STOCKHOLM SCHOOL OF ECONOMICS
Department of Economics
5350 Master's thesis in economics
Spring 2026

A Re-evaluation of Potential Access-Driven Heterogeneous Spillover Effects of the 2007 Mexico City Abortion Legalization

Simone Michele Bartlett Paul (42870)

Abstract: This thesis examines the potential for spatially heterogeneous effects of the 2007 Mexico City abortion legalization on the fertility rates of the neighboring Estado de México, where abortion remained illegal. Existing literature on the reform's effects on Mexico City are extensive, but less attention has been given to variation in spillover effect, specifically according to resident access. This thesis uses municipality-level fertility data from 2000-2015 to estimate a series of difference-in-differences models, comparing selected Estado de México municipalities to matched municipalities from other Mexican metropolitan areas. Access is proxied through Euclidean distance from each municipality to the relevant metropolitan center and analyzed using pooled and distance-band specifications. The findings indicate some evidence of post-2008 fertility declines in the treated municipalities, specifically within the general fertility rate and among women aged 20-24. However, the results do not provide convincing statistical support for the hypothesized access-gradient mechanism, failing to show that municipalities closer to Mexico City proper experienced larger fertility declines than those further away. Thus, this thesis does not establish definitive causal evidence of spillovers driven by the 2007 reform. Nevertheless, it contributes suggestive evidence that spatial access may yet play a part in understanding the complete effects of localized abortion policy shifts. Additionally, it motivates future research using more refined accessibility measures, a stronger counterfactual construction, and utilization of direct data on abortion uptake of non-residents.

Keywords: Abortion access; fertility; Mexico City, Estado de México; difference-in differences; spatial accessibility
JEL: I18; J13; C23; R12; O54

Supervisor:	Patrick Agte
Date submitted:	18 May 2026
Date examined:	29 May 2026
Discussants:	Hugo Ryberg
Examiner:	Sampreet Goraya

Table of Contents

Generative AI Usage Disclosure

Generative AI was used in several steps of the research process: identifying relevant literature, dummy-testing paper ideas, aiding in coding and debugging processes, and confirming general writing and paper continuity and quality.

In this case, ChatGPT was the major aid, however, ResearchRabbit, was also used in the literature review process. The use of generative AI allowed the author to focus on synthesis. While the author is proficient in STATA, she was able to streamline data analysis and visualization by requesting better looping mechanisms and getting feedback on debugging. Additionally, she found that generative AI models, while imperfect, often provided quality feedback when analyzing portions of her written text.

The author was committed to have her voice and mind carry through in every element of the paper; nowhere in the final paper exists a figure or table that was produced by generative AI software. In the most extreme cases, code was requested by the author to do a specific task, which was then modified for the case and run by the author herself.

AI was not used to produce the substantial text of the final paper; the author wished to maintain her individual style of writing and all text is original, unless otherwise stated as a reference. As previously alluded to, all figures and tables were produced using STATA software on the authors personal laptop. AI was never relied upon as a citation, but rather as a guide to more reliable sources; all sources are appropriately cited in the reference section and within the body of the paper, where relevant.

However, even though the author used generative AI in an admissible way, according to her understanding of the Stockholm School of Economics' policy, her use was more than she had expected and would have wished. A large reason for this was the late shake-up that resulted in her losing a thesis partner and restarting her work. This resulted in a cramped timeline for her to complete the research, produce thoughtful findings, and write the paper. Thus, targeted use of generative AI played a hand in allowing her to submit her thesis, complete and on time.

The author did notice limitations of utilizing AI. Most notably, she found that her writing began to feel more mechanical when incorporating AI suggestions. While, in many cases, economic writing is “better” when streamlined, she found that it resulted in the loss of her specific literary voice and made the writing process far less enjoyable.

From this experience, the author reaffirmed her belief that generative AI should be used cautiously in academia. While efficiency is attractive, she found herself reevaluating the purpose of a master’s thesis: the exercise is not to *produce* revolutionary or perfectly clean work, but instead to struggle through the independent research process and develop skills to approach future projects with increased wisdom and grace.

Acknowledgements

I would like to express my sincere gratitude to Patrick Agte for providing supportive guidance and feedback throughout the thesis writing process. While facing unexpected hurdles, I was able to consistently rely on him to provide succinct and targeted advice that allowed me optimal flexibility while designing and writing.

I would also like to thank the professors and supportive staff at the Stockholm School of Economics. I am grateful to Andrew for being a touchstone throughout my academic journey.

I am thankful for the brilliant and wise fixtures in my life: To Michael Paul -- who matches my curiosity with equivalent zeal -- for growing with me, challenging absolutes, and inspiring me to chase happiness. To Libbey Paul -- who I uniquely understand and am understood by -- for learning with me, encouraging mindfulness, and reminding me that my worth is independent of my productivity.

Thanks to all of you who have been there.

Introduction

There is strong research supporting the claim that access to healthcare has a measurable impact on key outcomes. This 'access' can be measured in a variety of defensible ways, one of which is distance. The concept of distance as a barrier to healthcare is not novel and is often considered when analyzing policies that cause variance in procedure legality by geography.

Concrete examples of this unequal access to healthcare occur with legal barriers to abortion services, with vast heterogeneity in abortion legality, both across and within countries, stemming from varying moral, religious, and political interpretations of the procedure.

Despite extensive political debate over abortion services, there is, nonetheless, well documented evidence of the effect increased abortion access has on maternal mortality, morbidity, and selected economic and social outcomes. Thus, it is important to conduct research aimed at analyzing the impact of abortion access on outcomes within true legal contexts, allowing for deeper understanding of existing accessibility structures as well as predicting the effect of future legal shifts.

Thus, this paper examines the effect of 2007 abortion legalization reform in Mexico City through this lens. Through thorough empirical analysis, this thesis attempts to isolate the heterogeneous effect of this reform on the northern border state of Estado de México, where abortion remained illegal. This selection was motivated by evidence that uptake of abortion services was concentrated to Distrito Federal and Estado de México residents.

This research area specification originated from the observation that previous studies analyzing the effect of the reform on Estado de México had done so in the aggregate, ignoring the states' residents' heterogeneity of access to Mexico City proper. Simply put, the author recognized that an analysis of the effect of a policy should consider the ease of "treated" populations to take part in the change.

The 2007 abortion legalization was restricted to a single territory within México, Distrito Federal, allowing for a unique study into the effects of a contained policy on surrounding populations. Moreover, the analyses of spillover effects of abortion bans/legalizations are particularly interesting when the border is permeable to patients, but not to doctors, allowing a unique analysis of one-sided commuting for healthcare. Additionally, it is important to note that non-Mexico City residents were permitted to receive abortion care within Distrito Federal on a sliding payment scale, making this spillover effect more plausible.

The empirical strategy of this paper centers around difference-in-differences regressions, through which the author attempts to isolate causal effects of the legalization on the neighboring populations' fertility trends. Distance from Mexico City proper is utilized as a proxy for access to attempt to isolate the gradient effect of access to abortion, measuring distance through continuous Euclidean distance and Euclidean distance band variables.

Within this thesis, the author estimates several difference-in-differences specifications, using municipality-level fertility data from 2000-2015, comparing trends in selected Estado de México municipalities to matched municipalities from other Mexican metropolitan areas.

This study finds some evidence of a post-2008 relative fertility decline in the treated municipalities for the general fertility rate and women aged 20-24. However, the results of the empirical analyses do not support the hypothesis of a clear access gradient mechanism; there is not statistically significant evidence that municipalities nearer to Mexico City proper experience larger fertility declines in the post-period compared to those further from the city center.

Nevertheless, this research adds to the existing literature surrounding the relationship between abortion access, uptake, and outcomes. This will be, to the best of the author's knowledge, the first paper to apply this healthcare access gradient effect concept to the context of Estado de México. This paper aims to add to the understanding of the impacts of the 2007 reform and motivate future research into state-level abortion policies in contexts where borders are permeable.

Institutional Background and Policy Context

Pre-2007 Situation

Prior to the 2007 Mexico City reform, elective abortion was illegal within the entire country of México. Abortion laws were created at the state level, resulting in some legal heterogeneity across the country, but country-wide, legal termination of pregnancy was reserved for extreme cases of incest, rape, and major maternal health issues (Becker et al., 2013). These laws were deemed highly restrictive by the international community (Schiavon et al., 2010).

During this period and within select states, induced abortion was considered a criminal offense, where women faced up to 30 years in prison (Clarke & Mühlrad, 2018). Even in Distrito Federal, historically the territory with more progressive laws, abortion was heavily restricted. In the rare cases when legal abortion was warranted, the process was deeply bureaucratic and time-consuming; in the six years prior to 2007 only 62 women accessed legal abortion services within Mexico City (Contreras et al., 2011).

While legal abortion was rare, clandestine abortion was commonplace (Juarez et al., 2010). In 2006, the national abortion rate was estimated to be 33 per 1000 women aged 15-44, with a majority being illegal procedures. Additionally, studies show that, historically, unsafe clandestine abortion was more common among women living in the poorest Mexican states (Kulczycki, 2011).

This pattern and the recognition of the dangers of clandestine abortion, in part, motivated the ensuing abortion reform in Distrito Federal (Becker et al., 2011). While initial reforms in 2000 worked to decriminalize abortion, shifting away from the historic laws attempting to maintain public morality, the major policy shock occurred in 2007 (Madrazo, 2010).

2007 Event

In April of 2007, elective, first-trimester abortion was legalized within Distrito Federal. Along with legalization came the launch of the public sector Interrupción Legal del Embarazo (ILE) program to provide free, legal abortion services to Distrito Federal residents (Mondragon y Kalb et al., 2011).

The law also increased the sexual education in schools and pushed for increased access to contraceptive care (Becker, 2013). This was applied specifically to the disbursement of contraceptives within the clinics carrying out abortions (Clarke & Mühlrad, 2018). In the years following the legalization, the government refined the recommended set of medical protocols for the safe practice of abortion in state facilities (Singh, 2012). Additionally, over time, the preferred abortion method shifted towards medication and manual vacuum aspiration abortions (Mondragon y Kalb et al., 2011).

Notably, abortion services were available to non-residents of Mexico City at an affordable sliding fee dependent on income (van Dijk et al., 2011). Additionally, by 2009, The Maria Abortion Fund for Social Justice was founded to financially support women traveling from outside of Mexico City. By 2013, the fund had supported 1000 women with travel expenses, food, and lodging (Becker, 2013).

Despite this refinement that happened over the following decade, almost immediately after the enactment of the new law, doctors received training from international NGOs and carried out safe and legal abortions (Singh, 2012). The implementation of abortion services quickly began within public medical facilities. Within a year, the ministry of health opened their first designated health center for abortion services (van Dijk et al., 2011).

Post-2007 Situation

By 2015, 143,550 legal abortions were carried out in ILE facilities (Secretaría de Salud del Distrito Federal, 2015). The population received abortion services varied in age and state of origin. Further analysis showed that women tended equally to seek abortion services to prevent first births and to limit or space births, with the former being the motivation for most teens and employed women (Darney et al., 2020).

Notably, while most patients were residents of Distrito Federal, around 30% of clients travelled from other locations. Further analysis has found evidence that educated women residing outside of Mexico City traveled to Mexico City to take advantage of the program at a higher rate. The program has largely seen uptake low-income women from within Mexico City, but not low-income women from elsewhere in México who lack the ability to travel (Senderowicz et al., 2018).

In further surveys of patient uptake of ILE services, the obstacles most reported to patients was getting time off work, family member opposition, and finding transportation. With the latter obstacle being more prevalent in women who resided outside of Mexico City (Becker et al., 2011).

Literature Review

To better the fit of this paper into the existing literature, the following section contains a systematic literature review, summarizing research on abortion policy outcomes, abortion access and spatial barriers, spillover effects of policies across jurisdictions, distance as a measure of treatment intensity, and the effects of the 2007 abortion legalization in Mexico City.

It is important to note that the literature on abortion is vast and the following review covers only a segment. However, the goal is not to outline all related papers, but instead carry out a comprehensive overview to support the methodology that follows.

Abortion Policy and Outcomes

There exists significant literature surrounding the effect of increased abortion access on positive outcomes and, conversely, increased restrictiveness on negative outcomes.

Burdick et al. (2023) use multivariable regression analysis to study the effect of abortion access restrictiveness on county-level infant mortality rates in the United States, from 2014 to 2018. They quantified restrictiveness through state-level legislation on abortion and driving distance from abortion facilities. The study found that more restrictive legislation was associated with higher county-level infant mortality. Additionally, this increased infant mortality unequally burdened Black individuals and those with lower education levels. Similarly, Farin et al. (2024), discuss the impact of legal abortion on maternal mortality, specifically examining the legalization of abortion in the United States and its relationship with maternal and abortion related mortality from 1959-1980. Through their analysis they find that legal abortion lowered non-white maternal mortality by 30 to 40 percent.

Adkins et al. (2025) utilize the recent Targeted Restrictions on Abortion Provider (TRAP) laws to estimate the association between reduced access and maternal and infant health in the

United States. They find that individuals living in states with TRAP laws had 15% higher odds of maternal morbidity compared to their non-TRAP counterparts. These findings are confirmed by Melville et al. (2026), where authors similarly use state-based variance in TRAP laws to measure the increase in restrictiveness of abortion care, finding that TRAP laws were associated with increases in preterm birth and maternal morbidity.

Redd et al. (2021) creates an index for state-level abortion restrictiveness to assess the association between legal restrictiveness and pre-term birth and low birthweight. Their analysis utilizes multivariable regression modeling and covers United States residents from 2005 to 2015. They find insignificant relationships at the national level, but significance in regional analyses, finding that increases in restrictiveness are associated with increased rates of preterm birth and low birthweights.

Velazquez (2024) studies the impact of the 2012 abortion legalization in Uruguay on adolescent fertility rates. Using synthetic control modeling of similar Latin American and Caribbean countries to attempt to identify a causal link, they find that adolescent fertility declined by approximately 15 percent in Uruguay compared to the control specification.

Abortion Access and Spatial Barriers

Beyond access and restriction, many studies are found to examine on the impact on abortion access on service uptake.

Quast et al. (2017) examines the relationship between abortion rate and the proximity of abortion facilities in Texas from 2004 to 2014. They connect the falling abortion rate to distance from abortion facilities using linear regressions, controlling for county- and state-level characteristics. They find that a 100-mile increase in distance from the nearest clinic is associated with a 10 percent fall in abortion rates. They find this relationship to be largely driven by women aged 20-34. Lindo et al. (2017) researches the similar effect of non-linear distance to clinics on abortion rates in Texas and finds comparable results when adding congestion proxies. Moreover, Fischer et al. (2018) studies the effect of access to abortion facilities on abortion uptake in Texas, but with a narrowed focus on 2010-2015. By exploiting the quasi-experimental variation in abortion access, they find that abortions fall by 16.7 percent and births rose by 1.3% in counties that change to not have a provider within 50 miles. Furthermore, Sauter et al. (2024) supports the findings of the prior two papers, attempting to further understand the unequal spatial effects of newly restrictive abortion law in Texas. Unlike the prior papers, they do not aim to identify causal relationships on outcomes, but instead outline the heterogenous changes in access with increased abortion restriction. They find that, while distance to care increased state-wide, the greatest increases occurred in neighborhoods with the highest levels of income inequality.

Kelly et al. (2022) studies the general effect of potential United States abortion bans on patient distance travelled and uptake of abortion. They use predicted change in distance to abortion care as a predictor of expected future abortion restriction. They predict that additional bans will increase travel time from clinics, disproportionately impacting women of color, low-income families, and those with less education. Rader et al. (2022) supports these findings and forecasts, through predictive cross-sectional spatial analysis of the September 2022 overturn of Roe v. Wade, that distance and travel time to abortion facilities would increase at an unequal rate.

Barr-Walker et al. (2019) shows evidence that traveling for abortion is laborious and expensive through a systematic review of existing studies on abortion travel. They largely focus on studies from the past five years on the US. They find that most studies quantified travel as road or straight-line distance, while only some studies incorporated costs, childcare needs, and psychological burdens. Overall, they find a significant base of quality literature addressing the disparities of access to abortion care, but emphasize the importance of continued studies on the effects of these burdens on tangible outcomes.

Torenz et al. (2023) examines the geographical distribution of abortion facilities in Germany in 2021 and the effects of unequal spatial accessibility. They define spatial access through measures of abortion provider density and workload and find distinct inequality in accessibility across the country.

Melo (2024) studies the effect on proximity to abortion providers on abortion uptake and procedure conditions in Portugal from 2008 to 2016, following abortion legalization in 2007. They find evidence that fewer abortions occur when women live further from care.

Accessibility/Transport/Distance as a Measure of Intensity

Building upon distance's direct impact on abortion uptake is the body of literature that focuses on access' impact on key outcomes, such as birthrates and health outcomes

Wright (2025) outlines the travel methods women use to get abortion care in the US. They employ a difference-in-differences design to compare behavior in states with varying levels of increasing legal restriction on abortion. The study finds evidence that state-level abortion bans increase births, but not necessarily through completely eliminating abortion. Instead, many women find alternative methods of termination by traveling to locations with looser restrictions.

Venator & Fletcher (2020) estimate the effect of abortion clinic closures on access, specifically measuring distance, congestion, abortion rates and birth rates in Wisconsin from 2009-2017. They find that 100-mile increases in distance are associated with 30.7 percent fewer abortions and 3.2 percent more births. Their findings support the claim that even a few clinic closures can have large effects on access.

Gardner (2024) examines the impact of abortion access changes with United States TRAP laws on health outcomes, using distance as an intensifier of access. Using variation of distance and timing in difference-in-differences analyses, they find that these restrictive policies increase negative maternal health outcomes and rates of infant low-birth weight and premature birth. They also find that increased travel distance from an abortion provider is associated with higher rates of chronic hypertension.

Lu (2018) researches the effect of the increase in distance from healthcare clinic on female preventative care utilization in Texas and Wisconsin. Through their analysis they find that a 100-mile increase in distance from a clinic is associated with a decrease of utilization of pap tests by 14 percent breast exams by 11 percent, and mammograms by 18 percent. They also find that this decrease is greater for women with less education.

México Specific Abortion Literature

Lastly, there exists significant research, both qualitative and quantitative, into the ILE system and its outcomes. This section will, first, outline the major literature surrounding outcomes from the reform and then, tie directly into the research design.

Gutierrez Vazquez & Parrado (2016) study the impact of the 2007 reform on Mexico City and the Greater Mexico City area fertility rates. They utilize census data in their difference-in-differences study, using time variance in both Mexico City and municipalities in the Greater Mexico City Metropolitan area. In their causal analysis they find that there was 4 percent decline in birth rates between 2000 and 2010 in all age groups except for ages 14-17 in Mexico City proper. The overall reduction is not seen in the Greater Mexico City area. However, when adding in parity-specific effects, the reduction is significant in the Greater Mexico City area. Additionally, they find marginal 'diffusion' effects with 25-29- and 30–34-year-old women, without parity, and more pronounced effects with parity.

Castillo Betancourt (2017) writes her master's thesis using the 2007 shock as a natural experiment to quantify the effects on child and maternal health. She uses difference-in-differences to analyze births and deaths from 2002-2012. She uses a synthetic control method to create a more robust comparison in terms of GDP, education, and GINI Coefficient measures. She finds that legislative change was associated with a reduction in the infant mortality rate by about 0.2 percent and the maternal mortality rate by about 0.55 percent.

Clarke & Mühlrad (2018, 2021) study the impact of the 2007 reform on key outcomes. They utilize state-based aggregates to analyze the effect of both the 2007 progressive reform and the reactive regressive reforms of other states, using neutral states as the collective controls. They analyze the changes' effects on abortion-related morbidity, hemorrhage, and birth rates. They find the progressive reform to have a large effect on maternal morbidity and birth rates. Moreover, they conduct a limited analysis of the spillover effects of the policy into neighboring states, finding non-significant evidence when analyzing at the state level. Another analysis is conducted on the heterogeneity of the impacts within Distrito Federal, finding health impacts to be the most prominent among women aged 20-24.

Dijk et al. (2011) provides a qualitative analysis of the barriers of access to the ILE services in 2008 through selected in-depth interviews, finding that a woman's ability to obtain abortion services was influenced by education, marital status, and location of residence.

Jacobson et al. (2021) describes the composition of those who travelled for abortion care to Mexico City between 2016-2019 through examination of 21,629 ILE clients. They find that most travelled from the least marginalized areas of the country with low adolescent fertility rates. Compared to the population of clients that did not travel, travelers tended to come from areas with higher female economic participation and schooling levels.

Friedman et al. (2019) examines the effect of travel time on abortion uptake in the Mexico City Metro Area from 2010-2012. They use travel time as qualifier for access, controlling for other drivers of abortion demand at the municipality level. They find that women who resided in an area requiring traveling into the city for legal abortions used services at 18.6 percent of the rate of locals. Additionally, those who lived where abortion was illegal had a 58.6 percent reduction in abortion 'access,' as defined in the paper. Notably, they find that each additional 15 minutes of travel reduced their 'access' measure by 33.7 percent.

Summarized simply, the literature suggests the following: Access to legal abortion has a positive impact on certain key outcomes. Access is unequally assigned and is exacerbated when abortion legality changes. Ease of access to abortion is associated with higher uptake of abortion services. Transportation distance and time are barriers that changes the ease of access to abortion services.

The literature also suggests that there was significant uptake of the abortion legalization program by Estado de México residents and the concentration of program uptake by Estado de Mexico residents was unequal.

The author thus posits that the analysis of the effect of the abortion policy on Estado de México using aggregates is insufficient and estimates are reasonably dulled by attenuation bias.

It follows that the understanding the true causal relationship requires properly addressing the inequality of access.

This motivates the utilization of distance to Mexico City proper as a measure of accessibility in a difference-in-differences analysis. The paper will capitalize on the pre-existing, unequal levels of access to Mexico City proper across Estado de México municipalities, as well as the quasi-experimental shock of the 2007 legalization of elective abortion within the Mexico City area.

This paper’s goal is not to re-estimate the overall effect of the Mexico City reform, but to reevaluate whether potential spillover effects were spatially heterogeneous within the neighboring state most directly exposed to the policy change.

Data and Sample Construction

Data Origin

Two data sets from the Instituto Nacional de Estadística y Geografía (INEGI) website were used for the empirical analysis within this paper: Censos y Conteos de Población y Vivienda (CPV) from the years 2020, 2010, 2005, and 2000, with 2005 being an intercensal count,[1] and Estadística de Nacimientos Registrados from the years 2000-2019.

---

[1] An attempt was made to use Encuesta Intercensal (EIC) 2015 survey to fill in the gap between the 2010 and 2020 census. However, due to geographic incompatibility through its classification at the district level rather than the municipality level, the data use was restricted to the above years from Censos y Conteos de Población y Vivienda (CPV).

The INEGI databases, while comprehensive, are sprawling, and require significant cleaning before efficient analysis. The processes of cleaning are described, briefly, within the following section.

Data Processing

Data from the Estadística de Nacimientos Registrados was utilized to craft a customizable fertility variable. These natality databases comprise individual-level entries, requiring the careful consideration of the "SSE Policy on the processing of personal data in students' individual projects" when outlining the data processing design. Due to these restrictions, aggregation was handled off-site, and no individual-level personal data was processed by the author of this paper. Nevertheless, the design of the aggregation of the data was directed by the author of the paper to ensure the intended aggregated values were adequately captured.

The cleaning included the creation of a temporary lag variable indicating the number of months between the birth and the birth record registration; births with a lag greater that 48 months were dropped.[2] Births with dates before 2000 and are 2015 were dropped. The states of interest are Estado de México, Jalisco, Nuevo León, Puebla, and Tlaxcala. Thus, only the births of mothers residing in the aforementioned states are kept. The directed depersonalization created data sets for each year of the registry database, allowing the author to work with two separate datasets aggregated at the month/municipality level for each age group.

[2] The timeline of interest is 2000-2015, however, in consistency with Clarke & Mühlrad (2021), the author chooses to "follow the procedure suggested by the National Population Council (known by its Spanish acronym CONAPO) of using birth registers up to four years following each birth date to ensure that we capture births even if they are registered with a considerable delay" and retain birth records submitted until 2019 and then filter with the defined lag variable.

Data files are separated by year, so data processing began with standardizing variables and appending the data files together. After appending, the birth counts were further collapsed to ensure one row for each municipality/month combination.

Data from the Censos y Conteos de Población y Vivienda (CPV) are already data privacy compliant, allowing the author to begin data cleaning immediately. Once again, census data files are separated by year, so data processing began with variable standardization and appending the data files together.

The key variables that were kept are measures of quality of life (counts of inhabited private dwellings with electricity, with piped water, and with drainage), of healthcare and benefit access (counts of individuals without access to health services, covered by the IMSS, entitled to ISSSTE benefits, and covered by the "seguro popular" or "seguro medico"), of education (average years of schooling of individuals aged 15 plus and count of Illiterate population aged 15 and over to total population). Additionally, population indicators (total population, female fertile aged population, population of 12+ individuals, and count of occupied dwellings) were retained to convert key variables to meaningful statistics upon aggregation to assigned groups.

The entries of each census year were narrowed to include municipality-level rows for the states of interest, Estado de México, Jalisco, Nuevo León, Puebla, and Tlaxcala. After the variable labels were standardized, the four cleaned census count documents are appended to create a data set with four rows for each municipality within the states of interest. This data set was used to create panel level data for the groups specified in the sample construction section. Within each defined group, the counts and population indicators of interest are used to create readable measures in terms of percents tailored to the research design.

Additionally, a separate data set including only counts of the female fertile aged population is retained. Important for the readability of the paper is the choice of denominators for fertility. In this case, municipality-level female population aged 15-49 was used, akin to similar studies of the area. Due to the intermittent nature of census data, 2000-2015, yearly municipalities populations were linearly interpolated from the 2000, 2005, 2010, and 2020 census data sets and. This linear interpolation of municipality level populations was subsequently merged into the birth count data set described prior. Thus allowing for the creation of a births-per-10,000 fertile aged women statistic to be used for the main empirical analysis.

This extensive cleaning produced two usable final data sets; a municipality/year-level census indicator file and a municipality/month birth statistic file.

Outcome Variable Isolation

The primary outcome of this paper is fertility; general fertility and fertility for the age groups 20-24, 25-29, and 30-34. This selection comes from the evidence that those traveling for abortion services tend to be non-teenage women; in their analysis of the reform in Mexico City, Gutierrez Vazquez & Parrado (2016) identify a causal effect on fertility for mothers aged 20-24, 25-29, 30-34 in the greater Mexico City, making the further analysis of these specific outcomes using the novel element of distance as a treatment intensifier well motivated.

Clarke & Mühlrad (2018, 2021) in their studies of the 2007 abortion reform, also analyze the following outcomes: maternal mortality (number of maternal deaths, number of maternal deaths owing to abortion) and maternal morbidity (inpatient cases for abortion-related causes, total inpatient for hemorrhage early in pregnancy, etc.). However, due to the scope of this research paper, the author narrows the outcomes of interest to fertility, allowing the analysis to more thorough in other elements.

The empirical design of the paper utilizes difference-in-differences regressions, requiring the establishment of a timeline of analysis. 2000-2015 were selected as the years of analysis, relatively in line analysis of the major papers analyzing the birth outcomes of the Mexico City abortion reform.[3] Note that the selection of the timeline of analysis was done blind to the analysis of post-2008 trends. The specified timeline restriction allows for eight years of a pre-period and seven years of a post-period. The selection of 2008 as the separator of pre- and post-period comes from the gestation period associated with using birth rates as the outcome of interest.

Distance Variable Isolation

The novelty of this research comes in specifying the treatment group. The underlying hypothesis is that those with reasonable access to Mexico City proper are the population assumed to more often utilize abortion services and thus have the associated measured health and fertility outcomes. Thus, the treatment group, broadly, is the fertile female population in Estado de México with reasonable access Mexico City proper.

Given this hypothesis, the treatment variable becomes continuous, rather than binary. However, it is unrealistic to assume that treatment is continuous. This motivates the use "accessibility bands;" effectively separating the treatment group into several categories to capture this hypothesized decay of effect.

Within this research, the empirical strategy centers around the simplest design, modifying, the design of Kelly et al. 2022; using STATA to calculate the distance between the

[3] Clarke & Mühlrad (2018, 2021) selected 2001-2013, Gutierrez Vazquez & Parrado (2016) selected 2000-2010.

population-weighted centroid of each municipality (as calculated by the 2005 Census population count and geographical coordinates) and the centroid of each of the metro areas.

While in most quality papers, like Venator & Fletcher (2020) and Weber & Peclat (2017), distance is measured through the STATA GEOROUTE command to try to isolate a more refined "travel distance" variable, due to the scope of this research, only the Euclidean distance was obtained.

Even absent the travel distance, the credibility of using the Euclidean distance was increased by narrowing the treatment and control groups in an effort to circumvent geographical obstacles.

Potential Panel Variable Identification

The selection of group level panel variables is motivated by similar research. Specifically, in Clarke & Mühlrad (2021), possible time varying confounders of abortion policy, such as measures of education, healthcare access, economic development, poverty levels, female economic activity rates, average salary for full time workers, and women's social inclusion are collected as panel data.

This is partially replicated in this paper. The prior confounds are quantified in 2005 and 2010 census data panel specifications to piece out differences between education and welfare dependance. While analyzing the differences in female economic activity, women's social inclusion, and religiosity are beyond the scope of this paper, future analysis would be wise to keep these differences in mind when selecting appropriate controls.

Treatment and Control Area Specification

Several treatment and control grouping systems were considered; groups consisting simply of the pre-defined metro area, groups of narrowed-pre-defined metro areas, and groups narrowed further. Note that all group creations and selections were done blind to the post-2008 trends to prevent bias and subconscious selection towards more attractive outcomes.

Additionally, in all cases, the 2008 opening and the 2009 extension of the Tren Suburbano acts as a direct time confound. This is the case because the line specifically services select Estado de México populations, connecting them to Cuauhtémoc and Azcapotzalco in Mexico City Proper. To attempt to counteract this confound, the three municipalities serviced by the commuter rail, Cuautitlán, Tlalnepantla, and Tultitlán, are omitted from all treatment specifications. Their incorporation into the treatment sample could lead to an erroneous over-estimation of the treatment effect.

Simple Grouping

The treatment group originally included the 58 municipalities within the overlap of Estado de México and the Mexico City Metro Area. This specification removes some of the confounds of geographical barriers. Additionally, evidence from later research suggests that abortion uptake may have been much higher in this specified area than the rest of the state, motivating a more reasonable application of distance a treatment intensifier.

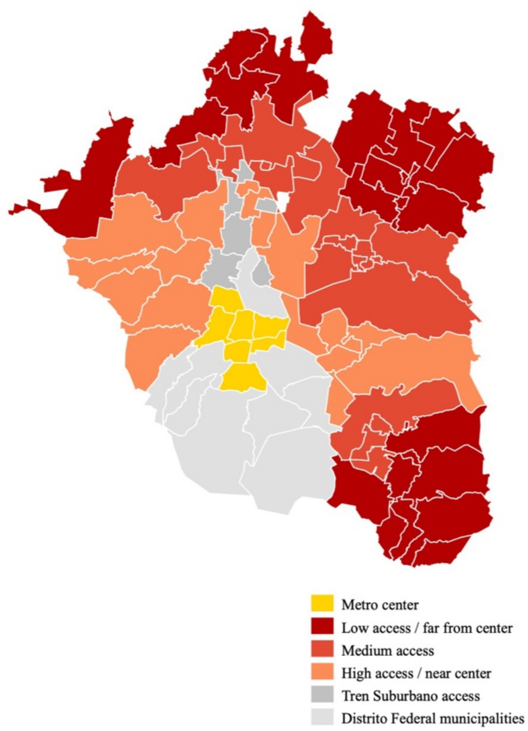
The pooled control comes from three separate metro areas, Puebla-Tlaxcala, Monterrey, and Guadalajara, with the sum of control municipalities at 58. The selection of the metro areas to build the pooled control came from the desire to select similarly large metro areas within México far enough from the treatment area. To attempt to keep consistency and have a better control, the control municipalities map to the predefined metro area. This was proven to be the better option when comparing full state versus metro area 2000 and 2005 census data; when narrowing the control population to the metro area, there existed much more consistency with the treatment population in health access, literacy, and welfare quantifiers, with the baseline health access being the most important indicator.

Specifications

Thus the treatment group is defined as municipalities within the overlap of Mexico City and Estado de México the control group is defined as municipalities within the pre-defined metro area of Puebla/Tlaxcala, Guadalajara, and Monterrey (see Appendix A).

Figure 1

Mexico: Treatment Area Access Terciles



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Each metro area has a defined city center, consisting of one or more municipalities, which is used for the calculation of distance and is ultimately omitted from the sample.

Additionally, the three municipalities served by the Tren Suburbano in the treatment group are omitted. In this case, terciles were created within each metro area. The final sample consists of 55 treatment municipalities and 54 control municipalities (see Appendix A). Data is at the municipality level, with data existing for births per 10,000 women aged 15-49. There are fertility outcomes for women aged 15-49, 20-24, 25-29, and 30-34.

To complement the analysis, two separate panel analyses were conducted on the pooled control and treatment groups, using data from the 2005 census. Table 1 describes the difference in key indicators between the pooled control and treatment groups irrespective of defined tercile. From this analysis, the control and treatment groups have similar levels of quality-of-life and education indicators. There is some divergence within the healthcare and benefit coverage between the groups, with the pooled control municipalities having lower health coverage and higher IMSS coverage.

Table 1: Simple sample: pooled sample, 2005

Variable	(1) Control	(2) Treatment
Dynamics		
Number of states	4	1
Number of municipalities	54	55
Total population	6,003,323	9,187,320
Women ages 15-49	1,655,581	2,561,158
Healthcare and Benefits Access		
No health coverage (%)	38.5	51.2
IMSS coverage (%)	49.4	32.2
ISSSTE coverage (%)	2.5	5.0
Seguro Popular / public coverage (%)	1.6	1.4
Education		
Average years of schooling	9.09	8.94
Illiterate population 15+ (%)	2.4	2.5
Quality of Life		
Households with electricity (%)	95.7	93.8
Households with piped water (%)	89.7	90.2
Households with drainage (%)	94.1	92.4

Source: Author's rendering of CPV data (2005)

Table 2 describes the difference in key indicators between the pooled control and treatment groups given the defined tercile. Note that T1 indicates municipalities within the furthest tercile from the city center. Once again, the trends in quality-of-life indicators remain relatively stable across terciles within each group. Additionally, education indicators still follow the pattern of reducing percent illiteracy and increasing average years of schooling in closer terciles in both the control and treatment groups. Also, there is still deviation within the healthcare and benefits access indicators, potentially raising questions regarding the quality of the control selection as an accurate counterfactual to the treatment group.

Table 2: Simple sample: tercile sample, 2005

Variable	**(1) Control T1**	**(2) Control T2**	**(3) Control T3**	**(4) Treatment T1**	**(5) Treatment T2**	**(6) Treatment T3**
Dynamics						
Number of states	4	4	4	1	1	1
Number of municipalities	17	18	19	19	19	17
Total population	462,566	1,383,996	4,156,761	546,956	1,343,342	7,297,022
Women ages 15-49	124,593	376,649	1,154,339	147,702	361,595	2,051,861
Healthcare and Benefits Access						
No health coverage (%)	60.5	34.1	37.5	66.5	57.4	48.9
IMSS coverage (%)	26.0	56.7	49.6	19.7	26.3	34.2
ISSSTE coverage (%)	4.1	2.1	2.5	2.5	5.0	5.2
Seguro Popular / public coverage (%)	1.7	0.9	1.9	1.7	0.3	1.6
Education						
Average years of schooling	8.03	8.64	9.35	7.83	8.67	9.07
Illiterate population 15+ (%)	3.6	2.2	2.3	4.3	2.8	2.4
Quality of Life						
Households with electricity (%)	96.2	95.7	95.7	95.5	92.7	93.9
Households with piped water (%)	87.3	91.4	89.4	90.0	86.9	90.8
Households with drainage (%)	89.3	93.8	94.7	85.6	90.1	93.3

Source: Author's rendering of CPV data (2005)

Parallel Trends and Elimination

Important to the integrity of the difference-in-differences analyses is the examination of the pre-period trends of the control and treatment groups. As Roth et al. (2023) emphasizes, the integrity of the difference-in-differences design relies on the assumption that trends in the control group would have remained in parallel, absent the treatment. Within this thesis, this element is particularly poignant because treatment is not only non-randomly assigned for treatment and control groups at the aggregate, but also within the additional hypothesized access gradient.

In the case of this simple group selection, pre-period trends were dramatically non-parallel. The mapped raw trends and normalized trends for all age groups within the pooled and tercile specifications are included in the appendix and will not be discussed within the body of the paper (see Appendix C).

Narrowed Treatment Area Grouping

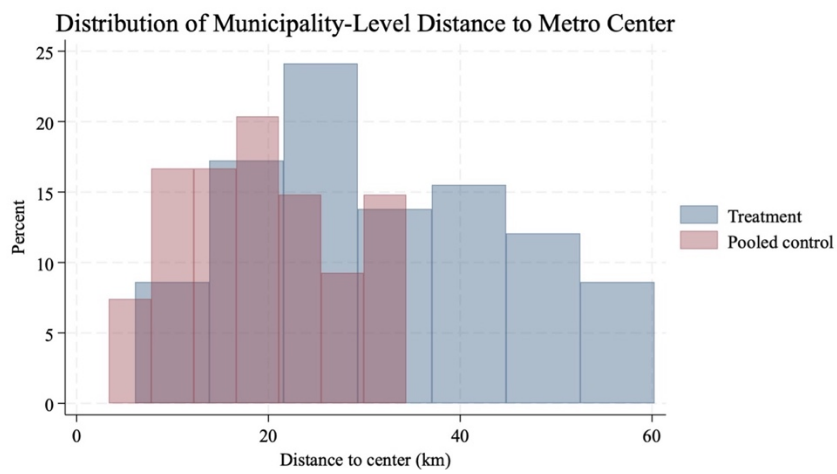
Due to the unsatisfactory parallel trends of the simple metro center grouping, further evaluation of the groups was conducted. The first issue that arose was the differentiated sprawl of the control and treatment groups. The pattern of distance from defined city center is illustrated in Figure 2. From this histogram the treatment group is far more sprawling than the control group. Since terciles were created in the simple group within each metro area, the low access terciles in the control were much closer in distance than their treatment tercile equivalents.

Thus for the next specification, the treatment group was narrowed to better match the sprawl of the intended control. The impact of the restriction on sprawl can be seen in Figure 3.

Specifications

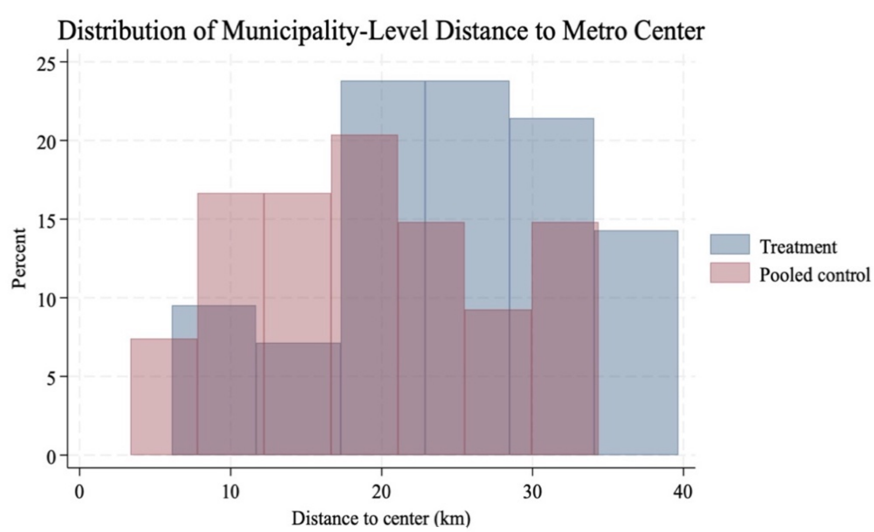
Thus, the treatment group within this redefined specification is still restricted as municipalities within the overlap of Mexico City and Estado de México, the control group is defined as municipalities within the pre-defined metro area of Puebla/Tlaxcala, Guadalajara, and Monterrey. However, unlike the first case, metro areas have been restricted such that only samples with distance to metro center between zero and 40 km are included. This restriction only removed treatment municipalities because the pre-defined metro areas of the control already fall within this restriction (see Appendix A).

Figure 2



Source: Author's rendering of CPV data (2005)

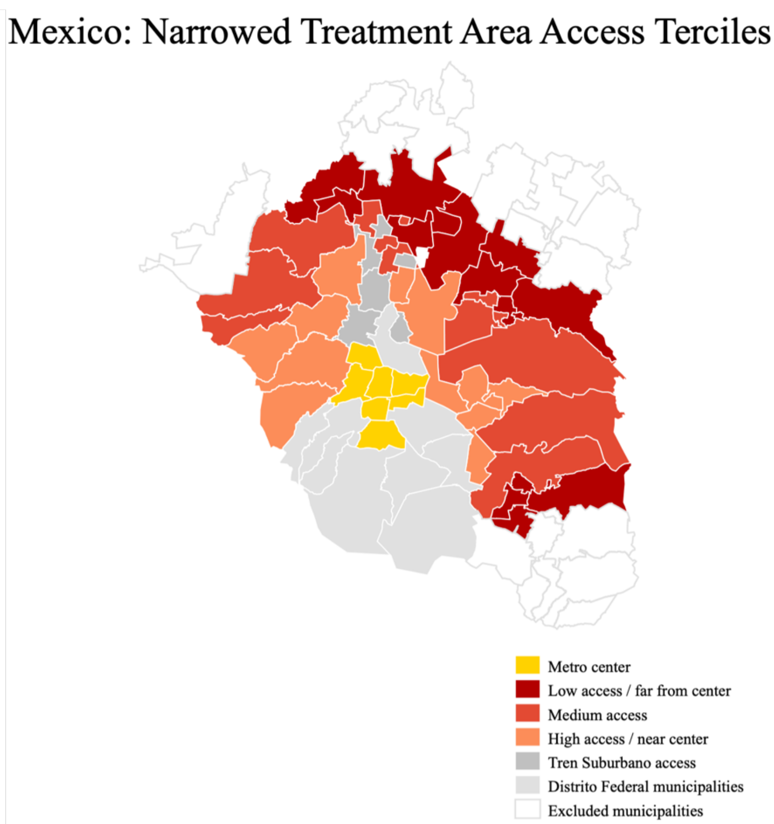
Figure 3



Source: Author's rendering of CPV data (2005)

Once again, each metro area has a defined city center (one or two municipalities) which is used for distance calculated and ultimately omitted from the sample and the three municipalities served by the Tren Suburbano are omitted from the treatment group. In this case, terciles were created within each restricted metro area, creating changes only within the treatment group (see Figure 4). The final sample consisted of 39 treatment municipalities and 54 control municipalities. Data is at the municipality level, with data existing for births per 10,000 women aged 15-49. There is data for women aged 15-49, 20-24, 25-29, and 30-34.

Figure 4



Source: Author’s rendering of INEGI Municipality Shapefiles,
using CPV data (2020, 2010, 2005, 2000)

Akin to the simple grouping, to complement the analysis, two separate panel analyses were conducted on the pooled control and treatment groups, using data from the 2005 census. Table 3 describes the difference in key indicators between the pooled control and treatment groups irrespective of defined tercile. There exist similar results as within the simple grouping; the restriction of the treatment group did not cause any major shifts to the aforementioned similarities and concerns.

Table 3: Narrowed sample: pooled sample, 2005

Variable	(1) Control	(2) Treatment
Dynamics		
Number of states	4	1
Number of municipalities	54	39
Total population	6,003,323	8,790,794
Women ages 15-49	1,655,581	2,454,413
Healthcare and Benefits Access		
No health coverage (%)	38.5	50.2
IMSS coverage (%)	49.4	33.0
ISSSTE coverage (%)	2.5	5.1
Seguro Popular / public coverage (%)	1.6	1.4
Education		
Average years of schooling	9.09	9.01
Illiterate population 15+ (%)	2.4	2.4
Quality of Life		
Households with electricity (%)	95.7	93.7
Households with piped water (%)	89.7	90.2
Households with drainage (%)	94.1	92.8

Source: Author's rendering of CPV data (2005)

Table 4 describes the difference in key indicators between the pooled control and treatment groups given the newly defined terciles. The trends in quality-of-life indicators remain relatively stable across terciles within each group. Additionally, education indicators follow the pattern of reducing percent illiteracy and increasing average years of schooling in closer terciles in both the control and treatment groups. There is still deviation within the healthcare and benefits access indicators, maintaining the concern regarding the quality of the control selection as an accurate counterfactual to the treatment group.

Table 4 Narrowed sample: tercile sample, 2005

Variable	(1) Control T1	(2) Control T2	(3) Control T3	(4) Treatment T1	(5) Treatment T2	(6) Treatment T3
Dynamics						
Number of states	4	4	4	1	1	1
Number of municipalities	17	18	19	14	13	12
Total population	462,566	1,383,996	4,156,761	771,515	1,614,445	6,404,834
Women ages 15-49	124,593	376,649	1,154,339	203,205	447,714	1,803,494
Healthcare and Benefits Access						
No health coverage (%)	60.5	34.1	37.5	52.7	54.0	48.9
IMSS coverage (%)	26.0	56.7	49.6	28.2	32.2	33.7
ISSSTE coverage (%)	4.1	2.1	2.5	4.3	4.8	5.3
Seguro Popular / public coverage (%)	1.7	0.9	1.9	0.3	0.3	1.8
Education						
Average years of schooling	8.03	8.64	9.35	8.74	8.64	9.13
Illiterate population 15+ (%)	3.6	2.2	2.3	2.6	2.8	2.3
Quality of Life						
Households with electricity (%)	96.2	95.7	95.7	91.1	94.0	94.0
Households with piped water (%)	87.3	91.4	89.4	87.3	87.5	91.2
Households with drainage (%)	89.3	93.8	94.7	89.4	91.4	93.6

Source: Author’s rendering of CPV data (2005)

Parallel Trends and Elimination

Once again, the examination of the pre-period trends of the control and treatment groups was conducted. Like in the case of this simple group selection, pre-period trends were still non-parallel. The mapped raw trends and normalized trends for all age groups within the pooled and tercile specifications are included in the appendix and will not be discussed further in the body of the paper (see Appendix C).

Slope Matched Grouping

Due to the inability of prior control selections and treatment restrictions to support sufficient evidence of parallel trends, a more extreme methodology was employed to narrow the controls further. This step was motivated by the logic of matching samples prior to statistical analysis, rather than relying on the adjustment of regressions after estimation. Ho et al. (2007) argues that matching can improve the quality of ensuing causal inference by reducing the imbalance between treatment and control groups, reducing model dependence. As such, this logic was adapted to this specific difference-in-differences setting by matching municipalities based off their pre-2008 fertility trends.

Creation

The third attempt at control group specification was split into several cases. Once again, for all cases, data is at the municipality level, with data existing for births per 10,000 women aged 15-49.

The motivation of this third sample was to select control municipalities to better fit the relationship between distance and birth rates in the pre-2008 trends. While the slope matching was enacted on two pre-defined specifications, only the first will be described within the body of the paper.[4] This narrowing was done by pulling from nearly all of the municipalities within each control state, such that the only omitted municipalities were those that were considered city

[4] The non selected narrowing was done on previously defined groups that were selected due to their identified relationship between distance and travel to city center for births that matched the treatment area. This specification proved too narrow and resulted in tiny samples.

centers, the non- metro area for the treatment group, and the three municipalities served by the Tren Suburbano in the treatment group. For both categories, there exist data for births of women aged 15-49, 20-24, 25-29, and 30-34.

Within each age definition and main category, two separate distance measures were used; continuous distance and distance buckets (<5, 5-15, 15-40, 40-55, 55-70, >70).

For each age definition, main category, and distance metric, narrowing of the control groups were done using slope matching; for each treatment municipality, the two control municipalities in the same distance band with the most similar pre-2008 fertility slope were selected. This resulted in a control group with a higher probability of parallel trends. There exist many caveats to this selection that will be mentioned in the discussion. Additionally, since the slope matching was carried out separately by age groups, it is important to be cautious of comparing results between age groups.

Ultimately, the groups that were selected from this methodology were groups defined by age for continuous treatment and for bucket-based treatment, resulting in eight separate control and treatment group specifications.

Within the newly established groups, panel analyses were conducted. Due to the nature of the slope-matching used, panels were created within each age group. Only panels for the 15-49 and 20-24, distance band groups are included in the body of the paper. Other panels for the distance band groups can be found in the appendix (see Appendix B).

Specifications: Continuous Treatment Groups

Within the slope-matched continuous groups, 65 control municipalities were retained for ages 15-49 and 57 for ages 20-24. Table 5 illustrates key outcomes for the aged 15-49 control and treatment group using the 2005 census. It shows more similar total healthcare coverage than the other grouping styles. However, the percent illiterate population within the control municipalities is much higher, indicating a potentially flawed comparison.

Table 5: Continuous pooled sample: ages 15–49, 2005

Variable	(1) Control	(2) Treatment
Dynamics		
Number of states	4	1
Number of municipalities	65	55
Total population	1,389,334	9,187,320
Women ages 15-49	374,388	2,561,158
Healthcare and Benefits Access		
No health coverage (%)	57.9	51.2
IMSS coverage (%)	28.9	32.2
ISSSTE coverage (%)	4.2	5.0
Seguro Popular / public coverage (%)	3.7	1.4
Education		
Average years of schooling	7.87	8.94
Illiterate population 15+ (%)	4.5	2.5
Quality of Life		
Households with electricity (%)	96.0	93.8
Households with piped water (%)	87.5	90.2
Households with drainage (%)	88.9	92.4

Source: Author's rendering of CPV data (2005)

Specifications: Distance Band Treatment Groups

Within the slope-matched distance band groups, 66 control municipalities were kept for ages 15-49 and 40 for ages 20-24. Tables 6 and 7 illustrate the panel on key outcomes for the 15-49 and 20-24 control and treatment groups using 2005 census data. The major takeaway is the tiny sample within both age groups for the 5-15 km and 55-70 km bands for both the control and treatment.

This resulted in the decision to include only the 15-40 km and 40-55 km groups within the banded regression. Figure 5 visualizes the grouping of the municipalities within the treatment group. Figures A.1.9-A.1.11 in Appendix A show the distance band slope-matching selection for ages 15-49 within the control states.

Table 6: Slope-matched distance-band sample: ages 15–49, 2005

Variable	(1) Control 5–15 km	(2) Control 15–40 km	(3) Control 40–55 km	(4) Control 55–70 km	(5) Treatment 5–15 km	(6) Treatment 15–40 km	(7) Treatment 40–55 km	(8) Treatment 55–70 km
Dynamics								
Number of states	3	4	4	2	1	1	1	1
Number of municipalities	5	41	16	4	5	36	11	3
Total population	223,578	1,083,960	239,554	21,751	2,891,084	5,927,088	330,804	38,344
Women ages 15-49	66,345	294,245	62,786	5,567	821,292	1,640,669	89,166	10,031
Healthcare and Benefits Access								
No health coverage (%)	41.2	55.8	64.6	79.2	48.2	51.3	72.4	80.5
IMSS coverage (%)	34.7	29.8	21.6	4.7	33.4	32.7	15.4	11.3
ISSSTE coverage (%)	1.7	5.0	3.1	1.2	5.6	4.9	2.1	2.3
Seguro Popular / public coverage (%)	0.2	3.4	7.6	13.7	1.6	1.3	2.7	0.1
Education								
Average years of schooling	10.00	8.21	6.71	5.72	9.28	8.86	7.53	7.26
Illiterate population 15+ (%)	2.5	3.7	7.7	10.5	2.4	2.5	4.9	5.7
Quality of Life								
Households with electricity (%)	95.7	96.0	96.5	98.0	94.8	93.2	95.5	97.7
Households with piped water (%)	82.1	89.9	87.4	86.6	93.4	88.6	90.0	93.7
Households with drainage (%)	91.5	89.7	84.9	72.6	94.6	91.9	82.5	78.7

Source: Author's rendering of CPV data (2005)

Table 7: Slope-matched distance-band sample: ages 20–24, 2005

Variable	(1) Control 5–15 km	(2) Control 15–40 km	(3) Control 40–55 km	(4) Control 55–70 km	(5) Treatment 5–15 km	(6) Treatment 15–40 km	(7) Treatment 40–55 km	(8) Treatment 55–70 km
Dynamics								
Number of states	2	4	4	2	1	1	1	1
Number of municipalities	3	24	10	3	5	36	11	3
Total population	161,456	767,948	177,195	56,295	2,891,084	5,927,088	330,804	38,344
Women ages 15-49	48,934	209,357	47,062	14,421	821,292	1,640,669	89,166	10,031

Healthcare and Benefits Access								
No health coverage (%)	36.0	62.1	67.9	73.4	48.2	51.3	72.4	80.5
IMSS coverage (%)	31.3	24.4	11.9	3.3	33.4	32.7	15.4	11.3
ISSSTE coverage (%)	1.5	5.7	2.8	0.5	5.6	4.9	2.1	2.3
Seguro Popular / public coverage (%)	1.9	3.3	15.8	21.7	1.6	1.3	2.7	0.1
Education								
Average years of schooling	10.53	8.25	6.94	4.99	9.28	8.86	7.53	7.26
Illiterate population 15+ (%)	2.3	4.5	6.2	13.3	2.4	2.5	4.9	5.7
Quality of Life								
Households with electricity (%)	95.5	95.9	96.9	97.6	94.8	93.2	95.5	97.7
Households with piped water (%)	79.5	88.3	91.5	87.6	93.4	88.6	90.0	93.7
Households with drainage (%)	90.3	88.8	86.4	76.5	94.6	91.9	82.5	78.7

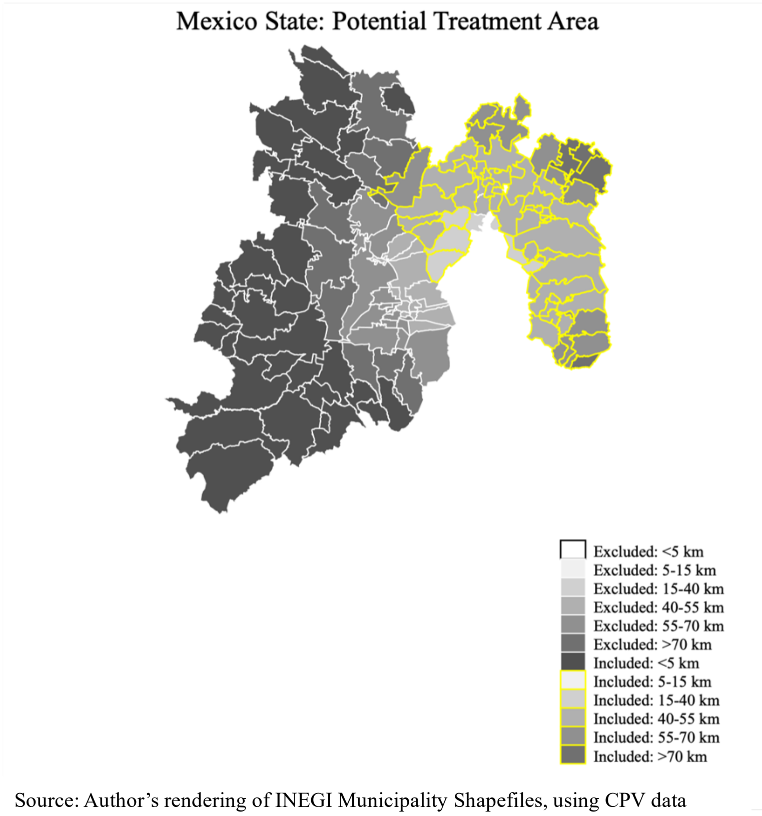
Source: Author's rendering of CPV data (2005)

Parallel Trends and Inclusion

In analyzing the parallel trends of the slope-matched groupings, visual analysis was done on all eight iterations, separating analysis by age and distance band. Visual analysis of the continuous groups is more challenging, so a similar analysis by band was conducted to provide some semblance of support.

For the distance band groups, only 15-40 km and 40-55 km parallel trends were assessed. In all age distinctions, pre-2008 trends were convincingly parallel. This assessment was done with both monthly and yearly trends and normalized and raw visuals. All visuals used for parallel trend assessment are attached in the appendix (see Appendix C).

Figure 5



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

For the continuous groups, the parallel trends were less convincing for most age groups outside of the general fertility rate. For other age groups, trends within 15-55 km were more convincing, but the volatility of the rest of the range significantly hampered the meaningful addition the continuous analysis outside of general fertility specifications could have made.

The result of this extensive pre-testing justified the decision to continue with several main categories of regressions using the distance band specification for all ages and restricted to 15-40 and 40-55 km buckets and using the continuous distance specification for general fertility.

Empirical Strategy

The data used in the regression is as follows: fertility data is collected from selected municipalities. Each municipality has a monthly birth rate for women aged 15-49, 20-24, 25-29, and 30-34 for all months between January 2000 to December 2015. The birth rates are weighted as number of births per 10,000 women aged 15-49. Additionally, within the distance band specification, each municipality is assigned to an access band, indicating their distance from identified metro center municipality.

Regression Design

Multiple regressions were conducted, each a difference-in-differences analysis, comparing birth trends pre- and post-2008 policy effect onset. Difference-in-differences and fixed effect models are widely utilized in economic literature as a method to exploit quasi-experimental variation while controlling for time-invariant differences across groups and common time shocks (Angrist & Pischke 2009).

The control group municipalities are municipalities selected from three different metro areas and the treatment group are municipalities selected from the metro area of Mexico City within Estado de México, with the selection of the different groups defined previously.

The formal regression analysis was restricted to the distance band slope-matched samples, rather than extending to the broader aforementioned samples. As mentioned prior, the slope-matched samples, naturally had a more defensible visual support for parallel trends. The incorporation of distance as an access measure within the empirical strategy was supported by the robust spatial-accessibility literature, in which proximity is often treated as an important element of healthcare access and uptake. For example, Guagliardo (2004) emphasizes the importance of geographic components when evaluating access to care and formally defines spatial accessibility as a measure of the potential for healthcare uptake.

All regressions include municipality and month-year fixed effects. Standard errors are clustered at the municipality level. This element is important in difference-in-differences settings where outcomes are serially correlated, because use of conventional standard errors risks overstating the precision of the model (Bertrand et al., 2004). Thus, appropriately clustering standard errors allows for within-municipality correlation in the regression errors; in this case, this allows for the regression to recognize that monthly observations for a single municipality are not independent of each other (Cameron & Miller, 2015). Additionally, because the slope-matching was done separately for each fertility outcome, the samples are age-specific.

For each specification, a pooled regression comparing trends in fertility pre- and post-2008 was also estimated. This model ignores heterogeneity in access. The model also estimates both post-period slope changes, through β_1, and post-period shifts, through β_0:

$$y_{mt}^{a} = \alpha_m + \delta_t + \beta_0(T_m \times Post_t) + \beta_1(T_m \times After_t) + \varepsilon_{mt}$$

For each continuous distance specification, a regression was run comparing trends in fertility pre- and post- 2008 with access as a continuous variable. For each banded distance specification, a regression was run with access as a discrete variable. The buckets were restricted to 15-40 km and 40-55 km. As defined previously, the 5–15 km and 55–70 km bands were excluded due to their volatility stemming from small sample size. This model allows the 15–40 km municipalities to have a different general post-2008 level and slope pattern than the 40–55 km municipalities, regardless of treatment status; the 40–55 km group is the baseline comparison for this general bucket trend:

$$y_{mt}^{a} = \alpha_m + \delta_t + \gamma_0(B_{2m} \times Post_t) + \gamma_1(B_{2m} \times After_t) + \beta_{02}(T_m \times B_{2m} \times Post_t) + \beta_{12}(T_m \times B_{2m} \times After_t) + \beta_{03}(T_m \times B_{3m} \times Post_t) + \beta_{13}(T_m \times B_{3m} \times After_t) + \varepsilon_{mt}$$

B_{3m} indicates the 15-40 km bucket and B_{2m} indicates the 40-55 km bucket. The 40–55 km bucket is the reference group for the general bucket-specific post-period pattern, while treatment effects are estimated separately for both middle-distance buckets. The main coefficients of interest are B_{12} and are B_{13} illustrating the fertility trend slope change post-2008, estimating whether treated municipalities in the 15–40 km and 40–55 km bands experienced differential post-2008 fertility trend changes relative to their corresponding controls in the same matched sample. The other coefficients of interest are B_{02} and B_{03}, which capture whether the municipalities in the corresponding experienced a post-2008 fertility level shift compared with their control counterparts.

Results

General Interpretation of Results

The slope-matched-group regressions show some evidence supporting the theory of a post-policy fertility trend change to treated municipalities, most prominently for the fertility rate for women aged 15-49 and 20-24. Despite this, the results do not support the hypothesis of a monotonic access gradient effect; the continuous access models were largely non significant and estimated effects were not consistently larger for closer distances in the access band models.

Continuous-Distance Group Specification Results

Table 8 presents the findings from the continuous-distance specifications using the slope-matched samples.

In the pooled estimates, treated municipalities were associated with a statistically significant negative post-period slope change for the general fertility rate and for the fertility rate of women aged 20-24. The Treatment x Post coefficient is -0.082 for women aged 15-49 in specification. These estimates suggest that, within the continuous-distance samples, treated municipalities experienced faster post-2008 fertility in specific the general fertility models declines compared to their control counterparts.

However, the estimates interacting treatment with access to the city do not support the access-gradient effect theory. All Treatment x Access x Post coefficients are not statistically significant. Conversely, there does exist statistically significant positive post-2008 *level* effects for women aged 15-49, contradicting the theory that access reduces fertility.

Thus, although this model provides some evidence of greater post-2008 fertility declines, this continuous-distance group ultimately does not provide support for the hypothesis that fertility declines are more prominent for municipalities with higher access to city centers, measured with Euclidean distance.

Table 8: Continuous-distance specifications

	(1)	(2)
	fert_rate_15_49_10000	fert_rate_15_49_10000
Treatment x Post	-0.685	-0.776
	(1.474)	(1.445)
Treatment x After	-0.082***	-0.082***
	(0.023)	(0.023)
Access x Post		-0.651
		(1.209)
Access x After		-0.009
		(0.017)
Treatment x Access x Post		2.627*
		(1.401)
Treatment x Access x After		0.019
		(0.019)
Outcome	15_49	15_49
Model	Pooled baseline	Continuous access
Observations	23030.000	23030.000
Municipalities	120.000	120.000
Adj. R-sq.	0.450	0.452
Municipality FE	Yes	Yes
Month-year FE	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

Bucket Group Specification Results: Middle Distance Samples

Table 9 outlines the results from the slope-matched sample model using distance bands for 15-40 km and 40-55 km.

Within the baseline pooled models, there was a negative post-period slope change for the general fertility rate and for the fertility rate of women aged 20-24. The Treatment x Post coefficient was -0.067 for women aged 15-49 in specification and -0.063 for women aged 20-24 in specification. These estimates are in line with the continuous-distance specification, suggesting that, within the distance band samples, treated municipalities experienced faster post-2008 fertility declines compared to their control counterparts. There was no clear slope change for women aged 25-29 or 30-34.

The bucket-specific analyses expanded on this pattern. For general fertility rates, the Treatment x Post x 15-40 km coefficient was -0.067 and the Treatment x Post x 40-55 km coefficient was -0.068. For women aged 20-24, the Treatment x Post x 15-40 km coefficient was -0.05 and the Treatment x Post x 40-55 km coefficient was -0.107. These four estimates are statistically significant. The model estimates for women aged 25-29 and 30-34 are small and not statistically significant.

These results again suggest some evidence of post-2008 relative fertility declines in treated municipalities compared to their control counterparts, specifically in the general fertility rate and for women aged 20-24. However, akin to the continuous distance model, this model did not support the access-gradient effect hypothesis; the closer access band did not show fertility declines than the further band.

Table 9: Middle-bucket specifications

	(1)	(2)	(3)	(4)
	fert_rate_15_49_10000	fert_rate_15_49_10000	fert_rate_20_24_10000	fert_rate_20_24_10000
Treatment x Post	-1.603		1.170	
	(1.567)		(0.935)	
Treatment x After	-0.067***		-0.063***	
	(0.024)		(0.016)	
Treatment x 15-40 km x Post		-0.664		0.301
		(1.898)		(0.979)
Treatment x 15-40 km x After		-0.067**		-0.050***
		(0.030)		(0.018)
Treatment x 40-55 km x Post		-3.787		4.277**
		(2.315)		(2.057)
Treatment x 40-55 km x After		-0.068*		-0.107***
		(0.039)		(0.032)
Outcome	15_49	15_49	20_24	20_24
Model	Pooled baseline	Middle-bucket model	Pooled baseline	Middle-bucket model
Observations	19960.000	19960.000	15509.000	15509.000
Municipalities	104.000	104.000	81.000	81.000
Adj. R-sq.	0.462	0.463	0.247	0.250
Municipality FE	Yes	Yes	Yes	Yes
Month-year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

Table 9 (cont.): Middle-bucket specifications

	(5)	(6)	(7)	(8)
	fert_rate_25_29_10000	fert_rate_25_29_10000	fert_rate_30_34_10000	fert_rate_30_34_10000
Treatment x Post	-1.027		-0.763*	
	(0.776)		(0.457)	
Treatment x After	-0.019		-0.003	
	(0.013)		(0.008)	
Treatment x 15-40 km x Post		-0.437		-0.344
		(0.906)		(0.542)
Treatment x 15-40 km x After		-0.019		-0.000
		(0.013)		(0.009)
Treatment x 40-55 km x Post		-2.919**		-2.074***
		(1.219)		(0.769)
Treatment x 40-55 km x After		-0.029		-0.005
		(0.034)		(0.015)
Outcome	25_29	25_29	30_34	30_34
Model	Pooled baseline	Middle-bucket model	Pooled baseline	Middle-bucket model
Observations	15935.000	15935.000	15147.000	15147.000
Municipalities	83.000	83.000	79.000	79.000
Adj. R-sq.	0.243	0.245	0.145	0.146
Municipality FE	Yes	Yes	Yes	Yes
Month-year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

Summary of Empirical Evidence

In summary, the aforementioned specifications partially support the treatment-control fertility difference but do not support the access gradient hypothesis. The specifications suggest that there exists some relative post-2008 fertility declines, especially for the general fertility rate and for women aged 20-24. This age-specific decline exists in both the continuous distance and middle-bucket sample models. However, there is no evidence to support the claim that fertility declines were larger in municipalities with a lower Euclidean distance to Mexico City. The magnitude of the access band estimates was greater for the 40-55 km band than for the 15-40 km band, contradicting this assumption.

Thus, the findings complicate the original access-gradient hypothesis. However, these results do not necessarily disprove the theory that access increases treatment effect. Instead, it is likely that Euclidean distance is a flawed proxy for effective access. Instead, practical access may be driven by travel time, information networks, medical clinic knowledge, and other forms of metro area integration that this simple model was unable to capture.

Discussion

The results are relatively mixed and should be interpreted cautiously. However, despite the limited scope of this research and the few statistically significant results, there is still opportunity for discussion.

Implications with Assumptions

For causality to hold in the pooled difference-in-differences regression analyses, certain elements had to hold true. (1) Treatment and control municipalities would have followed parallel fertility trends after 2008 assuming the reform had not occurred. (2) The control municipalities were not affected by the Mexico City 2008 abortion reform. (3) The treatment group was not affected by any other post-2008 shock. (4) The bandwidth of the regression is accurate to the expected timeline of the effects of the policy shock. (5) The composition of the municipalities did not change in a way that mechanically affects fertility rates.

For causality to hold in the access band difference-in-differences regression analyses this burden is increased. In addition to the above-mentioned elements, (6) treatment and comparable municipalities would have followed parallel trends within *each* distance band absent the reform. Holding these assumptions true, the statistically significant results from the selected models can be interpreted in the following way:

The pooled estimates address whether fertility trends of municipalities within the treated section of Estado de Mexico changed differently to the selected control municipalities. The statistically significant results from the pooled elements thus suggest that there may be a divergence in treatment and control area fertility trends for general fertility women aged 20-24, with the treated municipalities seeing a negative slope shift in fertility rate. These estimates do not address the access element.

The statistically significant results from the banded specifications address this element, considering whether post-2008 changes were concentrated among municipalities with higher access to city center. These results suggest that there is potential heterogeneity in fertility trend changes depending on distance band for general fertility women aged 20-24, but in the opposite direction as hypothesized.

However, even in the case that the aforementioned assumptions hold, there is not enough evidence to claim that the measured changes were caused by the abortion reform or through the channel of increased abortion access or uptake. Thus comes a thorough discussion of the internal and external validity limitations of the findings of this paper.

Wing et al. (2018) recognizes the widespread difference-in-differences design use in public health research, but cautions the over interpretation of causality. They emphasize the importance of comparison-group construction, identifying assumptions, robustness, and statistical inference. This thesis follows this guidance in many ways, explicitly evaluating pre-trends, narrowing the scope of the grouping to prioritize integrity over statistical significance, including municipality and month/year fixed effects, and clustering standard errors at the municipality level. Even so, the analysis does diverge from some of the recommendations for an optimal robust analysis; the treatment groups are not randomly assigned and relatively small in sample size, some distance bands continue to be volatile, and the parallel trends are partially supported but not completely convincing.

As such, the estimated results should not be interpreted as causal evidence, but instead as suggestive evidence that could inform discussion surrounding the differences in fertility trends following the 2007 abortion reform.

Limitations and Cautions

Internal Validity

Despite attempts to ensure empirical soundness, the internal validity of this study is imperfect. While the original groups' inadequate pre-2008 trends caused the need to narrow the sample by slope-matching pre-2008 control municipalities, the control was narrowed to such an extent that made statistical significance difficult to achieve. While the decision to narrow to ensure parallel trends was justifiable given the context, it results in less ideal empirical results.

Additionally, as Kahn-Lang & Lang (2020) emphasize, the integrity of a difference-in-differences' design depends not only on similar pre-treatment trends, but also on whether the treatment and control groups are comparable to make a counter factual possible. Thus, this required narrowing of the control can be interpreted as extreme enough to suggest that the unique relationship between distance from city center and fertility for Mexico City Metro area municipalities cannot be replicated by organically selecting from other large Mexican cities. Furthermore, even if fertility trends change smoothly with distance, there is little to suggest that the scale of this relationship would be reproduced in the selected control areas. For example, a 20 km change in distance from the city center in one location may imply very different access changes, dependent on city infrastructure, commuting, and healthcare integration differences.

Another important area of weakness is in the measurement of access through Euclidean distance. Such straight-line distance measurements do not incorporate the existing transportation infrastructure and commuting patterns that would naturally impact the actual or psychological cost of traveling for care. Additionally, even with an accurate travel time variable, it is very difficult to quantify the actual access and the equivalent barriers to healthcare services that come from differing levels of healthcare system integration and clinic service knowledge Luo & Wang (2023) show that GIS-based[5] measures of healthcare accessibility can better capture access when

[5] Geographic Information System - based

accounting for travel time, provider supply, and population demand, rather than relying solely on distance.

Additionally, there is potential for changing compositions of the treatment group because the analysis is done at a municipality level, rather than tracking individuals over time. Thus, the identified changes in fertility could be indicative of population cohort or composition changes, rather than a specific behavioral change in the same population.

Lastly, it is important to discuss other potential confounds that could call the internal validity of these results into question. For example, while the use of the control groups aims to control for country-wide time variant changes, there is no guarantee that the groups' fertility trends would respond the same way after major shocks, such as the 2008 financial crisis. Additionally, there may have been difficult to measure economic, migration, health, and urbanization shocks that the model did not account for. While unsupported by specific evidence, it is reasonable to predict that the additional decline in slope of fertility rates could be driven by any of these factors.

The potential of other impacting elements is cautioned by Jacobson et al (2021), where the dynamics of travel to Mexico City for abortion is quantified and analyzed. Despite the analysis being of data from 2016-2019, their findings are still relevant. As mentioned in the literature, they find that travel for abortion is concentrated among municipalities with low adolescent fertility and low marginalization. Individuals who traveled also had higher education rates and lower marriage rates. This confirms the importance of considering the aforementioned variables in future analysis. These elements could be accounted for by ensuring that control groups more accurately match education, marriage, and marginalization rates by distance.

In sum, fertility is affected by a wide range of factors that this study could not completely address, thus, claiming these findings as causal cannot currently be done, and should not be done without thorough further analysis.

External Validity

Additionally, outside of the empirical limitations, Mexico City and Estado de México are unusually integrated with a very permeable border, so the results are not easily generalizable to locations without these qualities. Moreover, due to the need to narrowing the sample to be able to justify Euclidean distance and to achieve satisfactory parallel trends, the external validity of the estimates have been reduced to apply most directly to the municipalities retained rather than all Mexican municipalities or even all large metropolitan areas in Mexico.

Takeaways and Motivations for Future Analysis

With these limitations considered, the paper does not claim definitive causal evidence of a spillover effect of this reform. Instead, it provides some novel evidence suggesting heterogenous fertility trend shifts when allowing for access variance in Estado de Mexico. This outcome, while modest, can reasonably motivate the use different access measures and more refined empirical strategies to further study potential access gradients.

Specifically, meaningful future research can begin by redefining the control groups through refined selection or synthetic control creation to better match the population and fertility dynamics of the treatment bands. Stuart (2010) emphasizes that targeted matching methods can help select treatment and control units with more similar covariate distributions, improving causal inference credibility. Additionally, redefining the distance measure could help create a better proxy of access. Similarly, attempting to access to individual or municipality level abortion statistics for Estado de México residents from 2007-2015 could make the mechanism of abortion uptake and its potential relationship with fertility trend more defensible, especially since the demographics of abortion travelers are not necessarily representative of the general population. Another methodology to better tie the changes to the abortion reform and abortion uptake is by incorporating outcomes of maternal and fetal morbidity.

These improvements can also help motivate research in other locations. For example, the mechanism of permeable border access to abortion care and its effects is more relevant than ever in the United States.

Conclusion

This paper reflects a cautious analysis of abortion and healthcare access literature. A series of thorough statistical tests were run to ensure integrity of the empirical analysis, resulting in several iterative attempts of control and treatment group selection. Where attempts fell short, assumptions were reevaluated and aided in the construction of more admissible empirical designs. The culmination of this testing was the slope-matched continuous and distance banded sample specifications. The pre-fertility trends of these new groups proved adequate to move on to regression analysis. After analyzing the results of several different difference-in-differences specifications, the statistically significant estimated coefficients do not support the theory of the access gradient effect of the abortion reform on fertility outcomes of the neighboring state. However, the findings also do not eliminate the possibility of access as an important determinant of the uptake and effect of the policy change.

As repeated throughout the length of the discussion, the findings of the empirical analysis of this paper will not be oversold as definitive causal evidence. Even so, this paper presents a thoughtful analysis of the under analyzed, heterogeneity of impact of the abortion reform in Mexico City.

References

Adkins, S., Talmor, N., Dechen, T., White, M. H., Singh, A., Molina, R. L., Zera, C. A., Stevens, J. P., & O'Donoghue, A. L. (2025). Association of restricted abortion access with maternal and infant health by maternal nativity: A difference-in-differences analysis. *BJOG: An International Journal of Obstetrics & Gynaecology, 132*(13), 2077–2085. https://doi.org/10.1111/1471-0528.18164

Angrist, J. D., & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press. https://doi.org/10.1515/9781400829828

Barr-Walker, J., Jayaweera, R. T., Ramirez, A. M., & Gerdts, C. (2019). Experiences of women who travel for abortion: A mixed methods systematic review. *PLOS ONE, 14*(4), e0209991. https://doi.org/10.1371/journal.pone.0209991

Becker, D., & Díaz Olavarrieta, C. (2013). Decriminalization of abortion in Mexico City: The effects on women's reproductive rights. *American Journal of Public Health, 103*(4), 590–593. https://doi.org/10.2105/AJPH.2012.301202

Becker, D., Díaz-Olavarrieta, C., Juárez, C., García, S. G., Sanhueza, P., & Harper, C. C. (2011a). Clients' perceptions of the quality of care in Mexico City's public-sector legal abortion program. *International Perspectives on Sexual and Reproductive Health, 37*(4), 191–201. https://doi.org/10.1363/3719111

Becker, D., Díaz-Olavarrieta, C., Juárez, C., García, S. G., Sanhueza, P., & Harper, C. C. (2011b). Sociodemographic factors associated with obstacles to abortion care: Findings from a survey of abortion patients in Mexico City. *Women's Health Issues, 21*(3 Suppl.), S16–S20. https://doi.org/10.1016/j.whi.2011.02.009

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics, 119*(1), 249–275. https://doi.org/10.1162/003355304772839588

Burdick, K. J., Coughlin, C. G., D'Ambrosi, G. R., Monuteaux, M. C., Economy, K. E., Mannix, R. C., & Lee, L. K. (2024). Abortion restrictiveness and infant mortality: An ecologic study, 2014–2018. *American Journal of Preventive Medicine, 66*(3), 418–426. https://doi.org/10.1016/j.amepre.2023.10.010

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources, 50*(2), 317–372. https://doi.org/10.3368/jhr.50.2.317

Castillo Betancourt, T. (2017). *The effect of abortion legalization on child and maternal health in Mexico City* [Master's thesis, Lund University]. LUP Student Papers.

Clarke, D., & Mühlrad, H. (2018). *The impact of abortion legalization on fertility and female empowerment: New evidence from Mexico* (Development Dissertation Brief 2018:05). The Expert Group for Aid Studies.

Clarke, D., & Mühlrad, H. (2021). Abortion laws and women's health. *Journal of Health Economics, 76*, 102413. https://doi.org/10.1016/j.jhealeco.2020.102413

Contreras, X., van Dijk, M. G., Sanchez, T., & Sanhueza Smith, P. (2011). Experiences and opinions of health-care professionals regarding legal abortion in Mexico City: A qualitative study. *Studies in Family Planning, 42*(3), 183–190. https://doi.org/10.1111/j.1728-4465.2011.00280.x

Darney, B. G., Fuentes-Rivera, E., Saavedra-Avendano, B., Sanhueza-Smith, P., & Schiavon, R. (2021). Preventing first births among adolescents in Mexico City's public abortion programme. *BMJ Sexual & Reproductive Health, 47*(3), e9. https://doi.org/10.1136/bmjsrh-2020-200795

Farin, S. M., Hoehn-Velasco, L., & Pesko, M. F. (2024). The impact of legal abortion on maternal mortality. *American Economic Journal: Economic Policy, 16*(3), 174–216. https://doi.org/10.1257/pol.20220208

Fischer, S., Royer, H., & White, C. (2017). *The impacts of reduced access to abortion and family planning services on abortions, births, and contraceptive purchases* (NBER Working Paper No. 23634). National Bureau of Economic Research. https://doi.org/10.3386/w23634

Friedman, J., Saavedra-Avendaño, B., Schiavon, R., Alexander, L., Sanhueza, P., Rios-Polanco, R., Garcia-Martinez, L., & Darney, B. G. (2019). Quantifying disparities in access to public-sector abortion based on legislative differences within the Mexico City Metropolitan Area. *Contraception, 99*(3), 160–164. https://doi.org/10.1016/j.contraception.2018.11.012

Gardner, G. (2024). The maternal and infant health consequences of restricted access to abortion in the United States. *Journal of Health Economics, 98*, 102938. https://doi.org/10.1016/j.jhealeco.2024.102938

Guagliardo, M. F. (2004). Spatial accessibility of primary care: Concepts, methods and challenges. *International Journal of Health Geographics, 3*, Article 3. https://doi.org/10.1186/1476-072X-3-3

Gutiérrez Vázquez, E. Y., & Parrado, E. A. (2016). Abortion legalization and childbearing in Mexico. *Studies in Family Planning, 47*(2), 113–128. https://doi.org/10.1111/j.1728-4465.2016.00060.x

Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2007). Matching as nonparametric preprocessing for reducing model dependence in parametric causal inference. *Political Analysis, 15*(3), 199–236. https://doi.org/10.1093/pan/mpl013

Instituto Nacional de Estadística y Geografía. (n.d.). *Estadística de Nacimientos Registrados (ENR)* [Data set]. Retrieved May 17, 2026, from https://www.inegi.org.mx/programas/natalidad/

Instituto Nacional de Estadística y Geografía. (2000). *XII Censo General de Población y Vivienda (CPV) 2000* [Data set]. https://www.inegi.org.mx/programas/ccpv/2000/

Instituto Nacional de Estadística y Geografía. (2005). *II Conteo de Población y Vivienda (Conteo) 2005* [Data set]. https://www.inegi.org.mx/programas/ccpv/2005/

Instituto Nacional de Estadística y Geografía. (2010). *Censo de Población y Vivienda (CPV) 2010* [Data set]. https://www.inegi.org.mx/programas/ccpv/2010/

Instituto Nacional de Estadística y Geografía. (2020). *Censo de Población y Vivienda (CPV) 2020* [Data set]. https://www.inegi.org.mx/programas/ccpv/2020/

Jacobson, L. E., Saavedra-Avendaño, B., Fuentes-Rivera, E., Schiavon, R., & Darney, B. G. (2022). Travelling for abortion services in Mexico 2016–2019: Community-level contexts of Mexico City public abortion clients. *BMJ Sexual & Reproductive Health, 48*(e1), e81–e87. https://doi.org/10.1136/bmjsrh-2021-201079

Juárez, F., Palma, J. L., Singh, S., & Bankole, A. (2010). *Barreras para la maternidad segura en México*. Guttmacher Institute.

Kahn-Lang, A., & Lang, K. (2020). The promise and pitfalls of differences-in-differences: Reflections on *16 and Pregnant* and other applications. *Journal of Business & Economic Statistics, 38*(3), 613–620. https://doi.org/10.1080/07350015.2018.1546591

Kelly, B. C., Brewer, S. C., & Hanson, H. A. (2022). Disparities in distance to abortion care under reversal of Roe v. Wade. *Utah Women's Health Review, 6*. https://doi.org/10.26054/0d-4zt7-ts67

Lindo, J. M., Myers, C. K., Schlosser, A., & Cunningham, S. (2017). *How far is too far? New evidence on abortion clinic closures, access, and abortions* (NBER Working Paper No. 23366). National Bureau of Economic Research. https://doi.org/10.3386/w23366

Lu, Y., & Slusky, D. J. G. (2016). The impact of women's health clinic closures on preventive care. *American Economic Journal: Applied Economics, 8*(3), 100–124. https://doi.org/10.1257/app.20140405

Luo, W., & Wang, F. (2003). Measures of spatial accessibility to health care in a GIS environment: Synthesis and a case study in the Chicago region. *Environment and Planning B: Planning and Design, 30*(6), 865–884. https://doi.org/10.1068/b29120

Madrazo, A. (2010). Corrigendum to "The evolution of Mexico City's abortion laws: From public morality to women's autonomy" [International Journal of Gynecology & Obstetrics, 106(3), 266–269]. *International Journal of Gynecology & Obstetrics, 110*(1), 84. https://doi.org/10.1016/j.ijgo.2010.03.010

Melo, A. (2024). Do all roads lead to the same destination? Proximity to abortion providers, abortions, and their conditions in Portugal. *Journal of Population Economics, 37*, 70. https://doi.org/10.1007/s00148-024-01048-1

Melville, S. J. F., Shi, J., Garg, B., Caughey, A. B., & Kornfield, M. (2026). Targeted regulation of abortion providers laws and pregnancies conceived through fertility treatment. *JAMA Health Forum, 7*(1), e255920. https://doi.org/10.1001/jamahealthforum.2025.5920

Mondragón y Kalb, M., Ahued Ortega, A., Morales Velazquez, J., Díaz Olavarrieta, C., Valencia Rodríguez, J., Becker, D., & García, S. G. (2011). Patient characteristics and service trends following abortion legalization in Mexico City, 2007–10. *Studies in Family Planning, 42*(3), 159–166. https://doi.org/10.1111/j.1728-4465.2011.00277.x

Quast, T., Gonzalez, F., & Ziemba, R. (2017). Abortion facility closings and abortion rates in Texas. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 54*, 1–7. https://doi.org/10.1177/0046958017700944

Rader, B., Upadhyay, U. D., Sehgal, N. K. R., Reis, B. Y., & Brownstein, J. S. (2022). Estimated travel time and spatial access to abortion facilities in the US before and after the Dobbs v Jackson Women's Health decision. *JAMA, 328*(20), 2041–2047. https://doi.org/10.1001/jama.2022.20424

Redd, S. K., Hall, K. S., Aswani, M. S., Sen, B., Wingate, M., & Rice, W. S. (2022). Variation in restrictive abortion policies and adverse birth outcomes in the United States from 2005 to 2015. *Women's Health Issues, 32*(2), 103–113. https://doi.org/10.1016/j.whi.2021.10.006

Roth, J., Sant'Anna, P. H. C., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics, 235*(2), 2218–2244. https://doi.org/10.1016/j.jeconom.2023.03.008

Sauter, S. R., Wallace, M. E., & Hernandez, J. H. (2024). Unequal spatial consequences of abortion restrictions in Texas, 2021–2023. *American Journal of Public Health, 114*(10), 1024–1033. https://doi.org/10.2105/AJPH.2024.307652

Schiavon, R., Troncoso, E., & Polo, G. (2010). Use of health system data to study morbidity related to pregnancy loss. In S. Singh, L. Remez, & A. Tartaglione (Eds.), *Methodologies for estimating abortion incidence and abortion-related morbidity: A review* (pp. 147–164). Guttmacher Institute/IUSSP.

Secretaría de Salud del Distrito Federal. (2015). *Interrupción legal del embarazo (ILE): Estadísticas, abril 2007–junio 2015*. Sistema de Información de Interrupción Legal del Embarazo. https://ile.salud.cdmx.gob.mx/wp-content/uploads/Interrupcion-Legal-del-Embarazo-Estadisticas-2007-2015.pdf

Senderowicz, L., Sanhueza, P., & Langer, A. (2018). Education, place of residence and utilization of legal abortion services in Mexico City, 2013–2015. *International Perspectives on Sexual and Reproductive Health, 44*(2), 43–50. https://doi.org/10.1363/44e6318

Singh, S., & Maddow-Zimet, I. (2016). 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 & Gynaecology, 123*(9), 1489–1498. https://doi.org/10.1111/1471-0528.13552

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science, 25*(1), 1–21. https://doi.org/10.1214/09-STS313

Torenz, R., Vollmer, H., Eckardt, S., Wyrobisch-Krüger, A., Thonke, I., & Hahn, D. (2023). Data on regional availability and accessibility of abortion providers in Germany. *Research in Health Services & Regions, 2*(1), Article 21. https://doi.org/10.1007/s43999-023-00036-4

van Dijk, M. G., Arellano Mendoza, L. J., Arangure Peraza, A. G., Toriz Prado, A. A., Krumholz, A., & Yam, E. A. (2011). Women's experiences with legal abortion in Mexico City: A qualitative study. *Studies in Family Planning, 42*(3), 167–174. https://doi.org/10.1111/j.1728-4465.2011.00278.x

Velázquez, C. (2024). *Abortion legalization and adolescent fertility: New evidence for Uruguay based on the synthetic control method* (Documentos de Trabajo del CEDLAS No. 339). CEDLAS, Universidad Nacional de La Plata.

Venator, J., & Fletcher, J. (2021). Undue burden beyond Texas: An analysis of abortion clinic closures, births, and abortions in Wisconsin. *Journal of Policy Analysis and Management, 40*(3), 774–813. https://doi.org/10.1002/pam.22263

Weber, S., & Péclat, M. (2017). A simple command to calculate travel distance and travel time. *The Stata Journal, 17*(4), 962–971. https://doi.org/10.1177/1536867X1801700411

Wing, C., Simon, K., & Bello-Gomez, R. A. (2018). Designing difference-in-differences studies: Best practices for public health policy research. *Annual Review of Public Health, 39*, 453–469. https://doi.org/10.1146/annurev-publhealth-040617-013507

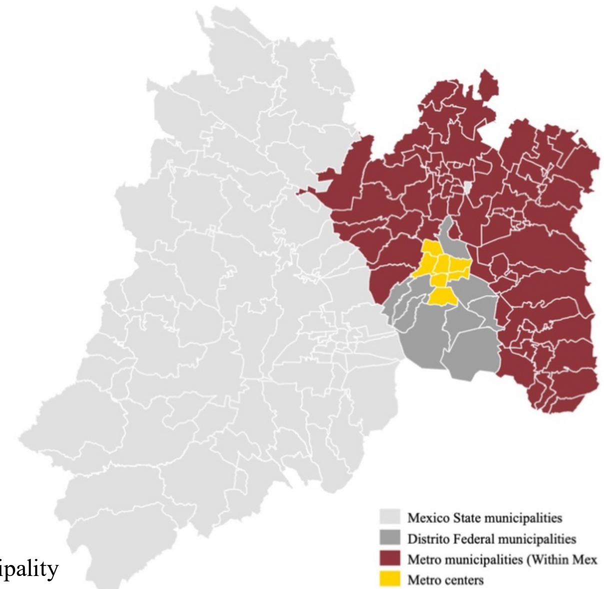
Wright, E. (2025). The effect of U.S. state abortion bans on births, abortions, and compensating behavior: Evidence using a quasi-experimental difference-in-differences analysis. *Pi Sigma Alpha Undergraduate Journal of Politics, 25*(2).

Appendix A

Maps

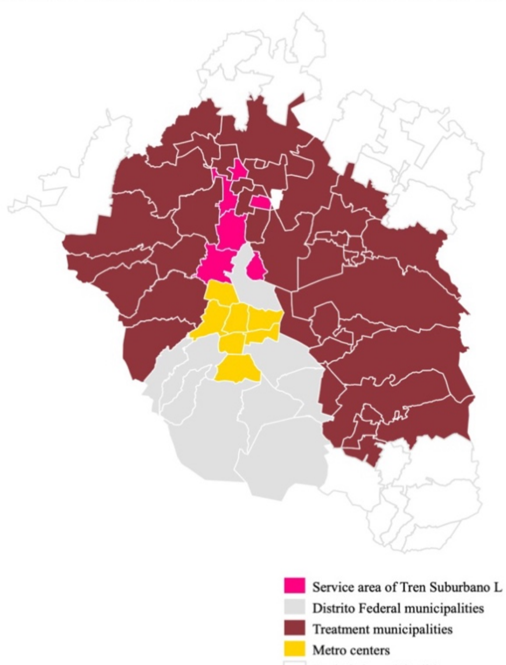
Figures A.1.1- A.1.2: Treatment Group in Simple and Narrow Specification

Figure A.1.1 Mexico State: Mexico City Metropolitan Area



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Figure A.1.2 Mexico State: Narrowed Treatment Area



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Figures A.1.3- A.1.5: Pre-defined Metro Areas in Selected Control States

Figure A.1.3

Jalisco: Guadalajara Metropolitan Area

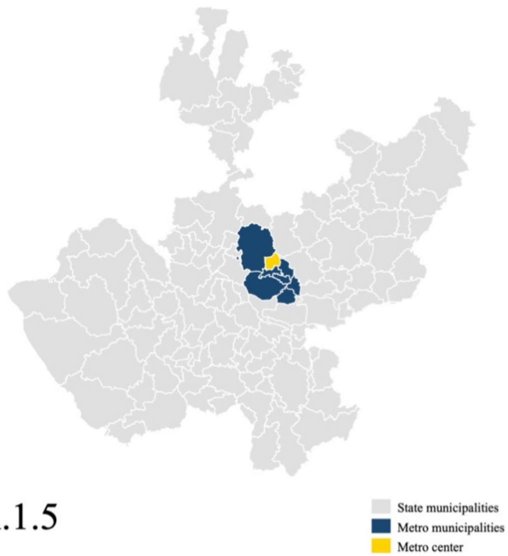


Figure A.1.4

Nuevo Leon: Monterrey Metropolitan Area

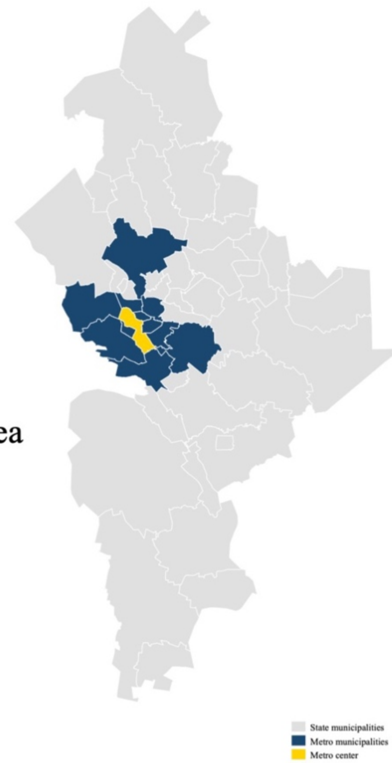
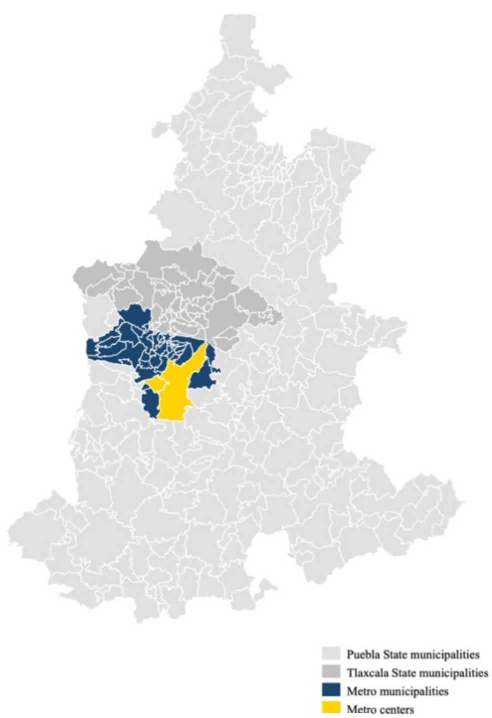


Figure A.1.5

Puebla/Tlaxcala: Puebla/Tlaxcala Metropolitan Area



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Figures A.1.6- A.1.8: Control Municipalities Selected in Simple and Narrow Specifications

Figure A.1.6

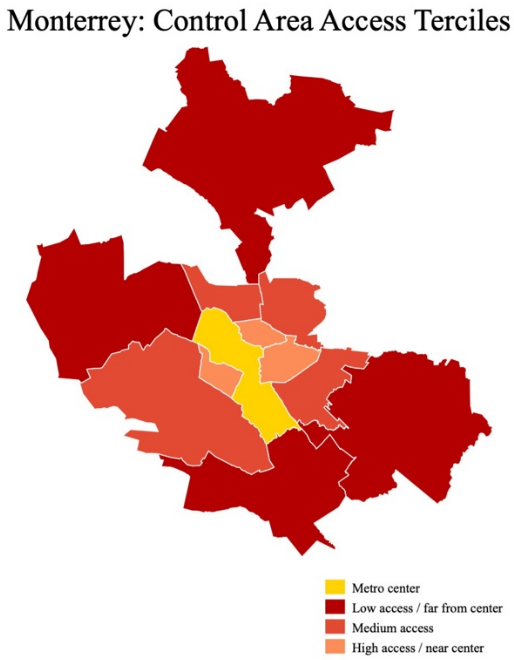


Figure A.1.7

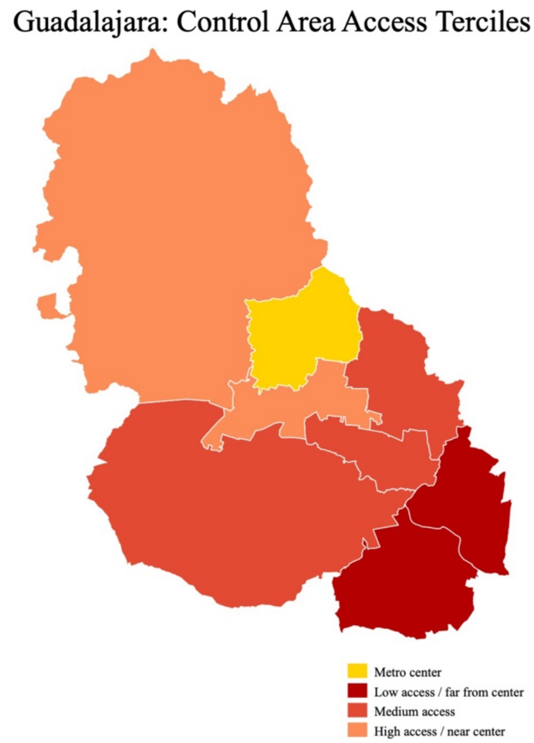
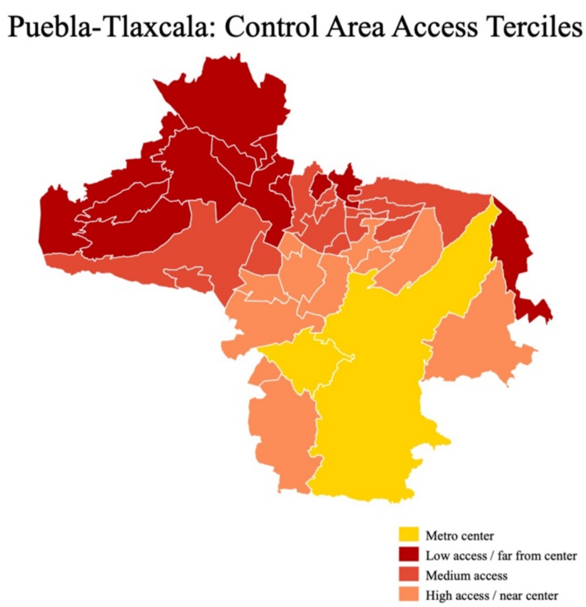


Figure A.1.8

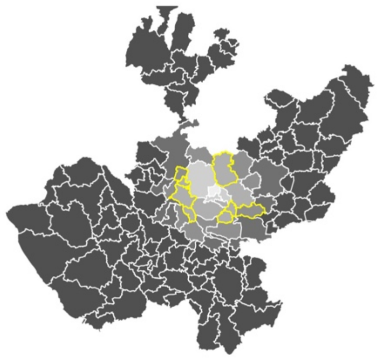


Source: Author’s rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Figures A.1.9- A.1.11: Control Municipalities Selected in Banded Distance Slope Matching, ages 15-49

Figure A.1.9

Jalisco: Selected Control Municipalities



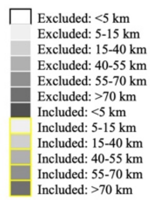


Figure A.1.10

Nuevo Leon: Selected Control Municipalities

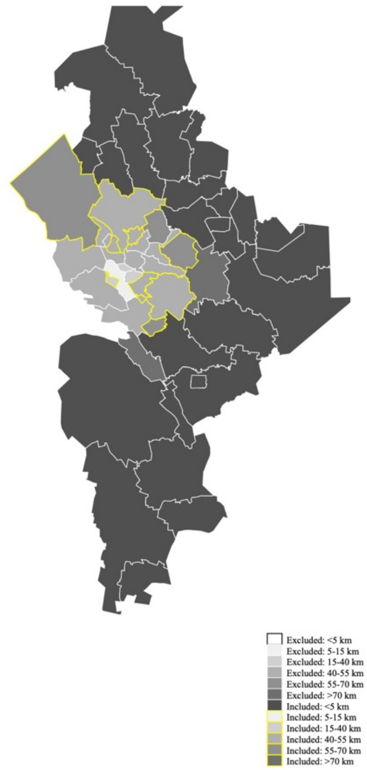
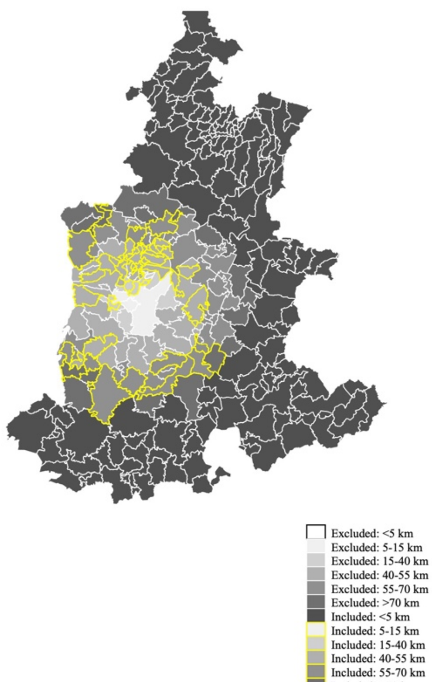


Figure A.1.11

Puebla/Tlaxcala: Selected Control Municipalities



Source: Author's rendering of INEGI Municipality Shapefiles, using CPV data (2020, 2010, 2005, 2000)

Appendix B

Panels

Figure B.1: Distance Banded Specification Panel, ages 25-29

Group 2 distance-band sample: ages 25–29, 2005

Variable	**(1) Control 5–15 km**	**(2) Control 15–40 km**	**(3) Control 40–55 km**	**(4) Control 55–70 km**	**(5) Treatment 5–15 km**	**(6) Treatment 15–40 km**	**(7) Treatment 40–55 km**	**(8) Treatment 55–70 km**
Dynamics								
Number of states	3	4	4	1	1	1	1	1
Number of municipalities	3	29	7	2	5	36	11	3
Total population	1,275,353	1,352,400	213,551	21,886	2,891,084	5,927,088	330,804	38,344
Women ages 15-49	354,031	370,960	55,936	5,673	821,292	1,640,669	89,166	10,031
Healthcare and Benefits Access								
No health coverage (%)	40.1	48.4	63.1	60.3	48.2	51.3	72.4	80.5
IMSS coverage (%)	43.9	41.4	14.1	4.2	33.4	32.7	15.4	11.3
ISSSTE coverage (%)	2.5	3.5	2.8	1.4	5.6	4.9	2.1	2.3
Seguro Popular / public coverage (%)	2.8	1.9	17.7	33.2	1.6	1.3	2.7	0.1
Education								
Average years of schooling	9.68	8.31	6.87	6.57	9.28	8.86	7.53	7.26
Illiterate population 15+ (%)	2.3	3.4	6.2	6.6	2.4	2.5	4.9	5.7

Quality of Life								
Households with electricity (%)	94.2	96.3	96.5	96.6	94.8	93.2	95.5	97.7
Households with piped water (%)	88.7	91.0	90.8	92.1	93.4	88.6	90.0	93.7
Households with drainage (%)	94.0	91.9	85.0	71.9	94.6	91.9	82.5	78.7

Source: Author's rendering of CPV data (2005)

Table B.2: Distance Banded Specification Panel, ages 30-34

Group 2 distance-band sample: ages 30–34, 2005

Variable	**(1) Control 5–15 km**	**(2) Control 15–40 km**	**(3) Control 40–55 km**	**(4) Control 55–70 km**	**(5) Treatment 5–15 km**	**(6) Treatment 15–40 km**	**(7) Treatment 40–55 km**	**(8) Treatment 55–70 km**
Dynamics								
Number of states	2	4	3	2	1	1	1	1
Number of municipalities	4	23	9	3	5	36	11	3
Total population	1,231,286	576,961	141,526	19,203	2,891,084	5,927,088	330,804	38,344
Women ages 15-49	342,032	152,538	39,329	4,897	821,292	1,640,669	89,166	10,031
Healthcare and Benefits Access								
No health coverage (%)	38.6	50.3	61.2	83.2	48.2	51.3	72.4	80.5
IMSS coverage (%)	45.0	36.7	27.0	3.5	33.4	32.7	15.4	11.3

ISSSTE coverage (%)	2.6	2.8	3.8	1.3	5.6	4.9	2.1	2.3
Seguro Popular / public coverage (%)	2.9	4.8	5.4	10.7	1.6	1.3	2.7	0.1
Education								
Average years of schooling	9.77	7.74	8.07	5.59	9.28	8.86	7.53	7.26
Illiterate population 15+ (%)	2.1	3.7	5.3	11.3	2.4	2.5	4.9	5.7
Quality of Life								
Households with electricity (%)	94.2	95.4	97.2	98.0	94.8	93.2	95.5	97.7
Households with piped water (%)	87.7	85.4	91.2	85.0	93.4	88.6	90.0	93.7
Households with drainage (%)	93.9	87.3	89.0	70.6	94.6	91.9	82.5	78.7

Source: Author's rendering of CPV data (2005)

Appendix C

Parallel Trends Fertility Plots

Figure C.1: Simple Specification Raw Fertility Trend pre-2008, Pooled
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

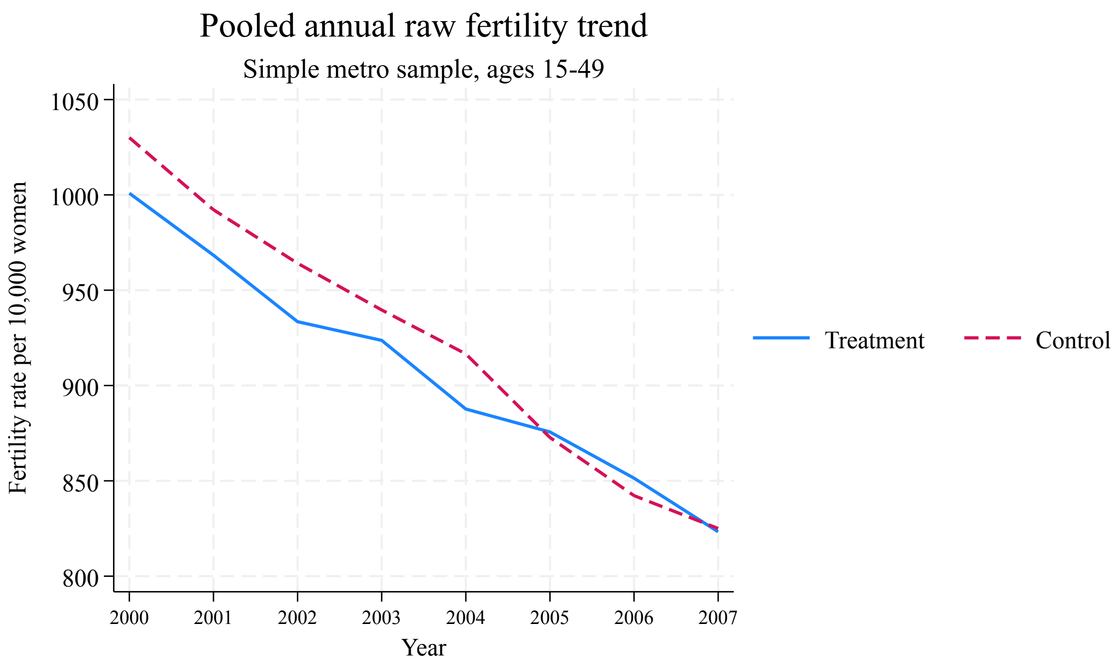


Figure C.2: Simple Specification Normalized Fertility Trend pre-2008, Pooled
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

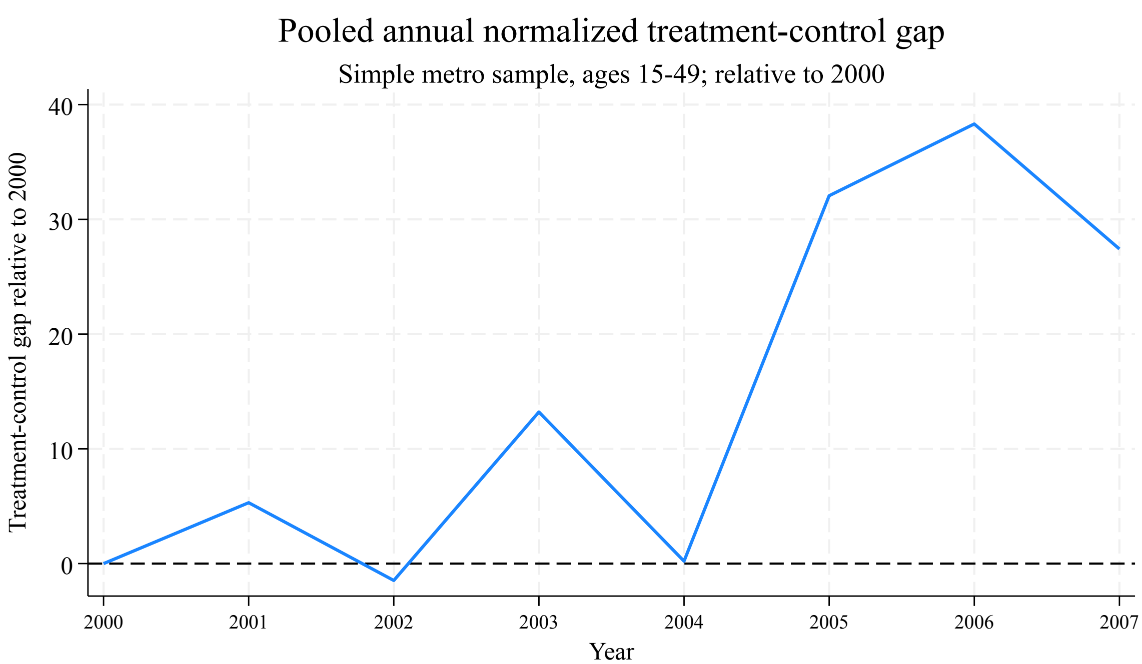


Figure C.3: Simple Specification Raw Fertility Trend pre-2008, Terciles
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

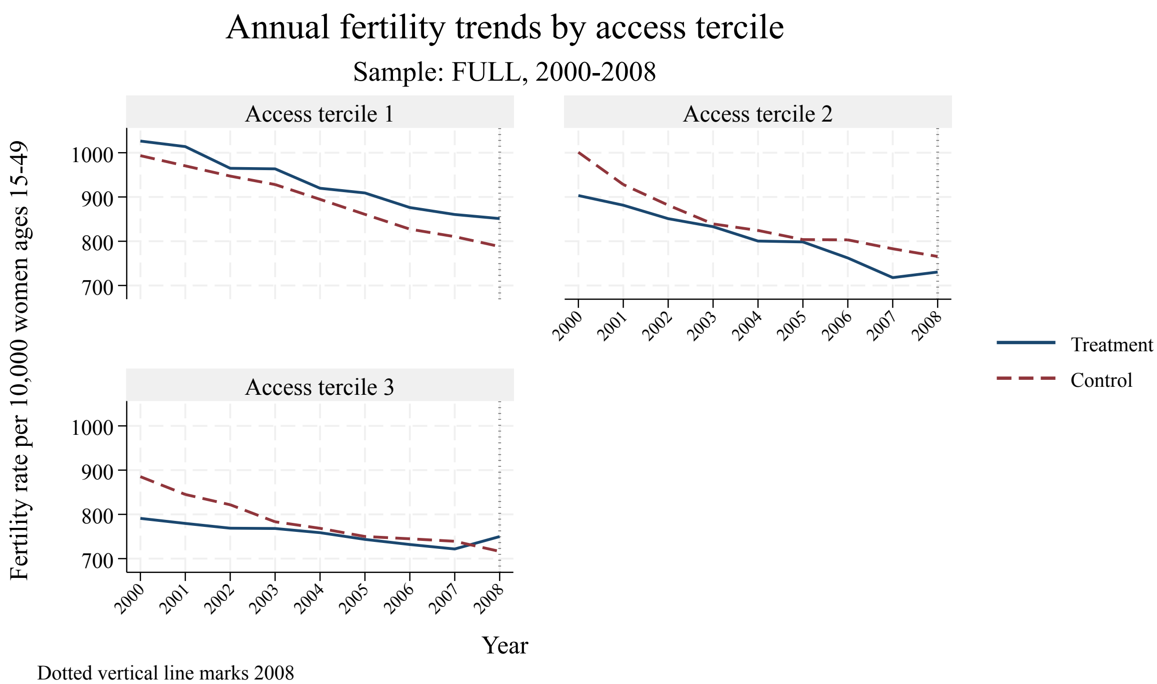


Figure C.4: Simple Specification Normalized Fertility Trend pre-2008, Terciles
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

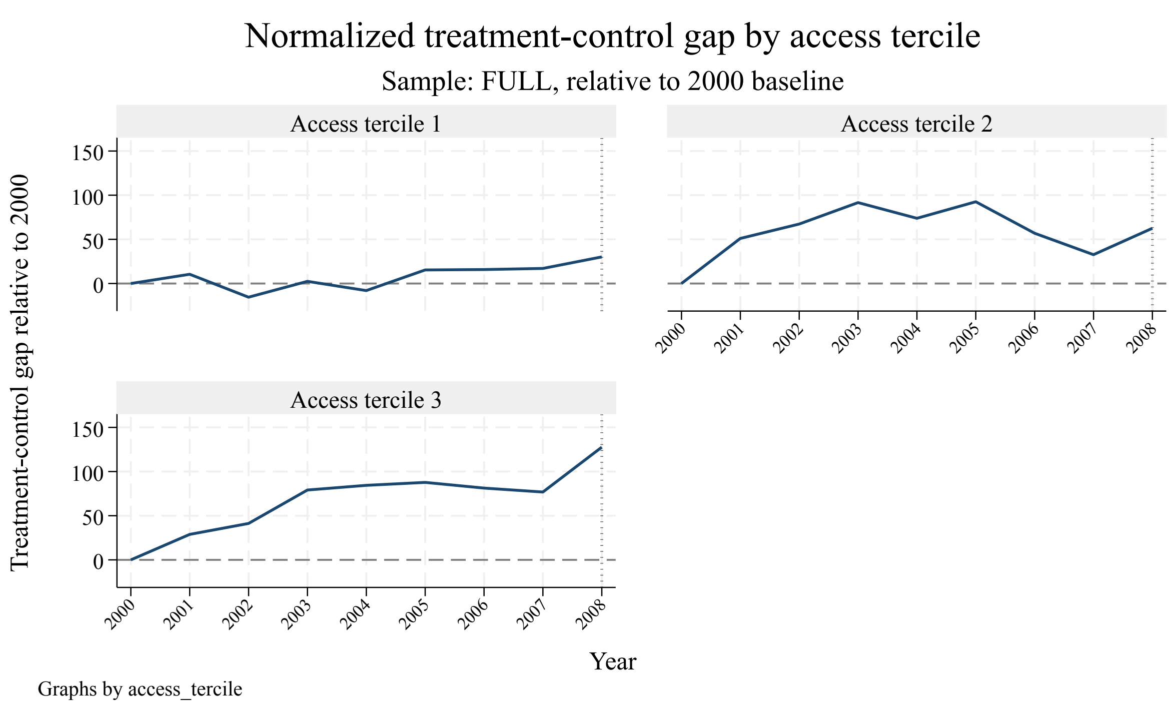


Figure C.5: Narrowed Specification Raw Fertility Trend pre-2008, Pooled
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

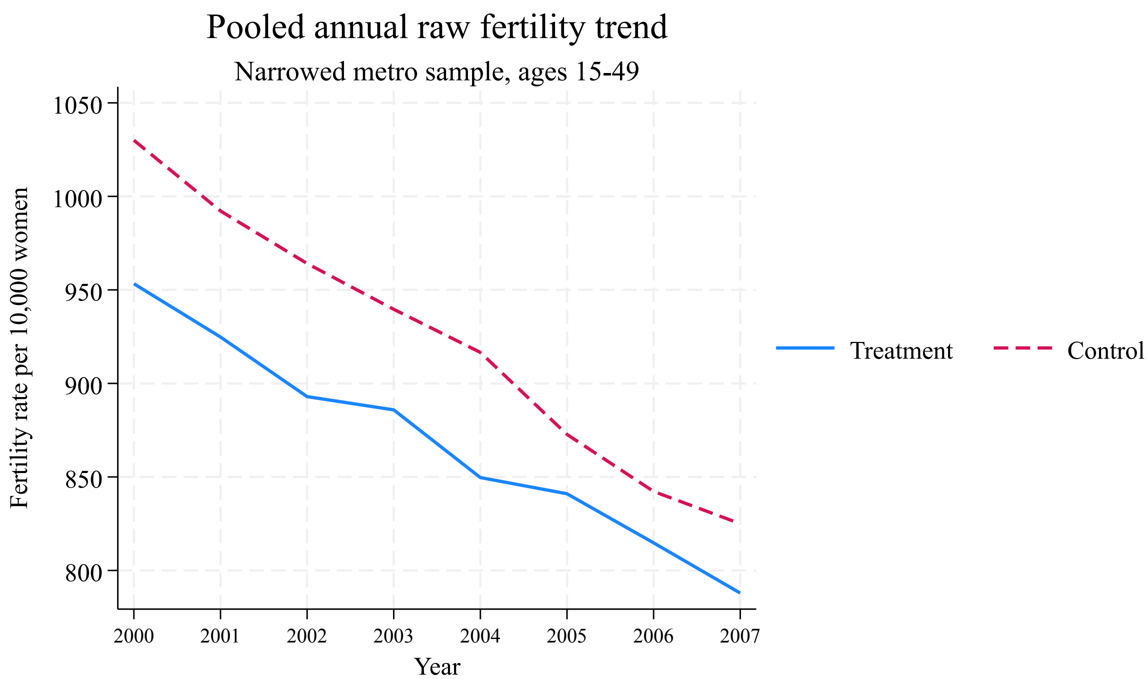


Figure C.6: Narrowed Specification Normalized Fertility Trend pre-2008, Pooled
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

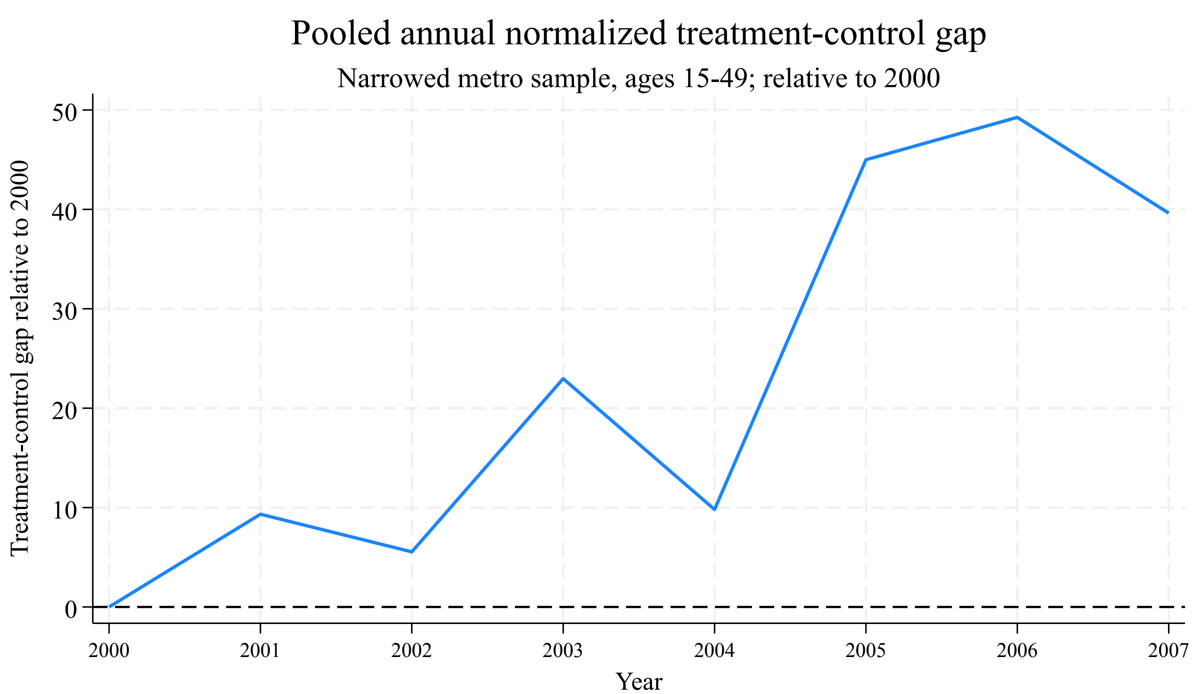


Figure C.7: Narrowed Specification Raw Fertility Trend pre-2008, Terciles
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

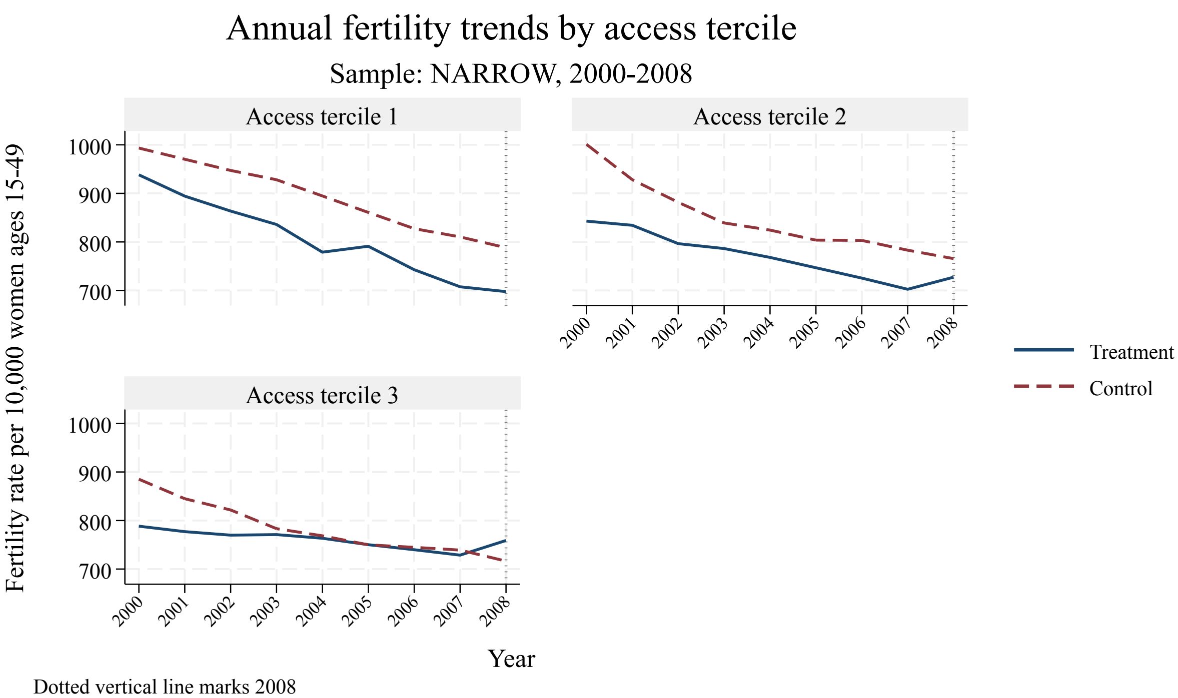


Figure C.8: Narrowed Specification Normalized Fertility Trend pre-2008, Terciles
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

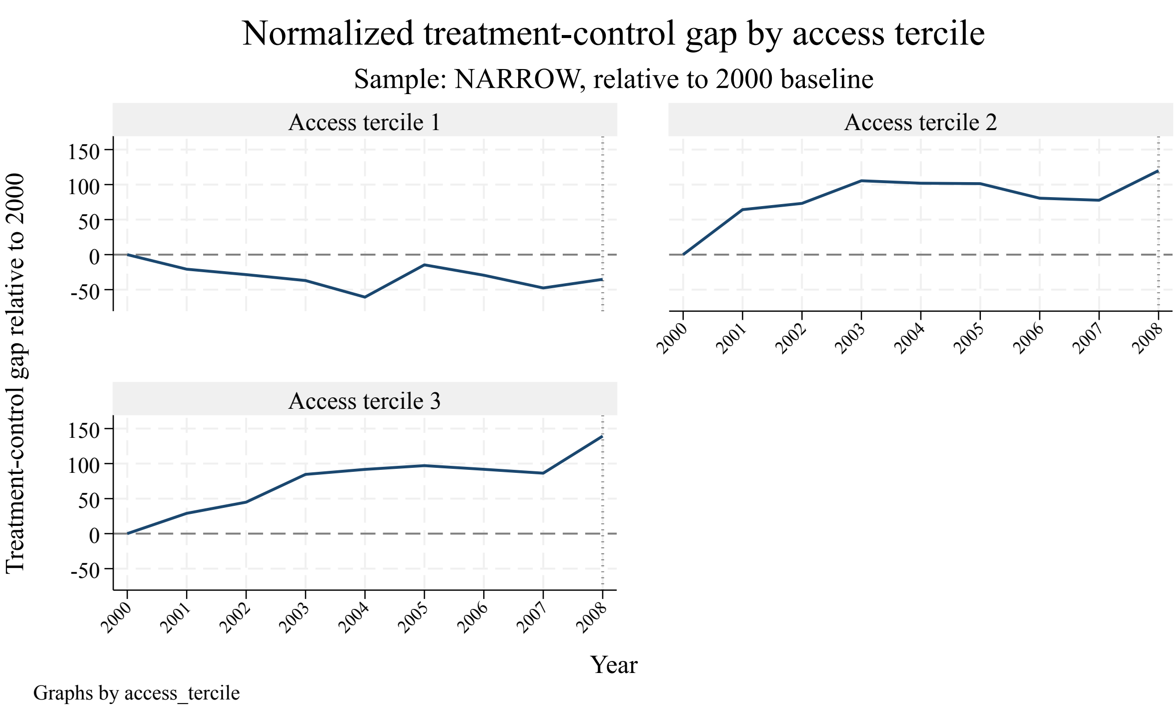


Figure C.9: Continuous Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 15-49
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

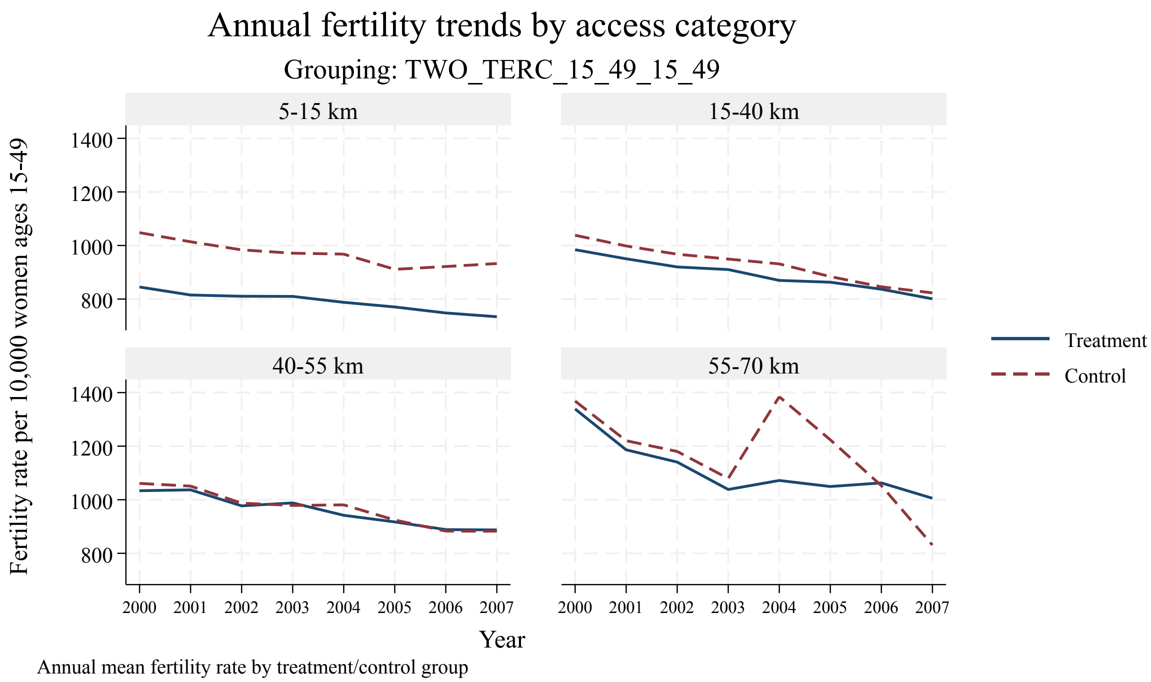


Figure C.10: Continuous Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 15-49
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

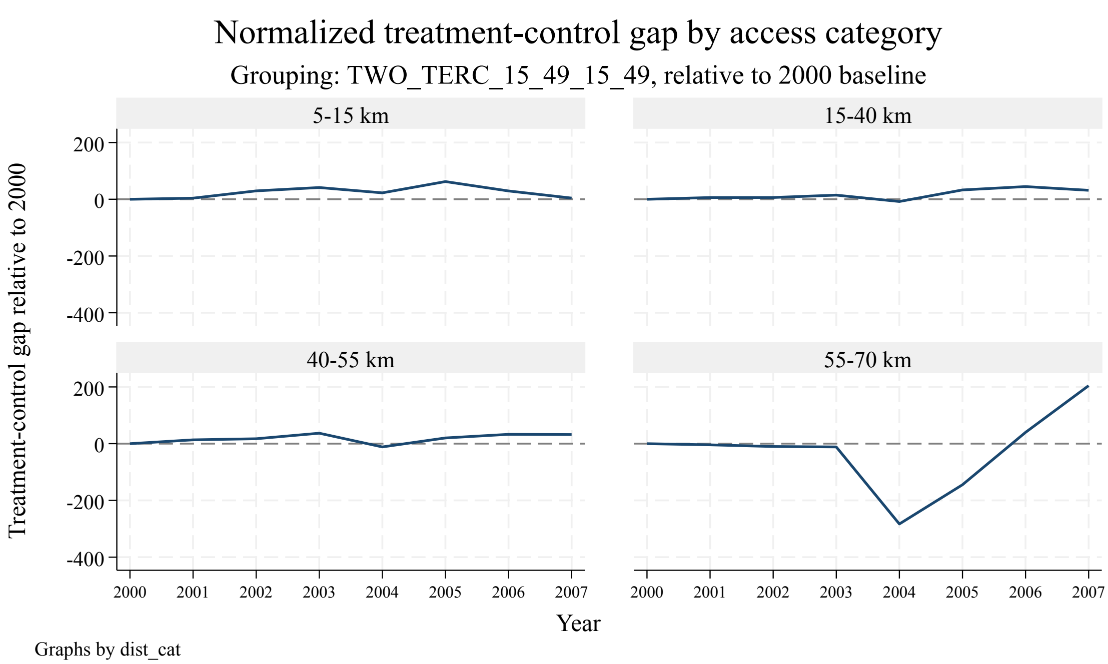


Figure C.11: Continuous Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 20-24
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

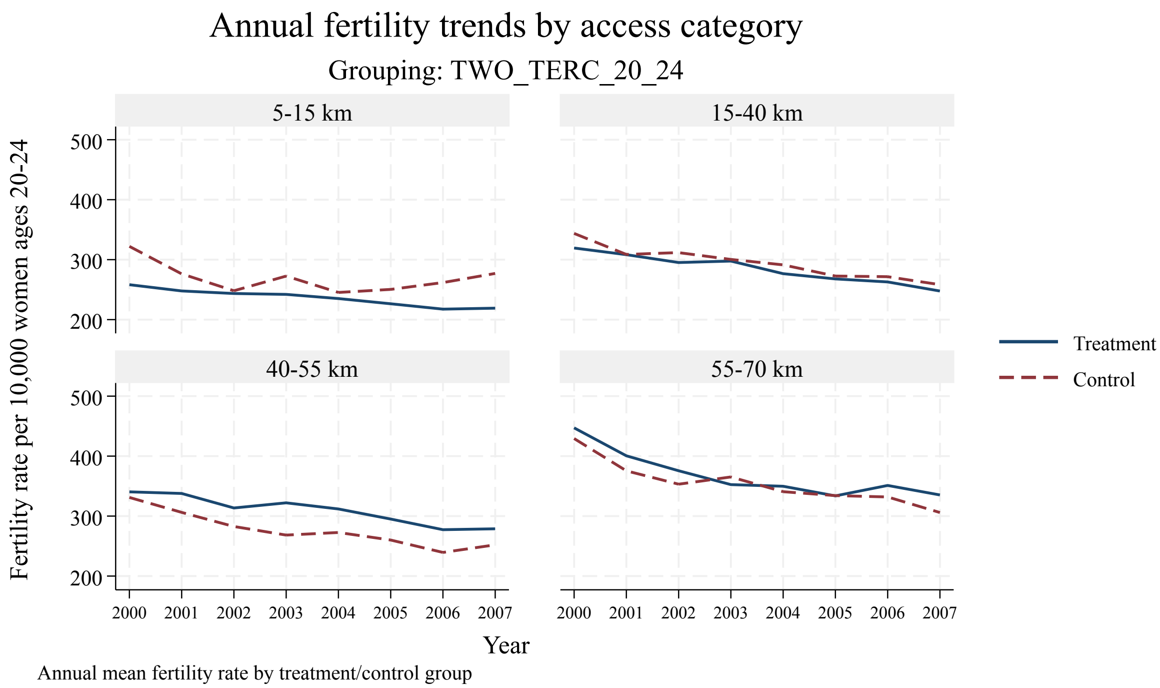


Figure C.12: Continuous Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 20-24
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

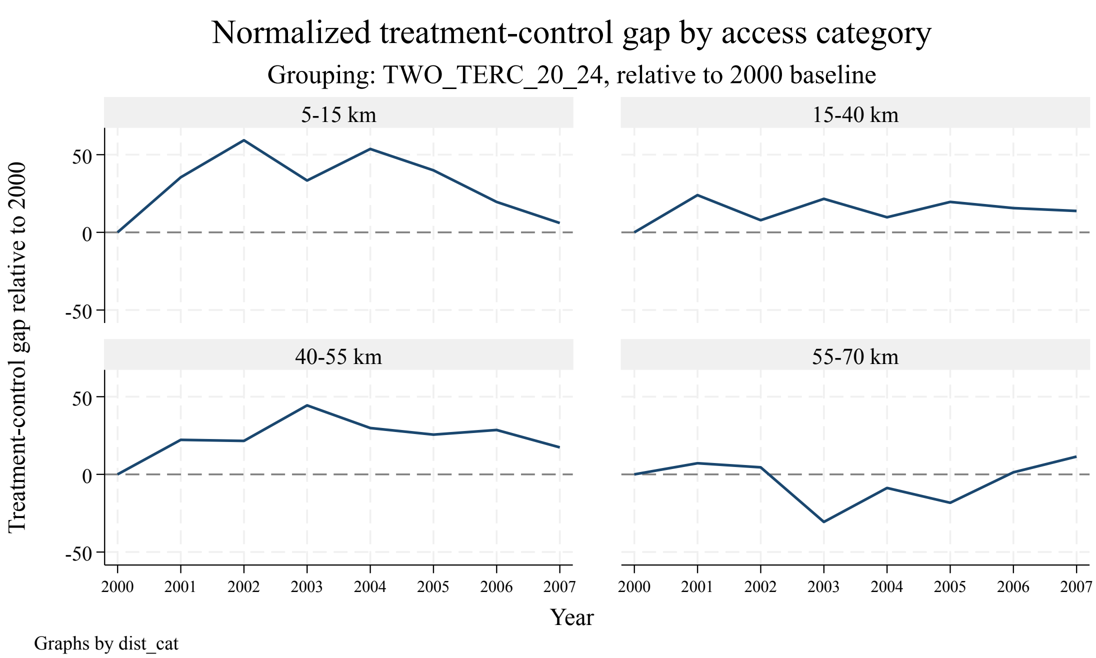


Figure C.13: Continuous Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 25-29
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

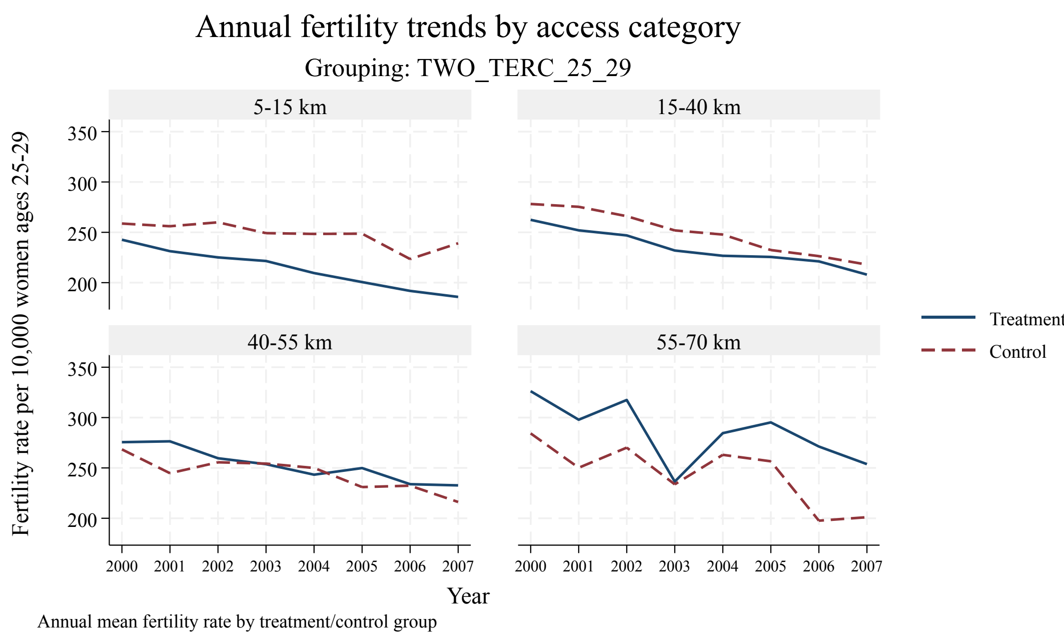


Figure C.14: Continuous Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 25-29
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

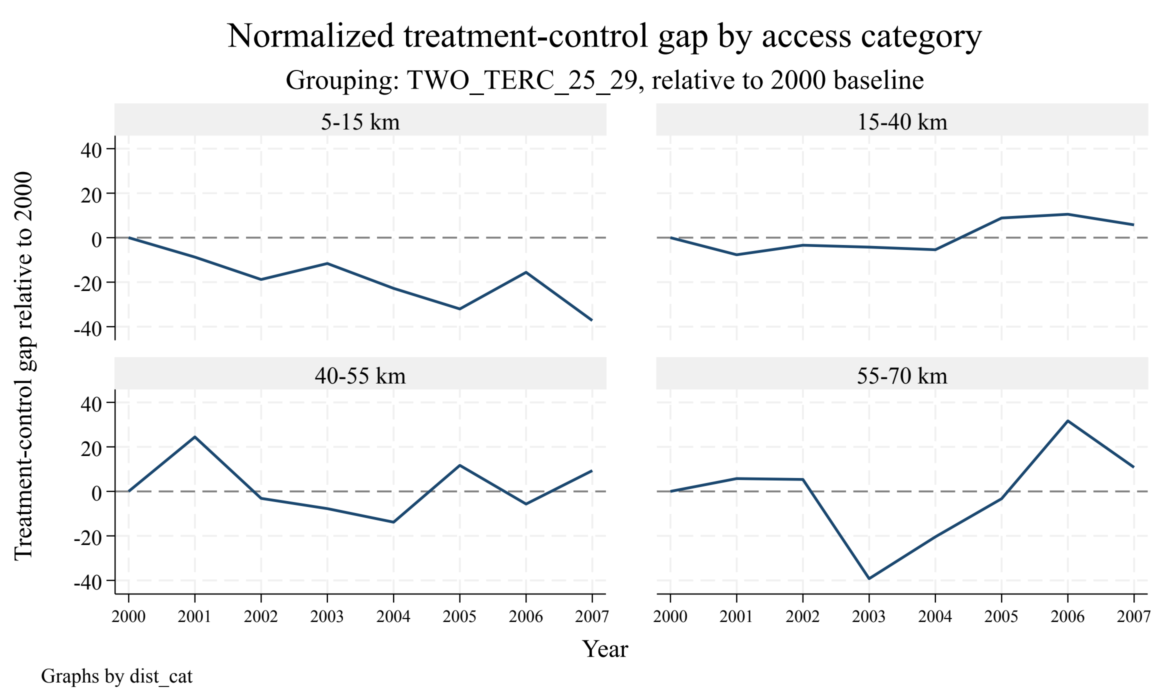


Figure C.15: Continuous Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 30-34
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

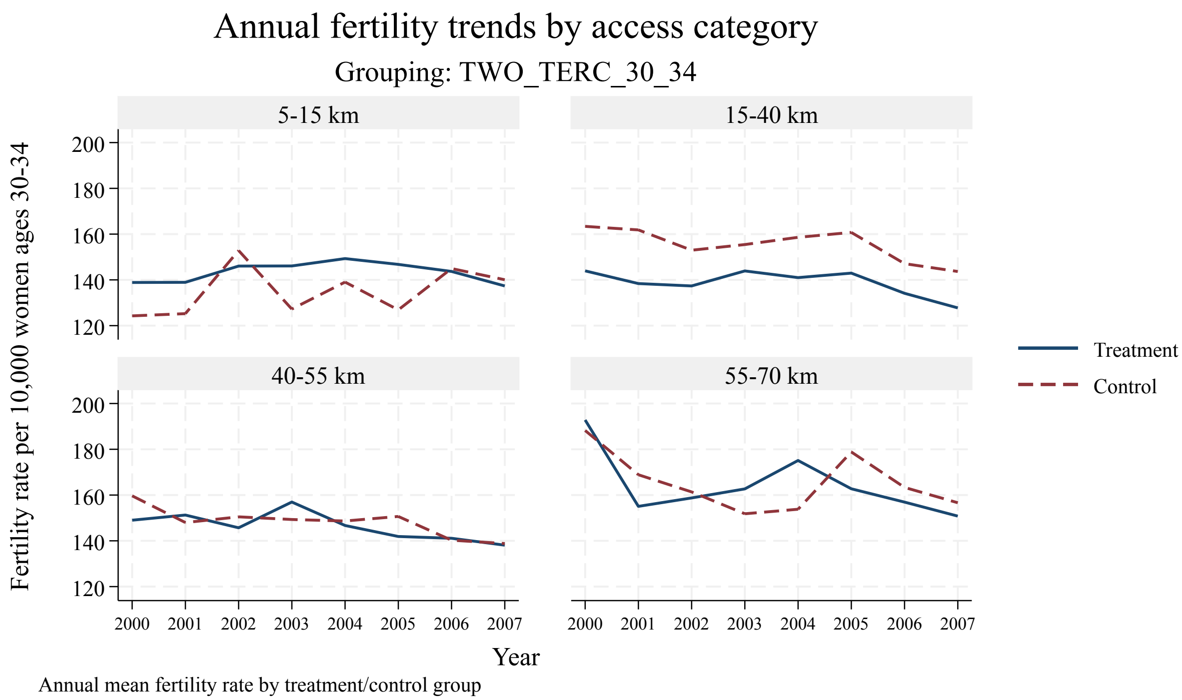


Figure C.16: Continuous Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 30-34
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

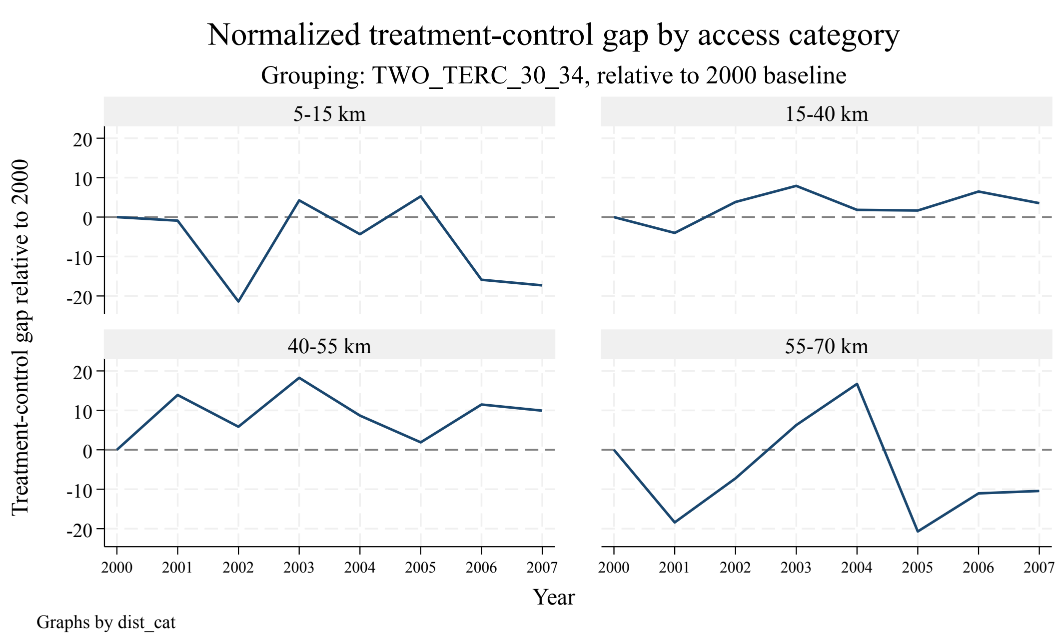


Figure C.17: Distance Banded Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 15-49
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

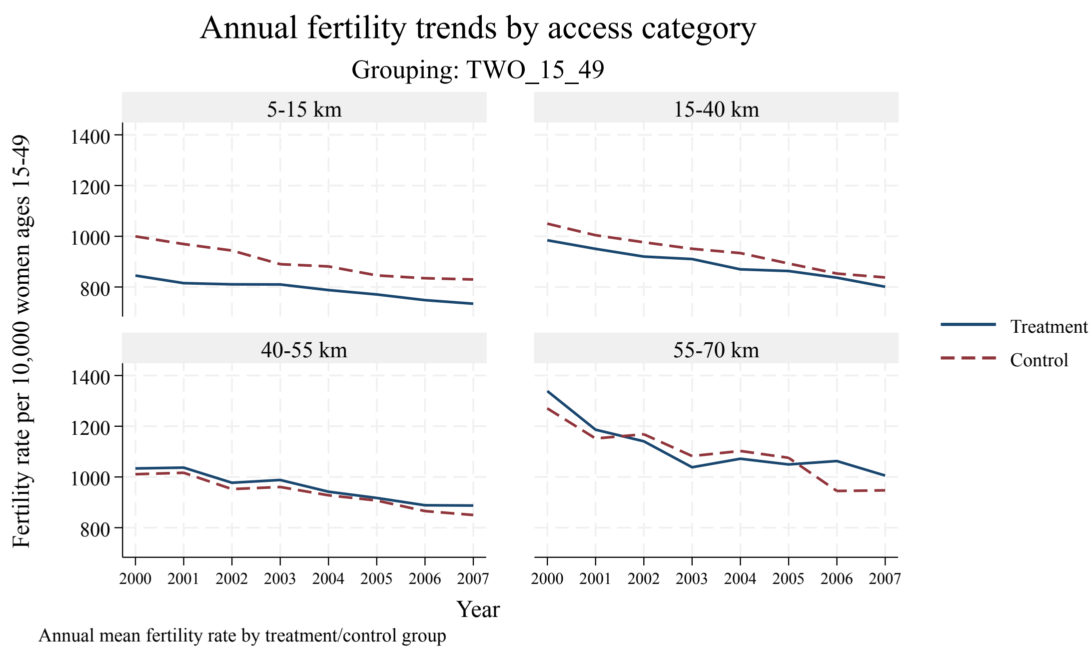


Figure C.18: Distance Banded Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 15-49
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

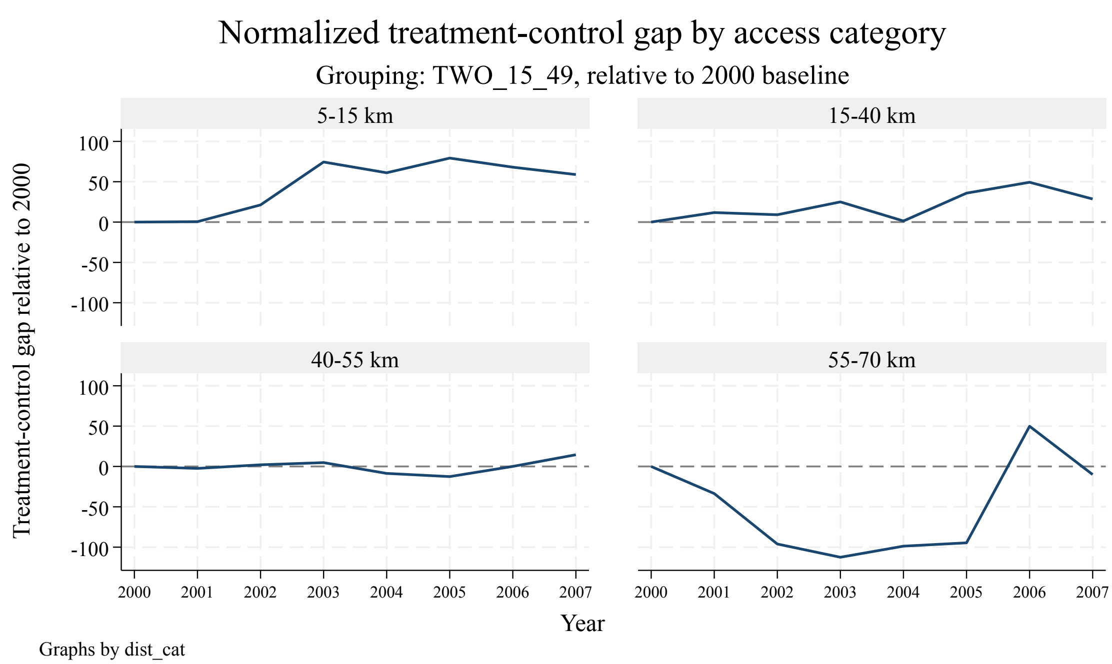


Figure C.19: Distance Banded Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 20-24
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

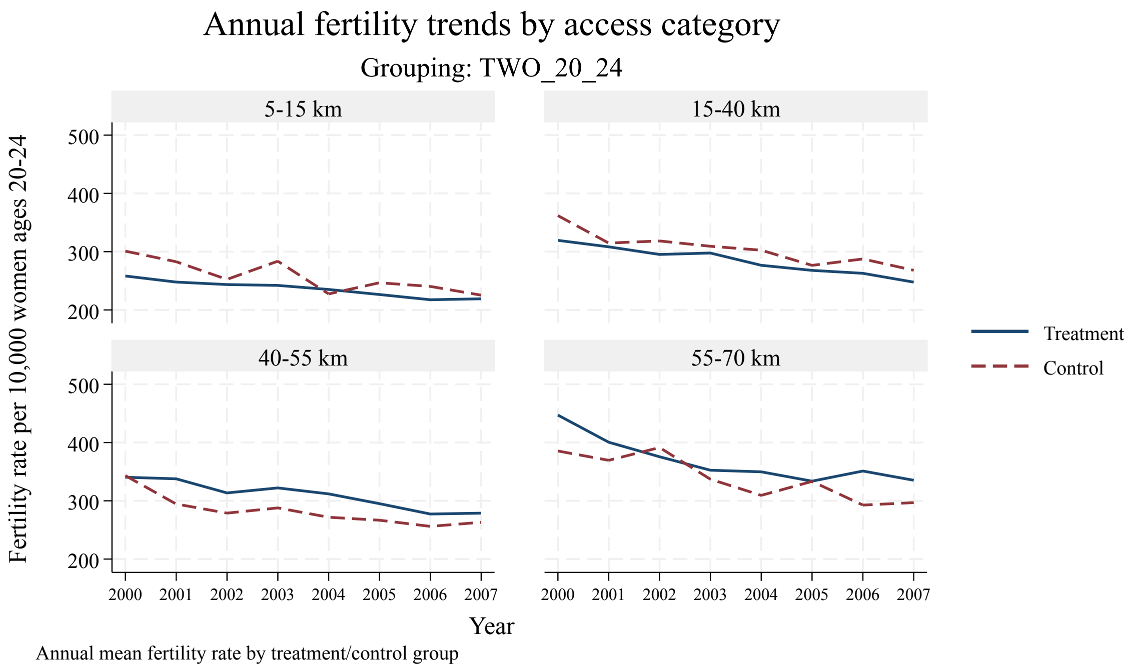


Figure C.20: Distance Banded Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 20-24
Source: Author’s findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

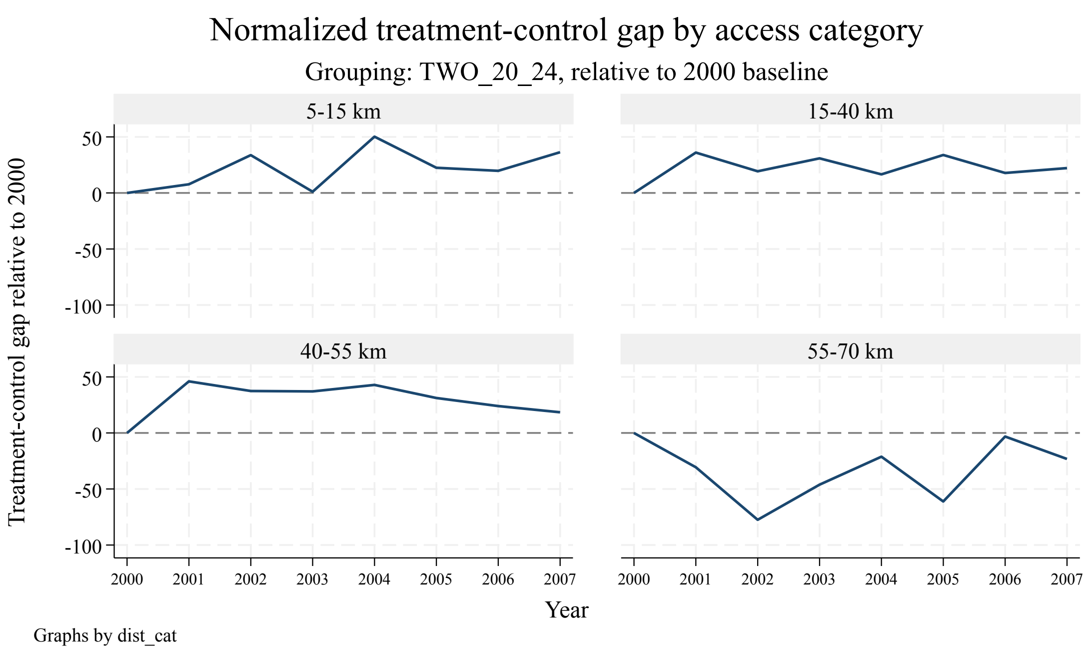


Figure C.21: Distance Banded Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 25-29
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

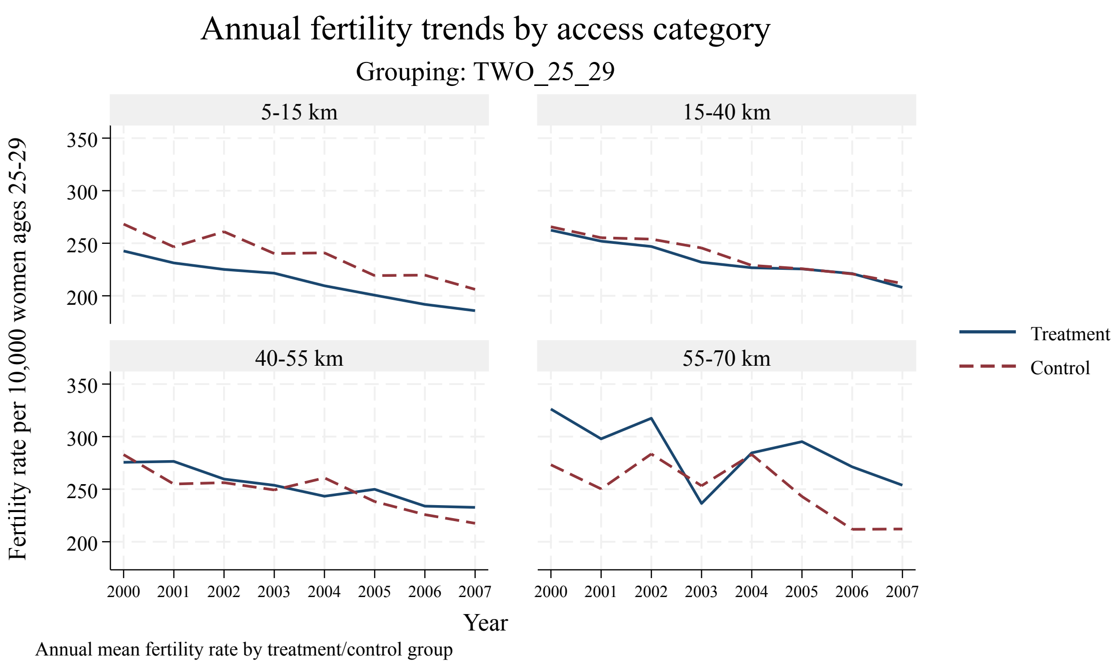


Figure C.22: Distance Banded Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 25-29
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

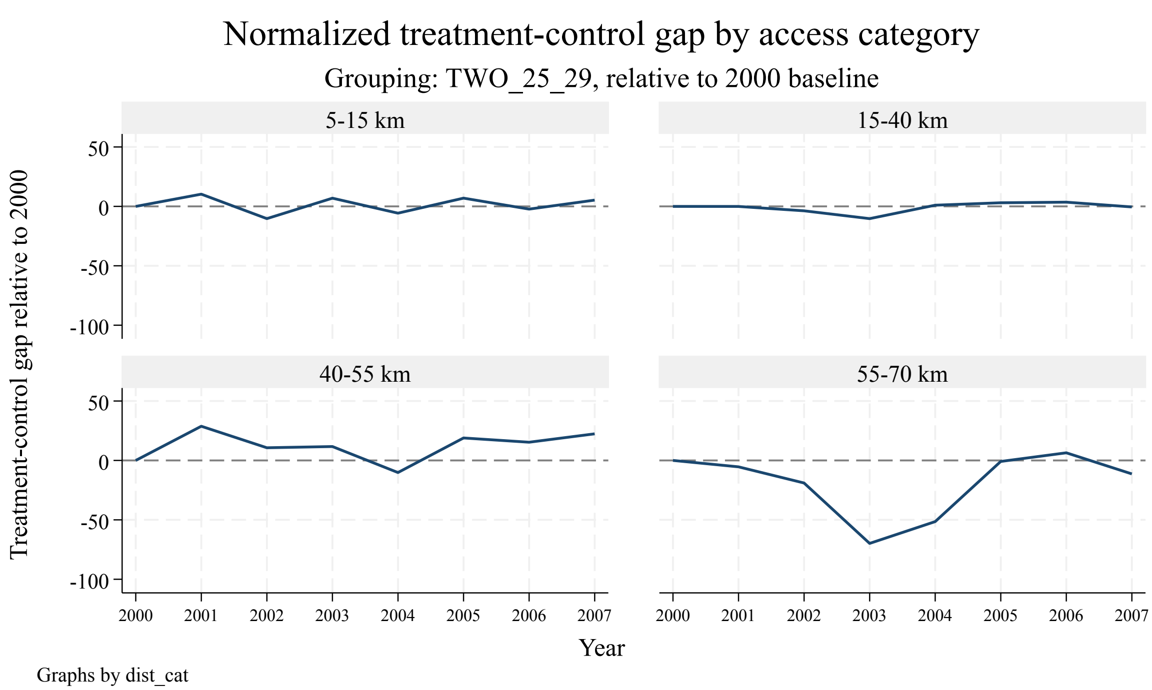


Figure C.23: Distance Banded Slope-Matching Specification Raw Fertility Trend pre-2008, by Access Category, Ages 30-34
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)

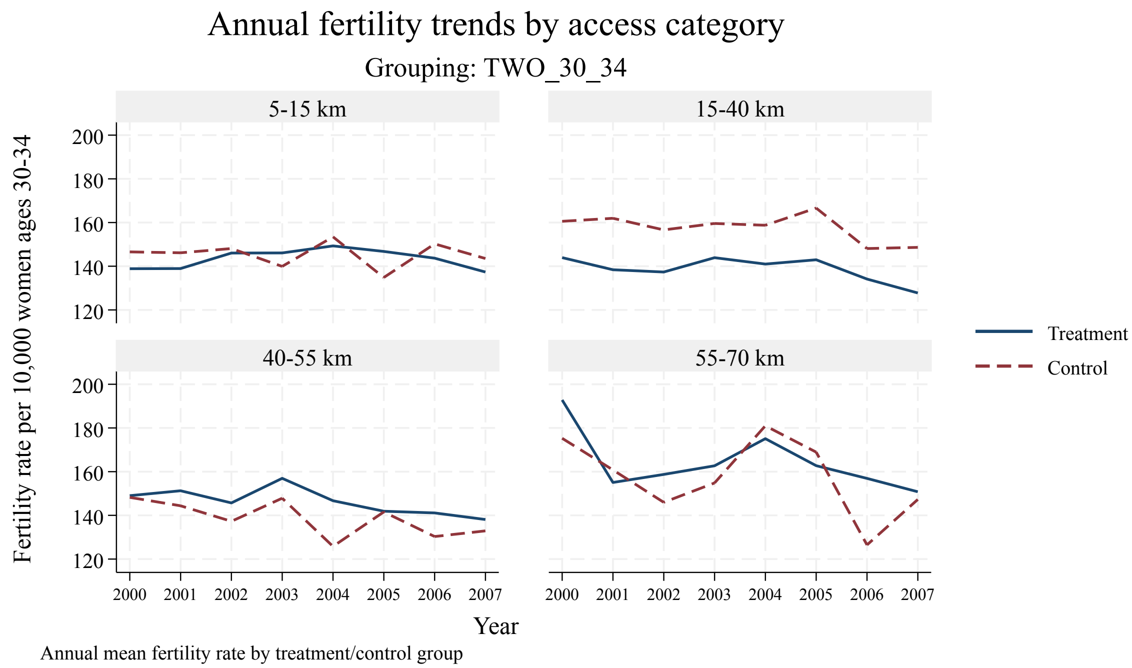


Figure C.24: Distance Banded Slope-Matching Specification Normalized Fertility Trend pre-2008, by Access Category, Ages 30-34
Source: Author's findings using ENR data (2000-2019) and CPV data (2020, 2010, 2005, 2000)