female entrants (enrolments minus repeaters) in the last grade of primary education, regardless of age. Due to children that enter primary school late or early, repeat classes, or are over- or under-aged, the proportion may be higher than 100% (UNESCO Institute for Statistics, 2022).

Total Fertility Rate (TFR) is the number of children a woman would have if she lived to the end of her reproductive years and had children in accordance with the age-specific fertility rates of the given year. The TFR illustrates the prospective impact of existing fertility trends on family size when completed. Because it is based on age-specific birth rates, the TFR is unaffected by changes in a population's age composition over time and can be used to compare fertility across time or within population groups (The World Bank, 2022a). Less restrictive abortion regulations that reduce the cost of abortion will undoubtedly increase the number of pregnancies and abortions. However, the magnitude of two opposing impacts on the number of births - the rise in pregnancies and the decline in the likelihood that a pregnancy would result in a birth - depends on the scope of less restrictive abortion legislation. The overall impact is unclear, and if the pregnancy effect is strong enough, declining abortion costs may result in an increase in births (Levine & Staiger, 2004).

Gender Development Index (GDI) measures gender equality in achievement in three fundamental areas of human development: health (measured by the difference between the life expectancy of men and women at birth); education (measured by the difference between the mean years of education for men and women aged 25 and older); and control of economic resources (measured by female and male estimated earned income) (UNDP, 2022). A lower score implies a bigger gender gap in the country.

Control variables

Data of control variables were extracted from the United Nations Population Division database, the United Nations Development Programme database, the World Bank database, UNESCO Institute for Statistics database, the International Labor Organization STAT database and World Health Organization Global Health Expenditure database. Control variables include Health Expenditure per Capita (in US dollars), Life Expectancy at Birth (years) and Gross Domestic Product per Capita (in US dollars). These variables are among the ones that are most commonly used to measure socioeconomic growth between countries. Table 4.1 provides specifics about the definitions and data sources.

5. Methodology

To study the effect of abortion flexibility on several outcomes, we estimate the following equation:

$$y_{it} = \beta \cdot abortion_{it} + \mathbf{X_{it}}\delta + u \tag{5.1}$$

where i denotes the country of observation within the sample and t denotes the year of observation from 1996 to 2015. The primary variable of interest in the model is $abortion_{it}$, indicating the abortion flexibility score in each country. $\mathbf{X_{it}}$ represents different control variables in the model that help explain dependent variables in each country. Finally, u is the normal error term.

5.1 Two-Way Fixed Effects Model

Based on the characteristic of our dataset, the two-way fixed effects model is found to be appropriate for the analysis. In ecological studies, panel data are widely analyzed by employing fixed effects regression models (FE). Within-country differences are assessed using fixed effects models, in other words, each country is the control of itself. For instance, the model considers the difference in dependent variables within a country when the abortion flexibility score is at different levels. This method eliminates time-invariant confounding from variables when we control country fixed-effects (Collischon & Eberl, 2020). For example, a country's ethnic and religious composition may remain quite consistent over time. By controlling year fixed-effects, we eliminate country-invariant confounding from variables, such as a global economic crisis.

Thus, we rewrite the error term u as follows and reach the two-way fixed effects model:

$$u = \alpha_i + \tau_t + \eta_{it} \tag{5.2}$$

where α_i represents the country-specific effect that is invariant during the study period, τ_t represents the year-specific effect that is invariant for each country in a single data category, and η_{it} is the error term.

If two conditions are met, the fixed effects model makes sense. First, we believe that all of the studies in the analysis are functionally identical. Second, rather than generalizing to other populations, our purpose is to compute the common impact size for the selected population (Borenstein et al., 2009). When we only want to analyse the impact of factors that change over time, the use of FE is preferred. Within a country, FE investigates the relationship between explanatory and outcome variables. Each country has unique characteristics that influence or do not influence the predictor variables. For example, a country's political system could have an impact on GDP per capita.

When using FE, we presume that something within each country may influence or bias the explanatory or outcome variables, and we must account for this. This is why the assumption of a correlation between the country's error term and explanatory variables is made. The effect of those time-invariant characteristics is removed by FE, allowing us to analyse the net effect of the explanatory variables on the dependent variable. Time-invariant characteristics are unique to each country and should not be associated with other individual characteristics is another fundamental assumption of the FE model (Mandal, 2022).

Because each item is unique, its error term and constant which captures individual features should not be associated with the others. If the error terms are correlated, then FE is not suitable since inferences may not be correct and we should consider that relationship using models such as random effects (RE), this is the main rationale for the Hausman test. As significant unmeasured time-invariant confounding between countries exists in the data, the Hausman test indicates that a fixed effects model is preferred in our study (Hausman, 1978).

5.2 Hausman Test for FE and RE

Generally, consider two estimators $\hat{\beta}$ and $\tilde{\beta}$ of $\beta \in \mathbb{R}^L$ such that:

$$H_0\colon (\hat{\beta} - \tilde{\beta}) \xrightarrow{p} 0 \text{ and } \sqrt{n}(\hat{\beta} - \tilde{\beta}) \xrightarrow{d} N(0, \mathrm{V}) \tag{5.3}$$

$$H_1\colon (\hat{\beta} - \tilde{\beta}) \overset{p}{\nrightarrow} 0 \tag{5.4}$$

The equation of Hausman statistic is defined in equation 5.5:

$$H = \left(\hat{\beta} - \tilde{\beta}\right)'(n^{-1}\widehat{\mathrm{V}})^{-1}\left(\hat{\beta} - \tilde{\beta}\right) \tag{5.5}$$

where

$$n^{-1}\widehat{\mathrm{V}} = var\left(\hat{\beta} - \tilde{\beta}\right) = var\left(\hat{\beta}\right) + var\left(\tilde{\beta}\right) - 2cov(\hat{\beta}, \tilde{\beta}) \tag{5.6}$$

Under H_0, H is distributed according to the chi-squared distribution:

$$H \sim \chi^2(L) \tag{5.7}$$

If $\hat{\beta}$ is efficient under H_0 then:

$$cov(\hat{\beta}, \tilde{\beta}) = var(\hat{\beta}) \quad (5.8)$$

Solving equations 5.6 and 5.8:

$$var(\hat{\beta} - \tilde{\beta}) = var(\tilde{\beta}) - var(\hat{\beta}) \quad (5.9)$$

Hence,

$$H = (\hat{\beta} - \tilde{\beta})'(\widehat{var}(\tilde{\beta}) - \widehat{var}(\hat{\beta}))^{-1}(\hat{\beta} - \tilde{\beta}) \quad (5.10)$$

Specifically, equation 5.11 defines the Hausman test for FE versus RE:

$$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})'\left(\widehat{var}(\hat{\beta}_{FE}) - \widehat{var}(\hat{\beta}_{RE})\right)^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{RE}) \sim \chi^2(L) \quad (5.11)$$

5.3 Fixed Effects Approach: Within Estimator

The general model of two-way fixed effects is defined in equations 5.12-5.14, assuming all variables vary with i and t:

$$y_{it} = \mathbf{X}_{it}\beta_i + \alpha_i + \tau_t + \eta_{it} \quad (5.12)$$

$$E[\mathbf{X}_{it}\alpha_i] \neq 0, E[\mathbf{X}_{it}\tau_t] \neq 0 \quad (5.13)$$

$$E[\mathbf{X}_{it}\eta_i] = 0 \quad (5.14)$$

where α_i $(i = 1 \dots N)$ is each country's unknown intercept (a total of N country-specific intercepts); τ_t $(t = 1 \dots T)$ is each year's unknown intercept (a total of T year-specific intercepts); y_{it} is the dependent variable where i denotes country and t denotes time; $\mathbf{X}_{it}$ represents one explanatory variable, β_i is the coefficient for that explanatory variable; η_{it} is the error term.

Unit-specific and time-specific unobserved confounders are both flexibly treated for by the inclusion of unit and time fixed effects. In further detail, unit and time fixed effects are defined as $\alpha_i = h(\mathbf{U}_i)$ and $\tau_t = f(\mathbf{V}_t)$, where $\mathbf{U}_i$ and $\mathbf{V}_t$ denote these unit- and time-specific unobserved confounders that are a frequent cause of the dependent and independent variables. In addition, researchers are unaware of the arbitrary functions $h(\cdot)$ and $f(\cdot)$. There is no functional-form limitation on $h(\cdot)$ and $f(\cdot)$, despite the assumption there's no interaction between the two categories of unobserved confounders. In other words, given the binary characteristic of treatment, the model's only limitations are the two categories of unobserved confounders' additivity and separability (Imai & Kim, 2021).

By first transforming the dependent and independent variables, and then regressing the former on the latter, it is possible to efficiently calculate the OLS estimator. The estimator is provided by:

$$\hat{\beta}_{FE} = \underset{\beta}{argmin} \sum_{i=1}^{N} \sum_{t=1}^{T} [\{(Y_{it} - \bar{Y}) - (\bar{Y}_i - \bar{Y}) - (\bar{Y}_t - \bar{Y})\} - \beta\{(X_{it} - \bar{X}) - (\bar{X}_i - \bar{X}) - (\bar{X}_t - \bar{X})\}]^2 \quad (5.15)$$

where $\bar{Y}_i = \sum_{t=1}^{T} Y_{it} / T$ and $\bar{X}_i = \sum_{t=1}^{T} X_{it} / T$ are unit-specific means, $\bar{Y}_t = \sum_{i=1}^{N} Y_{it} / N$ and $\bar{X}_t = \sum_{i=1}^{N} X_{it} / N$ are time-specific means, and $\bar{Y} = \sum_{i=1}^{N} \sum_{t=1}^{T} Y_{it} / NT$ and $\bar{X} = \sum_{i=1}^{N} \sum_{t=1}^{T} X_{it} / NT$ are overall means.

The two-way fixed effects estimator takes use of the covariation in the dependent and independent variables, as shown in Equation 5.15. In particular, the equation demonstrates that, for both dependent and independent variables, the OLS estimator is used after within-unit and within-time variations are eliminated from the total variation.

5.4 Generalized Variance Inflation Factor (GVIF)

In datasets, the value of $\det(\mathbf{X}^{\mathrm{T}}\mathbf{X})$ close to zero implies multicollinearity. A popular measure of multicollinearity is the Variance Inflation Factor (VIF) (Buteikis, 2020).

When we have a regression model defined in 5.16:

$$Y_i = \beta_0 + \beta_1 X_{1,i} + \cdots + \beta_k X_{k,i} + \epsilon_k \quad (5.16)$$

The VIF of $\hat{\beta}_j$ is:

$$VIF(\hat{\beta}_j) = \frac{1}{1 - R_j^2} \quad (5.17)$$

where R_j^2 is the coefficient of determination of the OLS regression of variable X_j as a function of all other explanatory variables.

However, VIF is not a good reference when a model includes indicator regressors for the same categorical variable (in our study, flexibility score), or polynomial regressors. This is due to the fact that the correlations between these variables are artificial because they are created by the structure of the model. Usually, we don’t pay our attention to such artificial correlations. What really matters is to figure out the impact of various explanatory variables.

Consequently, Fox and Monette (1992) introduced the Generalized Variance Inflation Factor (GVIF).

Assume that we have regression model 5.18:

$$\underset{N\times 1}{\mathbf{Y}} = \underset{N\times(k+1)}{\mathbf{X}}\underset{(k+1)\times 1}{\beta} + \underset{T\times 1}{\varepsilon} \tag{5.18}$$

Can be written as:

$$\underset{N\times 1}{\mathbf{Y}} = \beta_0 + \underset{(N\times r)}{\mathbf{X_1}}\underset{(r\times 1)}{\beta_1} + \underset{N\times(k-r)}{\mathbf{X_2}}\underset{(k-r)\times 1}{\beta_2} + \underset{T\times 1}{\varepsilon} \tag{5.19}$$

where:

- $\mathbf{X_1}$ contains the related r indicator variables;
- $\mathbf{X_2}$ contains the remaining variables, omitting the constant.

GVIF is defined in equation 5.20:

$$\mathrm{GVIF} = \frac{\det(\mathbf{R}_{11})\det(\mathbf{R}_{22})}{\det(\mathbf{R})} \tag{5.20}$$

where $\mathbf{R}_{11}$ is the correlation matrix for $\mathbf{X_1}$; $\mathbf{R}_{22}$ is the correlation matrix for $\mathbf{X_2}$; $\mathbf{R}$ is the correlation matrix for all variables in the whole design matrix $\mathbf{X}$, omitting the constant.

Therefore, the GVIF is often used to assess variables that need more than one coefficient and, consequently, more than one degree of freedom. In order to compare GVIFs across dimensions, Fox and Monette (1992) also suggested using $\mathrm{GVIF}^{1/(2*Df)}$, where Df (degrees of freedom) is the number of coefficients in the subset. The GVIF becomes a linear measure as a result. It is comparable to obtaining the normal VIF's square root. We can apply the usual VIF rule of thumb if we squared the $\mathrm{GVIF}^{1/(2*Df)}$ value.

6. Results

6.1 Descriptive Statistics

Table 6.1 presents descriptive statistics of the variables grouped by 5 years period. The generalized variance inflation factors (GVIF) taken to the power of $1/(2 * Df)$ for independent variables are below or around 2, demonstrating that our study doesn't have any significant multicollinearity problems (Fox & Monette, 1992).

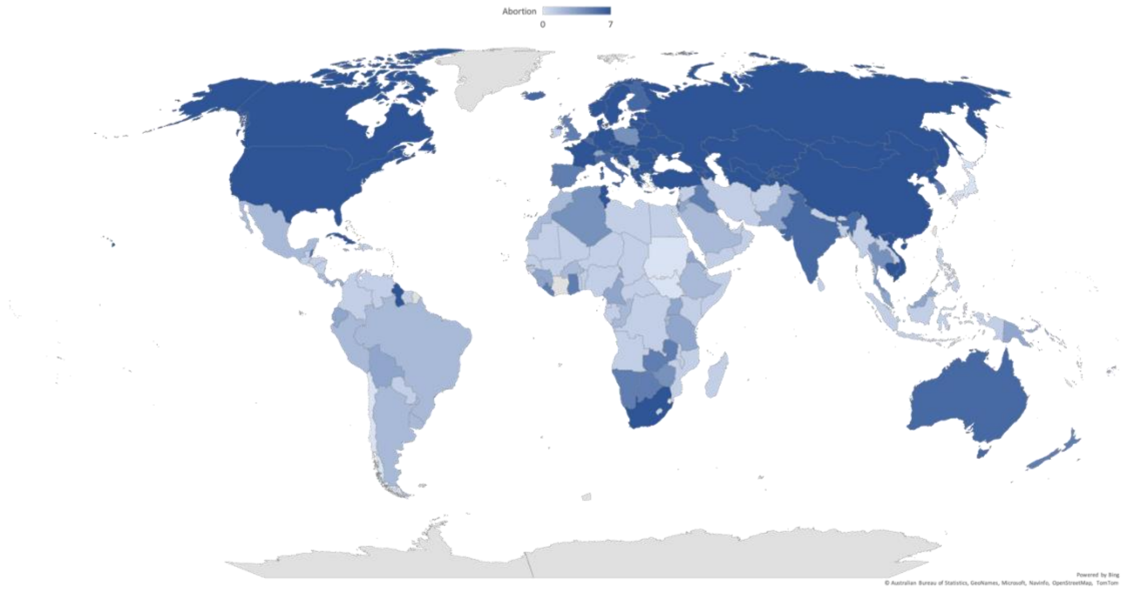
Table 6.1 Descriptive Statistics

Variable	Period	Mean	Standard Deviation	Min	Max	$GVIF^{1/(2*Df)}$	Obs
primary	1996-2000	78.769	27.781	7.141	142.123		2159
	2001-2005	83.820	25.925	14.390	133.230		
	2006-2010	86.840	20.607	20.220	125.160		
	2011-2015	90.690	17.615	26.000	118.030		
fertility	1996-2000	3.418	1.784	1.090	7.716		3521
	2001-2005	3.146	1.692	1.078	7.669		
	2006-2010	2.998	1.550	1.132	7.592		
	2011-2015	2.870	1.414	1.187	7.429		
labour	1996-2000	50.130	17.367	8.599	87.384		3391
	2001-2005	50.620	16.914	10.590	87.810		
	2006-2010	50.760	16.508	10.030	87.110		
	2011-2015	50.951	15.999	6.095	84.026		
GDI	1996-2000	0.903	0.093	0.515	1.028		3026
	2001-2005	0.912	0.084	0.504	1.050		
	2006-2010	0.926	0.075	0.560	1.042		
	2011-2015	0.938	0.068	0.547	1.032		
abortion	1996-2000	3.538	2.494	0	7	1.029	3686
	2001-2005	3.749	2.481	0	7		
	2006-2010	3.887	2.480	0	7		
	2011-2015	4.026	2.464	0	7		
health	1996-2000	442.597	762.523	4.335	4543.436	1.428	2885

	2001-2005	600.820	1084.631	4.485	6454.404		
	2006-2010	928.093	1572.614	8.214	7888.352		
	2011-2015	1082.050	1777.680	12.630	9578.650		
life	1996-2000	66.02	10.065	35.38	79.78	1.766	3514
	2001-2005	67.46	9.962	40.37	82.03		
	2006-2010	69.31	9.124	42.59	82.93		
	2011-2015	71.09	8.132	46.21	83.79		
log(GDP)	1996-2000	7.702	1.600	4.617	11.525	2.022	3608
	2001-2005	7.916	1.639	4.718	11.730		
	2006-2010	8.465	1.563	5.120	12.132		
	2011-2015	8.697	1.459	5.520	12.152		

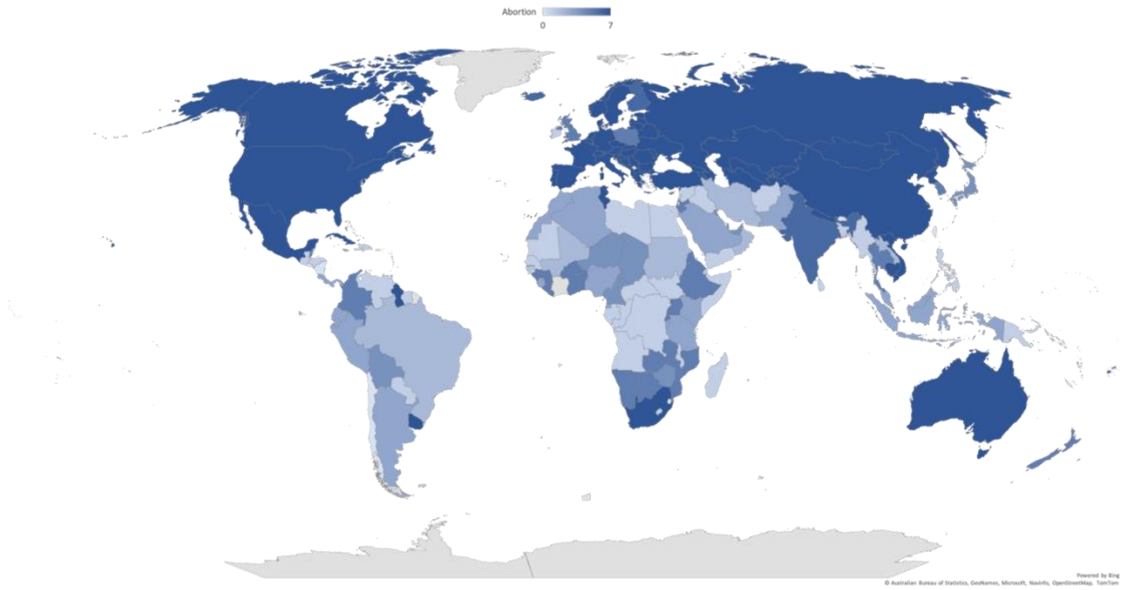
Figures 6.1 and 6.2 present the world abortion policy in 1996 and 2015 respectively from the data we obtained. South America and Africa are the regions with more restrictive abortion policies. In 1996, Andorra, Chile, El Salvador, Malta, South Sudan and Timor-Leste, in a total of 6 countries, prohibited abortion in any circumstance. In 2015, abortion was considered completely illegal in Chile, El Salvador, Malta and Nicaragua, a total of 4 countries.

Figure 6.1: World Abortion Flexibility Score in 1996



Source: elaborated by the author.

Figure 6.2: World Abortion Flexibility Score in 2015



Source: elaborated by the author.

Figure 6.3 presents the box plot of abortion flexibility and labour participation rate. We can see a general trend that higher abortion flexibility is associated with a higher women's labour participation rate. The trend decreases slightly when the flexibility score reaches 6 or 7.

Figure 6.3 Labor Participation Rate and Abortion Flexibility Score

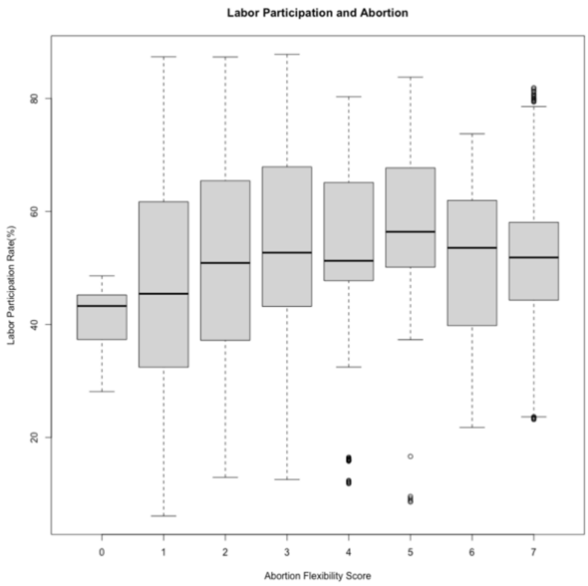


Figure 6.4 presents the box plot of abortion flexibility and primary completion rate. Women's primary completion rate is notably higher when flexibility is above 3 versus 3 or below.

Figure 6.4 Primary Completion Rate and Abortion Flexibility Score

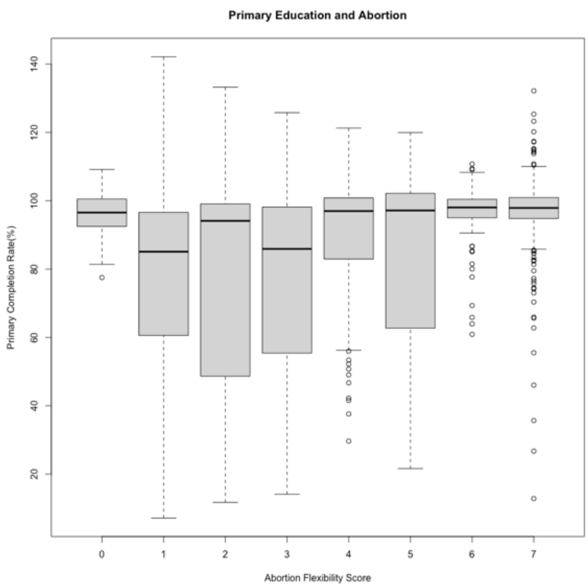


Figure 6.5 presents the box plot of abortion flexibility and total fertility rate. We note that the total fertility rate shows a decreasing trend when women have more flexible abortion access.

Figure 6.5 Total Fertility Rate and Abortion Flexibility Score

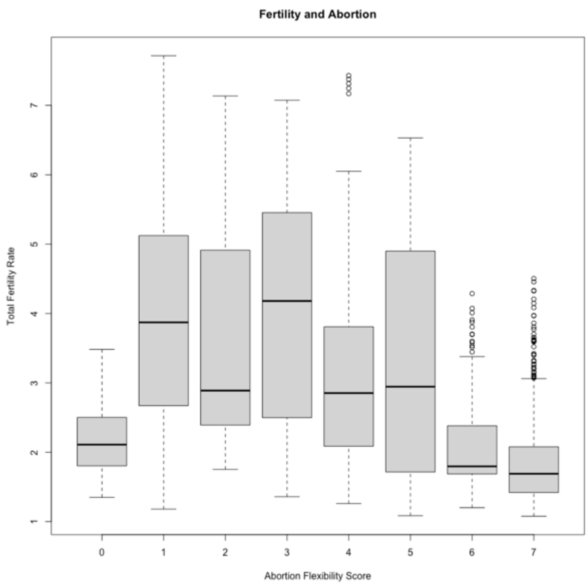
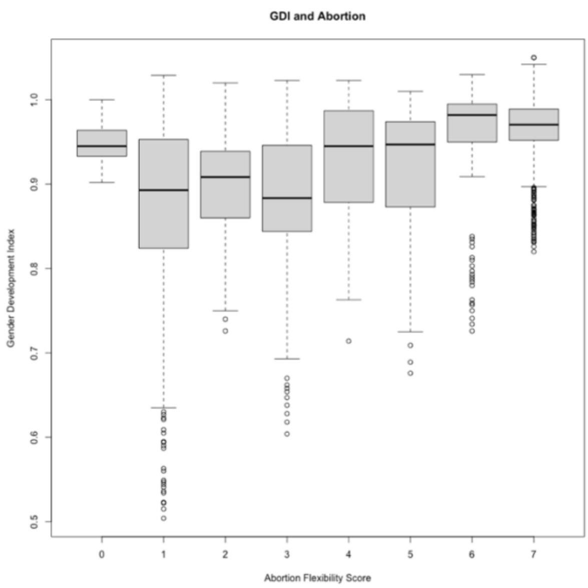


Figure 6.6 presents the box plot of abortion flexibility and gender development index. It seems that abortion access is positively correlated to gender equality. Countries with more flexible abortion policies generally have a smaller gender gap measured by the index.

Figure 6.6 Gender Development Index and Abortion Flexibility Score



6.2 Main Results

Table 6.2 shows that higher abortion flexibility scores are associated with a smaller gender gap measured by Gender Development Index. In the two-way fixed effects model, an abortion flexibility score above 3 on average increases GDI by 0.0088. Models of other dependent variables can be found in Appendix B. In the case without control variables, when the abortion flexibility score is included in the model as a binary variable of flexibility score of above 3 versus 3 or less, there is an increase of 3.421% in the primary completion rate and a decrease of 0.244 in total fertility rate when the abortion access is more flexible.

However, adjusted R-squared is low in all models without control variables, which suggests we must include control variables to raise the degree of the dependent variable's variance that can be explained by explanatory variables. The estimated primary completion rate increased in the group of flexibility score of more than 3 compared to the group of 3 or less by 2.313% after including control variables in our model. When abortion access is more flexible, there is an increase of 0.406% in the female labour participation rate and a decrease of 0.158 in total fertility rate.

Table 6.2 Regression models – GDI – Binary Variable

Independent variables	***Gender Development Index***					
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Dummy	0.0689*** (0.00266)	0.0278*** (0.00231)	0.00882*** (0.00179)	0.0349*** (0.00248)	0.00942*** (0.00176)	0.00757*** (0.00173)
log(GDP)				0.0242*** (0.00147)	0.0101*** (0.000862)	0.00114 (0.00122)
health				-0.0000102*** (0.00000105)	-0.00000507*** (-0.000000552)	-0.00000797 (0.000000599)
life				0.00172*** (0.000212)	0.00473*** (0.000177)	0.00347*** (0.000208)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	3026	3026	3026	2499	2499	2499
R^2	0.182	0.0482	0.00839	0.456	0.533	0.219

Adjusted R^2	0.182	-0.00669	-0.0558	0.455	0.499	0.158
p-value	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses. Dummy variable of 1 indicates an abortion flexibility score of above 3, and 0 indicates a score equals or below 3.

Then we estimate the models when we classify flexibility scores from 0 to 7. As the number of observations with a score of 0 is narrow in scope, we set score 1 as the baseline. According to Appendix B, the impact of abortion flexibility on labour participation is statistically significant at a 99% level when comparing scores 3 and 7 to score 1, increasing 1.022% and 3.432% of female labour participation respectively. Abortion flexibility is also found statistically significantly correlated to the total fertility rate. In general, higher flexibility lowers the number of children. The impact varies from -0.075 on score 2 to -0.429 on score 5.

Introducing control variables in the models attenuates the estimates while maintaining the same overall trend, and improving the statistical significance of our estimators. After adjusting for GDP per capita, health expenditure per capita and life expectancy, the adjusted R-squared of our models increases. There is clear proof that for all flexibility score levels of 2 and higher compared to level 1, a higher abortion flexibility score is related to a higher primary completion rate, a higher labour participation rate, and a lower total fertility rate. There is also evidence of an increase in the primary completion rate of between 3.201% and 10.896% when the scores are above 2 instead of 1.

Table 6.3 Regression models – GDI – Categorical Variable

Independent variables	***Gender Development Index***					
	(7)	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
abortion2	0.0241*** (0.00683)	0.0101** (0.00311)	0.00613* (0.00239)	0.00939 (0.00629)	0.00252 (0.00236)	0.00205 (0.00232)
abortion3	0.00671 (0.00429)	0.0200*** (0.00300)	0.00833*** (0.00232)	0.00571 (0.00368)	0.00280 (0.00229)	0.000891 (0.00226)
abortion4	0.0545*** (0.00599)	0.0269*** (0.00342)	0.00897*** (0.00266)	0.0208*** (0.00523)	0.00464 (0.00254)	0.00248 (0.00251)

abortion5	0.0471*** (0.00471)	0.0459*** (0.00339)	0.0204*** (0.00266)	0.0231*** (0.00409)	0.0163*** (0.00259)	0.0143*** (0.00255)
abortion6	0.0737*** (0.00697)	0.0397*** (0.00569)	0.0227*** (0.00440)	0.0258*** (0.00662)	0.0145** (0.00494)	0.00931 (0.00489)
abortion7	0.0913*** (0.00344)	0.0496*** (0.00416)	0.0108*** (0.00331)	0.0516*** (0.00323)	0.0165*** (0.00323)	0.0109*** (0.00321)
log(GDP)				0.0265*** (0.00148)	0.00952*** (0.000866)	0.00121 (0.00123)
health				-0.0000109*** (0.00000106)	-0.00000521*** (0.000000559)	-0.00000785*** (0.000000608)
life				0.00121*** (0.000218)	0.00469*** (0.000177)	0.00354*** (0.000209)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	2951	2951	2951	2436	2436	2436
R^2	0.230	0.0793	0.0239	0.479	0.537	0.232
Adjusted R^2	0.228	0.0241	-0.0418	0.477	0.502	0.169
p-value	< 2.22e-16	< 2.22e-16	1.7534e-12	< 2.22e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses.

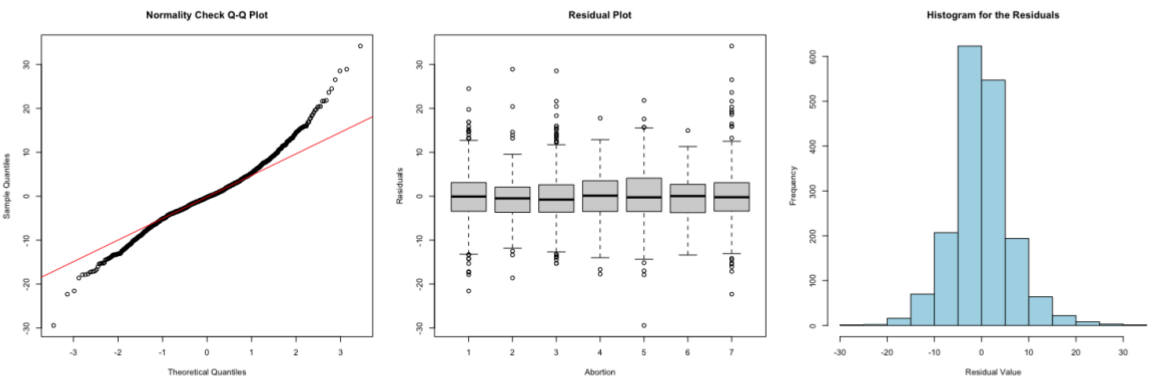
6.3 Assumptions Check

For a linear regression model, the following assumptions are made (Hannay, 2019). First, the dependent variable y is linearly connected to the explanatory variable, which is the most basic assumption of linear regression. The remainder of our analysis is predicated on this premise; thus, its failure renders the entire model incorrect. Examining a scatter plot of the two variables as well as the residual plot will allow us to verify or refute this assumption. Secondly, the independence of errors is also satisfied. We believe that all of the errors included in our model are independent. Thirdly, we presume that the error standard deviation is constant across all values of the explanatory variable x_i. Without this presumption, we would have to use weighted least squares, which often need more information than a straightforward linear regression. We may verify the veracity of this assumption using the residual plot. The final and least significant supposition is that the errors are normally distributed. If this is compromised, it affects the calculation of the confidence intervals for those parameters rather than the parameters that fit the model the best. By plotting the residuals on a Q-Q plot, we can confirm this assumption.

The figure 6.7 below helps us examine the assumptions of the model with the primary completion rate as the outcome variable and the inclusion of control variables. To begin with the histogram and Q-Q plot of the residuals, these two plots demonstrate that the errors are roughly normally distributed, with the Q-Q plot and mound-shaped histogram falling approximately along the line.

The residual values are represented as a function of the explanatory variable in the second figure. We can use the figure to see if the errors have equal variance. In this instance, when the explanatory variable increases, the width of the residuals stays relatively constant. This suggests that the noise terms' variance is constant. An additional feature of this figure is a flat tube of points centred at zero. This indicates that the first assumption of linearity is not violated. The results of tests for other models can be found in Appendix C.

Figure 6.7 Tests of assumptions for the model 36 with a primary completion rate



7. Discussion

Our study's findings demonstrate how crucial it is for women to have the freedom to make personal choices like whether or not to have children, which directly affect the attainment of SDG 5 on gender equality. Mahmoud Fathalla (1994), the former President of the International Federation of Gynecology and Obstetrics (FIGO) has said that:

> *Motherhood should be a dignified, informed, responsible choice. It is only recently that the world is realising the heavy price it is paying for not empowering women to make decisions in their lives, including reproductive decisions. Women are coerced into motherhood when governments fail to provide them with the information and means to regulate and control their fertility.*

Tens of millions of women desire the procedure every year, yet laws that penalize it show the legislature's continued disregard for the well-being, independence, and self-determination of women (Cook & Dickens, 2003). When a woman is forced to have an unwanted child in order to serve another man, her dignity and autonomy are flagrantly violated with abused reproductive abilities as well. Furthermore, by attempting to take away a woman's free will to examine the ethical factors involved in her choice to prolong or end pregnancy. Restrictive abortion policies essentially refute a woman's full citizenship. Women won't be able to participate equally in their nation's social, political, and economic life unless they have the freedom to choose their reproductive options and control their fertility (Borgmann & Weiss, 2003).

Undoubtedly, the factors that influence a woman's financial standing are diverse and complicated, and achieving gender equality necessitates large-scale change. Women with control over their fertility, including access to safe abortion, are better able to pursue opportunities for political engagement, employment, and education. They have a higher probability of achieving and maintaining personal health and well-being, in addition to productivity and society contributions. For instance, enabling unintentionally pregnant girls to continue their education rather than making them drop out will greatly boost their chances of eventually earning a living little over the poverty level (Crane & Hord, 2006).

Data have shown that women who have no access to safe abortion providers are more inclined to seek out clandestine clinics ending up in hospitalization due to complications (Roeder, 2021). By legalizing safe abortion options, public health systems may be able to spare resources for other crucial health requirements of the low-income populations they serve, avoiding the tremendous costs of treating complications from unsafe abortions in already overcrowded medical institutions. The reproductive health and well-being of poor women might be greatly enhanced by allocating the money released by safe abortion to crucial preventative and maternal care programmes.

Demographers have proven that the availability of abortion is a key driver to decreased fertility and slower population growth in nations where fertility was historically high (Bongaarts, 1997). These demographic changes support long-term development, poverty reduction, as well as economic prosperity. In the event of national population stabilization strategies, encouraging effective contraception's use as an alternative to abortion is generally seen as a good policy objective. Governments should promote contraception while facilitating easy access to safe, legal, and voluntary abortion.

Personal religious beliefs are frequently cited as major determinants in understanding attitudes on abortion and gender equality. One of the most significant determinants of views about abortion in the United States, according to researchers, is religion (Jelen & Wilcox, 2003). Because the majority of the world's main religions support traditional family arrangements and roles of gender, more religious individuals are less tolerant of abortion and have fewer egalitarian attitudes toward men and women. This connection can be found in various countries and religions (Adamczyk, 2013).

The existing legislation in Brazil has remained limited as it became a statute in 1940, despite legislative proposals to liberalize the law, notably from feminist organizations (Ogland & Verona, 2011). Opponents of the present abortion legislation point to facts that unsafe abortions are widespread in Brazil and pose a significant health and mortality threat to women, while proponents of the law contend that the privileges of the embryo or fetus take priority over the reproductive freedom of the woman (Martins-Melo et al., 2014). More than 20% of Brazilian women in metropolitan areas experienced at least 1 abortion by the time they reached reproductive age (Diniz et al., 2017). These statistics, which have made the issue of covert abortions, which may have negative repercussions on women's health, into a serious public health issue in Brazil, have frightened many Brazilians. Consequently, the campaign to legalize abortion has become a major subject for international women's rights activism and health organizations, despite facing resistance from religious groups (Ruibal, 2015).

The dynamic evolution of Brazil's religions has implications for capturing the populace's current attitude toward abortion concerns, notwithstanding the public image of religious organizations' opposition to abortion. The rise of Protestant religious followers, from 4% of the total population in 1960, to 22.2% in 2010, has been one of the most important recent shifts (IBGE, 2012). Pentecostal organizations, which were once considered a small minority religion group but have recently attracted a sizeable mass of believers among the poorest and most marginalized population, are partly responsible for this Protestantism's quick growth (Ramos et al., 2018). Pentecostalism in Brazil is extremely sectarian and guided by a moral austerity attitude. Pentecostals are known for their regular attendance at church gatherings and aggressive proselytizing, yet their fervent beliefs in traditional family values, inspired by a literal reading of the Bible, are likely to elicit conservative moral judgements on social issues (Burdick, 2019).

Pentecostals have recently been more active in Brazilian politics and that Pentecostal theological beliefs have political ramifications (Freston, 2013). There has been a significant influx of evangelical candidates entering Brazilian politics since the re-democratization movement in Brazil began in the middle of the 1980s. This incursion in politics has been made possible by an upsurge in evangelical propaganda and a quickly expanding voting constituency (Miguel et al., 2017). Pentecostals defended their involvement in politics by preventing the establishment of secular values in Brazil's society and preserving the bounds of sectarian reproduction, especially in relation to the family. Many Pentecostal politicians view their involvement in politically divisive religious issues as a struggle against laws that would legalize secular behaviours like abortion (Freston, 2004).

Catholicism is the most common religious group among Brazilians, making up around 64.6% of the population in 2010, despite the growth of Protestantism (IBGE, 2012). The Catholic Church's widespread influence over its parishioners, let alone throughout Brazilian society, should not be underestimated (González & González, 2007). The Catholic Church in Brazil, directly influenced by the Vatican and motivated by the belief that the right to life begins at conception, has consistently expressed opposition to abortion legalization and has effectively promoted this viewpoint among its members (Ogland & Verona, 2011).

Limited abortion access is a result of women's subordinate status. To develop this case, it is necessary to have a broader perspective on what might be viewed as equality. People should be aware that achieving equality requires not just the elimination of discrepancies in intervention, but as well as the removal of the structural oppressions that cause some groups to be marginalized in society, i.e., emphasis on the effects of the law on the persons affected by it instead of the disparity in treatment (Cunha de Barros Penteado, 2020). According to this viewpoint, limiting women's access to abortions to maintain their subordinate status has three main effects (Cook, 2014). The first one is to stereotype or symbolically reaffirm duties socially assigned to women. Another one is to impose substantial effects on the lives of real women. Motherhood generates significant drawbacks in the educational, professional, political, and personal dimensions in an uneven world where parenting tasks are asymmetrically assigned to women. Last is to confine women, especially ones in the most vulnerable situation, to the responsibility of reproduction. This approach is achieved by keeping them out of the process of developing values, knowledge, and even legislation.

The treatment and status of women in the workforce point to the fact that society should not enforce motherhood on women if it does not concurrently assume responsibility for child raising, respect women, or recognize the significance of women's efforts in raising children. Abortion, as part of a comprehensive reproductive health agenda, is therefore required to enable women to overcome obstacles to education and work, break the cycle of poverty and inequality, as well as to start to demonstrate respect for women's choices and lives (Birenbaum, 1996). The argument that restrictive abortion is a direct outcome, reflection, and reproducer of the gender inequalities already present in society originates from the larger awareness that power is unequally distributed between the genders. In general, the subordination of women is a problem that is greatly impacted by intersections of racial, social class, and sexual identity. Because of the numerous ways that current social power networks operate, institutions, policies, practices, and ideologies that both reflect and reproduce inequalities, the subordinate status is maintained in this setting. The restriction of abortion is one of these ideologies' tools of subordination (Cunha de Barros Penteado, 2020). This argument creates a strong new legal approach to promote abortion legalization in Brazil. The availability of abortions might be a pivotal milestone in the law governing reproductive rights.

8. Conclusion

The present study aims to systematically investigate the impact of abortion laws worldwide on the achievement of SDG 5 of gender equality. By applying the two-way fixed effects regression model to yearly data of abortion laws and socio-economic indicators from 194 countries, we confirm that flexible abortion policies are important to achieve gender equality by improving the educational completion and labour participation of women. The estimated primary completion rate increased in the group of an abortion flexibility score of 3 or more by 2.313%, compared to the group of less than 3 after the inclusion of control variables in our model. When abortion access is more flexible, there is an increase of 0.406% in the female labour participation rate and a decrease of 0.158 in the total fertility rate. SDG 5's goal of gender equality requires extensive legislative reform. Women who have control over their fertility, including access to safe abortion, are more likely to seek opportunities for political, work, and education involvement, as well as to attain and sustain overall health and well-being, productivity, and societal contributions.

Our study provides empirical support for the hypothesis that restricting access to abortion negatively affects women's educational success and labour force participation. The study adds value to existing knowledge by linking abortion access to the topic of gender equality, which deepens the interaction and states clearly that abortion access is more than just a religious issue. The research also contributes literature to the pertinent issue by addressing the case of Brazilian society.

A limitation of this study is the explanatory variable which was the abortion policies collected from the inquiry sent to governments by the United Nations. We should also be concerned about how rigorously the law is enforced in each country. For example, the final penalty received by women can be different in countries even if the policy classification is the same. The actual penalty imposed by each country, instead of the articles written in the law, could be the real impact of dependent variables in our study. The solution to the problem might be more detailed data collection, which would be a beneficial improvement for further study.

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Appendix A. Flexibility score definition

Table A.1: Summary of specific reasons for each flexibility score in sample countries

Score	Possible Combination	Observations	Percentage
0	Not allowed for legal abortion in any situation	80	2.16%
1	Life	1105	29.83%
2	Life + Juridical	47	1.27%
	Life + Narrow health	103	2.78%
	Life + Fetal defect	12	0.32%
3	Life + Narrow health + Broad health	523	14.12%
	Life + Narrow health + Juridical	22	0.59%
	Life + Narrow health + Fetal defect	15	0.40%
	Life + Juridical + Fetal defect	23	0.62%
	Life + Broad health + Juridical	13	0.35%
4	Life + Narrow health + Broad health + Juridical	84	2.27%
	Life + Narrow health + Juridical + Fetal defect	38	1.03%
	Life + Narrow health + Broad health + Fetal defect	55	1.48%
	Life + Narrow health + Broad health + Social	8	0.22%
	Life + Narrow health + Juridical + Social	15	0.40%
5	Life + Narrow health + Broad health + Juridical + Fetal defect	308	8.32%
	Life + Narrow health + Broad health + Fetal defect + Social	55	1.48%
	Life + Narrow health + Broad health + Juridical + Social	5	0.13%
6	Life + Narrow health + Broad health + Juridical + Fetal defect + Social	130	3.51%
7	Allowed in any situation	1063	28.70%
	Total	3704	100%

Appendix B. Other regression models

Table B.1: Regression models – Primary Completion Rate – Binary Variable

Independent variables	Primary					
	(13)	***(14)***	***(15)***	***(16)***	***(17)***	***(18)***
Dummy	15.808*** (0.937)	9.347*** (1.035)	3.421*** (0.952)	6.073*** (0.695)	2.784** (0.950)	2.313* (0.954)
log(GDP)				4.909*** (0.418)	1.751** (0.549)	-0.654 (0.792)
health				-0.00491*** (0.000323)	-0.00299*** (0.000395)	-0.00355*** (0.000421)
life				1.442*** (0.0603)	2.139*** (0.115)	1.988*** (0.136)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	2159	2159	2159	1802	1802	1802
R^2	0.117	0.0394	0.00651	0.625	0.352	0.186
Adjusted R^2	0.116	-0.0427	-0.0889	0.624	0.286	0.0941
p-value	< 2.2e-16	< 2.22e-16	0.0003368	< 2.2e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses. Dummy variable of 1 indicates an abortion flexibility score of above 3, and 0 indicates a score equals or below 3.

Table B.2: Regression models – Labor Participation Rate – Binary Variable

Independent variables	Labor					
	(19)	***(20)***	***(21)***	***(22)***	***(23)***	***(24)***
Dummy	4.502*** (0.568)	0.501 (0.257)	-0.0167 (0.261)	7.602*** (0.607)	0.746** (0.284)	0.406 (0.280)
log(GDP)				-1.685*** (0.347)	-0.472*** (0.143)	-1.953*** (0.199)
health				0.00398*** (0.000261)	0.00128*** (0.0000956)	0.000789*** (0.000103)

life				-0.800*** (0.0502)	-0.0151 (0.0302)	-0.235*** (0.0357)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	3391	3391	3391	2656	2656	2656
R^2	0.0182	0.00118	1.2747e-06	0.230	0.0698	0.100
Adjusted R^2	0.0179	-0.0529	-0.0604	0.229	0.00458	0.0311
p-value	3.135e-15	0.0513	0.949	< 2.2e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses. Dummy variable of 1 indicates an abortion flexibility score of above 3, and 0 indicates a score equals or below 3.

Table B.3: Regression models – Total Fertility Rate – Binary Variable

Independent variables	***Fertility***					
	(25)	***(26)***	***(27)***	***(28)***	***(29)***	***(30)***
Dummy	-1.618*** (0.0476)	-0.492*** (0.0318)	-0.244*** (0.0258)	-0.676*** (0.0318)	-0.199*** (0.0248)	-0.158*** (0.0240)
log(GDP)				-0.224*** (0.0184)	-0.0370** (0.0124)	0.131*** (0.168)
health				0.000216*** (0.0000138)	0.0000931*** (0.00000834)	0.000147*** (0.00000878)
life				-0.117*** (0.00267)	-0.0722*** (0.00262)	-0.0509*** (0.00302)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	3521	3521	3521	2739	2739	2739
R^2	0.248	0.0671	0.0263	0.761	0.426	0.239
Adjusted R^2	0.247	0.0151	-0.0339	0.761	0.385	0.180

p-value	< 2.2e-16	< 2.22e-16	< 2.22e-16	< 2.2e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses. Dummy variable of 1 indicates an abortion flexibility score of above 3, and 0 indicates a score equals or below 3.

Table B.4: Regression models – Primary Completion Rate – Categorical Variable

Independent variables	***Primary***					
	(31)	***(32)***	***(33)***	***(34)***	***(35)***	***(36)***
abortion2	-0.524 (2.375)	7.082*** (1.526)	4.836*** (1.387)	-1.583 (1.801)	4.621*** (1.390)	4.824*** (1.388)
abortion3	0.0739 (1.441)	14.741*** (1.520)	9.021*** (1.395)	-1.765 (1.018)	6.343*** (1.368)	5.697*** (1.373)
abortion4	12.986*** (2.132)	12.851*** (1.710)	5.895*** (1.574)	1.934 (1.549)	4.010** (1.500)	3.201* (1.507)
abortion5	8.0631*** (1.690)	23.868*** (1.793)	13.923*** (1.683)	3.846** (1.179)	8.760*** (1.648)	8.325*** (1.647)
abortion6	19.079*** (2.570)	19.546*** (3.167)	13.336*** (2.878)	3.557 (1.917)	10.706*** (3.137)	10.896*** (3.147)
abortion7	20.125*** (1.235)	18.826*** (2.212)	6.403** (2.075)	6.958*** (0.944)	8.656*** (1.952)	7.533*** (1.974)
log(GDP)				5.244*** (0.428)	1.274* (0.556)	-0.987 (0.802)
health				-0.00503*** (0.000335)	-0.00282*** (0.000403)	-0.00332*** (0.000428)
life				1.379*** (0.0634)	2.107*** (0.115)	1.991*** (0.137)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	2109	2109	2109	1758	1758	1758
R^2	0.151	0.101	0.041	0.629	0.365	0.199
Adjusted R^2	0.149	0.0207	-0.0544	0.627	0.297	0.106
p-value	< 2.22e-16	< 2.22e-16	2.7845e-15	< 2.22e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses.

Table B.5: Regression models – Labor Participation Rate – Categorical Variable

Independent variables	***Labor***					
	(37)	*(38)*	*(39)*	*(40)*	*(41)*	*(42)*
abortion2	4.844*** (1.401)	0.012 (0.343)	-0.052 (0.345)	7.318*** (1.534)	0.603 (0.378)	0.545 (0.373)
abortion3	6.715*** (0.907)	1.268*** (0.317)	1.022** (0.321)	6.046*** (0.876)	2.270*** (0.361)	2.090*** (0.356)
abortion4	7.501*** (1.319)	0.718 (0.391)	0.409 (0.396)	10.61*** (1.283)	1.327** (0.410)	1.079** (0.406)
abortion5	11.494*** (1.040)	0.561 (0.382)	0.083 (0.393)	13.80*** (1.014)	2.062*** (0.419)	1.684*** (0.415)
abortion6	4.436** (1.541)	0.368 (0.657)	0.053 (0.661)	8.592*** (1.668)	3.515*** (0.827)	2.712*** (0.821)
abortion7	5.438*** (0.740)	4.092*** (0.496)	3.432*** (0.514)	9.039*** (0.7956)	3.800*** (0.539)	3.001*** (0.538)
log(GDP)				-2.072*** (0.3516)	-0.655*** (0.138)	-1.864*** (0.195)
health				0.00421*** (0.0002651)	0.00121*** (0.0000936)	0.000817*** (0.000101)
life				-0.738*** (0.0521)	-0.0273 (0.0291)	-0.201*** (0.0348)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	3316	3316	3316	2593	2593	2593
R^2	0.043	0.035	0.026	0.248	0.094	0.117
Adjusted R^2	0.041	-0.019	-0.034	0.245	0.029	0.047
p-value	< 2.22e-16	< 2.22e-16	5.2713e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses.

Table B.6: Regression models – Total Fertility Rate – Categorical Variable

Independent variables	***Fertility***					
	(43)	***(44)***	***(45)***	***(46)***	***(47)***	***(48)***
abortion2	-0.321** (0.112)	-0.104* (0.043)	-0.075* (0.0351)	-0.0763 (0.0770)	-0.0335 (0.0344)	-0.0382 (0.0332)
abortion3	-0.0480 (0.0710)	-0.400*** (0.040)	-0.186*** (0.0327)	0.159*** (0.0431)	-0.101** (0.0328)	-0.0702* (0.0318)
abortion4	-0.959*** (0.106)	-0.595*** (0.049)	-0.331*** (0.040)	-0.0783 (0.0642)	-0.186*** (0.0373)	-0.145*** (0.0362)
abortion5	-0.827*** (0.081)	-0.812*** (0.048)	-0.429*** (0.0400)	-0.227*** (0.0497)	-0.305*** (0.0381)	-0.257*** (0.0369)
abortion6	-1.897*** (0.124)	-0.505*** (0.082)	-0.285*** (0.0672)	-0.626*** (0.0837)	-0.180* (0.0753)	-1.045 (0.0732)
abortion7	-2.172*** (0.058)	-0.784*** (0.062)	-0.233*** (0.0522)	-0.995*** (0.0393)	-0.323*** (0.0490)	-0.217*** (0.0478)
log(GDP)				-0.283*** (0.0176)	-0.0311* (0.0126)	0.129*** (0.0171)
health				0.000250*** (0.0000133)	0.0000941*** (0.00000852)	0.000144*** (0.00000898)
life				-0.103*** (0.00262)	-0.0713*** (0.00264)	-0.0509*** (0.00306)
Country FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Controlled	No	No	No	Yes	Yes	Yes
Observations	3446	3446	3446	2676	2676	2676
R^2	0.337	0.111	0.042	0.791	0.429	0.243
Adjusted R^2	0.336	0.060	-0.0191	0.790	0.387	0.182
p-value	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16	< 2.22e-16

Notes: ***indicates significance at the 0.001 level; **indicates significance at the 0.01 level; *indicates significance at the 0.05 level. Robust standard errors are presented in parentheses.

Appendix C. Assumptions check for models

Figure C.1: Tests of assumptions for the model 42 with the labor participation rate

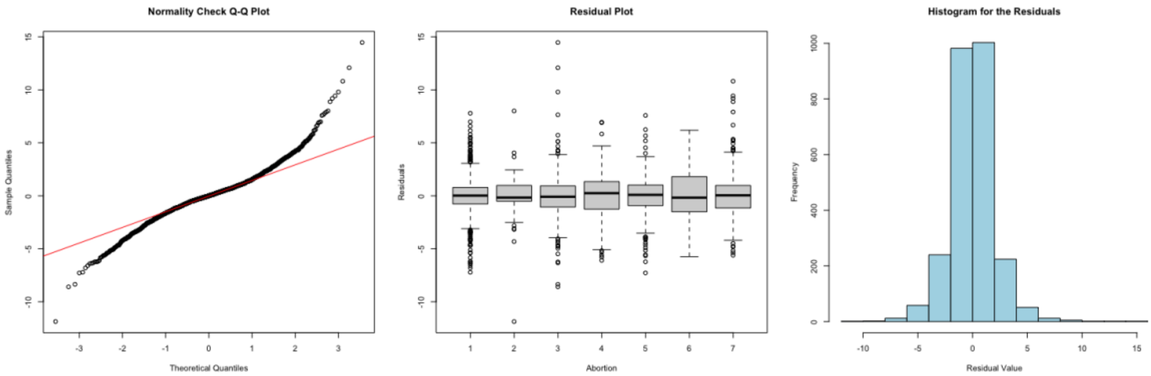

Figure C.2: Tests of assumptions for the model 48 with the total fertility rate

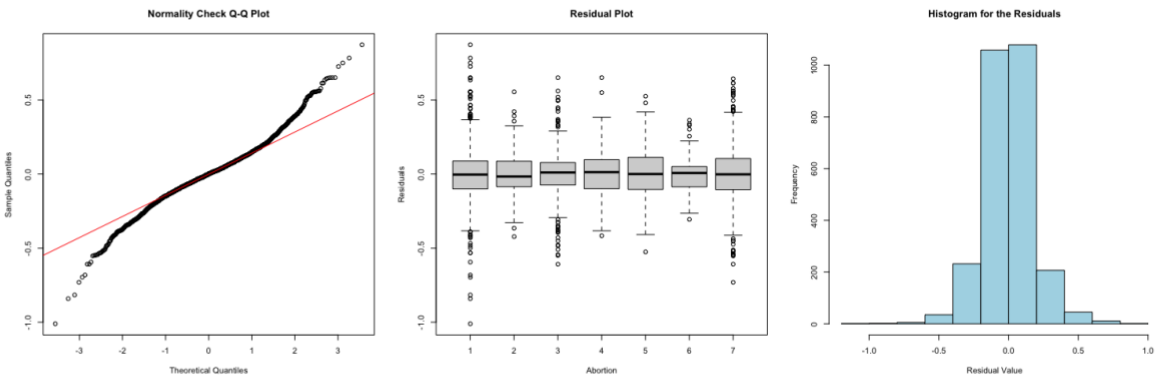

Figure C.3: Tests of assumptions for the model 12 with gender development index