Abortion Laws and Women's Health*

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Abstract

We examine the impact of progressive and regressive abortion legislation on women's health in Mexico. Following a 2007 reform in the Federal District of Mexico which decriminalised and subsidised early-term elective abortion, multiple other Mexican states increased sanctions on illegal abortion. We observe that the original legalisation resulted in a sharp decline in maternal morbidity, particularly morbidity due to haemorrhage early in pregnancy. We observe small or null impacts on women's health from increasing sanctions on illegal abortion. These results quantify the considerable improvements in non-mortal health outcomes flowing from legal access to abortion.

JEL Codes: I18; J13; K38; H75.

Keywords: Abortion; Maternal Morbidity; Maternal Mortality; Health Care Provision; Political Economy; Legislative Reform.

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1 Introduction

Appeals to women's health are frequently made when debating the merits of abortion legislation. These calls are made by both advocates of legal abortion, as well as those advocating for abortion to become, or remain, illegal. The arguments backing up such claims are drawn from a range of sources, which are often correlational or based on small or non-representative samples of women.[1]

In this study, we present the first population-level evidence of the impact of sub-national variation in abortion laws on maternal *morbidity*, as well as mortality, using the universe of administrative health records from Mexico.[2] We focus on a period in which considerable within-country reform of abortion policy was undertaken, with both a sweeping legalisation in the Federal District of the country (Mexico DF), and increasing sanctions on (already illegal) abortion in other regions. In this context, we are able to determine to what extent change in abortion laws, absent other major contraceptive revolutions, impact health indicators for the population of affected women. We combine the state-level variation over time resulting from legislative changes in abortion law with high-quality vital-statistics data recording over 30 million births, 18.4 thousand maternal deaths and 46 million inpatient cases for causes related to maternal health. To seek to understand the observed impact of abortion laws on health outcomes, we also take advantage of rich administrative and survey data to identify the reform's wider impact on birth rates, judicial sentencing, and on sexual behaviour, and explore potential channels of health impacts, including improvements in the quality of abortion care, and changes in the composition of women giving birth.

The environment under study provides a unique opportunity to examine simultaneous expansions and contractions of abortion policies.[3] While much of the existing literature on the impact of

[1] The use of such arguments even when based on weak evidence is not isolated to non-governmental organisations. Similar arguments are also made by politicians. One such example is a fact sheet published on the US National Cancer Institute website by the Bush administration positing an (unfounded) link between abortion and breast cancer (Special Investigations Division, Committee of Government Reform, House of Representatives, 2003).

[2] Associations between abortion legalization and maternal mortality or morbidity have been documented in the medical and public health literature for multiple countries (Benson et al., 2011) including Albania (Sahatci, 1993), Bangladesh (Chowdhury et al., 2007), Nepal (Henderson et al., 2013), Romania (Serbanescu et al., 1995; Stephenson et al., 1992), Singapore (Singh and Ratnam, 2015) and South Africa (Rees et al., 1997). Existing studies are mainly based on reviews of medical charts at selected hospitals, for example in the US (Goldstein and Stewart, 1972; Stewart and Goldstein, 1971; Seward et al., 1973; Kahan et al., 1975), Guyana (Nunes and Delph, 1997), Nepal (Henderson et al., 2013) and South Africa (Mbele et al., 2006; Jewkes et al., 2002). We are aware of no prior studies which are based on population-level data, and based on within-country variation in abortion reforms.

[3] As we discuss at more length in Sections 2.2-2.3 of this paper, the change due to the initial legalisation of abortion in Mexico DF was considerably larger than subsequent legislative tightenings in other Mexican states. In the case

abortion—and contraceptive policies more generally—focuses on expansions in access, there are a number of papers which focus on contractions in policies. These include historical restrictions in Romania (Pop-Eleches, 2010), the impact of parental consent or notification laws targeted at adolescents in the U.S. (Bitler and Zavodny, 2001; Joyce and Kaestner, 1996), and a recent hollowing out in the availability of providers due to state-specific legislation in the U.S. (Fischer et al., 2018; Lindo et al., 2019). However, the legalisation of abortion in Mexico DF, and the resulting spate of constitutional changes increasing the harshness of sentencing of illegal abortion, provides the opportunity to examine the impact of a contemporaneous series of restrictive and permissive abortion policies in a single country and time.

Reproductive health rights have been documented to be of considerable economic significance. This fact has been emphasized by a growing body of economic literature which has—empirically and theoretically—demonstrated how access to elective abortion and contraceptive methods has shaped fertility patterns, marital markets, crime, education, the labor market and female empowerment (e.g. Ananat et al. (2007); Bailey and Lindo (2017); Chiappori and Oreffice (2008); Guldi (2008); Mitrut and Wolff (2011); Myers (2017); Pop-Eleches (2010)). The impact of abortion laws on women's health has received less attention, and the causal relationship is yet to be established. To the best of our knowledge, this is the first study to provide well-identified population-level evidence of the impact of abortion legalisation on maternal morbidity and mortality based on within-country variation in abortion availability. While an association between abortion legalization and lower abortion-related complications has been documented in previous studies, comprehensively capturing the impact of the passage of abortion law on abortion-related morbidity is a considerable challenge, especially in clandestine settings, where under-reporting may occur (Singh et al., 2010).[4]

Using two-way fixed effect (FE) models and panel event study methods (and synthetic controls as a robustness check), as well as recent advances in a literature examining causal estimation with time varying policy reform (Rambachan and Roth, 2019; Goodman-Bacon, 2018), we observe consistent evidence to suggest the Mexico DF's abortion legalization brought about a sharp reduction in fertility

of the constitutional changes issued by states, in each case abortion was already illegal, and any changes owe to an increased threat of prosecution or sanction. Using the universe of legal decisions in the country, we do document evidence suggesting that these reforms increase the average length of sentences handed down to women.

[4]Maternal mortality is considered the "tip of the iceberg", where the mass consists of maternal morbidity (Loudon, 1992). In many settings, analyses of the impact of abortion on population health focuses only on maternal mortality due to a lack of universal health records measuring maternal morbidity.

(by 8%), haemorrhage early in pregnancy (by 35%) and abortion related morbidity (by 20%). Event study estimates examining increases in sanctions on (already illegal) abortion point to much smaller effects on these variables, which are generally not statistically significant. In general, we observe impacts on maternal *mortality* which are hard to consistently sign, given that they are considerably less precise, suggesting that when only examining impacts of abortion law on maternal mortality, analyses fail to account for the full weight of abortion reform on women's health.

Previous studies on Mexico's abortion reform laws include legal and ethical overviews (Johnson, 2013; Madrazo, 2009), qualitative studies on abortion provision (Contreras et al., 2011; Schiavon et al., 2010), quantitative studies on abortion services and patient characteristics using data from selected hospitals or surveys (Mondragón y Kalb et al., 2011; Becker et al., 2013), and fertility trends using vital statistics (Gutierrez-Vazquez and Parrado, 2015).[5] This paper contributes to previous studies by examining the causal impacts of abortion legalization, as well as regressive law changes, on women's health and well-being using the full power of vital statistics data including administrative microdata on births, maternal morbidity, maternal mortality and judicial statistics on penal matters. In addition, we examine heterogeneous effects of the reform as well as potential mechanisms such as usage and knowledge of contraceptive methods.

There is a large unmet need for family planning in low- and middle-income countries (Sully et al., 2019). Yet, the evidence on the impacts of reproductive health rights including safe and legal abortions in these settings, especially building on microdata, is very scarce. In light of this, our study provides strong evidence that abortion legalization in an emerging economy leads to rapid and discernible changes in political behavior, aggregate fertility rates, and (significant improvements in) maternal health. These results provide a number of important policy lessons for jurisdictions considering changes in abortion laws.

[5] In examining the abortion reform and fertility outcomes, Gutierrez-Vazquez and Parrado (2015) use national vital statistics to examine the effect on fertility across ages. Due to the use of a limited amount of data and limitations inherent in the empirical design one cannot assign a causal interpretation to the results with confidence. More specifically, only three different years of data are used (1990, 2000 and 2010). In a study by Koch et al. (2015), maternal mortality is found to increase in areas with more liberal abortion laws. Koch et al. (2015) however, has received strong criticism for highly misleading and inaccurate data selection (Darney et al., 2017).

2 Background

2.1 Unsafe Abortions and Maternal Mortality in Mexico

Globally, maternal mortality has declined from 385 maternal deaths per 100,000 live births in 1990 to 211 deaths per 100,000 live births in 2017. The overwhelming majority of these deaths occurred in low income countries. During the same period in Mexico, there has been a similar decline in maternal mortality from 88 to 33 deaths per 100,000 live births (Rodríguez-Aguilar, 2018; Bongaarts, 2016). However, Mexico has still not achieved its 2015 Millennium Development Goal, of a ratio below 22 deaths per 100,000 live births. In Mexico, the highest prevalence of maternal mortality is found in metropolitan areas and among women aged 20-34. Rates of maternal mortality is especially high in socially vulnerable populations across Mexico. Areas with the highest rates of maternal mortality exhibit some of the lowest levels of government expenditure on maternal health (Pérez-Pérez et al., 2019).

Abortion-related mortality represents a substantial proportion of all maternal deaths in Mexico, accounting for 7.2 % of all maternal deaths during 2000-2008 (Schiavon et al., 2012a). While there has been a downward trend in maternal mortality in Mexico between 1990-2008, maternal mortality attributed to abortion-related causes has not exhibited similar declines during this period. The majority of these deaths occur in women without health insurance (Schiavon et al., 2012a).

The rate of abortion-related mortality varies substantially across regions of Mexico. The highest rates can be found in some of the poorest states, such as Guerrero and Chiapas with as many deaths as 140 and 90 per 100,000 hospitalizations. This can be compared to Baja California Sur with only 9 deaths per 100 000 hospitalization. Yet, high rates of abortion-related mortality are not exclusively observed in poor states across Mexico. In Mexico City, for example, the abortion-related mortality rate was 38 per 100,000 hospitalizations during 2000-2008.

Unsafe abortion procedures account for most abortion-related mortality (Schiavon et al., 2012a). Rates of unsafe abortion are particularly high in the Latin America and Caribbean region with an estimated 4.2 million unsafe induced abortions being performed each year (World Health Organization, 2011). This region also exhibits some of the world's most conservative laws on abortion (United Nations, 2014). However, restrictive laws on abortion do not translate to lower rates of induced abortion but are instead associated with higher rates of unsafe abortion and correspond-

ing higher rates of abortion-related morbidity and mortality compared to settings with more liberal access policies (Guttmacher Institute, 2012).

Indeed, the rate of induced abortion in Mexico is considered high internationally (Becker, 2013). Despite high rates of contraceptive use, the estimated rate of induced abortions increased from 1990, with 25 abortions per 1,000 fertile-aged women, to 2006, with 33 abortions per 1,000 women (Juarez et al., 2008). Many of these induced abortions are performed in clandestine and often unsafe settings (Guttmacher Institute, 2012). Medical records from public hospitals in Mexico show high rates of abortion-related complications, with an estimated 150,000 women treated for complications in 2006 alone (Juarez et al., 2008).

2.2 The 2007 legal interruption of pregnancy reform in Mexico DF

Since the 1970s, women's rights advocates in Mexico have been promoting women's health rights including access to safe abortions (Kulczycki, 2011). To address the issue of unsafe abortions as a preventable cause of maternal morbidity and its huge burden on public health system, a National Pro-choice Alliance in Mexico was established in 2000 to promote women's sexual and reproductive health rights. This movement was supported by a wide range of groups including health care professionals, women's rights groups and activists, politicians, academics and Catholics with pro-choice views (Johnson, 2013; Madrazo, 2009; Kulczycki, 2011; Blanco-Mancilla, 2011).[6]

With the support of the leftist PRD party, the legislative assembly of the Federal District of Mexico voted to legalize elective abortion (termed legal interruption of pregnancy, or ILE for its name in Spanish) on April 24, 2007 (Kulczycki, 2011). The ILE reform was signed into law the following day, and published in the official Gazette of the Federal District on April 26, 2007 (Ciudad de México, 2007).This immediately permitted women above the age of 18 to request an abortion at up to 12 weeks of gestation without restriction and free of charge. Access for minors requires parental or guardian consent. Under this law, induced abortion was made legal in both the public and private health care sectors (though requiring payment in private clinics).

[6]This alliance was successful in moving the women's health agenda rapidly forward in the historically conservative setting on Mexico City using a number of different strategies including the involvement of health care officials, hospitals and other health care providers, which was not only important for building support for the reform, but also to facilitate a smooth implementation of the abortion program. They were also successful in gaining a strong presence in the public media for promoting women's health rights (Kulczycki, 2011; Johnson, 2013).

Immediate implementation was made possible by collaboration between the Ministry of Health of Mexico DF, members of the health department and international NGOs, which had thoroughly designed a program for public provision of abortion services called the "the ILE program" and its implementation even before the law was passed (Singh et al., 2012a). As such, abortion services were made available via public clinics immediately after the law was passed in April 2007, although with lower capacity and efficiency compared to current conditions. Abortion services were also quickly available in the private health care sector (Blanco-Mancilla, 2011). Additionally, under this law sexual education in schools was improved, and post-abortion contraceptives were made freely available directly from the health clinics which provided abortions (Contreras et al., 2011). On August 29, 2008 the decision to pass the ILE law was ratified by the Supreme Court of Mexico, making Mexico DF, together with Cuba and Uruguay, the most liberal jurisdiction in terms of abortion legislation in the entire Latin American and Caribbean region (Fraser, 2015).

Any abortions conducted in publicly run clinics are provided free of charge to residents of Mexico DF. Women with residency outside Mexico DF can also access the public provision of abortion through the Ministry of Health in Mexico DF (MOH-DF) but are charged based on a sliding fee scale depending on the woman's socioeconomic background. In 2010, 74% of all women who received an abortion through the public health care sector were women living in Mexico DF, 24% were living in the state of Mexico (which shares a border with Mexico DF) and 2% were living in other states (Mondragón y Kalb et al., 2011). The age profile of women seeking abortions largely mirrors the age-profile of births, occurring at slightly greater rates among younger (under 25 years) and older (above 36 years) groups (Appendix Figure A1).

Records from public hospitals show that during the year of 2007, when the reform was implemented, more than 7,000 abortion procedures were performed at 14 selected MOH-DF clinics. Over the years, the MOH-DF abortion program expanded its services and became more efficient in meeting the high demand for elective abortion. The MOH-DF program offers both surgical and medical abortion procedures and is the main provider of medical abortion (Winikoff and Sheldon, 2012). The large shift from 25% of all abortion procedures being medical in 2007 to as much as 74% in 2011 have played a key part of meeting the demand and reducing complications and side-effects (Becker,

2013).[7] As of 2015, approximately 150,000 abortions were carried out at the MOH-DF clinics.[8] Information regarding the private provision of abortion services is limited due to a lack of supervision of the private market for legal abortion services (Becker, 2013). Despite the fact that safe abortion, at no or low cost, is provided by the public health system in Mexico DF, women do seek abortion services within the private sector. A descriptive study by Schiavon et al. (2012b) suggests that private abortion services are provided at high costs (157–505 US dollars) and quality of care is inferior to that in the public sector, given that the less safe and efficient "dilation and curettage" is used as the main method in the private sector (71%).

2.3 Regressive law changes following the ILE Reform

Almost immediately following Mexico DF's ILE reform, a number of states began a series of counter-legislations to change the respective sections of their constitutions or penal codes, defining the beginning of human life as occurring at conception. Often, these legal responses directly referenced Mexico DF's ILE reform.[9] Even in cases where they did not directly refer to the ILE reform, it seems highly likely that the reform was a defining factor. For example, in the 20 years prior to the ILE reform there had been only two constitutionally defined changes to the articles relating to abortion in the penal codes of all states of Mexico (Gamboa Montejano and Valdés Robledo, 2014), compared to 18 changes between June 21, 2008 and November 17, 2009. Importantly, these reforms resulted in constitutional changes which recognised life as beginning at conception, opening the door for potential homicide charges. In order to understand the precise nature of law changes, we conducted a side-by-side reading of penal codes from pre- and post-reform for each state undertaking an abortion reform. The nature of changes implied by the reform are documented in Appendix Table A1. As we display there, of the states undertaking a regressive reform, all but 6 formally altered their penal codes to change sanctions in the case of proven abortions, while the remaining 6 only altered their state constitution to recognise life as beginning at conception.

[7] Misoprostol alone was the main regimen for medical abortions in MOH-DF until 2011 when Mifepristone (combined with Misoprostol) was introduced, making the medical abortion procedures provided by the ILE program more efficient and safe.

[8] To put this in context, we note that the quantity of abortions per year (adjusted for population) is similar to the quantity in the United States. In 2010 for example, 16,945 abortions were provided by the ILE program. In 2010 Mexico DF had approximately 8.55 million inhabitants. Thus, adjusted to the US population in 2010 (308.7 million), this would imply 611,803 abortions. In reality, 765,651 abortions were reported in the US in 2010 (Pazol et al., 2014).

[9] For example, the constitutional decree issued by the state of Nayarit when changing their penal code explicitly refers to the changes in the penal and civil code of Mexico DF (Gobierno de Nayarit, 2009, p. 14).

In Appendix Figure A2, we display the geographical distribution of law changes (progressive, regressive or neutral) over the period under study. The only progressive reform refers to Mexico DF's ILE reform, while 18 states made regressive changes (ie legal tightenings) after the initial reform. We have compiled on a state-by-state basis the exact dates the reforms were passed into law, and these are displayed in Appendix Table A2. To the best of our knowledge, there exists no centralized record of the dates and laws which were altered in the post ILE era, and as such we compiled these from our reading of legal source documents. In Section 4 of this paper we return to how we use the geographic and temporal variation in the passage of laws in our identification strategy.

2.4 The Potential Channels for Impacts of Abortion Reform

Legislative reforms to abortion policies could potentially impact health though a number of channels. We lay these out conceptually below, without yet seeking to assess their relative importance or relevance in explaining observed outcomes. We then move on to assess the likelihood that particular channels can explain observed impacts of abortion reform on maternal health (in the context of this paper) in Section 5.3.

1. Unsafe abortions are shifted to safe legal conditions This channel is relevant for individuals who would abort when abortion is illegal, and also abort when abortion is legal. As discussed in Section 2.1 unsafe abortion is thought to be a significant determinant of maternal death and hospitalisation, with evidence that a lack of access to safe abortion shifts the demand for abortion into clandestine and unsafe conditions (Haddad and Nour, 2009). To the degree that legalizing abortion shifts clandestine abortions at risk of complications to sanitary conditions with lower risk, there exists a hypothesised direct channel through which abortion reform may impact women's health. In this channel, holding all else constant, abortions which would have occurred whether abortion was legal or not should imply a direct improvement in women's health when abortion is legalised. We refer to this as the "quality of care channel".

2. Undesired pregnancies are avoided This channel is relevant for individuals who would not abort when abortion is illegal, but abort when abortion is legalized. To the degree that abortion being illegal discourages women who would otherwise have sought to discontinue their pregnancy

from seeking abortion, changes in laws will shift the demand for abortion. This channel, which we refer to as the "demand" channel could, theoretically at least, have varying impacts on women's health. These are (a) for undesired pregnancies which would have resulted in poor maternal health outcomes, the legalization of abortion and resulting avoidance of risky pregnancies will, all else constant, improve maternal health. However (b) for undesired pregnancies which would not have resulted in poor maternal health outcomes, the legalization of abortion may shift maternal health outcomes if abortion – even in safe legal conditions – implies some risk of complications.[10]

3. The composition of women becoming pregnant changes This channel is relevant for individuals who would not abort when abortion is illegal, and also not abort when abortion is legal. This channel is relevant only to the degree that the population of women giving birth following abortion reform will consist of more women who desire a birth, regardless of whether abortion is legal. As women's health complications arise throughout pregnancy, changes in the composition of women becoming pregnant and taking a pregnancy to term may result in changes in rates of health complications observed at the population level. Ex ante, this selection process has ambiguous impacts on maternal health, as it depends on the nature the selectivity. We will refer to this as the "selection channel".

3 Data

We construct a balanced panel recording morbidity and mortality outcomes, birth rates and legal outcomes for each of Mexico's 32 states between the years of 2001-2015. In principal models we consider a monthly panel, however also generate more temporally aggregate data (by year and by trimester) to include the universe of cases where monthly records are not available, as laid out below. We construct this from a large number of administrative microdata bases covering 100s of millions of records, which are described at more length in Appendix B and summarised below. Along with outcomes generated from administrative data, we collect a number of measures of sexual behaviour from survey data, time varying controls, and the exposure to the ILE reform or subsequent legal changes.

[10] As we discuss later in the paper, this second channel appears to be quite unlikely given that abortion in safe settings has very low rates of associated morbidity and mortality. In fact, induced abortion in safe setting are considered "one of the safest procedures in contemporary practice" with a mortality rate below 1 per 100,000 procedures (Grimes, 2005).

Health Outcomes We observe all morbidity events resulting in a hospital inpatient visit to any public hospital in Mexico. Depending on the hospital type (state run or social-security run), the microdata format varies, and as such, we can consistently group records only for the years 2004-2015, and only with a yearly total. Given this, we provide two sets of results: one based only on visits to state-run hospitals, as in this case we can calculate monthly aggregates for the longer period of 2001-2015, and another based on yearly records for the shorter 2004-2015 period when all hospitalisation data is observed. We similarly consider leakage to the private system using administrative records from all private hospitals.

Our principal measures of interest are maternal morbidity outcomes, classified according to International Classification of Diseases tenth revision (ICD-10) codes,[11] plausibly impacted by abortion. Specifically, these are (a) "abortion related morbidity" (ICD-10 codes O02-O08), and (b) haemorrhage early in pregnancy (ICD code O20).[12] The remainder of the ICD codes are not examined as it is unlikely that they are sequelae of abortion (for example eclampsia or pre-eclampsia), or are morbidities occurring in the puerperium period, and so unable to be sequelae of abortion. These two codes are not chosen arbitrarily by the authors, but rather in line with the fact that haemorrhage and incomplete abortion are the two most common complications of unsafe abortion (World Health Organization, 2018). We provide a full break-down of all ICD codes related to pregnancy, childbirth and the puerperium (the ICD-10 O codes) in Appendix Table A3 which documents both the considerable frequency of the two chosen classes, as well as the implausibility of impacts on other variables. Finally, as an exploratory analysis we aim to measure mental health outcomes of women. In practice, the only way that we can consistently measure this in our data is via the code F53 which captures post-partum depression.[13]

[11] It is important to note that the procedure of assigning ICD codes for a hospitalization is typically implemented by a particular person or persons in charge of coding diagnoses in hospitals (such as an epidemiologist or a hospital employee). This coding is made based on their reading of the treating team's charts, and is *not* determined by the team actually treating the patient (Velasco Sustaita, Undated). Moreover, the ICD coding is typically processed after the patient is discharged from the hospital. Anecdotal evidence suggests that the prosecution of women for the crime of abortion usually occurs during the hospital stay, after a clinician/nurse/social worker have raised "suspicion" to the police. There is no ICD-code of induced illegal abortion in the ICD-10 classifications, and indeed, evidence from other contexts suggests that if anything, providers may seek to record abortion related morbidity within sub-codes of ICD-10 classifications (such as recording abortions as spontaneous instead of induced), rather than classifying as an alternative code (Suh, 2014). The authors are grateful to Dr. Raffaela Schiavon for providing very useful background details in correspondence.

[12] For a longer discussion on classification of abortion-related morbidity see Schiavon et al. (2012a) and World Health Organization (2018).

[13] We additionally explored using external causes of morbidity to capture suicide attempts, however the inpatient

We additionally consider a number of placebo outcomes. We do this in a number of ways. A first placebo test consists of considering a (presumably) unaffected morbidity cause *within* the same ICD class (the O codes), namely late term obstetric complications (ICD codes O70-O75). While this is not a perfect placebo insofar as it may be impacted by changing composition of mothers (via the 'selection' channel indicated earlier), it is unlikely to be mechanically related to abortion, so provides a useful comparison to our main morbidity outcomes. Additionally, and to completely isolate the placebo tests from potential changes in composition of mothers, we consider a larger number of placebo outcomes coming from *other* ICD classifications.[14]

While our main interest here is to document the impacts of abortion reform on the much larger pool of morbidity outcomes, we additionally consider maternal *mortality* as recorded in Mexico's complete vital statistics registers. We thus calculate the number of all maternal deaths in each state and year, and additionally only those maternal deaths classified as owing to abortion. Additional discussion of the generation of these data, as well as the recording of microdata bases is provided in Appendix B.

Births In order to benchmark the Mexican abortion reforms' impact on birth rates with respect to the wider literature, we also require aggregate data on birth rates by state. We generate these state-level measures from publicly available microdata on births provided by INEGI. We use each birth register occurring to women aged 15–49 over the time period of 2001–2013; a sample of 30,341,376 births. As discussed at more length in the Data Appendix, we can only observe birth records up to the year of 2013 as we follow the procedure suggested by the National Population Council (CONAPO) of using birth registers up to four years following each date to ensure that we capture births even if they are registered with a considerable delay. We use these same data to measure average characteristics of mothers and fathers (where registered) to examine any changes in composition of parents following abortion reforms. In both the case of births and the case of health outcomes, in order to calculate rates of occurrence we record state.level population in each year for all women aged 15–49 provided

data from Mexico only consistently provides a single ICD code capturing the principal cause of hospitalization, while external causes are classified as a secondary ICD code. Thus, these external causes are not recorded consistently in administrative data.

[14]Specifically, these are Diseases of the ear and mastoid processes; Neoplasms; Endocrine, nutritional and metabolic diseases; Diseases of the blood and bloodforming organs; Diseases of the nervous system; and Diseases of the skin and subcutaneous tissue. We discuss these at more length in Section 5.3.

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Additional Measures We additionally collect a number of other state- and time-varying measures to examine potential mechanisms of action of the reform, or to dismiss alternative possible explanations of observed impacts. These measures consist of: (a) all first legal decisions made by the Mexican judiciary related to abortion compiled from microdata collected by Mexico's Judicial Statistics on Penal Matters; (b) information on contraceptive use and sexual behaviour from the Mexican Family Life Survey (MxFLS); and (c) time-varying controls to capture possible confounders of abortion policy, namely education, health investment and access including access to the public insurance program *Seguro Popular*, economic development, and women's social inclusion. These controls are fully described in Data Appendix B, as well in discussion of summary statistics below.

Summary Statistics Summary statistics of principal outcomes (maternal morbidity, mortality and births) are provided in Table 1. The total number of cases of each morbidity class are described in panel A, and mortality outcomes, both for all maternal deaths, and those only classified as owing to abortion, are provided in panel B. State by year×month averages of the number of births and births per 1,000 fertile-aged women are displayed in panel C of Table 1. On average, morbidity outcomes are various orders of magnitude higher than mortality outcomes. For example, the average quantity of hospitalisations for abortion related causes was 269 per state and month, versus 3 maternal deaths on average, or 0.2 maternal deaths when considering only those classified as owing to abortive causes. In this Table, morbidity data is recorded only based on public hospital data where the month of the visit is recorded. As we will discuss at more length below, we will also consider variation by state and year allowing us to capture the full universe of health outcomes from both state-run and social security run hospitals (see Appendix Table A4 for summary statistics), and control variables are summarised in Appendix Table A5.

Raw trends of principal maternal health outcomes are provided in Figure 1, pointing to important shifts in inpatient visits related to maternal health following the ILE reform. Figure 1(a) and (b) document the quantity of monthly inpatient cases for abortion related morbidity and haemorrhage in early pregnancy in Mexico DF, states that adopted a subsequent legal tightening, and states with no subsequent legal changes. We observe reductions in the absolute quantity of cases in Mexico

DF in both cases following the ILE reform in April 2007 (indicated as a vertical red line). Panels (a) and (b) are based only on hospitalization data from Secretary of Health hospitals. When we additionally extend to include Social Security hospitals in panels (c)-(f), observing yearly variation only, we see a similar pattern with reductions in total hospitalisations (panels (c) and (d)), and rates of hospitalisations for fertile-aged women (panels (e) and (f)).

Table 1: Summary Statistics for Month by Year by State Specifications

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Panel A: Morbidity Outcomes					
Total Number of Deliveries in Public Hospitals	5760	1455.9	1282.8	143	8496
Total Inpatient Cases for ICD O codes, except births	5760	1276.3	1002.8	139	6271
Total Inpatient Cases for Abortion-Related Causes	5760	268.7	232.9	27	1573
Total Inpatient Cases for Haemorrhage Early in Pregnancy	5760	31.4	27.2	0	207
Total Inpatient Days for Abortion-Related Causes	5760	361.3	327.4	28	2168
Total Inpatient Days for Haemorrhage Early in Pregnancy	5760	64.7	63.0	0	463
Total Inpatient Cases for Obstetric Complications	5760	36.0	51.1	0	375
Total Inpatient Cases for Post-Partum Depression	5760	0.1	0.3	0	6
Panel B: Mortality Outcomes					
Total Number of Maternal Deaths	6144	2.98	3.26	0.00	25.00
Total Number of Maternal Deaths due to Abortion	6144	0.21	0.50	0.00	4.00
Panel C: Demographic Outcomes					
Population of 15-49 Year-old Women	6144	864691	743706	116430	4228223
Total Number of Births	4992	6078	4904	719	28546
Birth rate per 1,000 women	4992	7	1	5	13

Each observation is a state×year×month cell. Mexico is composed of 32 States. The number of cells varies due to the number of years and months of data available. In panel A, morbidity data is displayed for 12 months in 12 years (2004-2015). Values are generated from all inpatient cases as classified from microdata from the primary care (hospital) records from all public hospitals administered by the Secretariat of Health (Social Security System hospitals do not report month of hospitalization). Each type of morbidity is classified by ICD-10 codes. In Panel B, mortality outcomes are displayed for 12 months in 16 years (2001-2016). In panel C, data on population is displayed for 12 months in 16 years (2001-2016), and data on births is displayed for 12 months in 13 years (2001-2013). Following CONAPO, the last four years of birth outcomes are suppressed to account for reporting outside of the period of birth. State×year summary statistics including Social Security System hospitals are provided in Appendix Table A4.

4 Methodology

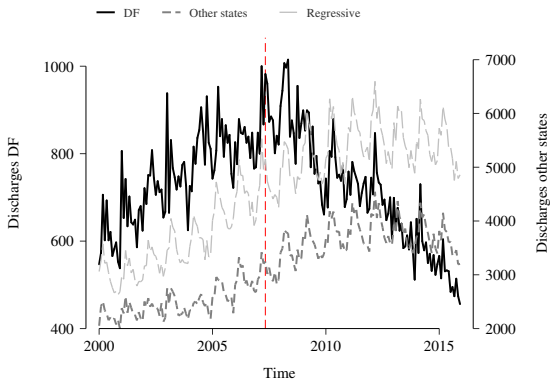
We aim to examine the impact of the ILE reform and regressive law changes, compared with outcomes in states in which no reform was implemented. We thus begin by estimating the following two "two way fixed effect" specifications[15]:

$$Health_{st} = \alpha_0 + \alpha_1 \text{ILE}_{st} + X'_{st}\Gamma_1 + \phi_s + \mu_t + (\phi_s \times month) + \varepsilon_{st} \quad (1)$$

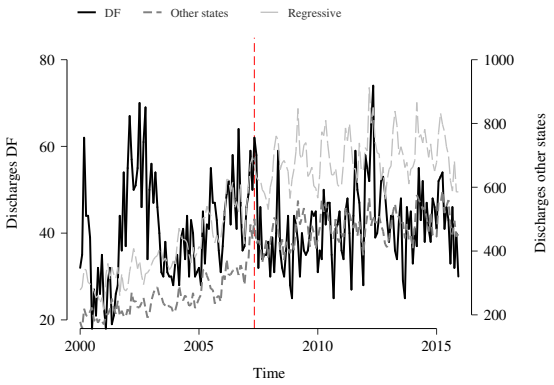
$$Health_{st} = \beta_0 + \beta_1 \text{Regressive}_{st} + X'_{st}\Gamma_2 + \phi_s + \mu_t + (\phi_s \times month) + \eta_{st} \quad (2)$$

[15] We estimate these models separately, however all results documented in this paper are robust to estimating a single model including both the ILE and Regressive variables. Full results in this set-up are documented in Clarke and Mühlrad (2018).

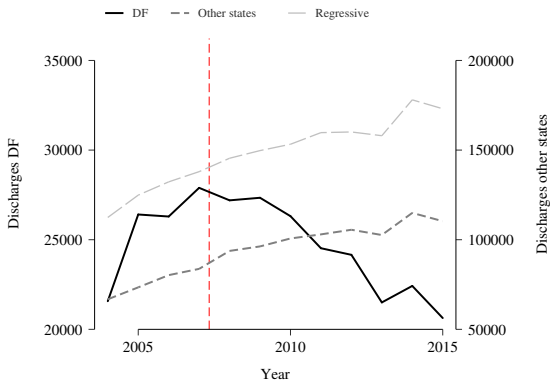
Figure 1: Raw Trends in Abortion Related Morbidity and Haemorrhage Early in Pregnancy



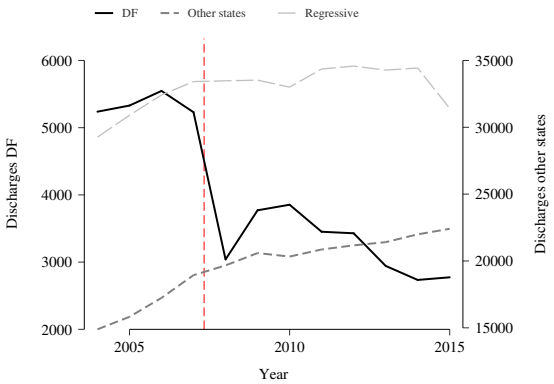
(a) Abortion-Related (Monthly)



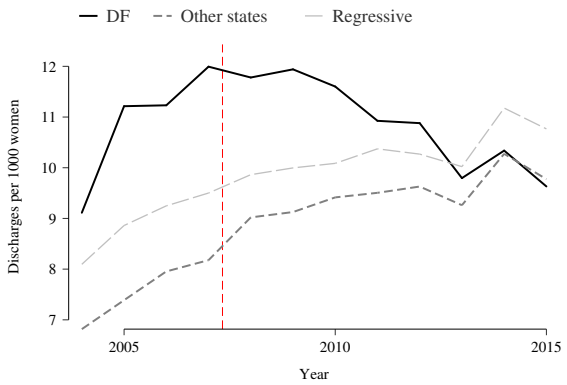
(b) Haemorrhage (Monthly)



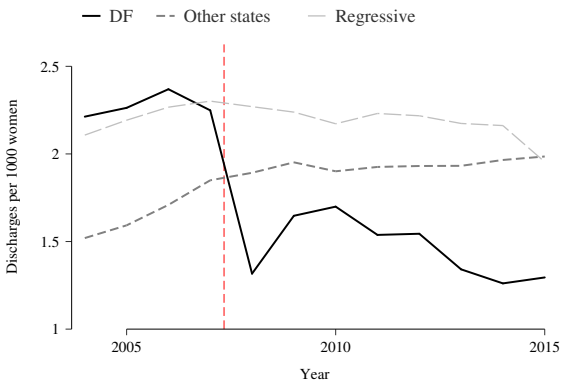
(c) Abortion-Related (Full Sample)



(d) Haemorrhage (Full Sample)



(e) Abortion Morbidity (per 1000 women)



(f) Haemorrhage (per 1000 women)

Notes: Figures present the total number of discharges due to abortion related morbidity (left-hand panels) and haemorrhage early in pregnancy (right-hand panels) in Mexico DF (which adopted the ILE reform), states which had a later tightening of abortion laws, and all other states. Panels (a) and (b) plot monthly trends based on all discharges from Health Secretariat hospitals given that these are the only registers which record month and year of discharge. Panels (c) and (d) plot yearly trends based on all public hospital discharges (both Health Secretariat hospitals and Social Security Hospitals which do not report month of discharge), and panels (e) and (f) plot yearly discharges based on all public hospital data expressed per 1,000 women of fertile age. The dotted vertical line is plotted in April of 2007, the date of passage of the ILE abortion reform, and wide-scale rollout of available abortions. Residualized plots and longer yearly plots based on panels (a) and (b) are provided as Appendix Figures A3 and A4 respectively.

Here $Health$ refers to average rates of morbidity or mortality in state s at time t, and ILE and Regressive refer to the post-ILE and post-Regressive Law changes in affected states. Our parameters of interest are α_1 from equation 1 and β_1 from equation 2. In the case of specification 1, the estimation sample consists of Mexico DF (which adopts ILE) and all non-reforming states, and in the case of specification 2, the sample consists of all states which adopt regressive abortion laws and all non-reforming states. We include state and year fixed effects as ϕ_s and μ_t respectively as well as state-specific monthly fixed effects ($\phi_s \times month$) to capture any potential state-specific seasonality, and examine stability to the inclusion of the time-varying controls X_{st} listed in Section B.2. In initial specifications, time t refers to monthly measures. This allows us to examine fine-grained temporal variation in outcomes in all hospitals run by the Mexican Secretariat of Health. However, to ensure that these results are also observed in the full universe of public health records, we also consider specifications where time t refers to yearly cells including all data.

In this two-way FE specification, the ILE variable in equation 1 is an indicator which switches from 0 to 1 at a particular point in time, however the Regressive indicator in equation 2 switches from 0 to 1 at varying times depending on the state. In the case of heterogeneous treatment effects and time-varying adoption, this single-coefficient model can considerably mis-estimate the average treatment effect on the treated (ATT), given that already treated units act as controls in future periods (Goodman-Bacon, 2018). While this is not of concern for our estimate of α_1, it is for our estimate of β_1, and so we will: (a) document the parameter decomposition derived in Goodman-Bacon (2018), and (b) additionally estimate event study specifications which avoid these potential biases. There are 32 states in Mexico (including the Federal District), and these laws are defined at the level of the state. In order to account for the possibility of unobserved correlations of outcomes for women within a state, standard errors are clustered by state using a clustered wild bootstrap.

Our outcomes of interest for this procedure are the measures of maternal morbidity and mortality discussed in Section 3, as well as birth rates. We additionally consider exploratory analyses examining post-partum depression. We thus implement the procedure for a measure of all abortion morbidity, morbidity due to haemorrhage early in pregnancy, post-partum depression, and total maternal mortality and maternal mortality due to abortion. In each case in the main outcomes, we focus on rates of morbidity and mortality per the population of fertile aged women. We express our outcomes in this way for two reasons. The first is that it allows us to capture the full effect of the

reform. As we will show that the abortion reform reduces fertility, if we express our outcomes as morbidity or mortality per live birth, this is equivalent to a partial impact, removing any impact of the reform which flows from the ability to avoid undesired, and potentially risky, births.[16] In practice, we are interested in the total impact of the reform, which consists of the reduction in morbidity and mortality due to fewer births, as well as any direct impact the reform may have on the composition of mothers giving birth. Secondly, this allows us to ignore any challenges arising from the endogenous decision of whether or not to engage in legal abortion. If we instead report the impact of the law on rates of morbidity and mortality per live birth, we will be confounding our estimates due to the fact that a non-random group of women choose to proceed with births following the reform, and this group may be selectively more or less healthy than the women who elect to abort. We address changes in the composition of mothers explicitly in Section 5.3 of this paper.

For two-way FE estimates to capture the causal effects of abortion laws, we require a parallel trend assumption to hold, or that outcomes in each of the "Regressive", "ILE" and untreated states would have evolved similarly in the absence of abortion reforms. We provide a partial test of this, and additionally quantify any dynamic reform effects, by estimating the following panel event-study specifications:

$$Health_{st} = \kappa_0 + \sum_{j=-36}^{36} \delta_{-j} \Delta \text{ILE}_{s,t+j} + X'_{st}\Gamma_1 + \phi_s + \mu_t + (\phi_s \times month) + \nu_{st} \quad (3)$$

$$Health_{st} = \kappa_1 + \sum_{k=-36}^{36} \gamma_{-k} \Delta \text{Regressive}_{s,t+k} + X'_{st}\Gamma_2 + \phi_s + \mu_t + (\phi_s \times month) + \upsilon_{st}. \quad (4)$$

We normalise both δ and γ setting $\delta_{-1} = 0$ and $\gamma_{-1} = 0$. These event-study specifications are increasingly common in panel settings, and here we adopt the notation of Freyaldenhoven et al. (2018). In this specification, we are interested in the leads and the lags of the policy changes, where lags capture any prevailing trends prior to the reform, and leads show the change in health outcomes following the reform's implementation. In main specifications 3-4, we present the model for morbidity data available from 2001 to 2015, which allows us to consider a large number of monthly lags and leads. We use 36 monthly lags and leads, where the final lag and lead indicates all periods beyond

[16] It is also important to note that the ILE reform included the option of accessing free contraceptives after undergoing an abortion procedure, which could also impact birth rates. We discuss this at more length in Section 5.3.

this time. As was the case with two-way FE models, we also examine robustness to using yearly data with all hospitalizations. In this case we are able to use data exclusively from 2004-2015, aggregated to a yearly-level, and as such we estimate 3 leads and 8 lags of the ILE reform, and 5 leads and 7 lags of regressive law changes. We can estimate additional lags for regressive reforms in this case given that there is greater variation in treatment timing.[17] In the case of mortality or fertility where longer periods of data are available, lags and leads are modified in yearly event studies to provide a fully saturated model in each case. In one case where parallel pre-trends appear less convincing, we conduct a newly described estimation and inference procedure known as "Honest DD" to examine possible implications of violations of the parallel trend assumption (Rambachan and Roth, 2019).

It is important to note here that unbiased estimation of reform impacts hinges, pivotally, on the assumption of (conditional) parallel trends, and on a SUTVA assumption implying no spillovers to un-treated states. We address the SUTVA assumption explicitly in Section 5.3 where we consider whether we observe appreciable policy spillovers. As always, the parallel trends assumption is something that cannot be tested formally given the unobserved counter-factual state for treated areas in the post-treatment period. Thus, the appearance of any simultaneous reforms *only* in treatment areas would result in biased estimates of reform impacts. Nevertheless, as discussed above, we aim to reduce the likelihood of such factors by controlling for time-varying factors (including the *Seguro Popular* rollout), and additionally consider a range of placebo tests to determine whether we observe similar patterns in variables which plausibly should *not* respond to abortion reforms.

5 Results

5.1 Abortion Laws and Maternal Morbidity and Mortality

5.1.1 Estimated Impacts on Maternal Morbidity

Two-way FE estimates (which for simplicity hereafter we will refer to as "DD" estimates given the similarity to double difference models) of the impact of the legal reforms on morbidity are presented in Table 2. All coefficients are cast as the effect of law changes on morbidity per 1,000 women. Columns 1-2 are baseline DD models including only time and state fixed effects, while columns 3-4 add in time-varying controls described previously. We present results for equation 1 in Panel

[17] Practical details are discussed in Clarke and Tapia Schythe (2020).

A, and for equation 2 in Panel B. On average, compared with non-reform states, the ILE reform resulted in a reduction in morbidity by approximately 0.06 to 0.08 cases per 1,000 women (per month) when considering all abortion-related morbidity, or be 0.013 to 0.016 cases per 1,000 women when considering the incidence of haemorrhage early in pregnancy. When compared to average rates of morbidities, this is approximately a 20% reduction in abortion related morbidity, and a 35% reduction in rates of haemorrhage. Note that these large effects were notable even in raw trends displayed in Figure 1.

In the case of subsequent restrictive reforms, we do not find evidence to suggest that these reforms shifted morbidity outcomes. For abortion related morbidity and for haemorrhage early in pregnancy, we find no significant impacts across specifications reported in Table 2. When instead of the total number cases we examine the total number of inpatient days (Appendix Table A6), we similarly observe a large reduction following Mexico's ILE reform, and no significant, or consistently signed, impact in the case of regressive reforms.

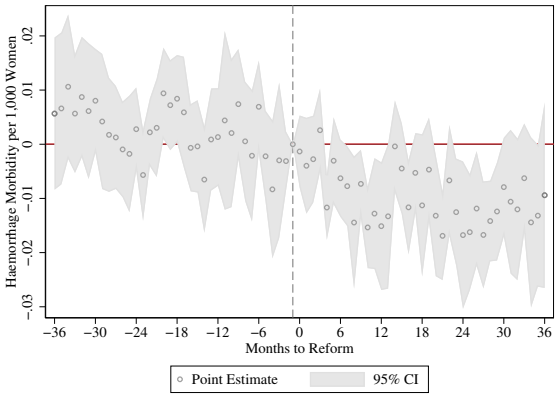
Figure 2a presents event study evidence for haemorrhage, and Figure 2b presents event study estimates for abortion-related morbidity. In both cases, the left-hand panel shows the lag and lead coefficients for Mexico DF surrounding the ILE reform (equation 3), and the right-hand panel shows the coefficients for regressive states (equation 4). In Figure 2a we observe an immediate sharp decline in rates of haemorrhage in Mexico DF following the adoption of ILE. Additionally, we observe little evidence of prevailing differences in treated and untreated states *before* the reform in all lags. In the case of regressive states (panel B), we observe a similar quite flat profile prior to the reform. Following the reform, we observe no similar reduction in rates of haemorrhage as that observed in DF, with no lead terms being statistically distinguishable from zero at 95% significance levels. These results support claims from the medical literature that haemorrhage is one of the major drivers of maternal morbidity and mortality following unsafe abortions (World Health Organization, 2011), as the appearance of a legal and sterile alternative to clandestine abortion resulted in an immediate sharp reduction in hospitalisations resulting from haemorrhage early in pregnancy. What's more, we observe that these reductions occur very quickly following the moment that abortion was legalised, suggesting an immediate effect of safe legal abortion on women's health outcomes.

Table 2: Difference-in-Differences Estimates of Legal Reforms on Morbidity

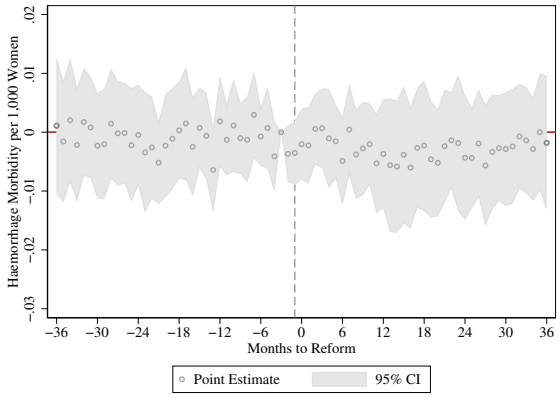
	Abortion Related Morbidity				Haemorrhage Early in Pregnancy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.064***	-0.071***	-0.063***	-0.075***	-0.014***	-0.016***	-0.014*	-0.013**
	(0.013)	(0.006)	(0.016)	(0.012)	(0.004)	(0.004)	(0.007)	(0.007)
Observations	2,496	2,496	2,496	2,496	2,496	2,496	2,496	2,496
Mean of Dependent Variable	0.338	0.338	0.338	0.338	0.044	0.044	0.044	0.044
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.001	0.000	-0.009	-0.007	-0.005	-0.003	-0.005	-0.002
	(0.013)	(0.011)	(0.011)	(0.011)	(0.006)	(0.004)	(0.006)	(0.004)
Observations	5,952	5,952	5,952	5,952	5,952	5,952	5,952	5,952
Mean of Dependent Variable	0.328	0.328	0.328	0.328	0.042	0.042	0.042	0.042
State and Year×Month FEs	Y	Y	Y	Y	Y	Y	Y	Y
Population Weights		Y		Y		Y		Y
Time-Varying Controls			Y	Y			Y	Y

Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of morbidity (inpatient cases). Each morbidity class is measured as cases per 1,000 fertile aged women each month, and average levels in the full set of data are available at the foot of the table. Each regression is estimated using states that adopt reforms (ILE in panel A, regressive reforms in panel B) versus other non-adopting states. All standard errors are clustered at the level of the state. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Figure 2a: Event Studies for Rates of Haemorrhage Early in Pregnancy

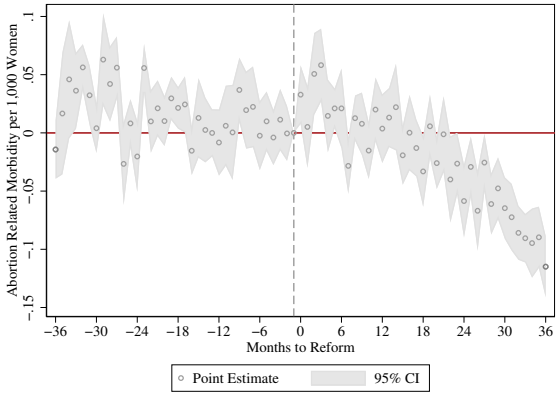


(a) Progressive Abortion Reform (ILE)

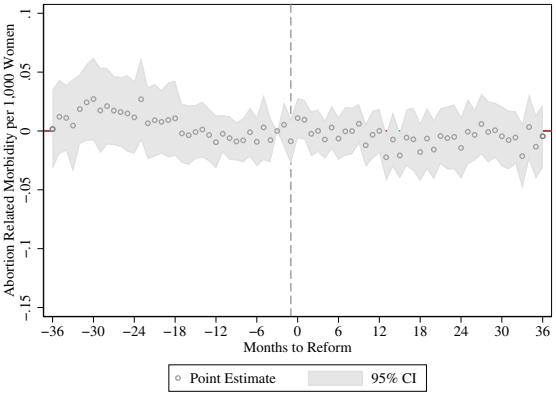


(b) Regressive Abortion Laws (Legal Tightening)

Figure 2b: Event Studies for Rates of Abortion Morbidity



(c) Progressive Abortion Reform (ILE)



(d) Regressive Abortion Laws (Legal Tightening)

Notes: Event studies document the evolution of rates of haemorrhage early in pregnancy (2a) and abortion related morbidity (2b) per 1,000 women surrounding the passage of abortion reforms. Each point estimate refers to the change in rates between treated and non-treated states, compared to their baseline differential immediately prior to the reform. The left-hand panel shows the difference between Mexico DF and untreated states surrounding the passage of the ILE reform. The right-hand panel shows the difference between regressive policy changers and non-changers around the (time-varying) date that each reform was passed. Regressions are weighted by the population of fertile-aged women, and the full set of time-varying controls are included.

When considering rates of abortion morbidity, event studies document larger prevailing (pre-reform) differences between DF and untreated states, although these are largely driven by a number of monthly fluctuations greater than 2 years prior to the reform.[18] This agrees with simple trends in

[18]In Appendix Figure A5 similar results, with fewer fluctuations in pre-periods, are observed when considering trimesterly rather than monthly cells.

outcomes documented in Appendix Figure 1, which suggest a number of relatively sharper jumps observed in Mexico DF prior to 2005 that were not seen in the rest of the country. However, these *do not* seem to point to radically different pre-reform trends, but rather cyclical outliers. In the case of states which altered legislation in response to ILE, we observe very little evidence of an impact of these reforms on abortion morbidity in 2b. In both the pre- and post-reform period, all estimates are not statistically distinguishable from zero, and are centred around a null impact. In the case of abortion morbidity, it is important to note that the procedure used for abortions realized under the auspices of ILE has changed over time, which may partially explain the delay in observed impacts on morbidity. Initially, the majority of abortions were performed by surgical procedures compared to medical abortions (25%). This gradually changed in subsequent years, with medical abortion procedures reaching 74% in 2011, and the use of dilation and curettage was eliminated entirely (in accordance with WHO recommendations for first-trimester abortions). In addition, the quality of medical abortions performed has also improved, due to the introduction of mifepristone (combined with misoprostol) in 2011 (Becker, 2013).

We note that these reductions in rates of maternal morbidity in Mexico DF surrounding the passage of the ILE reform are not simply capturing a general improvement in health outcomes in the region. In Appendix Figure A6 we estimate identical models for (late-term) obstetric complications, and observe no such improvements in Mexico DF, and evidence to suggest parallel trends throughout the entire period studied between Mexico DF, states implementing regressive reforms, and the rest of the country. Similarly, in Appendix Figures A7 and A8, when considering a much broader class of morbidity outcomes (such as neoplasms, endocrine diseases and so forth), we once again observe no systematic difference in rates of morbidity surrounding abortion reforms, with the exception of a number of monthly peaks/troughs observed in Mexico DF, indicative of no general improvements across the time period studied.

5.1.2 Maternal Mortality and "The Tip of the Iceberg"

Frequently, analyses of the impact of public policies on maternal health focus on maternal mortality, given a lack of access to high-quality morbidity records (such as those available in Mexico). An argument is made that if effects are observed on maternal morbidity, which is the "tip of the iceberg"

(see eg Firoz et al. (2013)), then there will logically be considerable impacts on maternal morbidity (the base of the iceberg). However, the much lower frequency of maternal deaths compared with maternal morbidity makes it much harder to precisely estimate impacts of health reforms on maternal mortality. Here we briefly consider how much precision is lost when considering impacts on maternal mortality, comparing our previously estimated impacts on morbidity with those focusing on maternal deaths. Given the much lower rates of maternal deaths, we focus on yearly models. And as these estimates are indeed considerably more noisy than estimated impacts on morbidity, we relegate results to an Online Appendix, discussing here broad patterns and lessons for estimating reform impacts on maternal health outcomes.

In Appendix Table A7 we present DD estimates following equations 1 (panel A) and 2 (panel B) for both all maternal deaths (columns 1-4), and only maternal deaths originating from abortive causes (columns 5-8). When focusing on the ILE reform, we observe mixed evidence pointing in the direction of negative though imprecisely estimated effects. Both weighted and unweighted estimates suggest a reduction in all maternal deaths following ILE (columns 1 and 2), of approximately 0.5 per 100,000 fertile aged women (versus a mean value of 4 deaths per 100,000 women in Mexico). Note however, that when adding time-varying controls in column 3, these estimates are reduced by about one third, and become statistically insignificant at typical levels. Similarly, in the case of abortion related maternal mortality, we observe significant reductions when using weighted or unweighted simple DD models (with point estimates of around -0.09 per 100,000 fertile aged women), though these become insignificant with the inclusion of time-varying controls. In the case of regressive reforms we find, across the board, relatively less evidence of any impacts of these reforms on maternal mortality. We do consistently observe negative point estimates of a magnitude approaching that observed in Mexico DF following the ILE reform, however these are only (marginally) significant in two models. We note however that, as discussed, standard errors are quite wide, thus precluding us from concluding that these estimates suggest tightly estimated zero-impacts.

In general these results point to the fact that focusing only on mortality when studying reforms which impact maternal health may considerably understate their importance as a determinant of well-being. Both Table A7 (as well as event studies presented in Appendix Figures A9a for all maternal mortality and A9b for mortality due to abortion) suggest noisy results with little power to reject a range of nulls. While event studies suggest that reductions in mortality may have been observed in

Mexico DF, these are certainly not as clearly observed as the morbidity results presented in Section 5.1.1 of this paper.

5.2 Benchmarking Impacts on Birth Rates

While our main focus in this paper is on quantifying the health costs of abortion reform, it is illustrative to also estimate impacts on birth rates. This allows us to consider the magnitude of these reforms compared with a range of other contexts which have been well-documented in the economic literature. As summarised in Table A8, across studies on abortion legalization in the US, Nepal, Norway, Romania and Uruguay we observe a drop in birth rates of between 1.2 to 8%. Studies on the impact of regressive abortion law changes (including parental consent laws and restricted funding of abortions) find considerably more heterogeneous results, with results ranging from significant reductions in birth rates (Kane and Staiger, 1996), insignificant impacts (Levine et al., 1996), and increases in rates of birth (Lahey, 2014).

Table 3: Monthly Difference-in-Differences Estimates of Abortion Reforms on Fertility

	Births per 1,000 Women			
	(1)	(2)	(3)	(4)
Panel A: ILE versus Non-Reformers				
Post-ILE Reform (DF)	-0.531***	-0.636***	-0.537***	-0.608***
	(0.075)	(0.106)	(0.110)	(0.106)
Observations	2,028	2,028	2,028	2,028
Mean of Dependent Variable	7.302	7.302	7.302	7.302
Mean of Dependent Variable (Mexico DF)	7.433	7.433	7.433	7.433
Panel B: Regressive Reforms versus Non-Reformers				
Post Regressive Law Change	-0.191**	-0.269***	-0.202**	-0.228**
	(0.089)	(0.097)	(0.085)	(0.112)
Observations	4,836	4,836	4,836	4,836
Mean of Dependent Variable	7.266	7.266	7.266	7.266
Mean of Dependent Variable (Regressive States)	7.434	7.434	7.434	7.434
State and Year FEs	Y	Y	Y	Y
Population Weights		Y		Y
Time-Varying Controls			Y	Y

Each column displays a difference-in-differences regression of the impact of abortion reform on birth rates. Birth rates are measured as the number of births per 1,000 fertile aged women each month. Time-varying controls are documented in Section B.2. All standard errors are clustered at the level of the state using a wild clustered bootstrap procedure. *p< 0.10; **p< 0.05; ***p< 0.01.

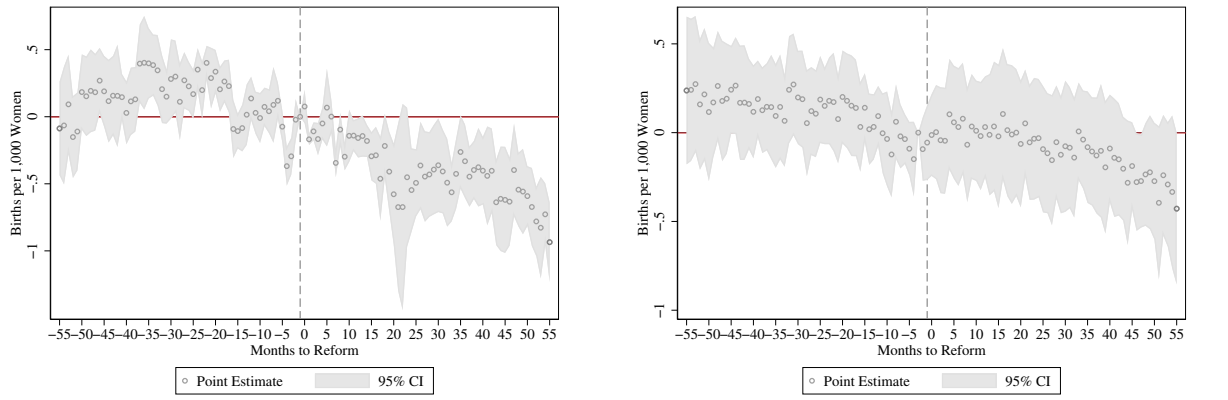
Our results from the Mexican abortion reforms suggest broadly similar impacts on birth rates to those observed in other settings following the elimination of abortion restrictions. In Table 3 we present DD estimates of the impact of reforms on birth rates, weighted and unweighted by the number of fertile-aged women in each state by month cell. In general, across specifications, results are quite stable in suggesting a significant reduction in births in Mexico DF following the ILE reform. Depending on estimation weights, we observe a reduction of between 0.53 and 0.64 births per 1,000 women per month, or a reduction of between 7 and 8.5% in birth rates compared with pre-reform levels in the state. Our preferred estimates are those including population weights with full time-varying controls, which suggest a reduction of 0.64 births per 1,000 women of fertile age in the years following the ILE reform, or a 8.5% reduction in birth rates in Mexico DF. In the case of states passing regressive laws altering their penal codes or state constitutions related to abortion, we find some evidence to suggest smaller reductions in birth rates in these DD specifications. Depending on the model, point estimates vary from -0.19 to -0.27 births per 1,000 women per month, or a 2.5 to 3.6% reduction in birth rates.[19] We return to examine the nature of these legal reforms in more detail in Section 5.3, revisiting the smaller estimated impacts on birth rates.

We provide full event studies corresponding to the passage of progressive and regressive reforms in Figure 3a. Given the considerable seasonality, and even monthly variations, in the quantity of births, we additionally present event studies by trimester in Figure 3b which allow for some smoothing of sharp monthly changes. In the left-hand panel of both monthly and trimesterly event studies, we observe a reduction in birth rates in Mexico DF when compared with all non-reform states, which becomes consistently observed from around 7-10 months (or 2-3 trimesters) post-reform (2008) onwards. This is in line with lags in birth rates expected to be observed approximately 7-9 months following the passage of abortion reforms due to the gestational period and limits on gestational length when undertaking abortion. Estimates in the pre-reform period are not completely flat, if anything suggesting evidence of a slightly upward trend a number of years pre-adoption in Mexico DF. If this upward trend were expected to continue in the post-reform period, this would suggest

[19] As we will discuss below, we note that these estimates are significant only in the case of two-way FE models, and not in event study models. In general, in the case of the regressive reforms which are rolled out in a time-varying way, two way FE models potentially mis-estimate the true nature of the ATT, and so we find event study estimates more credible. Nonetheless, we do note that in some literature discussed in Table A8 reductions in fertility are observed following legal restrictions on abortion access, and this could potentially be explained if increasing sanctions on abortion act to discourage marginal births. A theoretical model of such a case is provided in Ananat et al. (2009).

that we actually underestimate the true impact of the ILE policy.

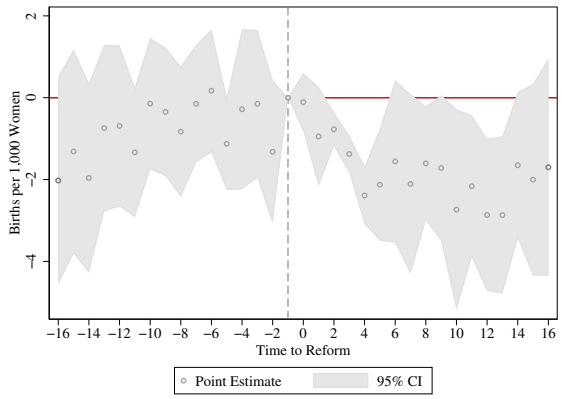
Figure 3a: Monthly Event Studies for Birth Rates



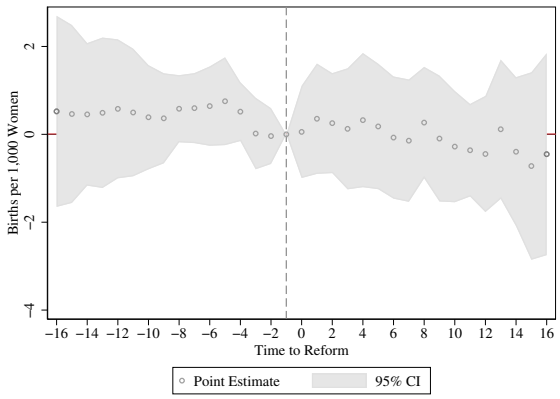
(a) Progressive Abortion Reform (ILE)

(b) Regressive Abortion Laws (Legal Tightening)

Figure 3b: Trimesterly Event Studies for Birth Rates



(c) Progressive Abortion Reform (ILE)



(d) Regressive Abortion Laws (Legal Tightening)

Notes: Event studies document the evolution of birth rates per 1,000 women surrounding the passage of abortion reforms. Each point estimate refers to the change in rates between treated and non-treated states, compared to their baseline differential immediately prior to the reform. Figure 3a presents event studies based on monthly birth rates while Figure 3b is based on trimesterly birth rates. In each case, the left-hand panel shows the difference between Mexico DF and untreated states surrounding the passage of the ILE reform. The right-hand panel shows the difference between regressive policy changers and non-changers around the (time-varying) date that each reform was passed. Regressions are weighted by the population of fertile-aged women, and the full set of time-varying controls are included.

This can be formally examined using "Honest DD" methods proposed by Rambachan and Roth (2019). These methods propose a robust estimation and inference technique assuming that trends in the post-event period do not diverge 'too much' from those in the pre-event period. We document how our estimated event study coefficients would vary under a range of assumptions using these

"Honest DD" techniques in Appendix Figures A10, A11 and A12. Given that these require bounding *each* figure in the event study, we conduct these methods with yearly analogues of the monthly event studies (confidence intervals for baseline yearly event studies are presented in blue in these plots). Importantly, as well as allowing for varying violations of parallel trends, they document that in each case, if trends had remained constant in the post-event period, the true estimate would be both more negative and consistently statistically significant (as documented in cases where $M = 0$ in Appendix Figures). In Appendix C we also document the stability of these estimates when compared to a judiciously chosen synthetic control group. The right-hand panel of Figure 3a documents the same point estimates and standard errors for states altering their constitutions or criminal codes to increase legal sanctions on abortion. In the case of regressive reforms, while we observe a gradual reduction in estimated coefficients following legal changes, these effects are not observed to be statistically distinguishable from zero in event study models. In this case, prevailing trends in the pre-reform period are observed to be somewhat downward sloping, with little evidence of a trend break following the implementation of regressive reforms. These event studies suggest that if anything, DD estimates presented in Table 3a likely over-state the impact of legislative tightenings. It is important to note that, given recent advances in work on interpretation of two-way fixed effect models, in the case of regressive abortion laws which are rolled out in a time-varying ways, these event study models which suggest insignificant effects should be preferred over the models presented in Table 3. This owes to the fact that the weighting in the two-way fixed effect models may result in estimates which are not truly capturing the ATE. We return to this point in the following Sub-section.

5.3 Understanding impacts of abortions laws

5.3.1 Why do we observe changes in women's health?

In Section 2.4 we discussed three conceptual channels through which abortion reform could impact maternal health: the "quality of care" channel, the "demand" channel, and the "selection" channel. We consider which of these various channels could explain the observed impacts of abortion reform on women's health laid out in Section 5.1.

The selection channel suggests that the composition of women giving birth may change owing due to selective interaction with abortion laws. We consider this directly in Appendix Table A9

where we use the same two-way fixed effect set-up to examine how maternal/paternal characteristics vary surrounding both the ILE reform as well as regressive reforms. We observe in general, that parents who give birth following the ILE reform are both older, as well as more educated. We *also* see some change of composition of parents following regressive reforms with parents being more likely to be married, potentially suggesting that there are impacts on the types of women conceiving when sanctions on abortions are raised. While this suggests that a *selection* channel may be occurring, it is an indirect test, not allowing us to sign the direction this channel works in, as it does not directly consider the interaction of these changing characteristics on health outcomes. We test this directly in Appendix Table A10. Here we consider the same two-way fixed effect models examining reform impacts on health outcomes, however now additionally controlling for variables which capture parental selection (namely, all outcomes considered in Appendix Table A9). This allows us to ask whether the estimates of the impact of abortion reforms on health that we observe are completely explained by the changes in composition of parents.

The results of Table A10 suggest a number of important interpretations. Firstly, in the case of abortion related morbidity, much of the observed impacts of the ILE reform *do* appear to flow from changes in the characteristics of parents. And in particular, the fact that our significant estimates are attenuated towards zero conditional on these controls suggests that those giving birth following the reform are selectively healthier (at least considering the likelihood of having a miscarriage or other types of abortion related morbidity. However, in the case of haemorrhage early in pregnancy, we observe no such change in the coefficients. This suggests that the observed impacts are not simply a compositional impact, but rather likely owe to the demand channel or the quality of care channel. In the case of Mexico, it seems likely that the quality of care channel explains the large reduction in haemorrhage. In clandestine settings, where misoprostol is used without adequate access to information, haemorrhage and resulting hospitalisation is likely to occur, something which can be avoided when care is sought through ILE providers who give both treatment as well as information related to post-abortion care. However, without data on the usage of clandestine abortion prior to the ILE reform, it is difficult to assess the degree to which legalizing abortion may have resulted in the avoidance of marginal births. Thus, in principle, while the evidence suggests that the observed impacts of legalized abortion on rates of haemorrhage early in birth do not owe to the selection channel, and it seems likely that the quality of care channel is a main determinant, without data on clandestine

abortion, we cannot formally rule out the demand channel.[20]

5.3.2 *De Jure* versus *De Facto* Legal Reforms

In general we find no impact of regressive law changes on resulting morbidity, and small impacts on birth rates. One potential explanation of this is that the although *de jure* changes were made to state constitutions, the *de facto* implementation of laws and penal codes was unchanged. As we document in Appendix Table A1, in many cases, while constitutions were altered—generally to declare that human life begins at conception—this did not always translate in concrete legal changes in the criminal sanctions imposed on women. This has been similarly noted in legal analyses of the reform (Singh et al., 2012b). And even in cases where criminal sanctions were increased, it may be the case that state-level judiciaries do not alter the likelihood of imposing sanctions on abortion.

We examine whether there is evidence of changes in the likelihood of being sentenced to prison for undertaking an abortion, or in the length of prison sentences received, based on the passage of the abortion laws examined in this paper. These data cover all individuals in the country, and here our outcomes are focused explicitly on whether an individual is sentenced to prison for undertaking an abortion. DD results following specifications 1-2 are displayed in Table 4. We observe, firstly, that there is a sharp reduction in the number of prison sentences for undertaking an abortion in Mexico DF following the reform (in line with the legalisation of abortion), however this was observed along side an estimated increase in sentence lengths.[21] Importantly, we observe evidence of a dual impact in regressive states. We observe mixed evidence pointing to a slight reduction in the number of prison sentences handed down, falling by 1.36 cases in weighted regressions (compared with a mean number of sentences per state and year of 1.806). In the case of the length of sentences, we observe a considerable increase, of between 4.1 and 5.2 years, depending on the specification estimated. In the case of weighted estimates, we observe an average increase of 5.2 years, which is considerable, even at the lower end of the 95% confidence interval, when compared with the mean sentence length

[20] Given the expansion of the medical abortion regime (i.e. the use of misoprostol and mifepristone) in Mexico City (Becker, 2013), complications due to the abortion procedures themselves following the ILE reform appear low (Grimes et al., 2006a). It is therefore unlikely that channel 2b, from Section 2.4, explains large movements in maternal health.

[21] Note that in Mexico DF, while abortion was legalised by the ILE reform, this was only the case for abortions realised up to 12 weeks of gestation. Thus, in theory, custodial sentences can still be handed down for abortion when not meeting this condition. In practice, a non-zero number of sentences was only observed in Mexico DF in 2011 (refer to Appendix Figure A13 for trends over time).

Table 4: Difference-in-Differences Estimates of Abortion Reforms on Judicial Outcomes

	Number of Prison Sentences		Length of Prison Sentences	
	(1)	(2)	(3)	(4)
Panel A: ILE versus Non-Reformers				
Post-ILE Reform (DF)	-4.018***	-4.050***	2.251**	2.150**
	(0.294)	(0.340)	(1.032)	(1.063)
Observations	117	117	56	56
Mean of Dependent Variable	1.427	1.427	3.606	3.606
Panel B: Regressive Reforms versus Non-Reformers				
Post-Regressive Law Change	-0.648	-1.362**	4.144*	5.220**
	(0.464)	(0.607)	(2.361)	(2.439)
Observations	279	279	171	171
Mean of Dependent Variable	1.806	1.806	3.749	3.749
State and Year FEs	Y	Y	Y	Y
Population Weights		Y		Y

Difference-in-difference models illustrate how abortion reforms correlate with prison sentences handed down by the judiciary, and the length of these prison sentences in years. Total number of sentences and the average length of prison sentences are generated from administrative records captured in Mexico's Judicial Statistics on Penal Matters. This is the universe of judiciary decisions in the country based on the first legal judgment, and so does not include any subsequent appeals. Analysis of the length of prison sentences presented in columns 3 and 4 is conditional on any prison sentences being handed down in each state and year. Prison sentence lengths are calculated from a categorical variable capturing bins of between 6 months and two years, and in each case we record the total years (or fractions of years) based on the midpoint of each bin. Bins are consistently used in the period displayed here. All standard errors are clustered at the level of the state and calculated using a wild bootstrap procedure. Identical models using population-standardised values for dependent variables are presented in Appendix Table A11. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

of 3.7 years. Thus, these results suggest that while the changes in law did not necessarily always prescribe a change in prison sentences, there is a detectable increase in the length of prison sentences observed in administrative data, conditional on being sentenced to prison. This increase in average sentence length is observed to hold in event study analysis, with significant impacts observed from 1 year post-reform onwards (Appendix Figure A14).

5.3.3 Considering the Universe of Health Records

Considering the Universe of the Public Health System In principal models, we have used month ×year×state measures of outcomes, given that as documented in Table A2, a wave of legal restric-

tions were put in place in varying months of 2008 and 2009. However, as discussed in the Data Section of this document, only hospitals administered by Mexico's Secretariat of Health (available to all individuals) report month of hospitalisation in administrative data. In order to determine whether a similar pattern is observed across the entire public health system, we additionally conduct analysis pooling by hospitalisations in hospitals administered by the Secretariat of Health, as well as those administered by Social Security Providers. In this case, given the lack of monthly records in Social Security Hospitals, we can only estimate models by year. In Figure 4 we present yearly event studies for the main morbidity outcomes considered, extending to this full sample.

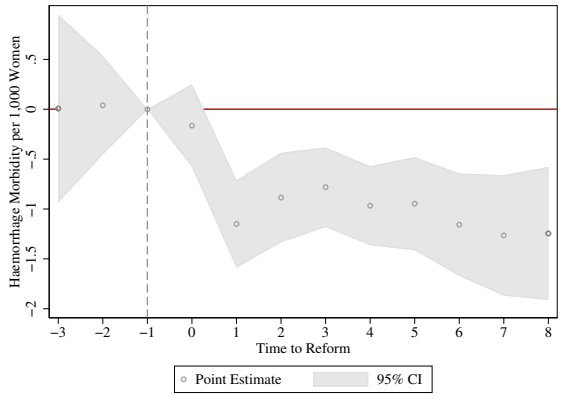
In all cases, we observe broadly similar results in each case. In the case of haemorrhage morbidity, we observe a sharp fall of around 1 per 1,000 cases per year immediately following the reform in Mexico DF (panel a), with no similar results observed states undertaking reform tightenings (panel b). Similarly, reductions in abortion related morbidity are observed in Mexico DF, appearing gradually over time as observed in monthly event studies, with no similar changes observed in regressive states (panels (c) and (d)).

Leakage to the Private Health System One potential alternative explanation of the observed morbidity results in all public hospitals is that rather than being driven entirely by the abortion reform, they may reflect changes of usage of the health system, with a larger number of women opting to use the private health care system. This explanation cannot explain the impact on fertility and maternal mortality, as these outcomes are based on the complete records of births and deaths in the country. However, it could partially explain the impacts observed on morbidity, as our administrative data records inpatient stays in the public health system (refer to Section 3 for additional discussion).

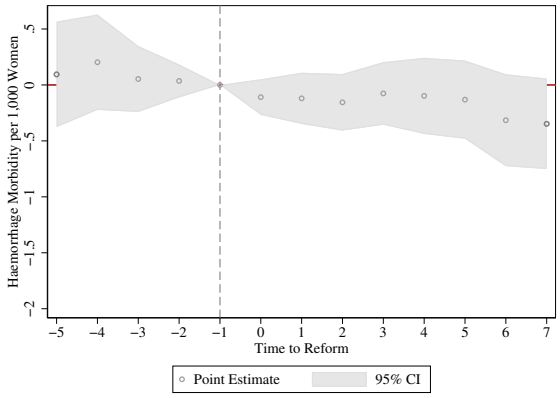
While we can't consistently merge public and private health data at the most dissagregated level of morbidity causes, we *are* able to consider all causes of abortion morbidity in the private health care system.[22] In Appendix Figure A15 we plot rates of abortion related morbidity in the universe of private hospitals (left-hand panel) and the universe of public hospitals (right-hand panel). These descriptive plots suggest that if anything, results in the private system will only strengthen our esti-

[22]Note that as documented in Appendix Table A3, this mapping captures all ICD-10 codes O00-O08, while typically abortion morbidity is calculated from codes O02-O08. In Figure A15 we plot comparisons using precisely the same aggregated codes in public and private hospitals.

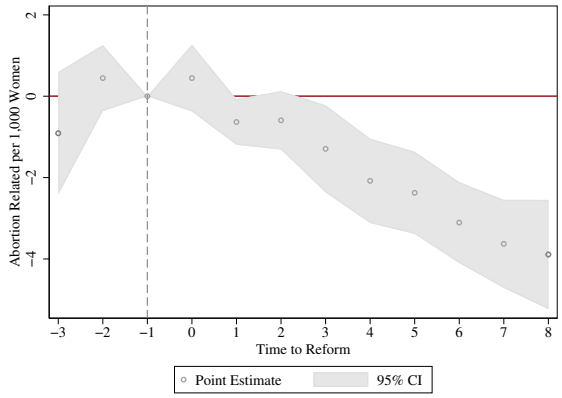
Figure 4: Yearly Event Studies Based on all Public Data



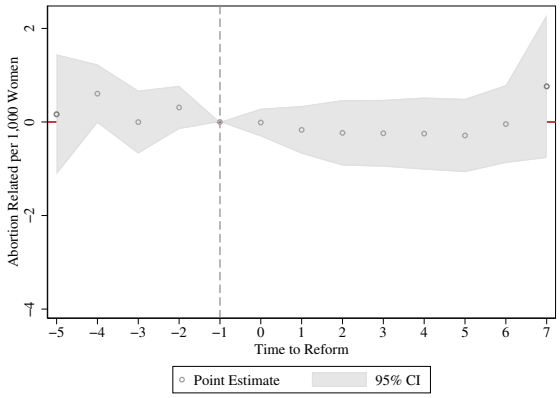
(a) Haemorrhage (Progressive)



(b) Haemorrhage (Regressive)



(c) Abortion Related (Progressive)



(d) Abortion Related (Regressive)

Notes: Event studies replicate those from Figures 2a and 2b, however using yearly administrative records based on Secretariat of Health hospitals *and* Social Security Hospitals. All details follow those indicated in notes to Figures 2a and 2b however we now work with the universe of hospital visits in all public hospitals. DD models are provided in Appendix Table A12 (and Appendix Table A13 for birth rates).

mates, as we observe a sharper reduction in abortion related morbidity in private hospitals than we observe in public hospitals. In the case of morbidity due to haemorrhage early in pregnancy, we are unable to observe this as a sole cause in the private health records, but we are able to observe the class in which this cause falls and again we observe a considerably sharper reduction in morbidity following the reform in the private health system than we observe in the public health system (Appendix Figure A16).

5.3.4 Reform Spillovers and Heterogeneity

Reform Spillovers As outlined in Section 2.2, the ILE reform was not strictly limited to residents of Mexico DF. Recent evidence from the United States documents a willingness to travel over a significant distance to access abortion providers (Lindo et al., 2019; Venator and Fletcher, 2019). In Appendix Table A14 we provide summary figures of the state of precedence of users of abortion services in Mexico DF based on administrative data for 2007-2015. While the majority of users (72.5%) are women from Mexico DF, women residing all throughout Mexico have access to ILE. The largest non-DF population comes from nearby Mexico State (24.2%). In general, users of the ILE reform are clustered in states geographically close to Mexico DF. A descriptive plot is presented in Appendix Figure A17. Residents in Mexico DF have by far the highest rate of abortion, at 5.8 abortions per 1,000 women aged 15-49, followed by Mexico State (at 1 per 1,000), and then two nearby states (Hidalgo and Morelos) with rates of 0.1 per 1,000. Remaining states have rates which are an additional order of magnitude lower than this.

Despite some evidence of very localised geographic spillovers, we do not observe clear evidence of changes in birth or maternal health outcomes in nearby states. In Table A15 we estimate DD models augmenting specification 1 with a post ILE×spillover state indicator, where spillover states refer Mexico State, Morelos and Hidalgo (the three states with most considerable abortion usage per population). In no case do we observe statistically significant reductions in fertility, morbidity or mortality, if anything observing weakly positive impacts. Additional discussion is provided in Appendix C.

An alternative model which captures both the impacts of the reform in Mexico DF as well as any reform spillovers to the rest of the country, replaces the ILE variable in equation 1 with the intensity of treatment in each state. This intensity measure is captured as the rate of abortion per 1,000 women (documented in Appendix Table A14) in the post-reform period in each state. This information is reported in official ILE reports, however is only available at the level of the year, and as such in this case we estimate yearly models as in Section 5.3.3. If outcomes per 1,000 women are regressed on abortion usage per 1,000 women, this provides a back-of-the-envelope calculation of the elasticity of outcomes with respect to the availability of a legal abortion. For example, if each additional legal abortion results in 1 fewer births, we will estimate a coefficient of -1 in this model, suggesting full

pass-through of legalised abortion to birth rates. We note however in our case that the figures on abortions refer *only* to those abortions provided by official ILE provides. To the degree that private providers additionally provide access to legal abortion, these estimates should be seen as an upper bound estimate on the magnitude of pass through. We estimate models of this type in Appendix Table A16. In general we observe that, using the full data on abortions across Mexico resulting from the ILE reform, impacts per abortion are considerable, suggesting approximately 0.9 fewer birth per every abortion provided, 0.16 fewer cases of abortion related morbidity, and 0.14 fewer cases of morbidity due to haemorrhage. These values must be viewed in line with the caveat above, that any abortions accessed from private providers will reduce the actual magnitude of pass-through (likely considerably given the relevance of the private sector), and as such, these are upper bound estimates.

Individual Heterogeneity in Reform Impacts Effects discussed up to this point have focused on average outcomes over all women aged 15–49. However, given evidence documenting heterogeneous impacts of abortion reform in other contexts (Ananat et al., 2007), and heterogeneity in access to abortion in Mexico (Friedman et al., 2019), we consider heterogeneity in a number of contexts here. In Tables A17 and A18 we examine the impacts of the reform on abortion related morbidity and on haemorrhage early in pregnancy by quinquennial age groups and by individual's insurance coverage. While we would like to consider impacts by individual income level, this latter category of insurance coverage is one of the closest proxies of income which we can observe in hospitalization microdata. In the case of both outcomes we observe three broad stylised facts. The first, health impacts are observed across the age distribution; the second, that these impacts are largest in size among younger women, peaking in the age group of 20–24 years; and the third that results appear to the driven by individuals who *do* have insurance coverage. This final fact suggests that impacts may be higher among higher income women, however it is important to note that this classification by insurance status is very crude, as not having formal insurance likely signifies a considerable disconnection from the public health system.

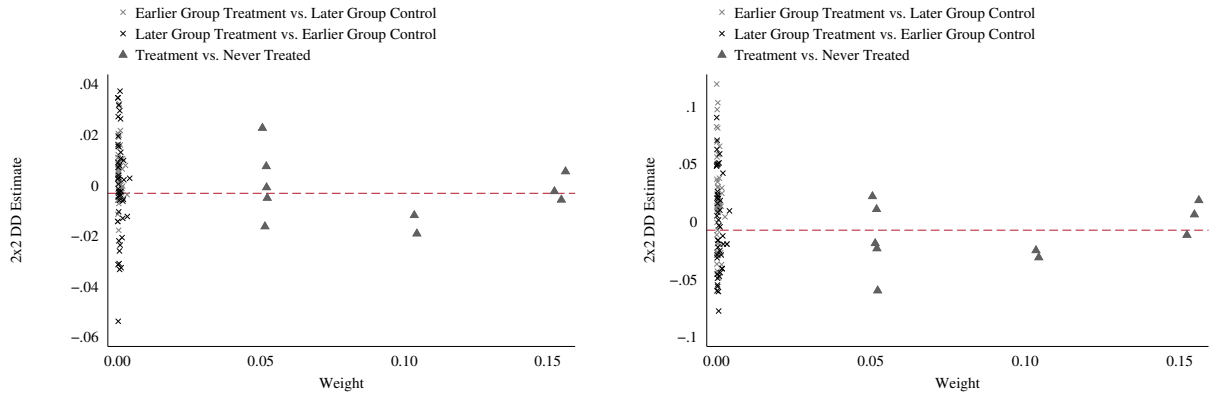
Finally, in Appendix Figure A18 we document impacts more finely by age, specifically focusing on teen-aged and younger women. Given that minors require parental consent, we may expect that impacts on these women are reduced, in line with reduced rates of usage. In Appendix Figure A18 we observe single-coefficient DD estimates for each age, where we estimate models 1 (presented

as hollow circles) and 2 (presented as black squares) separately in each yearly age group. Here, while we do observe a general increase in the magnitude of coefficients while increasing from 15 to 18 years and above, we do observe that even among younger adolescents (for example 16 year-olds), significant impacts of ILE are observed on both rates of haemorrhage, and abortion related morbidity.

Temporal Heterogeneity in Reform Impacts An additional concern related to the timing of adoption of the regressive reforms is that single-coefficient DD estimates (equation 1) may be capturing heterogeneity and variation in law implementation, rather than the ATT itself (Goodman-Bacon, 2018). In particular, we may be concerned that small effects are being driven by the incorrect use of already treated units as controls in future periods. This will bias towards zero any effects of the laws if these impacts are growing over time. We thus follow Goodman-Bacon (2018) in explicitly decomposing the single-coefficient DD model into its component parts of a pure "treated versus never-treated" effect, and effects owing simply to the variation in timing of the passage of laws. We note that this decomposition is only of concern in the case of regressive laws given that ILE was adopted in a single moment of time (and a single state). This decomposition is displayed graphically in Figure 5 following Goodman-Bacon (2018); Goodman-Bacon et al. (2019). We plot the full set of "2×2" DD estimates of the impact of regressive reforms on morbidity outcomes,[23] where these models come from all variation in treatment timing and all possible control groups. We observe that estimates are largely clustered around zero, particularly for the Treated versus Never-Treated comparisons of interest. We present the global decomposition in Appendix Table A19, and observe—reassuringly—that in each case the majority of the weight in the single coefficient DD estimate comes from the Treated versus Never-Treated comparison (around 92%), and in general, estimates even within the timing-only groups are similarly small when compared to the Treated versus Never-Treated effect.

[23] Estimates for birth rates are provided in Appendix Figure A19.

Figure 5: Goodman-Bacon (2018) Decomposition Based on 2×2 Difference-in-Difference Models



(a) Haemorrhage

(b) Abortion Related

Notes: Figures document the Goodman-Bacon decomposition into a series of 2×2 difference-in-differences models depending on the type of comparison unit. Here the "treatment" refers to the passage of a regressive abortion law, and the outcomes refer to rates of morbidity per 1,000 women. The passage of the ILE reform occurred at a single moment in time, and as such, decompositions need not be performed. The global decomposition is given in Table A19.

5.3.5 Broader Impacts of the ILE Reform

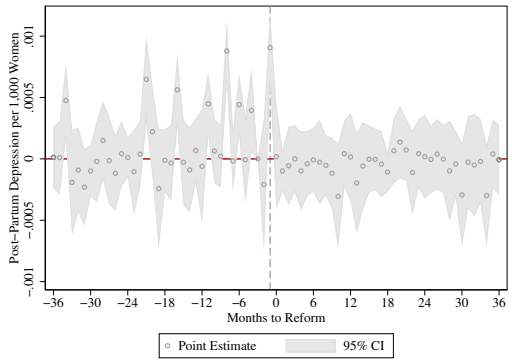
The ILE reform was a significant change, noteworthy even within the entire continent of Latin America (Sánchez Fuentes et al., 2008). Evidence from literature in economics such as Chiappori and Oreffice (2008); Oreffice (2007) suggests that abortion reform can have significant impacts beyond health and fertility outcomes, extending to broader spheres within households and individual well-being. Here we briefly discuss a number of possible additional impacts of abortion reform on women's mental health and family outcomes. Given challenges in measurement and reporting,[24] this work should be considered as exploratory, and subject to future research.

To examine the impact on maternal mental health, we consider the predominant mental disorders in this domain—namely post-partum depression and other mental and behavioral disorders associ-

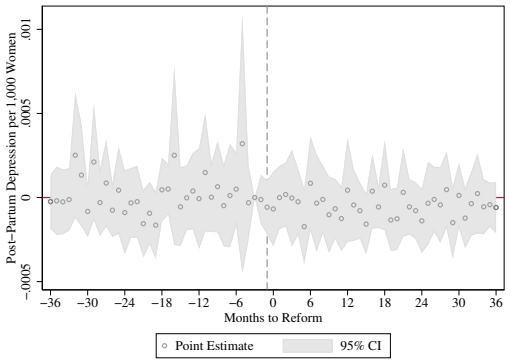
[24] When screened for, maternal depression (and other mental health issues related to childbirth) is a common condition both antenatal and post-partum, with estimates suggesting a prevalence between 13-18% in Mexico (Albuja et al., 2017). However, as in most countries, the prevalence of maternal depression is difficult to establish as maternal depression is often under-diagnosed and under-reported (on the end of both health care professionals as well as patients) (Anokye et al., 2018). Our ability to capture post-partum depression (and similar conditions) is limited given that we don't have access to outpatient or pharmaceutical data. Being hospitalised for post-partum depression is rare and hospitalisations are likely to capture the most serve cases of mental illness while the majority of women are most likely treated elsewhere if diagnosed.

ated with the puerperium (Organization et al., 2015). We use the same administrative health records as used previously, recording all hospitalisations classified as owing to mental and behavioral disorders associated with the puerperium including post-partum depression (ICD-10 code F53).[25]

Figure 6a: Monthly Event Studies Examining Post-Partum Depression

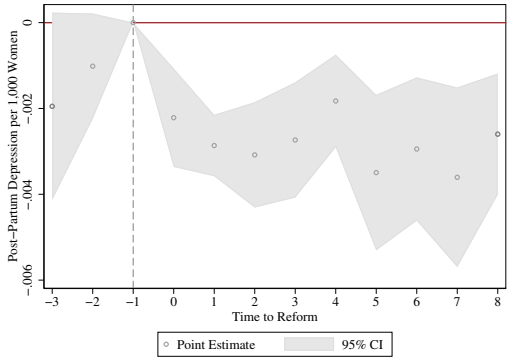


(a) Progressive Abortion Reform (ILE)

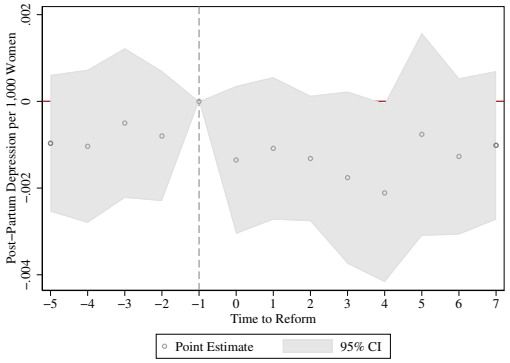


(b) Regressive Abortion Laws (Legal Tightening)

Figure 6b: Yearly Event Studies Examining Post-Partum Depression



(c) Progressive Abortion Reform (ILE)



(d) Regressive Abortion Laws (Legal Tightening)

Notes: Event studies document the evolution of rates of post-partum Depression per 1,000 women surrounding the passage of abortion reforms. Each point estimate refers to the change in rates between treated and non-treated states, compared to their baseline differential immediately prior to the reform. Figure 6a presents event studies based on monthly rates of post-partum Depression (using data from Secretary of Health hospitals only), while Figure 6b presents event studies based on yearly rates of post-partum Depression using data from all public hospitals (both Secretary of Health and Social Security providers). In each case, the left-hand panel shows the difference between Mexico DF and untreated states surrounding the passage of the ILE reform. The right-hand panel shows the difference between regressive policy changers and non-changers around the (time-varying) date that each reform was passed. Regressions are weighted by the population of fertile-aged women, and the full set of time-varying controls are included.

In Figure 6a and 6b we estimate impacts of abortion reform following equations 1-2 on rates of

[25] Another relevant mental health outcome is suicide attempt. However, this is an extreme measure of poor mental health. Moreover, in the ICD system suicide attempts are recorded separately as external causes, which are not consistently available in all micro-data over time.

post-partum depression. While Figure 6a suggests no consistently observable impacts on rates of post-partum depression around the passage of abortion reforms (for both progressive and regressive reforms), there is some evidence suggesting a reduction in rates of depression in Mexico DF compared with other non-treated states when examining yearly estimates in Figure 6b. No such clear evidence is observed in the case of states undertaking legal tightenings.

Finally, while in this paper we are focusing principally on the health impacts of the adoption of abortion laws, there are potentially much broader impacts of such a policy. For example, Lauletta (2019) provides evidence of potential reductions in domestic violence flowing from these reforms, in line with economic theory suggesting improvements in women's bargaining power flowing from birth control reforms.

5.3.6 Mechanisms: Availability, education, or behavior

Along with the law change legalising abortions, the ILE reform included additional components relating to sexual education and disbursement of additional contraceptives in clinics (refer to Section 2.2). To examine the channels through which the reform affected birth rates: whether it be only access, or a combination of access with behavioral change, we use the MxFLS data which follows women over time, and has survey rounds both before and after the abortion reforms of interest. To examine the potential effect of the other aspects of the reform (sexual education and contraceptives), we estimate a version of equation 1, however at the level of the individual, which allows for individual-specific fixed-effects given the panel nature of the MxFLS data.

We examine the effect of abortion reform on all available measures of contraceptive use (using any contraceptive or using modern contraceptives), the number of reported sexual partners and whether the respondent reports having knowledge of modern contraceptive methods. These results are presented in Appendix Table A20. In general, we find very little evidence to suggest that the results of the abortion reform flow from an increase in *other* contraceptive knowledge in reform areas, or change in risky sexual behavior as a result of the reform. We find quite close to zero effects for change in contraceptive use and knowledge, and an insignificant reduction in the number of sexual partners reported. In all cases, these results are insignificant at the 10% level[26] suggesting that the

[26]Summary statistics are provided in Appendix Table A21, and similar results are observed using a repeated cross

ILE reform's effect is largely due to the sharp increase in utilization of abortion services, rather than alternative contraception or information channels. Similarly, we do not find that regressive changes in abortion laws cause women to seek additional information or be more likely to use contraceptives, or change sexual behavior as proxied by the number of sexual partners compared to areas which were not subject to a regressive reform. We do note in the case of the number of sexual partners that while we cannot reject that the impact is significant even at a 10% level, we cannot rule out economically meaningful effects given the reasonably inexact point estimate.

6 Conclusion

In this paper we examine the impact of abortion law on women's health. We consider a context in which considerable heterogeneity in legislative reform is observed. In Mexico in the late 2000s both a substantial loosening, and a series of tightenings of abortion policies were undertaken at the sub-national level. Using comprehensive vital statistics data on maternal health outcomes, we observe that safe legal abortion available in the first trimester of pregnancy in Mexico DF resulted in a sharp drop in maternal morbidity due to haemorrhage, and a slower decline in morbidity due to abortion, perhaps in line with the gradual adoption of recommended abortion techniques by public health clinics. These declines were of substantial importance, suggesting 8,600 fewer inpatient visits in the post-abortion years in Mexico DF. In general, we observe quite weak effects of the tightening of *de facto* sanctions on abortion, even though, as we show, these sanctions did lead to changes in the length of sentences handed down to women.

We document that the impact of Mexico DF's ILE reform on birth rates, at around a 8% reduction, is in line with impacts estimated in other settings, for example the US in the 1970s. We observe generally weaker effects of regressive reforms on birth rates, though note that in the case of Mexico, these state-level reforms may have *reduced* fertility by around 1-2%. Importantly, when examining the impacts of abortion reforms on rates of maternal death, our estimates are considerably noisier than those for maternal morbidity. This is of importance given that a range of papers examining the impact of abortion on women's health limit analyses to maternal death, given a paucity of high-quality health records. Our results suggest that this focus on "the tip of the iceberg" may lead to less convincing results than when focusing on maternal morbidity. While focusing on surviving

section of women (Appendix Table A22).

child birth should be an absolute minimum when designing public policies to protect maternal and women's health, maternal morbidity is of considerable importance when quantifying life-time well-being, and avoiding a considerable health burden leading to chronic conditions.

The results of this paper are becoming relevant once again as a number of countries revisit abortion legislation and attempt to make considerable changes in constitutions and penal codes. Among others, legislative reforms have been undertaken or attempted in Ireland, Argentina, Australia, Chile and New Zealand in 2017-2020 focusing on legalising abortion in certain circumstance, and increasing restrictions have been enacted or proposed in Poland and a number of US states. This paper documents that these policies are likely to have a considerable impact on women's health and well-being.

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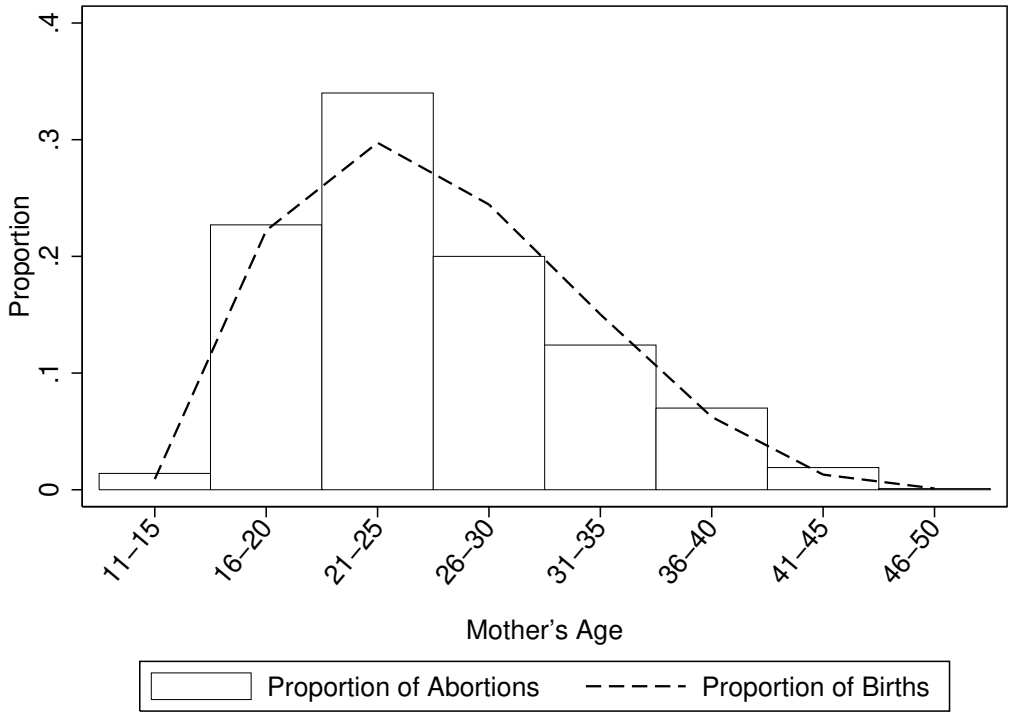
Online Appendices

"Abortion Laws and Women's Health

Damian Clarke & Hanna Mühlrad

A Appendix Figures and Tables

Figure A1: Proportion of births and abortion in MOH-DF clinics



Notes: Proportion of births by age are generated from administrative data provided by INEGI. Proportion of abortions by age are compiled from summary data released by the Ministry of Health of Mexico DF.

Table A1: Changes in Penal Codes Surrounding Abortion Laws

State	Pre-Reform Sanction	Post-Reform Sanction	Additional Changes
Chiapas	1-3 years prison	1 to 3 years prison	Added detail to the penal code, increased sentences for "collaborators"
Chihuahua	3 months to 5 years prison	6 months to 3 years prison	Added detail to the penal code, increased sentences for "collaborators"
Colima	1-3 years prison and fine	1-3 years prison and fine	No changes to penal code (only state constitution)
Durango	1-3 years prison	1-3 years prison and fine	Increased sentences for "collaborators"
Guanajuato	6 months to 3 years prison and fine	6 months to 3 years prison and fine	Increased sentences for "collaborators"
Jalisco	4 months to 1 year prison	4 months to 1 year prison	Added possibility of psychological treatment in commutation of prison
Mexico DF	1-3 years prison	3-6 months prison or community work	Added possibility of community work in commutation of prison
Morelos	1-5 years prison	1-5 years prison and fine	Added possibility of psychological treatment in commutation of prison
Nayarit	1-3 years prison and fine	1-3 years prison and fine	No changes to penal code (only state constitution)
Oaxaca	6 months to 2 years prison	6 months to 2 years prison	No changes to penal code (only state constitution)
Queretaro	1-3 years prison	1-3 years prison	No changes to penal code (only state constitution)
Quintana Roo	6 months to 2 years prison	6 months to 2 years prison	No changes to penal code (only state constitution)
San Luís de Potosí	1-3 years prison and fine	1-3 years prison and fine	Monetary amount of fine altered
Sonora	1-6 years prison and fine	1-6 years prison and fine	No changes to penal code (only state constitution)
Tamaulipas	1-5 years prison	1-5 years prison	Added possibility of psychological treatment in commutation of prison
Yucatan	1-5 years prison	1-5 years prison	Changed sanctions in certain specified circumstances

All details are collated from a side-by-side reading of penal codes prior to and posterior to the reform. In cases where no changes were made in the penal codes, this implies that changes were only made in the State Constitutions, which were altered to recognise life as beginning at conception.

Table A2: Constitutional Changes Following Mexico DF's ILE Reforms

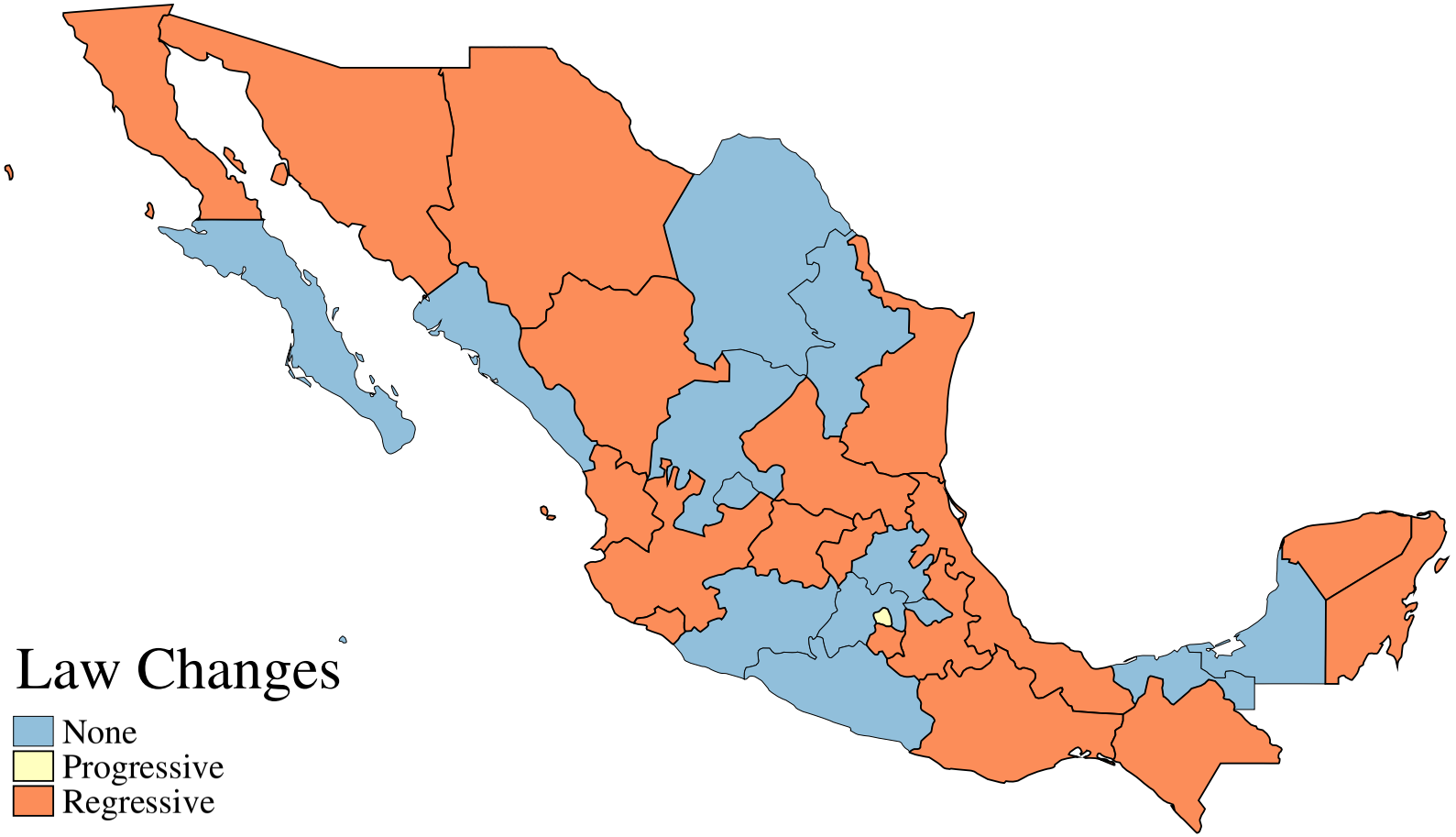
State	Reform Date	Constitutional Decree	Article in Question
Baja California	Dec 26, 2008	Decree 175	7
Chiapas	Jan 20, 2009	Decree 139	178
Chihuahua	Jun 21, 2008	Decree 231-08	143
Colima	Nov 25, 2009	Decree 296	187
Durango	May 31, 2009	Decree 273	350
Guanajuato	May 26, 2009	Dictamen 836	158
Jalisco	Jul 02, 2009	Decree 22361	228
Morelos	Dec 11, 2008	Decree 1153	115
Nayarit	Jun 06, 2009	Decree 50	335
Oaxaca	Sep 11, 2009	Decree 1383	312
Puebla	Jun 03, 2009	SPI-ISS-27-09*	136
Querétaro	Sep 18, 2009	P. O. 68‡	339
Quintana Roo	May 15, 2009	Decree 158	92
San Luis Potosí	Sep 02, 2009	Decree 833	128
Sonora	Apr 06, 2009	Law 174	265
Tamaulipas	Dec 23, 2009	Decree LX-1850	356
Yucatán	Aug 07, 2009	Decree 219	389
Veracruz	Nov 17, 2009	G. L. 155‡	150

Notes: All states which formally altered their constitutions following Mexico DF's ILE reform are indicated above. Constitutional decree refers to the law composed to alter the state constitution, and article in question refers to the article altered in the constitution or penal code which was altered by the decree. Dates, decrees and articles are collated by the authors from various state government sources. The official document approving each decree and its associated date is available in a zipped folder on the authors' websites.

* Decrees or official newspapers for the State of Puebla could not be located by the authors. The date and article in question is suggested by Gamboa Montejano and Valdés Robledo (2014).

‡ P. O. refers to the official newspaper where laws are published in Querétaro, and G. L. refers to the same newspaper in Veracruz. The law was published without number (pp. 9857-9859) in P. O. 68 and in G. L. 155 (pp 2-5) in Querétaro and Veracruz respectively.

Figure A2: Geographical Distribution of State Law Changes (post August-2007)



Notes: The August 2007 ILE reform occurred in Mexico DF (yellow). Resulting (regressive) reforms in other states are indicated in red, with states highlighted in blue indicating that no law change occurred between 2007 and 2016.

Table A3: Maternal Morbidity in Mexico

ICD-10 Code	Private Code	Name	Cases	Percent
O00	236	Ectopic pregnancy	187,315	0.534
O01	236	Hydatidiform mole	30,190	0.086
O02	236	Other abnormal products of conception	650,198	1.852
O03	234	Spontaneous abortion	335,081	0.954
O04	235	Medical abortion	7,268	0.021
O05	236	Other abortion	53,928	0.154
O06	236	Unspecified abortion	2,153,004	6.133
O07	236	Failed attempted abortion	996	0.003
O08	236	Complications following abortion and ectopic/molar pregnancy	12,047	0.034
O10	237	Complications due to Pre-Existing Hypertension	81,301	0.232
O11	237	Pre-existing hypertensive disorder with superimposed proteinuria	2,504	0.007
O12	237	Gestational oedema and proteinuria without hypertension	967	0.003
O13	237	Gestational hypertension without significant proteinuria	592,387	1.687
O14	237	Severe pre-eclampsia	666,635	1.899
O15	237	Eclampsia	49,263	0.140
O16	237	Unspecified maternal hypertension	145,099	0.413
O20	242	Haemorrhage in early pregnancy	677,757	1.931
O21	242	Excessive vomiting in pregnancy	60,311	0.172
O22	242	Venous complications in pregnancy	7,322	0.021
O23	242	Infections of genitourinary tract in pregnancy	792,372	2.257
O24	242	Diabetes mellitus in pregnancy	252,069	0.718
O25	242	Malnutrition in pregnancy	956	0.003
O26	242	Maternal care for other conditions predominantly related to pregnancy	86,511	0.246
O28	242	Abnormal findings on antenatal screening of mother	1,354	0.004
O29	242	Complications of anaesthesia during pregnancy	1,104	0.003
O30	239	Multiple gestation	116,853	0.333
O31	239	Complications specific to multiple gestation	4,178	0.012
O32	239	Maternal care for known or suspected malpresentation of fetus	377,630	1.076
O33	239	Maternal care for known or suspected disproportion	1,237,260	3.524
O34	239	Maternal care for known or suspected abnormality of pelvic organs	1,483,859	4.227
O35	239	Maternal care for known or suspected fetal abnormality and damage	16,046	0.046
O36	239	Maternal care for other known or suspected fetal problems	737,348	2.100
O40	239	Polyhydramnios	33,782	0.096
O41	239	Other disorders of amniotic fluid and membranes	694,761	1.979
O42	239	Premature rupture of membranes	1,079,039	3.074
O43	239	Placental disorders	12,270	0.035

O44	238	Placenta praevia	98,225	0.280
O45	238	Premature separation of placenta (abruptio placentae)	54,260	0.155
O46	238	Antepartum haemorrhage, not elsewhere classified	8,770	0.025
O47	239	False labour	1,214,865	3.461
O48	239	Prolonged pregnancy	85,304	0.243
O60	242	Preterm delivery	436,889	1.244
O61	242	Failed induction of labour	74,634	0.213
O62	242	Abnormalities of forces of labour	235,129	0.670
O63	242	Long labour	263,861	0.752
O64	240	Obstructed labour due to malposition and malpresentation of fetus	255,257	0.727
O65	240	Obstructed labour due to maternal pelvic abnormality	478,134	1.362
O66	240	Other obstructed labour	134,555	0.383
O67	242	Labour and delivery complicated by intrapartum haemorrhage	9,832	0.028
O68	242	Labour and delivery complicated by fetal stress (distress)	761,623	2.169
O69	242	Labour and delivery complicated by umbilical cord complications	133,400	0.380
O70	242	Perineal laceration during delivery	82,045	0.234
O71	242	Other obstetric trauma	22,141	0.063
O72	241	Postpartum haemorrhage	91,844	0.262
O73	242	Retained placenta and membranes, without haemorrhage	51,166	0.146
O74	242	Complications of anaesthesia during labour and delivery	4,832	0.014
O75	242	Other complications of labour and delivery	167,982	0.478
O80	243	Single spontaneous delivery	14,383,652	40.972
O81	242	Single delivery by forceps and vacuum extractor	57,556	0.164
O82	242	Single delivery by caesarean section	2,465,467	7.023
O83	242	Other assisted single delivery	98,323	0.280
O84	242	Multiple delivery	46,596	0.133
O85	244	Puerperal sepsis	25,599	0.073
O86	244	Other puerperal infections	35,657	0.102
O87	244	Venous complications in the puerperium	2,418	0.007
O88	244	Obstetric embolism	1,147	0.003
O89	244	Complications of anaesthesia during the puerperium	8,855	0.025
O90	244	Complications of the puerperium, not elsewhere classified	76,866	0.219
O91	244	Infections of breast associated with childbirth	7,497	0.021
O92	244	Other disorders of breast and lactation associated with childbirth	791	0.002
O94	244	Sequelae of complication of pregnancy, childbirth and the puerperium	1,809	0.005
O95	244	Obstetric death of unspecified cause	38	0.000
O96	244	Death from obstetric cause >42 days but < 1 year after delivery	10	0.000
O97	244	Death from sequelae of direct obstetric causes	10	0.000
O98	244	Maternal infectious and parasitic diseases	97,048	0.276
O99	244	Other maternal diseases complicating pregnancy, birth and the puerperium	491,279	1.399

TOTAL	35,106,332	100.000

Table A4: Summary Statistics on Morbidity in All Public Primary Care

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Panel A: Morbidity Outcomes					
Total Number of Deliveries in Public Hospitals	384	44405	34708	7109	211999
Total Inpatient Cases for ICD O codes, except births	384	47018	32696	9085	172656
Total Inpatient Cases for Abortion-Related Causes	384	8366	6587	1454	37857
Total Inpatient Cases for Haemorrhage Early in Pregnancy	384	1765	1208	252	6426
Total Inpatient Days for Abortion-Related Causes	384	11841	9681	1805	49671
Total Inpatient Days for Haemorrhage Early in Pregnancy	384	3812	2961	495	14781
Total Inpatient Cases for Obstetric Complications	384	468	619	10	3601
Total Inpatient Cases for Post-Partum Depression	384	1	1	0	11
Panel B: Mortality Outcomes					
Total Number of Maternal Deaths	512	36	33	1	182
Total Number of Maternal Deaths due to Abortion	512	3	3	0	15
Panel C: Demographic Outcomes					
Population of 15-49 Year-old Women	512	860298	741558	116430	4196244
Total Number of Births	416	73074	58625	10991	300349
Birth rate per 1,000 women	416	88	10	64	129

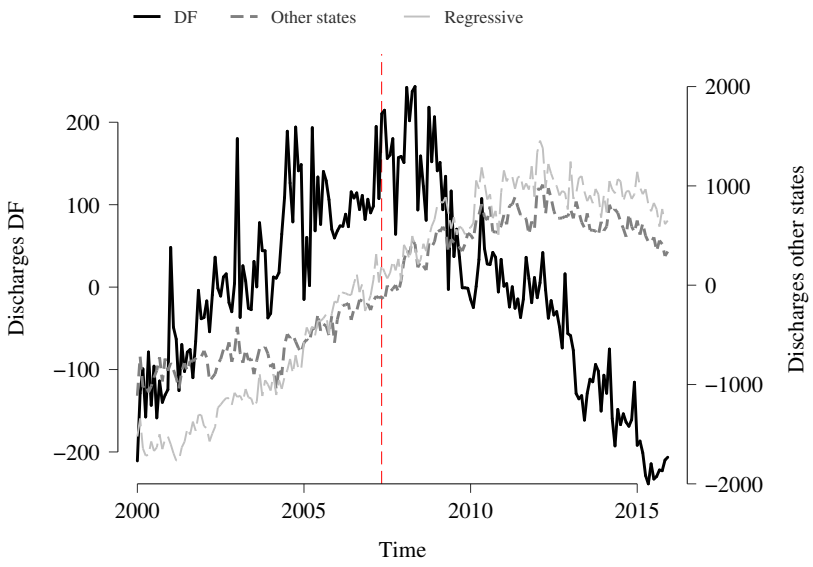
Each observation is a state×year cell. Mexico is composed of 32 States. The number of cells varies due to the number of years of data availability. In panel A, morbidity data is displayed for 12 years (2004-2015). Values are generated from all inpatient cases as classified from microdata from the primary care (hospital) records from all public hospitals, both those administered by the Secretariat of health and the Social Security System. Each type of morbidity is classified by ICD-10 codes. In Panel B, mortality outcomes are displayed for 16 years (2001-2016). In panel C, data on population is displayed for 16 years (2001-2016), and data on births is displayed for 13 years (2001-2013). Following CONAPO, the last four years of birth outcomes are suppressed to account for reporting outside of the period of birth.

Table A5: Summary Statistics on Time-Varying Controls

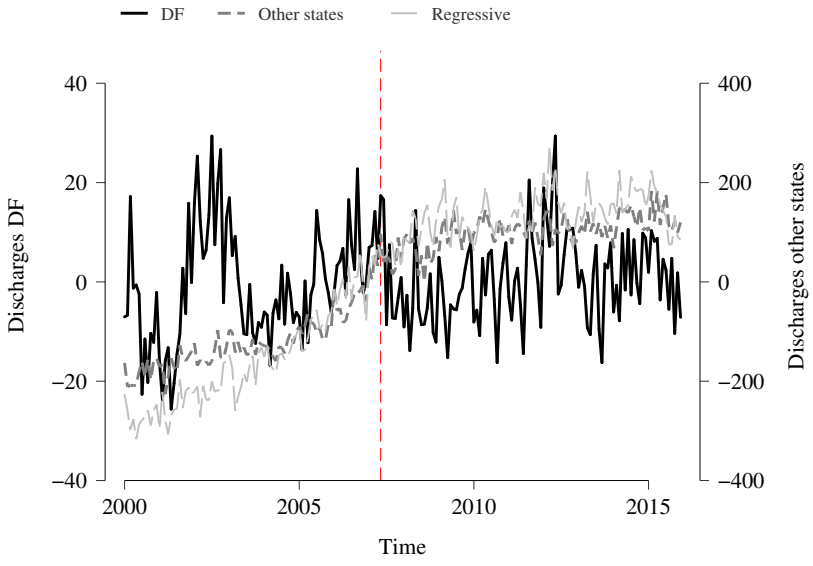
Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Percent of State Living Below Poverty Line	512	46.81	14.58	17.58	83.85
Percent of State Residents with Access to Health Institutions	512	48.88	14.07	20.66	90.69
Average Schooling of Adult Population	512	8.43	0.99	5.71	11.05
Percent of Women of Working Age Economically Active	512	37.05	2.85	26.66	44.69
Average Salary of Full Time Workers	512	5037.28	1089.12	1957.12	8022.83
Proportion of Municipalities with Seguro Popular Coverage	512	0.78	0.38	0.00	1.00

Each observation is a state×year cell. Mexico is composed of 32 States. The number of observations represents 32 states and years 2001-2016. State poverty is provided by the National Council for the Evaluation of Social Development Policy (CONEVAL). The proportion of residents with access to health institutions is provided by the Mexican Secretary of Health. Years of schooling are compiled from the National Educational Information System (SNIP). The proportion of economically active women and average salaries by state are calculated from the trimestral National Occupation and Employment Survey (ENOE) provided by INEGI. Seguro Popular coverage is calculated from municipal rollout data, and records the proportion of each municipalities in the state having access. Prior to 2002 this value is always 0, and after 2007 this value is always 1.

Figure A3: Monthly Trends in Residualized Specific Morbidities using Secretary of Health Hospitals Only



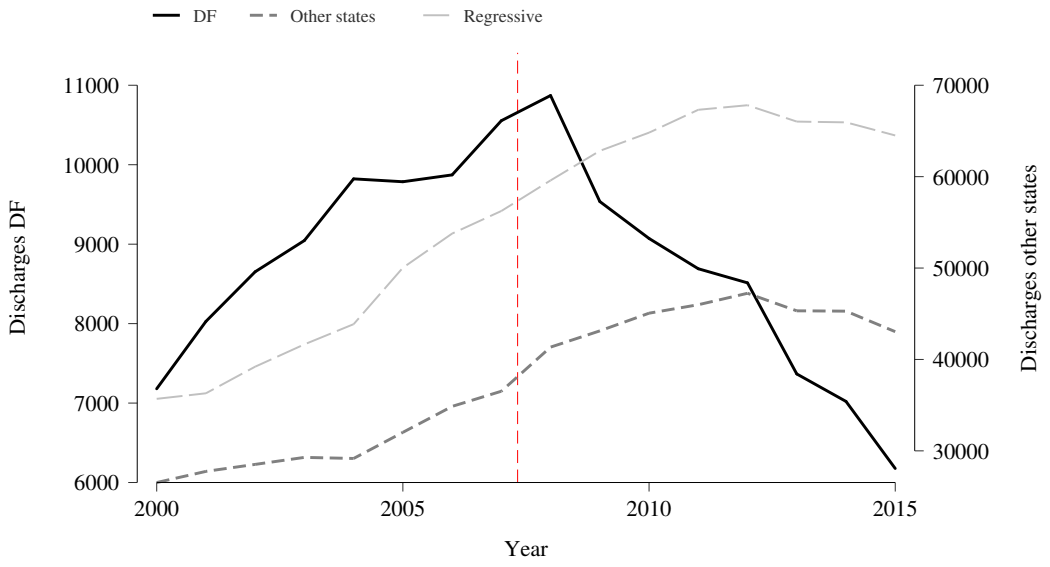
(a) Abortion Morbidity (Total)



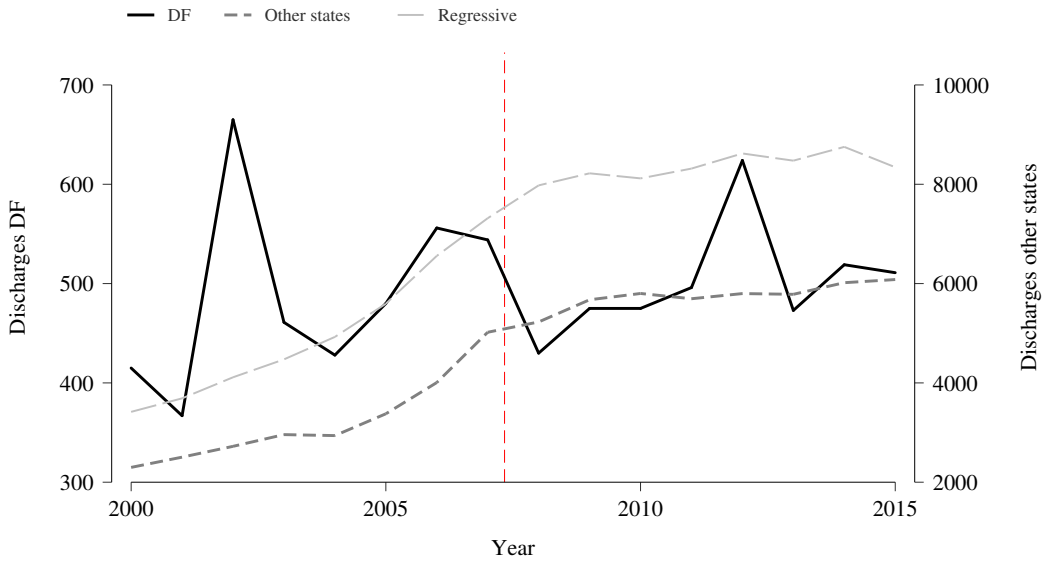
(b) Haemorrhage Early in Pregnancy (Total)

Notes: Monthly averages of the residual of the total number of cases of abortion related morbidity and haemorrhage early in pregnancy are presented. The residuals are calculated conditional on state-specific month fixed effects, as well as state fixed effects, to smooth regular monthly variation by state. Raw totals are presented in Figure 1. Monthly averages can only be plotted for data from hospitals administered by the Secretariat of Health. The dotted vertical line is plotted in April of 2007, the date of passage of the abortion reform, and wide-scale rollout of available abortions.

Figure A4: Longer Trends in Specific Morbidities using Secretary of Health Hospitals Only



(a) Abortion Morbidity (Total)



(b) Haemorrhage Early in Pregnancy (Total)

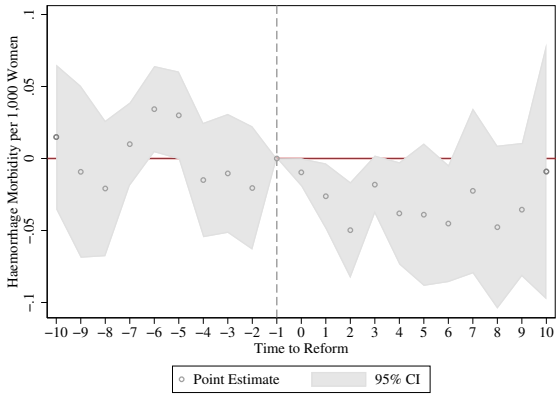
Notes: Figures present the total number of discharges due to abortion related morbidity (panel A), and haemorrhage early in pregnancy (panel B). Each trend is based on data from hospitals administered from the Secretariat of Health only (available from 2000 onwards). Data in Figure A25 is based on the universe of the public health system, and also includes hospitals administered by Social Security Institutes.

Table A6: Difference-in-Differences Estimates of Legal Reforms on Morbidity using Inpatient Days

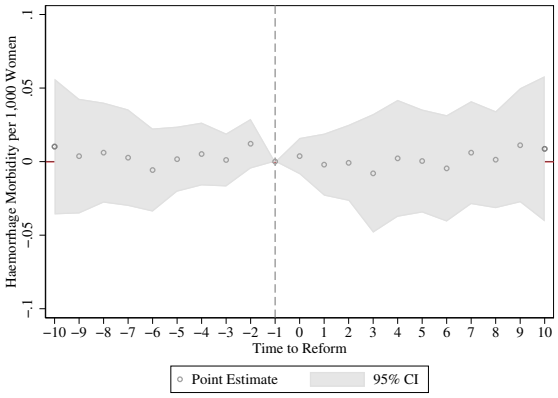
	Abortion Related Morbidity				Haemorrhage Early in Pregnancy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.082***	-0.086***	-0.069***	-0.078***	-0.026***	-0.031***	-0.027	-0.027*
	(0.018)	(0.014)	(0.026)	(0.024)	(0.009)	(0.009)	(0.017)	(0.016)
Observations	2,496	2,496	2,496	2,496	2,496	2,496	2,496	2,496
Mean of Dependent Variable	0.444	0.444	0.444	0.444	0.084	0.084	0.084	0.084
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.011	0.007	-0.022	-0.004	-0.008	-0.003	-0.008	-0.001
	(0.020)	(0.017)	(0.017)	(0.017)	(0.012)	(0.010)	(0.012)	(0.009)
Observations	5,952	5,952	5,952	5,952	5,952	5,952	5,952	5,952
Mean of Dependent Variable	0.433	0.433	0.433	0.433	0.082	0.082	0.082	0.082
State and Year FEs	Y	Y	Y	Y	Y	Y	Y	Y
Population Weights		Y		Y		Y		Y
Time Varying Controls			Y	Y			Y	Y

Notes: Specifications replicate those in Table 2, however now instead of estimating the impact of the reforms on the number of inpatient cases, we estimate impacts on the total number of inpatient days corresponding to these cases. Additional notes are available in Table 2. *p< 0.10; **p< 0.05; ***p< 0.01.

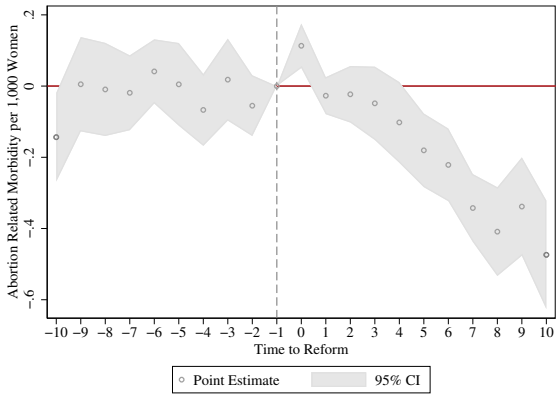
Figure A5: Event Studies Based on Trimesterly Registers



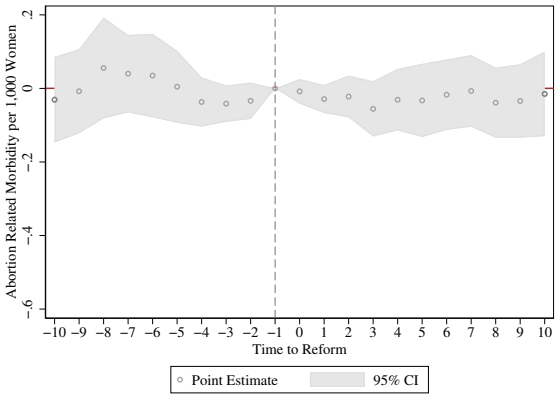
(a) Haemorrhage (Progressive)



(b) Haemorrhage (Regressive)



(c) Abortion Related (Progressive)



(d) Abortion Related (Regressive)

Notes: Event studies replicate those from Figures 2a and 2b, however using trimesterly administrative records. All details follow those indicated in notes to Figures 2a and 2b where we work only with the universe of hospital visits in public (Ministry of Health) hospitals, given unavailability of exact dates (beyond year) in hospital records run by the Social Security system. Additionally, in each case we include trimester by state fixed effects to flexibly control for seasonality in births.

Table A7: Difference-in-Differences Estimates of Legal Reforms on Maternal Mortality

	All Maternal Mortality				Maternal Mortality due to Abortion			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.585*	-0.517	-0.262	-0.370	-0.093*	-0.085*	-0.015	-0.067
	(0.351)	(0.329)	(0.688)	(0.703)	(0.052)	(0.047)	(0.100)	(0.090)
Observations	208	208	208	208	208	208	208	208
Mean of Dependent Variable	3.981	3.981	4.028	4.028	0.278	0.278	0.276	0.276
Panel B: Regressive Reforms versus Non-Reformers								
Post Regressive Law Change	-0.476	-0.421	-0.480	-0.552	-0.095*	-0.063	-0.095*	-0.074
	(0.336)	(0.351)	(0.321)	(0.337)	(0.057)	(0.043)	(0.054)	(0.047)
Observations	496	496	496	496	496	496	496	496
Mean of Dependent Variable	3.976	3.976	4.028	4.028	0.272	0.272	0.276	0.276
State and Year FEs	Y	Y	Y	Y	Y	Y	Y	Y
Population Weights		Y		Y		Y		Y
Time-Varying Controls			Y	Y			Y	Y

Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of maternal mortality. Maternal mortality (all causes) and maternal mortality for abortive causes are each measured as total deaths per 100,000 fertile aged women each year, and average levels in the full set of data are available at the foot of the table. All standard errors are clustered at the level of the state. *p< 0.10; **p< 0.05; ***p< 0.01.

Table A8: Review of Estimates of Abortion Reform on Birth Rates

Authors	Context	Reform	Outcome	Estimate
Panel A: Progressive Law Changes				
Angrist and Evans (1996)	United States	1970 abortion reforms	Probability of teen motherhood	−0.045 (0.012) for black women and −0.012(0.04) for white women.[a]
Ananat et al. (2007)	United States	Roe v Wade	Number of children per woman up to age 39.	−0.054 (0.012).[b]
Ananat and Hungerman (2012)	United States	Abortion and the pill	Birth rate for women in ages 14-20.	−0.0476 (0.0135).[c]
Antón et al. (2018)	Uruguay	Abortion	log Number of births	−0.081 (0.038) DD estimate comparing unplanned vs planned.[d]
Bailey (2009)	United States	Abortion and the pill	Probability of first birth before age 21.	Effect of abortion: −0.009 (0.026). Effect of abortion and the pill: −0.013 (0.024).[e]
Gruber et al. (1999)	United States	Roe v Wade	Birth rate for women 15-44.	−0.059 (0.005).[f]
Guldi (2008)	United States	Abortion and the pill	Birth rate for women in ages 15-21.	−0.100 (0.054) for white women −0.030 (0.048) for nonwhite women.[g]
Joyce and Kaestner (1996)	United States	Expansions in Medicaid income eligibility	Probability of abortion.	−2 to −5% points (significant at least at 10% level) among unmarried non-black women aged 19-22 and 23-27.[h]
Joyce et al. (2013)	United States (NY)	Roe v. Wade	Birth rate for women 15-44.	−0.36 births per 1000 given a mean distance of 23 miles.[i]
Levine et al. (1999)	United States	Roe v Wade	Birth rate women 15-44.	−0.050(0.008). [j]
Mølland (2016)	Norway	abortion in Oslo	Probability of teen motherhood (<20).	−0.029(0.009). [k]
Myers (2017)	United States	abortion	Probability of giving birth before age 19.	−0.0284(0.0070). [l]
Pop-Eleches (2010)	Romania	abortion plus contraception	Probability of giving birth.	−0.068(0.015) for women 20-24 with low education.[m]
Valente (2014)	Nepal	Access to an abortion center	Probability of giving birth conditional on conception women aged 15-49.	Living within 28.6 km to an abortion center led to −0.0737(0.0272). [n]
Our Estimate	Mexico	ILE reform	Birth rates women 15-49	−0.054(0.015)
Panel B: Regressive Law Changes				
Kane and Staiger (1996)	United States	Medicaid restriction and parental consent	Number of births to mothers 15-19.	White women, Medicaid: −0.0005(0.0002), parental consent: −0.0012(0.0002). [o]
Cook et al. (1999)	United States (NC)	Abortion funding	Log of birth count.	0.047(0.014) for black women and 0.015(0.010) for white women.[p]
Levine et al. (1996)	United States	Medicaid funding restrictions	Birth Rate women 15-44.	−0.582(0.400).[q]
Joyce et al. (2006)	United States (TX)	Texas Parental Notification Law	Rate ratio of birth among minors 17.50-17.74 years of age.	rate ratio, 1.04 (95 % CI, 1.00 to 1.08).[r]
Lahey (2014)	United States	Laws restricting abortion in the nineteenth century	ln(child woman ratio) for women aged 15-44.	4 – 12% increase.[s]
Our Estimate	Mexico	Regressive law changes	Birth rate women 15-49	−0.019(0.015)

Notes: [a] Columns 5 and 10 (3 years of exposure), table 3, p. 88. [b] Column 4, Table 1 p. 386. [c] Column 1, table 3 p. 43. [d] Table 3, column 2, p. 11. [e] Table 2, p. 12. [f] Column 2, table 1 p. 279. [g] Column 1, table 3, p. 823. [h] Columns 2-4, table 2, p. 186. [i] Section 4.2.2. Regressions of birth rates on distance, p. 813. [j] Column 1, table 2, p. 19. [k] Column 1, row 1, table 1, p. 12. [l] Effect of "abortion legal" and Model 4, table 2 p. 45. [m] Column 2 (estimate: β_2), table 2, p. 983. [n] Table 1 p. 232. [o] Among nonwhite women, Medicaid: 0.0021(0.0011), parental consent:x -0.0003(0.0009). Column 4, Table 3 p. 485. column 4, Table 4 p. 486. [p] Table 6 p. 254. [q] Column 8, table 5, p. 33. [r] See text on p. 1030. [s] Table 2 p. 943.

Table A9: Difference-in-Differences Estimates Examining Maternal/Paternal Characteristics

	Mother Age (1)	Father Age (2)	Mother Primary (3)	Mother Secondary (4)	Father Primary (5)	Father Secondary (6)	Married (7)	Number Children (8)	First Birth (9)
Panel A: ILE versus Non-Reformers									
Post-ILE Reform (DF)	0.286***	0.331***	0.055**	0.001	0.042**	0.027*	0.008	0.084	0.001
	(0.054)	(0.112)	(0.021)	(0.019)	(0.019)	(0.016)	(0.025)	(0.073)	(0.022)
Observations	2,028	2,028	2,028	2,028	2,028	2,028	2,028	2,028	2,028
Mean of Dep. Var.	25.618	28.950	0.286	0.659	0.267	0.604	0.492	2.122	0.413
Mean of Dep. Var. (Mexico DF)	26.343	29.390	0.187	0.794	0.152	0.753	0.464	1.896	0.443
Panel B: Regressive Reforms versus Non-Reformers									
Post-Regressive Law Change	-0.003	0.024	-0.001	0.019	-0.001	0.017*	0.024**	-0.011	-0.006
	(0.043)	(0.054)	(0.011)	(0.012)	(0.010)	(0.010)	(0.011)	(0.036)	(0.012)
Observations	4,836	4,836	4,836	4,836	4,836	4,836	4,836	4,836	4,836
Mean of Dep. Var.	25.531	28.982	0.327	0.612	0.298	0.561	0.463	2.160	0.412
Mean of Dep. Var. (Regressive States)	25.557	29.068	0.385	0.557	0.336	0.523	0.480	2.223	0.402

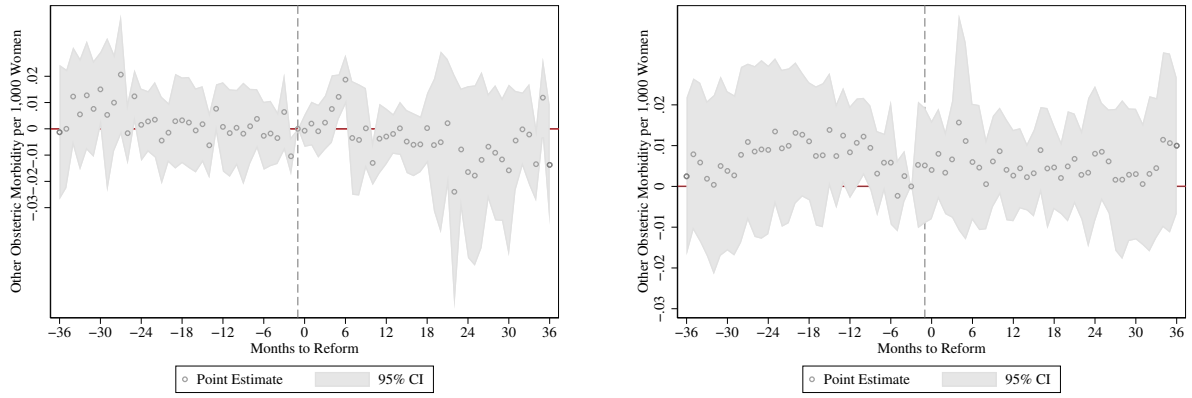
Notes: Each column displays a two way fixed effect model following equation 1 (panel A) and equation 2 (panel B), where the outcome consists of state by month level averages of maternal and paternal characteristics from all birth microdata. Average levels of each outcome are displayed in table footers. All standard errors are clustered at the level of the state. *p< 0.10; **p< 0.05; ***p< 0.01.

Table A10: Examining Channels of Impacts of Abortion Reform on Morbidity

	Abortion Related Morbidity				Haemorrhage Early in Pregnancy			
	No Characteristics		Parental Characteristics		No Characteristics		Parental Characteristics	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.042***	-0.057***	-0.013	-0.002	-0.012**	-0.012**	-0.009**	-0.013***
	(0.014)	(0.009)	(0.018)	(0.021)	(0.005)	(0.005)	(0.005)	(0.003)
Observations	2,028	2,028	2,028	2,028	2,028	2,028	2,028	2,028
Mean of Dependent Variable	0.341	0.341	0.341	0.341	0.044	0.044	0.044	0.044
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.010	-0.008	-0.010	-0.013*	-0.004	-0.002	-0.004	-0.003
	(0.010)	(0.010)	(0.008)	(0.007)	(0.005)	(0.004)	(0.005)	(0.003)
Observations	4,836	4,836	4,836	4,836	4,836	4,836	4,836	4,836
Mean of Dependent Variable	0.329	0.329	0.329	0.329	0.043	0.043	0.043	0.043
State and Year×Month FEs	Y	Y	Y	Y	Y	Y	Y	Y
Time-Varying Controls	Y	Y	Y	Y	Y	Y	Y	Y
Population Weights		Y		Y		Y		Y

Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of morbidity (inpatient cases). Each morbidity class is measured as cases per 1,000 fertile aged women each year, and average levels in the full set of data are available at the foot of the table. Each regression is estimated using states that adopt reforms (ILE in panel A, regressive reforms in panel B) versus other non-adopting states. All standard errors are clustered at the level of the state. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Figure A6: Monthly Event Studies for Rates of (Late) Obstetric Complications

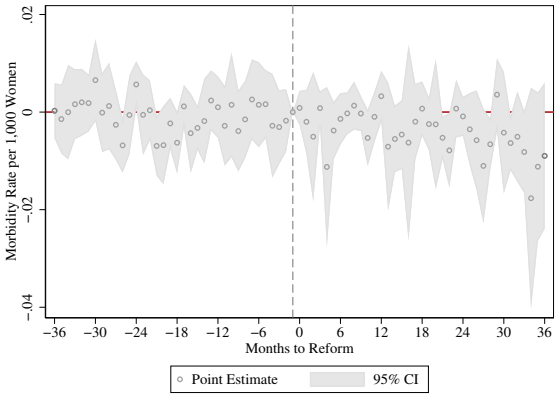


(a) Progressive Abortion Reform (ILE)

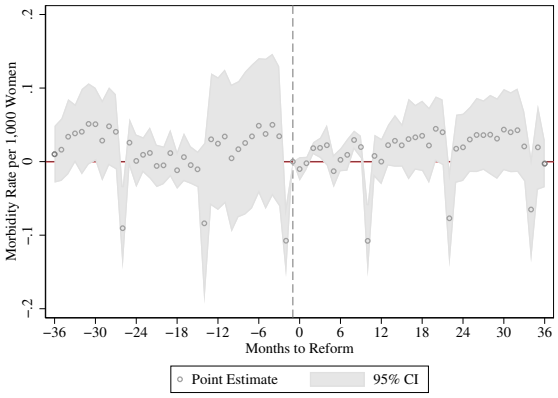
(b) Regressive Abortion Laws (Legal Tightening)

Notes: Event studies document the evolution of rates of obstetric complications (ICD codes O70-O75 inclusive) per 1,000 women surrounding the passage of abortion reforms. Each point estimate refers to the change in rates between treated and non-treated states, compared to their baseline differential (1 month prior to the reform). The left-hand panel shows the difference between Mexico DF and untreated states surrounding the passage of the ILE reform. The right-hand panel shows the difference between regressive policy changers and non-changers around the (time-varying) date that each reform was passed. Regressions are weighted by the population of fertile-aged women, and the full set of time-varying controls are included.

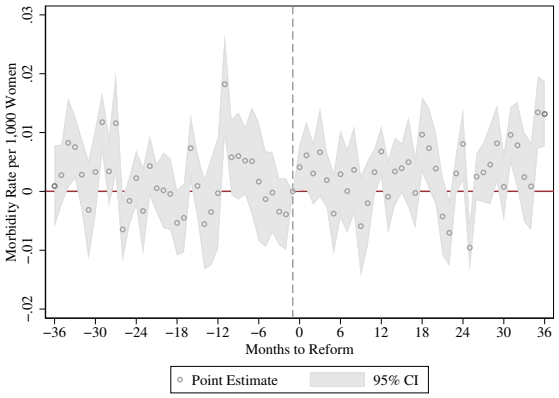
Figure A7: Alternative Placebo Tests – Non-Obstetric Outcomes (ILE Reform)



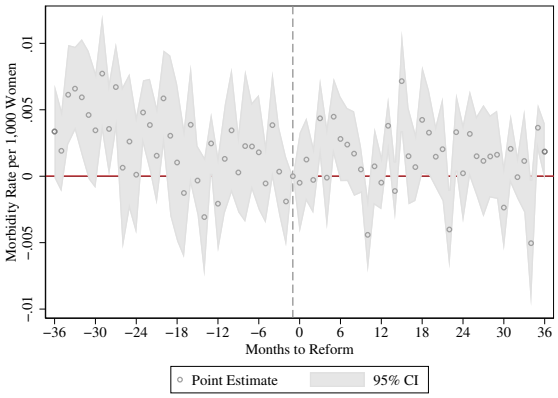
(a) Diseases of the ear and mastoid process



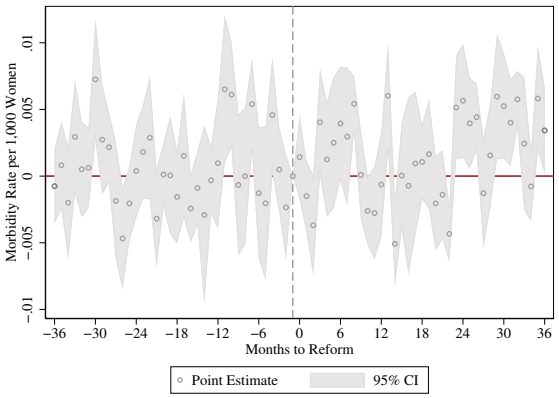
(b) Neoplasms



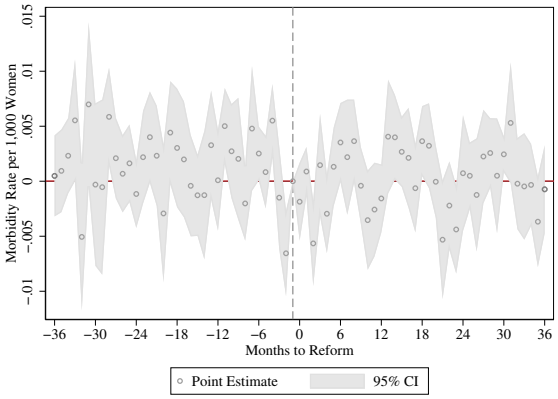
(c) Endocrine, nutritional and metabolic diseases



(d) Diseases of the blood and blood-forming organs



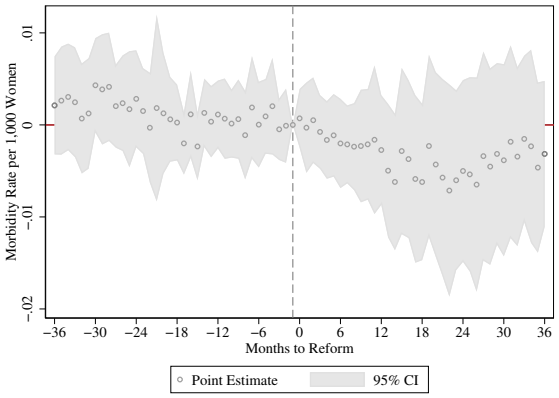
(e) Diseases of the nervous system



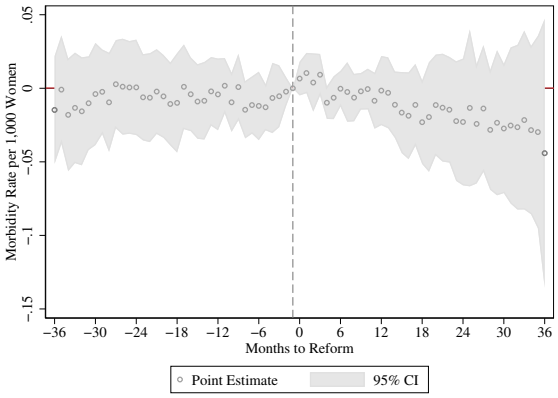
(f) Diseases of the skin and subcutaneous tissue

Notes: Event studies are documented examining the impact of the ILE abortion reform on alternative ICD codes (classes not related to pregnancy, childbirth and the puerperium). Each outcome is measured per 1,000 women aged 15–49 (as per Figures 2a-2b) focusing on the same group of fertile aged women. All additional details follow equation 3.

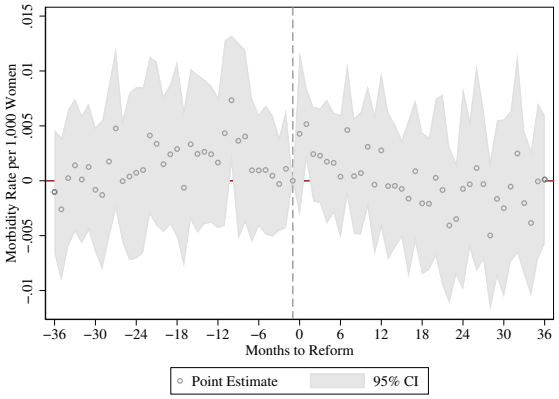
Figure A8: Alternative Placebo Tests – Non-Obstetric Outcomes (Law Tightenings)



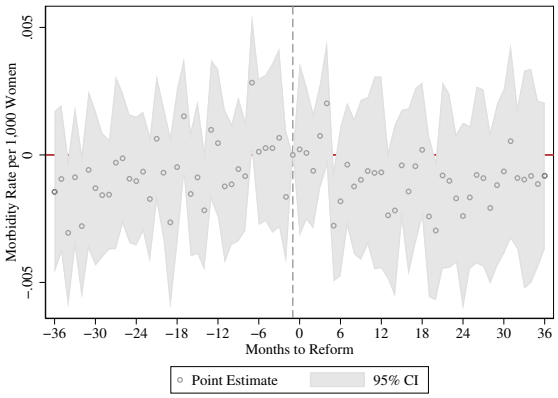
(a) Diseases of the ear and mastoid process



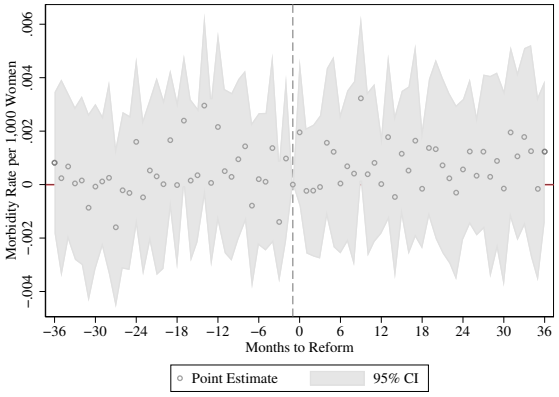
(b) Neoplasms



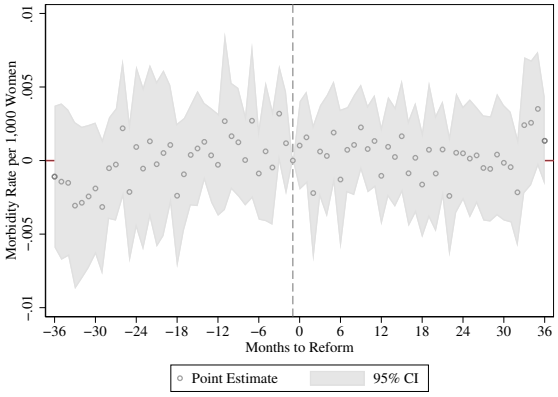
(c) Endocrine, nutritional and metabolic diseases



(d) Diseases of the blood and blood-forming organs



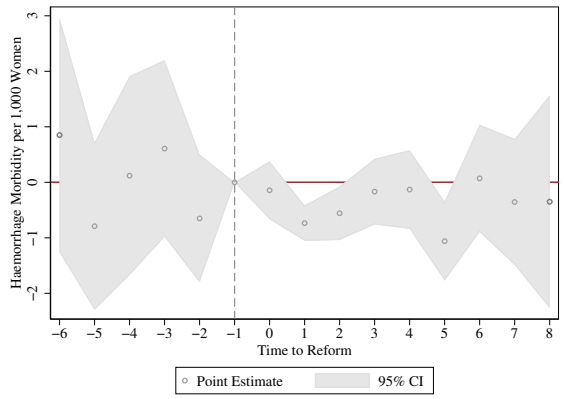
(e) Diseases of the nervous system



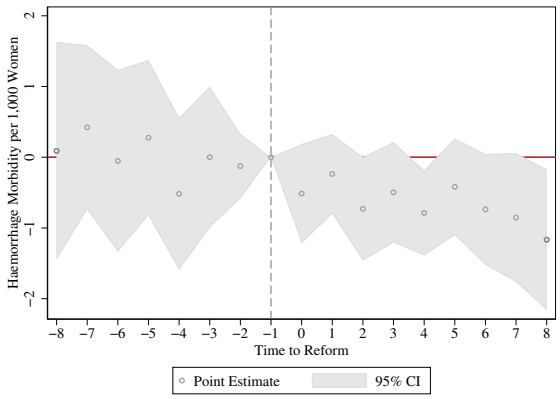
(f) Diseases of the skin and subcutaneous tissue

Notes: Event studies are documented examining the impact of the regressive abortion reform on alternative ICD codes (classes not related to pregnancy, childbirth and the puerperium). Each outcome is measured per 1,000 women aged 15–49 (as per Figures 2a-2b) focusing on the same group of fertile aged women. All additional details follow equation 4.

Figure A9a: Event Studies for Rates of Maternal Mortality

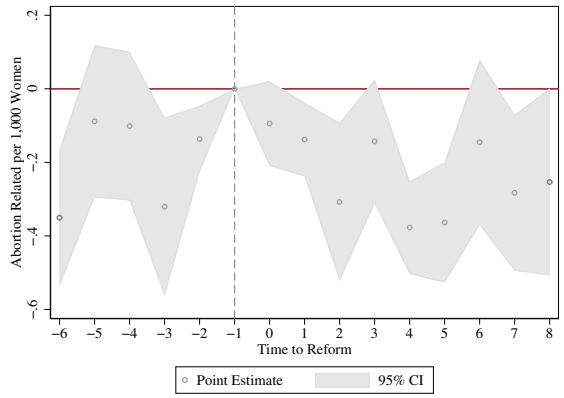


(a) Progressive Abortion Reform (ILE)

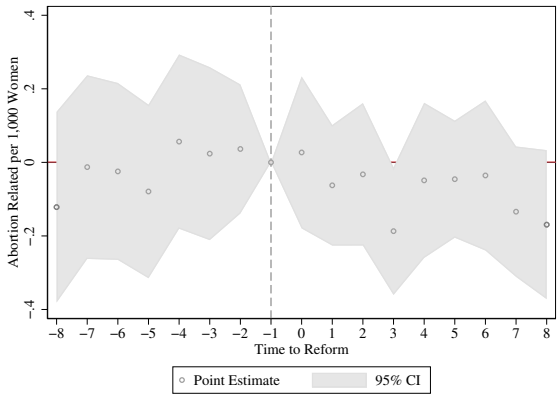


(b) Regressive Abortion Laws (Legal Tightening)

Figure A9b: Event Studies for Rates of Maternal Mortality due to Abortion



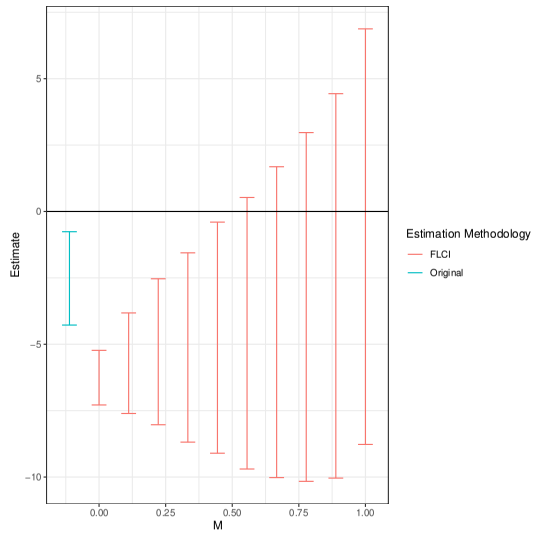
(c) Progressive Abortion Reform (ILE)



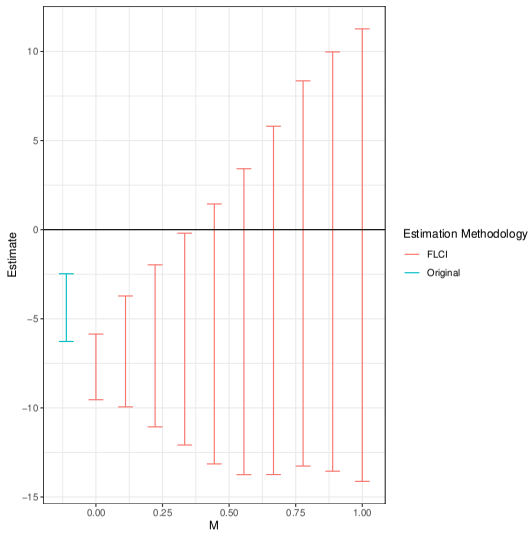
(d) Regressive Abortion Laws (Legal Tightening)

Notes: Event studies examine the impact of abortion reforms on all maternal deaths in Figure A9a and all maternal deaths relating expressly to abortion (ICD codes O02-O08) in Figure A9b. In both cases these are measured as deaths per 100,000 women of fertile age. Additional notes related to the estimation procedure are provided in Figure 2a.

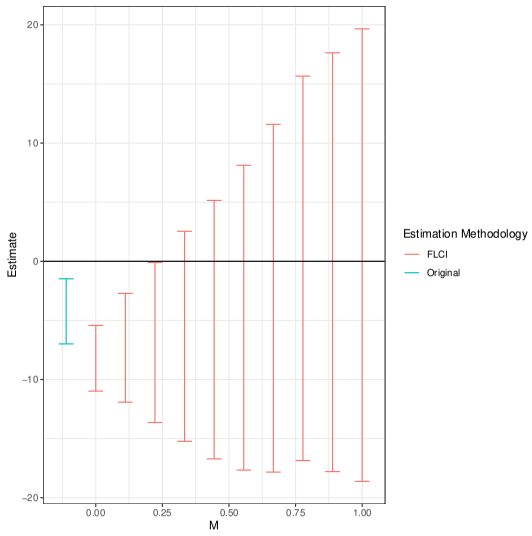
Figure A10: Application of "Honest DiD" Methods Considering Two-Sided Violation of Parallel Trends (Birth Rates)



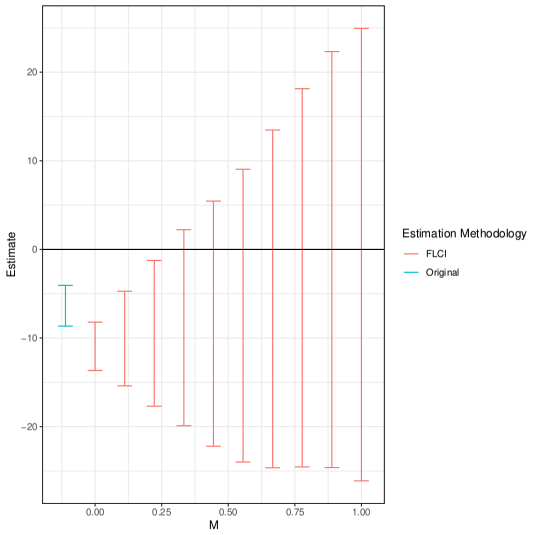
(a) Lead 1



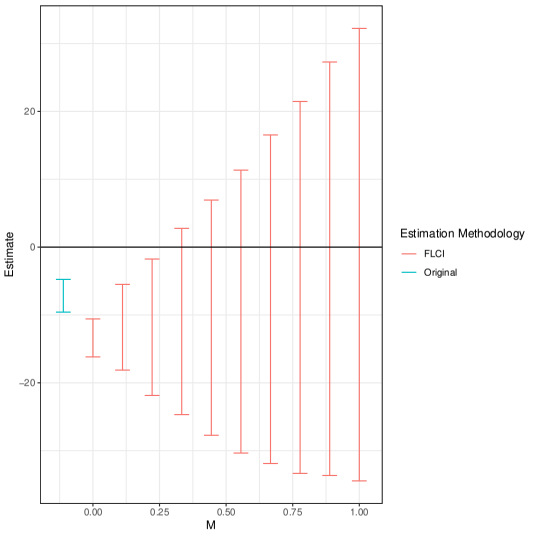
(b) Lead 2



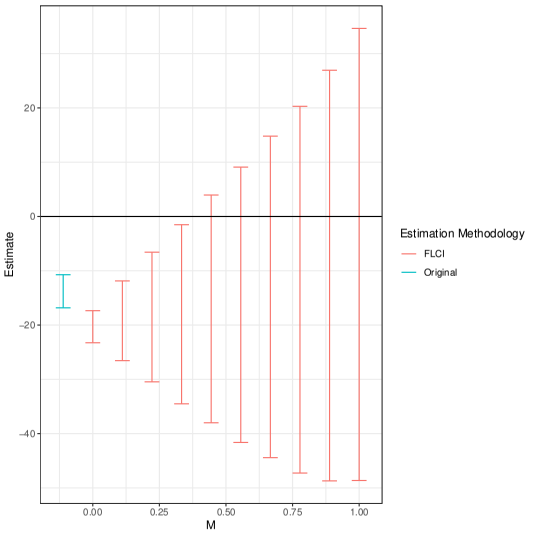
(c) Lead 3



(d) Lead 4



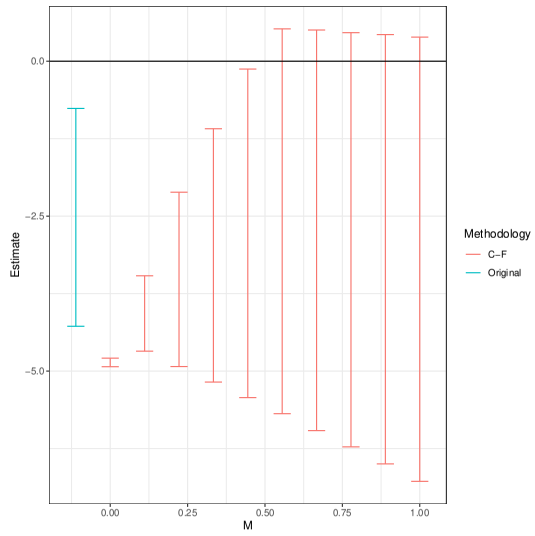
(e) Lead 5



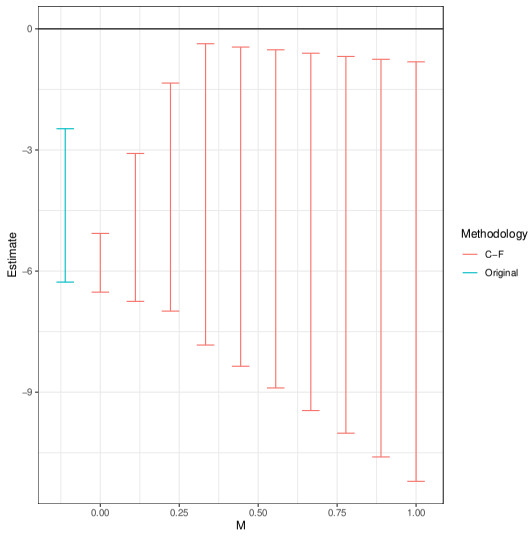
(f) Lead 6

Notes: Each plot presents the estimated event study lead (from leads 1-6) based on alternative assumptions about the evolution of outcomes in Mexico DF versus untreated areas in the absence of the ILE reform. The first (blue) CI is the original event study 95% CI based on a parallel trends assumption. Additional (red) CIs are 95% CIs based on an assumption that the Mexico DF and the untreated states would have continued following a linear trend based on pre-trends, and allowing for this trend to not deviate by more than M units between each period, where M is indicated on the horizontal access. All inference follows Rambachan and Roth (2019)'s Fixed Length Confidence Interval procedure.

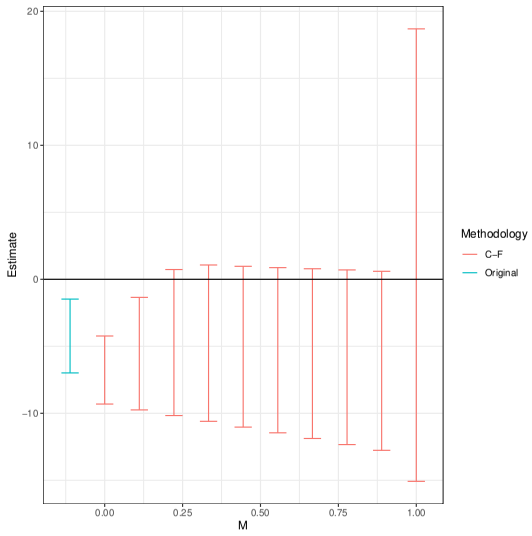
Figure A11: Application of "Honest DiD" Methods Considering Positive Violation of Parallel Trends



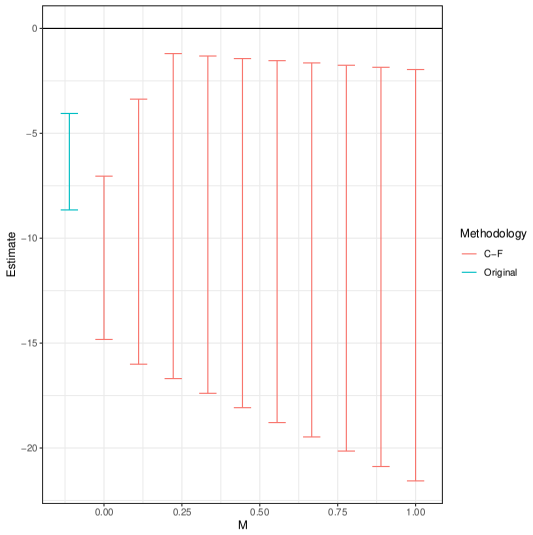
(a) Lead 1



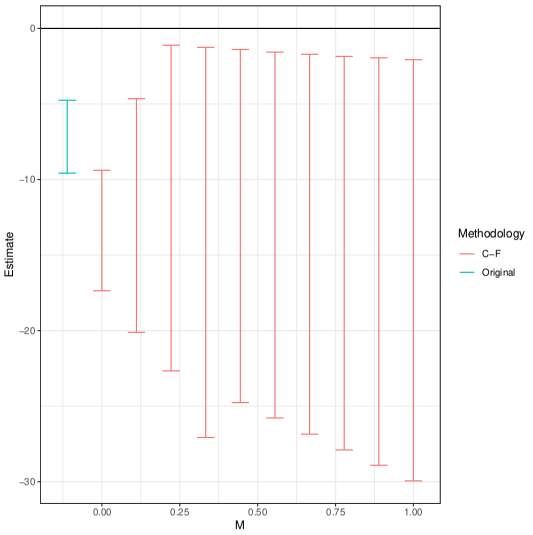
(b) Lead 2



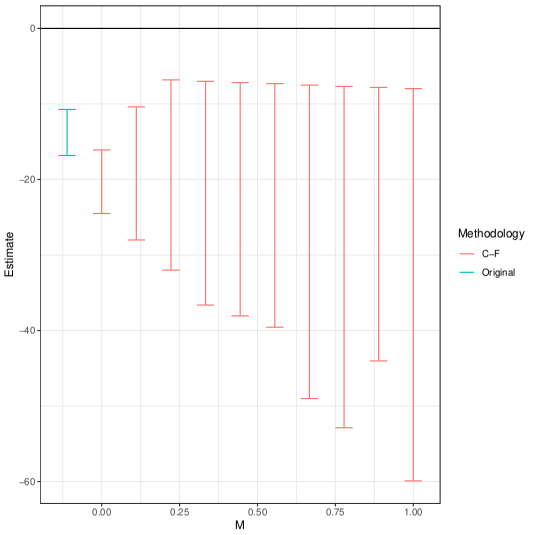
(c) Lead 3



(d) Lead 4



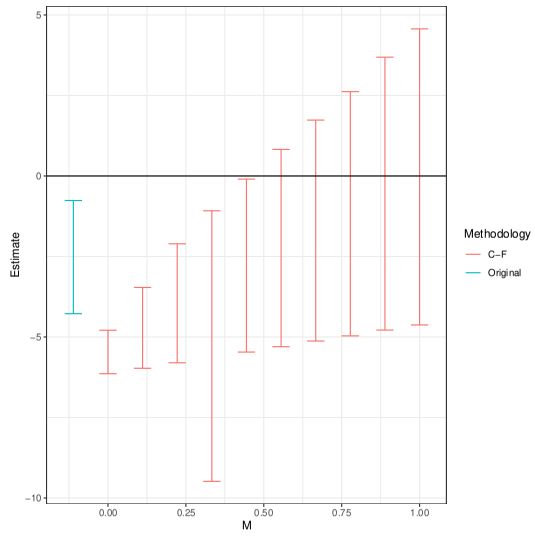
(e) Lead 5



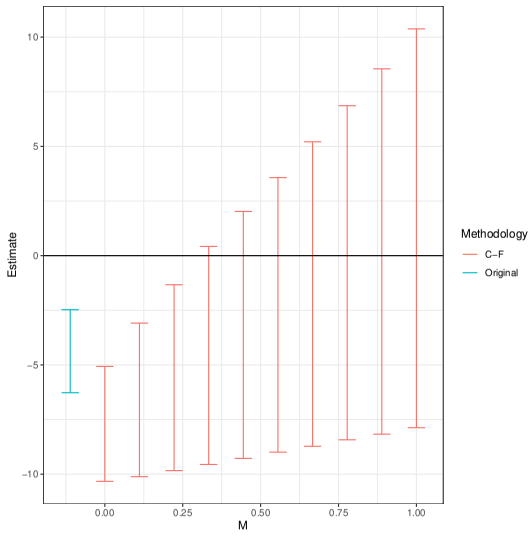
(f) Lead 6

Notes: Refer to notes to Figure A10. Here similar methods are implemented, however in this case only considering positive violations of the linear trend assumption, where outcomes are allowed to (positively) vary by as much as M units.

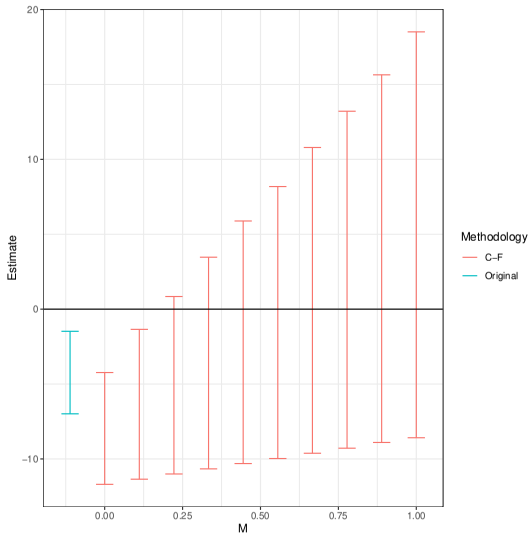
Figure A12: Application of "Honest DiD" Methods Considering Negative Violation of Parallel Trends



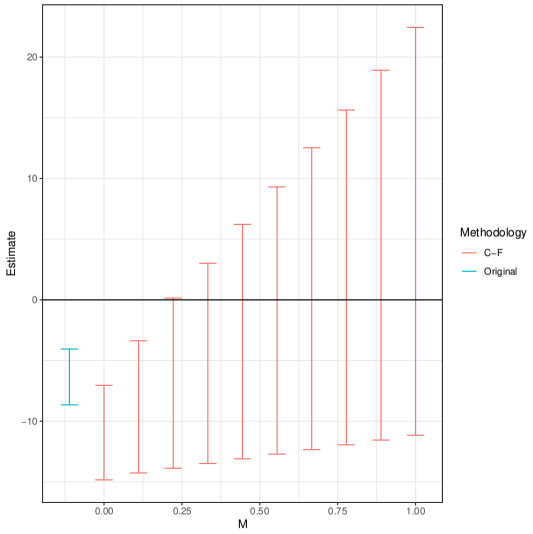
(a) Lead 1



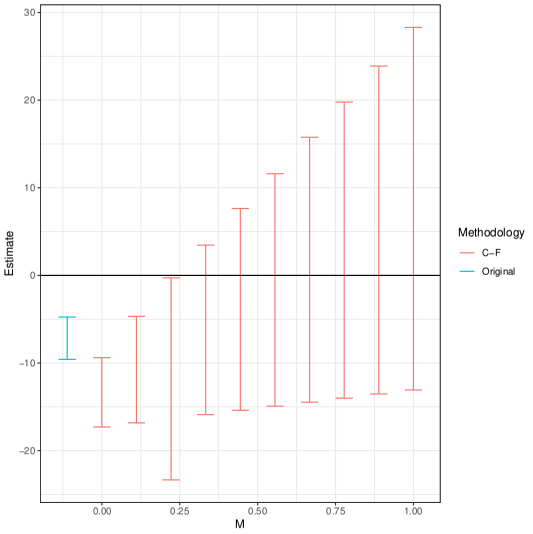
(b) Lead 2



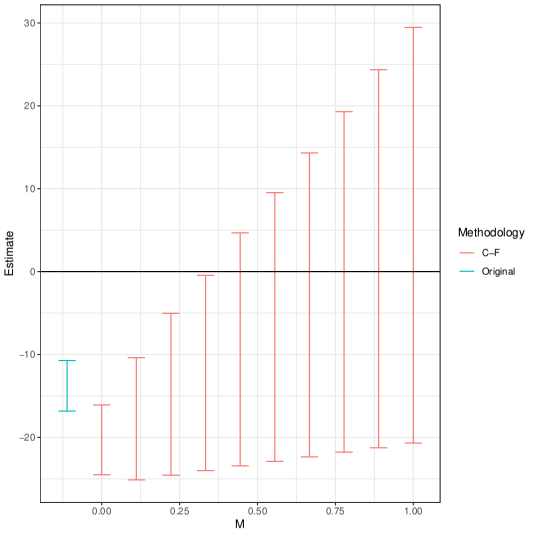
(c) Lead 3



(d) Lead 4



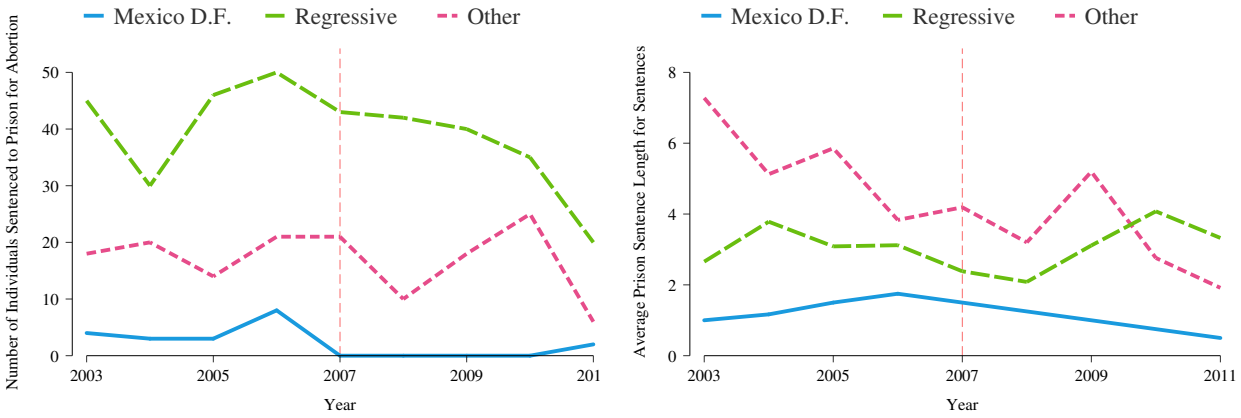
(e) Lead 5



(f) Lead 6

Notes: Refer to notes to Figure A10. Here similar methods are implemented, however in this case only considering negative violations of the linear trend assumption, where outcomes are allowed to (negatively) vary by as much as M units.

Figure A13: *De Jure* Sentencing of Abortion: Trends by State Type

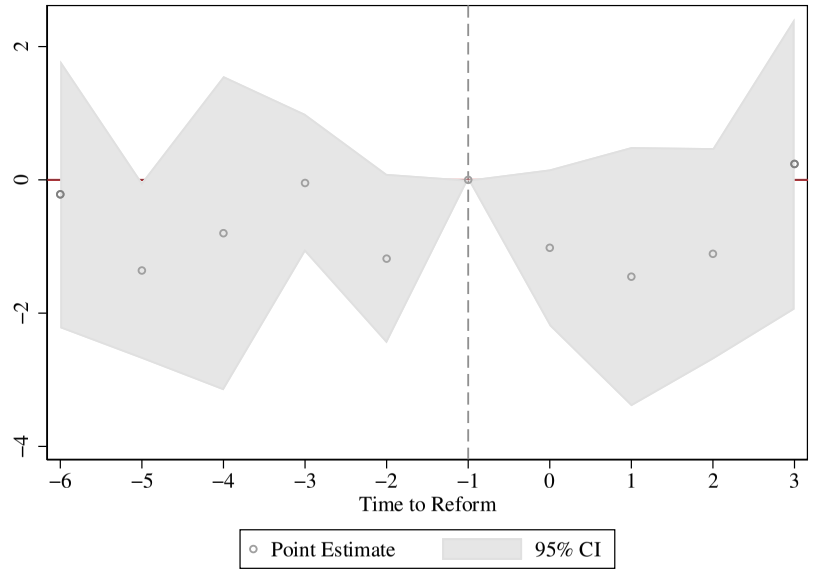


(a) Number of Individuals Sentenced to Prison

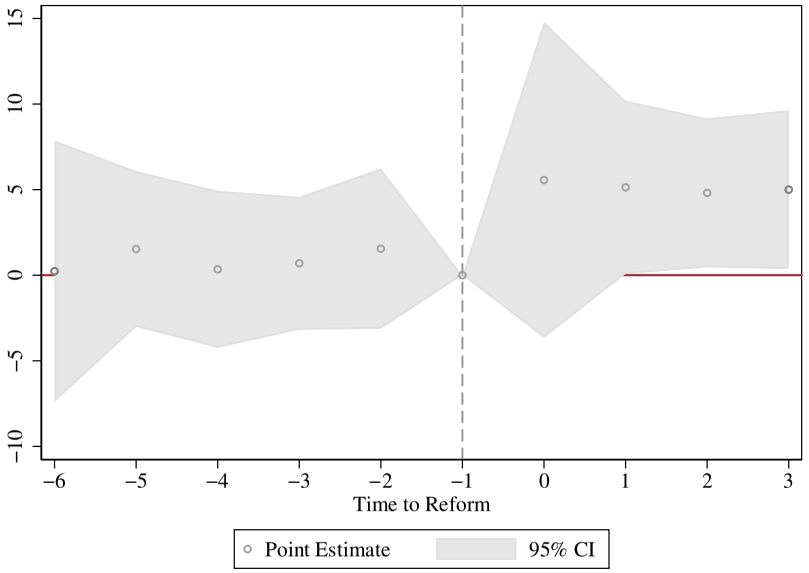
(b) Average Length of Prison Sentences (Years)

Notes: Total number of sentences for crimes relating to abortion and the average length of prison sentences are generated from administrative records captured in Mexico's Judicial Statistics on Penal Matters. This is the universe of judiciary decisions in the country based on the first legal judgment (and here we focus only on cases relating to abortion), and so does not include any subsequent appeals. Prison sentence lengths are calculated from a categorical variable capturing bins of between 6 months and two years, and in each case we record the total years (or fractions of years) based on the midpoint of each bin. Bins are consistently used in the period displayed here. Regressive states refer to any states tightening abortion laws in the period under study.

Figure A14: *De Jure* Sentencing of Abortion: Event Studies for Regressive Law Changes



(a) Number of Individuals Sentenced to Prison



(b) Average Length of Prison Sentence

Notes: Event studies document the evolution or criminal outcomes for cases relating to abortion surrounding the passage of regressive abortion laws in Mexican States. Total number of sentences and the average length of prison sentences are generated from administrative records captured in Mexico's Judicial Statistics on Penal Matters. This is the universe of judiciary decisions in the country based on the first legal judgment (and here we focus only on cases relating to abortion), and so does not include any subsequent appeals. Prison sentence lengths are calculated from a categorical variable capturing bins of between 6 months and two years, and in each case we record the total years (or fractions of years) based on the midpoint of each bin. Bins are consistently used in the period displayed here.

Table A11: Difference-in-Differences Estimates of Abortion Reforms on Judicial Outcomes (Standardized by Population)

	Number of Prison Sentences		Length of Prison Sentences	
	(1)	(2)	(3)	(4)
Panel A: ILE versus Non-Reformers				
Post-ILE Reform (DF)	-0.001***	-0.001***	0.003**	0.002
	(0.001)	(0.000)	(0.002)	(0.002)
Observations	117	117	56	56
Mean of Dependent Variable	0.002	0.002	0.004	0.004
Panel B: Regressive Reforms versus Non-Reformers				
Post-Regressive Law Change	-0.000	-0.001	0.005*	0.004*
	(0.001)	(0.001)	(0.003)	(0.002)
Observations	279	279	171	171
Mean of Dependent Variable	0.002	0.002	0.006	0.006
State and Year FEs	Y	Y	Y	Y
Population Weights		Y		Y

Refer to notes to Table 4. Models replicate those in Table 4, however now outcome variables are standardized per 1,000 fertile-aged population. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Table A12: Difference-in-Differences Estimates of Legal Reforms on Morbidity using Yearly Data

	Abortion Related Morbidity				Haemorrhage Early in Pregnancy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-1.194***	-1.477***	-1.562***	-1.481***	-0.952***	-1.053***	-1.034***	-0.930***
	(0.278)	(0.200)	(0.312)	(0.349)	(0.120)	(0.142)	(0.243)	(0.196)
Observations	156	156	156	156	156	156	156	156
Mean of Dependent Variable	10.474	10.474	10.474	10.474	2.364	2.364	2.364	2.364
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.241	-0.402	-0.348	-0.394	-0.339*	-0.319**	-0.352**	-0.214*
	(0.314)	(0.262)	(0.278)	(0.287)	(0.182)	(0.147)	(0.176)	(0.117)
Observations	372	372	372	372	372	372	372	372
Mean of Dependent Variable	10.318	10.318	10.318	10.318	2.363	2.363	2.363	2.363
State and Year FEs	Y	Y	Y	Y	Y	Y	Y	Y
Population Weights		Y		Y		Y		Y
Time-Varying Controls			Y	Y			Y	Y

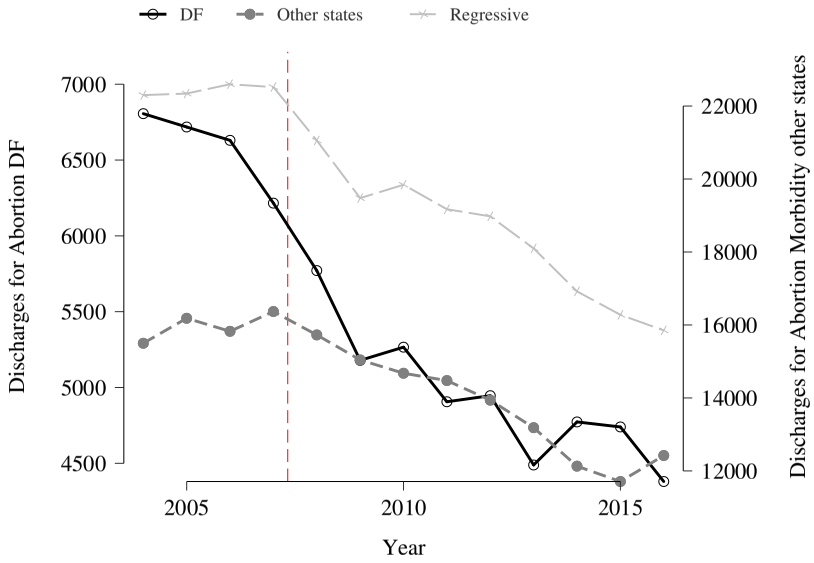
Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of morbidity (inpatient cases) following equation 1 and 2. Each morbidity class is measured as cases per 1,000 fertile aged women each year, and average levels in the full set of data are available at the foot of the table. All standard errors are clustered at the level of the state. *p< 0.10; **p< 0.05; ***p< 0.01.

Table A13: Difference-in-Differences Estimates of Abortion Reforms on Fertility by Year

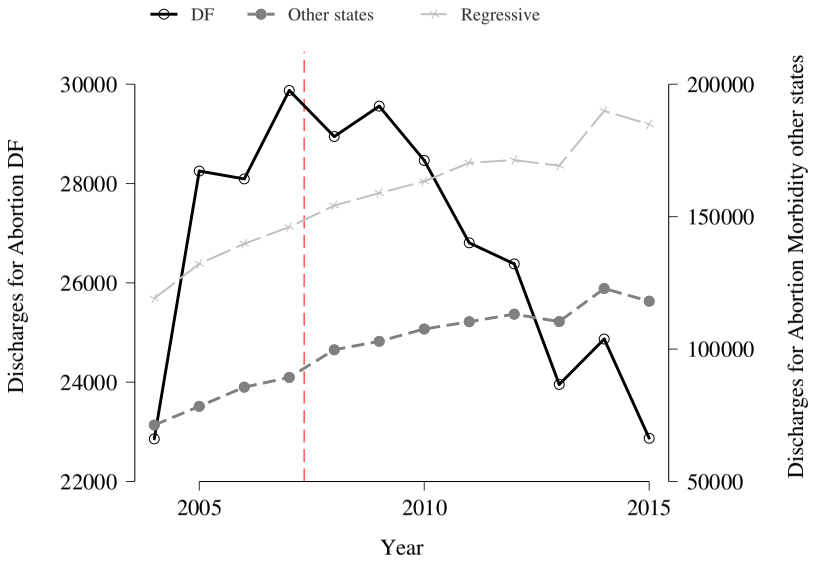
	Births per 1,000 Women			
	(1)	(2)	(3)	(4)
Panel A: ILE versus Non-Reformers				
Post-ILE Reform (DF)	-6.421***	-7.652***	-6.509***	-7.349***
	(0.927)	(1.264)	(1.343)	(1.299)
Observations	169	169	169	169
Mean of Dependent Variable	88.310	88.310	88.310	88.310
Mean of Dependent Variable (Mexico DF)	89.041	89.041	89.041	89.041
Panel B: Regressive Reforms versus Non-Reformers				
Post Regressive Law Change	-2.166**	-3.336***	-2.317**	-2.880**
	(1.090)	(1.230)	(1.044)	(1.290)
Observations	403	403	403	403
Mean of Dependent Variable	88.310	88.310	88.310	88.310
Mean of Dependent Variable (Regressive States)	90.623	90.623	90.623	90.623
State and Year FEs	Y	Y	Y	Y
Population Weights		Y		Y
Time-Varying Controls			Y	Y

Each column displays a difference-in-differences regression of the impact of abortion reform on birth rates. Birth rates are measured as the number of births per 1,000 fertile aged women each year. Time-varying controls are documented in Section B.2. All standard errors are clustered at the level of the state using a wild clustered bootstrap procedure. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Figure A15: Trends in Public and Private Health System Morbidity: Abortion-Related



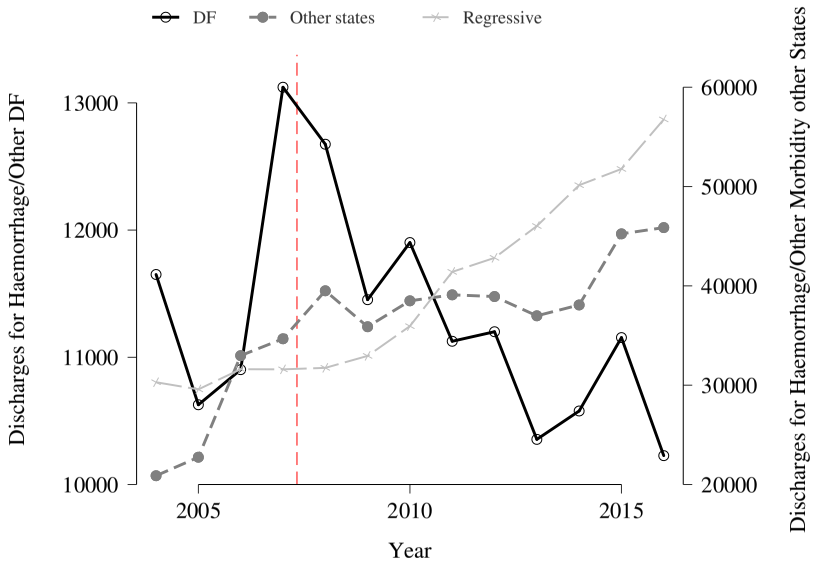
(a) Quantity of Hospital Visits in the Private Sector



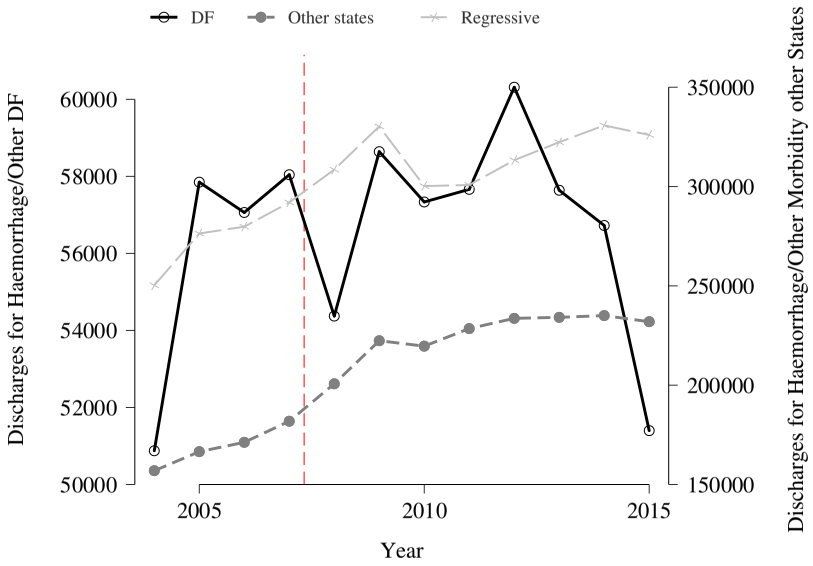
(b) Quantity of Hospital Visits in the Public Sector

Notes: Left-hand panel plots all abortion morbidity according to the universe of private health records. Microdata on these records are available by request from INEGI. Right-hand panel plots all abortion morbidity coded using the same codes as in private records based on the universe of public hospital records. A description of how these codes are merged between the public and private system is available in Appendix Table A3.

Figure A16: Trends in Public and Private Health System Morbidity: Other Maternal Causes (including Haemorrhage)



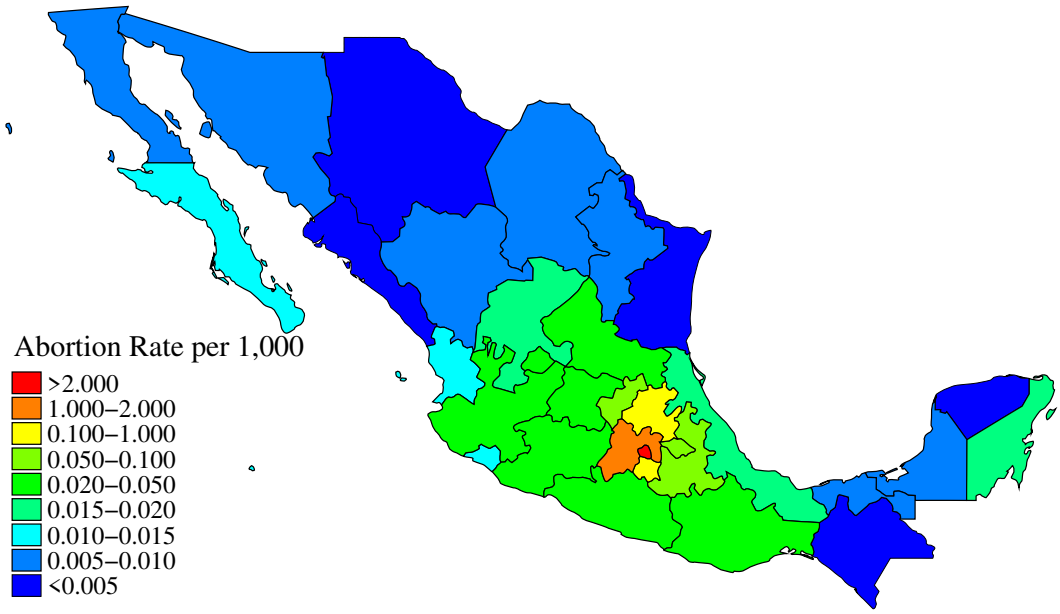
(a) Quantity of Hospital Visits in the Private Sector



(b) Quantity of Hospital Visits in the Public Sector

Notes: Left-hand panel plots all "Other Maternal Causes" (including haemorrhage early in pregnancy) according to the universe of private health records. Microdata on these records are available by request from INEGI. Right-hand panel plots all "Other Maternal Causes" coded using the same codes as in private records based on the universe of public hospital records. A description of how these codes are merged between the public and private system is available in Appendix Table A3.

Figure A17: Geographic Variation in Usage of Mexico DF's ILE Program to Access Abortion



Notes: Each state is shaded according to the rate of abortions per 1,000 women provided under the auspices of the ILE reform. All rates are calculated based on administrative records of state of residence. Refer to Table A14 for the precise number and rate in each state.

Table A14: State of Residence of Users of ILE: 2007-2015

State	Number of Patients	Rate per 1,000 women
Aguascalientes	87	0.036
Baja California	40	0.006
Baja California Sur	19	0.014
Campeche	11	0.006
Chiapas	34	0.003
Chihuahua	31	0.004
Coahuila	28	0.005
Colima	19	0.014
Mexico D.F.	104,048	5.833
Durango	21	0.006
Guanajuato	268	0.023
Guerrero	161	0.025
Hidalgo	637	0.118
Jalisco	334	0.023
Mexico State	34,703	1.084
Michoacán	309	0.035
Morelos	464	0.128
Nayarit	27	0.012
Nuevo León	66	0.007
Oaxaca	230	0.031
Puebla	807	0.068
Querétaro	329	0.085
Quintana Roo	58	0.020
San Luis Potosí	108	0.021
Sinaloa	19	0.003
Sonora	28	0.005
Tabasco	32	0.007
Tamaulipas	30	0.004
Tlaxcala	188	0.078
Veracruz	267	0.018
Yucatán	18	0.005
Zacatecas	52	0.018
Non-Mexican Residents	52	—
Unknown	250	—
Total	143,550	0.628

Notes: The quantity of abortions are provided from administrative data compiled as the Information System for Legal Interruption of Pregnancy from Mexico City's Secretary of Health, and are for the years 2007-2015. Rates per women refer to the number of abortions per 1,000 women aged 15-49.

Table A15: DD Estimates Examining Policy Spillovers

		Maternal Morbidity		Maternal Mortality	
	Births	Abortion	Haemorrhage	All	Abortive
	(1)	(2)	(3)	(4)	(5)
Post-ILE Reform (DF)	-5.499***	-0.964**	-0.836***	-0.007	-0.001
	(1.243)	(0.403)	(0.154)	(0.005)	(0.001)
Post-Regressive Law Change	-1.854	-0.199	-0.183	-0.006*	-0.000
	(1.295)	(0.322)	(0.123)	(0.004)	(0.000)
Post-ILE (Spillover State)	3.558**	0.321	0.052	-0.003	0.001**
	(1.774)	(0.373)	(0.159)	(0.003)	(0.000)
Observations	416	384	384	512	512
Mean of Dependent Variable	87.798	10.336	2.343	0.040	0.003
Mean of Dependent Variable (Mexico DF)	89.041	10.519	2.282	0.065	0.005
Mean of Dependent Variable (Regressive States)	90.623	9.783	2.555	0.046	0.003
Mean of Dependent Variable (Spillover States)	85.128	8.071	1.746	0.046	0.003

Notes: DD estimates replicate specification 1, however now additionally control for a post-ILE indicator for states in residents were recorded as having significant access the ILE reform (according to administrative records). Each specification includes full time-varying controls, weights by state population, and standard errors are clustered using a wild bootstrap. For additional details, refer to Notes to Table 2. *p< 0.10; **p< 0.05; ***p< 0.01.

Table A16: DD Estimates of the Impact of ILE Usage Intensity on Birth Rates and Health

		Morbidity		Mortality	
	Births	Abortion	Haemorrhage	Maternal	Abortive
	(1)	(2)	(3)	(4)	(5)
Abortions per 1,000 Women	-0.939***	-15.634***	-14.212***	-0.113	-0.009
	(0.221)	(5.165)	(2.641)	(0.096)	(0.013)
Post-Regressive Law Change	-2.419*	-24.575	-20.171*	-0.566*	-0.060
	(1.364)	(33.186)	(11.829)	(0.335)	(0.048)
Observations	416	384	384	512	512
Mean of Dependent Variable	87.798	1033.568	234.314	4.028	0.276

Notes: DD estimates replicate specification 1, however the ILE program is measured as the number of abortions accessed per 1,000 women in each state in the post-reform period. Post-Regressive Law Change is measured as a binary variable, so does not capture intensity, and is not interpreted in the same way as abortions per 1,000 women. Each outcome is measured per 1,000 women in the state and year (except Abortion and Haemorrhage, which are displayed per 100,000), and are identical to the outcomes in Tables 2, 3 and A7 in the paper. Each specification includes full time-varying controls, weights by state population, and standard errors are clustered using a wild bootstrap. For additional details, refer to Notes to Table 2. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Table A17: Heterogeneity in DD Estimates by Age and Insurance Coverage – Abortion Related Morbidity

	Age Groups						Insurance Coverage	
	15–19	20–24	25–29	30–34	35–39	40–44	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.106***	-0.110***	-0.072***	-0.065***	-0.033***	-0.008**	-0.049*	0.014
	(0.010)	(0.017)	(0.017)	(0.013)	(0.010)	(0.004)	(0.027)	(0.028)
Observations	2,340	2,340	2,340	2,340	2,340	2,340	2,340	2,340
Mean of Dependent Variable	0.402	0.521	0.406	0.301	0.217	0.099	0.144	0.148
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.020	-0.010	-0.011	-0.003	-0.002	-0.003	-0.006	-0.006
	(0.014)	(0.016)	(0.014)	(0.011)	(0.008)	(0.004)	(0.018)	(0.014)
Observations	5,580	5,580	5,580	5,580	5,580	5,580	5,580	5,580
Mean of Dependent Variable	0.393	0.504	0.389	0.290	0.210	0.097	0.136	0.144

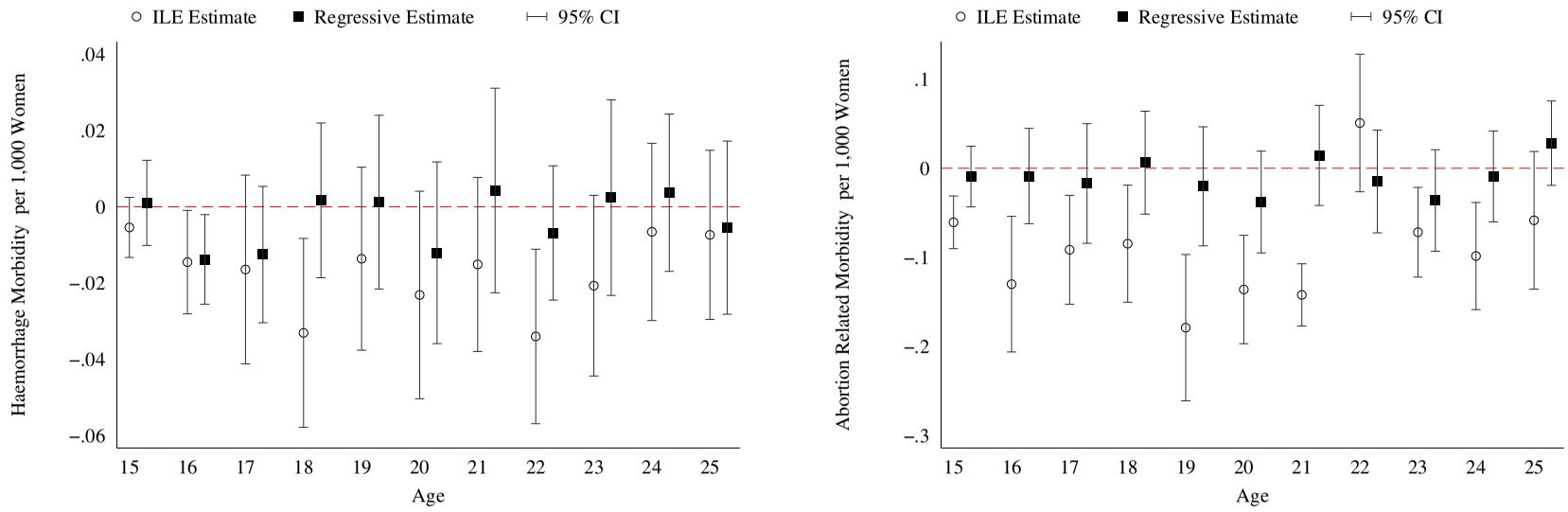
Notes: Each column displays estimated reform impacts on abortion related morbidity based on two-way FE models following equation 1 (panel A) and 2 (panel B), however now only for a specific demographic group (quinquennial ages in columns 1-6, and insurance coverage status in columns 7-8). All additional details follow notes to Table 2. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Table A18: Heterogeneity in DD Estimates by Age and Insurance Coverage – Haemorrhage in Early Pregnancy

	Age Groups						Insurance Coverage	
	15–19	20–24	25–29	30–34	35–39	40–44	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ILE versus Non-Reformers								
Post-ILE Reform (DF)	-0.018***	-0.020*	-0.018**	-0.011*	-0.007**	-0.001	-0.015**	0.002
	(0.007)	(0.011)	(0.009)	(0.007)	(0.004)	(0.001)	(0.007)	(0.002)
Observations	2,340	2,340	2,340	2,340	2,340	2,340	2,340	2,340
Mean of Dependent Variable	0.056	0.073	0.058	0.038	0.020	0.005	0.023	0.017
Panel B: Regressive Reforms versus Non-Reformers								
Post-Regressive Law Change	-0.003	-0.005	-0.003	-0.001	-0.000	-0.001	-0.004	0.002
	(0.005)	(0.007)	(0.006)	(0.004)	(0.002)	(0.001)	(0.004)	(0.003)
Observations	5,580	5,580	5,580	5,580	5,580	5,580	5,580	5,580
Mean of Dependent Variable	0.054	0.072	0.056	0.037	0.019	0.005	0.021	0.017

Notes: Each column displays estimated reform impacts on haemorrhage early in pregnancy based on two-way FE models following equation 1 (panel A) and 2 (panel B), however now only for a specific demographic group (quinquennial ages in columns 1-6, and insurance coverage status in columns 7-8). All additional details follow notes to Table 2. $^{*}p< 0.10$; $^{**}p< 0.05$; $^{***}p< 0.01$.

Figure A18: Estimated Impacts by Age Groups Among Young Women



(a) Haemorrhage Early in Pregnancy

(b) Abortion Related Morbidity

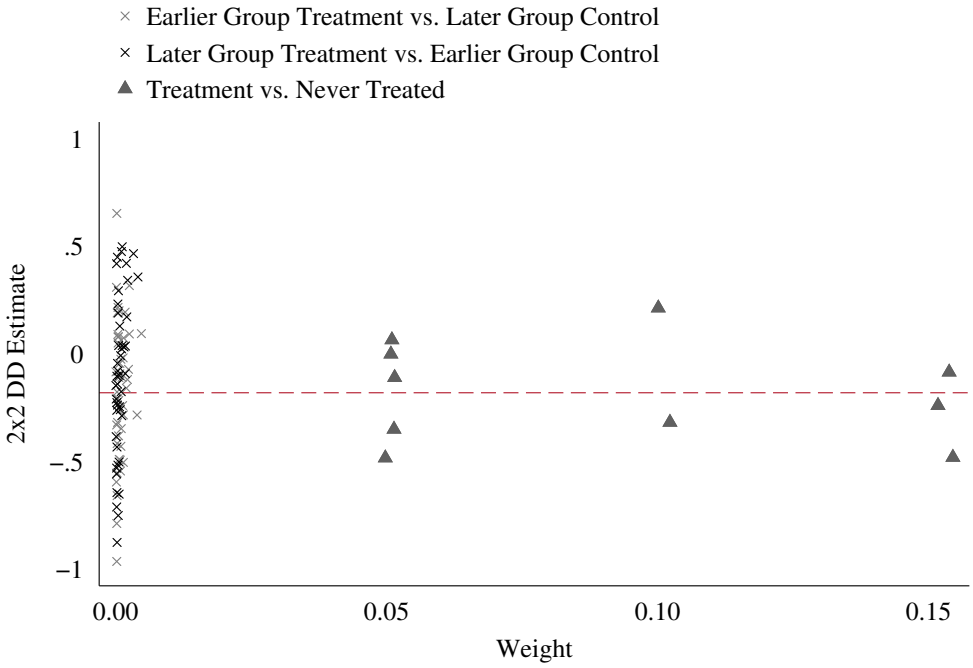
Notes: Figure replicate estimates from Table 2, however now for each yearly age group between 15–25 years. In each case specifications follow those documented in Panel A of Table 2 (indicated by hollow circles) and Panel B of Table 2 (shaded squares), working only with the proportion of women of that particular age suffering the indicated morbidity outcomes. Each specification is weighted by the population of women of this age. All additional details follow equations 1-2.

Table A19: Weights and Estimates from the Goodman-Bacon (2018) Decomposition

	Weight	Estimate
Panel A: Haemorrhage Morbidity		
Earlier Treated vs. Later Control	0.032	0.005
Later Treated vs. Earlier Control	0.039	-0.002
Treated vs. Never Treated	0.929	-0.004
Difference-in-difference Estimate		-0.003
Panel B: Abortion Related Morbidity		
Earlier Treated vs. Later Control	0.032	0.009
Later Treated vs. Earlier Control	0.039	-0.007
Treated vs. Never Treated	0.929	-0.008
Difference-in-difference Estimate		-0.007
Panel C: Fertility		
Earlier Treated vs. Later Control	0.045	-0.103
Later Treated vs. Earlier Control	0.038	0.085
Treated vs. Never Treated	0.917	-0.195
Difference-in-difference Estimate		-0.180

Notes: The Goodman-Bacon (2018) decomposition above displays the weights and components making up the global "single coefficient" DD model where treatment refers to states adopting regressive abortion policies. Decompositions are documented for haemorrhage and abortion morbidity (panels A and B), and for fertility (panels C) where all models follow specification 2. For the decomposition, each components' weight is given along with the point estimate for this comparison. The global estimate is displayed at the foot of each panel. Each of these components is statistically insignificant at the 95% level. A unit-by-unit decomposition is given in Figure 5 (morbidity) and Figure A19 (fertility).

Figure A19: Goodman-Bacon (2018) Decomposition Based on 2×2 Difference-in-Difference Models for Birth Rates



Notes: Figures document the Goodman-Bacon decomposition into a series of 2×2 difference-in-differences models depending on the type of comparison unit. Here the "treatment" refers to the passage of a regressive abortion law, and the outcome is the birth rate per 1,000 women. The passage of the ILE reform occurred at a single moment in time, and as such, decompositions need not be performed. The global decomposition is given in Table A19.

Table A20: The Effect of the Abortion Reform on Reported Sexual Behaviour (Panel Specification)

	(1) Modern Contracep Knowledge	(2) Any Contraception	(3) Modern Contraception	(4) Num of Sex Partners
ILE Reform	0.002	-0.012	-0.013	-0.111
	(0.276)	(0.914)	(0.901)	(0.776)
Regressive Law Change	-0.009	0.041	0.014	0.267
	(0.304)	(0.492)	(0.814)	(0.064)
Observations	10007	10007	10007	10007
R-Squared	0.889	0.568	0.558	0.531
Mean of Dependent Variable	0.999	0.569	0.610	1.418

Each column presents a seperate regression of a contraceptive or sexual behaviour variable on abortion reform measures, household fixed effects, year fixed effects and time-varying controls. p-values are presented below coefficients in parentheses.

Table A21: Summary Statistics, MxFLS data on women aged 15-44

	(1) **Mexico City**	(2) **Regressive States**	(3) **Rest of Mexico**	(4) **Full Country**
Contraception knowledge	0.991	0.997	1.000	0.998
	(0.094)	(0.051)	(0.011)	(0.044)
Use modern method	0.676	0.589	0.578	0.590
	(0.469)	(0.492)	(0.494)	(0.492)
Use any method	0.686	0.638	0.617	0.632
	(0.465)	(0.481)	(0.486)	(0.482)
Age marriage	20.535	19.603	19.643	19.668
	(3.891)	(3.825)	(3.827)	(3.834)
Age first sex	18.807	18.957	18.998	18.965
	(3.676)	(3.593)	(3.541)	(3.577)
Number of sex partners	1.762	1.339	1.354	1.367
	(1.545)	(1.088)	(1.037)	(1.101)
Observations	187	5081	3526	8794

Notes: Data on household decision making and sexual behavior is obtained from the Mexican Family Life Survey (MxFLS), which was conducted in 2002-2003, 2005-2006 and 2009-2012. The sample consits of women aged 15-44 who were interviewed in all three rounds, and hence form the panel data sample. Panel A presents summary statistics from household decision making module and Panel B from the reproductive health module. Mean values are displayed with standard deviations in parentheses. Regressive states are those which ever had a regressive law change posterior to 2008.

Table A22: The Effect of the Abortion Reform on Reported Sexual Behaviour (Repeated Cross-Section Specification)

	(1) Modern Contracep Knowledge	(2) Any Contraception	(3) Modern Contraception	(4) Num of Sex Partners
ILE Reform	-0.011	-0.050	-0.057	-0.111
	(0.513)	(0.579)	(0.520)	(0.675)
Regressive Law Change	-0.002	0.093	0.065	0.150
	(0.815)	(0.008)	(0.065)	(0.106)
Observations	10007	10007	10007	10007
R-Squared	0.037	0.027	0.029	0.033
Mean of Dependent Variable	0.999	0.569	0.610	1.418

Each column presents a seperate regression of a contraceptive or sexual behaviour variable on abortion reform measures, year fixed effects and time-varying controls. p-values are presented below coefficients in parentheses.

B Data Appendix

B.1 Maternal morbidity, maternal mortality and birth records

Complete data on morbidity and mortality are available for both the public and private health care systems in Mexico. Microdata on each hospital stay record the age and sex of the patient, the number of nights in hospital, as well as the principal diagnosis based on ICD-10 codes. There are approximately 165 million single records for the period of 2004-2015 accounting for 558 million nights of hospitalisation. Of these, 46 million visits and 84 million nights of hospitalisation are related to "Pregnancy, childbirth and the puerperium" (the ICD-10 "O" code). These data are universal and include all hospital visits in the country.[27]

Complete microdata are released in three different formats depending on the hospital type where treatment is provided. Hospitals in the public health system are administered by one of two types of providers. The first, the Mexican Secretariat of Health, is the ministry of health of the national government, and accounts for 47.0% of all hospital stays related to pregnancy, childbirth and the puerperium in the period under study. The second are hospitals run by public Social Security providers, principally the Mexican Institute of Social Security (IMSS), and the State Workers' Institute of Security and Social Services (ISSSTE), which account for 29.5% of hospital stays in the ICD-10 "O" class. Finally, the remainder of hospital stays (23.5% of ICD-10 "O" cases) are treated in private hospitals. All private hospitals are required to provide information on each hospital stay in a standardised format, which is reported to the National Institute of Statistics and Geography (INEGI).

All public hospitalisation records are freely available as microdata files. However, data from hospitals run by the Secretariat of Health are available from 2000-2015 with the exact dates of hospitalisation, while data from hospitals run by Social Security Providers are available only from 2004-2015, and only provide the year of hospitalisation. Our analysis of impacts of abortion reform on maternal health use these databases, where we compile state by year measures for key causes of morbidity for each year between 2004-2015. We also undertake monthly analysis with only data from hospitals administered by the Secretariat of Health given that these allow us to examine exact dates of hospitalisation, and hence generate state by year *by month* morbidity measures. Data from the private system are available for remote processing by request from INEGI. We follow a similar process with these microdata files, generating state by year values for the number of events in key morbidity classes defined below. However, while private hospitals provide information on the cause of hospitalisation, this is provided at a more highly aggregated level than public records. In particular, 10 different diagnosis classes are provided which map from the 76 diagnosis codes included in the three digit ICD-10 "O" codes. We document the mapping for each diagnosis in the public and private sector morbidity data in Appendix Table A3. While our principal analysis focuses on the public data given the lower level of aggregation available, we show that results in aggregate private-sector data are consistent with our main results.

We focus on two particular morbidity classes when examining the impact of abortion reform on female health outcomes. These are abortion-related causes, and haemorrhage early in pregnancy. The first outcome is typically examined when considering the impacts of unsafe abortion on women's health in the medical and public health literature. It includes all forms of morbidity classified in ICD-10 codes O02-O08. A full discussion of this coding is provided in Singh and Maddow-Zimet (1999).

[27] The only exception is that these databases do not include standard hospital-stays for newborns following birth.

We additionally consider the impact of abortion reform on haemorrhage in early pregnancy. This is classified as haemorrhage prior to 20 weeks of gestation, and is coded from ICD-10 code O20. We focus on this outcome given that haemorrhage (along with incomplete abortion) is one of the two most common complications of unsafe abortion (World Health Organization, 2018; Gerdts et al., 2013), and given the widespread use of misoprostol as an abortifacient agent in clandestine abortions prior to the ILE reform in Mexico DF. While bleeding is a normal side-effect of misoprostol use as an abortive agent, when taken in unsupervised settings misoprostol can lead to heavy bleeding and haemorrhage (Pourette et al., 2018).[28] Together these two outcomes cover 8 of the 76 ICD-10 code classes, but make up 11.1% of all maternal hospitalisations in the years under study, or 21.5% of maternal morbidity when excluding deliveries (refer to Appendix Table A3 for a full description of all maternal morbidity causes). With the exception of a 'placebo' test based on examining (late term) obstetric complications (ICD code O70-O75), the remainder of the ICD O codes are not examined as outcomes as it is unlikely that they are sequelae of abortion (for example eclampsia or pre-eclampsia), or are morbidities occurring in the puerperium period, and so unable to be sequelae of abortion.

Finally, measures of maternal mortality by state and year are generated from INEGI's full mortality register. This register classifies maternal deaths according to ICD-10 codes.[29] Mexico's register of maternal deaths is recognised to be of high quality, with Mexico being classified as belonging to the "A-class" (World Health Organization, 1987) in the latest WHO report on maternal mortality trends. These data have had particular improvements from 2001, and as such, we restrict our period of analysis to 2001-2016 (see Schiavon et al. (2012b)).

Vital statistics for births in Mexico are compiled by INEGI based on birth registries completed by each parent or guardian at the civil registry, rather than being based on birth certificates issued at hospitals (as is the case, for example with the National Vital Statistics System in the USA and in various developing and emerging economies, like Chile and Argentina).[30] The birth register is released once per year, containing all births *registered* in that year, as well as the year the birth occurred. In order to avoid problems of under-reporting, differential reporting over time, and double-reporting, we collate all birth registers between 2002-2016, and then keep all births registered within 4 years of the date of birth.[31] This implies that we have complete birth registers based on birth years up to (and including) 2013.[32] Unregistered births will only be a problem if rates of birth registration

[28] Accounts of self administered abortion in a case study in Brazil described in Grimes et al. (2006b), suggest that even though the use of Misoprostol as an abortifacient increased safety, hospitalisation due to haemorrhage was the outcome in cases of complications. They state: "Women would self-administer the drug orally and then seek medical assistance if the uterine bleeding did not stop" (Grimes et al., 2006b, p. 1916).

[29] Formally, maternal deaths are defined by the WHO as "The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes".

[30] Using data from the 2010 census and birth records up until 2009, a recent (backward looking) analysis suggests that 93.4% of all births in Mexico were registered within 1 year of birth of the child, and in total, 94.2% of births are eventually registered at the national level (Instituto Nacional de Estadística y Geografía, 2012).

[31] This allows us to record births even when they are registered months after birth (up to 36 months following the birth). Considering additional registration lags results in virtually unchanged estimates, as nearly all ever-registered births are registered within 4 years of birth. This is identical to the methodology employed by Mexico's population authority in their calculation of official demographic trends (Consejo Nacional de Población, 2012).

[32] While these birth registers are not universal, they are considered as being of very good quality compared to many other registry systems in developing economies. On average, dated estimates suggest that across all developing countries 41% of births are unregistered, and this figure for Latin America alone is 14% (UNICEF, 2005).

change differentially between regions of Mexico over the period under study. Empirical evidence on changes in birth records between 1999 and 2009 do not suggest a strong relationship between reform and non-reform areas, and changes in rates of coverage (Instituto Nacional de Estadística y Geografía, 2012).

The INEGI Birth Register contains information about the date of birth, actual birthplace and the official residency of the mother. In addition, information on maternal characteristics such as age, total fertility, educational attainment, marital status and employment status are recorded. In principal analysis we examine full state by month by year aggregate figures for each of the 32 states. Summary statistics are provided in Table A4. In additional specifications we consider birth rates for quinquennial age groups (15-19, 20-24, 25-29, 30-34, 35-39 and 45-49), where state aggregates are calculated in an identical manner, however subsetting only to births occurring to each women aged in the relevant group at the moment she gives birth.

B.2 Administrative records on criminal offenses, survey data on sexual behaviour and additional data sources

To examine *De Jure* sentencing of abortion, we use administrative records from Mexico's Judicial Statistics on Penal Matters provided by INEGI. These records contain microdata registering each prison sentence handed down by the Mexico judiciary, the reason for the sentence, and the length of each sentence. It comprise the universe of judiciary decisions in the country based on the first legal judgment, and so does not include any subsequent appeals. We calculate prison sentence lengths from a categorical variable which records sentence lengths in binned windows (ranging from 0-2 months to > 20 years). These bin widths in microdata do not change over the period under study, and are identical in each state of the country. We consider *all* legal findings related to abortion impacting any individual. Trends in *De Jure* sentencing of abortion are presented in Appendix Figure A13.

For a small number of supplementary tests we use survey data from the Mexican Family Life Survey (MxFLS). The MxFLS is a nationally and regionally representative longitudinal data set that follows the Mexican population over time, covering various topics regarding the well-being of individuals including information on reproductive health.[33] The survey was conducted in three waves during 2002-2003, 2005-2006 and 2009-2012.

We use the reproductive health module from the MxFLS which collects information on contraceptive knowledge and usage as well as information on sexual behavior such as the number of sexual partners. This sample consists of a panel of women aged 15-44 who completed the reproductive health questionnaire resulting in a total of 5,404 women. Summary statistics for reproductive health across regions are provided in Appendix Table A21) and show that average knowledge of at least any kind of modern contraceptive methods are generally high across all regions, while the average usage of any kind of contraceptives and modern contraceptives are higher in Mexico DF compared to other states.

We collect a number of additional variables measured at the level of state and year. These are

[33] The MxFLS dataset is publicly available, developed and operated by the Iberoamerican University (UIA) and the Center for Economic Research and Teaching (CIDE) and also supported by multiple institutions in both Mexico (INEGI and National Institute of Public Health) and the USA (Duke University and Universities of California, Los Angeles).

either used to calculate rates of exposure for health and fertility outcomes (in the case of population), or as time-varying controls in regression analyses. The population of women aged from 15-49 by state is accessed from the National Population Council of Mexico (CONAPO). Time-varying controls are compiled to capture possible confounders of abortion policy, namely education, health investment and access, economic development, and women's social inclusion. We collect measures for each state and year from 2001 to 2016 describing the proportion of each state living in poverty, the proportion of women who are economically active, the average level of completed schooling of the population, the average salary paid to full-time workers, the proportion of the population with access to health-care facilities, and the rollout of the national health insurance program *Seguro Popular*.[34] Summary statistics for each variable as well as a list of sources are provided in Appendix Table A5. In the period under study we observe that state averages for years of schooling of adults is 8.5 years, 37% of women of working age are economically active, and the average salary is slightly over 5000 Mexican Pesos. These variables are merged by year and state to the morbidity, mortality, and birth data discussed earlier in this Section.

[34]Mexico's General Health Law underwent a major reform in 2003, which intended to provide 50 million Mexican citizens lacking social security with subsidized and publicly financed health insurance. The core of this reform was the health insurance program *Seguro Popular* (SP). The "People's Insurance" or *Seguro Popular* was launched in 2002, offering health service free of charge or subsidized to those without formal health insurance.

C Synthetic Control Estimates

The evidence in this paper is based on difference-in-difference and event study models. DD and event study estimates base the control group on all non-reform states. As a consistency check on these results and to ensure that estimates for the impact of the ILE reform are not driven by any pre-existing differential trends, we also compare outcomes in Mexico DF with those in a single synthetic control state. Although specifications 3 and 4 provide evidence in favour of parallel (pre-)trends if we can reject that each $\delta_j = \gamma_j = 0 \; \forall \; j < 0$, we may nonetheless be concerned with unobserved heterogeneity between treated and non-treated states. As an additional test and a plausability check of estimates from equations 1 and 3 *for the impact of the ILE reform only*, we construct a synthetic control estimate to compare with Mexico DF. This procedure is particularly suitable to quantify the effect of the ILE reform in Mexico DF where there is a single treated unit, however not for the Regressive policy changers where a number of states adopt at different points in time. Our interest is to quantify the impact of the ILE reform, by comparing health outcomes in Mexico DF, the treated area, with outcomes in the rest of Mexico. This consists of determining the counterfactual state for a single treated state, following Abadie et al.'s (2010) synthetic control method where the single counterfactual "synthetic control" unit is generated based on a re-weighted pool of all the untreated states. This counterfactual is chosen to minimise the matrix norm based on the distance between average outcomes in the pre-treatment period, and the estimated ATT is inferred as the difference between the treated unit and the synthetic control unit in the post-treatment period. Our implementation of the synthetic control procedure is standard, as outlined in Abadie et al. (2010). The "donor" pool from which we calculate synthetic controls include each of the remaining states with the exception of neighbouring Mexico State, in which a non-trivial proportion of abortions were accessed by women. We have discussed spillover effects in Section 5.3 of this paper.

In order to conduct inference on the estimated treatment effect, we similarly follow Abadie et al. (2010), and undertake permutation inference. In graphical analysis, we calculate identical synthetic controls for the 30 untreated donor states, and generate placebo reform estimates assuming an identical reform timing. We then compare the true reform impact in each year with the impact for each of the placebo estimates in this year, to determine whether the estimated impact in the treated region is large compared with placebo cases where no substantial impact should be observed. When considering inference on a single ATT based on the mean post-treatment decline, we implement permutation inference comparing our main effect with the effect in all potential control states, and all potential treatment periods, as suggested in Abadie et al. (2010, p. 497).[35] This provides a larger pool of placebo outcomes, giving greater precision to reported p-values resulting from permutation inference.

All results of this consistency check using synthetic control methods are provided in this Appendix.

[35] In particular, the p-value associated with the ATT for the impact of ILE on health outcomes is calculated as:

$$p = \frac{\sum_{s=2}^{31} \sum_{t=2004}^{2014} 1\{|\hat{\alpha}_{1,2007}| \leq |\hat{\alpha}_{t,s}|\}}{N_{s,t}}$$

where $\hat{\alpha}_{s,t}$ refers to the average post-treatment difference between the treated (or placebo) unit and its synthetic control for state s where the (placebo) treatment is assigned as occurring in year t. Here state $s = 1$ refers to Mexico DF and the true treatment year is $t = 2007$, and so $\hat{\alpha}_{1,2007}$ is the true treatment effect, while permutations of each state×year pair $(2, \ldots, 31)\times(2004 \ldots 2014)$ are placebo trials. $N_{s,t}$ refers to the total number of placebo permutations.

Morbidity Effects In Figure A20 we present results based on a consistency check comparing rates of haemorrhage early in pregnancy and rates of morbidity for all abortion related causes in Mexico DF and in a synthetic control state. In Panel A we observe an immediate and sharp fall in rates of haemorrhage early in pregnancy, falling from approximately 2.3 cases per 1,000 fertile aged women to approximately 1.3 cases per 1,000 women. This agrees with DD and event study results documented above. Additionally, this supports claims from the medical literature that haemorrhage is one of the major drivers of maternal morbidity and mortality following unsafe abortions (World Health Organization, 2011), as the appearance of a legal and sterile alternative to clandestine abortion resulted in an immediate a 43% reduction in hospitalisations resulting from haemorrhage early in pregnancy. In the sub-set of data for which the month as well as the year of hospitalisation is recorded (those in hospitals administered by the Secretary of Health), we observe that this fall occurs precisely in the month that abortion was legalised, suggesting that changes in haemorrhage morbidity were immediate with the arrival of new legislation (see Figure 1).

In Panel B of Figure A20 we present trends in rates of morbidity due to abortive causes. In this case we observe a more gradual reduction in morbidity, with a clear difference 4 years post-reform. In longer trends from public hospital data displayed in Appendix Figure A4, descriptive figures do suggest that this was a turning point in Mexico DF, with a peak in 2008, after a steady increase from 2000, and then a steady decline in the total number of cases of hospitalisation up until 2015. In the case of abortion morbidity, as noted in the paper, it is important to highlight that the procedure used for abortions realized under the auspices of ILE has changed over time, from a baseline rate of only 25% medical abortions versus 75% surgical, to around 75% medical abortion by 2011. The large rise in medical abortion has both improved the safety of the program and enabled for the high demand for elective abortion to be met.

In Figure A22 we present a visual representation of permutation inference for synthetic control estimates following Abadie et al. (2010). In the left-hand panel, we compare the difference between haemorrhage morbidity in Mexico DF and its synthetic control with placebo differences in each other state in Mexico compared to its own synthetic control. In the first post-reform year, the true estimate exceeds all other placebo iterations, and this largely remains to be true in subsequent years, although from 5 years post-reform a number of more extreme outcomes are observed in certain (generally smaller) states. To calculate an exact permutation p-value, we follow the state and year permutation procedure, generating the null distribution displayed in Appendix Figure A23. A two-tailed test suggests a p-value of 0.09, and a one tailed test suggests a p-value of 0.06, respectively implying that only 9% of placebo outcomes result in an average post-placebo change which is more extreme than the true post-treatment change in D.F, and only 6% of placebos have a larger reduction. In the right-hand panel of Figure A22 we observe similar placebo estimates for abortion related morbidity. In line with the slower-reduction in abortion-related morbidity, we do not observe that the outcome in Mexico DF is more extreme than all placebo outcomes until multiple years post-reform. Only in 2014 and 2015 is the difference more extreme in the true treated state than each placebo iteration. Complete randomization inference similarly suggests that average treatment effects over the whole reform period are less extreme than in the case of haemorrhage. Specifically, two-tailed tests suggest a p-value of 0.19, or 0.087 in the case of one-tailed tests (Appendix Figure A24).

Birth Rates The difference between outcomes in Mexico DF and the synthetic control state are documented in Figure A25. Here we observe that while there was a downward trend in birth rates

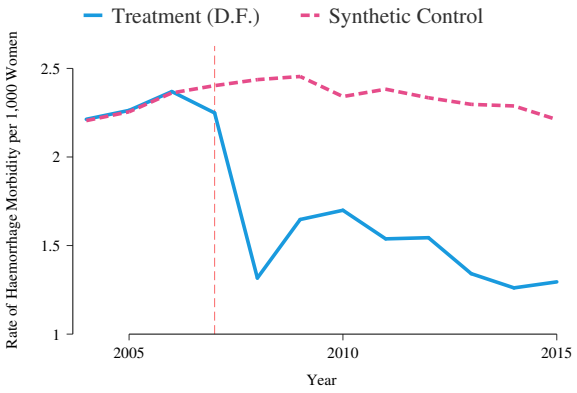
in DF including prior to the reform,[36] synthetic control results suggest that this decline accelerated following the implementation of ILE in 2007 when comparing Mexico DF with the synthetic control state. Figure A25a shows the trend in Mexico DF (solid line) as compared to the synthetic control (dashed line), where the synthetic control is chosen to minimise the RMSE in the difference between these two rates prior to the reform. The fertility rates in Mexico DF are substantially below those of the synthetic control, and appear to diverge over time. The average difference in rates of birth per 1,000 women over the time-period under study is 6.8 births (comparable to the DD results discussed above), and this difference is as large as 15 births per 1,000 women 6 years following the ILE reform. When cast in terms of the average fertility rates of Mexico DF in the pre-reform period (89 births per 1,000 women), this accounts for approximately a 7.5% reduction.

In Figure A25b, we compare the synthetic control estimates for Mexico DF with a series of placebo reforms for each of the remaining 30 states to determine whether the estimated impacts on morbidity are relatively large compared with contexts in which a zero impact would be expected. In initial years, particularly in 2008, we do not observe that outcomes in Mexico DF are extreme when compared to placebo cases, and so cannot suggest an immediate statistically significant effect. However, in general we observe that over time, differences in Mexico DF become more extreme than all placebo outcomes. From 4 years post-reform, the difference between Mexico DF and its synthetic control is larger in absolute terms than any of the 30 placebo changes. In Appendix Figure A27 we compare this mean outcome with a null distribution based on permutations of treatment by state and year. We observe that the outcome observed in Mexico DF is extreme with respect to the null distribution. Only 4.2% of placebo iterations have a more extreme outcome than that observed in Mexico DF following the ILE reform, and this falls to 0.3% if considering only those which suggest a larger reduction than in Mexico DF (corresponding to two- and one-tailed p-values of 0.042 and 0.003 respectively).

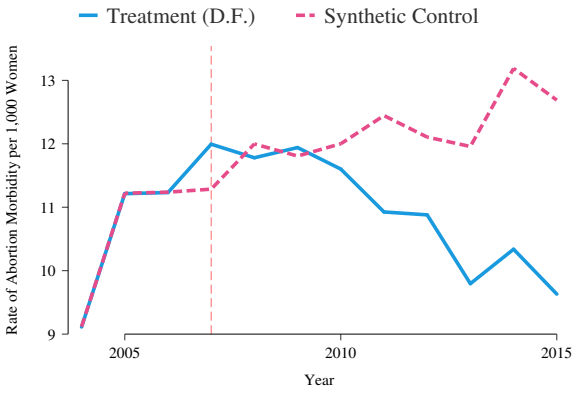
Policy Spillovers with a Synthetic Control Finally, we return to consider the possibility of spillovers from the ILE reform to nearby states where some access to abortion was observed (Mexico State, Hidalgo and Morelos), comparing these states to their own synthetic control state. These are presented in Table A23. Full graphical output and inference is documented in Figures A28, A29, and A30. For comparison we present synthetic control estimates from Mexico DF from Figure A25 (births) and Figure A20 (morbidity). In each case, the synthetic control is chosen from among all remaining states (ie all states except for Mexico DF, Mexico State, Morelos and Hidalgo). Along with estimates, p-values are presented, which quantify the proportion of placebo iterations resulting in more extreme estimates than the difference between the state in interest and its synthetic control. Here, placebos are all permutations of donor states and years. In each of the three non-DF states where the largest proportion of abortions were performed, no significant impact was observed on rates of birth, or maternal morbidity. Point estimates are both considerably smaller in magnitude to those from Mexico DF (the largest is a reduction of 2 births per 1,000 women in the state of Morelos), and p-values all suggest little evidence to reject null hypotheses of no spillover impacts of reforms on these outcomes in this time period.

[36] This is in line with a general trend in declining fertility across the country, which began in the 1960's or 1970's depending on the state (Tuiran et al., 2004).

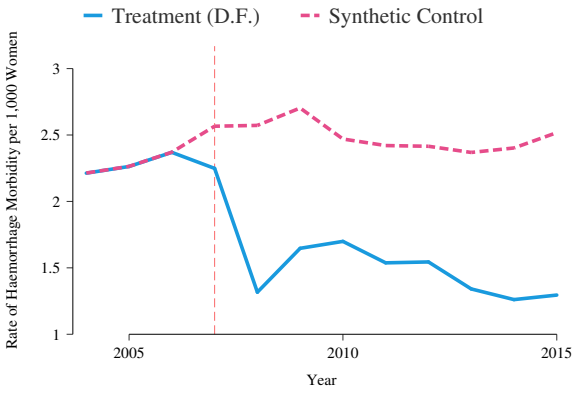
Figure A20: Morbidity Outcomes in Mexico DF and a Synthetic Control Group



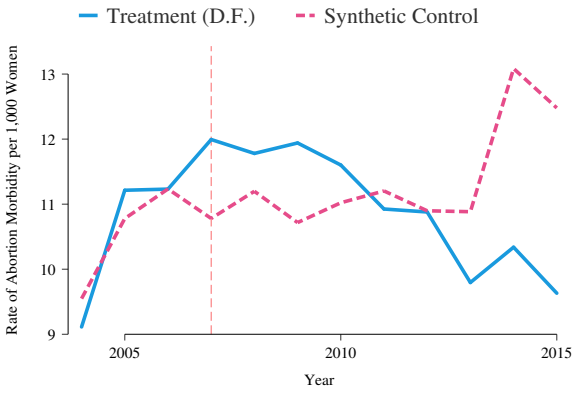
(a) Haemorrhage Early in Pregnancy



(b) Abortion Morbidity



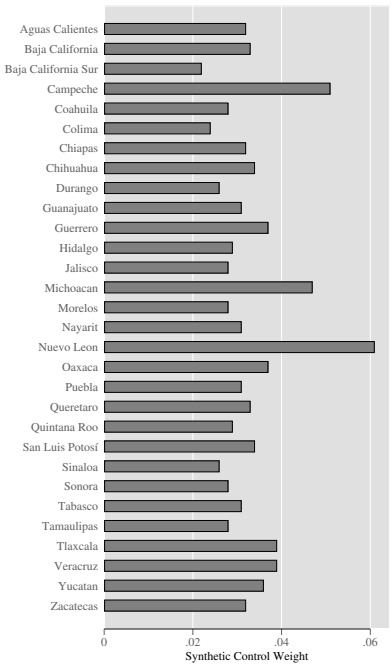
(c) Haemorrhage Early in Pregnancy



(d) Abortion Morbidity

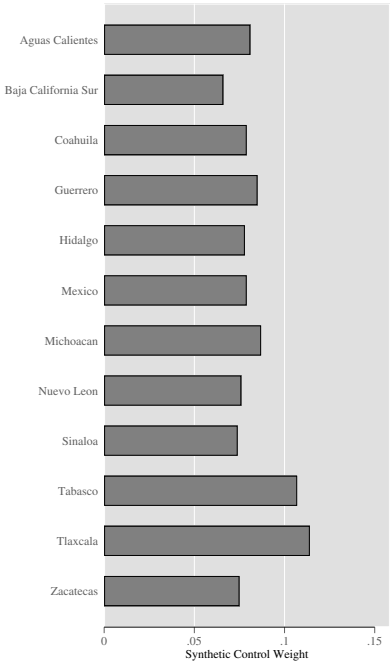
Notes: Left-hand panel displays all morbidity classified as ICD codes O02-O08 (for reasons relating to abortion). Right hand panel displays morbidity for haemorrhage early in pregnancy (prior to week 20 of gestation). In each case synthetic controls are based on a pool of the 30 other states of Mexico (excluding Mexico DF and Mexico State) in the top row (panels a and b) and based only states which do not subsequently implement a regressive reform in the bottom row (panels c and d). All synthetic controls are selected based on rates of abortion morbidity in all *pre*-reform years. Morbidity is per 1,000 women aged 15-49 residing in the state. The weighting of states to form the synthetic control in each panel is displayed in Figure A21.

Figure A21: Synthetic Control Weights for Morbidity Outcomes

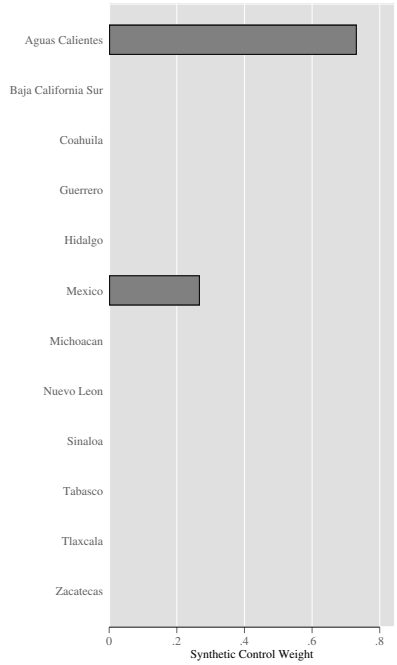


(a) Haemorrhage Early in Pregnancy

(b) Abortion Morbidity



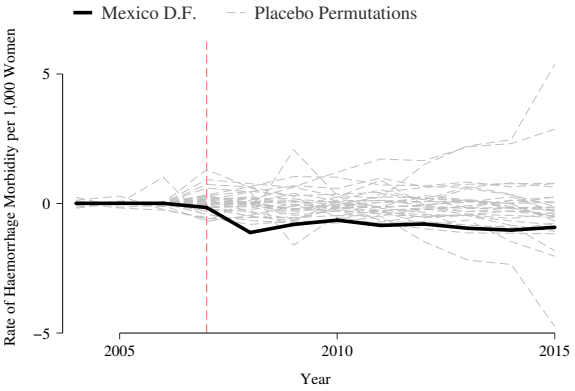
(c) Haemorrhage Early in Pregnancy



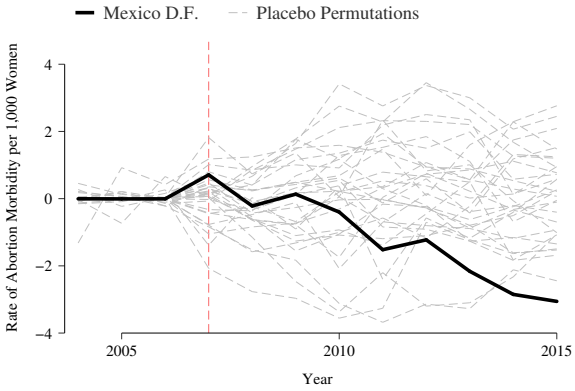
(d) Abortion Morbidity

Notes: The composition of each synthetic control is displayed, where bars refer to the weight given to each state. Weights are greater than or equal to 0 for each state, and sum to 1 over all states. The weights correspond to each panel displayed in Figure A20. Refer to notes to Figure A20 for differences between panels.

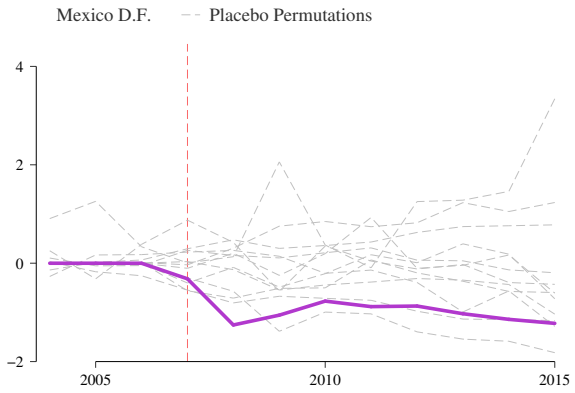
Figure A22: Inference: The Impact of Abortion Reform on Maternal Morbidity



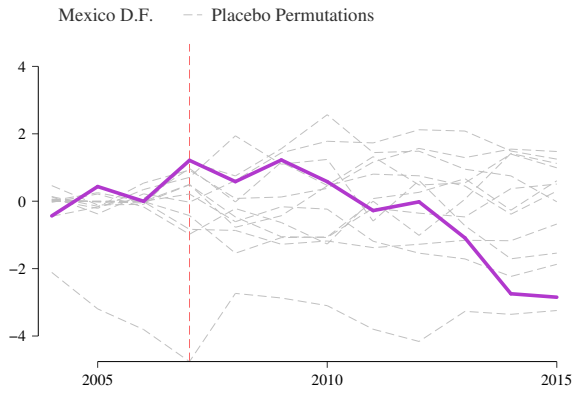
(a) Haemorrhage Early in Pregnancy



(b) Abortion Morbidity



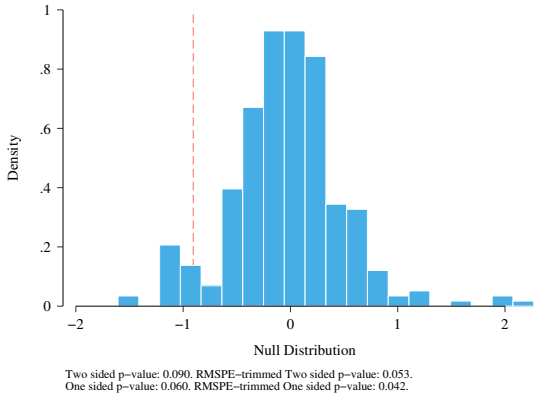
(c) Haemorrhage Early in Pregnancy



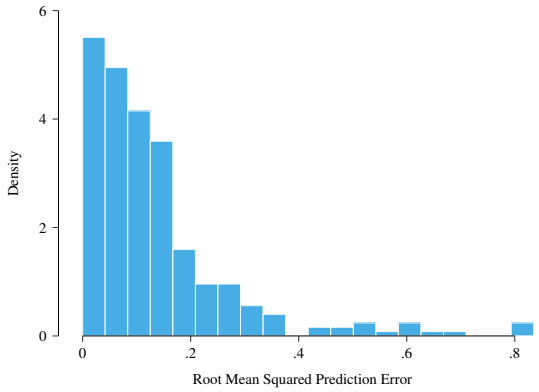
(d) Abortion Morbidity

Notes: Inference for synthetic control estimates of the impact of the ILE reform on morbidity based on placebo permutations are displayed. Each panel displays the difference between Mexico DF and its synthetic control (as a thick solid line), and all other placebo permutations, where the remaining states are considered as treated in 2006, and their synthetic control is determined based on an identical procedure as for Mexico DF. These are displayed as thin dashed lines. In the top row, all other states with the exception of Mexico are considered as part of the pool of placebos, and in the bottom row, only states which did not implement a subsequent regressive reform are considered as placebos.

Figure A23: Complete Randomization Inference for Synthetic Control: Haemorrhage Morbidity



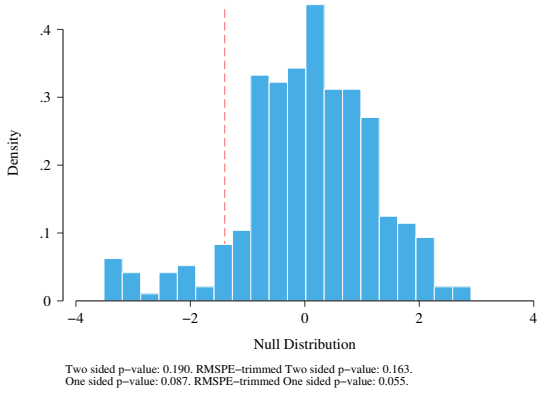
(a) Null Distribution based on Randomization Inference



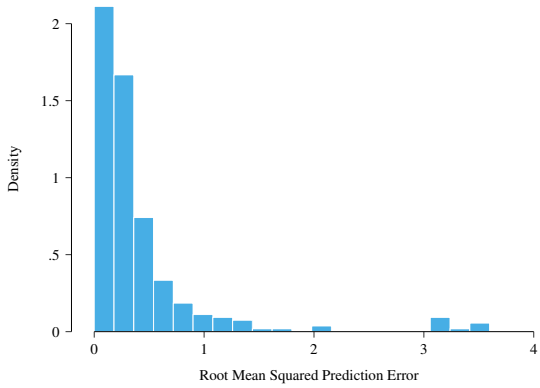
(b) RMSPE from Placebo Synthetic Controls

Notes: Left-hand panel plots the null distribution of average synthetic control placebo estimates $\hat{\alpha}^*$, and the actual estimate as the vertical dashed line. The actual estimate in this case is $\hat{\alpha} = -0.906$. Each placebo estimate is generated from a synthetic control permutation where the placebo-treatment state is one of the 30 non-ILE states, and the treatment year is one of the years from 2005-2014. Full permutations for each state and year combination are generated. The right-hand panel plots the RMSPE associated with each synthetic control procedure. When considering trimmed p-values, we trim the sample at RMSPE<0.4 to avoid cases where the synthetic control does not re-create pre-reform averages. Untrimmed p-values are based on the full set of permutations.

Figure A24: Complete Randomization Inference for Synthetic Control: Abortion Related Morbidity



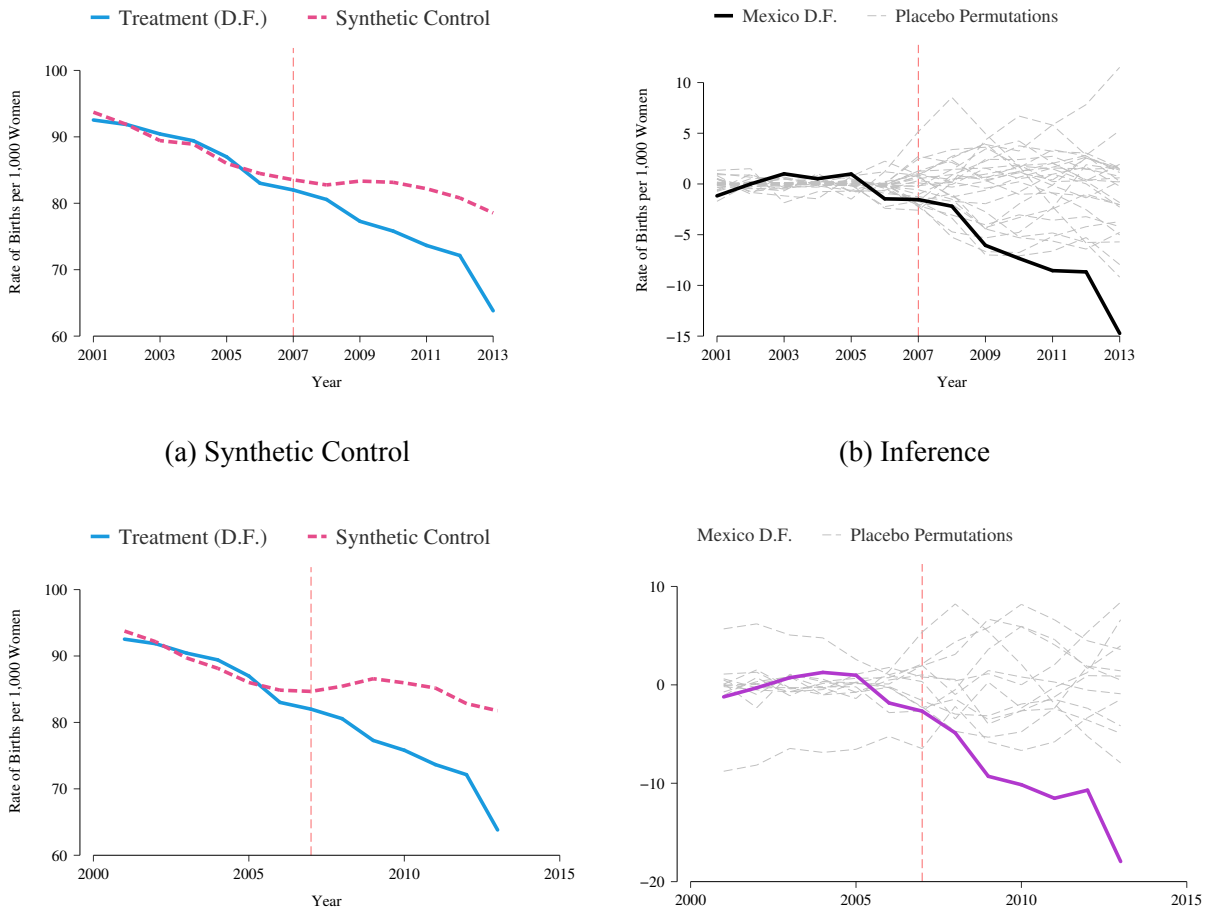
(a) Null Distribution based on Randomization Inference



(b) RMSPE from Placebo Synthetic Controls

Notes: Refer to notes to Appendix Figure A23. An identical procedure is followed, however now using abortion related morbidity as the outcome instead of haemorrhage early in pregnancy. The actual estimate in this case is $\hat{\alpha} = -1.399$. The RMSPE trimming constant in this case is set at 2 when trimmed p-values are displayed.

Figure A25: Fertility in Mexico DF and a Synthetic Control Group



(a) Synthetic Control

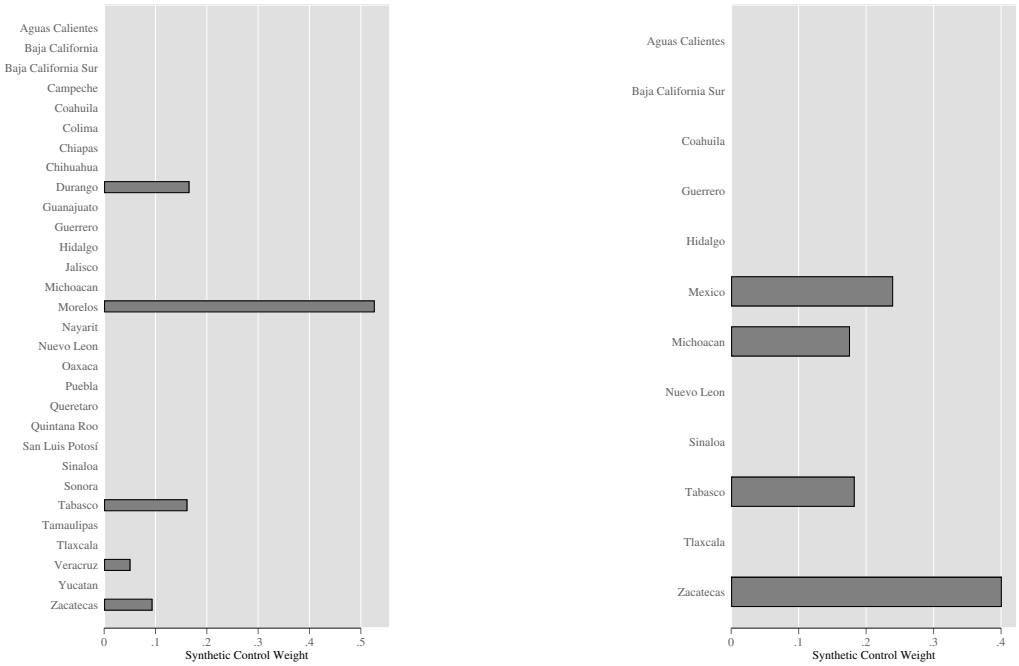
(b) Inference

(c) Synthetic Control

(d) Inference

Notes: Left-hand panel displays birth rates per 1,000 women aged 15-49 in Mexico DF (solid line), and a synthetic control formed from the remaining 30 states (excluding Mexico DF and Mexico State) in the top row (panels a) and formed only using states which did not implement a subsequent regressive reform in the bottom row (panel c). The synthetic control is chosen based on birth rates in all *pre*-reform years (2001-2006). The right hand panel displays the difference between Mexico DF and its synthetic control (thick solid line), and other placebo permutations, where the remaining states are considered as treated in 2006 (panel b) or where only non-regressive states are considered as treated (panel d), and their synthetic control is determined based on an identical procedure as in Mexico DF.

Figure A26: Synthetic Control Weights for Birth Rates

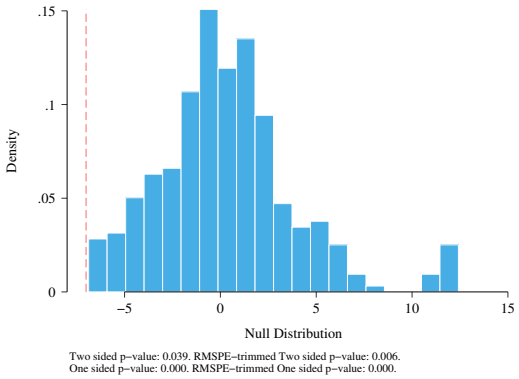


(a) 30 States as Donors

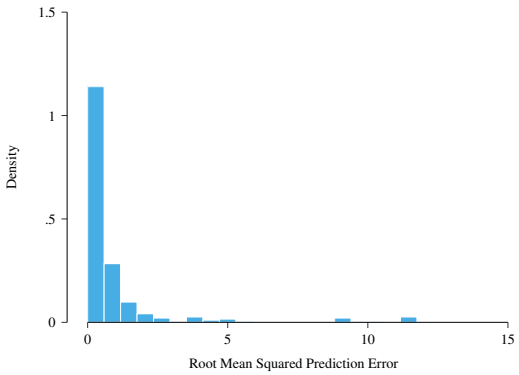
(b) Only Non-Regressive States as Donors

Notes: The composition of each synthetic control in Figure A25 is displayed, where bars refer to the weight given to each state. Weights are greater than or equal to 0 for each state, and sum to 1 over all states. The weights correspond to panels a and c in Figure A25.

Figure A27: Complete Randomization Inference for Synthetic Control: Fertility Rates



(a) Null Distribution based on Randomization Inference



(b) RMSPE from Placebo Synthetic Controls

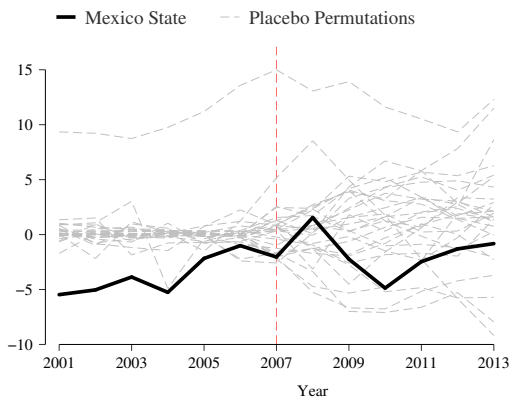
Notes: Left-hand panel plots the null distribution of average synthetic control placebo estimates $\hat{\alpha}^*$, and the actual estimate as the vertical dashed line. The actual estimate in this case is $\hat{\alpha} = -7.009$. Each placebo estimate is generated from a synthetic control permutation where the placebo-treatment state is one of the 30 non-ILE states, and the treatment year is one of the years from 2002-2012. Full permutations for each state and year combination are generated. The right-hand panel plots the RMSPE associated with each synthetic control procedure. When considering trimmed p-values, we trim the sample at RMSPE<5 to avoid cases where the synthetic control does not re-create pre-reform averages. Untrimmed p-values are based on the full set of permutations.

Table A23: Synthetic Control Estimates and Inference on Spillover Effects

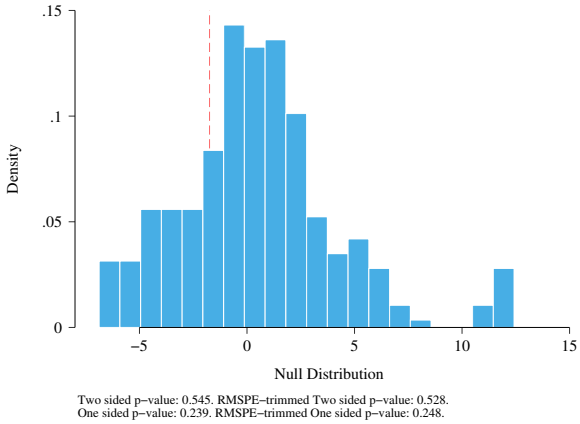
	Births		Abortion Morbidity		Haemorrhage Morbidity	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Main Synthetic Control Estimate						
Mexico DF	-7.009	[0.039]	-1.399	[0.190]	-0.906	[0.090]
Synthetic Control Estimate for Spillover States						
Mexico State	-1.741	[0.545]	0.333	[0.741]	0.559	[0.200]
Morelos	-1.764	[0.545]	0.749	[0.470]	0.118	[0.781]
Hidalgo	-0.182	[0.939]	-0.679	[0.500]	-0.264	[0.519]

Notes: Each point estimate refers to the average post-treatment difference between each state and its synthetic control, and p-values are calculated using permutation inference described in Section 4. A full display of each synthetic control estimate and permutation inference is provided in Appendix Figures A28 (Mexico States), A29 (Morelos) and A30 (Hidalgo).

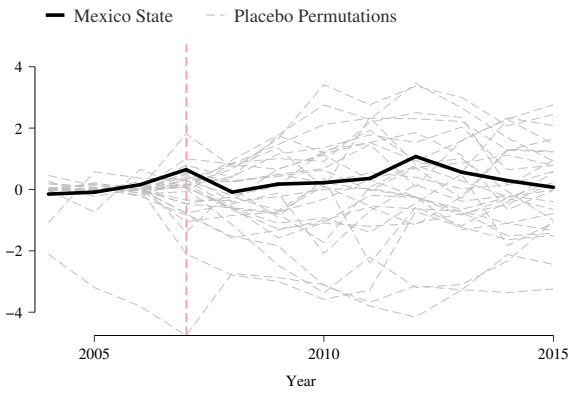
Figure A28: Synthetic Control Estimates for Spillovers: Mexico State



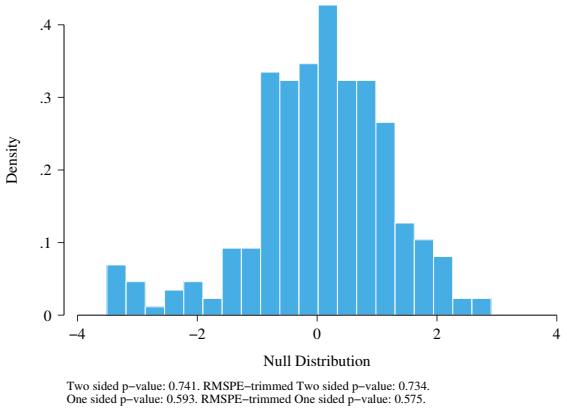
(a) Birth Rates: Inference by State



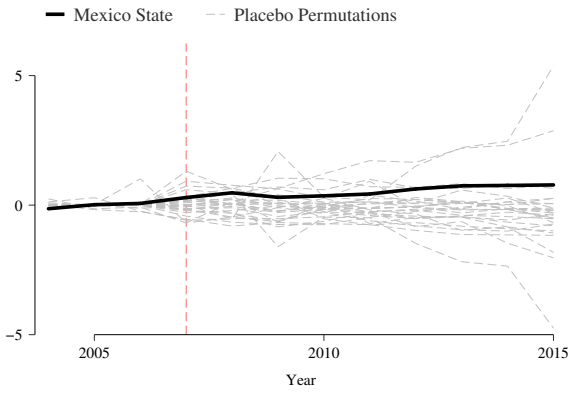
(b) Birth Rates: Inference by State and Time



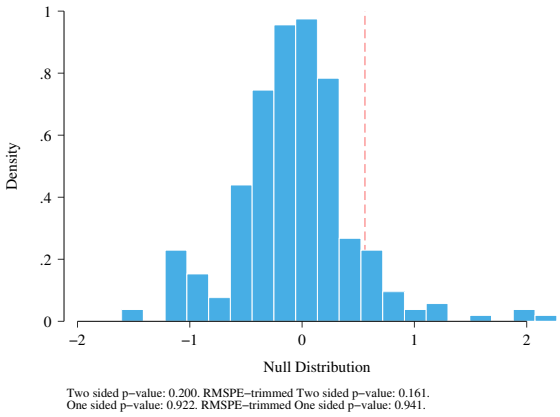
(c) Abortion Morbidity: Inference by State



(d) Abortion Morbidity: Inference by State and Time



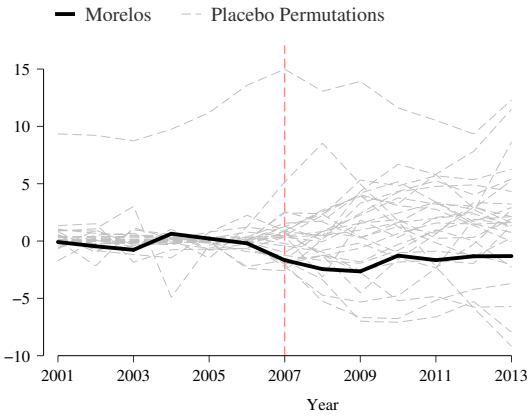
(e) Haemorrhage Morbidity: Inference by State



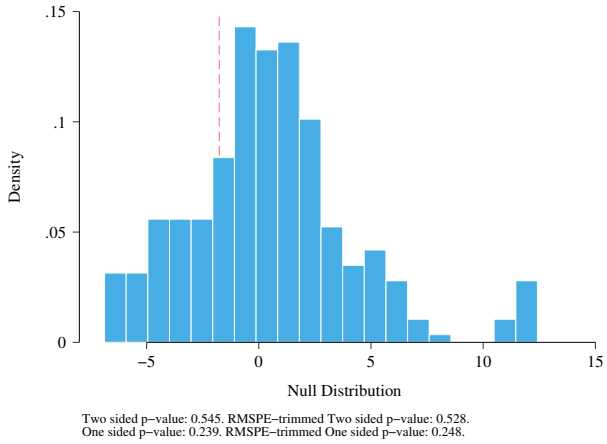
(f) Haemorrhage Morbidity: Inference by State, Time

Notes: Left-hand panels present plots of the difference between outcomes in Mexico State and similar differences between placebo states and their synthetic controls. Right hand plots compare average post-treatment differences between Mexico State and its synthetic control with a null distribution constructed permuting treatment over each donor state and time period. Panels (a) and (b) are for birth rates, (c) and (d) for abortion morbidity, and (e) and (f) for haemorrhage morbidity.

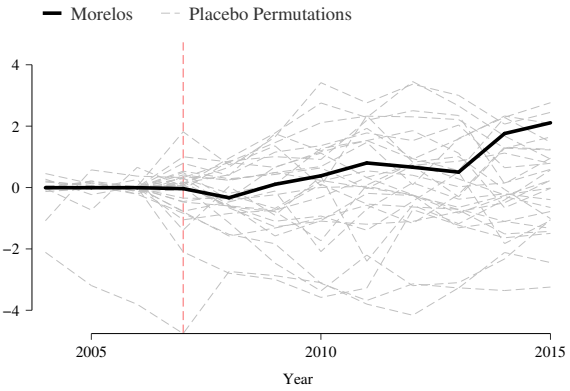
Figure A29: Synthetic Control Estimates for Spillovers: Morelos



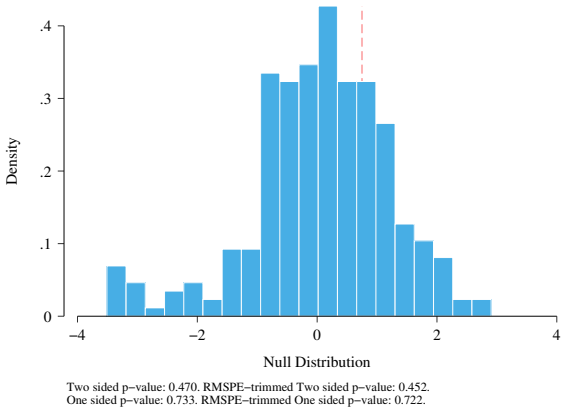
(a) Birth Rates: Inference by State



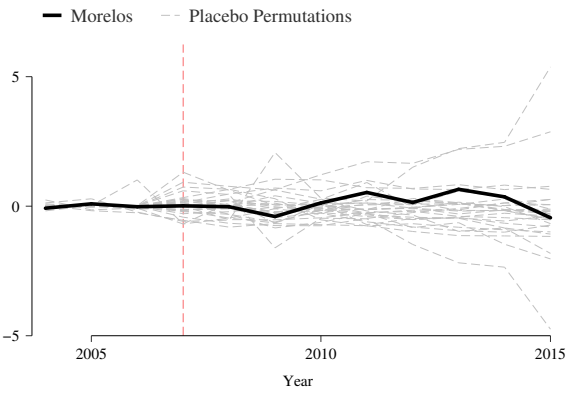
(b) Birth Rates: Inference by State and Time



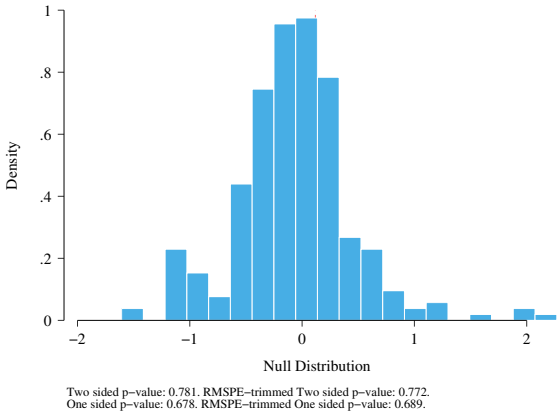
(c) Abortion Morbidity: Inference by State



(d) Abortion Morbidity: Inference by State and Time



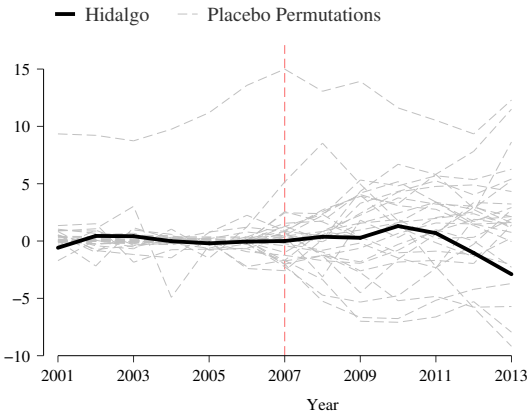
(e) Haemorrhage Morbidity: Inference by State



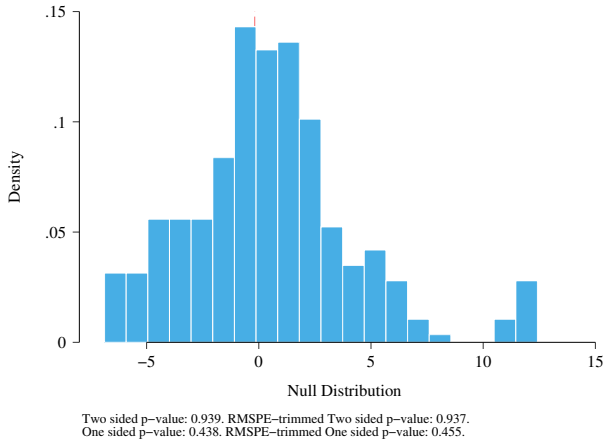
(f) Haemorrhage Morbidity: Inference by State, Time

Notes: Refer to notes to Appendix Figure A28. All details are identical, however now results are displayed for the state of Morelos.

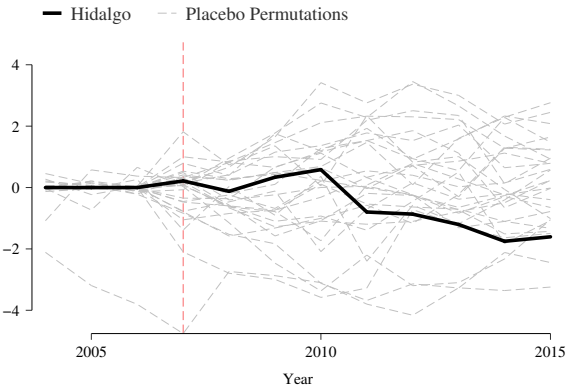
Figure A30: Synthetic Control Estimates for Spillovers: Hidalgo



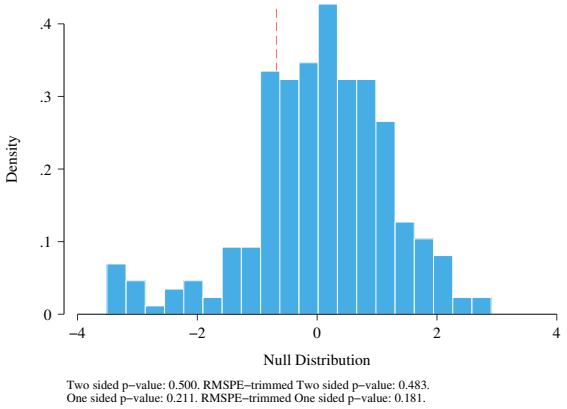
(a) Birth Rates: Inference by State



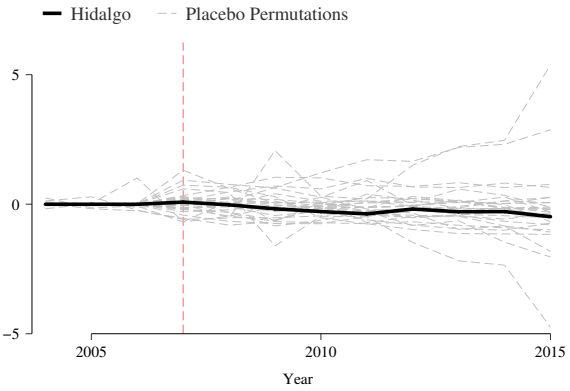
(b) Birth Rates: Inference by State and Time



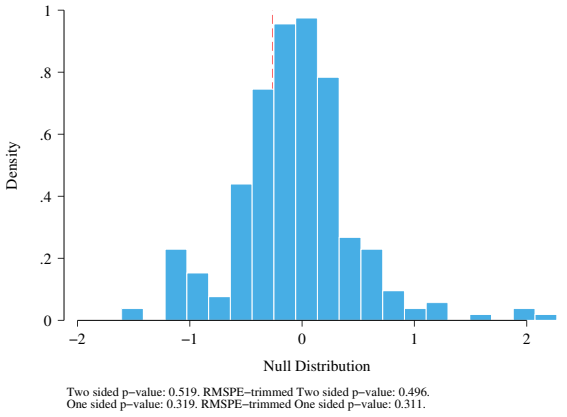
(c) Abortion Morbidity: Inference by State



(d) Abortion Morbidity: Inference by State and Time



(e) Haemorrhage Morbidity: Inference by State



(f) Haemorrhage Morbidity: Inference by State, Time

Notes: Refer to notes to Appendix Figure A28. All details are identical, however now results are displayed for the state of Hidalgo.