

DISCUSSION PAPER SERIES

IZA DP No. 13134

**Access to The Emergency Contraceptive Pill
Improves Women's Health:
Evidence from Chile**

Damian Clarke
Viviana Salinas

APRIL 2020

DISCUSSION PAPER SERIES

IZA DP No. 13134

Access to The Emergency Contraceptive Pill Improves Women's Health: Evidence from Chile

Damian Clarke

Universidad de Santiago de Chile, IZA and MLIV

Viviana Salinas

Pontificia Universidad Católica de Chile and MLIV

APRIL 2020

Any opinions expressed in this paper are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but IZA takes no institutional policy positions. The IZA research network is committed to the IZA Guiding Principles of Research Integrity.

The IZA Institute of Labor Economics is an independent economic research institute that conducts research in labor economics and offers evidence-based policy advice on labor market issues. Supported by the Deutsche Post Foundation, IZA runs the world's largest network of economists, whose research aims to provide answers to the global labor market challenges of our time. Our key objective is to build bridges between academic research, policymakers and society.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Access to The Emergency Contraceptive Pill Improves Women's Health: Evidence from Chile*

We examine the sharp expansion in availability of the emergency contraceptive pill in Chile following legalized access through municipal public health-care centres. Combining a number of administrative datasets on health outcomes and pharmaceutical use, and using difference-in-difference and event study methods, we document that this expansion improved women's reproductive health outcomes, particularly reducing rates of haemorrhage early in pregnancy. These improvements are most notable in areas of the country in which the rollout of the pill was largest. We also document some evidence that refusal to grant the pill upon a women's request is linked with a worsening in reproductive health outcomes.

JEL Classification: I18, J13, K38, H75

Keywords: emergency contraceptives, maternal morbidity, haemorrhage, abortion, event studies, difference-in-differences

Corresponding author:

Damian Clarke
Universidad de Santiago de Chile
Av. Libertador Bernardo O'Higgins 3363
Estación Central
Santiago de Chile
Chile
E-mail: damian.clarke@usach.cl

* We acknowledge institutional support from the Ministry of Economics of the Government of Chile in funding the Millennium Nucleus for the Study of Life Course and Vulnerability (MLIV), and Clarke gratefully acknowledges FONDECYT Chile (grant number 1200634) for financial support. We thank the editor Mark D. Hayward and three anonymous referees, as well as Blair G. Darney, Alejandra Ramm, Amanda Stevensen, Christine Valente and participants at PAA Austin and the Institute for Research in Market Imperfections and Public Policy workshop for useful comments. We thank Electra González and Ingrid Leal Fuentes for providing information related to Emergency Contraceptive usage in Chile. We also thank Valentina Jorquera Samter, José Mora Castillo and Kathya Tapia Schythe for excellent research assistance. Replication materials for all results in this paper are available at <https://github.com/damianclarke/pillHealth>.

1 Introduction

This study examines whether access to the emergency contraceptive (EC) pill can impact maternal health. Contraceptive use has been linked with an improvement in maternal health indicators, at least when considering survival (Cleland et al., 2012; Stover and Ross, 2010).¹ Bongaarts and Westoff (2000) had formerly proposed the idea that increasing contraceptive use could reduce abortion, an idea that more recently has been supported by the work of Miller and Valente (2016), who point to modern contraceptives acting as substitutes for abortion. What's more, there is clear evidence that unsafe abortion significantly impacts maternal health and survival (United Nations, 2014; Grimes et al., 2006) as well as evidence in the medical literature that abortive agents bought on the black market² are used in the absence of legal alternatives (see eg Grimes et al. (2006)). Thus, a causal chain could plausibly exist which is that the availability of the EC pill reduces clandestine abortions, and the reduction in clandestine abortions results in improvements in health outcomes.

To empirically test for a link between EC pill access and maternal health, we focus on the sharp expansion in availability of the EC pill in Chile over the first two decades of the 21st century. We seek to determine whether this availability resulted in reductions in key maternal morbidity events by examining legislative reform which made the EC pill available for free to any women enrolled in the public health system. In the entirety of the period under study, abortion was completely illegal in Chile, and our working hypothesis is that the EC provides an alternative post-coital contraceptive option for women, potentially avoiding clandestine and unsafe abortions. In line with this, our

¹Maternal mortality has received considerably more attention in the literature (Loudon, 1992), and is often referred to as the “tip of the iceberg”, with the remaining mass consisting of the many events of maternal morbidity. For every woman who dies due to causes related to child birth, 20–30 more experience events inducing chronic morbidity with ongoing sequelae (Reichenheim et al., 2009; Firoz et al., 2013). As such, in this study we focus principally on morbidity outcomes.

²Or even over the counter in the case of misoprostol, which, while designed to treat stomach ulcers, has an off-label effect of inducing abortion in pregnant women.

key maternal health measures are those caused by unsafe abortion, namely haemorrhage in early pregnancy, and abortion related morbidity. In general, we focus on the large number of non-mortal hospital visits (ie morbidity), though also document effects on mortality.

While we aim to continue a line of research which considers the impact of modern contraceptives on women's health, to our knowledge, this paper is the first study to examine the impact of access to the EC pill on maternal health. This study takes advantage of universal microdata on full inpatient visits, as well as variation in the availability of EC pill over time by municipalities within Chile, providing a credible causal estimate of the impact of the EC pill. Using difference-in-differences and event study methods we are able to control for all fixed characteristics at the level of municipalities and time, while also controlling for additional potential confounders, namely, political characteristics of each municipality, and other contraceptive coverage in the country. Our estimates suggest that upon arrival of the EC pill, municipalities which disburse the EC pill see improvements in maternal health outcomes compared with municipalities which had not yet provided the EC pill. We observe that this effect is most marked in municipalities where there was particularly high request and granting of the EC pill. We additionally observe some suggestive evidence that the opposite result obtains when EC requests are refused: conditional on fixed municipal and time characteristics, abortion morbidity and morbidity due to haemorrhage early in pregnancy are higher when a higher proportion of requests for access to the EC pill are denied.

The roll-out of the EC pill in the Chilean public health system is emblematic, given that there was sub-national variation in availability over a number of years, and an absence of alternative post-coital reproductive control outcomes in the country. This paper joins a small number of studies examining the EC pill in Chile including recent work by Nuevo-Chiquero and Pino (2019), considerably updating and extending earlier work of Bentancor and Clarke (2017), as well as a

number of studies examining the EC pill's impact in the USA, UK and other countries (Gross et al., 2014; Durrance, 2013; Girma, 2006, 2011; Mulligan, 2015; Moreau et al., 2009; Hu et al., 2005). However, these studies focus nearly exclusively on fertility outcomes and the prevalence of sexually transmitted infection.

In what remains of the paper, we first provide some background on the nature of the expansion of the EC pill in Chile. We then describe the various sources of administrative data used in this paper in section 3.1, and the estimation methodology in section 3.2. We provide all results in section 4, and a brief discussion and conclusion in section 5.

2 Background on The EC Pill and its Rollout in Chile

The EC pill is a post-coital contraceptive which can be taken in the day(s) following unprotected sexual intercourse to reduce the likelihood of conception (von Hertzen et al., 2002). In Chile, the rollout of the EC pill followed a lengthy legislative process resulting in periods of sub-national (municipal) variation in availability of the medication. We note that abortion was illegal in Chile for the entire period of interest of this study, only being legalised in the case of three limited circumstances in 2017.³ A full discussion of the rollout is provided in Casas Becerra (2008) and Nuevo-Chiquero and Pino (2019); Bentancor and Clarke (2017) (whose empirical strategies we broadly follow). Here we provide a brief overview of the rollout and the way this interacts with our identification strategy (discussed below). Interested readers are directed to Online Appendix B, or the aforementioned references, where fuller details are available.

Until 2008, the EC pill was completely unavailable in Chile, or available for only very short temporal windows and in limited cases (such as in case of rape). From 2008, a legal finding im-

³A discussion of induced abortion in Chile over this period is provided by Prada and Ball (2016). This report cites figures suggesting anywhere between 60,000-300,000 clandestine abortions p.a., and highlights that there have been few changes in the methods of clandestine abortion used from 1990 onwards, apart from growing use of misoprostol.

plied that mayors in each of the country's 346 municipalities could dictate whether the EC pill was available from local primary care clinics (Dides et al., 2009; Dides C. et al., 2010, 2011). There were subsequent legal challenges to EC pill availability, but in practice around half of Chilean municipalities reported that they disbursed the EC pill in the years following the 2008 finding, with the remainder either not providing the EC pill, or only providing it in very restricted circumstances. This municipal variation in EC pill availability lasted for around three years. Between 2010 and 2013 there were a number of legal findings which gradually opened access to the EC pill to the entire country. For the sake of our analysis, we consider the period of 2009–2011 to be the period in which there is considerable municipality-level variation in EC pill availability. The end of this period in 2011 was with the passage of national law 20533 which modifies the sanitary code to allow midwives to provide the EC pill.

The fact that midwives were explicitly allowed to provide EC pill is important given that all EC pill requests through the Chilean public health system are channelled through midwives. Public provision of the EC pill in Chile is completely free, with users simply required to request the medication at their local primary care clinic. To do so, they must make an appointment with a midwife at the clinic, as midwives⁴ are indicated by law as responsible for providing sexual health advice and contraceptive access (Congreso Nacional de Chile, 2010). This is the same procedure necessary to request any publicly provided contraceptive method including condoms, oral contraceptive pills or injectable contraceptives (which are all also freely provided).

Following 2011, according to the National Norms of Fertility, all midwives are obliged to provide the EC pill upon request provided that the sexual encounter occurred within the last 5 days.⁵ Prior to the laws clarifying access (discussed at more length in Appendix B) requests were fre-

⁴These are known as *matronas/matrones* (if female/male) and play a key role in the provision of reproductive health and contraceptive advice (see eg Finley Baba et al. (2020) for discussion).

⁵The contents of these norms were confirmed in a structured interview with a midwife.

quently rejected in line with the Mayor’s decision to provide or not provide the EC pill in the municipality (Casas Becerra, 2008). The only requirement for request is that women should be enrolled in the public health system, and associated with a health centre in the municipality. In Chile in the period under study around 3/4 of all fertile-aged women are enrolled in the public health system, with the remaining 1/4 enrolled in a the private health system.⁶ In the case of the quarter of women who have private health insurance, access to the EC pill required a prescription and could be purchased in a pharmacy at prices of around 18 USD (Casas Becerra, 2008). To our knowledge, comprehensive data on private provision of the EC pill is not available, though anecdotal evidence suggests limited availability in pharmacies around 2008–2009 (Congreso Nacional de Chile, 2010, p. 45) . While our aim in this paper is to assess the impact of the free public provision of the EC pill, we discuss how private provision interacts with our identification strategy below.

3 Data and Methods

3.1 Data

We construct a municipality×year dataset based upon various sources of administrative health records and measures of EC pill availability. We include a number of time-varying controls to capture potential determinants of municipal-level rollout.⁷ Our data cover the 15 year period from 2002–2016, which we consider as (i) the pre-EC pill period of 2002-2008 which is used as a base-

⁶For example, in 2010, figures from FONASA, the public health insurance system, show there were 3,507,325 women enrolled, and figures from the National Institute of Statistics of Chile estimate the total population of fertile-aged women was 4,574,965. This suggests 76.7% of fertile-aged women are enrolled in public health. On average, users of the public health system in Chile have a lower income, though the public health system is widely used across income quintiles (Frenz et al., 2013).

⁷The municipal determinants of the decision to provide the EC pill have been discussed in Bentancor and Clarke (2017). Among a large number of variables considered, EC pill provision was only robustly correlated with mayoral party, with provision less likely where mayors represented ‘conservative’ parties. As we discuss in the methods section, our estimates later in the paper do not rely on mayor characteristics being unrelated to the decision to provide the EC pill, just that they are not systematically related to both the precise moment the EC pill was made available, and other investments in maternal health.

line, (ii) the rollout period of 2009–2011 where we can measure municipal-level variation in availability, and (iii) the full supply period of 2012–2016. In both the “rollout” and “full supply” periods we perfectly observe the number of EC pills disbursed by the Chilean public health system, as we discuss at more length below.

Measures of maternal health Our object of interest, maternal morbidity, is measured by two outcomes: the rate of abortion related morbidity and the rate of hemorrhage early in pregnancy. Abortion-related causes is a variable often examined in the wider literature when considering the impacts of unsafe abortion and includes all forms of morbidity classified as one of ICD-10 codes O02-O08 (for instance, spontaneous abortion and complications following induced terminations). This coding is provided in Singh and Maddow-Zimet (1999). Secondly, we consider “haemorrhage prior to 20 weeks of gestation” (ICD-10 code O20). This outcome is of interest (a) given its importance as one of the major complications of unsafe abortions (Gerdtts et al., 2013; World Health Organization, 2018) and (b) given that it may plausibly respond to the arrival of the EC pill, due to the widespread use of misoprostol as an abortifacient agent in clandestine abortions prior to the availability of the EC pill in Chile. Discussions of the relationship between misoprostol use, clandestine abortion, and haemorrhage are provided in Clarke and Mühlrad (2018); Pourette et al. (2018); Grimes et al. (2006). The key potential mechanism of action is that safe EC pill usage may crowd out unsupervised and potentially unsafe use of misoprostol, which can result in severe bleeding. Estimates from medical literature suggest that 22% of deaths due to haemorrhage in the first trimester are caused by abortion (Haeri and Dildy, 2012) (similar values are not reported for non-mortal complications) lending weight to this suggested link. We generate municipality level rates of these events from high-quality micro-data registers recording all inpatient hospitalizations in the country, which are available from 2001–2017. These records consist of an observation for

each inpatient stay, and include a limited number of covariates such as patient's sex and age, the ICD10 code registering the reason for the stay, and the date of entry and exit.⁸ While we capture any hospitalization using this data, we will *not* observe any ambulatory visits to primary care clinics. In general these visits will be far less serious. It is however important to note that all estimates in the paper do not account for these cases.⁹

Measures of EC pill rollout and usage We generate two measures of rollout and usage of the EC pill in Chile, which is our principal independent variable of interest. For the rollout, our first indicator is a dummy variable, coming from a series of telephone surveys conducted by FLACSO between 2009–2011 (Dides et al., 2009; Dides C. et al., 2010, 2011). In these surveys, local health centres in each municipality were asked whether they prescribe the EC pill, and under what circumstances. If the centres respond that they do, the municipality is classified as providing EC. If they report that they do not, or that they only provide it in the limited case of rape, then they are classified as non-pill municipalities. Secondly, for measuring intensity of use, we generate a rate of pill disbursements and a rate of pill rejections, by harmonizing previously unused administrative data provided by the MoH. In the case of rejected pill requests, these only began being recorded in 2010, so data on this is not observed in 2009. A graph of the number of municipalities recorded to allow EC pill disbursement, and the actual disbursements according to MoH Data is provided as Figure 1. In Appendix Table A1 we document that these sources are in general agreement.

⁸We observe the universe of 26.2 million hospital visits occurring over this period, 99.74% of which are correctly matched to the municipality of residence of the patient. These data unfortunately don't include richer covariates such as religion or ethnicity.

⁹While we do not have access to microdata for ambulatory visits, macro-level information shows that there are many such visits in the country each year. For example, in 2016 nationwide there were 755,547 ambulatory visits classified as gynecological check-ups. This compares to 299,855 hospitalizations for reasons related to maternal health in this period. Thus, our microdata captures only one (important) margin of healthcare utilization.

Other municipal level records Finally, we collected or generated a number of other data sources at the municipal×year level. These are (a) the population of fertile-aged women (provided by the National Statistical Institute); (b) the identity, sex and party of each municipal mayor and his/her vote share (from the Electoral Service); (c) administrative records on all other contraceptive disbursements through the public health service, and (d) placebo health outcomes generated from the same administrative health records (male morbidity, and morbidities in the puerperium period).

Combining these data sources, we were able to ensemble a dataset of a maximum of Chile’s 346 municipalities over 15 years of data, or 5190 observations/registers. A small number of observations have missing measures in certain periods. In particular, our measure of EC pill availability has 103 missing observations for years in which municipalities did not provide information on their pill disbursement status. Similarly, the measure of refused pills is not recorded in 2009 only. We document summary statistics in the following section.

3.2 Methods

We exploit the staggered arrival of the EC pill to different municipalities by estimating the following difference-in-differences (DD) event-study specification:

$$Health_{ct} = \alpha_0 + \sum_{j=-9}^8 \delta_{-j} \Delta EC Pill_{c,t+j} + X'_{ct} \Gamma + \phi_c + \mu_t + \varepsilon_{ct} \quad (1)$$

These event-study specifications are increasingly common in DD settings, and here we adopt the notation of Freyaldenhoven et al. (2018), normalising δ by setting $\delta_{-1} = 0$ so that our reference period is one year prior to pill adoption in each municipality. In this specification, we are interested in the leads and the lags of the policy change, where leads capture any prevailing trends prior to the reform in earlier versus later-adopting municipalities, and lags show the change in health outcomes

following the availability of the EC pill. If the EC pill has any impact on health outcomes, we should see a divergence in health outcomes emerge only *after* the arrival of the EC pill to each municipality.

In specification 1, we include a set of 9 yearly leads and 8 yearly lags to capture dynamic impacts of the reform. Given variation in reform timing, initial lags and leads capture differences in treatment status (treated vs. untreated), while later periods capture pure variation in timing. Recent work by Goodman-Bacon (2018) suggests event-study specifications as a key strategy in such a setting if treatment effects are not constant over time. Year and municipal fixed effects μ_t and ϕ_c absorb time- and municipal-invariant factors, and standard errors are clustered by Chile's 346 municipalities. As well as capturing any dynamic impacts of the reform, for example any technology diffusion over time, specification 1 provides evidence in favour of parallel (pre-)trends if we can reject that each $\delta_j = 0 \forall j < 0$, given that *prior* to the reform outcomes in both treated and untreated municipalities were following similar tendencies. The observation of parallel pre-trends provides some support for identifying assumptions of parallel trends in post-treatment counterfactuals.

In equation 1 $Health_{ct}$ refers to average rates of morbidity in municipality c at time t , and EC Pill refers to the availability of the emergency contraceptive pill in the same municipality and time period. We examine stability to the inclusion of the time-varying controls X_{ct} capturing socio-political characteristics of each municipality, as laid out in the Data section. Observations are consistently weighted by population.¹⁰ Finally, it is important to note that in all cases, EC Pill refers to free provision by the *public* health system. In Chile, following the passage of the EC pill laws, the pill was also sold at private pharmacies. Unlike public data on EC pill usage, official data on EC pill usage in the private system is not available (Fernández et al., 2016). Thus, all estimates

¹⁰We do, however, document unweighted results in Appendix Table A2 and Figure A1, but our preferred estimates always weight by population to ensure that estimates are not driven by municipalities with very few hospitalizations where small total shifts can result in very large proportional changes.

refer to the impact of public provision. While we cannot formally assess the impact of private market provision without data on disbursements, to the degree that private provision fills gaps not met by the public health system and availability ‘spills over’ to areas not yet treated by the public system, we may expect our estimates to understate the actual full (public and private) effect of EC pill availability in Chile (Clarke, 2019).

DD event study models such as those in equation 1 have a number of significant advantages over standard parametric ‘single-coefficient’ DD models where a binary indicator takes the value of 1 if the EC pill is available, and 0 otherwise.¹¹ However, there is one drawback with such event-study models, and this is that they are based on binary treatment adoption indicators. Thus, while this model works well when considering the arrival of the EC pill, it does not work well when considering the *intensity of use* of the EC pill in each municipality and time period. In order to examine the intensive margin of use the EC pill (ie the intensity of use), we consider two additional models. The first is a single-coefficient DD model, where the EC Pill indicator is replaced with a measure of the rate of pill disbursements in a given municipality per 1000 women:

$$Health_{ct} = \alpha + \beta \text{Pill Disbursements}_{ct} + X'_{ct}\Gamma + \phi_c + \mu_t + \varepsilon_{ct}. \quad (2)$$

Here, once again any municipal-specific or time-specific factors are captured by respective fixed effects, and β captures the intensive margin impact of EC pill availability. We additionally explore one specification where $\text{Pill Disbursements}_{ct}$ is replaced with $\text{Pill Rejections}_{ct}$, the rate of pill requests per 1000 women which municipalities *refuse* to provide. In this single-coefficient specification, estimated impacts $\hat{\beta}$ will capture both the interaction of the supply of the EC pill as

¹¹Namely, (i) they allow us to capture dynamic effects, (ii) they provide a test of parallel pre-trends, and (iii) they take care of recent critiques that single coefficient models may be biased if effects are heterogeneous over time (Goodman-Bacon, 2018; de Chaisemartin and D’Haultfoeuille, 2019).

well as the demand for the EC pill, so can no longer be viewed as a pure treatment effect of the policy reform. Finally, to consider a pure policy effect while also allowing for heterogeneous impacts owing to intensity of use we, we provide a fully interacted event-study specification, where we re-estimate equation 1, however we now estimate a series of lags and leads for three municipality types, those with low, medium and high intensity of EC pill usage based on terciles of EC pill disbursements from official MoH disbursement data.¹² This model extends equation 1 to examine whether any health impacts are larger in areas with more intensive usage of the EC pill. Note that here we are simply breaking down average impacts from equation 1 into intensity-specific groups in a single model, allowing for treatment heterogeneity where groups are constant over time. In this case heterogeneity is considered by intensity of policy adoption. Such models documenting heterogeneity in a DD setting are frequently estimated, see for example Bhalotra and Venkataramani (2015) (heterogeneity by race/age), and Myers and Ladd (2020) (heterogeneity by exposure time).

4 Results

4.1 Descriptive Statistics

We provide descriptive plots of the two principal health outcomes over time in Figure 2. In the case of hemorrhage early in pregnancy (panel A), while there is a general downward trend from 2002–2005 which then flattens until 2009, there is a clear reduction following the rollout of the

¹²Specifically:

$$Health_{ct} = \alpha_0 + \sum_{i=1}^3 \sum_{j=-8}^8 \delta_{i,-j} \Delta (\text{EC Pill}_{c,t+j} \times \text{Pill Intensity} = i) + X'_{ct} \Gamma + \phi_c + \mu_t + \varepsilon_{ct}, \quad (3)$$

where all details follow equation 1, however we now estimate a series of lags and leads for three municipality types based on intensity of EC pill usage (indexed with i here). The separation into terciles of intensity of EC pill usage is an arbitrary choice. We could present alternative groups, however this complicates presentation of results and additionally challenges statistical power, as such we limit results here to three policy-specific exposure groups.

EC pill in Chile in 2009. In the case of abortion morbidity (panel B), while there is again a sharp drop following the EC pill rollout in 2009, this trend is much noisier, with a sharp rise observed from 2007-2009, and then additionally from 2012 onwards. Plots by quinquennial age group are provided in Appendix Figures A2 and A3.

Descriptive statistics of all morbidity and contraceptive measures by municipality and year are provided in Table 1. We observe that morbidity for hemorrhage early in pregnancy is considerably more common than abortion related causes, at around 34 and 3 per 100,000 fertile-aged women respectively. Rates of morbidity in the puerperium are again higher, at 110 per 100,000 fertile-aged women.¹³ On average, each municipality prescribes 21 EC pills per year, though larger municipalities prescribe many more, with maximum disbursements of 1029. The number of pills refused is considerably lower, at around 2.4 per municipality on average, though once again we note that there are municipalities who refuse many requests, with a maximum of 914 per year.

4.2 Binary Treatment Measures Capturing EC Roll-out

In Figure 3 we present main event study specifications following equation 1, reporting 90 and (as standard) 95% confidence intervals. These document how rates of morbidities respond around the dates of first reported EC pill adoption in each municipality. Here we consider a baseline model without time-varying controls, and discuss a number of alternative specifications in section 4.6.

Figure 3a displays the event study for rates of haemorrhage early in pregnancy, with typically quite flat pre-reform coefficient estimates. While there is a single pre-period in which a downwards blip is observed, in general these leads surround the dotted red line indicating 0 *pre*-reform impact. In the post-reform period, in the case of haemorrhage, while we observe a gradual reduction in rates of haemorrhage (reaching a high of a 15–20 per 100,000 unit reduction), these are not estimated with

¹³As we discuss in section 4.6, we will consider this in placebo test.

sufficient precision to reject a zero impact at typical levels of statistical significance, potentially given that there is considerable heterogeneity in actual EC usage, as discussed later. In the case of abortion morbidity (Figure 3b), we once again observe estimates quite tightly clustered around zero in the *pre*-reform period, suggesting that there were no prevailing differences between early and later adopters, and once again observe a reduction *after* the adoption of the EC pill. In this case, this reduction is immediately statistically significant, at around -1.3 fewer cases of abortion morbidity per 100,000 women, growing to reach an impact of up to 5 fewer cases of abortion morbidity on average, though as in the case of haemorrhage morbidity the standard errors grow as the estimated effect size increases. It is important to note however, that with the case of the first year post-adoption, significant impacts reflect changes in rates of abortion morbidity in municipalities that have adopted the EC pill compared with municipalities that have not yet adopted.

4.3 Combining Binary Treatments with Intensity of EC Pill Usage

To examine the *intensity* of use of the EC pill and the impact of total disbursements on health, we first estimate the DD specification described in equation 2 where our dependent variable is now the number of pills disbursed per 1,000 women. These models are presented in Table 2. In panel A, we estimate that for each additional pill disbursed per 1,000 women, rates of haemorrhage fall by 0.439 cases per 100,000 in the full population of women. We additionally consider rates by age, observing that these results are quite transversal across age groups, and are statistically distinguishable from 0 for ages 20-24, 25-29 and 35-39. In section 4.5 we put the magnitude of these effects in context. In Panel B we present DD estimates examining intensity of pill usage and the impacts on abortion related morbidity. In this case, unlike in binary models, we do not observe a large or consistent reduction in rates of abortion with increased usage of the pill. Indeed, the majority of the estimates suggest an impact of less than 0.1 cases of abortion specific morbidity per

100,000 women. The DD estimate for all women in column 1 suggests a small positive estimate of 0.029 cases, though not statistically distinguishable from zero.

Given that single coefficient DD models potentially suffer from bias in situations such as the case in Chile where treatment occurs in different areas at different times¹⁴ we combine the binary model of EC rollout with measures of EC pill usage intensity in an interacted event study specification, displaying results in Figure 4. Each set of coefficients are estimated in a single event study specification, and in each case, the baseline period is 1 year prior to the moment of reform implementation.

In Figure 4a, we document that high-intensity pill municipalities have the largest reduction in haemorrhage morbidity following the introduction of the EC pill. Over time, a significant reduction emerges in rates of haemorrhage, and this is driven specifically by this high-intensity group. While medium and low-intensity municipalities also have a reduction in rates of morbidity following the reform (with no similar divergence in the pre-reform period), these are never statistically significant. In general here when documenting heterogeneity by intensity of EC pill disbursements we note that estimates are considerably less precise. Thus, in the case of haemorrhage, while a clear reduction is observed from year 2 post-adoption onwards, this only becomes significant at 95% 5 years post-adoption. We replicate these results for abortion related morbidity in Figure 4b. In this case, and in line with the fact that there are fewer cases of abortion related morbidity and in general more noisy measures, we are less able to distinguish between group-specific estimates. There is, however, some evidence of an immediate reduction in rates of abortion in high and medium intensity areas, and a longer term reduction which is significant for high-intensity areas only. In both cases, we observe evidence to suggest that the arrival of the EC pill reduced rates of morbidity

¹⁴In particular, Goodman-Bacon (2018) shows that this is because units which have been previously treated but do not change their treatment status in a given period act as part of the control group, and can substantially bias estimates.

owing to reproductive health causes, in a way consistent with less need to access unsafe abortion.

4.4 The Impact of Rejection of EC Pill Requests on Outcomes

Finally, we consider the role that *rejected* requests for the EC pill plays on maternal health outcomes. In Table 3 we present DD models where the independent variable is the rate of *rejected* pill requests per 1,000 women. We present two specifications; those in columns 1 and 3 which use the full set of years, including the pre-pill period where the rate of rejection is 0 by construction (given that there is no request or rejection), and those in columns 2 and 4 (our preferred specifications) where we consider only the post-EC pill period. We observe suggestive evidence of a mirror impact of the results described earlier in this paper. Here, a higher rate of rejected pill requests results in higher rates of haemorrhage (and this is statistically significant at least in the post-EC pill period), and higher rates of abortion morbidity, regardless of the specification examined. These results are consistent with failure to provide EC pills upon request shifting women into seeking more risky contraceptive options, such as clandestine abortion, with worse associated health outcomes.

In general these estimates are relatively substantive in magnitude. For example, column 2 which is based on variation in the intensity of pill requests after the arrival of the EC pill suggests that – even conditional on municipal-specific and time-specific factors – an additional 1 pill rejection per 1,000 women in a municipality is associated with an increase in 0.15 cases of haemorrhage per 100,000 women. To put this in perspective, we can ask how a 1 standard deviation increase in rates of rejected requests would correlate with rates of haemorrhage. From Table 1, a 1 standard deviation increase in pill rejections is 12.55 pill rejections per 1,000 women. Thus, a 1 standard deviation increase is associated with $12.55 \times 0.152 = 1.91$ fewer cases of haemorrhage per 100,000 women, or around 7% of the mean of the dependent variable in this period. A similar calculation

for rates of abortion related morbidity is $12.55 \times 0.077 = 0.97$, or around 42% of the mean of the dependent variable listed at the foot of the table. We now turn to a more complete discussion of estimated effect sizes.

4.5 Effect Sizes in Context

Given estimates presented up to this point, it is important to ask about how these effect sizes map into real reductions in morbidities. We place estimated effect sizes in context here, also providing a back of the envelope calculation of their implications for healthcare costs. This also acts as a sanity check of our estimates as it allows us to ask roughly what they imply for the efficacy of each pill disbursed. It is important to note as a caveat here that this discussion is all based on extrapolating *marginal* estimates presented from previous analyses.

In this analysis we will document a calculation based on continuous DD models for illustration, and then also extend to ask what the *point estimates* from all event studies imply in a similar strategy. To begin, consider the estimate presented in Table 2, Panel A, column 1. This estimate suggests that a marginal increase in pill availability by 1 per 1,000 women in all municipalities in Chile reduces haemorrhage by 0.439 per 100,000 women. The question in calculating the implications for the total effect is how many cases of haemorrhage nation-wide are 0.439 per 100,000 fertile-aged women? Based on Table 1, the average municipality has 13,016.5 fertile-aged female residents, and there are 346 municipalities in the country. We can thus estimate the total number of estimated avoided haemorrhages per marginal increase in EC pill as:

$$13,016.5 \frac{\text{residents}}{\text{municip.}} \times 346 \text{ municip.} \times \frac{0.439 \text{ cases of haemorrhage}}{100,000 \text{ residents}} = 19.77 \text{ cases of haemorrhage.}$$

This implies that for each additional pill disbursed per 1,000 women in a given year, our estimate

suggests a total of 19.8 fewer cases of haemorrhage in the country. Note however that on average, in the post EC period in Chile there were a total of 3.05 EC pills disbursed per 1,000 women (figures provided in Appendix Table A3), and so the estimated *total* reduction in cases of haemorrhages owing to the EC pill is $19.77 \times 3.05 = 60.3/\text{year}$. Finally, on average, each year after the arrival of the EC pill, 14,120.3 pills were disbursed, implying that for every 234 pills, a single case of haemorrhage was avoided.¹⁵

We can undertake a similar activity using estimated impacts from event studies. Consider Figure 3. If we examine the coefficient on the second lag of this plot, this coefficient is -3.92 in panel (a), and -1.59 in panel (b). These are expressed as morbidities per 100,000 women given that the municipality made the EC pill available 2 years prior. Thus, if we wish to approximately estimate the impact in terms of total avoided cases, this would be $-3.92/100,000 \times (13,016.5 \times 346) = -176.5$ cases of haemorrhage, or $-1.59/100,000 \times (13,016.5 \times 346) = -71.6$ cases of abortion related morbidity. If we consider such a calculation for each of the lag terms indicated in Figure 3, this suggests that in total over all years, based on these estimates, the passage of EC pill reform has accounted for 2806 fewer cases of haemorrhage, and 889 fewer cases of abortion related morbidity (full calculations are provided in Appendix Table A4). When these total cases are expressed in terms of the total numbers of pills disbursed following the implementation of the EC reform (112,962), this suggests that for every 40 pills disbursed a single case of haemorrhage was avoided, and for every 127 pills disbursed, a single case of abortion related morbidity was avoided.^{16,17}

¹⁵This value is calculated as $14,120.3/60.3 = 234.2$.

¹⁶We note that the values estimated for haemorrhage range between 1 fewer case per 234 pills in the case of DD models to 1 fewer case per 40 pills in the event study model. It is important to note that both of these estimates are based on coefficients only. These estimates are broadly comparable when taking into account the reported confidence intervals.

¹⁷We can undertake similar calculations with event studies presented separately by the intensity of EC pill disbursements in Figure 4. We document similar figures for *high intensity EC pill municipalities only* in Appendix Table A5. In the case of haemorrhage this suggests an estimated 1,446 fewer cases in these municipalities only, and in the case of abortion related morbidity, 261 fewer cases. In these municipalities, 64,991 EC pills were disbursed, implying that for every 44.9 pills disbursed a single case of haemorrhage was avoided, and for every 249 EC pills disbursed a single

In Appendix Figure A4 we document potential combinations of the impact of EC pills on (a) reduced conceptions/pill, and (b) reduced morbidities/conception that could theoretically explain the estimated effect sizes.

These rough estimates can be used to provide a back of the envelope calculation of the cost savings implied by the EC reform. We collated the cost of the EC pill as paid by the MoH from public government records.¹⁸ The unitary price for a single EC dose varied from as low as 886 Chilean Pesos (CLP) to as high as 5,676 CLP (or 1.50 USD to 8.22 USD based on exchange rates at the time of purchase), with an average price of 3,379 CLP (4.75 USD). While it is difficult to estimate the full costs of an inpatient visit to the health system, estimates presented by the Chilean Budgetary Department suggest that a single night of hospitalization on average costs 43,842 CLP (Instituto de Administración de Salud, 2016). The administrative data used in this paper shows that the average hospitalization for haemorrhage resulted in 2.3 nights, and the average stay for abortion related morbidity resulted in 3.4 nights. Bringing this all together, we can determine a back of the envelope estimate of total costs for pills disbursed as $112,962 \text{ pills} \times 3379 \text{ CLP/pill} = 381.83 \text{ million CLP}$, and total savings in hospitalizations as $2806 \text{ cases of haemorrhage} \times 2.3 \text{ nights per case} \times 43,842 \text{ per night}$ plus $889 \text{ cases of abortion related morbidity} \times 3.4 \text{ nights per case} \times 43,842 \text{ per night} = 415.46 \text{ million CLP}$. These rough estimates, which only include the direct savings in terms of hospitalization suggest that the government may have saved 33.6 million pesos due to the reform.¹⁹

case of abortion-related morbidity was avoided.

¹⁸These records were compiled from CENABAST, (the National Centre for Medical Provision), and are available for 9 different bulk purchases of the EC pill from 5 different suppliers from between 2015–2020. We searched for all purchases using the generic name Levonorgestrel, which covers 3 different brands supplied (Cerciora, Escapel-2, and Pregnon).

¹⁹This equates to around 50,000 USD based on prevailing exchange rates in 2017. This is a clear lower bound, given that the EC pill has generated other cost savings for the health system, such as fewer births.

4.6 Placebo Outcomes, Alternative Explanations and Additional Tests

Despite the event-study evidence and lack of pre-trends, we still may be concerned that these results are capturing systematic differences in prevailing health outcomes within municipalities. If for example, at the same time the EC pill was adopted municipalities engaged in general health-promoting policies, our estimates may capture this, rather than a true EC pill effect.

We examine this in a number of ways. First, we document that results are virtually unchanged when including controls for a mayor's party, gender, and vote share upon election. These results are provided as online Appendix Figures A5, A6, A7 and A8 (corresponding, respectively, to Figures 3a, 3b, 4a and 4b). Second, to provide a test of the idea that these results may be capturing general improvements in health rather than anything related to the EC pill, we conduct a number of placebo tests. These tests consist of estimating identical specifications following equation 1, however now using health outcomes which do not plausibly depend on EC pill availability. The first of these is a pure placebo test where we consider rates of male morbidity between the ages of 15-49. This is an analogous age to the reproductive health outcomes considered previously, however for men rather than women. We consider an alternative placebo based on morbidity during the puerperium period for women aged 15-49. While this will not reflect the mechanism discussed earlier in which the EC pill can act as a substitute for clandestine abortion, it is not necessarily a perfect placebo if the EC pill impacts the *composition* of cohorts of mothers.²⁰

In Figure 5 we present these results. Figure 5(a) documents the impact of the roll-out of the EC pill on all-cause male morbidity. We observe no significant impacts, with results clustered around 0 cases per 100,000 men (the mean for this outcome displayed in Table 1 is around 4,000

²⁰We note however that Bentancor and Clarke (2017) find relatively little evidence for changing composition of mothers following the EC pill, at least in terms of education and age.

inpatient visits per 100,000 men per year), suggesting the findings discussed earlier in the paper are not simply proxying generalised improvements in health occurring earlier in municipalities which adopted the EC pill earlier. We document results for complications in the puerperium in Figure 5(b). Once again, we observe no statistically significant lag or lead terms, although point estimates are slightly noisier. These results again suggest that the reproductive health outcomes documented earlier are not simply proxying general improvements in health, or even general improvements in maternal health, but are specific to causes early in gestation, consistent with the EC pill acting to crowd-out unsafe health behaviours early in pregnancy. We additionally note that these placebo tests hold even when considering intensity of use of the EC pill and single-coefficient DD models. Identical event studies estimated by different terciles of EC pill use (as presented for the main outcomes in Figure 4) are displayed in Appendix Figure A9, and DD models are presented in Appendix Table A6, in both cases with no significant effects.

Recent work by Nuevo-Chiquero and Pino (2019), which provides a comprehensive analysis of the EC pill rollout and its impacts on other contraceptive use, suggests that the EC pill in Chile may have—beyond any direct effect—also had a technological change effect given that it caused shifts towards more modern contraceptive methods. We examine whether these shifts may be responsible for the health effects documented in previous sections. To do so, we collected and systematised administrative records on the full coverage of contraceptive methods used in Chile for the entire population covered by the public health system. These data record all freely provided contraceptive methods disbursed by the state. In Figure 6 we plot trends in alternative contraceptive methods used in Chile between 2003 and 2017 based on these administrative data. It is interesting to note in Figure 6 that there has been a clear and gradual shift in contraceptive methods used within the public health system in the country, in particular, a steady shift away from the copper IUD and

towards injectable birth control methods.

To examine whether the health results observed in this paper may owe to shifting behaviours in birth control methods *apart* from the expansion of the EC pill, we additionally include full time-varying measures of rates of birth control coverage, for each method, in each of our estimated specifications. However, we note that the administrative data that we could harmonize on full contraceptive measures is only available at the level of each health service in Chile, while our principal regressions are each based on data at the level of each municipality. Each health service includes multiple municipalities, and so the rates of birth control coverage refer to average coverage at the level of each health service, rather than each individual municipality.²¹ In Appendix Figure A10 we document the correspondence between health services and municipalities within the country. In Appendix Figures A11, A12, A13 and A14 we replicate our analysis of the health impacts of the EC pill, and observe that in each case, the documented findings hold, even after conditioning on available measures of birth control coverage within the country.

Throughout this paper our main interest has been considering maternal *morbidity* outcomes. In Appendix results we document alternative measures of interest. Table A7 and Figures A15–A16 present estimates using birth rates, which broadly agree with findings from Bentancor and Clarke (2017) (trends are provided in Figure A17). Of particular interest are results from Table A8 and Figures A18–A19 which document the same estimates for maternal *mortality*. In the case of mortality, we do not observe any significant impacts, in line with the idea that these events represent

²¹That is to say, we augment specification 1 to control for birth control methods (*BC*) at the level of the health service. In particular this is:

$$Health_{cst} = \alpha_0 + \sum_{j=-8}^8 \delta_{-j} \Delta EC Pill_{cs,t+j} + X'_{cst} \Gamma + BC'_{st} \xi + \phi_c + \mu_t + \varepsilon_{cst}, \quad (4)$$

where we explicitly add subscript *s* here to denote that birth control methods only vary at the level of health services *s*, while our measure of EC pill availability varies by municipality (*c*) within each health service.

just a very small ‘tip of the iceberg’ of maternal health outcomes.²² This underlies the importance of focusing on maternal morbidity outcomes to capture the full weight of reform impacts.

5 Discussion and Conclusion

In this study we examine the impact of the EC pill on a number of women’s health outcomes. To do so, we consider the case of a municipal-rollout in EC pill availability in Chile’s public health system. This is an illustrative case, given that unlike a number of other studies of the rollout of the EC pill, in the entire period under study abortion was illegal. This work is the first to our knowledge which has full measures of both the intensity of usage of the EC pill as well as a measure of unfulfilled requests, in a setting where there is a sharp expansion in the availability of the EC pill. We document that in this case, the availability of the EC pill can have appreciable impacts on women’s health outcomes, and in particular observe that a higher intensity of EC pill disbursement is associated with reductions in rates of haemorrhage early in pregnancy, and abortion morbidity.

These results are at odds with a number of previous evaluations of the impact of the EC pill, which often find no, or small, impacts at the population level. We have conducted several robustness checks which indicate that these results are not an artifact/spurious, but that, in Chile during the period we study, the municipal rollout and usage of the EC pill indeed had beneficial effects on maternal morbidity. A potential explanation of these divergent results owes to context. Unlike previous studies often based in the UK and US, this study examines a setting where abortion was entirely illegal. Thus, a potential explanation of these results is that growing EC pill availability reduced the need to be exposed to the health risks inherent in clandestine abortion.²³ Our

²²The magnitudes in Chile are small. In 2014, 34 maternal deaths occurred in the country and 252,194 live births occurred, giving a maternal mortality ratio of 13.5 deaths per 100,000 live births. Of these 34 deaths, only 3 were classified as owing to abortion.

²³We unfortunately are not able to directly measure rates of induced abortion, and certainly our outcomes include morbidity related to spontaneous abortion, therefore, this statement is only speculative.

results are consistent with the EC pill and abortion functioning as substitutes in at least some cases, particularly in contexts where access to abortion is limited. This finding echoes results in Miller and Valente (2016),²⁴ providing evidence on a particular expansion in the supply of contraceptive methods. More importantly, our results indicate that the EC pill can improve women's health in this context where access to abortion is severely restricted. Even though access to some type of abortion is legal in most countries of the world, restrictions on access are not only common, but have been increasing in recent years, particularly in the U.S. (Stotland, 2018), suggesting a broadening relevance for the results in this study.

While the Chilean case offers a number of important lessons and an ideal setting to study the EC pill in isolation of abortion, there are a number of limitations to this study. Our measures of EC pill and contraceptive use covers only the population using the public health system. These results should thus be interpreted with this in mind. Secondly, while the rollout of the EC pill depends on decisions beyond the scope of each woman who requests EC pills, it is still based on a political calculus, namely depending on mayoral decisions. Similarly, as discussed in the body of the paper, while this study covers a considerable variation in availability of the EC pill in each municipality, it is impossible to isolate all variation in availability of the EC pill in the country given the sporadic availability of the EC pill in the lead up to the reform, as well as the ability of women to simulate the EC pill with the ordinary oral contraceptive pill.

This research relates to an established and growing body of work documenting the importance of women's autonomy as a determinant of health (see eg Bloom et al. (2001)). In particular, we find that a higher rate of rejected pill requests is associated with higher rates of haemorrhage and abortion related morbidity, possibly because women who see their request unfulfilled end up using far riskier

²⁴Miller and Valente (2016, p. 979) state "This finding has important implications for public policy and foreign aid, suggesting that an effective strategy for reducing expensive and potentially unsafe abortions may be to expand the supply of modern contraceptives"

options to terminate their pregnancies. There is an ample range of variation in the rejection of pill request in the period we studied, with certain municipalities denying several hundreds of pill requests a month. Certainly, some requests are rejected for medical reasons, such as a late timing of the request. However, in the particular case of Chile, there is reason to think that rejections were not only medically based. During the years in which access to the EC pill was contingent on the mayor's will, anecdotal evidence suggested the existence of "ideological rejections". For instance, the mayor of the largest municipality of the country stated that the EC pill was against his moral principles and that he would not allow its disbursement.²⁵ Our results suggest that these type of decisions not only go against the right of women to make autonomous decisions about their own body and reproductive function, but severely hinder women's health.

²⁵Such press coverage (in Spanish) can be found, for example, here: <https://www.latercera.com/noticia/pildora-del-dia-despues-alcaldes-de-el-bosque-y-puente-alto-discrepan-por-dictamen-de-contraloria> and here <https://m.elmostrador.cl/braga/2017/06/13/vecina-de-puente-alto-le-reclama-a-ossandon-que-no-entregan-pildora-del-dia-despues-en-municipios-de-derecha/>.

References

- Ahmed, S. and W. H. Mosley (2002): “Simultaneity in the use of maternal-child health care and contraceptives: evidence from developing countries,” *Demography*, 39, 75–93.
- Bentancor, A. and D. Clarke (2017): “Assessing Plan B: The Effect of the Morning After Pill on Children and Women,” *The Economic Journal*, 127, 2525–2552.
- Bhalotra, S. and A. Venkataramani (2015): “Shadows of the Captain of the Men of Death: Early Life Health Interventions, Human Capital Investments, and Institutions,” Mimeo, University of Essex.
- Bloom, S. S., D. Wypij, and M. das Gupta (2001): “Dimensions of Women’s Autonomy and the Influence on Maternal Health Care Utilization in a North Indian City,” *Demography*, 38, 67–78.
- Bongaarts, J. and C. F. Westoff (2000): “The potential role of contraception in reducing abortion,” *Studies in Family Planning*, 31, 193–202.
- Casas Becerra, L. (2008): “La Saga de la anticoncepción de emergencia en Chile: avances y desafíos,” Serie documentos electrónicos no. 2, FLACSO-Chile Programa Género y Equidad.
- Clarke, D. (2019): “A convenient omitted variable bias formula for treatment effect models,” *Economics Letters*, 174, 84–88.
- Clarke, D. and H. Mühlrad (2018): “Abortion Laws and Women’s Health,” IZA Discussion Papers 11890, Institute for the Study of Labor (IZA).
- Cleland, J., A. Conde-Agudelo, H. Peterson, J. Ross, and A. Tsui (2012): “Contraception and health,” *The Lancet*, 380, 149–156.
- Congreso Nacional de Chile (2010): “Historia de la Ley 20418,” D. Oficial 28 jan, 2010, Library of the National Congress of Chile.
- de Chaisemartin, C. and X. D’Haultfoeuille (2019): “Two-way Fixed Effects Estimators with Heterogeneous Treatment Effects,” Working Paper 25904, National Bureau of Economic Research.
- Dides, C., M. C. Benavente, and J. Manuel Moran (2009): “Entrega de la Píldora Anticonceptiva de Emergencia en el Sistema de Salud Municipal, Chile: Estado de Situación,” Documento de trabajo, FLACSO-Chile. Programa Género y Equidad.
- Dides C., C., C. Benavente R., and I. Sáez A. (2010): “Entrega de la Píldora Anticonceptiva de Emergencia en el Sistema de Salud Municipal de Chile,” Estado de situación, FLACSO-Chile / CLAE, Consorcio Latinoamericano de Concepción de Emergencia.
- Dides C., C., C. Benavente R., I. Sáez A., L. Nicholls S., and T. Correa D. (2011): “Provisión de Anticoncepción de Emergencia en el Sistema de Salud Municipal de Chile: Estado de Situación,” Serie de documents, no. 2, Universidad Central de Chile.
- Dides Castillo, C. (2006): *Voces en emergencia: el discurso conservador y la píldora del día después*, Chile: FLACSO.

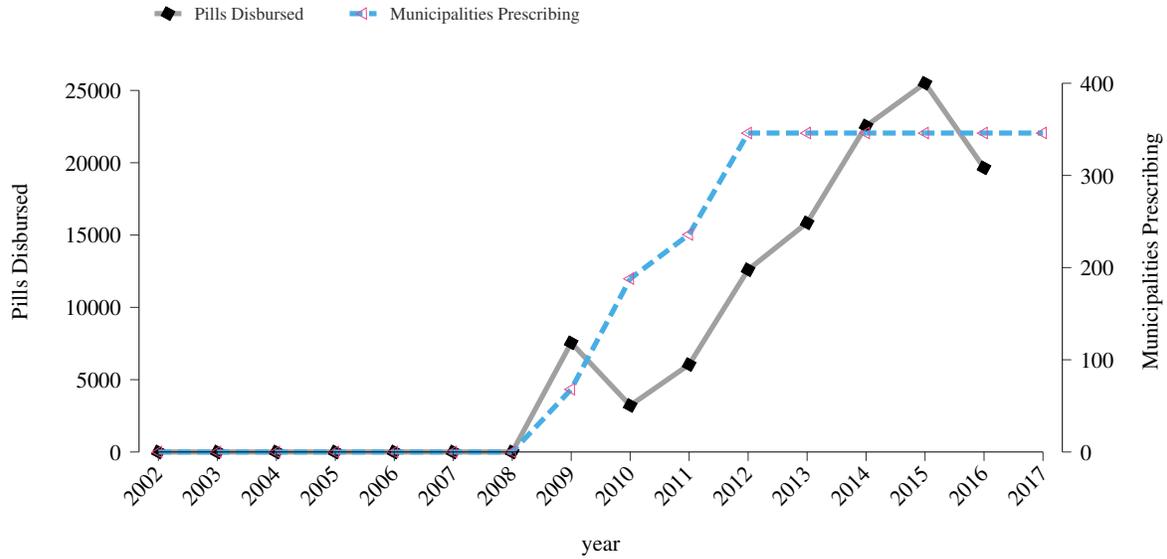
- Durrance, C. P. (2013): “The Effects of Increased Access to Emergency Contraception on Sexually Transmitted Disease and Abortion Rates,” *Economic Inquiry*, 51, 1282–1695.
- Ellerson, C., K. Blanchard, A. Webb, A. Bigrigg, and S. Haskell (1998): “Emergency Contraception,” *The Lancet*, 352, 1477.
- Escobar, B., C. Román, C. Muñoz, and F. López (2008): “Perfil biosocial de las usuarias que demandan la píldora de anticoncepción de emergencia en un centro de salud de Santiago, 2006-2007,” *Revista Chilena de Obstetricia y Ginecología*, 73, 223–227.
- Fernández, C., C. Dides, and E. Soto (2016): “Primer Informe Salud Sexual Salud Reproductiva y Derechos Humanos En Chile,” Estado de Situación 2016, Miles Chile.
- Finley Baba, C., L. Casas, A. Ramm, S. Correa, and M. A. Biggs (2020): “Medical and midwifery student attitudes toward moral acceptability and legality of abortion, following decriminalization of abortion in Chile,” *Sexual & Reproductive Healthcare*, 24, 100502.
- Firoz, T., D. Chou, P. von Dadelszen, P. Agrawal, R. Vanderkruik, O. Tunçalp, N. v. Laura A Magee, and L. Say (2013): “Measuring maternal health: focus on maternal morbidity,” *Bulletin of the World Health Organization*, 91, 794–796.
- Frenz, P., I. Delgado, J. S. Kaufman, and S. Harper (2013): “Achieving effective universal health coverage with equity: evidence from Chile,” *Health Policy and Planning*, 29, 717–731.
- Freyaldenhoven, S., C. Hansen, and J. M. Shapiro (2018): “Pre-event Trends in the Panel Event-study Design,” Working Paper 24565, National Bureau of Economic Research.
- Gerdts, C., D. Vohra, and J. Ahern (2013): “Measuring Unsafe Abortion-Related Mortality: A Systematic Review of the Existing Methods,” *PLoS ONE*, 8, e53346.
- Girma, S. and Paton, D. (2006): “Matching estimates of the impact of over-the-counter emergency birth control on teenage pregnancy,” *Health Economics*, 15, 1021–1032.
- (2011): “The impact of emergency birth control on teen pregnancy and STIs,” *Journal of Health Economics*, 30, 373–380.
- Gold, M. A., J. E. Wolford, K. A. Smith, and A. M. Parker (2004): “The effects of advance provision of emergency contraception on adolescent women’s sexual and contraceptive behaviors,” *Journal of Pediatric and Adolescent Gynecology*, 17, 87–96.
- Goodman-Bacon, A. (2018): “Difference-in-Differences with Variation in Treatment Timing,” Working Paper 25018, National Bureau of Economic Research.
- Grimes, D. A., J. Benson, S. Singh, M. Romero, B. Ganatra, F. E. Okonofua, and I. H. Shah (2006): “Unsafe Abortion: The Preventable Pandemic,” *The Lancet*, 368, 1908–1919.
- Gross, T., J. Lafortune, and C. Low (2014): “What Happens the Morning After? The Costs and Benefits of Expanding Access to Emergency Contraception,” *Journal of Policy Analysis and Management*, 33, 70–93.

- Haeri, S. and G. A. Dildy (2012): “Maternal Mortality from Hemorrhage,” *Seminars in Perinatology*, 36, 48–55.
- Hu, X., L. Cheng, X. Hua, and A. Glasier (2005): “Advanced provision of emergency contraception to postnatal women in China makes no difference in abortion rates: a randomized controlled trial,” *Contraception*, 72, 111 – 116.
- Instituto de Administración de Salud (2016): “Informe Final Evaluación del Gasto Institucional de la Red de Urgencia del Ministerio de Salud,” Report Provided for the Dirección del Presupuesto, Government of Chile available https://www.dipres.gob.cl/597/articles-160333_informe_final.pdf. (Accessed 12 Feb, 2019), Universidad de Chile.
- International Consortium for Emergency Contraception (2019): “EC Status and Availability: Countries with no EC pill brands registered,” Available at: <https://www.cecinfo.org/country-by-country-information/status-availability-database/countries-with-no-ec-pill-brands-registered/>. Accessed 26 August, 2019.
- Lavanderos, S., C. Riquelme, J. Haase, and A. Morales (2016): “Perfil sociodemográfico y factores asociados a consultas por anticoncepción de emergencia,” *Revista Médica de Chile*, 144, 1134–1143.
- Loudon, I. (1992): *Death in Childbirth. An international study of maternal care and maternal mortality 1800-1950*. 1992, Oxford: Clarendon Press Oxford.
- Miller, G. and C. Valente (2016): “Population Policy: Abortion and Modern Contraception Are Substitutes,” *Demography*, 53, 979–1009.
- Ministerio de Salud (2018): “Normas Nacionales Sobre Regulación de Fertilidad,” ISBN 978-956-348-151-8, Government of Chile.
- Morán Faúndes, J. (2013): “La anticoncepción de emergencia en Chile: Estructuración de su demanda en función de variables socioeconómicas,” *Revista Brasileira de Estudos de População*, 30, 125–144.
- Moreau, C., J. Trussell, F. Michelot, and N. Bajos (2009): “The Effect of Access to Emergency Contraceptive Pills on Women’s Use of Highly Effective Contraceptives: Results From a French National Cohort Study,” *American Journal of Public Health*, 99, 441–442.
- Mulligan, K. (2015): “Contraception Use, Abortions, and Births: The Effect of Insurance Mandates,” *Demography*, 52, pp. 1195–217.
- Myers, C. and D. Ladd (2020): “Did Parental Involvement Laws Grow Teeth? The Effects of State Restrictions on Minors’ Access to Abortion,” *Journal of Health Economics*, 102302.
- Nuevo-Chiquero, A. and F. J. Pino (2019): “To Pill or not to Pill? Access to Emergency Contraception and Contraceptive Behaviour,” Working Papers wp477, University of Chile, Department of Economics.

- Pourette, D., C. M. nd Rila Ratovoson, and P. Raharimalala (2018): “Complications with use of misoprostol for abortion in Madagascar: between ease of access and lack of information,” *Contraception*, 97, 116–121.
- Prada, E. and H. Ball (2016): “Induced Abortion in Chile: In Brief,” Tech. rep., Guttmacher Institute.
- Raymond, E., J. Trussell, and C. Polis (2007): “Population Effect of Increased Access to Emergency Contraceptive Pills A Systematic Review,” *Obstetrics & Gynecology*, 109, 181–188.
- Reichenheim, M. E., F. Zylbersztajn, C. L. Moraes, and G. Lobato (2009): “Severe acute obstetric morbidity (near-miss): a review of the relative use of its diagnostic indicators,” *Archives of Gynecology and Obstetrics*, 280, 337–343.
- Schiappacasse, V., T. Bascuñan, K. Frez, and I. Cortés (2014): “Píldora anticonceptiva de emergencia: características de la demanda en una organización no gubernamental en Chile,” *Revista Chilena de Obstetricia y Ginecología*, 79, 378–383.
- Singh, S. and I. Maddow-Zimet (1999): “Facility-based treatment for medical complications resulting from unsafe pregnancy termination in the developing world, 2012: a review of evidence from 26 countries,” *BJOG: An International Journal of Obstetrics and Gynaecology*, 123, 1489–1498.
- Stotland, N. L. (2018): “Abortion in America: the war on women is not hyperbole,” *The Lancet Psychiatry*, 5, 862–864.
- Stover, J. and J. Ross (2010): “How Increased Contraceptive Use has Reduced Maternal Mortality,” *Maternal and Child Health Journal*, 14, 687–695.
- Task Force on Postovulatory Methods of Fertility Regulation (1998): “Randomised controlled trial of levonorgestrel versus the Yuzpe regimen of combined oral contraceptives for emergency contraception,” *The Lancet*, 352, 428–433.
- United Nations (2014): “Abortion Policies and Reproductive Health around the World 2014,” .
- von Hertzen, H., G. Piaggio, A. Peregoudov, J. Ding, J. Chen, S. Song, G. Bártfai, E. Ng, K. Gemzell-Danielsson, A. Oyunbileg, S. Wu, W. Cheng, F. Lüdicke, A. Pretnar-Darovec, R. Kirkman, S. Mittal, A. Khomassuridze, D. Apter, and WHO Research Group on Postovulatory Methods of Fertility Regulation (2002): “Low dose mifepristone and two regimens of levonorgestrel for emergency contraception: a WHO multicentre randomised trial,” *The Lancet*, 360, 1803–1810.
- World Health Organization (2018): “Preventing unsafe abortion,” Accessed at <http://www.who.int/news-room/fact-sheets/detail/preventing-unsafe-abortion> (consulted August 28, 2018).

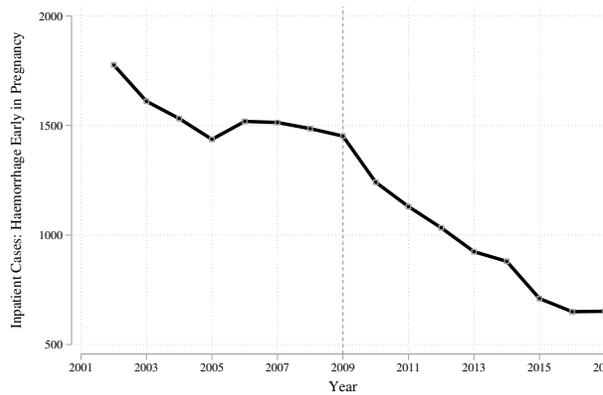
Figures and Tables

Figure 1: The Rollout of the Emergency Contraceptive Pill in Chile

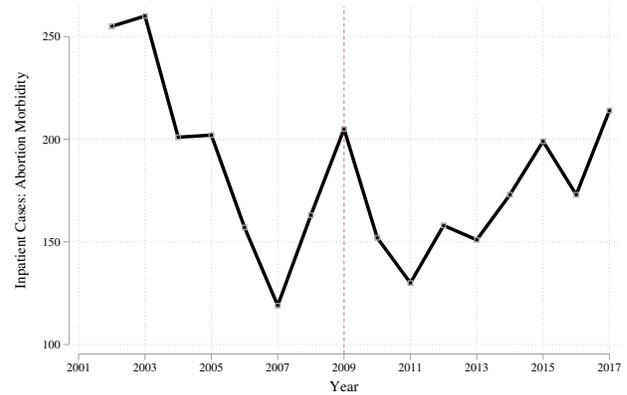


Notes: Administrative data on pill disbursements were transcribed from the full Monthly Health Statistics (*Resumen de Estadísticas Mensuales*) of the Ministry of Health of the Government of Chile. These values were provided in a series of disaggregated online ledgers by the MoH. We have transcribed these ledgers to form a consistent municipal level register of all EC pills disbursed. A research assistant first transcribed this data by hand. A full audit of the transcription was then conducted, with discrepancies in transcription found in 0.29% of cases. These were corrected in the audit, resulting in the final database.

Figure 2: Descriptive Trends of Main Morbidity Outcomes of Interest



(a) Haemorrhage



(b) Abortion Morbidity

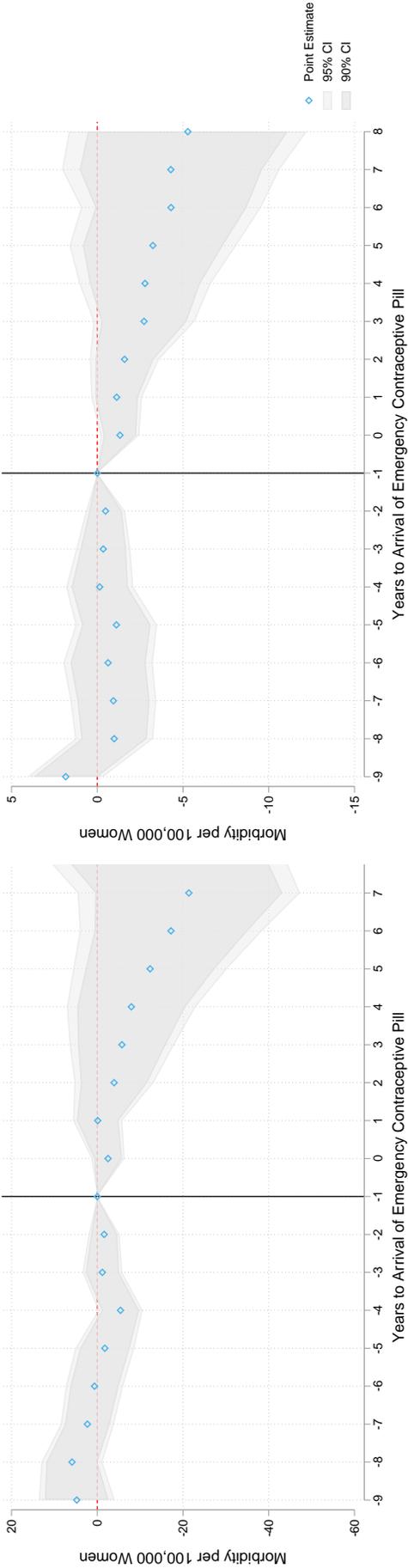
Notes: All cases of morbidities are calculated from administrative health data on all hospitalizations in the country. Haemorrhage refers to “Haemorrhage early in pregnancy” (ICD-10 code O20) and Abortion morbidity refers to all ICD-10 codes capturing pregnancies with abortive outcomes (O02-O08).

Table 1: Summary Statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
Number of Cases of Abortion Related Morbidity (15-49)	5190	0.52	1.97	0	36
Number of Cases of Haemorrhage Early in Pregnancy (15-49)	5190	3.64	7.26	0	106
Number of Complications Related to the Puerperium (15-49)	5170	9.93	18.59	0	661
Number of Cases of all Cause Male Morbidity (15-49)	5170	588.42	981.19	0	9378
Population of Fertile-Aged Women (15-49)	5190	13016.50	21084.08	10	175979
Population of Fertile-Aged Men (15-49)	5190	13157.60	20848.55	68	173079
Rate of Abortion Morbidity per 100,000 Reproductive Age Women	5190	3.06	10.32	0	155
Rate of Haemorrhage per 100,000 Reproductive Age Women	5190	33.93	47.49	0	490
Rate of Complications Related to the Puerperium	5170	110.03	223.78	0	5513
Rate of Male Morbidity per 100,000 15-49 year-old Men	5170	4139.65	1864.88	0	36508
Municipality Has Pill Availability	5087	0.44	0.50	0	1
Number of Pills Disbursed	5190	21.77	74.58	0	1029
Number of Pills Refused	4844	2.43	22.78	0	914
Pills Disbursed per 1000 Women	5190	1.92	8.60	0	405
Pill Requests Rejected per 1000 Women	4844	0.38	12.55	0	862

Notes: Summary statistics are documented for municipality by year cells, based on administrative data on inpatient stays released by the Chilean Ministry of Health, and measures of the availability and usage of the morning after pill collected by survey, and in a municipal health surveillance system. Information on populations is provided by the National Institute of Statistics. As codified in Decree 1671 of the MoH, any hospitalizations must be recorded in a standard way, and records exist for each visit starting at the administrative point of entry to the hospital, so will capture visits even if they are for less than one day.

Figure 3: Event Study Tests of the Impact of the EC Pill on Maternal Health Outcomes



33

Notes: Event studies follow specification 1, where the outcome variable is the rate of haemorrhage early in pregnancy (<21 weeks) per 100,000 fertile-aged women (Panel A) and the rate of abortion related morbidity per 100,000 fertile-aged women (Panel B). Specifications are weighted using the number of fertile-aged women in each municipality, and standard errors are clustered by municipality. The vertical solid line indicates 1 year prior to the first year in which a municipality disburses the EC pill.

Table 2: Difference-in-Differences Estimates of Pill Disbursements on Haemorrhage and Abortion Related Morbidity

	All Women							
	Age-Specific Groups							
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Haemorrhage Early in Pregnancy								
Pills Disbursed per 1000 Women	-0.439** (0.218)	-0.346 (0.216)	-0.446** (0.204)	-0.998** (0.439)	-0.391 (0.592)	-0.574** (0.266)	-0.211 (0.168)	-0.030 (0.066)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	33.928	26.146	39.898	51.220	49.403	43.313	26.393	4.927
Panel B: Abortion Related Morbidity								
Pills Disbursed per 1000 Women	0.029 (0.048)	0.039 (0.064)	-0.005 (0.050)	0.139 (0.117)	0.072 (0.109)	0.002 (0.084)	-0.028 (0.039)	-0.003 (0.009)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	3.058	1.508	3.117	4.511	5.549	4.879	1.737	0.304

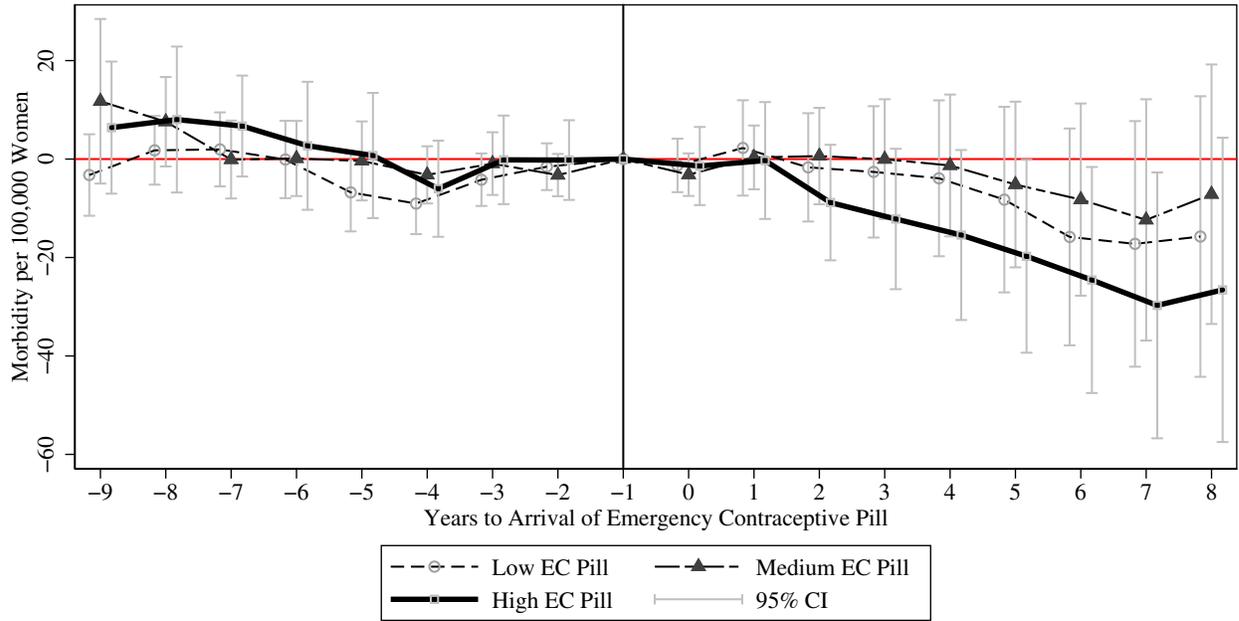
Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of morbidity (inpatient cases) for haemorrhage early in pregnancy (prior to 21 weeks) and for reasons related to abortion (ICD codes O02-O08). Each morbidity class is measured as cases per 100,000 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 municipality.

Table 3: The Effect of Rejected Pill Requests on Births and Morbidity Outcomes

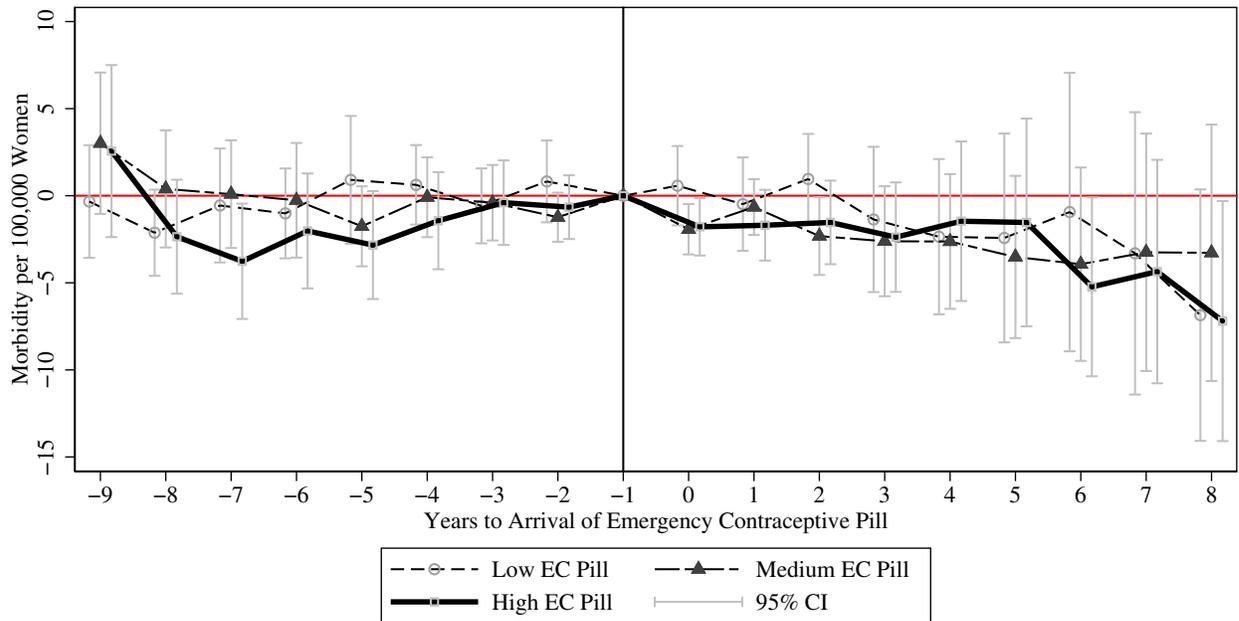
	Haemorrhage 15-49		Abortion 15-49	
	All (1)	Post (2)	All (3)	Post (4)
Pill Requests Rejected per 1000 Women	0.071 (0.046)	0.152*** (0.058)	0.094*** (0.011)	0.077* (0.040)
Observations	4,844	2,422	4,844	2,422
Mean of Dependent Variable	33.753	25.003	2.998	2.826

Each column displays a difference-in-differences regression of the impact of increases in rates of rejected pill requests on women's health outcomes. The models labelled "All" use data from 2002 to 2016, with the exception of 2009 for which no measure of pill rejections is available. In these cases, in the pre-EC pill period, the number of rejected pills is mechanically 0, given that no EC pills were requested, and hence no requests were denied. The models labelled "Post" use data from the post-EC pill period only, namely 2010-2016. Municipal and year fixed effects are consistently included. All standard errors are clustered at the level of the municipality.

Figure 4: Event Study Tests of the Intensity of the EC Pill on Maternal Health Outcomes



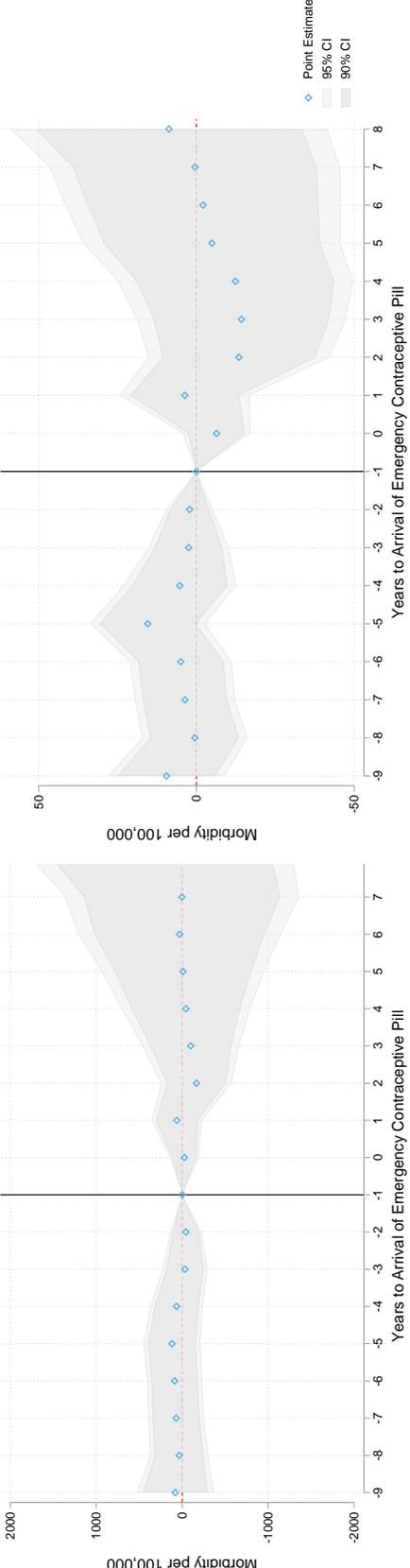
(a) Intensity of EC Pill and Haemorrhage Early in Pregnancy



(b) Intensity of EC Pill and Abortion Related Morbidity

Notes: Each set of point estimates and 95% confidence intervals refer to the EC pill roll-out leads and lags for municipalities with low, medium, and high rates of pill disbursements. These definitions are created based on the rate of pill disbursement per municipality, splitting the sample into three evenly sized groups. Coefficients are slightly shifted around the yearly lags and leads to visualise each estimate separately. All additional details follow Figure 3.

Figure 5: Placebo Tests using Full Morbidity Records and Puerperium Health Outcomes

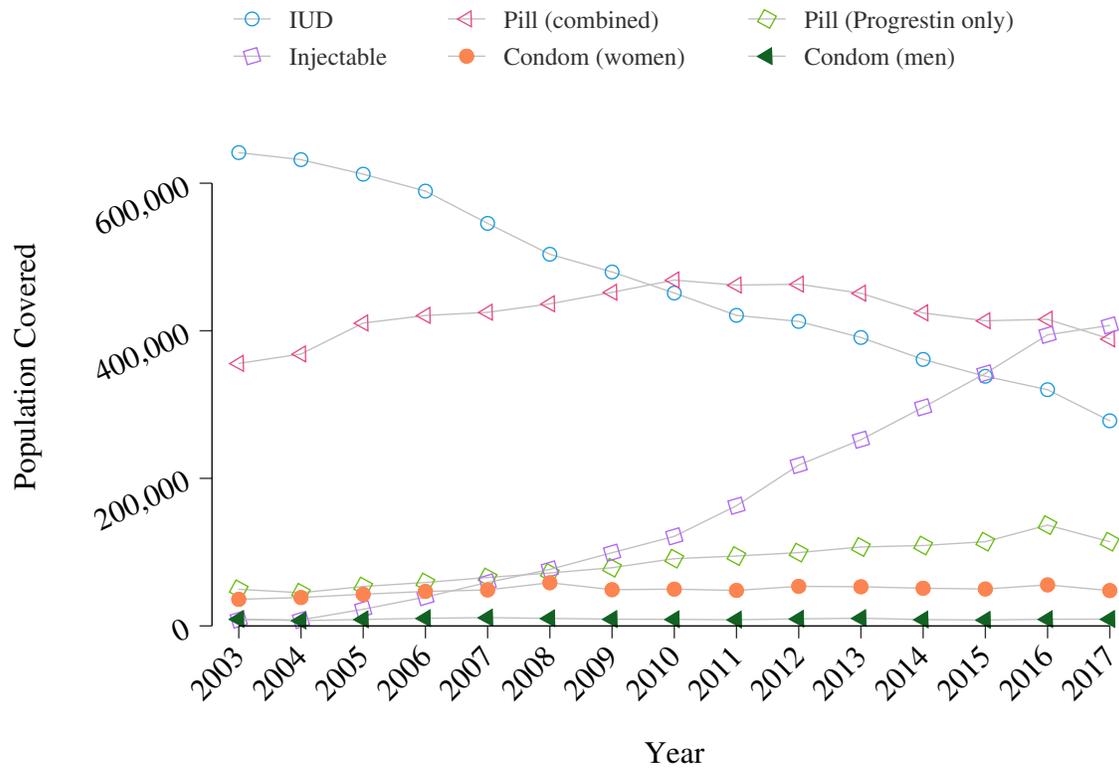


(a) Male Morbidity

(b) Puerperium

Notes: Event studies follow specification 1, where the outcome variables are all-cause male morbidity between the ages of 15–49 in panel (a), and morbidity owing to complications related to the puerperium period (based on ICD codes O85-O92) in panel (b). Each outcome is per 100,000 residents of the same sex aged 15–49 (per 100,000 males in panel (a) and 100,000 females in panel (b)). Specifications are weighted using the number of fertile-aged men and women respectively in each municipality, and standard errors are clustered by municipality.

Figure 6: Coverage of Alternative Contraceptive Methods used in Chile



Notes: Administrative data on all contraceptive disbursements provided by the public health system were transcribed (at the health service level) from the full Monthly Health Statistics (*Resumen de Estadísticas Mensuales*) of the Ministry of Health of the Government of Chile. Data are provided for the copper intrauterine device (IUD), the oral pill (both the combined oestrogen and progestogen pill as well as the progestogen-only pill), injectable contraceptives, and condoms (both those requested by women and those requested by men). Trends displayed here are for the total population covered by each method in the entirety of the country.

Appendix for

“Access to The Emergency Contraceptive Pill Improves Women’s Health: Evidence from Chile”

Damian Clarke and Viviana Salinas

Online only, not for print.

A Appendix Figures and Tables

Table A1: Correlation Between Stated Availability of EC Pill and Actual Disbursements

	Unweighted Specifications			Weighted by Municipal Population		
	(1)	(2)	(3)	(4)	(5)	(6)
EC Pill Available	3.847*** (0.235)	0.745*** (0.009)	45.723*** (2.005)	3.380*** (0.091)	0.829*** (0.008)	156.209*** (3.808)
Constant	0.220 (0.155)	0.095*** (0.006)	1.702 (1.325)	0.134** (0.061)	0.122*** (0.005)	4.600* (2.561)
Observations	5,087	5,087	5,087	5,087	5,087	5,087
Outcome Variable:						
Pills per capita	Y	-	-	Y	-	-
Any pills disbursed	-	Y	-	-	Y	-
Total pills disbursed	-	-	Y	-	-	Y

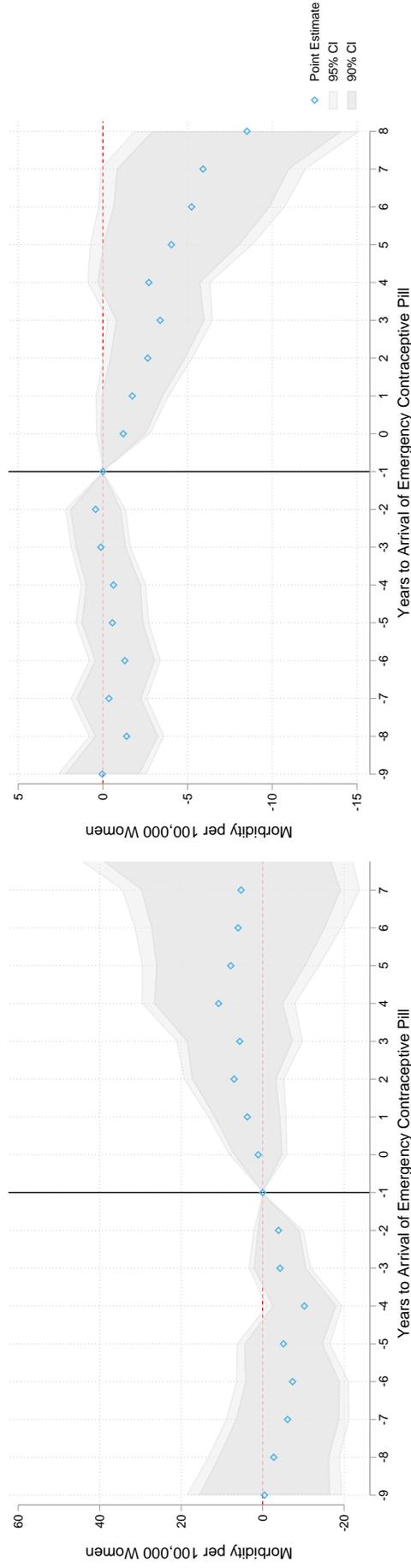
Notes: Each column displays a simple bivariate regression of a measure of EC pill usage from administrative data of EC pill disbursement on an indicator of whether the EC pill is available in the municipality according to municipal authorities. This availability measure was collected in telephone surveys implemented by Dides et al. (2009); Dides C. et al. (2010, 2011). The outcome variable in each case is indicated in the table footer. Weighted and unweighted specifications are shown, where weights are defined based on the number of women aged between 15 and 49 years in each municipality. * p<0.10, ** p<0.05, *** p<0.01.

Table A2: Difference-in-Differences Estimates with Unweighted Cells

	All Women							
	15-19 (1)	20-24 (2)	25-29 (3)	30-34 (4)	35-39 (5)	40-44 (6)	45-49 (7)	45-49 (8)
Panel A: Haemorrhage Early in Pregnancy								
Pills Disbursed per 1000 Women	0.008 (0.045)	-0.105 (0.140)	-0.140 (0.134)	0.057 (0.102)	0.471 (0.360)	-0.202 (0.178)	0.013 (0.057)	-0.024 (0.035)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	33.928	26.146	39.898	51.220	49.403	43.313	26.393	4.927
Panel B: Abortion-Related Morbidity								
Pills Disbursed per 1000 Women	0.003 (0.013)	0.067 (0.089)	-0.004 (0.011)	0.027 (0.051)	-0.012 (0.014)	-0.023 (0.024)	-0.017 (0.018)	-0.007 (0.010)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	3.058	1.508	3.117	4.511	5.549	4.879	1.737	0.304
Panel C: Birth Rates								
Pills Disbursed per 1000 Women	-0.008 (0.016)	-0.214** (0.106)	-0.073* (0.040)	0.050 (0.036)	0.015 (0.031)	-0.004 (0.028)	0.017 (0.059)	-0.000 (0.002)
Observations	5,142	5,117	5,142	5,142	5,127	5,142	5,142	5,127
Mean of Dependent Variable	53.504	55.754	89.917	87.206	74.131	45.915	13.738	0.742

Notes: Regression results are identical to those in Table 2 (panels A and B) and Table A7 (panel C), however now do not weight by municipality population. Given the large number of small municipalities where small absolute changes in rates of morbidity can have large relative impacts, we strictly prefer weighted specifications presented in Figure 3, as these give equal weights to each *woman* rather than each *municipality* in the country. Refer to notes to Table 2 for additional discussion.

Figure A1: Event Study Tests of the Impact of the EC Pill on Maternal Health Outcomes (Unweighted)

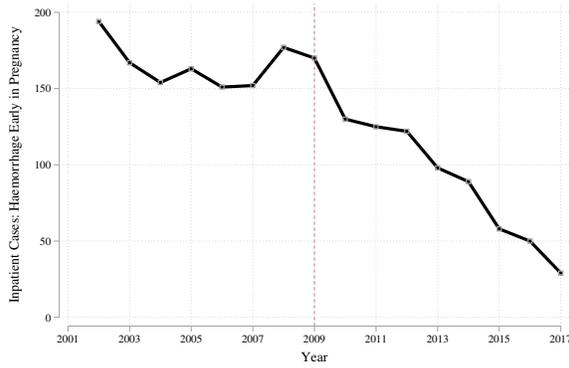


(a) Haemorrhage Early in Pregnancy

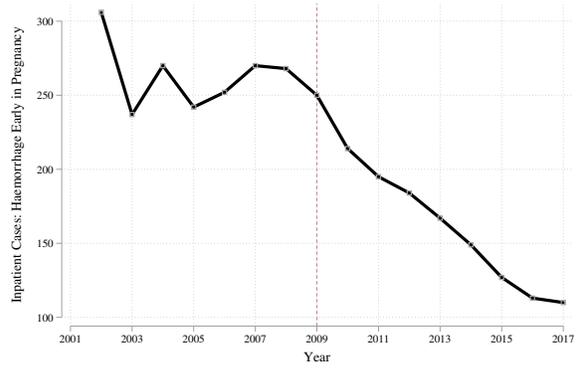
(b) Abortion-Related Morbidity

Notes: Event studies are identical to those in Figure 3, however now do not weight by municipal population. Given the large number of small municipalities where small absolute changes in rates of morbidity can have large relative impacts, we strictly prefer weighted specifications presented in Figure 3, as these give equal weights to each *woman* rather than each *municipality* in the country. Refer to notes to Figure 3 for additional discussion.

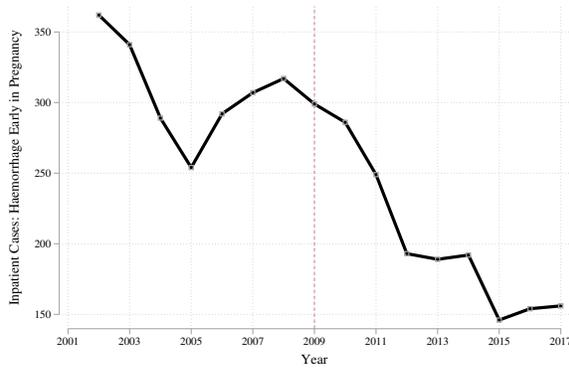
Figure A2: Descriptive Figures by Quinquennial Age Groups (Haemorrhage)



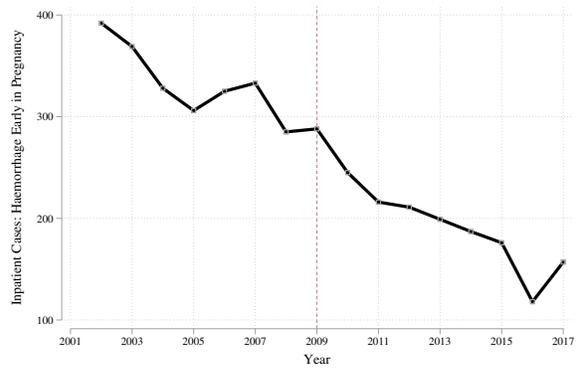
(a) 15-19



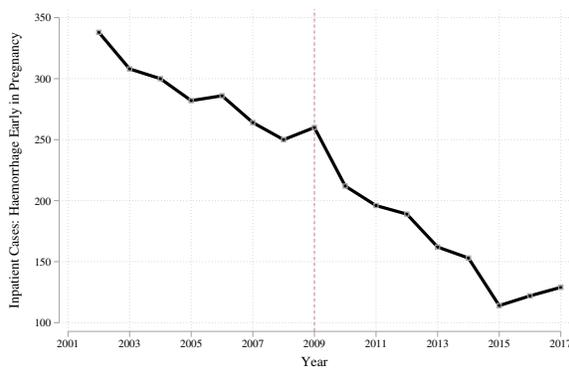
(b) 20-24



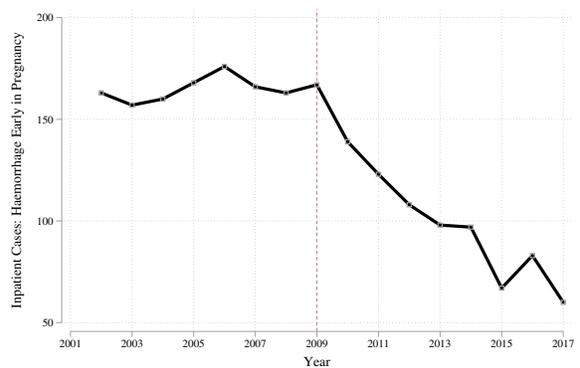
(c) 25-29



(d) 30-34



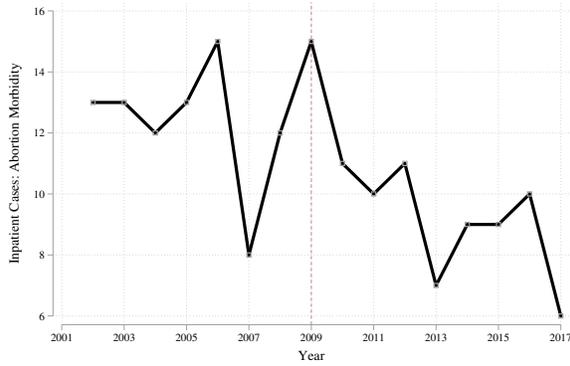
(e) 35-39



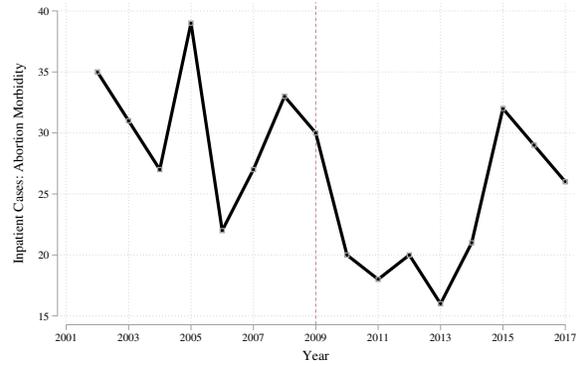
(f) 40-44

Notes: Each panel displays the total number of hospital visits in administrative health data recorded as “Haemorrhage early in pregnancy” (ICD-10 code O20). Quantities are calculated for each quinquennial age group.

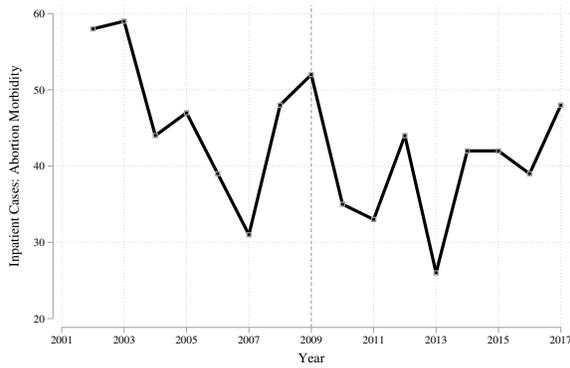
Figure A3: Descriptive Figures by Quinquennial Age Groups (Abortion)



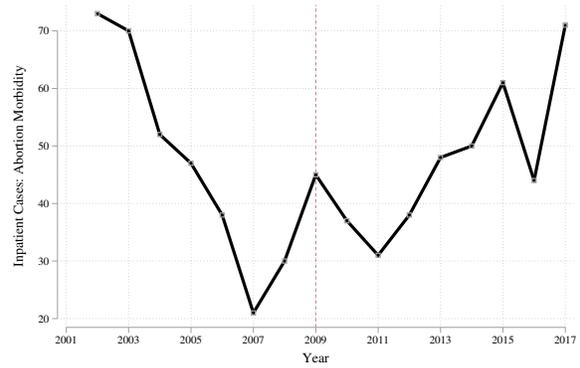
(a) 15-19



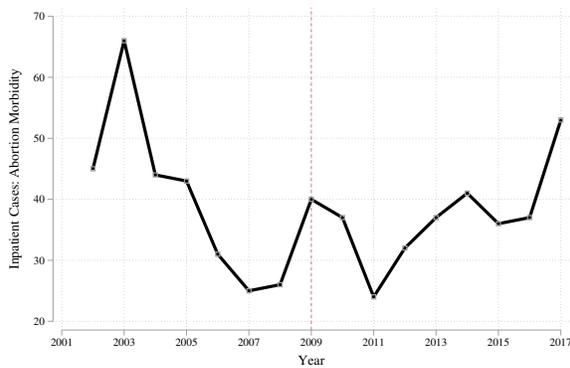
(b) 20-24



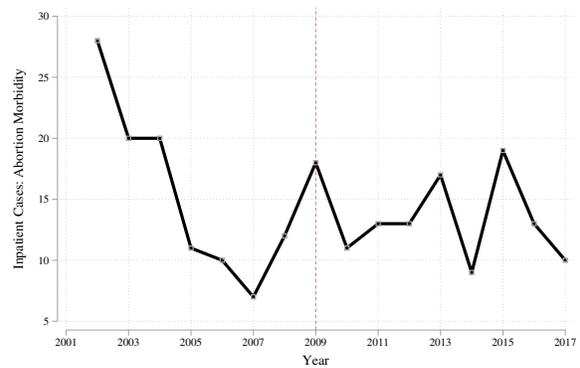
(c) 25-29



(d) 30-34



(e) 35-39



(f) 40-44

Notes: Each panel displays the total number of hospital visits in administrative health data recording pregnancies with abortive outcomes (ICD-10 codes O02-O08). Quantities are calculated for each quinquennial age group.

Table A3: Number of EC Pills Disbursed and Total Population of Fertile-Aged Women

Year	EC Pills	Population	EC Pills/1,000 Women
2009	7,552	4,547,573	1.66
2010	3,219	4,574,965	0.70
2011	6,047	4,598,663	1.31
2012	12,603	4,619,565	2.72
2013	15,847	4,636,571	3.42
2014	22,544	4,649,712	4.85
2015	25,497	4,659,663	5.47
2016	19,653	4,667,215	4.21
Average	14,120.3	4,619,241	3.05

Notes: Number of EC pills disbursed is calculated from administrative data provided by the Ministry of Health. Total population per year is provided by the Chilean National Institute of Statistics (INE).

Table A4: Estimated Reductions in Morbidity from Event Study Plots

Lag	Haemorrhage			Abortion Related Morbidity		
	Point Estimate	Population Affected	Estimated Cases	Point Estimate	Population Affected	Estimated Cases
0	-2.51	4,582,073	-115.1	-1.32	4,582,073	-60.6
1	-0.09	4,604,620	-4.2	-1.12	4,604,620	-52.0
2	-3.92	4,623,828	-181.3	-1.59	4,623,828	-73.5
3	-5.74	4,639,446	-266.7	-2.72	4,639,446	-126.5
4	-7.94	4,651,479	-369.5	-2.78	4,651,479	-129.5
5	-12.3	4,660,770	-574.3	-3.24	4,660,770	-151.2
6	-17.2	4,175,903	-717.8	-4.30	4,175,903	-179.6
7	-21.3	2,705,208	-577.7	-4.29	2,705,208	-116.0
Total			-2806.6			-888.8

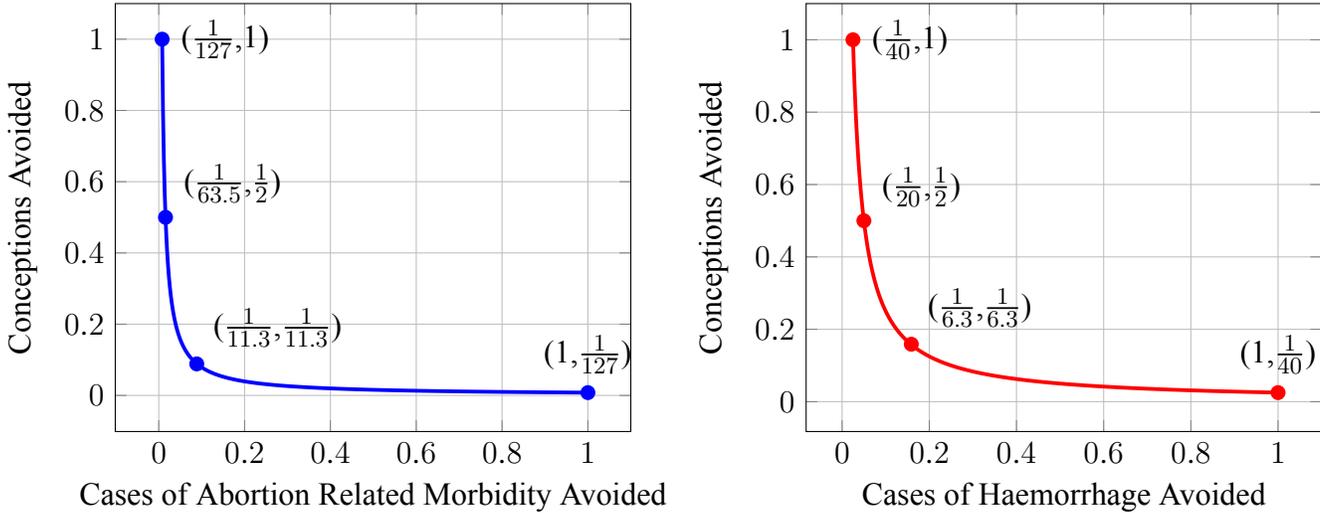
Notes: Each point estimate is drawn from event study models displayed in Figure 3. Population affected refers to the total population of women in municipalities at the precise moment that each lag is observed, and estimated cases refers to the Point Estimate/100,000× Population Affected, given that the point estimate refers to the estimate per 100,000 women. Estimated Cases thus captures the estimated total effect of the reform in terms of cases avoided, and the total sum is given in the final row of the table.

Table A5: Estimated Reductions in Morbidity from Event Studies (High Intensity Municipalities)

Lag	Haemorrhage			Abortion Related Morbidity		
	Point Estimate	Population Affected	Estimated Cases	Point Estimate	Population Affected	Estimated Cases
0	-1.42	1,434,638	-20.4	-1.78	1,434,638	-25.5
1	-0.30	1,439,694	-4.3	-1.69	1,439,694	-24.3
2	-8.84	1,443,650	-127.6	-1.53	1,443,650	-22.1
3	-12.2	1,446,210	-176.5	-2.38	1,446,210	-34.4
4	-15.4	1,447,445	-222.9	-1.46	1,447,445	-21.1
5	-19.7	1,447,566	-285.2	-1.54	1,447,566	-22.3
6	-24.6	1,334,469	-328.2	-5.23	1,334,469	-69.8
7	-29.7	947,279	-281.3	-4.35	947,279	-41.2
Total			-1446.4			-260.7

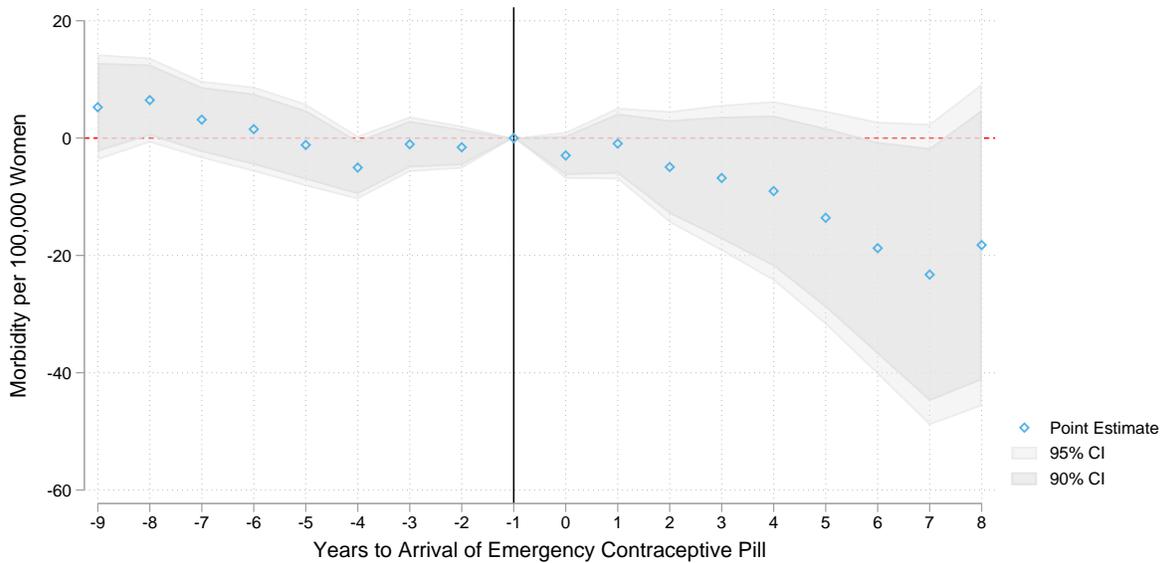
Notes: Each point estimate is drawn from event study models displayed in Figure 4 (for high EC pill intensity municipalities only). Population affected refers to the total population of women in these high EC pill intensity municipalities at the precise moment that each lag is observed for, and estimated cases refers to the Point Estimate/100,000× Population Affected, given that the point estimate refers to the estimate per 100,000 women. Estimated Cases thus captures the estimated total effect of the reform in terms of cases avoided in these municipalities, and the total sum is given in the final row of the table.

Figure A4: Implications of Estimated Effect Sizes for EC Pill Efficiency



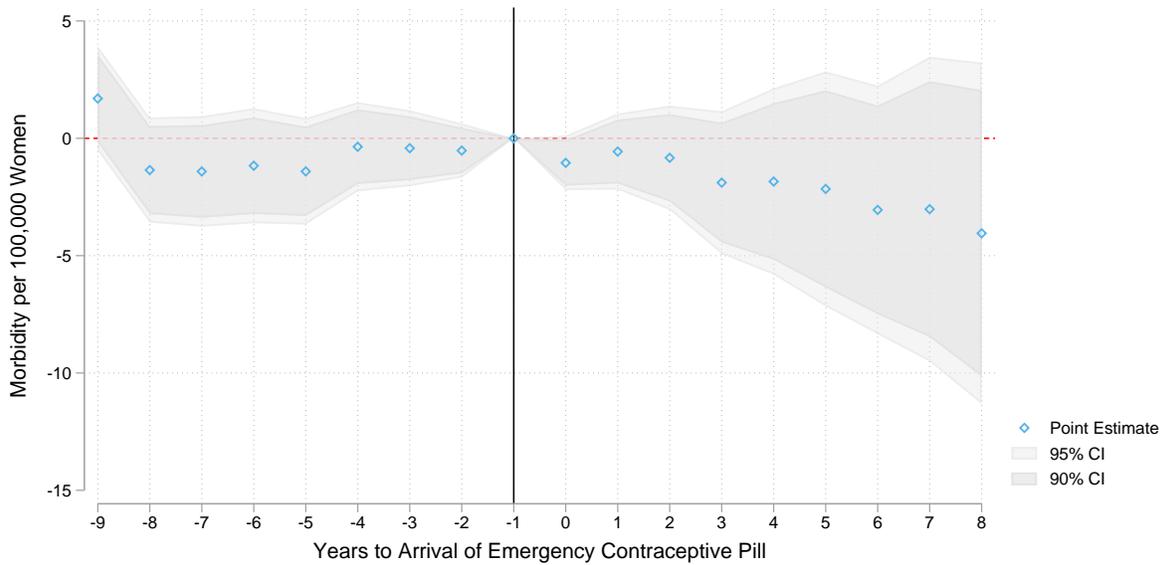
Notes: Plots provide possible combinations which explain effect sizes reported in the paper. The curves in each plot provide the proportion fewer conceptions per EC pill and the proportion fewer complications per each conception that would justify the estimated effects. The left-hand panel documents possible combinations for abortion-related morbidity, while the right-hand panel documents possible combinations for haemorrhage. For example, in the case of abortion related morbidity, we estimate that for each 127 pills a single case is avoided. This could occur if each pill avoided a single conception, and for each 127 conceptions a morbidity case is avoided (or any other point documented on the blue feasibility curve). Certain other combinations are indicated in text on the plot.

Figure A5: Event Studies with Political Controls: Haemorrhage Early in Pregnancy and the Emergency Contraceptive Pill



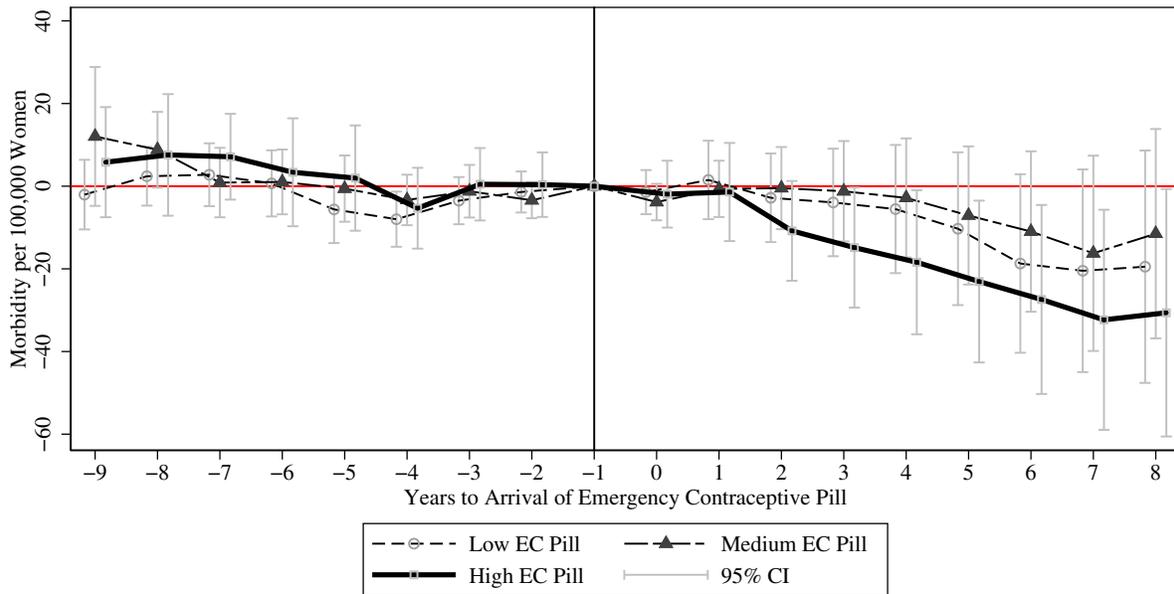
Notes: Event studies follow specification 1, where the outcome variable is cases of haemorrhage early in pregnancy (<21 weeks) per 100,000 fertile-aged women. Specifications are weighted using the number of fertile-aged women in each municipality, and standard errors are clustered by municipality.

Figure A6: Event Studies with Political Controls: Abortion Morbidity and the Emergency Contraceptive Pill



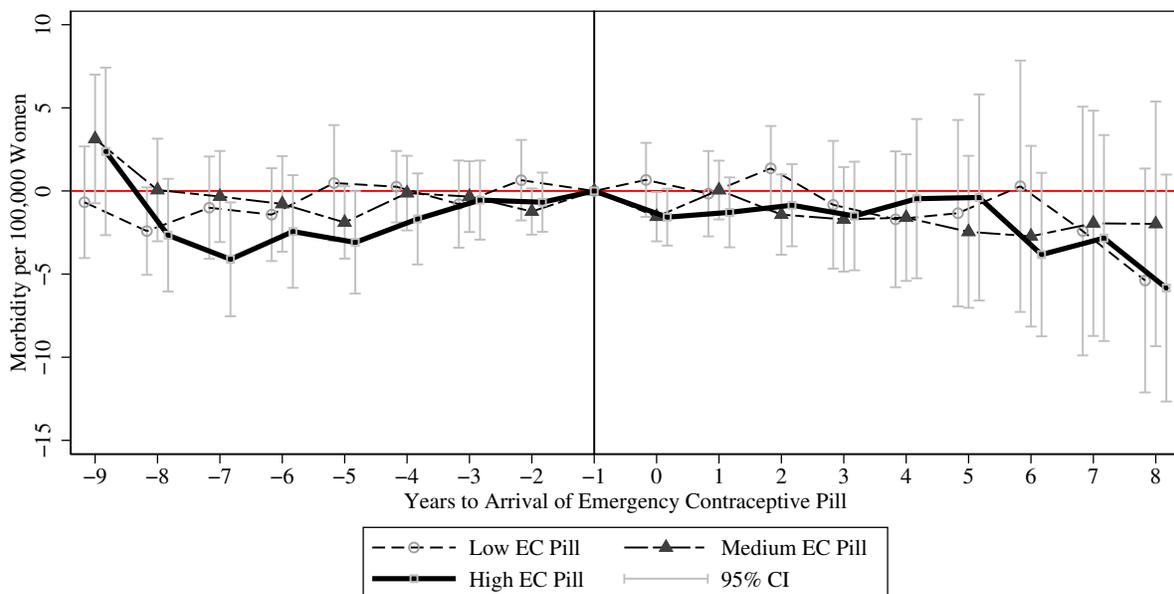
Notes: Refer to notes to Figure A5. An identical specification is estimated, however now with rates of abortion-related morbidity per 100,000 women as the dependent variable.

Figure A7: Event Studies with Political Controls: Intensity of EC Pill and Haemorrhage



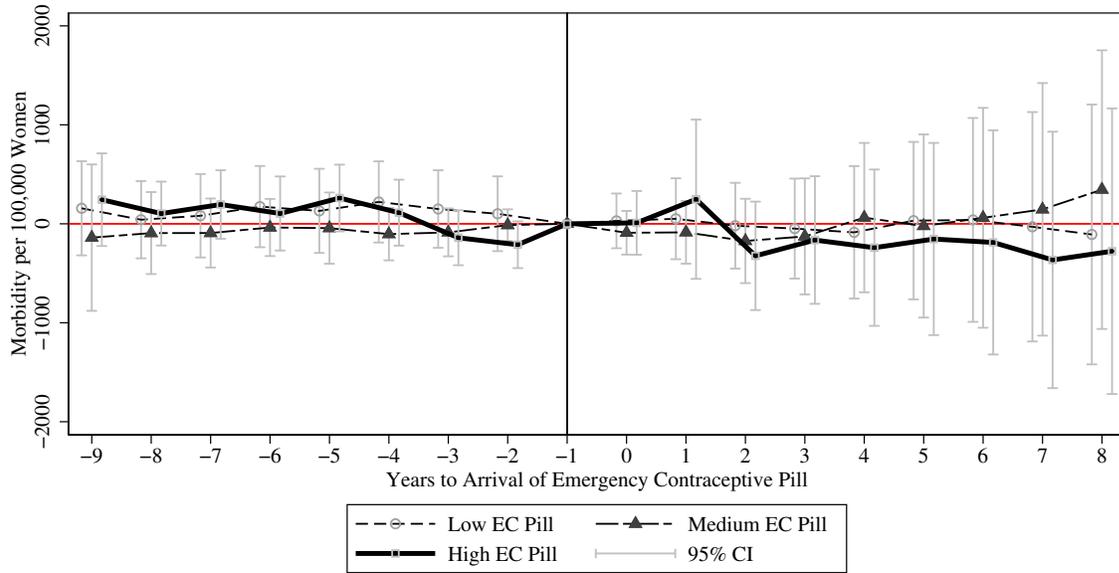
Notes: Each set of point estimates and 95% confidence intervals refer to the EC pill roll-out leads and lags for municipalities with low, medium, and high rates of pill disbursements. These definitions are created based on the rate of pill disbursement per municipality, with splits into three evenly sized groups. Coefficients are slightly shifted around the yearly lags and leads to visualise each estimate separately.

Figure A8: Event Studies with Political Controls: Intensity of EC Pill and Abortion

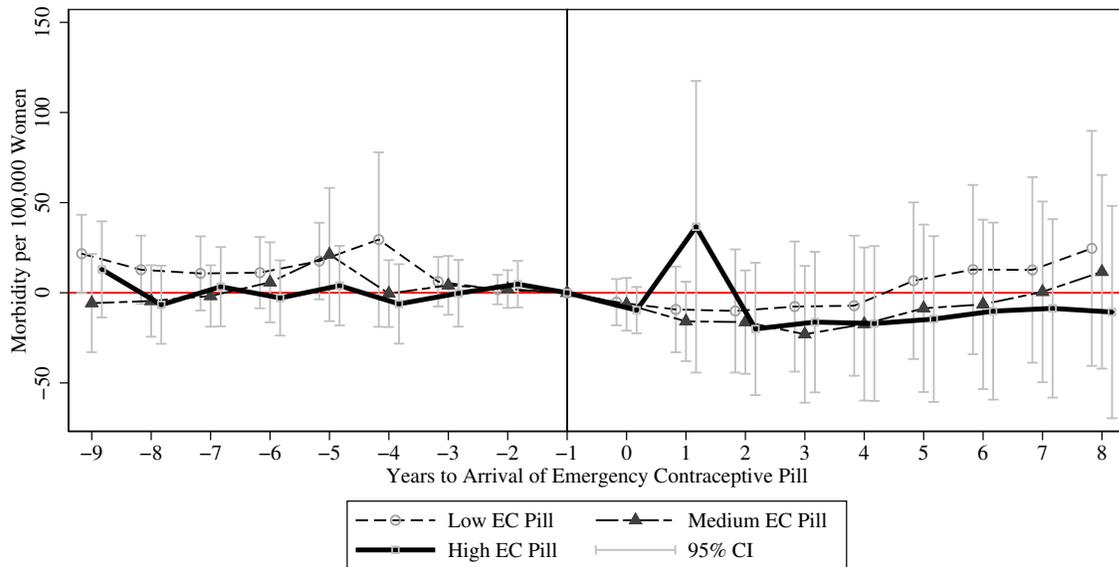


Notes: Refer to notes to Figure A7.

Figure A9: Placebo Tests using Male Morbidity and Puerperium Health Outcomes by Pill Intensity



(a) Male Morbidity



(b) Puerperium

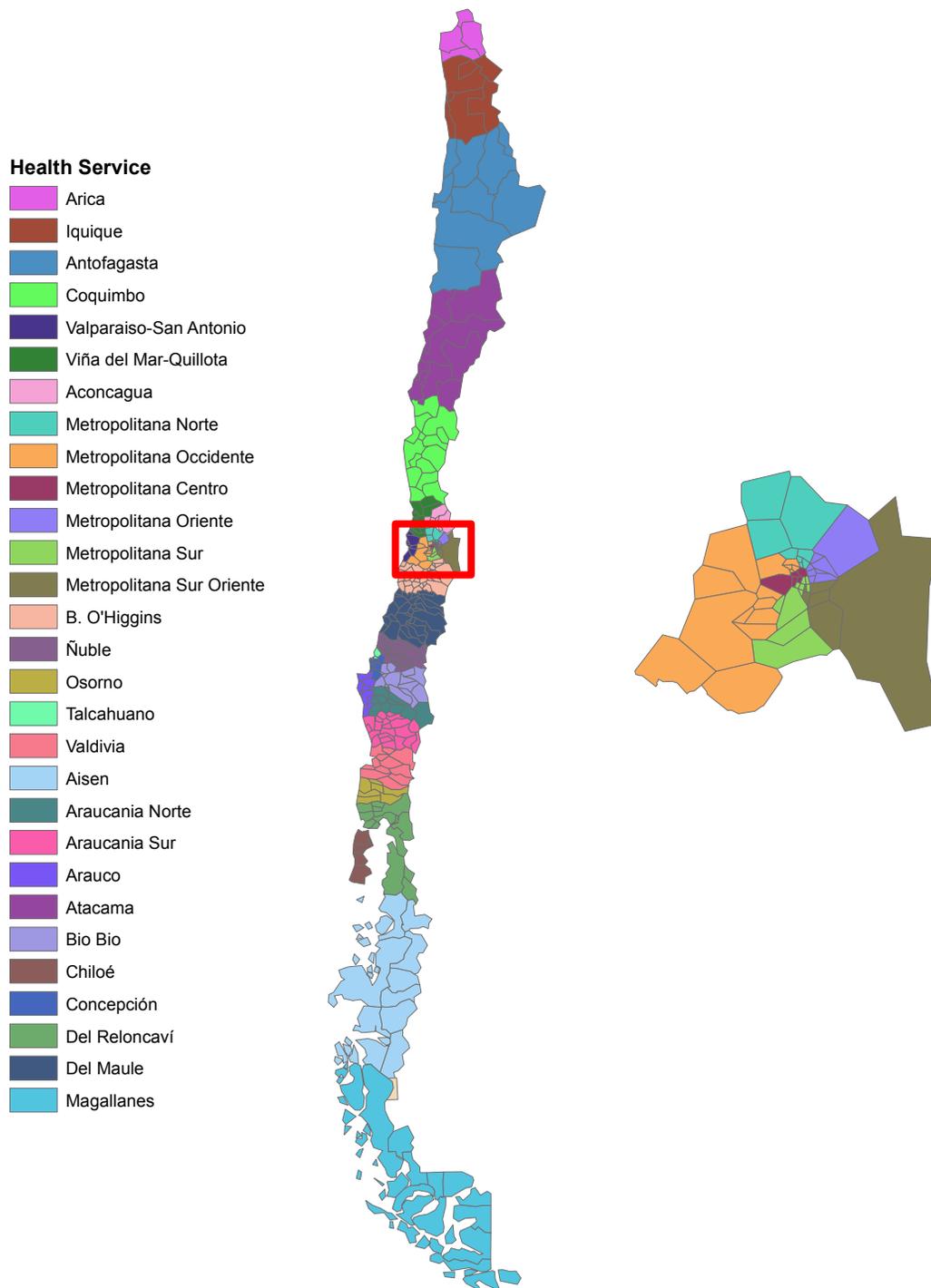
Notes: Each set of point estimates and 95% confidence intervals refer to the EC pill roll-out leads and lags for municipalities with low, medium, and high rates of pill disbursements. These definitions are created based on the rate of pill disbursement per municipality, with splits the sample into three evenly sized groups. Coefficients are slightly shifted around the yearly lags and leads to visualise each estimate separately. All additional details follow Figure 5.

Table A6: Difference-in-Differences Estimates of Pill Disbursements on Placebo Outcomes

	Age-Specific Groups							
	All Women	15-19	20-24	25-29	30-34	35-39	40-44	45-49
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Morbidity During the Puerperium								
Pills Disbursed per 1000 Women	0.008 (0.045)	-0.105 (0.140)	-0.140 (0.134)	0.057 (0.102)	0.471 (0.360)	-0.202 (0.178)	0.013 (0.057)	-0.024 (0.035)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	33.928	26.146	39.898	51.220	49.403	43.313	26.393	4.927
Panel B: Male Morbidity								
Pills Disbursed per 1000 Women	0.006 (0.042)	-0.087 (0.102)	-0.124 (0.118)	0.031 (0.095)	0.416 (0.307)	-0.168 (0.152)	0.013 (0.052)	-0.021 (0.030)
Observations	5,190	5,175	5,190	5,190	5,190	5,190	5,190	5,190
Mean of Dependent Variable	31.765	23.517	36.963	48.665	47.721	40.639	24.294	4.458

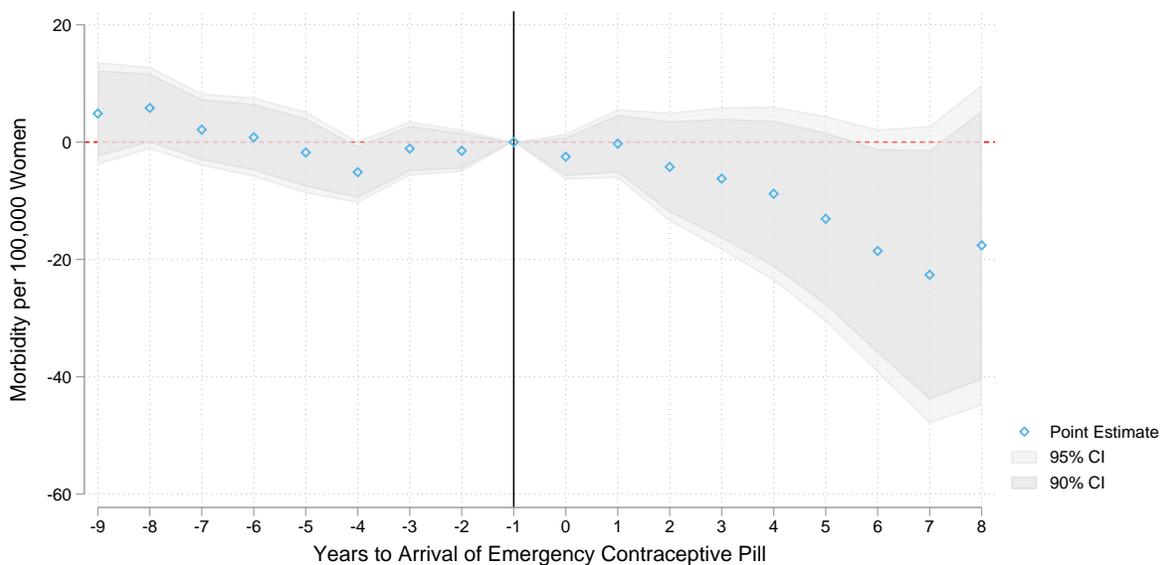
Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of maternal mortality. Panel A presents regressions where the outcome is the maternal mortality ratio (maternal deaths per 100,000 live births), where each regression is weighted using the number of births in each group. Panel B presents regressions where the outcome is the number of deaths per 100,000 fertile-aged women, where each regression is weighted using the number of fertile-aged women. All other details follow those in Table 2.

Figure A10: Health Services and Municipalities



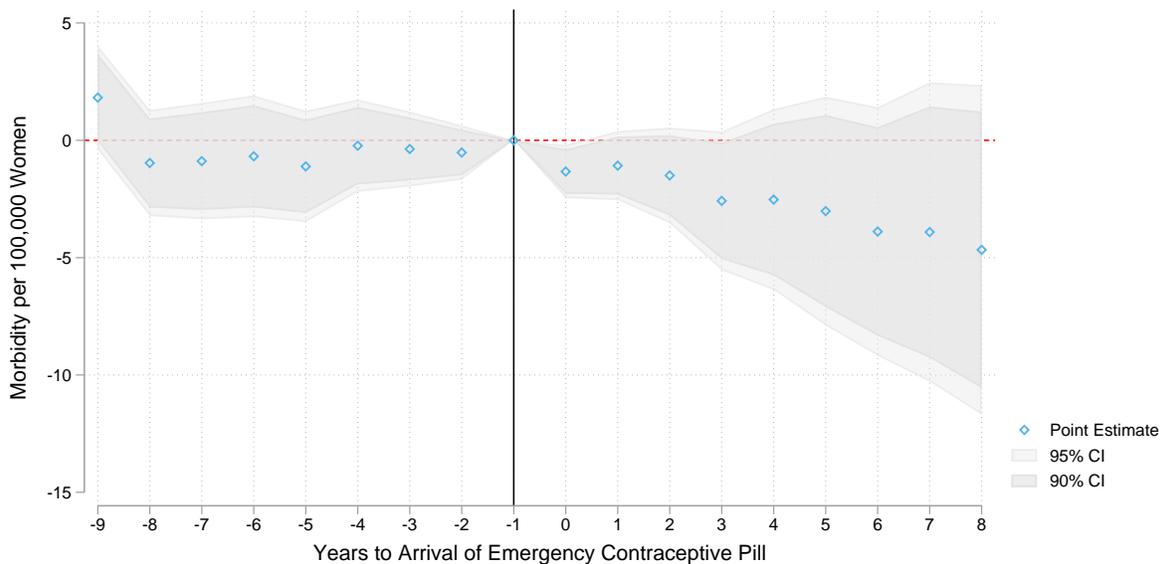
Notes to Figure A10: Municipalities are indicated by municipal boundaries, and health services are indicated by colours. Each of Chile's 346 municipalities belongs to one of 29 Health Services. The entire country is displayed at right, and the densely populated Metropolitan Region of Santiago is displayed at left.

Figure A11: Event Studies with contraceptive controls: Haemorrhage Early in Pregnancy and the Emergency Contraceptive Pill



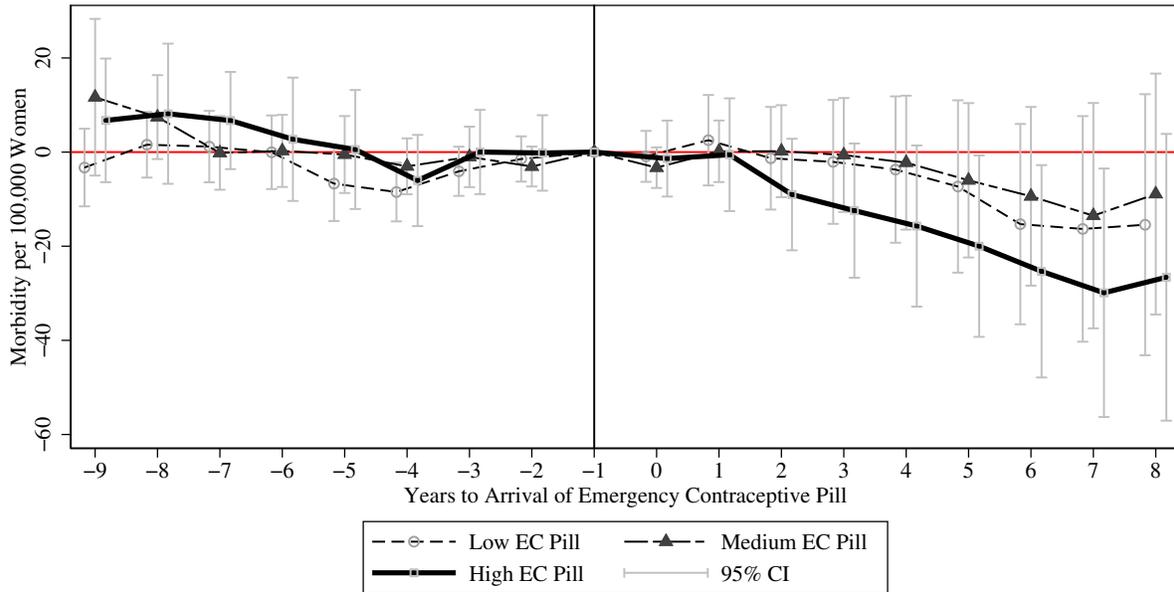
Notes: Event studies follow specification 4, where the outcome variable is cases of haemorrhage early in pregnancy (<21 weeks) per 100,000 fertile-aged women. Specifications are weighted using the number of fertile-aged women in each municipality, and standard errors are clustered by municipality.

Figure A12: Event Studies with contraceptive controls: Abortion Morbidity and the Emergency Contraceptive Pill



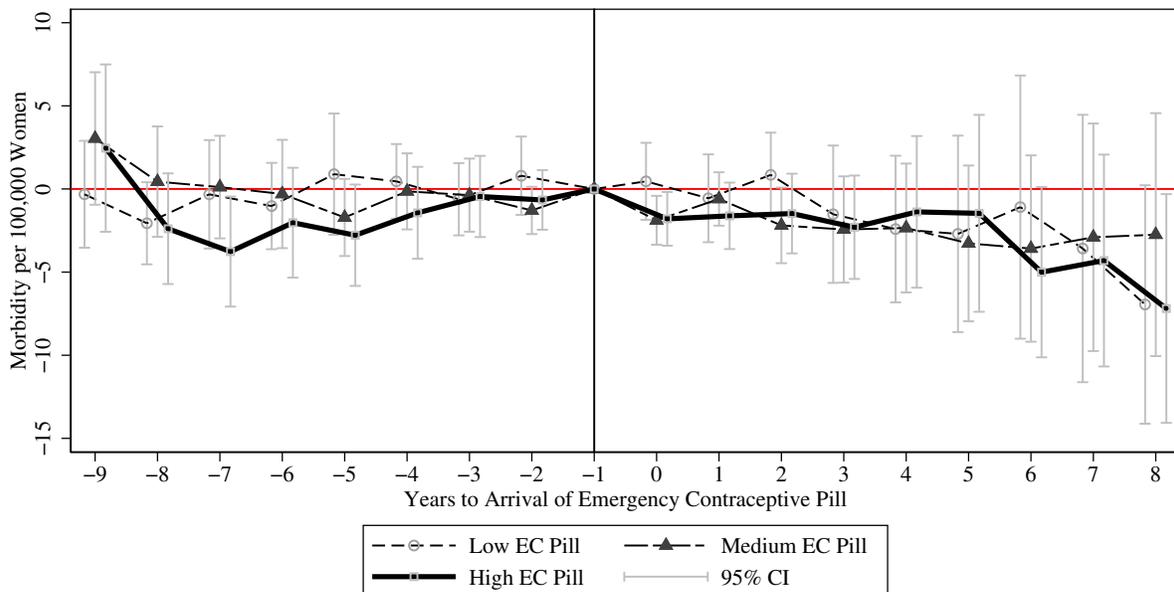
Notes: Refer to notes to Figure A11. An identical specification is estimated, however now with rates of abortion-related morbidity per 100,000 women as the dependent variable.

Figure A13: Event Studies with contraceptive controls: Intensity of EC Pill and Haemorrhage



Notes: Each set of point estimates and 95% confidence intervals refer to the EC pill roll-out leads and lags for municipalities with low, medium, and high rates of pill disbursements. These definitions are created based on the rate of pill disbursement per municipality, with splits into three evenly sized groups. Coefficients are slightly shifted around the yearly lags and leads to visualise each estimate separately.

Figure A14: Event Studies with contraceptive controls: Intensity of EC Pill and Abortion



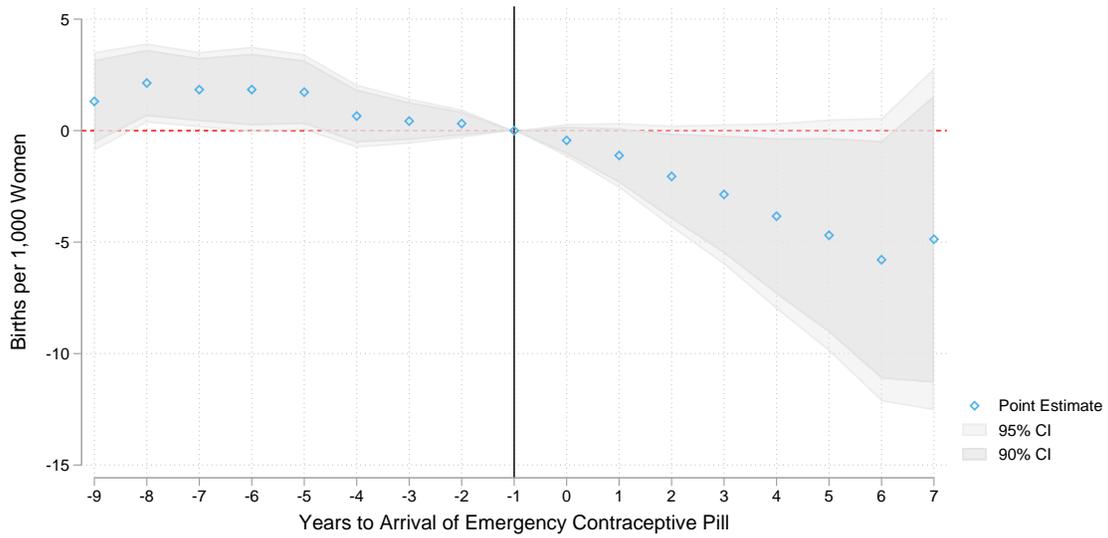
Notes: Refer to notes to Figure A13.

Table A7: Difference-in-Differences Estimates of Pill Disbursements on Births

	All Women		Age-Specific Groups							
	(1)	(2)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
Pills Disbursed per 1000 Women	-0.059 (0.040)	-0.112** (0.056)	-0.238*** (0.087)	-0.046 (0.084)	0.099 (0.074)	0.006 (0.074)	-0.003 (0.027)	-0.006* (0.003)		
Observations	5,142	5,117	5,142	5,142	5,142	5,127	5,142	5,127		
Mean of Dependent Variable	53.504	55.754	89.917	87.206	74.131	45.915	13.738	0.742		

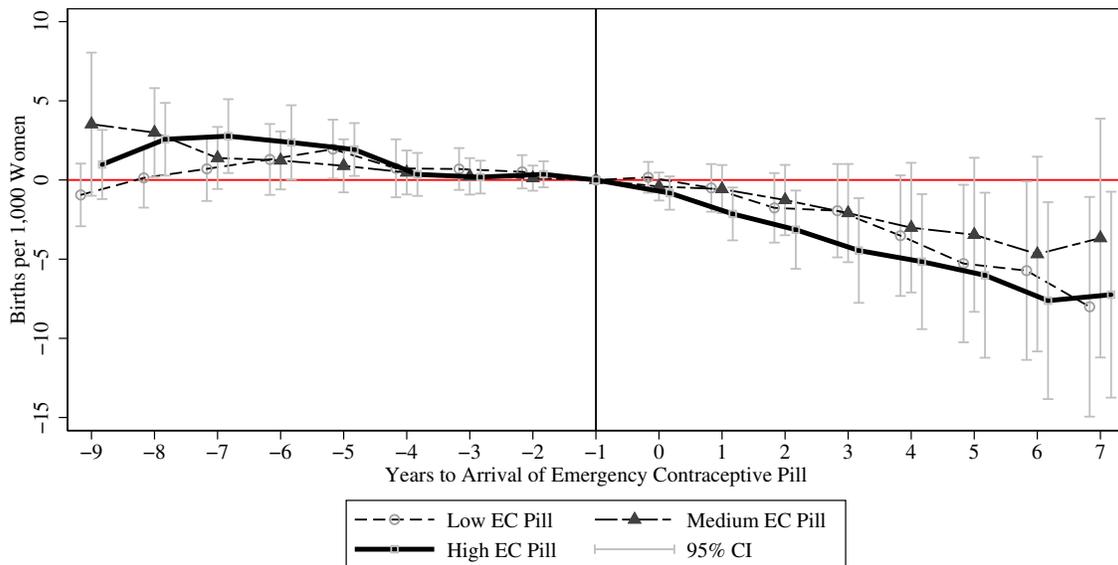
Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of birth in each municipality. Birth rates are measured as the number of births occurring per 1,000 fertile-aged women each year, and average levels in the full set of data are available at the foot of the table. All standard errors are clustered at the level of the municipality. * p<0.10, ** p<0.05, *** p<0.01.

Figure A15: Event Study Tests of the Impact of the EC Pill on Birth Rates



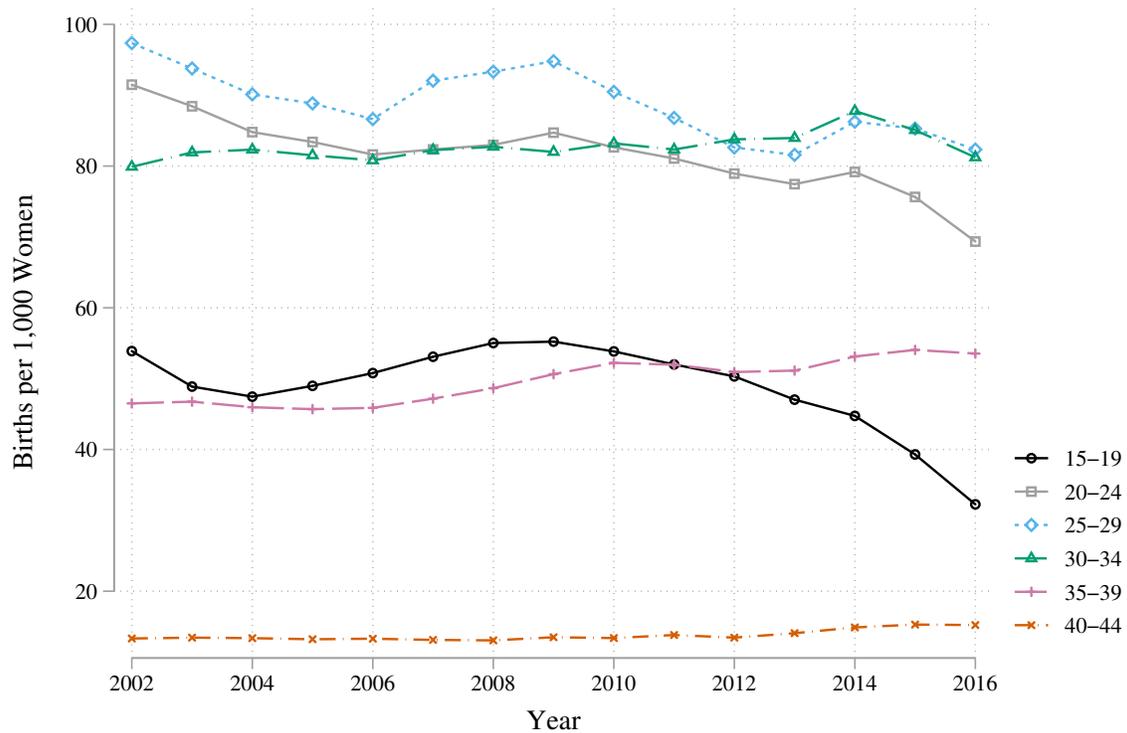
Notes: Event studies follow specification 1, where the outcome variable is the number of births occurring per 1,000 fertile-aged women (15-49 year-olds). Specifications are weighted using the number of fertile-aged women in each municipality, and standard errors are clustered by municipality. The vertical solid line indicates 1 year prior to the first year in which a municipality disburses the EC pill.

Figure A16: Event Study Tests of the Intensity of the EC Pill on Birth Rates



Notes: Refer to notes to Figure 4. Identical results are documented, where the outcome is now the total number of births per 1,000 fertile-aged women.

Figure A17: Birth Rates in Chile, 2002-2016



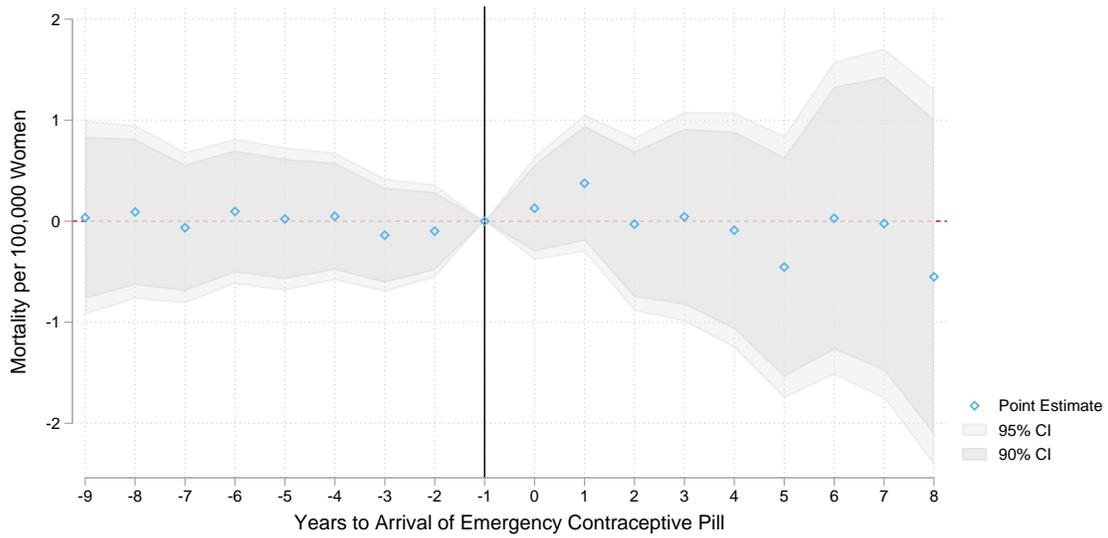
Notes: Fertility rates are calculated from full microdata on births released by the Chilean Ministry of Health, and population records calculated by the National Institute of Statistics.

Table A8: Difference-in-Differences Estimates of Pill Disbursements on Maternal Mortality

	All Women							
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Maternal Mortality Ratio								
Pills Disbursed per 1000 Women	0.007 (0.193)	-0.466 (0.405)	-0.197 (0.534)	0.029 (0.368)	-0.038 (0.388)	1.043 (0.866)	-0.497 (1.060)	-5.976 (14.127)
Observations	5,141	5,017	5,067	5,084	5,064	5,024	4,812	2,291
Mean of Dependent Variable	20.780	13.074	15.460	18.440	22.233	36.153	70.097	100.393
Panel B: Maternal Mortality Rate								
Pills Disbursed per 1000 Women	-0.000 (0.010)	-0.022 (0.019)	-0.021 (0.038)	0.001 (0.037)	-0.004 (0.030)	0.054 (0.042)	-0.008 (0.016)	0.001 (0.005)
Observations	5,190	5,153	5,190	5,190	5,175	5,190	5,190	5,175
Mean of Dependent Variable	1.082	0.613	1.333	1.557	1.686	1.581	0.719	0.089

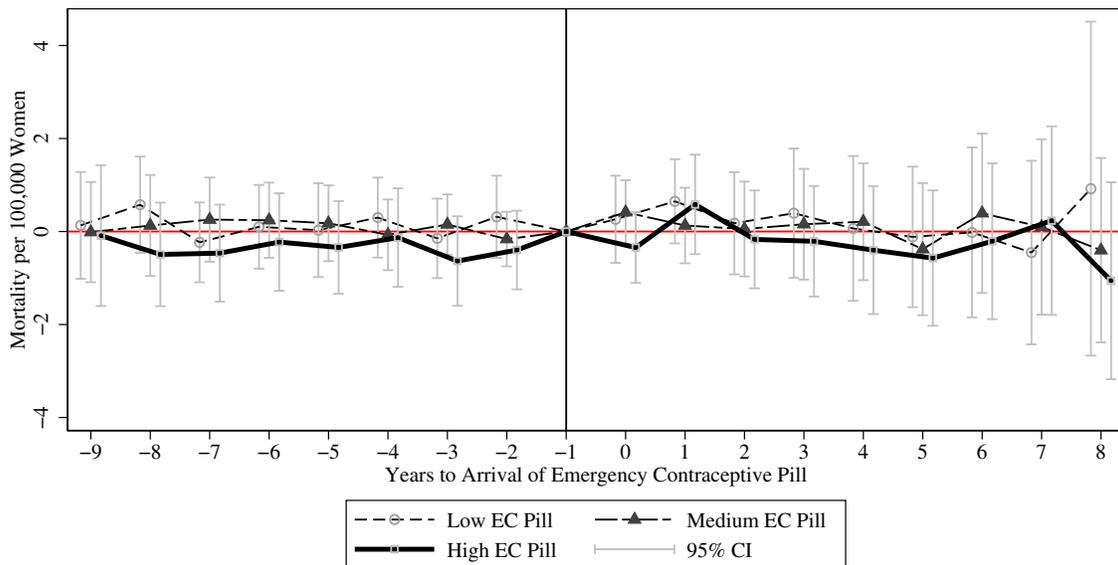
Notes: Each column displays a difference-in-differences regression of the impact of abortion reform on rates of maternal mortality. Panel A presents regressions where the outcome is the maternal mortality ratio (maternal deaths per 100,000 live births), where each regression is weighted using the number of births in each groups. Panel B presents regressions where the outcome is the number of deaths per 100,000 fertile-aged women, where each regression is weighted using the number of fertile-aged women. All other details follow those in Table 2.

Figure A18: Event Study Tests of the Impact of the EC Pill on Maternal Mortality



Notes: Event studies follow specification 1, where the outcome variable is the number of maternal deaths per 100,000 fertile-aged women. Specifications are weighted using the number of fertile-aged women in each municipality, and standard errors are clustered by municipality. The vertical solid line indicates 1 year prior to the first year in which a municipality disburses the EC pill.

Figure A19: Event Study Tests of the Intensity of the EC Pill on Maternal Mortality



Notes: Refer to notes to Figure A19. Identical results are documented, where the outcome is now maternal deaths per 100,000 fertile-aged women.

B Additional Background on The EC Pill and its Rollout in Chile

The EC pill is a hormonal treatment that women can use within up to five days of unprotected sex to reduce the probability of conception, although it is most most effective when taken within 12 hours (von Hertzen et al., 2002). It is composed of the progestin levonorgestrel, or a combination of oestrogen and progestin. Typically EC is taken either as a single pill or two pills in a 12 hours period (von Hertzen et al., 2002), even though the high dose of hormones these pills contain can be obtained by combining large amounts of normal birth control pills (Ellerson et al., 1998).²⁶ The effectiveness of the EC pill, based on typical usage, is estimated to be 75-90 percent, depending on the method used. Even though EC has been of clinical interest since the late 1960s, the EC pill is still not available worldwide.²⁷ The first countries that made the EC pill available did so in the mid-1980s and many countries made it available only in this millennium (Bentancor and Clarke, 2017).

Previous evaluations of the EC pill have been conducted mainly in the U.S. and in the United Kingdom (Gross et al., 2014; Durrance, 2013; Girma, 2006, 2011; Mulligan, 2015). These studies focus nearly exclusively on fertility outcomes, the prevalence of sexually transmitted infections, unprotected sex and changes in contraceptive use, either in the total population or only in adolescents. They generally conclude that EC is not associated with more unprotected intercourse or less condom or hormonal contraceptive use (Gold et al., 2004). There have also been studies of the impact of the EC pill on pregnancy and abortion rates, most of which find no effects at a population level (Durrance, 2013; Gross et al., 2014; Raymond et al., 2007). All of these studies are in countries in which abortion is legal. On the contrary, a study conducted in Chile in a period in which all forms of abortion were still illegal concluded that the EC pill reduced the general fertility rate by (a somewhat noisy) 1.6 percent and that it reduced fetal death (which may in part reflect illegal abortions) by 40 percent among adolescents (Bentancor and Clarke, 2017). A recent study by Nuevo-Chiquero and Pino (2019) additionally finds an impact of the rollout of the EC pill in Chile on other methods of contraceptive use. These results are consistent with EC potentially having a significant effect in contexts in which access to abortion is restricted.

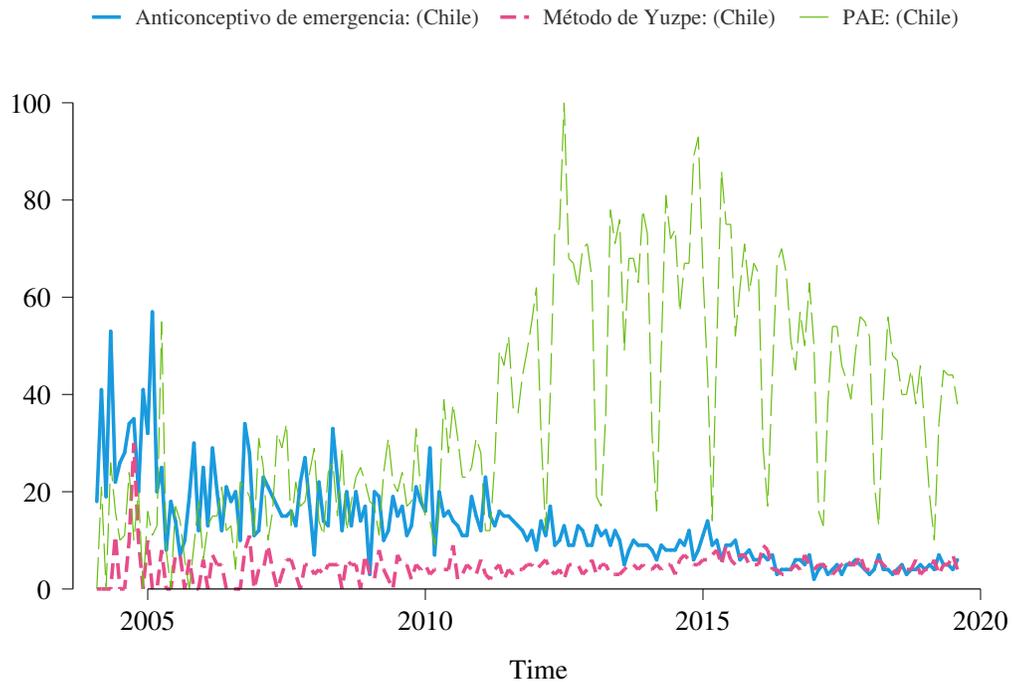
In Chile the introduction of the EC pill was complex, with an extended period in which the EC pill was available in only certain municipalities. As with a number of historical legislative initiatives in the country related to either reproductive health or marriage, more conservative sectors blocked the action of more progressive sectors resulting in piecemeal reforms. In the particular case of the EC pill, the first discussions and administrative inquires took place in 2001, but only in 2005 the Supreme Court determined that it was constitutionally valid for the EC drug to be included in the national pharmaceutical register. Detractors quickly challenged this decision, presenting cases both before ordinary and Constitutional Tribunal (Casas Becerra, 2008; Dides Castillo, 2006). Between

²⁶This method is known as the Yuzpe regime. There is clear evidence showing that the Yuzpe regime is less effective than the levonorgestrel treatment available in the EC pill (Task Force on Postovulatory Methods of Fertility Regulation, 1998). Randomised Control Trial estimates suggest levonorgestrel drugs have 87% effectiveness, while the Yuzpe method has only 57% effectiveness in preventing pregnancy. Nevertheless, the Yuzpe method can always be followed provided the oral contraceptive pill is available, even in the absence of legal availability of the EC pill. In general, data based on google searches provided in Appendix Figure B1 suggests no substantial change in rates of search for this method in the country around the time of the roll-out of the EC pill.

²⁷The International Consortium for Emergency Contraception (2019) currently lists 47 countries with no EC pill availability, spanning Africa, Asia, South America and Europe.

2005 and 2008, a number of legislative findings meant that the EC pill was sporadically available, either for purchase in private pharmacies or disbursement in state run clinics, however these periods were typically short-lived, with restrictions on availability, or with inconsistent stocks available. For example, until February 2007, the EC pill was only available from the public health service in the case of rape (Nuevo-Chiquero and Pino, 2019). A more complete description of this period from 2005 to 2008, including a brief period of legality, is available in Nuevo-Chiquero and Pino (2019) and in Bentancor and Clarke (2017, Appendix B).

Figure B1: Frequency of Search on Google for Certain Terms, Chile 2004-2019



Notes: Each line documents the intensity of search based on google trends data for 3 terms. These are (a) “Anticonceptivo de emergencia” (blue solid line) which is “emergency contraceptive” in English, (b) “Método de Yuzpe” (dashed pink line) which is Yuzpe Method in English, and (c) “PAE” (thin green line) which refers to “Pildora Anticonceptivo de Emergencia” the common term for the Emergency Contraceptive Pill in Chile. Note that the first two terms are grouped by google as a “topic” capturing any related terms, while PAE is simply a “term” which will capture any search including this term. Data is publicly available from google trends, and was consulted August 2, 2019. This graph can be replicated including future dates at the following address: <https://trends.google.com/trends/explore?date=all&geo=CL&q=%2Fm%2F04sc1,%2Fm%2F0461ns,PAE>

A key event occurred in 2008, where the country’s Constitutional Tribunal made it expressly illegal for the centralized public health system to distribute the EC pill, however did not expressly limit municipal health centres, run by local councils in nearly each of the country’s 346 municipalities, from providing the EC pill. This began a period in which each municipality, under the guidance of the municipal mayor, controlled whether the EC pill was freely available upon request from local primary care clinics (Dides et al., 2009; Dides C. et al., 2010, 2011). In practice, about half of the Chilean municipalities distributed the EC pill freely and the other half refused to distribute it or

distribute it under very restrictive conditions. As we document in the body of this paper, in general usage of the EC pill has increased over time, however there was a reduction in 2010 owing to an additional finding of the government auditor (*Contraloría*) suggesting that the EC pill could not be prescribed in municipal health centres. Nevertheless, there was confusion surrounding this finding, and certain municipalities continued to prescribe the EC pill (Dides C. et al., 2011). This situation of municipal variation in availability lasted for around three years, ending due to the passage of two laws. The first of these laws (Law 20.418) was approved in January of 2010, and makes explicit that the State is obliged to provide the EC pill. However, this law was only eventually made operational in May of 2013 (Nuevo-Chiquero and Pino, 2019). The second of these laws which was made operational in September of 2011 (Law 20.533) ensures that midwives can provide the EC pill, theoretically putting an end to the municipal variation in the EC pill in Chile from this time onwards.²⁸ As we discuss in section 2 of this paper, the 2011 reform was key given that midwives are the public health professionals which provide consultations and access to the EC pill in all public health clinics with the country. Indeed, this 2011 date is the access date highlighted in the Chilean Ministry of Health's (MoH) official National Norms of Fertility (Ministerio de Salud, 2018, §A.2).

There are a number of studies examining the use of the EC pill in Chile, though with the exception of the two aforementioned papers, these are descriptive, and written in Spanish. These studies indicate that the main users of this contraceptive method are young women, most of whom are single, have no children, are students and have only had one or two sexual partners (Escobar et al., 2008). Two studies report that about a third of the EC pills disbursed in state-clinic are given to adolescents (Schiappacasse et al., 2014; Morán Faúndes, 2013). In the same vein, the number of visits to state-clinics requesting EC pills increased 11.5 times between 2009 and 2010 among women younger than 20 years old, but it only increased 0.3 times among older women (Lavanderos et al., 2016). There is also some evidence that the request of EC pills is higher in rural areas (Morán Faúndes, 2013). Recent work by Nuevo-Chiquero and Pino (2019) finds that the availability of the EC pill has no significant impact on the age of sexual debut or more unprotected intercourse, which is consistent with the U.S. based literature, but it is significantly related to an increase in the use of modern contraceptive methods and to a decrease in the use of traditional contraceptive methods. The authors find that this is driven by an 'information channel' with health care providers advising on the use of alternative methods in the future when women visit to request the pill. All of these effects are stronger among adolescents (Nuevo-Chiquero and Pino, 2019).

²⁸In the period under study, abortion was completely illegal in Chile. In 2017 a law was passed allowing abortion in cases of severe risk to the mother's life, when the fetus is inviable, that is to say, it will not survive the pregnancy, or in cases of rape, but only during the first 12 weeks of pregnancy. EC was then, and to a certain extent still is, the only legal way to avoid an unwanted pregnancy after unprotected intercourse.