Do all roads lead to the same destination? Proximity to abortion providers, abortions and their conditions in Portugal*

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Abstract

Portugal legalized abortion in 2007, making it available through the National Health Service (NHS) free-of-charge. This paper analyzes how variations in proximity to an abortion provider affect the probability of aborting and the conditions under which abortions occur, namely when, where, and how. We find suggestive evidence that there are fewer abortions among women living further away from a provider relative to women living closer. We also find evidence that *(i)* these women abort later, *(ii)* are more likely to be referred by public hospitals to private clinics and, consequently, *(iii)* have an increased risk of aborting surgically, an invasive procedure which is more costly than the medical method.

JEL Codes: I11, I12, J13

Keywords: Abortion Access; Abortion Care; Family planning.

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1. INTRODUCTION

Women undergoing unsafe abortion are at a higher risk of having health problems or even dying (Grimes et al. 2006). The World Health Organization (WHO) has defined the elimination of unsafe abortion as one of its top five priorities of its global reproductive health strategy (WHO 2004). Legalizing abortion was shown to be an effective way to decrease maternal mortality and morbidity (Clarke and Mühlrad 2021), and, indeed, since 2007, when Portugal made abortion legal and fully subsidized, there has been a decrease in the number of abortion-related deaths. Between 2001 and 2007, there were, on average, two deaths per year – out of an estimated number of 20,000 yearly illegal abortions –while, between 2008 and 2014, a total of two deaths were registered in seven years – for this period, the annual number of abortions ranged between 16,762 and 20,480 (Vicente 2020). However, the legal status of abortion is not the only dimension of access at stake. As Grimes et al. (2006) point out: "enabling abortion legislation is necessary but not sufficient: a new law might not translate into widespread access to safe services" (p. 6).

One important dimension is the actual distance to a provider, which can be seen as the physical, logistical, and emotional cost faced by women when traveling to an abortion facility (Kimport 2022). Increases in this cost render abortion more difficult to obtain, and thus, likely influence not only whether women abort (Kane and Staiger 1996), but also the conditions under which they abort, namely when (Bitler and Zavodny 2001; Lindo et al. 2020), where, and how. This is, of course, relevant for the well-being of women. In fact, not being able to abort can lead to worse present and future financial and economic conditions (Miller et al. 2020). Furthermore, when a woman is able to abort, "any delay increases the risk of complications" (Cates et al. 1977:268). Given that later abortions are more demanding in terms of logistics and training of healthcare professionals (Harris 2008), delays may also reduce the number of available abortion providers. In addition, as medically induced abortions lose efficiency after the ninth week of pregnancy (Winikoff et al. 2008), delays may lead to the use of surgical abortion, a less time-consuming method but an invasive and more costly procedure.[1]

The role of proximity to abortion services in affecting whether women abort is a growing topic in applied economics. Quast et al. (2017), Fischer et al. (2018), Lindo et al. (2020), Venator and Fletcher (2021), and Myers (2021) document that the number of abortions in U.S. counties fell in response to increases in the travel distance to the nearest provider. However, there is not much research on how proximity affects when, where, or how women abort. To the best of our knowledge, only Lindo et al. (2020) address how being close to a provider affects when abortions occur.

In this paper, not only do we analyze the association between proximity to a provider and whether and when women abort, but we also consider how proximity affects other characteristics of abortions such as where they take place – with a public hospital or a private clinic – and how they are performed – using the medical or surgical method.

To measure proximity, we use the travel time from the women's municipality of residence to the nearest abortion provider. In Portugal, travel times to the nearest abortion provider have varied over time due to the shutdowns and openings of abortion services. To examine how changes in travel time affects abortion numbers and their conditions, we rely on an individual-level dataset of all abortions occurring in Portugal between 2008 and 2016. It contains information on the number of weeks of gestation at the time of abortion and women's socioeconomic characteristics, including their municipality of residence. Together with the information on the location of abortion providers throughout time, this allows us to compute the travel time from the populational center of each municipality to the nearest abortion provider. We find that living far away from a provider is associated with fewer abortions in the

[1] The Portuguese General-Directorate of Health recommends the use of the surgical method to terminate pregnancies above nine weeks of gestation (DGS 2007a).

area of residence and also with aborting later. Moreover, these late abortions appear to be primarily caused by late arrivals to abortion care. For abortion services, it may prove challenging to accommodate women at later gestational ages, within the legal time limits, and to use the medical method since it is more time-consuming than the surgical procedure but non-invasive and less costly.[2] The challenge is particularly difficult for public hospitals, which are chronically short of healthcare professionals who are not conscientious objectors (Oliveira da Silva 2009). As a consequence, they have the incentive to refer women to private clinics that predominantly use the surgical method. We provide evidence of this mechanism by showing that longer trips to a provider are associated both with a higher likelihood of being referred from a public hospital to a private clinic and with a greater risk of having a surgical abortion. Although abortion supply might be partially determined by demand, in the Discussion section, we show that our results are unlikely to be driven by the endogeneity of the travel time to the nearest abortion provider. Finally, even though women living far away are at a higher risk of having the more costly surgical abortion, a back-of-the-envelope calculation suggests that providing proximity abortion services through the NHS would only save a limited amount of public money. However, this would reduce the individual burden of having to undergo a late and invasive abortion.

This paper contributes to the economic literature studying how abortion access, in particular proximity, affects abortion rates. Theoretically, decreased access to abortion should reduce the number of abortions through two different channels (Kane and Staiger 1996; Levine and Staiger 2002). On the one hand, pregnant women may decide to carry their pregnancy to term, as abortion becomes too costly. On the other hand, women may exert more effort to avoid

[2] For medical abortions, women need to make two to three visits to the doctor: one to take the mifepristone, and another, 48 hours later, to take Misoprostol. If abortion did not take place during the second visit, a third visit is required to check if abortion was successful (DGS 2007b). As for surgical abortions, women only need to make one trip to the doctor. However, as it is a surgical procedure, it demands more hospital resources, namely an operating room and an anesthesiologist (DGS 2007c).

pregnancy, leading to fewer pregnancies and, consequently, fewer abortions (Kane and Staiger 1996; Levine and Staiger 2002). Both theoretical predictions find support in empirical studies, most of which rely on natural experiments conducted in the USA as a source of exogenous variations in abortion access. Cook et al. (1999) take advantage of North Carolina's intermittent reimbursement of abortion procedures throughout the year – that randomly left some women uncovered – to show that unexpected funding restrictions reduce the number of abortions. Quast et al. (2017), Fischer et al. (2018), Lindo et al. (2020), and Venator and Fletcher (2021) exploit restrictive abortion laws that led to drastic reductions in the number of abortion clinics in Texas and Wisconsin and show that increasing the distance to an abortion provider reduces abortion rates. Recently, Myers (2021) used variation in distances to the nearest provider across the entire United States to find similar impacts to the ones found for Texas and Wisconsin. In our paper, we explore a setting where, unlike the United States, a universal health care system provides abortions free-of-charge and where traveling is the only tangible cost faced by women. In Portugal, the time constraint is particularly relevant since the legal gestational age limit for abortion is only ten weeks, the lowest among high-income countries (Popinchalk and Sedgh 2019). To our knowledge, together with Brooks and Zohar (2021),[3] this is also one of the few papers using non-US data to examine how abortion access affects the number of abortions.

Our paper also contributes to the literature on how barriers to abortion affect its timing. The intuition is that women with deprived access may need more time to reach abortion services, hence delaying abortions (Lindo et al. 2020). For the United States, a number of state-specific studies find that women abort later when facing mandatory reflection periods (Joyce and Kaestner 2001; Lindo and Pineda-Torres 2019), or the need to obtain parental consent (Joyce and Kaestner 2001), or congested abortion services (Lindo et al. 2020; Kelly 2020). However,

[3] Brooks and Zohar (2021) examine how expanding access to free abortion in Israel affected abortion rates. They find that abortions increased in response to this policy, while the probability to become pregnant was not affected.

it is unclear how proximity affects abortion timing (Lindo et al. 2020). In the present paper, we find suggestive evidence that living far away from a provider leads women to abort later. As far as we know, we are the first to examine how access affects abortion timing in a European country. We also look at the consequences that these delays cause in other aspects of the abortion process, namely where – being referred to a private clinic by a public hospital – and how women abort – medical or surgical method – which has not been tackled so far in the literature.

The structure of the paper is the following: Section 2 provides institutional background on the legal framework and distribution of abortion services in Portugal; Section 3 presents the empirical strategy; Section 4 introduces and describes the data; Section 5 provides the results, and Section 6 presents the discussion and some conclusions.

2. INSTITUTIONAL BACKGROUND

Before dwelling on how proximity to a provider affects the number of abortions and the conditions under which they occur, we must point out that in Portugal, abortion on request only became legal in 2007 (Law 16/07). The Portuguese law is quite restrictive compared to its European counterparts: it has the lowest gestational age limit among high-income countries (Popinchalk and Sedgh 2019) – ten weeks of pregnancy – and it requires a mandatory reflection period of three days, as well as parental consent for minors below the age of 16.

Upon legalization, there was a swift effort to generalize access to abortion services, either public or private. A key factor for that rapid expansion was the provision of abortions free-of-charge within the pre-existing public maternity network of the NHS, which is of universal access (Simões et al. 2017). To that end, the law determined that all public hospitals with a gynecology or obstetrics department should provide abortion services (Portaria741-A/2007).

According to the standard procedure, to access public abortion, women should first contact primary care services, which should refer these women to the regional specialized public hospital. However, it is admissible that women bypass this system and access hospital services directly (Simões et al. 2017).

However, as 85% of gynecologists in Portugal were conscientious objectors (Oliveira da Silva 2009), some hospitals could not provide abortion services, undermining the local supply of abortion and leading to discrepancies in the geographical distribution of providers, which, as we show in Figure 1, varied across time.

If public hospitals do not have abortion services or cannot promptly provide them within the legal limit of ten weeks of gestational age, hospitals must redirect women living in the area they cover toward another provider – either a public hospital or a certified private clinic. In that case, the cost of the abortion is directly paid by the hospital first contacted by the woman to that which performed the abortion – at a set price, defined by law, depending on the abortion method. Overall, in the NHS, the financing of abortion procedures, outsourced or not, is provided through each hospital's fixed budget. Hospital budgets are set according to the hospital's cost history, use, and complexity indicators (Simões et al. 2017). Women may also directly access private providers, but, in this case, they must pay for the abortion procedure themselves.

3. EMPIRICAL STRATEGY

The first goal of this paper is to understand how proximity affects the probability that women abort. Given that we do not have individual-level data for all fertile females in Portugal, but only for women who abort, to estimate how variations in travel time affects the probability to abort, we conduct an analysis on the number of yearly abortions at the municipality-level – the lowest geographical aggregation level at our disposal. Then, using individual-level data on all abortions, we examine how proximity affects the conditions under which abortion occurs, namely when, where, and how.

3.1. Number of abortions in municipalities

We start by examining how travel time affects the number of abortions among all women at the municipality-level. As some municipalities had no abortions in a number of years – as can be seen in Figure B1 (online appendix) – we use a Poisson pseudo-maximum likelihood estimator.[4,5] We estimate the model below:

$$N^{o}Abortions_{mt} = \beta_1 Time_{mt} + X_{mt}\beta_2 + \varphi_m + \zeta_t + u_{mt} \quad (1)$$

where $N^{o}Abortions_{mt}$ is the number of abortions among women living in municipality m, in year t. $Time_{mt}$ is the travel time between the the nearest abortion provider and the town hall of municipality m in year t. X_{mt} is a vector of time-varying municipal controls. φ_m and ζ_t are municipal and year fixed effects, respectively. u_{mt} is the error term. We use the number of fertile women as the exposure variable of the Fixed Effects Poisson model, which has its coefficient restricted to one.[6] The coefficient of interest is β_1, which we expect to carry a negative sign, as increases in travel time should make abortion more costly, leading women to either carry their pregnancies to term or to avoid becoming pregnant at all.

[4] The recent literature on abortion access and rates at the local level uses the Poisson pseudo-maximum likelihood estimator (Lindo et al. 2020; Fischer et al. 2018; Venator and Fletcher 2021) as, unlike other count models with fixed effects, it does not suffer from the incidental parameters problem (Cameron and Trivedi 2005).

[5] One problem of the Poisson model is that if the variance is larger than the expected value, there is a risk of underestimating the standard errors. Nevertheless, as Lindo et al. (2020) note, "while the possibility of overdispersion is the main theoretical argument that might favor alternative models, overdispersion is corrected by calculating sandwiched standard errors (Cameron and Trivedi 2005)" (p. 1148), which is what we do here.

[6] As Lindo et al. (2020), we also estimated the above model by OLS, using an Inverse Hyperbolic Sine Transformation of the dependent variable. As evidenced in Table B1 (online appendix) the results are robust to this change, both in magnitude and in statistical significance.

As a second step, to understand the potential channels in action, we analyze how travel time affects the number of abortions among pregnant women. To do so, we estimate the model described in equation (1), using the number of pregnant women as the exposure variable, which is equivalent to estimating the effect of travel time to the nearest provider on the abortion ratio – i.e. the number of abortions divided by the number of pregnancies. Again, β_1 should be either negative or zero, as increases in travel time should make abortion harder to obtain, and thus, some pregnant women may no longer be able to abort.

One potential concern with this analysis is the possibility that changes in abortion supply could be driven by changes in demand. In the discussion, we show that these concerns are unlikely to hold. In short, if providers' openings and closures are driven by demand, then past abortion rates should predict the opening or closure of clinics. We find no evidence of this in our data. In fact, given that most gynecologists are conscientious objectors, changes in supply are likely caused by changes in the composition of hospitals' medical staff. This will only pose a threat to identification if changes in the share of conscientious objectors within hospitals correlate with local trends in social norms and if changes in social norms correlate with variations in abortion demand. In that regard, we conduct event studies and show that our proxies for local social norms are stable before the openings or closures of abortion providers. Furthermore, the number of abortions in municipalities appears to be orthogonal to these proxies, which we use as controls in all regressions throughout this paper.

Finally, one could also worry that women's migration patterns are determined by their likelihood to abort and by the local level of abortion supply. As we later discuss, this is unlikely, given that most abortion services locate within public hospitals. Thus, even women who think they will never abort may still need to use a hospital with an abortion service to access other types of medical care. Furthermore, the fact that the magnitude of internal migration flows in

Portugal is small further attenuates our concerns that residential sorting may threaten the validity of our results.

3.2. Abortion conditions

We then analyze how travel time affects the conditions under which abortion takes place. Using individual-level data on women who aborted, we estimate the following model by OLS, clustering the standard errors at the municipality level:

$$Y_{imt} = \lambda_0 + \lambda_1 Time_{mt} + X_{imt}\lambda_2 + \varphi_m + \zeta_t + v_{imt} \quad (2)$$

where Y_{imt} stands for the six different outcomes related to abortion conditions of woman *i* living in municipality *m* and conceiving her pregnancy at year *t*. $Time_{mt}$ is the travel time between the nearest abortion provider and the town hall of municipality *m* where woman *i* lives, at the year of the conception of her pregnancy *t*. X_{imt} is a vector of individual controls, and ε_{imt} is the error term.

First, we examine four outcomes related to the timing of abortion, namely: i) the gestational age at the moment when women make the first contact with abortion care, ii) the number of waiting days between that moment and the abortion intervention, iii) the gestational age at the time of abortion, and iv) the probability of having an abortion after nine weeks of pregnancy, a turning point in the quality of care, as it increases the risk of complications and the use of the surgical method. In fact, over nine weeks of pregnancy the General Directorate of Health (DGS) recommends the use of the surgical method to abort (DGS, 2007a), as the efficiency of medical abortion decreases overtime (Winikoff et al. 2008). Second, we analyze where abortions occur, namely, v) the probability of being referred by a public hospital to a private clinic. Third and last, we examine how travel time affects the abortion method, namely, vi) having a surgical abortion, which is invasive, unlike the medical method. We expect the main coefficient of interest, λ_1, to be positive for these different outcomes.

4. DATA

4.1. Data sources

To carry out our investigation on the relationship between proximity and abortion numbers and conditions, we use administrative data on all who aborted in Portugal between 2008 and 2016.[7] These data were provided by the DGS (2020) and contains detailed information on women, particularly their socioeconomic characteristics, and municipality of residence, which is crucial to measure proximity to an abortion provider. This dataset also allows us to track women through important stages of the abortion process, namely the timing at which they request and obtain an abortion, the type of provider they go to, and the abortion method they use.

To obtain the location of abortion providers for each year of the analysis, we construct a list of the abortion services operating in Portugal and the bordering regions of Spain – that women living in Portugal may potentially use. This information is provided by the DGS and the Spanish Ministry of Health, respectively, in annual reports on abortion registers (DGS 2010-2017; Sanidad 2009-2018).[8] For Portugal, these reports disclose the number of abortions that each provider performed. We only consider a provider to have been in operation if it performed at least five abortions in a given year. Our results are robust to considering other thresholds, namely, having had at least one or ten abortions in a given year – see Tables B1 to B3 (online appendix). Using the name of the hospital or clinic provided in the reports, we identify the

[7] Miscarriages or involuntary abortions are not included in the abortion data.

[8] To compute travel time to the nearest Spanish provider we only consider Spanish private clinics as most abortions in Spain occur in the private sector – 91.9% in 2014 (Sanidad 2009-2018). Also, women living in Portugal are unlikely to follow the Spanish National Health System referral path since abortions abroad are not covered by the national health insurance neither in Portugal nor in Spain. For the period under study, the closest Spanish municipalities with a private abortion clinic were always Badajoz, Vigo, Huelva, Leon, Valladolid, or Salamanca, so that there is no variation in the travel time to the nearest Spanish municipality with an abortion provider.

coordinates where that abortion facility is based. Because of the 2018 General Data Protection Regulation, the DGS stopped publishing the number of abortions per provider in their annual reports. Since the report of 2017 was only published in 2018, we do not have information on the providers operating from 2017 onwards, and we can only conduct our analysis on the 2008-2016 period.

We also gather data to characterize the socioeconomic and demographic characteristics of municipalities. The data on the yearly number of births, marriages, population by age and gender, and the regional-level per capita Gross Domestic Product (GDP) come from Statistics Portugal (2020a, 2020b, 2020c, 2020d). In addition, data on the number of people receiving unemployment benefits originate from the Portuguese Employment Office (IEFP 2008-2017).

4.2. Variables

Proximity to the nearest provider is at the core of our analysis and is measured by the travel time to the nearest abortion provider. Not knowing the exact coordinates where women live, we assume that they all live in the populational centroid of their municipality of residence, which is proxied by the coordinates of the town hall. We then compute travel times to the coordinates of the nearest abortion provider for each of the 278 municipalities in mainland Portugal between 2008 and 2016. We also calculated the travel time between each municipality and the closest Spanish municipality with a private abortion clinic – see section A.1 in the online appendix for more information on the travel time to Spanish providers' data. To compute these travel times, we use the Stata user-written GEOROUTE command (Weber and Péclat 2017). According to the specifications, travel time is introduced in the regressions either as a linear variable or as a categorical variable to account for possible non-linear effects. In the latter case, we consider three travel time bins, namely, living in a municipality *i*) within 30 minutes of an abortion provider; *ii*) between 30 minutes and one hour, and *iii*) more than one hour away from the nearest abortion provider – see Figure B2 in the online appendix for the distribution of municipalities across time bins.

When examining how travel time to the nearest provider affects the number of abortions at the municipality-level, we control for the age structure of the population, using the share of all age groups in the population of fertile-age women.[9] We also control for the economic conditions in the municipality of residence. These are proxied by the number of persons receiving unemployment benefits as a percentage of the active population in the municipality (aged 15 to 65) and by the GDP per capita growth rate in Purchasing Power Standards of the NUTS III region. Additionally, as our analysis covers a nine-year period, we consider potential changes in social norms within municipalities. As a proxy of the level of conservatism, we control for the number of marriages and catholic marriages per thousand inhabitants in the municipality. Additionally, to estimate the effect of travel time on the abortion ratio, we use the number of pregnancies as the exposure variable of the Poisson Fixed Effects model, which we compute as the number of both abortions and births occurring in a municipality, in a given year.

To examine how proximity affects the conditions under which abortion occurs, we explore a detailed individual-level dataset of all abortions in Portugal, which allows us to control for several woman specific characteristics. The control variables we use are women's marital status (married, single, widowed, divorced, and separated), cohabitation status (living with or without a partner), occupation,[10] municipality of residence, age, educational level (illiterate, knows how to read/write, primary school, lower middle school, higher middle school, high-school, and college), nationality (Portuguese or Foreign), number of previous children, and number of

[9] Each age group is defined on the basis of a five-year interval.

[10] There are ten occupational categories in the abortion dataset, namely: 1- Armed Forces (ISCO-08 major group 0); 2- Managers (ISCO-08 major group 1); 3- Professionals (ISCO-08 major group 2); 4- Technicians and associate professionals (ISCO-08 major group 3); 5- Clerical support workers, service and sales workers, and other services (ISCO-08 major groups 4 and 5); 6- Skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers (ISCO-08 major groups 6, 7, and 8); 7- Elementary occupations (ISCO-08 major group 9); 8- Unemployed; 9- Students; 10- Non-remunerated domestic workers.

previous abortions. Finally, we use the number of weeks of pregnancy at the time of abortion to estimate the date of the start of the pregnancy.

It should be noted that, in our analysis of abortion conditions, we exclude outliers. Namely, women who abort after age 60 (172 observations) – who should not be fertile anymore. We note that the 60-year-old cutoff is a conservative threshold since between 55 and 60 years old we only have one woman in our data.[11] Regarding the number of previous children, we discard women with more than 15 children (four observations) and women who aborted more than 15 times (five observations). In addition, we drop women with a negative estimated number of completed weeks of pregnancy at the time of access to abortion services. We also exclude observations with missing information on any control variable. Our final sample contains 152,124 abortions for the time period ranging from 2008 to 2016.

4.3. Descriptive statistics

In our set-up, it is essential that travel time varies within municipalities across time for its effect to be identified, as our preferred specifications have municipality fixed effects that capture all time-invariant features of municipalities. In Portugal, between 2008 and 2016, travel times from municipalities to their nearest abortion provider varied, as illustrated by Figure 1. These variations in travel time are primarily due to the shutdowns and openings of public abortion providers – that represent the vast majority of abortion providers (online appendix Figure B3). The most staggering variation occurred in the south of Portugal, where the shutdown of a provider in 2011 – later reversed in 2015 – led to increases by more than one hour in travel time for several municipalities (Figure 1).

[11] The remaining 171 observations are most likely due to miscoding of the age variable. For example, there was one women with 1419 years of age.

Tables C1 and C2 (online appendix) present summary statistics of the variables we use in the municipality-level analysis;[12] while Tables C3 and C4 (online appendix) provide the descriptive statistics of women who abort. As we can see in Table C3 (online appendix), between 2008 and 2016, 84% of abortions occurred among women living within 30 minutes of an abortion provider, 13% among those residing between 30 and 60 minutes, and 3% among women living over one hour away from an abortion provider. Upon arrival at an abortion provider, the average gestational age was 6.58 weeks, while it was 7.32 weeks at the time of the abortion. On average, women waited for 8.25 days between their first contact with abortion care and abortion, with 5% of them aborting above nine weeks of gestation. Most abortions occurred in an NHS hospital (69%) and are medically induced (68%). The proportion of abortions referred to private clinics increases from 21% – among women living within 30 minutes of a provider – to 37% – among women living over one hour away. Similarly, the proportion of surgical abortions increases from 31% among women living within 30 minutes from an abortion provider to 44% for those facing travel time over one hour. Finally, 97% of all abortions in the NHS were medically induced, whereas, in the private sector, surgical abortions represented 97%.

[12] The size of Portuguese municipalities varies widely. They range between 1721 square kilometers (Odemira) to eight (São Joao da Pesqueira). The average size is 315 square kilometers. For population statistics see Table D1 (online appendix).

5. RESULTS

5.1. Distance to an abortion provider, number of abortions and the probability to abort

We start by examining how travel times to the nearest provider affect the number of abortions at the municipality-level. In the regressions displayed in panel a of Table 1, the dependent variable is the number of abortions by all women in fertile-age – 15 to 49 years old.

All regressions include municipality fixed effects. Odd columns of Table 1 regress the number of abortions on a linear measure of travel time, while even columns use travel time as a categorical variable. In this case, the reference category is municipalities within 30 minutes of an abortion provider. The regressions in columns 3 and 4 introduce municipal time-varying controls, and columns 5 and 6 add municipality specific linear time trends. Across all linear specifications, we observe a negative – although insignificant – relationship between travel time to the nearest provider and the number of abortions in a municipality.

In the regressions using travel time categories, we find that municipalities that are over one hour away from an abortion provider experience fewer abortions, with the gap ranging from 10.97 (column 4) to 7.79% (column 6) according to the specification, always significant at least at the 5% level.[13] This suggests that long travel times to the nearest provider are associated with a reduced probability of abortion. To understand if the decrease in the number of abortions we observe is due to women living far away from a Portuguese provider aborting in Spain – country for which we have no data on abortions –, we exclude municipalities closer to a Spanish abortion clinic than to a Portuguese one – see online appendix Table B1. The results of this analysis are similar to the ones present in Table 1.

[13] Percent effects are computed in the following way: $(e^{\beta} - 1) \times 100$.

As mentioned above, women may not abort either because they avoid pregnancy or because they carry their pregnancy to term. To test the latter possibility, we examine the relationship between travel time and getting an abortion if pregnant. Again, we regress the number of abortions in the municipality on our measures of travel time. However, instead of using the number of fertile women as the exposure variable of the Fixed Effects Poisson model, we use the number of pregnancies, which is equivalent to estimating the impact of travel time on the abortion ratio. As Table 2 shows, we find evidence of a non-linear association between travel time and the abortion ratio, with municipalities over one hour away from an abortion provider having lower abortion ratios than in municipalities within half an hour of one. This negative association ranges from 12.26 (column 4) to 7.76% (column 6) (statistically significant at least at the 5% level).

Overall, these results suggest that municipalities located further away from an abortion provider experience fewer abortions and that some pregnant women living in those municipalities are unable to abort as a result of hindered access to abortion care.

5.2. Proximity and the conditions under which abortion takes place

In the section above, we provided evidence that pregnant women living far away from a provider abort less. In this section, we will examine if proximity also affects the conditions under which abortion takes place.

We first analyze the timing of abortion. It arguably depends both on when women request an abortion and on the waiting time to get it. In columns 1 and 2 of Table 3, we estimate equation (2) for the number of weeks pregnant at the time of the first contact with abortion care. In our linear specification in column 1, we find no statistically significant association between travel time to the nearest provider and the gestational age at the time of access to abortion services. However, in our non-linear specifications in column 2, we find that women living over one hour away from the nearest abortion service arrive two days later in the course of their pregnancy than women living within 30 minutes of a provider (statistically significant at the 1% level). Moreover, these women experience longer waiting periods between the first contact with abortion care and abortion (columns 5 and 6). Overall, the combined effect of travel time on both later arrivals to abortion care and on waiting days leads women living over one hour away from a provider to abort two and a half days later than the reference group (columns 3 and 4).

In columns 7 and 8, we analyze how travel time affects the probability of having an abortion beyond nine weeks of pregnancy – which we refer to as late abortions. Again, in our categorical specification in column 8, we find evidence of an association between travel time and aborting later. We estimate that, relative to living within 30 minutes away from a provider, women living between 30 minutes and one hour away have a 112%[14] higher probability to abort after nine weeks of gestation, while women living over one hour away have a 103% higher probability of late abortion. Both estimates are significant at the 1% level.

With only ten weeks to abort legally, the delays we observe can explain why regions with low access to abortion have lower abortion ratio, as women may be requesting abortions too late. These delays can also have repercussions at other stages of the abortion process, namely, on where and how abortions occur. Public hospitals attending women near the legal gestational age limit may encounter difficulties providing abortion in due time. We find evidence of this in columns (9) and (10), where we consider the probability of being referred to a private clinic by the NHS when one wants to abort. This probability increases indeed with the travel time to an abortion provider, whatever the specification we use.

[14] This percentage is computed as follows: (point estimate × 100)/(% Late abortion among women residing within 30 min of a provider) = (0.0564 × 100)/5 = 112%

As mentioned before, private clinics almost exclusively perform surgical abortions. The increased likelihood of referral by the NHS to private clinics, together with the higher probability of aborting after nine weeks of pregnancy, can arguably lead women who live further away from a provider to be more prone to surgical abortion. Our findings are consistent with this mechanism. In column 11, we find that an increase by 15 minutes in travel time is associated with an increase by 9.8 percentage points – i.e. a 31% increase – in the probability of having a surgical abortion, significant at the 1% level. When exploring possible non-linear effects, we find that living between 30 and 60 minutes away from a provider is associated with a 82% increase in the probability of having a surgical abortion, while living over one hour away is associated with a 172% increase.

These findings suggest that living far away from a provider makes it more difficult to obtain an abortion and may even prevent pregnant women from aborting. It takes more time for them to reach an abortion provider, making them more likely to have a late abortion. In a setting where abortions are only legal until ten weeks of pregnancy, these delays may impede women from accessing aborting services in due time. Moreover, aborting late leads women to be referred by the NHS to private clinics and eventually have a surgical rather than a less invasive medical abortion.

6. DISCUSSION AND CONCLUSION

In this paper, we provide evidence that proximity to abortion services is an important dimension of abortion access that affects the obtainment of abortion and the conditions under which it occurs. However, one could be concerned by the fact that changes in proximity are not random. In what follows, we discuss whether such changes are likely to be endogenous. We also provide a back-of-the-envelope estimate of the potential savings that the NHS could make by providing proximity abortion care to all women in Portugal. We conclude with a brief overview of our findings and potential avenues for future research.

6.1. Causal interpretation of the estimates

Our estimates of the effect of travel time on the extensive and intensive margin of the probability to abort could suffer from endogeneity biases. The first worry is that variations in abortion demand may determine variations in abortion supply. This would generate an upward bias in our estimates of the effect of travel time to the nearest abortion provider on the number of abortions in municipalities and on the abortion ratio. We show, in what follows, that we do not find evidence of this in our data. If providers reacted to demand, past variations in the abortion rate should predict the opening or closure of a provider. To test for this, we construct a provider region-by-year panel by aggregating the number of abortions occurring within each provider's catchment area, which we define as all municipalities that, at some point in time, were closer to that provider than to any other. We then define a dummy variable equal to 1 if the provider status changed from open to closed or the other way round, and 0 otherwise. We regress this dummy variable on the absolute value of the variation in the abortion rate – the number of abortions per 10,000 fertile women – in the provider's region. We find no evidence that variations in the abortion rate of catchment areas predict opening or closure of abortion providers, even when controlling for two lagged values of our variable of interest – see Table B4 (online appendix). The event studies presented in section D (Figures D1 and D2 in the online appendix) further support this conclusion. This suggests that the provision of abortion services does not change in reaction to demand.

The real limitation in providing abortion services is the availability of doctors and nurses since most gynecologists in Portugal are conscientious objectors (Oliveira da Silva 2009).[15] This raises the concern that changes in norms may simultaneously affect abortion demand and supply. If conscientious objectors choose to work in growingly conservative areas where abortion demand is decreasing, then our estimates of the effect of travel time on the number of abortions will again be upward biased. However, we find no evidence of this in our data. In the event studies that we conduct in section D of the online appendix (Figures D3 and D4), we do not observe any changes in social norms – which we proxy by the number of marriages and catholic marriages per thousand inhabitant – before the closures or openings of abortion providers. Furthermore, to test whether these proxies of social norms are correlated with local abortion rates, we regress the number of abortions in municipalities on municipality fixed effects only. We then extract the residuals and regress them on all the control variables we use in the municipality-level analysis. As evidenced in Table B5, the number of abortions appears to be uncorrelated with our proxies of the local level of conservatism.

The other potential source of bias is residential sorting. If women who believe they will never abort choose to live further away from an abortion center, we will not be able to tell apart the effects of travel time to the nearest abortion provider from those of preferences. However, since most abortion centers are located within hospitals that provide a variety of health care services in addition to abortion, this is highly unlikely. As a matter of fact, women may still have to go to a hospital because of other health conditions even if they exclude that they will ever need an abortion. Also, the 2011 Census shows that from 2005 to 2011, only 8.5% of Portuguese families migrated across Portuguese municipalities (Gomes et al. 2019). Hence, between 2008

[15] Even in areas with high abortion demand, such as Lisbon, it is difficult to open abortion services due to the lack of non-conscientious objecting medical staff. For example, Lisbon's Hospital university, one of the largest hospitals in Portugal, had to stop providing abortions for one month due to lack of specialized nurses willing to perform abortions. https://www.publico.pt/2018/01/12/sociedade/noticia/hospital-santa-maria-encaminha-abortos-para-clinica-privada-por-falta-de-enfermeiros-1799111

and 2016 most Portuguese women resided in the same municipality where they lived in 2007, when abortion was legalized by referendum. It is doubtful that women chose their home location based on the expectation of how far their house would become from a legal abortion provider, in case the "Yes" vote would win in the referendum.

A last concern about selection could arise if the preferred abortion timings or methods of women who do not abort because they became too far from a provider differ from those who abort. However, if selection is the mechanism driving our results because longer travel times reduce the number of women who abort, we should observe a change in the share of late or surgical abortions but no positive effect on the overall number of late and surgical abortions. To check for this, in line with Kelly (2020), we regress the number of abortions in each municipality according to referral type, gestational age, and method on our measures of travel time to an abortion provider. We find that longer travel times increase the number of late and surgical abortions in municipalities – see Table B6 (online appendix). This suggests that selection does not drive the effects of travel time on abortion conditions.

6.2. Medical vs. Surgical abortion costs: back of the envelope calculation

We now discuss how our results may contribute to assess the efficiency of the current organization and financing of abortion care in Portugal.

Our findings suggest that women who live further away from a provider are more likely to abort late, be referred by the NHS to a private clinic, and have a surgical abortion. As mentioned in section 2, the NHS can outsource abortions to private clinics. Surgical abortions are more costly to provide and are reimbursed at a higher rate than medical abortions. As living further away from a provider increases the risk of having a surgical abortion, it is interesting to estimate how much the NHS would spend on abortion procedures in a hypothetical scenario where no woman would be more than 30 minutes away from an abortion service, as compared to what it currently spends.

Bringing women closer to an abortion provider would have increased the number of abortions in Portugal. According to our estimates, in that scenario, municipalities over one hour away from a provider would have had 7.8% more abortions between 2008 and 2016, i.e. 410 additional abortions. Thus, the total number of abortions would have been 152,534 instead of 152,124. As 92% of women access abortion care through the public services, this would have resulted in 140,331 women accessing abortion through the NHS, instead of 140,207.

In parallel, bringing women closer to abortion providers would reduce the risk of aborting surgically. As shown in Table D3 (online appendix), 26% of women who accessed public abortion services and lived within 30 minutes of a provider had a surgical abortion. Transporting this proportion to our hypothetical scenario, there would have been a total of 36,486 surgical abortions instead of 38,603 (respectively, 103,845 medical abortions instead of 102,265). Therefore, in our scenario, the NHS would have paid for 2,117 fewer surgical abortions and 1,580 more medical abortions. Assuming an average cost of 400 euros per surgical procedure and 300 euros per medical abortion,[16] this would have translated into a reduction in abortion spending by 372,800 euros over nine years.

If expanding abortion services required building new facilities or recruiting professionals in the NHS, the costs of making all women within 30 minutes of a provider likely exceeded the potential savings. The 358,450 euros saved on abortion costs indeed do not even allow employing one more entry-level general practitioner (GP) over ten years.[17] Nevertheless, to

[16] Between 2008 and 2016 the reimbursement rates of surgical abortions ranged from 368 to 444 euros, while medical abortions were reimbursed at a rate ranging from 283 to 368 euros (Portaria n.8781-A/200; Portaria n.163/2013; Portaria n.20/2014; Portaria n.234/2015).

[17]As of 2012, entry-level specialized doctors in the public sector earn a gross annual income of 38,447.36 euros (Acordo Coletivo de Trabalho n.5/2012).

promote equitable access to abortion, the NHS could take advantage of its already existing primary care network since, according to the WHO, medical abortions are not demanding in terms of expertise or equipment and can be provided by nurses and GPs (WHO 2012). In fact, this solution has already been implemented in three health care centers in Portugal.[18]

6.3. Conclusion

This paper shows that proximity to an abortion provider is likely to affect whether or not women are able to get an abortion in due time. We show that Portuguese municipalities that are more than one hour away from the nearest provider have 7.8% fewer abortions than municipalities located within 30 minutes.

We also document that proximity affects the conditions under which abortions occur. We show that women living further away from a provider abort later in their pregnancies and that this delay is primarily caused by their later arrivals at abortion services, possibly due to ignorance of how to access them. Late abortions make it difficult for public hospitals to provide abortions within the legal gestational age limit of 10 weeks, forcing them to outsource abortions to private clinics, where 97% of abortions are surgical. This likely explains why we find that women living further away from providers are more likely to be referred to private clinics and to have a surgical abortion.

Finally, a back-of-the-envelope calculation indicates that the NHS can only expect limited savings on abortion spending from providing proximity abortion care to all women in Portugal. However, this would enable more women to access to abortion within the legal gestational limit, while allowing those who abort to escape invasive surgical abortions, thereby improving their health-related welfare.

[18] In the health care centers of Amarante, Penafiel, and Viana do Castelo.

Recently, the COVID-19 pandemic has disrupted healthcare provision globally, and abortion care was no exception. This led some countries to relax abortion legislation – such as gestational age limits, mandatory reflection periods, or even enabling women to abort from home – while others did not or even made abortion more difficult to access (Moreau et al., 2020). This natural experiment will provide a valuable opportunity to investigate how varying access to abortion impacts abortion decisions and conditions in the context of deprived access to healthcare facilities.

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Figure 1 Provision of abortion across municipalities and travel time to the nearest abortion provider

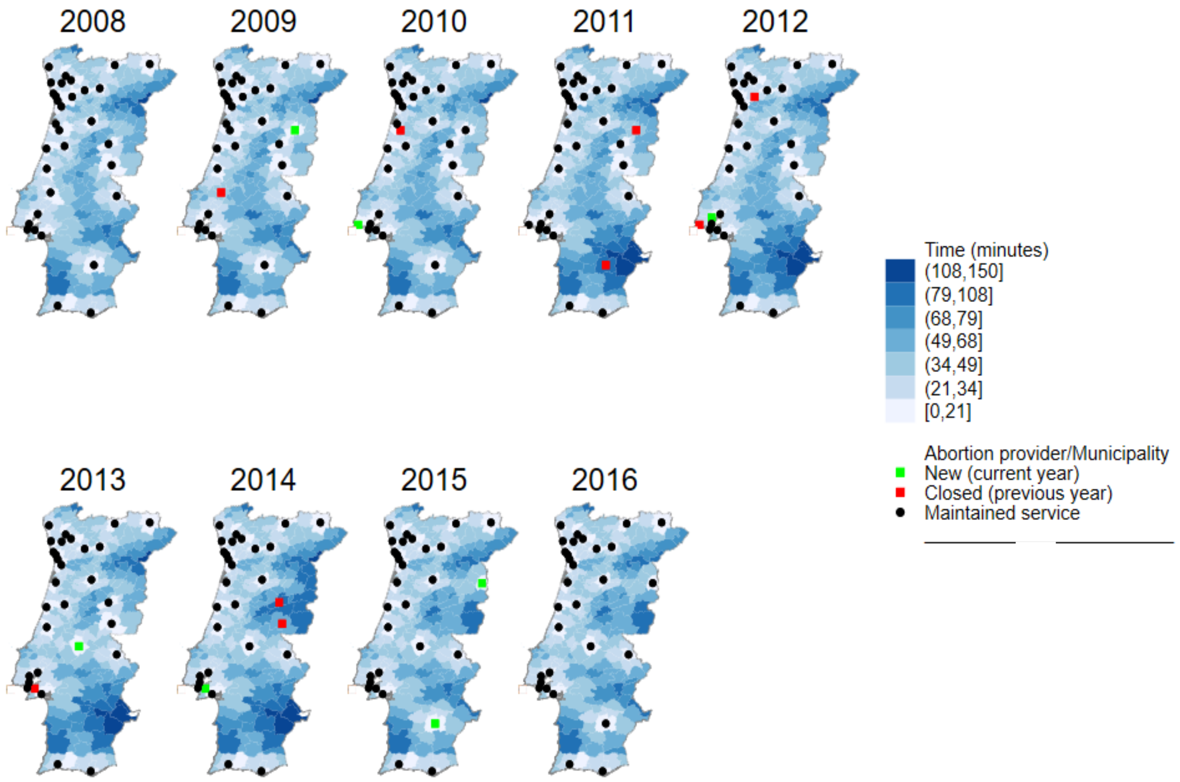


Table 1 Number of abortions and access to abortion

	Number of abortions in municipality					
	(1)	(2)	(3)	(4)	(5)	(6)
Linear travel time						
Travel time (min.)	-0.0009		-0.0010		0.0000	
	(0.0006)		(0.0006)		(0.0007)	
Bins of travel time						
(Ref: within 30min.)						
30 to 60min.		0.0124		-0.0039		0.0575
		(0.0411)		(0.0432)		(0.0482)
Over 60min.		-0.1162***		-0.1431***		-0.0812**
		(0.0348)		(0.0365)		(0.0361)
Observations	2,502	2,502	2,502	2,502	2,502	2,502
Municipalities	278	278	278	278	278	278
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Includes controls	No	No	Yes	Yes	Yes	Yes
Municipality specific time trend	No	No	No	No	Yes	Yes

Notes: All regressions were estimated by Poisson quasi-maximum likelihood in which the exposure variable is the number of fertile-age women in the municipality. All regressions have year and municipal fixed effects. Odd columns present access linearly, while even columns present access categorically. Columns 3-4 introduce time-varying control variables namely the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages and catholic marriages per thousand inhabitants in the municipality. Columns 5-6 have municipality specific time trends. Robust standard errors in parenthesis. * p <.1; ** p <.05; *** p <.01

Table 2 Abortion ratio and access to abortion

	Number of abortions in municipality					
	(1)	(2)	(3)	(4)	(5)	(6)
Linear travel time						
Travel time (min.)	-0.0009*		-0.0011**		-0.0003	
	(0.0005)		(0.0005)		(0.0006)	
Bins of travel time						
(Ref: within 30min.)						
30 to 60min.		-0.0305		-0.0328		0.0390
		(0.0399)		(0.0398)		(0.0440)
Over 60min.		-0.1308***		-0.1460***		-0.0808**
		(0.0317)		(0.0321)		(0.0337)
Observations	2,502	2,502	2,502	2,502	2,502	2,502
Municipalities	278	278	278	278	278	278
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Includes controls	No	No	Yes	Yes	Yes	Yes
Municipality specific time trend	No	No	No	No	Yes	Yes

Notes: All regressions were estimated by Poisson quasi-maximum likelihood in which the exposure variable is the number of pregnant women in the municipality. All regressions have year and municipal fixed effects. Odd columns present access linearly, while even columns present access categorically. Columns 3-4 introduce time-varying control variables namely the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages and catholic marriages per thousand inhabitants in the municipality. Columns 5-6 have municipality specific time trends. Robust standard errors in parenthesis. * p <.1; ** p <.05; *** p <.01

Table 2 Conditions under which abortion occurs and abortion access

	Number of weeks pregnant				No. of waiting days		Having abortion over 9 weeks		NHS referral to private clinic		Having surgical abortion	
	First contact with services		Abortion intervention				Yes		Yes		Yes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Linear travel time												
Travel time in min.	0.0012		0.0018		0.0043		-0.0000		0.0072***		0.0065***	
	(0.0014)		(0.0016)		(0.0031)		(0.0004)		(0.0006)		(0.0006)	
Bins of travel time												
(Ref: within 30min.)												
30 to 60min.		0.1434		0.1611*		0.0880		0.0564***		0.3132***		0.2532***
		(0.0990)		(0.0906)		(0.2183)		(0.0192)		(0.0667)		(0.0551)
Over 60min.		0.2813***		0.3478***		0.4650**		0.0515***		0.5841***		0.5318***
		(0.0602)		(0.0537)		(0.2251)		(0.0123)		(0.0866)		(0.0784)
R^2	0.0685	0.0686	0.0943	0.0945	0.1234	0.1234	0.0431	0.0432	0.7588	0.7580	0.6070	0.6065
Observations	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	140,868	140,868	152,124	152,124

Notes: All regressions were estimated by OLS. All regressions include municipality specific time trends and have year of age, occupation, education, number of children, number of previous abortions, nationality, cohabitation, year and municipality-level fixed effects. All regressions also control for the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages, and catholic marriages per thousand inhabitants in the municipality. Odd columns present access linearly, while even columns present access categorically. Robust standard errors in parenthesis. * p <.1 ; ** p <.05; *** p <.01

ONLINE APPENDIX

A Descriptive statistics: figures

Figure A1 Number of municipalities with zero abortions

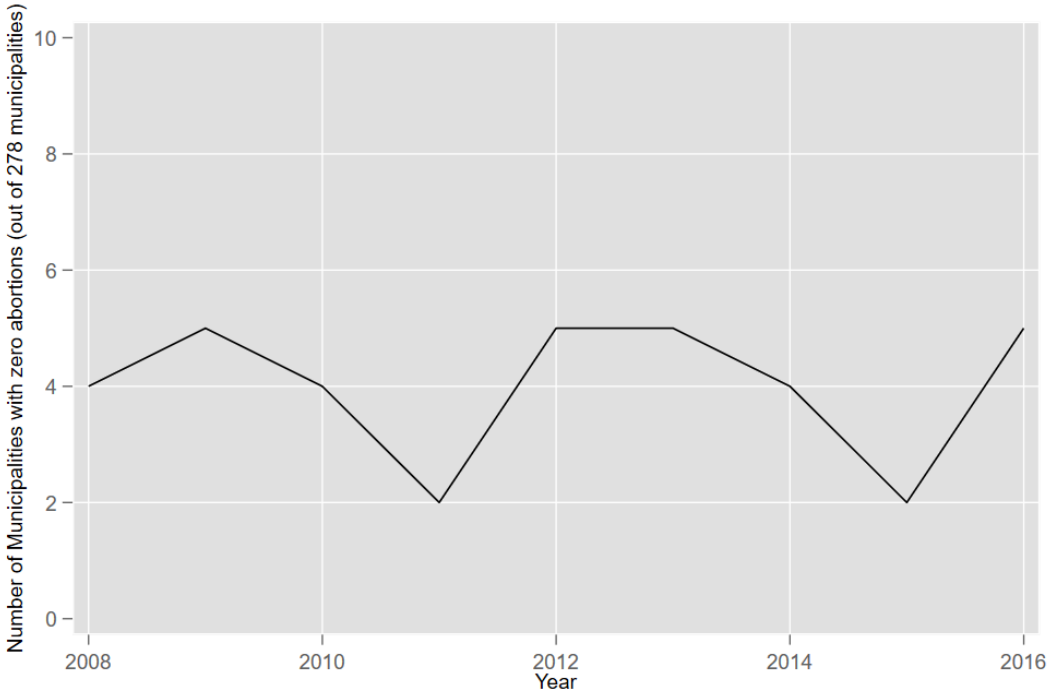


Figure A2 Number of municipalities travel time bin

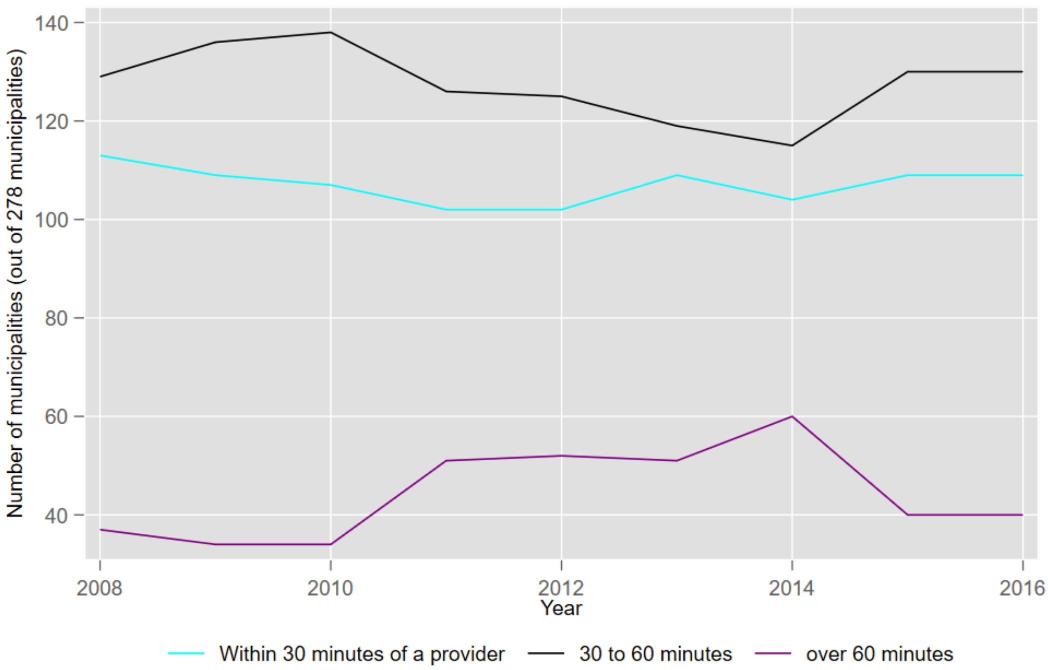
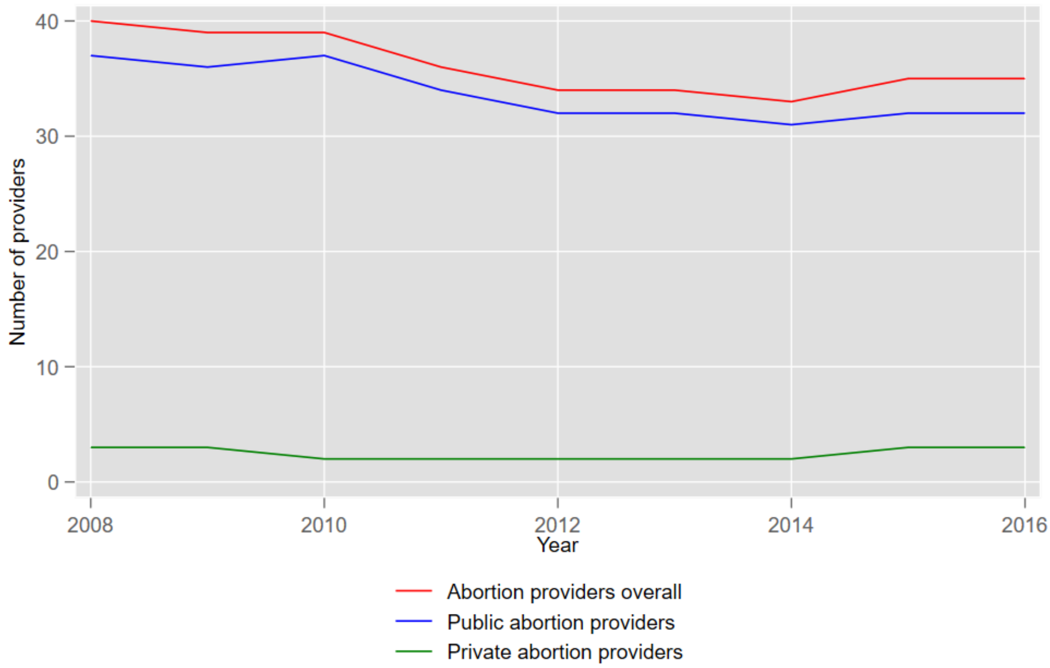


Figure A3 Number of providers by type of abortion provider



B Robustness checks

Table B1 Abortions and access to abortion

Outcome:	Number of abortions in municipality						$\log\left(\frac{No.Abortions \times \sqrt{No.Abortions^2+1}}{No.Women}\right)$	
	Excluding municipalities closer to a Spanish provider than to a Portuguese one		Provider open if performs more than 1 abortion		Provider open if performs more than 10 abortions			
	(1)	(2)	(3)	(4)	(5)	(6)	(9)	(10)
Linear travel time								
Travel time (min.)	0.0004		0.0001		-0.0001		-0.0007	
	(0.0007)		(0.0006)		(0.0006)		(0.0008)	
Bins of travel time								
(Ref: within 30min.)								
30 to 60min.		0.0470		0.0292		0.0576		0.0292
		(0.0505)		(0.0549)		(0.0471)		(0.0549)
Over 60min.		-0.0682*		-0.0858**		-0.0834**		-0.0881*
		(0.0356)		(0.0341)		(0.0351)		(0.0526)
Observations	2,369	2,369	2,502	2,502	2,502	2,502	2,502	2,502
Municipalities	265	265	278	278	278	278	278	278
Estimation	Poisson FE	Poisson FE	Poisson FE	Poisson FE	Poisson FE	Poisson FE	OLS	OLS

Notes: All regressions estimated by Poisson quasi-maximum likelihood have the number of fertile-age women in the municipality as the exposure variable, while OLS regressions are weighted by the average number of fertile-age women between 2008 and 2016. All regressions control for the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages and catholic marriages per thousand inhabitants in the municipality. All regressions also include year and municipality-level fixed effects, as well as a municipality specific time trends. Robust standard errors in parenthesis. * p <.1; ** p <.05; *** p <.01

Table B2 Conditions under which abortion occurs and abortion access: Criteria of open provider = at least 1 abortion

	Number of weeks pregnant				No. of waiting days		Having abortion over 9 weeks		NHS referral to private clinic		Having surgical abortion	
	First contact with services		Abortion intervention				Yes		Yes		Yes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Linear travel time												
Travel time in min.	0.0011		0.0016		0.0035		0.0001		0.0071***		0.0063***	
	(0.0014)		(0.0016)		(0.0031)		(0.0003)		(0.0007)		(0.0006)	
Bins of travel time												
(Ref: within 30 min.)												
30 to 60 min.		0.0869		0.1107		0.0943		0.0486***		0.2264***		0.1802***
		(0.0715)		(0.0680)		(0.1635)		(0.0145)		(0.0691)		(0.0570)
Over 60 min.		0.2491***		0.3069***		0.3599		0.0514***		0.5578***		0.5145***
		(0.0587)		(0.0580)		(0.2350)		(0.0115)		(0.0862)		(0.0771)
R^2	0.0685	0.0686	0.0943	0.0944	0.1233	0.1234	0.0431	0.0432	0.7587	0.7577	0.6070	0.6064
Observations	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	140,868	140,868	152,124	152,124

Notes: All regressions were estimated by OLS. All regressions include municipality specific time trends and have year of age, occupation, education, number of children, number of previous abortions, nationality, cohabitation, year and municipality-level fixed effects. All regressions also control for the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages, and catholic marriages per thousand inhabitants in the municipality. Odd columns present access linearly, while even columns present access categorically. Robust standard errors in parenthesis. * p <.1 ; ** p <.05; *** p <.01

Table B3 Conditions under which abortion occurs and abortion access: Criteria of open provider = at least 10 abortions

	Number of weeks pregnant				No. of waiting days		Having abortion over 9 weeks		NHS referral to private clinic		Having surgical abortion	
	First contact with services		Abortion intervention				Yes		Yes		Yes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Linear travel time												
Travel time in min.	0.0011		0.0016		0.0044		0.0001		0.0069***		0.0062***	
	(0.0014)		(0.0016)		(0.0029)		(0.0003)		(0.0007)		(0.0006)	
Bins of travel time												
(Ref: within 30 min.)												
30 to 60 min.		0.1356		0.1543*		0.0759		0.0547***		0.3100***		0.2520***
		(0.0976)		(0.0898)		(0.2162)		(0.0190)		(0.0672)		(0.0557)
Over 60 min.		0.2528***		0.3192***		0.4819*		0.0521***		0.5538***		0.5055***
		(0.0650)		(0.0605)		(0.2120)		(0.0121)		(0.0858)		(0.0778)
R^2	0.0685	0.0686	0.0943	0.0944	0.1234	0.1234	0.0431	0.0432	0.7585	0.7577	0.6068	0.6063
Observations	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124	152,124

Notes: All regressions were estimated by OLS. All regressions include municipality specific time trends and have year of age, occupation, education, number of children, number of previous abortions, nationality, cohabitation, year and municipality-level fixed effects. All regressions also control for the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages, and catholic marriages per thousand inhabitants in the municipality. Odd columns present access linearly, while even columns present access categorically. Robust standard errors in parenthesis. * p <.1 ; ** p <.05; *** p <.01

Table B4 Abortion supply and variations in abortion rates

	Probability of change in abortion provision status (equal to 1 if opened or closed and 0 otherwise)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel a: No year or Provider's Catchment Area Fixed Effects							
Absolute value of the variation in the abortion rate							
Between year T-1 and T	0.2758			0.1948	-0.2228*		-0.2165
	(0.2567)			(0.2474)	(0.1350)		(0.1440)
Between year T-2 and T-1		0.0207		-0.0191		-0.0200	-0.0157
		(0.0632)		(0.0539)		(0.0575)	(0.0637)
Between year T-3 and T-2			-0.1268		-0.1227	-0.1161	-0.1195
			(0.0932)		(0.0917)	(0.0965)	(0.0951)
R^2	0.0206	0.0001	0.0057	0.0099	0.0123	0.0066	0.0124
Observations	296	259	222	259	222	222	222
Panel b: With Provider's Catchment Area Fixed Effects							
Absolute value of the variation in the abortion rate							
Between year T-1 and T	0.2895			0.2681	-0.1830		-0.1794
	(0.2587)			(0.2569)	(0.1585)		(0.1599)
Between year T-2 and T-1		0.0159		0.0069		-0.0307	-0.0197
		(0.0577)		(0.0575)		(0.0652)	(0.0676)
Between year T-3 and T-2			-0.1331		-0.1505	-0.1329	-0.1500
			(0.1142)		(0.1201)	(0.1153)	(0.1210)
R^2	0.0217	0.0001	0.0059	0.0202	0.0097	0.0062	0.0098
Observations	296	259	222	259	222	222	222
Panel c: With Year and Provider's Catchment Area Fixed Effects							
Absolute value of the variation in the abortion rate							
Between year T-1 and T	0.2879			0.2614	-0.1944		-0.1869
	(0.2549)			(0.2621)	(0.1574)		(0.1563)
Between year T-2 and T-1		-0.0233		-0.0193		-0.0717	-0.0638
		(0.0710)		(0.0712)		(0.0869)	(0.0906)
Between year T-3 and T-2			-0.1679		-0.1916	-0.1709	-0.1934
			(0.1221)		(0.1593)	(0.1248)	(0.1323)
R^2	0.0347	0.0182	0.0266	0.0355	0.0306	0.0281	0.0318
Observations	296	259	222	259	222	222	222

Notes: All regressions were estimated by OLS. Robust standard errors in parenthesis. The panel on which this regressions are estimated is composed of 37 municipalities that had an abortion provider between 2008 and 2016. The variable of interest is the absolute value of the variation of the abortion rate in the catchment area of each municipality that ever had an abortion provider. We define catchment area of a provider as the set of municipalities that, at some point between 2008 and 2016, were closer to that provider than to any other abortion service in Portugal. Hence, it is possible that one municipality is considered to be in the catchment area of more than one provider. *$p<0.1$

Table B5 Correlation between abortions and controls

Outcome:	Residuals of regression: $NºAbortions_{mt} = Municipality\ FE + u_{mt}$	
	Coefficients	SD
Demographic controls		
Share of age group in population of fertile women		
15 to 19 y.o.	-96.826*	(51.408)
20 to 24 y.o.	(omitted)	(omitted)
25 to 29 y.o.	10.536	(49.620)
30 to 34 y.o.	2.156	(39.737)
35 to 39 y.o.	27.617	(38.158)
40 to 54 y.o.	-153.583***	(41.304)
45 to 49 y.o.	2.186	(40.593)
Economic controls		
Unemplyment rate	29.636**	(14.649)
GDP per capita growth (NUTS III)	-24.851*	(9.997)
Controls for social norms		
Marriages (*per* 1000 inhabitants)	-0. 601	(0.668)
Catholic marriages (*per* 1000 inhabitants)	0.858	(0.877)
Observations	2502	
Municipalities	278	
R^2	0.024	

Notes: The first regression was estimated by Poisson quasi-maximum likelihood, with the number of fertile women in the municipality as the exposure variable. The regression of the residuals on the controls was estimated by OLS. * *p* <.1; ** *p* <.05; *** *p* <.01

Table B6 Conditions under which abortion occurs and abortion access – municipal-level analysis

	Abortions below 7 weeks		Abortions between 7 and 9 weeks		Abortions over 9 weeks		NHS referral to private clinic		Surgical abortions		Medical abortions	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Linear travel time												
Travel time in min.	-0.0009		0.0015		0.0065**		0.0202***		0.0159***		-0.0163***	
	(0.0009)		(0.0009)		(0.0036)		(0.0041)		(0.0028)		(0.0025)	
Bins of travel time												
(Ref: within 30min.)												
30 to 60min.		0.0909		-0.0433		0.4237		0.8745***		0.6367***		-0.3895***
		(0.0704)		(0.0661)		(0.3589)		(0.1739)		(0.1239)		(0.1491)
Over 60min.		-0.2151***		0.0635		1.0827***		1.5849***		1.2796***		-1.07075***
		(0.0547)		(0.0682)		(0.2683)		(0.3091)		(0.2232)		(0.1794)
Observations	2502	2502	2502	2502	2502	2502	2502	2502	2502	2502	2502	2502
Municipalities	278	278	278	278	278	278	278	278	278	278	278	278

Notes: All regressions were estimated by Poisson quasi-maximum likelihood with the number of fertile women as the exposure variable. All regressions include municipality specific time trends and have year and municipality-level fixed effects. All regressions also control for the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP, the number of marriages, and catholic marriages per thousand inhabitants in the municipality. Odd columns present access linearly, while even columns present access categorically. Robust standard errors in parenthesis.

* p <.1; ** p <.05; *** p <.01

C Descriptive statistics: Tables

Table C1 Descriptive statistics of municipalities

Variable	Panel	Mean	SD	Min	Max	Observations
Abortion access						
Travel time (minutes)	Overall	39.25	23.61	1.38	159.68	N = 2502
	Between Municipalities		21.51			Municipalities = 278
	Within Municipalities		9.81			Years = 9
Demographics						
Number of abortions	Overall	63.08	183.39	0	2,700	N = 2502
	Between Municipalities		182.16			Municipalities = 278
	Within Municipalities		23.58			Years = 9
Number of women in fertile-age	Overall	8,353.50	13,548.56	317	117,277	N = 2502
	Between Municipalities		13,552.08			Municipalities = 278
	Within Municipalities		701.57			Years = 9
Number of pregnancies	Overall	378.15	765.58	6	8,920	N = 2502
	Between Municipalities		763.72			Municipalities = 278
	Within Municipalities		68.62			Years = 9
Economy						
Insured unemployment rate	Overall	7.93	2.57	2.01	18.81	N = 2502
	Between Municipalities		2.09			Municipalities = 278
	Within Municipalities		1.49			Years = 9
NUTSIII GDP per capita (thousand euros)	Overall	18.24	3.97	11.75	32.89	N = 2502
	Between Municipalities		3.83			Municipalities = 278
	Within Municipalities		1.06			Years = 9
Proxies for social norms						
Marriages (*per* 1000 inhabitants)	Overall	2.70	0.91	0	7.12	N = 2502
	Between Municipalities		0.64			Municipalities = 278
	Within Municipalities		0.65			Years = 9
Catholic marriages (*per* 1000 inhabitants)	Overall	1.19	0.66	0	3.93	N = 2502
	Between Municipalities		0.50			Municipalities = 278
	Within Municipalities		0.43			Years = 9

Table C2 Abortion rates per travel time bin

	Travel time to nearest provider							
	Within 30 minutes		*30 to 60 minutes*		*Over 60 minutes*		*Total*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Abortion rates (per 10000 fertile women)								
Overall	6.228	3.992	4.659	2.642	4.785	2.611	5.283	3.310
Below 7 weeks of gestation	3.735	2.446	2.922	1.880	2.953	1.811	3.240	2.142
Between 7 and 9 weeks	2.256	1.919	1.584	1.308	1.667	1.392	1.856	1.614
Between 9 and 10 weeks	0.237	0.389	0.153	0.318	0.166	0.382	0.187	0.359
Referred from NHS to Private	0.611	2.500	0.913	1.917	1.368	2.603	0.861	2.152
Surgical abortions	0.968	2.504	1.159	2.097	1.600	2.702	1.154	2.368
Medical abortions	5.241	3.347	3.472	2.716	3.158	2.515	4.105	3.082
Abortions to pregnancies ratio								
Overall	0.140	0.061	0.124	0.057	0.128	0.060	0.131	0.059

Table C3 Descriptive statistics of women who abort – outcome variables

	Travel time to nearest provider											
	Within 30 minutes			*30 to 60 minutes*			*Over 60 minutes*			*Total*		
	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)
Abortions	127,783	100	84	19,088	100	13	5,253	100	3	152,124	100	100
Weeks pregnant												
Less than seven	71,014	56	84	10,915	57	13	3,078	59	4	85,007	56	100
From seven to nine	50,319	39	84	7,317	38	12	1,930	37	3	59,566	39	100
From nine to ten	6,450	5	85	856	4	11	245	5	3	7,551	5	100
Total	127,783	100	84	19,088	100	13	5,253	100	3	152,124	100	100
Type of provider												
Private clinic - own initiative	10,334	8	87	1,252	7	11	331	6	3	11,917	8	100
Private clinic - NHS referral	27,318	21	77	6,172	32	17	1,950	37	6	35,440	23	100
NHS Hospital	90,131	71	86	11,664	61	11	2,972	57	3	104,767	69	100
Total	127,783	100	84	19,088	100	13	5,253	100	3	152,124	100	100
Method												
Medical abortion	88,346	69	86	11,612	61	11	2,965	56	3	102,923	68	100
Surgical abortion	39,437	31	80	7,476	39	15	2,288	44	5	49,201	32	100
Total	127,783	100	84	19,088	100	13	5,253	100	3	152,124	100	100
Method (Among women accessing to services through the NHS)												
Medical abortion	87,749	74	86	11,560	65	11	2,956	60	3	102,265	73	100
Surgical abortion	30,294	26	78	6,332	35	16	1,977	40	5	38,603	27	100
Total	118,043	100	84	17,892	100	13	4,933	100	4	140,868	100	100
Method (Abortions performed in the NHS)												
Medical abortion	87,163	97	86	11,496	99	11	2,934	99	3	101,593	97	100
Surgical abortion	2,968	3	94	168	1	5	38	1	1	3,174	3	100
Total	90,131	100	86	11,664	100	11	2,972	100	3	104,767	100	100
Method (Abortions performed in private clinics)												
Medical abortion	1,183	3	89	116	2	9	31	1	2	1,330	3	100
Surgical abortion	36,469	97	79	7,308	98	16	2,250	99	5	46,027	97	100
Total	37,652	100	80	7,424	100	16	2,281	100	5	47,357	100	100
		Mean	SD		Mean	SD		Mean	SD		Mean	SD
Weeks pregnant at:												
Time of access		6.57	1.53		6.59	1.50		6.67	1.46		6.58	1.52
Time of abortion		7.32	1.37		7.30	1.32		7.29	1.29		7.32	1.36
Waiting days		8.31	4.69		8.07	4.62		7.53	4.32		8.25	4.67
Travel time (minutes)		13.57	8.77		40.5	7.72		75.35	16.25		20.31	17.53

Table C4 Descriptive statistics of women who aborted – control variables

	Mean	SD	No.	Travel time to nearest provider								
				Within 30 minutes			*30 to 60 minutes*			*Over 60 minutes*		
				No.	Col (%)	Row (%)	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)
Age	28.5	7.3										
Less than 15			640	536	0	84	79	0	12	25	0	4
15 to 19			16,499	13,957	11	85	1,998	10	12	544	10	3
20 to 24			34,559	29,502	23	85	3,926	21	11	1,131	22	3
25 to 29			32,908	27,930	22	85	3,881	20	12	1,097	21	3
30 to 34			30,956	25,851	20	84	4,042	21	13	1,063	20	3
35 to 39			25,134	20,767	16	83	3,415	18	14	952	18	3
Over 40			11,422	9,234	7	81	1,747	9	15	441	8	4
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Education												
Illiterate			418	344	0	82	52	0	12	22	0	5
Reads/writes			307	248	0	81	44	0	14	15	0	5
Primary school			6,147	5,123	4	83	807	4	13	217	4	4
Lower middle school			18,751	15,404	12	82	2,645	14	14	702	13	4
Higher middle school			41,032	34,205	27	83	5,372	28	13	1,455	28	4
High school			54,342	45,691	36	84	6,750	35	12	1,901	36	3
College			31,127	26,768	21	86	3,418	18	11	941	18	3
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Occupation												
Agriculture (ISCO08:6-8)			23,926	19,679	15	82	3,454	18	14	793	17	3
Armed Forces (ISCO08:0)			827	705	1	85	110	1	13	12	0	2
Services (ISCO-08:4-5)			16,621	14,154	11	85	2,013	10	12	454	10	3
Unskilled (ISCO-08:9)			27,892	23,558	18	84	3,605	19	13	729	16	3
Managers (ISCO-08:1)			1,520	1,357	1	89	134	1	9	29	1	2
Professionals (ISCO-08:2)			10,628	9,183	7	86	1,152	6	11	293	6	3
Technicians (ISCO-08:3)			11,664	10,036	8	86	1,312	7	11	316	7	3
Domestic worker			3,445	2,662	2	77	634	3	18	149	3	4
Student			25,554	21,768	17	85	2,996	15	12	790	17	3
Unemployed			30,047	24,921	20	83	4,039	21	13	1,087	23	4
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3

Table C4 (continued)

	Mean	SD	No.	Travel time to nearest provider								
				Within 30 minutes			*30 to 60 minutes*			*Over 60 minutes*		
	Mean	SD	No.	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)	No.	Col (%)	Row (%)
Nationality												
Portuguese			125,483	104,010	81	83	16,802	88	13	4,671	89	4
Other			26,641	23,773	19	89	2,286	12	9	582	11	2
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Civil Status												
Married			37,375	30,118	24	81	5,727	30	15	1,530	29	4
Divorced			11,317	9,168	7	81	1,743	9	15	406	8	4
Separated			2,263	1,890	1	84	295	2	13	78	1	3
Single			100,518	86,098	67	86	11,208	59	11	3,212	61	3
Widow			651	509	0	78	115	1	18	27	1	4
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Cohabitation												
Lives with partner			74,954	61,528	48	82	10,513	55	14	2,913	55	4
Lives without partner			77,170	66,255	52	86	8,575	45	11	2,340	45	3
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Previous children	1.0	1.0										
0			61,676	52,725	41	85	7,006	37	11	1,945	37	3
1			44,694	37,767	30	85	5,386	28	12	1,541	29	3
2			33,630	27,365	21	81	4,962	26	15	1,303	25	4
3			8,959	7,271	6	81	1,330	7	15	358	7	4
4			2,247	1,892	1	84	281	1	13	74	1	3
More than 4			918	763	0	83	123	0	13	32	0	4
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3
Previous abortions	0.4	0.7										
0			112,079	93,180	73	83	14,845	78	13	4,054	77	4
1			30,607	26,306	21	86	3,354	18	11	947	18	3
2			6,887	6,050	5	88	651	3	9	186	4	3
3			1,676	1,482	1	88	153	1	9	41	1	2
4			503	454	0	90	39	0	8	10	0	2
More than 4			176	142	0	81	23	0	13	11	0	6
Total			152,124	127,783	100	84	19,088	100	13	5,253	100	3

D Event studies

To better understand if openings and closures of abortion providers are driven by abortion demand or broader social forces, we conduct event studies which are displayed in Figures E1 to E4 below. In this analysis, we use the abortion rate and the number of marriages and catholic marriages of the catchment area of a provider – which is defined as the set of municipalities to which that provider was, at some point in time, the closest abortion provider – as an outcome and estimate the model described below:

$$Log(Y_{rt}) = \sum_{i=-Pre}^{-2} \alpha_i T_{rti} + \sum_{i=0}^{Post} \alpha_i T_{rti} + X_{rt}\beta + \varphi_r + \zeta_t + u_{rt}$$

Where $\boldsymbol{Y_{rt}}$ is either the abortion rate or one of our four proxies for social norms (number of marriages and catholic marriages per thousand inhabitants) and $\boldsymbol{T_{rti}}$ is a dummy equal to one for the catchment area of provider $\boldsymbol{r}$, in year $\boldsymbol{t}$, which is $\boldsymbol{i}$ years away from the event (opening or closure of provider). Xrt is a vector of time-varying characteristics of the provider's catchment area, namely: the share of all age groups in the population of fertile-age women, the insured unemployment rate, the growth rate of the NUTS III region's GDP. If the outcome variable is the abortion rate, we also include as controls the number of marriages and catholic marriages per thousand inhabitants. φr and ζt are provider's catchment area and year fixed effects, respectively. u_{rt} is the error term.

However, estimating this model by a standard OLS regression with two-way fixed effects is problematic, as regions where an abortion provider closed in year T-1 will be used as controls for regions experiencing a shutdown in year T (Sant'Anna and Zhao 2020; Callaway and Sant'Anna 2021; Sun and Abraham 2021). To correctly estimate the value of the coefficient of both leads and lags, we implement the procedure which Callaway and Sant'Anna (2021) propose, where only not-yet-treated observations are used in the control group. This was done using the Stata csdid command (Sant'Anna and Zhao 2020; Callaway and Sant'Anna 2021).

As shown in Figures E1 to E4, we find no evidence that there were systematic differences in abortion rates or changes in social norms prior to the closures or openings of abortion providers.

APPENDIX REFERENCES

Callaway, B. & Sant'Anna, P. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics*, *225*, 200-230.

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Sun, L. & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, *225*, 175-199.

Figure D1 Abortion rate before and after clinic closure

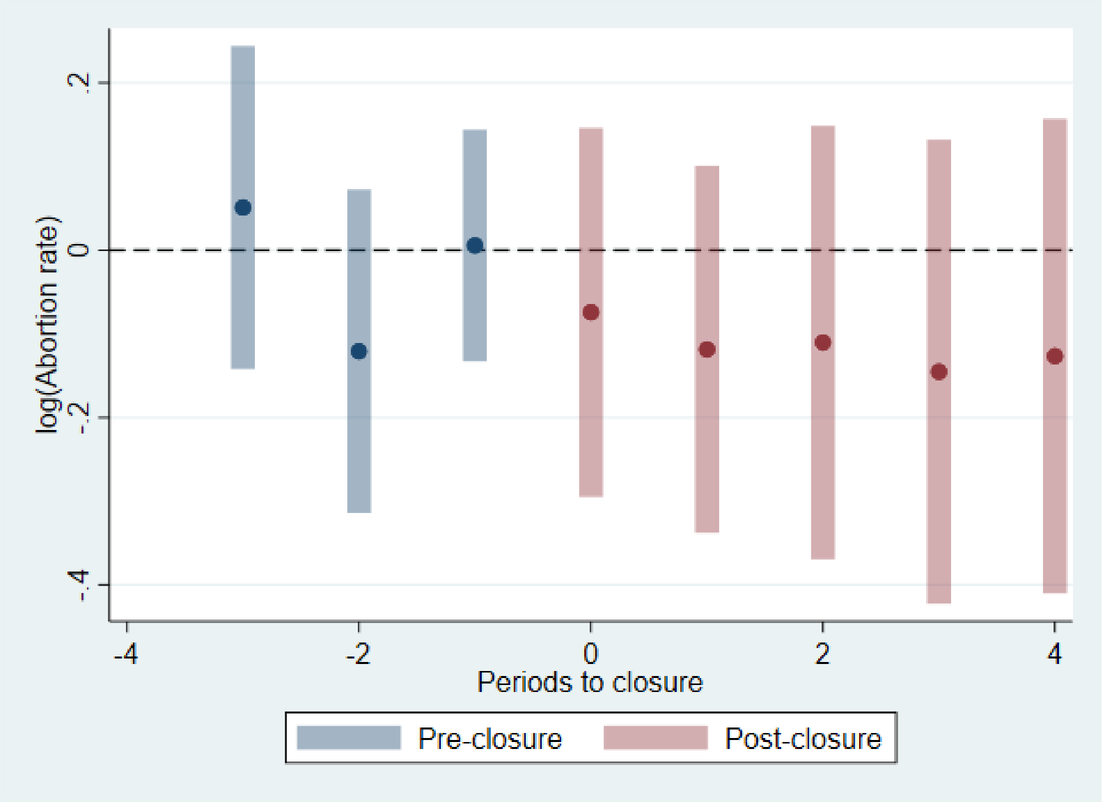


Figure D2 Abortion rate before and after clinic opening

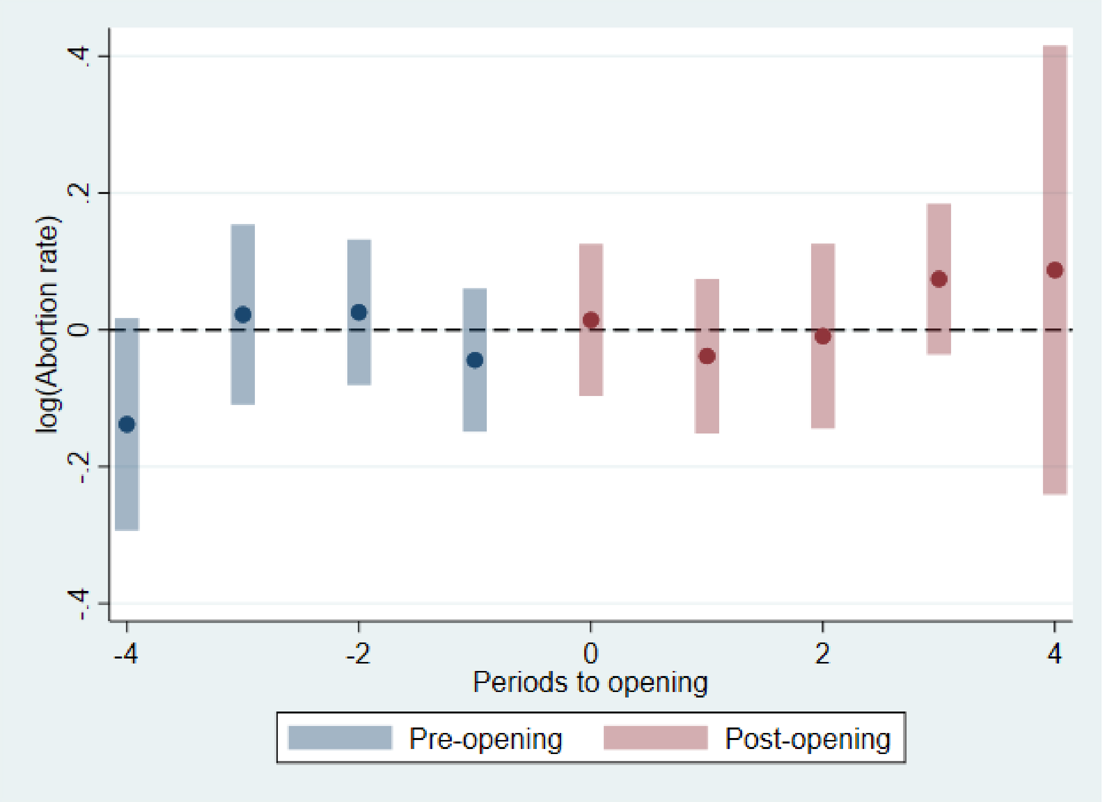
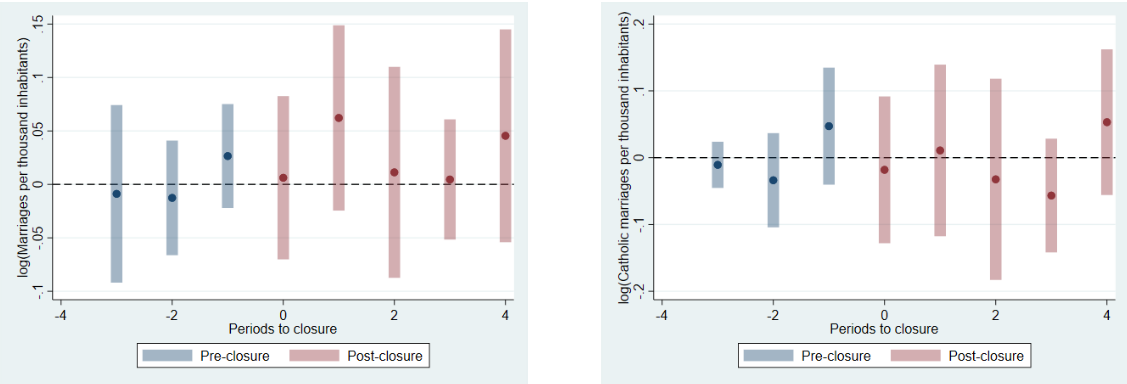
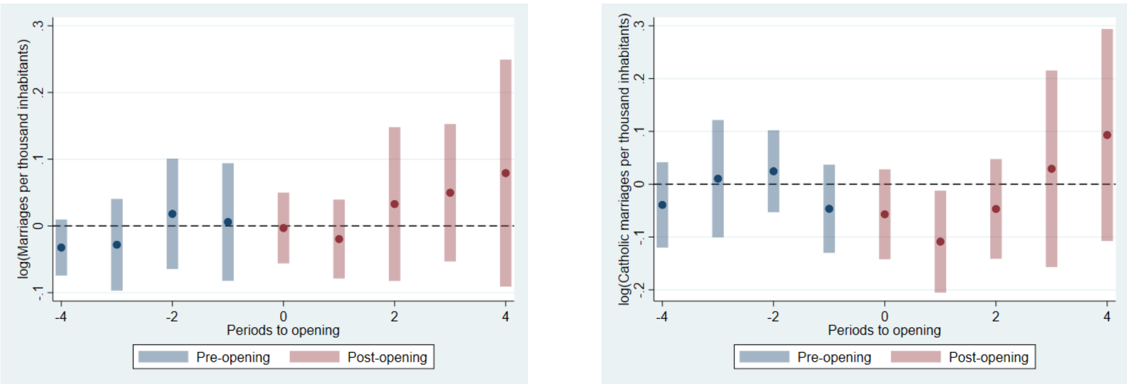


Figure D3 Marriages before and after clinic closure



Panel a Marriages in the population **Panel b Catholic marriages in the population**

Figure D4 Marriages before and after clinic opening



Panel a Marriages in the population **Panel b Catholic marriages in the population**