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Abortion Legalization in Uruguay: Effects on Adolescent Fertility[1]

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Abstract

The Latin America and the Caribbean adolescent fertility rate is among the highest in the world: about 1.7 million children are born to teen mothers every year, and most of them are declared as being unintended pregnancies. The region also has the highest rate of unintended pregnancy of any world region, and nearly half of such pregnancies end in abortion. However, fewer than 18% of the region's women live in countries where abortion is broadly legal. This paper estimates the causal effect of abortion legalization on adolescent fertility in Uruguay, using official data on legal abortions provided after the 2012 reform. We employed a difference-in-differences strategy, classifying states by whether they are responsive or unresponsive to the reform. The results suggest that abortion reform had a negative impact on the adolescent birth rate by 2.5 to 2.8 births per thousand adolescents aged 15–19 (4% decrease from the pre-intervention average). Additionally, we exploited variation in reform implementation intensity through the estimation of fixed-effect linear regression models and found consistent results. Our findings are robust to controlling for a concurrent large-scale program of contraceptive implants. We conclude that legislation aimed at enhancing rights and reducing avoidable deaths and complications from unsafe abortions may also have spillover effects that help reduce adolescent fertility.

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1. Introduction

Uruguay, a small country with a population of 3.4 million, stands out in Latin America for its low religiosity, high per capita income, and low level of inequality and poverty (Latinobarometro and SEDLAC).[4] The last two decades have witnessed significant technological and policy changes regarding abortion. At the beginning of the century, the development and widespread adoption of abortive drugs changed abortion practices worldwide, replacing surgical abortions with drug-induced abortions (Zamberlin et al., 2012). Despite legal restrictions, abortions were commonly performed in Uruguay, where women have been using misoprostol for self-induced home abortions since the early 2000s (López-Gómez, 2014). Uruguay legalized abortion in late 2012, allowing pregnancy termination during the first trimester in the health system, with all associated costs covered. This reform sets Uruguay—along with Cuba, Guyana, Puerto Rico, Mexico City, Argentina and recently Colombia—among the first places in the region where abortion on request is legal (Remez et al., 2020; Singh et al., 2018).

Abortion legalization, which has as its main expected results the full realization of sexual and reproductive rights and the reduction of unsafe abortion-related morbidity and mortality,[5] might also have unexpected positive impacts on adolescent fertility. The effect of a policy legalizing abortion on pregnancy will depend on how abortion access affects sexual activity and the use of other methods before, during, and after a sexual encounter (Bailey and Lindo, 2018). In other words, the fertility effects of expanding access to abortion are theoretically ambiguous, because they might have a positive impact on both pregnancies and terminations (Ananat et al., 2009). Ultimately, the extent to which—or the direction in which—liberalizing abortion affects fertility remains an empirical question. This paper aims to answer this question by estimating the causal effect of abortion legalization on adolescent fertility in Uruguay, using official data on legal abortions provided after the 2012 abortion reform.

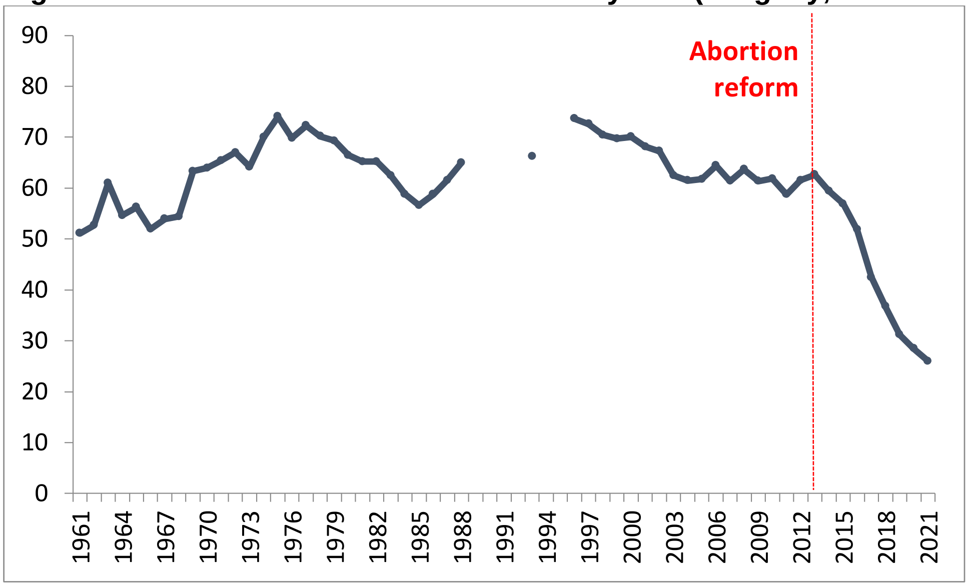
Abortion reform in Uruguay was followed by a decline in births that was more substantial among adolescents. The total fertility rate declined steadily since 2016 and reached 1.4 children per woman in 2021, consolidating Uruguay as a very low-fertility

[4] Latinobarometro and SEDLAC databases (CEDLAS and World Bank), both consulted on March 1, 2022.

[5] According to the classification of Singh et al. (2018), induced abortions in Uruguay were medically "least safe" before the wide spread of misoprostol in the early 2000s, "less safe" before the legalization of abortion, and "safe" afterwards. However, in this paper, we refer to safe and unsafe abortions as legal and illegal procedures, respectively.

country. The adolescent fertility rate has fallen sharply by more than half, from 61‰ in 2013 to 26 births per thousand women aged 15–19 in 2021 (see Figure 1). This significant decline distinguishes Uruguay from other Latin American and Caribbean countries.

Figure 1. Evolution of the adolescent fertility rate (Uruguay, 1961–2021)



Source: Vital Statistics, Ministry of Health and the Office of National Statistics.

Figure 1 could lead us to conclude that fertility among young women has been significantly affected by the abortion reform. However, it is not simple to assess the degree to which the adolescent fertility decline is attributable to abortion legalization rather than other concurrent policies. During this time, the government also unified several uncoordinated and isolated efforts for preventing unintended pregnancy among adolescents and articulated them into a national strategy. A central component of this strategy was the launch, in 2015, of a program offering for the first time 5-year subdermal implants at no cost to women users of the public health system (López-Gómez et al., 2019). Even controlling for all relevant concurrent policies, it is difficult to ascertain whether the decline in adolescent fertility is a direct result of abortion reform. Other factors could be driving both the fertility rates and the probability of reformed abortion laws (i.e., legislative changes and their implementation may be endogenously determined).

Building on the impact evaluation literature, researchers use policy changes relating to abortion to address endogeneity issues and isolate the causal effects of abortion access on fertility and other outcomes.[6] Their findings indicate that changes in abortion access have an impact on fertility, with more substantial effects among adolescents and poorer women; see Bailey and Lindo (2018) for the US; González et al. (2018) for Spain; Mølland (2016) for Norway; Valente (2014) for Nepal; Pop-Eleches (2010, 2006) for Romania; and Clarke and Mühlrad (2016) and Gutiérrez-Vázquez and Parrado (2016) for Mexico City.

Following its legalization of abortion, Uruguay represents an exciting case study. There is still scarce research on the effects of the abortion reform, partly because it is very recent and also because access to information is limited. Most of the reviewed papers have analyzed the progress of the law from different perspectives, particularly from health sciences (Fiol et al., 2016; Labandera et al., 2016); social sciences (Ituarte and López-Gómez, 2021; López-Gómez and Couto, 2017); and the implementation of legal abortion services (MYSU, 2014, 2015, 2016a, 2016b, 2017). To our knowledge, Antón et al. (2018) is the only previous study that has used impact evaluation techniques. They found an 8% decline in the number of births from unplanned pregnancies driven by the group of women aged 20–34 with completed secondary education, an improvement in prenatal care and a smaller share of single mothers. However, they did not find any impact among adolescents.

After this introduction, the rest of the paper is organized as follows: Section 2 provides the background for adolescent fertility trends in Uruguay and presents a description of the abortion reform. Section 3 describes the data used in this study and lays out the methodology. Section 4 presents the main findings, and section 5 concludes.

[6] In addition to the fertility effects, changes to abortion access may affect outcomes for women and the next generation (Azevedo et al., 2012; Bernstein and Jones, 2019). First, empirical evidence about the effect for women facing different abortion policies on their educational and labor prospects is significant and positive in Norway (Mølland, 2016) and Spain (González et al., 2018). In the United States, the evidence is mixed, with some studies finding no effect (Angrist and Evans, 1999; Ribar, 1994), while others show the strong long-lasting negative impact of denying abortion to adolescents. This is, for example, the conclusion of the large longitudinal study Turnaway, the main result of which is that denying women abortions leads to poorer economic, health, and family outcomes (Foster, 2019). Second, the empirical evidence shows significant effects for the cohort of affected children in the US (Ananat et al., 2009; Donohue and Levitt, 2001; Gruber et al., 1999); Norway (Mølland, 2016); and Romania (Pop-Eleches, 2006). However, no intergenerational effects were found in a high-fertility country such as Nepal (Valente, 2014).

2. Adolescent fertility and abortion in Uruguay

2.1. Evolution of adolescent fertility

The persistence of high adolescent fertility rates is a peculiar characteristic of the Latin American fertility regime, although the Total Fertility Rate (TFR) has been declining steadily since the 1970s (Cabella and Pardo, 2014; ECLAC, 2011). The adolescent fertility rate in the region is one of the highest in the world, second only to that of the African continent. Latin America also has the highest rate of unintended pregnancy in any world region, and more than 24 million women face an unmet need for modern contraception, as indicated in the work of Singh et al. (2018). The same report estimates that 14 million unintended pregnancies occur each year, 46% of which end in abortion. However, fewer than 18% of the region's women live in countries where abortion is broadly legal.[7] The unwanted adolescent fertility rate on the continent is also the highest globally, reaching 50%, and has increased in recent years (Rodríguez-Vignoli, 2017).

Uruguay faced a high adolescent fertility rate between the 1990s and the mid-2010s, well above the level expected considering its low total fertility rate and its socioeconomic indicators (Rodríguez-Vignoli and Cavenaghi, 2014; Varela-Petito et al., 2014). This trend reversed in 2016 when the country witnessed a steep reduction in adolescent and very young fertility. After more than 40 years of cycles of increase–decrease–stagnation at high levels, adolescent fertility is now leading the decline between 2015 and 2018: 29% of the fall in TFR is explained by the reduction in adolescent fertility, and the fall in the rate between the ages of 15 and 22 years explains 50% of the decline in the TFR, which in 2018 reached 1.59 children per woman (Cabella et al., 2019).

The stagnation of adolescent fertility is one of the aspects of Uruguayan sexual and reproductive health that has received the most attention during the last 15 years, both from academia and in the field of public health, particularly because it reflects strong social polarization in reproductive behavior (Cardozo and Iervolino 2009; Nathan et al., 2016; Varela-Petito et al., 2012, 2014; Videgain, 2006). Adolescent girls from the

[7] Remez et al. (2020) and Singh et al. (2018) report that fewer than 3% of women of reproductive age in Latin America and the Caribbean lived in places where abortion was broadly legal, that is, permitted either without restriction due to reason (Cuba, Guyana, Puerto Rico, Mexico City and Uruguay) or on socioeconomic grounds (Barbados, Belize and St. Vincent and Grenadines). This share was updated to 18% using female population 15–49 data by age group from United Nations (2019) to include Argentinian and Colombian recent reforms.

higher social sectors tend to start their sexual life later (Cabella et al., 2017), rely more frequently on contraception, and use it consistently; thus, they have their children later and face fewer births that are earlier than desired. Adolescent motherhood is a phenomenon that is almost exclusive to poor settings and is generally associated with inconsistent use of contraceptive methods and reluctance to carry out an abortion (Brunet et al., 2019); according to official data, 70% of adolescent mothers report that their pregnancies were unwanted or mistimed (Cabella et al., 2017).

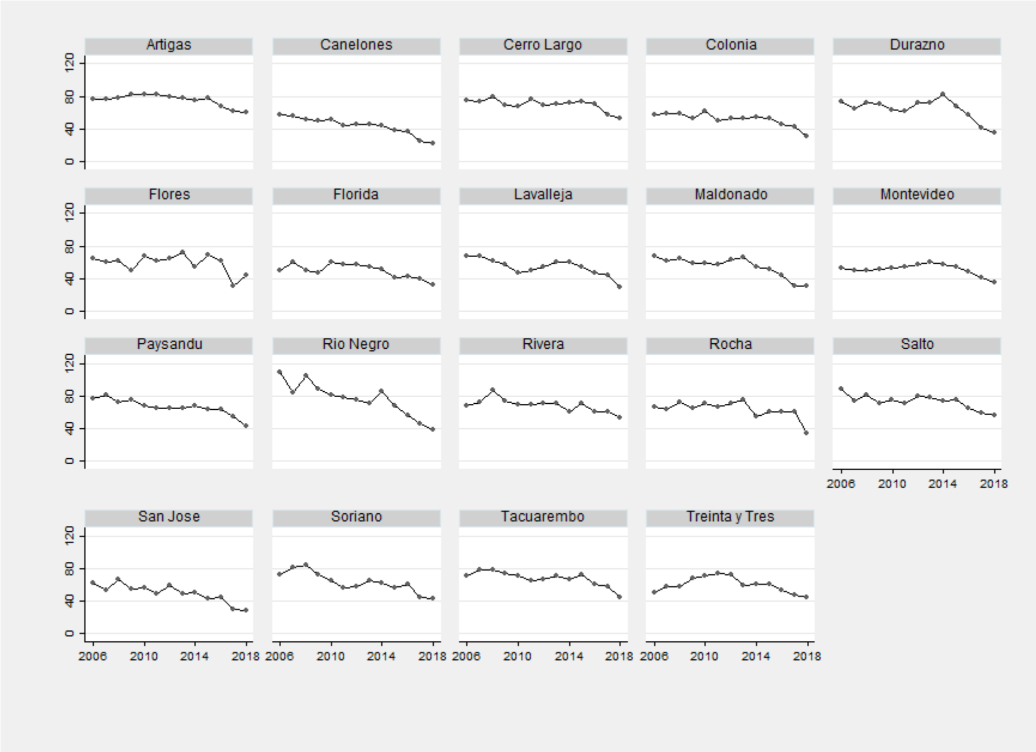
Differences in the timing of first birth are strongly rooted and have deepened during the process of fertility decline. These differences are anchored in educational and socioeconomic inequalities that define the centrality of motherhood in young women's life alternatives (Nathan, 2015; Varela-Petito et al., 2012). Adolescent girls with a low level of education, who are mostly outside the education system, perceive the arrival of a child as a factor of entrenchment of their social identity and a way to reduce the uncertainty and lack of security provided by the social environment (Amorin et al., 2006; De Rosa et al., 2016). Women with a higher level of education face a set of alternatives that are more attractive than motherhood at that stage of life, while, for less-educated women, there are fewer incentives to give up the reproductive project, which in many cases is the only one they envision. [8]

Adolescent fertility also shows important territorial variations.[9] As shown in Figure 2, it is higher in the northern and northeastern states of the country (Artigas, Salto, Paysandú, Rivera, Río Negro, and Tacuarembó) where economic and social development is lower. However, it is worth noting that the recent drop in adolescent fertility rate occurred in all states. At different rates and starting from different levels, it is evident that they are all converging toward a lower adolescent fertility rate.

[8] Human capital accumulation and reproductive decisions are either joint decisions, which result in a potential reverse causality problem or are both affected by unobservable factors, causing selection bias. Alzúa and Velázquez (2017), Berthelon and Kruger (2011), Cortés et al. (2016, 2010) and Novella and Ripani (2016) provide causal evidence for Argentina, Chile, Colombia and the Dominican Republic that supports the hypothesis that education reduces fertility among youths.

[9] Uruguay is organized as a unitary state divided into 19 political units called departments. They differ widely in population size; 60% of the population is concentrated in the capital, Montevideo, and its metropolitan area, while the departments in the center of the country are virtually empty (Durazno, Flores, Lavalleja).

Figure 2. Evolution of the adolescent fertility rate by state (Uruguay, 2006–2018)



Source: Vital Statistics, Ministry of Health and the Office of National Statistics.

It should be noted that the strong annual variations observed in some states are related to their small population.

2.2. Legal framework and implementation of abortion reform

Abortion in Uruguay was briefly decriminalized between 1934 and 1938. Since then, it has been punishable by law and only permitted to save the woman's life and to preserve her health. Although the law mentioned rape, "family honor," and "economic problems" as grounds for abortion, exemptions were very rare, and services that would provide abortions under the established grounds were never implemented. Since 1985, the topic entered the public agenda, and all subsequent parliaments have considered bills on abortion. Even in 2008, a bill legalizing abortion was passed by parliament but promptly vetoed by the president in a highly contested decision (López-Gómez and Abracinskas, 2009).

Despite legal restrictions, since 2001 health professionals of the main public maternity hospital in Montevideo began to provide counselling and care to women who wanted to terminate a pregnancy, both before and after a clandestine abortion. These professionals informed women about the use of abortive drugs (mainly misoprostol), but they were legally restricted from providing them (Fiol et al., 2012; Labandera et al., 2016). Misoprostol could be purchased on the black market since 2002, although at very expensive prices. Since its availability, surgical abortions at clandestine clinics have been replaced by drug-induced abortions at home (López-Gómez, 2014).

Uruguay passed its abortion law reform in December 2012 (Law 18987 of Voluntary Termination of Pregnancy). The reform allows for pregnancy termination in the health system with all associated costs covered, upon request until the 12th week of pregnancy, in the cases of rape until the 14th week, and at any time during pregnancy in cases of risk of maternal death or fetal anomalies incompatible with life.

Three consultations are required before the termination of unwanted pregnancies. During the first consultation with the gynecologist, the professional must verify that the gestational age requirements are met. The gynecologist schedules the second consultation within the next 24 hours, with a board composed of a gynecologist, a social worker, and a psychologist who provide women with information on the decision (risks of the procedure, alternative options, and social support programs for maternity or adoption). After a mandatory waiting period of 5 days, the woman can confirm her decision, and the gynecologist determines the most suitable procedure. The vast majority (98.8%) of legal abortions were medication-induced abortions (mifepristone and misoprostol regimen), and almost 97% of those women used the medication as outpatients (Fiol et al., 2016). A fourth and final consultation for a medical check and for providing a contraceptive method is scheduled 10 days after the abortion.[10]

The number of abortions registered in health services increased by 45% in the 6 years between 2013 and 2018 (Table 1). The legal abortion rate (the number of legal abortions per thousand women aged 15–49) increased from 8.6 to 12.1 in the same period. However, the growth rate has slowed down, as it has in other countries where abortion has been decriminalized (see for Mexico Darney et al., 2019; and for a more general reference Singh et al., 2018). The overall annual increase in legal abortions among adolescents aged 15–19 was significantly lower, registering an 18% increase between 2013 and 2018. The legal abortion rate in this age group increased from 8.9 in 2013 to 11.2 in 2018. Following the rise during the first 2 years of abortion reform implementation, the annual number of legal abortions has tended to stabilize or even decline within this age group.

[10] Adolescents below the legal age of majority (18 years old) can decide to terminate a pregnancy if the three-professional board approves it after assessing her progressive autonomy.

Table 1. Legal abortions and births (Uruguay, 2013–2018)

Year	Total: women aged 15-49				Teenagers: women aged 15-19			
	Legal Abortions	**Live Births**	**Legal Abortion Rate**	**Total Fertility Rate**	**Legal Abortions**	**Live Births**	**Legal Abortion Rate**	**Adolescent Fertility Rate**
2013	7171	48681	8.6	1.96	1200	8172	8.9	60.9
2014	8537	48368	10.1	1.94	1404	7779	10.5	58.1
2015	9362	48926	11.1	1.96	1603	7371	12.1	55.6
2016	9719	47058	11.4	1.88	1597	6575	12.2	50.3
2017	9830	43036	11.5	1.71	1476	5367	11.5	41.6
2018	10373	40139	12.1	1.60	1421	4554	11.2	35.8

Notes: The legal abortion rate represents the total number of legal abortions per 1,000 women aged 15–49 in the left panel and the number of legal abortions among adolescents per 1,000 women aged 15–19 in the right panel. Source: Based on information about legal abortions provided by the Ministry of Health, Vital Statistics (Ministry of Health and Office of National Statistics of Uruguay), and mid-year population estimates (Office of National Statistics of Uruguay, 2013 Revision).

Although abortion is legal nationwide following the reform, there are still barriers to access. The law requires abortions to be provided in health services by gynecologists, but allows them to refuse due to issues of conscientious objection. Regulatory changes regarding conscientious objection, combined with the fact that many regions of the country face a shortage of physicians specializing in gynecology,[11] result in considerable variation across states over time in the actual provision of abortion services (López-Gómez and Couto, 2017). A particular example is the case of the state of Salto, where the 12 resident gynecologists invoked conscientious objection, leaving women without access to abortion services for several months (MYSU, 2014).

Unfortunately, there is no complete information at the state level about the evolution of conscientious objectors. The scarce official information shows that, in the first year after the reform (2013), 30% of Uruguayan gynecologists declared themselves to be objectors. This rose to 40% in 2015 (data provided by the Ministry of Health).

In those cities or towns where all gynecologists refuse to provide abortions due to conscientious objection, women must be referred to other cities in the country for care. In all cases, when services are overcrowded, women are referred to the main public maternity hospital in Montevideo. The travel costs must be covered by the institution that fails to provide the service, although this is not always the case (MYSU, 2014,

[11] According to the latest information provided by the Ministry of Health, Uruguay has a total of about 650 gynecologists. This yields a rate of approximately 0.4 gynecologists per thousand women aged 14 or above. The physicians specializing in gynecology are unevenly distributed across the country and are highly concentrated in the country's capital Montevideo.

2015, 2016a, 2016b, 2017). The appendix presents further details about the evolution of regulations and the geographical distribution of conscientious objection.

Despite the difficulties in implementing the law, it is important to note that maternal mortality has improved since the abortion law was passed.[12] From legalization (2012) until 2019, there have been a total of 57 maternal deaths in the country, of which 4 were in adolescents. In the last four years (2016–2019), there were no maternal deaths among adolescents according to official data (Ministry of Health).

[12] Uruguay has stood out in the region for its very low level of maternal mortality for several decades. In the recent period, this has continued to decrease, and, since the law was passed, it has experienced a further decline.

3. Empirical strategy

3.1. Data

Data about legal abortions in Uruguay are not publicly available. For this paper, we have accessed the information on abortions for the period from December 2012 to December 2018 through an Agreement with the Ministry of Health.[13] The Ministry of Health has gathered data on legal abortions from each private and public health center monthly since December 2012. Health centers must report the total number of women who attend the second, third, and fourth consultations by aggregate age group (14 or younger, 15–19, 20–44, and 45 and over). Unfortunately, abortion information is collected at the health center level and there is no information at the individual level, nor is there any aggregate information about women, such as previous births or abortions, contraceptive use, marital status, or place of residence. To merge abortion data with information on births, we aggregated the data at the state level based on each health center's location. Due to the low number of observations, we aggregated monthly data on a quarterly basis.

We thus constructed a balanced panel of quarter state-level data from 2006 to 2018. The total number of quarter-state observations is 988 (19 states, 4 observations each year, 13 years). For the period 2006 to the third quarter of 2012 (i.e., pre-reform), the number of legal abortions (and the legal abortion rate) is zero. We discuss the implications of omitting clandestine abortions in the Discussion (section 4.3).

To examine the effects of the abortion reform on fertility, we used the Vital Statistics on all births registered in Uruguay. Birth data are compiled by the Ministry of Health and the Office of National Statistics based on live-birth certificates issued at hospitals. We focused on the number of live births by the age and state of residence of the mother.

We calculated the adolescent legal abortion rate as the number of legal abortions among adolescents aged 15–19 per thousand women aged 15–19 years. Likewise, we computed the adolescent fertility rate as the number of live births among adolescents aged 15–19 per thousand women aged 15–19 years. The population of women (variation by age group, year, and state of residence) was taken from mid-year

[13] Under this agreement, we did not have access to women's identified information, nor the possibility of linking it to their medical records. For this reason, the Ministry of Health did not consider necessary the approval of an ethics committee to provide us with the data.

population estimates (Office of National Statistics of Uruguay, 2013 Revision). Quarterly rates were annualized by multiplying by 4.

An important concern regarding attempts to establish causality is the existence of interventions occurring at the same time as the abortion reform, such as the contraceptive implant program launched in 2015. To deal with this issue, we used two different measures for the subdermal implant program adoption. First, we employed a dummy variable taken from Ceni et al. (2021), indicating the dates of the program's start in each state. Second, we included a measure based on information about subdermal implant shipments from the Ministry of Health to health facilities in all states. This information is provided by Ceni et al. (2021); according to their estimations 80% of women using the implant are under 30 years of age. We used the accumulated stock of implants shipped as a proxy variable for women using implants,[14] and we calculated the rate taking women aged 15–29 as the reference population.

Bearing in mind that abortion is allowed until the 12th week of pregnancy, the abortion law rules out those women who discover that they are pregnant after this limit. The gestational age at the beginning of prenatal care among live births to adolescent mothers, available in the Vital Statistics, serves as a proxy for the time it usually takes for a young woman to realize that she is pregnant.

Finally, we merged a set of time- and state-varying covariates for each quarter and state. This includes the youth unemployment rate (15–24 years old)—from Uruguay's national household survey conducted by the Office of National Statistics—as an economic cycle indicator. We also used the number of public secondary schools per 10,000 inhabitants, from the Education Statistics National Yearbooks (Ministry of Education) as a proxy for the state schooling infrastructure. The number of physicians and the number of nurses per 10,000 inhabitants, from the records of the Pension and Retirement Fund of University Professionals, were also included as a proxy for state health resources. Finally, we used the state share of the total population from mid-year population estimates (Office of National Statistics of Uruguay, 2013 Revision) as an indicator of the state's size. It should be noted that the number of schools, physicians, nurses, and the population varies yearly, not quarterly.

[14] The accumulated stock of implants shipped can serve as a proxy variable for women using implants under the following assumptions: (a) no new implants are sent until the stocks are exhausted; (b) women do not travel out of state to access implants; and (c) all implants shipped are used and there are no removals (Ceni et al., 2021). The available data from the pilot program carried out in 2014 show high continuation rates (fewer than 10% of the women removed the implant after one year) that have been rising thereafter (López-Gómez et al., 2019).

3.2. Estimation strategy

Since the abortion reform in Uruguay was not accompanied by any strategy to evaluate its impact causally, we had no other choice but to rely on observational data to derive our results. First, we employed a difference-in-differences framework to determine whether states more responsive to the reform performed better in reducing adolescent fertility. Second, we exploited variation in treatment intensity through the estimation of fixed-effect linear regression models, regressing adolescent fertility rates on lagged legal abortion rates for the same age group. Third, we implemented a robustness test to address concerns about regional mobility. All specifications control for state fixed effects, time dummies, and state-average socioeconomic and demographic variables, as well as including two alternative measures of contraceptive implants.

We use a difference-in-differences strategy because time variation in the application of the law across states implies that women of the same age but living in different states had different levels of access. Some women would have faced more significant barriers to obtaining legal abortion services according to the time and their place of residence, and this could have a differential effect between states in fertility rates.

Based on the average of post-reform legal abortion rates from adult women aged 20–44, we split states in treatment and control using the median to obtain two groups of similar size. We referred to the states above the median as “responsive” and the other states as “unresponsive” to the reform—that is, treatment and control group, respectively. The states in each group can be observed in Figure 3. We then compared the adolescent fertility rates of responsive states with unresponsive states, before and after the reform implementation.

We assume that the sub-national variation in legal abortion rates of adult (20–44) women is driven by idiosyncratic variation in the provision of abortion services at the state level, related to the regulation and use of conscientious objection (i.e., supply factors) and unrelated to adolescent’s decisions (i.e., demand factors). This identifying assumption is quite reasonable, because supply-side constraints are fundamental, particularly during the reform’s initial months. The decision to invoke conscientious objection responds to economic and corporate interests, led by some gynecologists who are opponents to the reform (López-Gómez and Couto, 2017), and is therefore exogenous to adolescent's reproductive decisions. See the appendix for further details regarding context on conscientious objection.

We used the balanced-panel quarter state-level dataset described in the previous section and estimated the following equation:

$$(1)\ Fertility_{jt} = \alpha_1 Responsive_j * Post_t + \alpha_2 \rho_j + \alpha_3 \sigma_t + \alpha_4 X_{jt} + \omega_{jt}$$

where $Fertility_{jt}$ is the number of live births among adolescents during quarter t multiplied by 4 per thousand women aged 15–19 years in state j (i.e., the annualized adolescent fertility rate). $Responsive_j$ is a binary variable taking the value of 1 if the state is responsive to the abortion law reform and 0 otherwise, and $Post_t$ is a dummy equal to 1 in the post-reform period (second quarter 2013 onwards) and 0 otherwise (although the law was passed in December 2012, we must bear in mind that current abortions impact births 5–7 months later). $Responsive_j * Post_t$ is an interaction term between these variables.

Evaluation of the impact of a new law involves several challenges. Of particular concern is the fact that the implementation of the abortion reform may be endogenously determined. That is, the sub-national legal abortion rates are likely to be correlated with observed and unobserved state characteristics. The inclusion of state fixed effects (ρ_j) removes any time-invariant heterogeneity, because all observable and unobservable state-specific invariant factors are absorbed into the fixed effect. We also included time dummies (σ_t) to reduce the correlation across states and control for common factors that affect fertility across all states within a specified quarter. We also introduced a set of time-varying controls at the state level (X_{jt}), detailed in the previous section. To address potential heteroskedasticity, serial correlation, and cross-sectional correlation issues in the idiosyncratic error term (ω_{jt}), we estimated Driscoll and Kraay's standard errors.[15]

[15] We did not perform estimations with clustered standard errors at the state level as is customary because few clusters mean biased standard errors and misleading inferences; that is, 19 groups are not enough for reliable inference (Angrist and Pischke, 2008). Driscoll and Kraay (1998) propose a nonparametric covariance matrix estimator that produces heteroskedasticity- and autocorrelation-consistent standard errors that are robust to general forms of spatial and temporal dependence. We implemented Driscoll and Kraay's standard errors using the Stata XTSCC module (Hoechle, 2007). The maximum lag order of autocorrelation was set at 3, determined by Hoechle's (2007) rule of thumb: $floor[\ 4(T/100)^{\ 2/9}]$.

An important concern regarding the identification strategy is the existence of interventions occurring at the same time as the abortion reform, specifically the contraceptive implant program launched by the Uruguayan Government in 2015.[16] To deal with this issue, we sought additional information about this program. We estimated the following equations:

$$(2)\ Fertility_{jt} = \beta_1 Responsive_j{*}Post_t + \beta_2 ImplantsDummy_{jt-k} + \beta_3\rho_j + \beta_4\sigma_t + \beta_5 X_{jt} + \omega_{jt}$$

$$(3)\ Fertility_{jt} = \gamma_1 Responsive_j{*}Post_t + \gamma_2 ImplantsUse_{jt-k} + \gamma_3\rho_j + \gamma_4\sigma_t + \gamma_5 X_{jt} + \omega_{jt}$$

As discussed above, we used two types of variables for implants: $ImplantsDummy_{jt-k}$, a binary variable indicating the start of the subdermal contraceptive program in each state and $ImplantsUse_{jt-k}$, the share of women aged 15–29 using implants. Given that the current insertion of contraceptive implants will prevent births 9 months later and thereafter, we included implant variables lagged by 9 months (i.e., *k=9 months*). It is worth pointing out that we lagged the monthly data and then aggregated them quarterly.

The above difference-in-differences model assumes adolescent fertility trends (conditional on *X*) would have been the same in both groups of states in the absence of the abortion reform. This assumption is necessary to obtain a causal interpretation of the estimates of α_1, β_1, and γ_1 in equations (1) to (3). The parallel or common trends assumption is inherently non-testable, but a good validity check is to compare the trends in pre-treatment periods (see Figure 4 in section 4.1.).

Second, to provide additional evidence of our results, we estimated fixed-effect linear regression models, regressing adolescent fertility rates on lagged legal abortion rates for the same age group. Up to this point, we compared two groups of states with high and low legal abortion rates for women aged 20–44, we then exploited variation in legal abortion rates for adolescents (variation in treatment intensity). We estimated the following equation:

$$(4)\ Fertility_{jt} = \delta_1 Abortion_{jt-1} + \delta_2\rho_j + \delta_3\sigma_t + \delta_4 X_{jt} + \omega_{jt}$$

[16] Another relevant intervention is the program *Metas asistenciales* (which uses a pay-for-performance scheme). This program has fostered the early detection of pregnancy since 2008, and as a result prenatal visits have become increasingly early. We included in our estimates the gestational age at the beginning of prenatal care among live births to teen mothers.

where $Abortion_{jt\text{-}l}$ is the number of legal abortions among adolescents during quarter *t–l* multiplied by 4 per thousand women aged 15–19 years in state *j* (i.e., the lagged value of the annualized adolescent legal abortion rate). Bearing in mind that termination is allowed until the 12th week of pregnancy while the length of adolescent pregnancy is about 38 weeks, current abortions will affect fertility rates approximately 6 months later. We used the adolescent legal abortion rate lagged by 5, 6, and 7 months (i.e., we have different specifications for *l=5, l=6,* and *l=7 months*). We lagged the monthly data and then we aggregated them quarterly, as we did with implant contraceptive variables.

All specifications control for state fixed effects (ρ_j), time dummies (σ_t), and the same set of state-average socioeconomic and demographic variables listed above (X_{jt}). Again, we included two alternative measures of contraceptive implants:

$$(5)\ Fertility_{jt} = \tau_1 Abortion_{jt-l} + \tau_2 ImplantsDummy_{jt-k} + \tau_3\rho_j + \tau_4\sigma_t + \tau_5 X_{jt} + \omega_{jt}$$

$$(6)\ Fertility_{jt} = \pi_1 Abortion_{jt-l} + \pi_2 ImplantsUse_{jt-k} + \pi_3\rho_j + \pi_4\sigma_t + \pi_5 X_{jt} + \omega_{jt}$$

Third, we implemented a robustness test to address concerns about regional mobility. Our measure of abortion is based on the health facility location where the woman attends the third consultation to terminate her pregnancy, but we do not have information about her state of residence. As discussed above, in those cities where the share of objectors among gynecologists is high, women must be referred to other cities in the country for attention. Some women may also prefer to travel out of town, seeking anonymity, given the social stigma that still surrounds abortion. To address this concern about regional mobility, we performed a robustness test estimating the following equations:

$$(4')\ Fertility_{jt} = \delta'_1 Pre\text{-}AbortionVisit_{jt-l} + \delta'_2\rho_j + \delta'_3\sigma_t + \delta'_4 X_{jt} + \omega_{jt}$$

$$(5')\ Fertility_{jt} = \tau'_1 Pre\text{-}AbortionVisit_{jt-l} + \tau'_2 ImplantsDummy_{jt-k} + \tau'_3\rho_j + \tau'_4\sigma_t + \tau'_5 X_{jt} + \omega_{jt}$$

$$(6')\ Fertility_{jt} = \pi'_1 Pre\text{-}AbortionVisit_{jt-l} + \pi'_2 ImplantsUse_{jt-k} + \pi'_3\rho_j + \pi'_4\sigma_t + \pi'_5 X_{jt} + \omega_{jt}$$

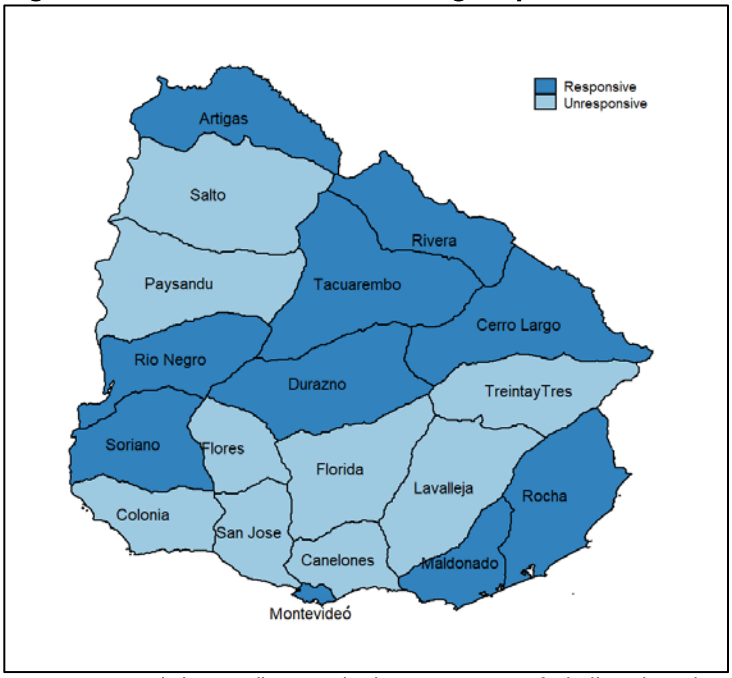
where $Pre\text{-}AbortionVisit_{jt-1}$ is the number of pre-abortion consultations during quarter $t-1$ multiplied by 4 per thousand women aged 15–19 in state j (i.e., the lagged value of the annualized adolescent pre-abortion rate). Note that, in this case, state j is based on the health facility location where the woman attends the second consultation—that is, the counseling consultation (while $Abortion_{jt-1}$ is based on the location where the woman attends the third consultation). Because there is a mandatory five-day waiting period between the second and the third consultation, it is more likely that a woman will attend the second consultation in her place of residence and then travel to another city to attend the third consultation.

4. Results

4.1. Difference-in-differences estimates

The first step for employing the difference-in-differences method is to classify the states into two groups. Figure 3 distinguishes responsive (treatment) and unresponsive (control) states.

Figure 3. Treatment and control groups of states



Notes: we used the median to obtain two groups of similar size –based on the average of post-reform legal abortion rates from women aged 20-44- and classified states by whether they are responsive or unresponsive to the abortion law reform.

Table 2 shows the means of adolescent fertility rates and those of the state socioeconomic and demographic variables for each group of states. It also gives the difference between the two groups in the pre-reform period. As can be seen, states differ significantly in many dimensions. In general, adolescent fertility rates, the number of physicians per inhabitant, and the youth unemployment rate are higher for the states in the treatment group, which also have a larger population. Treatment states also present a lower number of secondary schools per inhabitant, and women attend prenatal visits later, on average, than the control group. These pre-existing differences indicate the importance of controlling for these state characteristics for unbiased estimations.

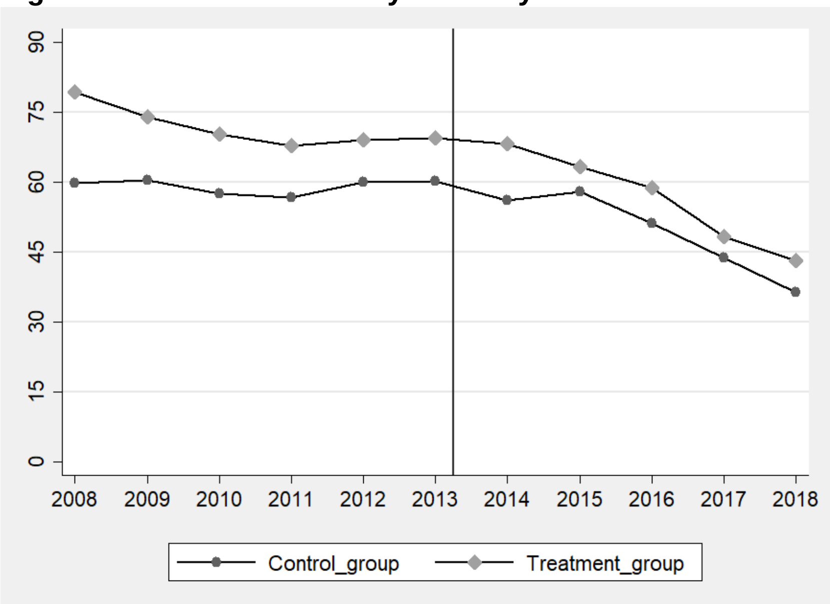
Table 2. Differences in means, Treatment and control group. Pre-reform period.

Variables	Treat (i)	Control (ii)	Diff. (ii)-(i)	t	p-value
Teenage (15-19) fertility rate (‰), annualized	70.66	61.30	-9.36	-8.09	0.00
Number of physicians per 10,000 inhabitants	24.49	21.60	-2.89	-2.62	0.01
Number of nurses per 10,000 inhabitants	8.15	8.20	0.05	0.13	0.89
Number of public secondary schools per 10,000 inhabitants	1.23	1.33	0.10	3.10	0.00
Unemployment rate (%), 15-24 years old	22.35	21.19	-1.16	-1.72	0.09
State share of total population (%)	6.41	3.98	-2.43	-3.25	0.00
Beginning prenatal care among live births to teen mothers (average weeks pregnant)	15.23	14.54	-0.69	-5.13	0.00
Observations	290	261			

Notes: The table reports simple state-level averages for quarters in the sample before the reform (2006 to 1st quarter 2013) for treatment (column 1) and control group (column 2), and tests on the equality of means between both groups (columns 3 to 5).

Figure 4 presents the adolescent fertility rates for responsive and unresponsive states conditional on state-average socioeconomic and demographic variables and contraceptive implants. Adolescent fertility levels are lower for the unresponsive group of states than for the responsive states. Despite the difference in levels, both groups exhibit similar trends during the pre-reform period, and there is a reduction in the gap between the two groups after the law was passed.

Figure 4. Adolescent Fertility Rates by Treatment Status



Notes: The graph shows the predicted means trends for adolescent fertility rates for responsive (treatment group) and unresponsive states (control group) using OLS regressions by year conditional on state-average socioeconomic and demographic controls and a measure of contraceptive implants. Covariates: a dummy variable indicating for each state the implants program start, the youth unemployment rate, number of secondary schools per 10,000 inhabitants, number of physicians and nurses per 10,000 inhabitants, state share of the total population, and average weeks pregnant when beginning prenatal care among live births to teen mothers.

Data presented in Figure 4 suggest that those states responsive to the abortion law reform performed better in reducing adolescent fertility. The econometric estimates of this effect are reported in Table 3: the first column displays coefficient α_1 from equation (1); column 2 presents coefficients β_1 and β_2 from equation (2); and column 3 presents γ_1 and γ_2 from equation (3). The last row in Table 3 reports the simple state-level average of adolescent fertility rates for the period before the implementation of the abortion reform (2006 to first quarter 2013).

The treatment effect in column 1 represents the effect of abortion legalization on fertility among teenagers conditional on state fixed effects, time dummies, and the set of state-specific time-varying controls listed above. The result indicates a statistically significant decrease in adolescent fertility rates for the group in states responsive to the abortion reform relative to the unresponsive group of around −2.8 births per thousand women aged 15–19.

Columns 2 and 3 also account for two alternative measures for the contraceptive implant program 9 months earlier. We observe that accounting for this program produces a qualitatively similar set of results. The coefficients for abortion reform remain negative, statistically significant, and quite similar to those reported in column 1, although smaller. To sum up, the abortion reform has had a negative impact on adolescent births rates by 2.5 to 2.8 births per thousand adolescents aged 15–19. In terms of the pre-intervention average, this effect represents a 4% decrease in the adolescent fertility rate.

We also considered the coefficients for contraceptive implant measures. In column 2, the dummy variable indicating the program launch for each state, significant at the 10% level, shows a reduction of 1.5 births per thousand women aged 15–19. In column 3, we include the share of women aged 15–29 using implants instead of the dummy variable, the coefficient results significant at the 1% level, implying that an increase of one percentage point in the implant use rate reduces by about 0.13 the number of births per thousand girls (aged 15–19) 9 months later.

Table 3. Effect of abortion legalization and the contraceptive implant program on fertility rates among women aged 15–19

	(1)	(2)	(3)
Responsive x Post	-2.796*	-2.654*	-2.495*
	(1.441)	(1.428)	(1.404)
Subdermal Implants *(t-9m)*		-1.544*	-0.126***
		(0.865)	(0.030)
Dependent variable mean	66.2	66.2	66.2
Observations	988	988	988
State Fixed Effects	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Subdermal Implants *(t-9m)*		Program start (dummy)	Women 15-29 using implants (%)

Notes: The results are from estimating equations (1) to (3) in columns 1 to 3 respectively. The table displays the coefficients of the interaction term $Responsive_j *Post_t$. In columns 2 and 3, the table also displays the coefficients of the variables for $Implants_{jt-k}$ lagged by 9 months: a dummy variable indicating for each state the program start (column 2) and a proxy for the percentage of women aged 15–29 using implants (column 3). Covariates: the youth unemployment rate, number of secondary schools per 10,000 inhabitants, number of physicians and nurses per 10,000 inhabitants, state share of the total population, and average weeks pregnant when beginning prenatal care among live births to teen mothers. The reported mean for the dependent variable corresponds to the pre-reform period (2006 to 1st quarter 2013). Driscoll–Kraay standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

4.2. Regression of fertility rates on lagged legal abortion rates for teenagers

Table 4 reports the estimations of equations (4) to (6). The first column displays coefficient δ_1 in equation (4); column 2 presents coefficients τ_1 and τ_2 in equation (5); and column 3 presents π_1 and π_2 from equation (6). Each panel shows the estimated coefficients of the variable $Abortion_{jt-l}$ with $l=5$, $l=6$, and $l=7$ months in panels A, B, and C, respectively.

Column 1 represents the effect of a one-point increase in the legal abortion rate on fertility among adolescents, controlling for the state fixed effect, time dummies, and the set of covariates listed before. We find that a one-point increase in the adolescent legal abortion rate reduces—5, 6, and 7 months later—the number of births per thousand girls aged 15–19 by about 0.18 to 0.24.

Columns 2 and 3 also account for two alternative measures for the contraceptive implant program 9 months earlier. Again we observe that accounting for this program produces a qualitatively similar set of results. The coefficients for abortion remain negative, statistically significant, and roughly equal to those reported in column 1.

We also considered the coefficients for implants contraceptive measures. In column 2, the dummy variable indicating the program launch for each state, significant at the 10% level (except for panel C, which reports a statistically insignificant coefficient for implants), ranges from −1.7 to −1.6. In column 3, we include the share of women aged 15–29 using implants instead of the dummy variable, and the coefficients are significant at the 1% level, implying that an increase of one percentage point in the implant use rate reduces 9 months later the number of births per thousand girls aged 15–19 by about 0.13.

Table 4. Effects of abortion legalization and the contraceptive implant program on fertility rates among women aged 15–19

	(1)	(2)	(3)
Panel A			
Abortion Rate *(t-5m)*	-0.239***	-0.234***	-0.238***
	(0.083)	(0.083)	(0.083)
Subdermal Implants *(t-9m)*		-1.704*	-0.133***
		(0.948)	(0.029)
Panel B			
Abortion Rate *(t-6m)*	-0.178*	-0.171*	-0.174*
	(0.090)	(0.090)	(0.089)
Subdermal Implants *(t-9m)*		-1.669*	-0.131***
		(0.957)	(0.029)
Panel C			
Abortion Rate *(t-7m)*	-0.198**	-0.190*	-0.192**
	(0.098)	(0.098)	(0.095)
Subdermal Implants *(t-9m)*		-1.589	-0.131***
		(0.993)	(0.029)
Observations	988	988	988
State Fixed Effects	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Subdermal Implants *(t-9m)*		Programme start (dummy)	Women 15-29 using implants (%)

Notes: The results are from estimating equations (4) to (6) in columns 1 to 3 respectively. The table displays the coefficients of the variable $Abortion_{jt-l}$ (the lagged value of the annualized adolescent legal abortion rate) for *l=5, 6* and *7* months in panels A, B and C, respectively. In columns 2–3, the table also displays the coefficients of the variables for $Implants_{jt-k}$ lagged by 9 months: a dummy variable indicating for each state the program start (column 2) and a proxy for the percentage of women aged 15–29 using implants (column 3). Covariates: the youth unemployment rate, number of secondary schools per 10,000 inhabitants, number of physicians and nurses per 10,000 inhabitants, state share of the total population, and average weeks pregnant when beginning prenatal care among live births to teen mothers. Driscoll–Kraay standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

As discussed in section 3.2, we used the state legal abortion rates of adolescents, which are based on the health facility location where the women attend the third consultation to terminate their pregnancy, but we do not have information about their state of residence. We re-estimate equations (4) to (6) using the number of pre-abortion consultations (i.e., the second counseling consultation with the three-professional board) per thousand women aged 15–19 as a proxy for women's place of residence. Table 5 reports the estimations of equations (4') to (6').

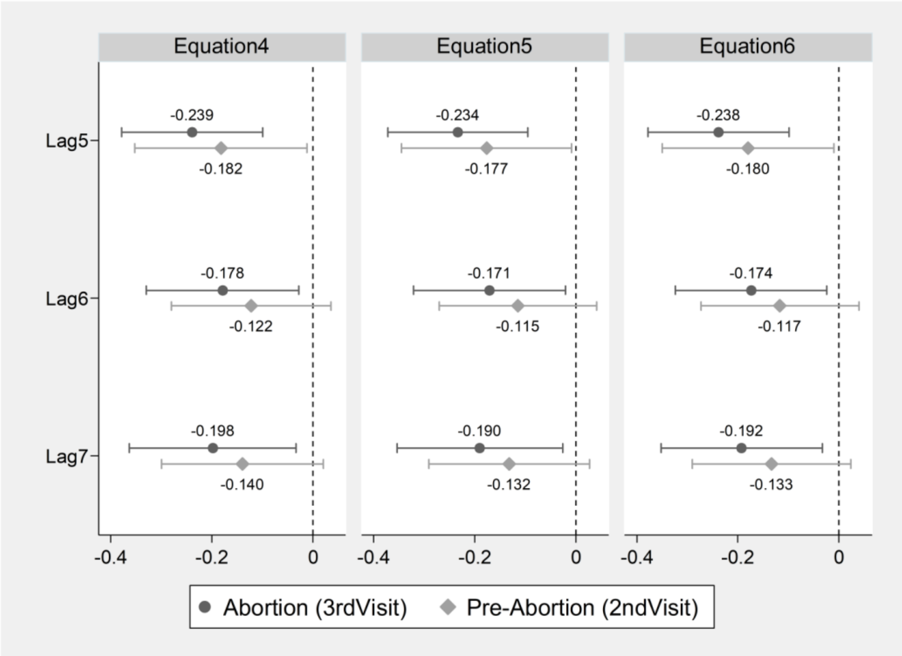
Table 5. Robustness check

	(1)	(2)	(3)
Panel A			
Pre-abortion visit rate (*t-5m*)	-0.182*	-0.177*	-0.180*
	(0.102)	(0.101)	(0.101)
Subdermal Implants (t-9m)		-1.727*	-0.132***
		(0.962)	(0.029)
Panel B			
Pre-abortion visit rate (*t-6m*)	-0.122	-0.115	-0.117
	(0.094)	(0.093)	(0.093)
Subdermal Implants (t-9m)		-1.750*	-0.132***
		(0.947)	(0.029)
Panel C			
Pre-abortion visit rate (*t-7m*)	-0.140	-0.132	-0.133
	(0.096)	(0.095)	(0.094)
Subdermal Implants (t-9m)		-1.671*	-0.131***
		(0.990)	(0.028)
Observations	988	988	988
State Fixed Effects	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Subdermal Implants (t-9m)		Programme start (dummy)	Women 15-29 using implants (%)

Notes: The table replicates the results from Table 4, replacing the variable $Abortion_{jt-l}$ (the lagged value of the annualized adolescent legal abortion rate) with $\textit{Pre-AbortionVisit}_{jt-l}$ (the lagged value of the annualized number of pre-abortion counseling consultations per 1,000 women aged 15–19). Covariates: the youth unemployment rate, number of secondary schools per 10,000 inhabitants, number of physicians and nurses per 10,000 inhabitants, state share of the total population, and average weeks pregnant when beginning prenatal care among live births to teen mothers. Driscoll–Kraay standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

The results in Table 5 are similar to those in Table 4, although the coefficients are less significant and smaller. However, it is worth mentioning that these differences are not statistically significant. Figure 5 shows the estimated coefficients accompanied by a 90% confidence interval. The overlapping of confidence intervals in all cases indicates that the coefficients for the legal abortion rates (Table 4) are not statistically different from the coefficients for the pre-abortion visits for mandatory counseling prior to abortion (Table 5). This addresses the concern that regional mobility across states might bias our main results.

Figure 5. Comparison of estimated effects



Notes: This figure compares estimated coefficients from Table 4 (Legal Abortion rates, corresponding to the third consultation when the woman attends to terminate her pregnancy) and Table 5 (Pre-Abortion visit rate, corresponding to the second consultation for mandatory counseling previous to abortion). Each point on the figure indicates the estimated coefficients accompanied by a 90% confidence interval.

4.3. Discussion

Our findings indicate that abortion legalization helped reduce adolescent fertility in Uruguay. The results are in line with those of Bailey and Lindo (2018), González et al. (2018), Mølland (2016), Pop-Eleches (2010 and 2006), and Valente (2014), who provide evidence for the US, Spain, Norway, Romania, and Nepal, respectively. These articles show that legal changes that improve access to abortion affect fertility and that the effects are more substantial among adolescents and poorer women. Because there are few places in Latin America where abortion is broadly legal, the literature is very scarce. Research for Mexico City by Clarke and Mühlrad (2016) and Gutiérrez-Vázquez and Parrado (2016) is noteworthy. Both found reductions in fertility levels, and particularly in adolescent fertility, following the expansion of access to legal abortion.[17]

In the case of Uruguay, the seminal study by Antón et al. (2018) found no significant effects among adolescent girls. The differing evidence with our results may be due to

[17] Gutiérrez-Vázquez and Parrado (2016) split the analysis of adolescent fertility into two age groups, 14–17 and 18–19, finding significant effects only for the older group.

differences in (a) period analyzed, (b) geographical scope, and (c) data sources. First, the research by Antón et al. (2018) was very close to the reform—that is, they estimated the early effects (only considering the first two years after the law came into force). Second, they only used data for Montevideo, where pre-and post-abortion care provided in the main public maternity hospital was already operating in practice: "*The females attending this public health center, mostly with a low socioeconomic status, would have had better access to abortion than women treated at other hospitals"* (Antón et al., 2018, p. 14). Third, they used data from the Perinatal Information System (SIP, in its Spanish acronym) about the planned or unplanned nature of live births. This entails a potential problem with the filling out of medical records, because adolescent pregnancies are most often assumed to be unplanned. These reasons help to explain why the study by Antón et al. (2018) found statistically null effects for abortion legalization on adolescent fertility.

Using official data up to 2018 for the whole country, our study shows that the decriminalization of abortion in Uruguay contributed to a decline in adolescent fertility. However, different considerations need to be taken into account when interpreting our results. Among them, the importance of clandestine abortions before and after the liberalization of abortion stands out.

Before the reform, very few legal abortions were practiced, but clandestine abortion was common. According to Sanseviero et al. (2003), abortions reached 38.5 per thousand women aged 15–49 in Uruguay by 1999–2001. Hence, some of the legal abortions provided after the reform simply replaced illegal ones. This may reduce unsafe abortion-related morbidity and mortality and improve the quality of abortion records but has no direct effects on fertility rates. However, it may impact fertility, because the new law includes the supply of a contraceptive method 10 days after abortion from legal services during the post-abortion consultation (according to Ministry of Health data, 50% of women received contraception after termination).

Legal abortions are not necessarily a substitute for illegal ones, and attitudes more prone toward abortion, for example, may change in response to more liberal policy contexts. The law provided a free, legal, and safe alternative for women who cannot afford or do not want to undergo a clandestine abortion, risking their lives in unsafe settings to terminate an unwanted pregnancy. Our estimates capture both effects on adolescent fertility together—that is, the improved access to contraceptives through the replacement effect of illegal abortions and the more direct fertility effects due to changes in overall abortion levels.

Another consideration is that women may still abort outside of the formal sector after the reform (as pointed out by MYSU, 2017). Our results may be biased if the number of illegal terminations is large, in particular, if clandestine and legal abortion rates are positively (negatively) related to each other, the estimated effects are likely to be biased upward (downward). It is most likely that clandestine abortions are negatively correlated with legal abortions, as states in which women face greater barriers to legal abortions foster the black market for misoprostol. Therefore, our estimates can be considered as a lower bound of the impact of abortion reform.

In line with our results, we expected a reduction in unwanted pregnancies. However, the latest available SIP data show that the share of unplanned pregnancies in adolescents' births remains stable despite the possibility of interrupting unwanted or mistimed pregnancies and the supply of free implants. We can envision at least two explanations for this paradoxical finding: (a) problems with the filling out of medical records because adolescent pregnancies are most often assumed to be unplanned; and (b) the gestational limit of 12 weeks rules out those women who recognize pregnancy later, which is common in adolescence because of psychological mechanisms of denial, difficulties in assessing future consequences, and poor sexual education (see for Uruguay Ituarte and López-Gómez, 2021; and for Mexico see Saavedra-Avendano et al., 2018).

Finally, it is important to note that abortion reform implementation met with challenges. The law requires a physician specializing in gynecology. Because most abortions are drug-induced (non-surgical), a general physician could give the prescription for misoprostol, as is the case in other countries where abortion is permitted (MYSU, 2017). One study in Mexico even shows that nurses can also provide medical abortions successfully (Díaz Olavarrieta et al., 2015). This evidence suggests that it is possible to reconcile the gynecologists' rights to exercise their conscientious objection with women's rights to have access to legal abortion services, for instance by allowing general physicians and nurses to provide medical abortions. In fact, in the case of the implant program, one of the keys to its success was that family physicians and nurse-midwives were trained in the insertion and removal of these devices, so implants were available at the primary health care level. It is worth mentioning that all reproductive-health-related tasks were solely reserved for gynecologists in the past.

5. Final remarks

This paper estimated the causal effect of abortion legalization on adolescent fertility in Uruguay, using official data on legal abortions provided after the 2012 reform. First, we employed a difference-in-differences strategy. We classified states by whether they are responsive or unresponsive to the abortion law reform using the median to obtain two groups of similar size based on the average of post-reform legal abortion rates from women aged 20–44. The results suggest that abortion reform had a negative impact on the adolescent births rates by 2.5 to 2.8 births per thousand adolescents aged 15–19. In terms of the pre-intervention average, this effect represents a 4% decrease in the adolescent fertility rate.

Then, we exploited variation in reform implementation intensity, through the estimation of fixed-effect linear regression models, regressing adolescent fertility rates on lagged legal abortion rates for the same age group. For every one-unit increase in the adolescent legal abortion rate, we estimated a reduction ranging from 0.17 to 0.24 births per 1,000 adolescents aged 15–19 years old. Because the legal abortion rate per thousand women aged 15–19 rose from zero to 11 between 2011 and 2018, our results mean a decrease of about 2.2 births per thousand girls over the whole reform period, which is quite consistent with our difference-in-differences estimates.

All models take into account the health program supporting contraceptive implants. Our estimated abortion reform effects are robust to the inclusion of measures of contraceptive implant availability. We also found that the implant program has had negative and significant effects on adolescent fertility, in line with Ceni et al. (2021).

Finally, we also examined the robustness of our findings to an alternative indicator of the reform, because our measure of abortion was based on the health facility location the woman attends to terminate her pregnancy (third consultation), but we do not have information about her state of residence. We used pre-abortion or counseling consultation (because it is more likely that a woman will attend the second consultation in her place of residence). We found similar results, addressing concerns about regional mobility across states which might have biased our estimates.

We found that abortion legalization in Uruguay caused a statistically significant reduction in birth rates for adolescent women, but it accounts for only a small proportion of the sharp decline experienced by adolescent fertility rates in recent years.

The contribution of our paper is twofold: (a) it provides rigorous evidence of the effects of abortion legalization in Uruguay exploiting official data and (b) it controls for the concurring program of contraceptive implants.

Abortion reform placed Uruguay at the forefront of the region in terms of women's rights. In addition to helping, as expected, to decrease the number of avoidable deaths and complications among women, we found that abortion legalization had unexpected positive impacts and helped to reduce adolescent fertility.

As mentioned above, Latin America and the Caribbean countries have high rates of adolescent fertility, unintended pregnancy, and an unmet need for modern contraception. The lessons from the Uruguayan case—namely, that the provision of safe abortion services coupled with expanded access to high-quality contraception may be a useful tool to tackle adolescent fertility—are relevant to many countries in the region.

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Appendix. Conscientious objection

Conscientious objection has been identified as an important barrier to abortion access in many countries where abortion is legally permitted under broad criteria. The situation in Latin America and the Caribbean is worrying, where nearly every country has highly restrictive abortion laws (Remez et al., 2020; Singh et al., 2018).[18] Even where abortion has been decriminalized, conscientious objection is one of the strongest barriers to its implementation (for Mexico City, see Ortiz-Millán, 2018). In Uruguay, this issue was identified as the main barrier to access to legal abortion.

There is no complete information at the state level about the evolution of conscientious objectors. The little official information available shows that, in the first year after the reform (2013), 30% of Uruguayan gynecologists declared themselves to be objectors. This rose to 40% in September 2015 (data provided by the Ministry of Health).

Data collected by the nongovernmental organization "Women and Health Uruguay" (*MYSU* in its Spanish acronym) regarding conscientious objectors show a large disparity and alarming figures in some states. So far, MYSU has collected data at different points in time in about 10 of the 19 states, covering 64% of the national population. Figure 6 shows the distribution of conscientious objectors across the country.

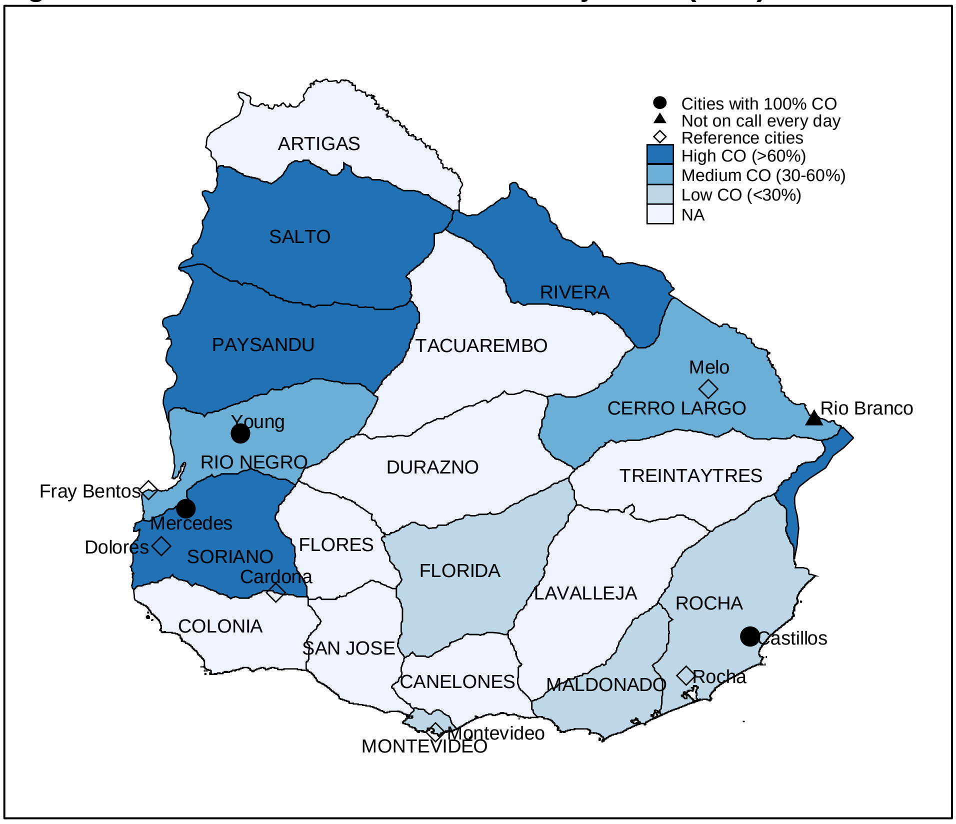
After legalization, all 12 gynecologists residing in the state of Salto claimed conscientious objection, leaving women in Salto without access to abortion services until September 2013, when the Ministry of Health began to send a non-objecting gynecologist for the third consultation once a week (the ratio of objectors was reduced to 92%). Currently, 80% of gynecologists are conscientious objectors in Salto. There are also worrying figures in the states of Paysandú (87%); Soriano (82%, rising to 100% in the principal town, Mercedes); Rivera (above 60%),; Río Negro (43%, rising to 100% in the second most important city, Young); and Cerro Largo (30%–60%, but in Río Branco city the only non-objecting gynecologist is not on call every day of the month). In the state of Rocha, the ratio of objectors is below 30%, but it rises to 100% in the third most important city, Castillos. Finally, in the states of Montevideo (the

[18] López-Gómez (2015) provides a literature review on attitudes toward abortion and conscientious objection among health professionals in several Latin American countries: Brazil, Mexico, Argentina, Paraguay, Jamaica, and Uruguay. See Fink et al. (2016) for Colombia and Casas et al. (2020) for Chile.

country's capital), Maldonado, and Florida, fewer than 30% of gynecologists declare conscientious objection (MYSU, 2014, 2015, 2016a, 2016b, 2017).

In those cities or towns where 100% of gynecologists invoke conscientious objection, women must be referred to other cities of the country for treatment. From the city of Young, they are referred to Fray Bentos (the state capital, about 100 km away); from Mercedes to other cities in the state, such as Dolores or Cardona (39 km and 96 km away, respectively) and also to Fray Bentos (at 35 km); and from Castillos to the city of Rocha (the state capital, 57 km away). On those days when the gynecologist is not available or on call in the city of Río Branco, women are referred to Melo (the state capital, 80 km away). In all cases, when the services are overcrowded, women are referred to the Pereira Rossell Hospital in Montevideo. Their travel costs must be covered by the institution that failed to provide the service, although this does not always occur (MYSU, 2014, 2015, 2016a, 2016b, 2017).

Figure 6. Distribution of conscientious objectors (COs) across the country



Note: So far, MYSU has collected data at different points in time in about 10 of the 19 states, covering 64% of the national population.
Source: Own elaboration based on MYSU (2014, 2015, 2016a, 2016b, 2017).

In addition to the state-level variation, there is also significant variation over time. Law 18987 on Voluntary Termination of Pregnancy recognizes health professionals' right to refrain from performing abortions. However, the detailed rules on the procedures to be followed when seeking recognition as a conscientious objector have faced stiff resistance and have even been changed several times. Figure 7 summarizes the legislation changes.

Regulatory Decree 375/012 established that gynecologists must inform the authorities of all health facilities in which they work of their conscientious objection in writing and that it applies only to the third of the four consultations required. This means that gynecologists with a pro-life stance may assist women before and after pregnancy termination, placing them in a vulnerable situation. This is of particular concern during the counseling consultation (López-Gómez and Couto, 2017).

In June 2013, the pro-life movement organized a non-binding referendum, but the threshold required for repealing Law 18987 on Voluntary Termination of Pregnancy was not reached. One month after the failure of this referendum, a group of 20 gynecologists[19] (including two of the three titular professors of gynecology at the main public university) submitted a request for partial annulment of the regulatory decree to the administrative court (*TCA* to use its Spanish acronym). Their main argument was that the decree impeded the exercising of the right of conscientious objection enshrined in Law 18987 and in the National Constitution.[20]

In August 2014, those articles in the regulatory decree regarding conscientious objection were suspended by the TCA until a final decision was made. Health professionals were released from caring for women before and after abortion. The requirement to provide written notification of conscientious objection was also suspended. In August 2015, the TCA's final decision extended the right of conscientious objection to paraclinical and administrative staff, who were not previously included. It also extended the right to pre- and post-abortion consultations. However, the obligation to report conscience-based refusal to provide abortions in writing was reinstated.

[19] Our empirical analysis could benefit from information on this group of gynecologists, particularly their place of residence. Unfortunately, we do not have such information.

[20] It is important in this matter to draw a distinction between conscientious objection and civil disobedience: *"Conscientious objection (…) is an individual act that does not aim to change the law, and neither does it seek for others to revise their decision. It is different from civil disobedience since it consists of a group of people who state they do not want to observe a legal provision, it aims to abolish it and to exert a group pressure on the government"* (Mautone and Rodríguez-Almada, 2013).

In April 2016, the Ministry of Health passed two new ordinances introducing further changes. Those ministerial ordinances guarantee the confidentiality of the names of conscientious objectors. In addition, they require that, during the second of the four consultations, the three members of the board must provide information in one single meeting. In other words, the legal abortion services need to coordinate the schedules of a non-objecting gynecologist, a social worker, and a psychologist. This presents great difficulty in those cities or towns that are facing a shortage of professionals.

In sum, the scant information available suggests that the share of Uruguayan gynecologists claiming conscientious objection is substantial enough to be a meaningful barrier to safe, legal abortion access in many states. This problem was exacerbated during those periods marked by the administrative court (TCA) decisions, when the use of conscientious objection was subject to lax or less strict criteria.

Figure 7. Legislation changes