How Far Is Too Far?
New Evidence on Abortion Clinic Closures, Access, and Abortions

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Abstract

We estimate the effects of abortion-clinic closures on clinic access and abortions using variation generated by Texas HB2, a "TRAP" law that shuttered nearly half of Texas' abortion clinics in late 2013. Our results suggest a substantial and non-linear effect of distance to clinics. Increases from less than 50 miles to 50–100, 100–150, and 150–200 miles reduce abortion rates by 15, 25, and 40 percent, respectively, while additional increases in distance appear to have no additional effect. We also introduce a proxy for congestion that captures the potential for there to be effects of closures which have little impact on distance but which reduce per-capita capacity. We demonstrate that this is also an important mechanism through which closures affect abortion; moreover, ignoring this mechanism causes the effects of distance to be somewhat overstated. Several features of the data imply that magnitude of the effects on abortion are too big to be explained by interstate travel. That said, the results of a simulation exercise demonstrates that the effects are too small to plausibly be detected in analyses of birth rates.

JEL Codes: I11, I12, J13, K23

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1 Introduction

In June of 2016, the United States Supreme Court issued its first major abortion ruling in a quarter century, striking down Texas HB2, an abortion law that had shuttered many of the clinics in the state and threatened to close all but a handful of those that remained (*Whole Woman's Health v. Hellerstedt*, 2016a). This landmark case set a new precedent for evaluating abortion regulations against the "undue burden standard" established in *Planned Parenthood v. Casey* (1992). In particular, the decision in *Whole Women's Health v. Hellerstedt* stated that courts must "consider the burdens a law imposes on abortion access together with the benefits those laws confer" and highlighted a critical role for empirical evidence.

Quite notably, however, there is very little empirical evidence on the causal effects of targeted regulation of abortion provider (TRAP) laws and, more generally, on the causal effects of abortion clinic closures and access to abortion services. In this study we aim to fill these gaps in knowledge. Though this evidence comes too late to inform *Whole Women's Health v. Hellerstedt*, it comes at a key moment in the broader history of abortion provision in the United States as legislators continue to propose laws that make it more difficult for abortion clinics to operate and as the constitutionality of these laws continue to be contested in court. What happens if/when these laws are passed and enacted, forcing clinics to close? Or what if some other factor causes closures? And to what degree do are any effects of closures caused by increases in distance as opposed to increased congestion at remaining clinics?

As Supreme Court Justice Elena Kagan observed during oral arguments in Whole Woman's Health (2016b), Texas' recent history is "almost like the perfect controlled experiment" to learn the answers to these questions. Texas HB2, which was enacted in July 2013, required physicians at abortion clinics to have admitting privileges at a hospital within 30 miles of the facility and required abortion facilities to meet the standards of an ambulatory surgical center. When the first of these requirements went into effect on November 1, 2013, nearly half of the abortion clinics in Texas immediately closed (Figure 1). On average this doubled a

Texas resident's distance to her nearest clinic (including those in adjacent states), but those in some counties were affected more than others (Figure 2). As clinics shut down, the number of physicians providing abortions in the state dropped from 48 to 28 and survey evidence indicates that wait times climbed as high as three weeks for some of the remaining clinics (TPEP, 2015).

In this paper, we treat Texas' experience as a case study to document the causal effects of abortion clinic access. Specifically, we leverage geographic variation in the effects of abortion clinic closures on abortion clinic access to estimate the effects using difference-in-differences models. To implement this research design, we construct a panel of data on abortion clinic operations from 2009 through 2015 in Texas. We use these data to measure driving distances from each county to its nearest clinic in each year. Driving distance is a common measure that has been used in prior studies and which has been referenced by the Supreme Court.[1] While driving distance is certainly a useful measure of access, it notably *fails* to capture changes in capacity, or per-capita capacity. For example, many abortion clinics in Dallas, Fort Worth, San Antonio, and Houston closed in the wake of HB2. These closures had trivial impacts on distances to clinics—because other nearby facilities remained open in each of these areas—but dramatically increased the number of women each remaining clinic was expected to serve. Closures in other areas can also increase the number of women each clinic was expected to serve. For example, no abortion clinics in Austin closed in the wake of HB2; however, the number of women for whom Austin was the nearest option increased considerably. An approach that focuses on distance alone ignores the possibility that reductions in per-capita capacity could influence abortion rates through increased waiting times. Given substantial anecdotal and survey evidence that wait times increased following HB2 (TPEP, 2015), this may be an important mechanism through which abortion clinic closures affect abortion rates. We explore this mechanism with the use of a new proxy for congestion, constructed based on

[1] See *Planned Parenthood v. Casey* (1992) and *Whole Woman's Health v. Hellerstedt* (2016a), as well as transcripts of oral arguments in *Whole Woman's Health v. Hellerstedt* (2016b) in which travel distances are repeatedly discussed.

the population expected to be served by each clinic.

After showing that the pre-existing trends in abortion rates (and other predictors of abortion rates) were unrelated to changes in access, our econometric analysis indicates that a 100 mile increase in distance to the nearest abortion clinic reduces abortion rates by 22 percent on average. We also find evidence of a non-linear relationship in which increases in distance have less effect in counties that already are more than 200 miles away from an abortion clinic. Relative to having an abortion clinic within 50 miles, abortion rates fall by 15 percent if the nearest clinic is 50-100 miles away, by 25 percent if the nearest clinic is 100-150 miles away, and by 40 percent if the nearest clinic is 150-200 miles away, from which point additional increases have little additional effect. Our estimates also indicate that abortion clinic closures affect abortion rates through congestion. Specifically, our estimates imply that increasing the number of women served per clinic in a region by 10,000 reduces abortions by 0.9 percent. Moreover, ignoring this mechanism causes the effects of distance to be somewhat overstated.

We conduct two analyses which demonstrate that these main results are unlikely to be driven by interstate travel to obtain abortions. First, we use our models to calculate how much abortions were reduced in Texas as a whole as a result of reductions in access following HB2. We show that this number dwarfs the number of abortions that Texas residents may have in nearby states based on abortion data we collected from other state agencies.[2] We also show that our main results are largely unchanged if we focus only on "interior counties" from which interstate travel for abortion is unlikely.

Our results naturally raise the question: what are these women doing who would have obtained abortions if clinics had not closed? Though we cannot answer this question in a definitive manner, we do take some steps in this direction. To begin, we consider the possibility that women may be self-inducing abortions as a substitute for obtaining abortions

[2]Louisiana and New Mexico are by far the most common destinations for Texas women seeking out-of-state abortions. Texas residents' abortions in Louisiana are included in our data during the period of dramatic changes in access. New Mexico abortions are not.

at clinics. This analysis is motivated by substantial anecdotal evidence suggesting that many women sought to self-induce abortions using an abortafacient sold over-the-counter at Mexican pharmacies under the brand name Cytotec (Eckholm, 2013; Hellerstein, 2014). Consistent with the idea that this is an important mechanism, we find especially large effects of clinic access for Hispanic women and women living near the Mexican border. Birth rates are another obvious outcome that could be affected by reduced by any measure that affects abortion. We do not find any robust evidence of effects of abortion clinic access on birth rates. However, the results of a simulation exercise we conduct suggests that this evidence should be interpreted with great caution—the estimated effects on abortion rates are too small relative to birth rates to be plausibly detected in such an analysis. As such, the data do not allow us to determine whether all of the "missing abortions" result in additional births or whether they are offset by other behavioral changes.

To put the contribution of our work into context, it is important to note that U.S. legislators seeking to reduce abortions have historically attempted to do so through "demand-side policies" that directly target pregnant women seeking abortions, such as parental involvement and mandatory delay laws (Joyce, 2011), and that these sorts of policies have been studied extensively in prior work. "Supply-side policies" targeting abortion facilities are a more-recent phenomenon and thus have received far less attention from researchers. On the topic of supply-side policies, Grossman et al. (2017) show that 2012–2014 changes in distance-to-nearest-abortion-facility are negatively correlated with abortion rates across Texas counties. In a causal analysis, Lu and Slusky (2016b) show that closures of "women's health clinics from a specific network of providers"—which includes both family planning and abortion clinics—increased birth rates in Texas. Because their study uses data from an earlier time in Texas when family planning clinics—and not abortion clinics—closed en masse, their estimates likely reflect the effects of family planning clinic closures as opposed to abortion clinic closures.[3] The most closely related study that predates our own is Quast

[3]In related work, Lu and Slusky (2016a) also show that the closure of such clinics reduce preventative care.

et al. (2017), who use a similar research design to evaluate the effects of "crow flies" distance to abortion clinics on abortion rates. While timely, this earlier study used operating licenses to measure clinic operations, which does not capture circumstances in which clinics were forced to shut down before their licenses expired or circumstances in which closed clinics held on to their licenses in hopes of reopening. We find *substantially* larger effects of distance, which is consistent with their acknowledgement that measurement error is likely to bias their estimates towards zero. Given this extant literature, we believe our study is the first to provide credible estimates of the causal effects of reduced access to abortion clinics using data on actual operations, the first to estimate the effects of a measure of congestion, and the first to consider heterogeneity using proxies for access to drugs to self induce. We are also the first to argue that the magnitude of the effects on abortion are too small to be plausibly detected by an analysis of birth rates.[4]

The remainder of this paper is organized as follows. In the next section, we provide a brief history of U.S. abortion legislation and Texas abortion legislation before describing Texas HB2 in detail. We then describe our data and research design in sections 3 and 4. We present the results of our analysis in Section 5 and then discuss these results in our conclusion.

2 Background

2.1 Abortion Legislation in the United States

Prior to 1973, when *Roe v. Wade* legalized abortion nationwide, abortion was largely regulated at the state level. From the 19th and through the mid-20th century, abortion regulations

[4]Since we initially released our study, Fischer et al. (2017) have also released an analysis that also leverages variation induced by Texas HB2. Specifically, they estimate the effects of distance using a similar research design which similarly controls for access to family planning clinics. They find similar effects of distance on abortion rates but do not consider the effects of congestion. Though they find statistically significant effects on birth rates, we show that there is no visual evidence of effects and that model-based estimates are highly sensitive the model that is used and to the lag structure. This renders this evidence inconclusive, which is consistent with our evidence that impacts on abortion rates are too small relative to birth rates to be plausibly detected.

were restrictive and appear to have increased childbearing (Lahey, 2014). The regulatory trend shifted in the late 1960s. Between 1967 and 1972, 13 "reform states" liberalized their abortion laws and five "repeal states" and the District of Columbia made abortion legal under most circumstances (Myers, 2016). Researchers have exploited this variation in modern state policies, using quasi-experimental research designs to provide evidence that the legalization of abortion had strong effects on abortion and childbearing (Levine et al., 1999; Angrist and Evans, 2001; Ananat et al., 2007; Joyce et al., 2013; Myers, 2016).

The controversy over abortion did not subside after the sweeping national liberalization of access; in fact, abortion regulation increased in many states as legislators sought to define the legal limits of access. For the first three decades following *Roe*, state abortion regulations were primarily focused on codifying when and under what circumstances women can obtain an abortion and what sources of funding are available (Guttmacher Institute, 2016a). From an economic standpoint, such policies can be classified as "demand-side regulations" because they focused on regulating the consumers of abortion: pregnant women. These laws include parental consent requirements, waiting periods, mandated counseling and ultrasounds, restrictions on the use of public funds, and bans of abortions later in pregnancy.

Beginning roughly a decade ago, regulatory efforts increasingly focused on abortion supply as states began enacting "targeted regulation of abortion providers" or "TRAP" laws that directly govern abortion facilities and providers. At present twenty-four states have enacted some version of these laws, though enforcement is enjoined in some states (Guttmacher Institute, 2016b). Eleven states have enacted laws requiring abortion providers to have admitting privileges at a local hospital or an alternative arrangement, such as an agreement with another physician who has admitting privileges. Seventeen states have requirements for facilities, such as specifying the sizes of procedure rooms or the minimum distance to the nearest hospital, or requiring transfer agreements with the nearest hospital. The most stringent facilities requirements mandate structural standards comparable to those for surgical centers (Guttmacher Institute, 2016b). While proponents of TRAP laws argue that they make

abortion safer, critics have argued that they do no such thing, and that the true intention is to limit access to abortion by making it difficult or impossible for some clinics to continue operations.

2.2 Texas HB2 and its Aftermath

Texas HB2, which was enacted in July 2013, had two key provisions: (1) It required all abortion providers to obtain admitting privileges at a hospital located within 30 miles of the location at which an abortion was performed and (2) It required all abortion facilities to meet the standards of an ambulatory surgical center, regardless of whether they were providing surgical abortions or providing medication to induce abortions (Texas HB2, 2013). In addition to these provisions, HB2 also prohibited abortions after 20 weeks gestation and required physicians to follow FDA protocols for medication-induced abortions, which restricted the use of abortion pills to within 49 days post-fertilization and required that the medication be administered by a physician.[5] Proponents of the law argued that these requirements ensured the safety of abortion services and easy to access to a hospital in the event of complications (*Whole Woman's Health v. Hellerstedt*, 2016a).

Obtaining admitting privileges can be lengthy process, as it takes time for hospitals review a doctor's education, licensure, training, board certification, and history of malpractice. Moreover, many hospitals require admitting doctors to meet a quota of admissions. After the enactment of HB2, a group of Texas abortion providers filed suit, challenging the enforcement of the admitting privileges requirement that was scheduled to take effect on October 29, 2013. A District Court ruled in their favor, concluding that admitting privileges "have no rational relationship to improved patient care" and that "the vast majority of abortion providers are unable to ever meet the threshold annual hospital admissions, because the nature of the physicians' low-risk abortion practice does not generally yield any admissions" (*Planned*

[5] The FDA guidelines have since been revised (March 2016) to indicate that these pills can be used up to 70 days into a pregnancy and that the second abortion pill need not be administered by a physician. In particular, it states that the second pill can be taken at a "location appropriate for the patient."

Parenthood of Greater Texas Surgical Health Services v. Abbott, 2013b).[6] However, the State appealed the ruling and the Fifth Circuit Court of Appeals permitted the admitting privileges requirement to take effect on November 1, 2013 (*Planned Parenthood of Greater Texas Surgical Health Services v. Abbott*, 2013a). As a result, nearly half of Texas' abortion clinics shuttered their doors because they were unable to comply with the requirement (*Whole Woman's Health v. Hellerstedt*, 2016a).

The second major restriction of HB2, the ambulatory surgical center requirement, required clinics to meet additional size, zoning, and equipment requirements to meet the licensure standards for ambulatory surgical centers. This requirement was scheduled to take effect on September 1, 2014, 10 months after the admitting privileges requirement, and threatened most of Texas' remaining clinics. At the time HB2 was passed, only 6 facilities in 4 cities—Austin, Fort Worth, Houston and San Antonio—met the standards of an ambulatory surgical center.[7] A group of abortion providers filed suit for a second time, challenging both the ambulatory surgical center requirement and also requesting relief from the admitting privileges requirement as applied to two specific clinics, Whole Woman's Health in McAllen and Reproductive Services in El Paso. In response the District Court enjoined enforcement of both provisions, but again the Fifth Circuit reversed, allowing the ambulatory surgical center requirement to go into effect on October 2, 2014. Two weeks later, the United States Supreme Court intervened, issuing an order blocking enforcement of the ambulatory surgical center requirement for all clinics and of the admitting privileges requirement for the clinics in McAllen and El Paso.

In June of 2016, the United States Supreme Court struck down these two provisions of Texas HB2, issuing a majority opinion that Texas had failed to demonstrate that they served a legitimate interest in regulating women's health and that they imposed an undue burden

[6]Henshaw (1999) estimates that 0.3 percent of abortion patients experience a complication that requires hospitalization. As a point of comparison, Callaghan et al. (2012) estimates that 1.3 percent of delivery hospitalizations involve a severe complication.

[7]In response to the law, Planned Parenthood opened an additional facility in Dallas in the summer of 2014 at a cost of over 6 million dollars (Martin, 2014). Two additional ambulatory surgical centers opened the following year. Both were in San Antonio, where Planned Parenthood built a new surgical facility at a cost of 6.5 million dollars (Stoeltje, 2014a) and Alamo Women's Reproductive Services relocated to a surgical facility at a cost of 3 million dollars (Garcia-Ditta, 2015).

on access to abortion (*Whole Woman's Health v. Hellerstedt*, 2016a). It remains to be seen whether the many clinics that closed as a result of this requirement will re-open or otherwise be replaced following the Supreme Court ruling. As of March 2017, only one clinic, Whole Woman's Health in Austin, has announced plans to do so (Tuma, 2017).

In the wake of the *Whole Woman's Health v. Hellerstedt* ruling, abortion opponents continue to focus on supply-side abortion restrictions. Many states with TRAP laws continue to enforce them (Guttmacher Institute, 2016b) and, two days after the Supreme Court struck down HB2, Texas legislators proposed new rules requiring that abortion providers bury or cremate fetal remains. Similar laws have been proposed in Indiana and Louisiana, and could add substantially to the cost of an abortion (Zavis, 2017).

As such, policy considerations in the future are likely to depend on knowing what happens when abortion clinics close. The remainder of this paper focuses on answering this question, using the Texas experience as a case study. One important part of this context is that Texas has a law requiring a 24-hour waiting period after a counseling session before an abortion can be performed. This law went into effect in 2011 and does not apply to women who live more than 100 miles from the clinic. We note that the effects of access to abortion clinics may interact with these laws in important ways that could make it difficult to extrapolate from the results of our analysis to other contexts. That said, Texas is not atypical in having such laws: 35 states have counseling requirements, 27 have waiting periods, and 24 hours is the most common waiting period (Guttmacher Institute, 2017).

3 Data

Table 1 summarizes the variables used in our analysis: measures of abortion access, abortion rates, birth rates, and variables measuring county demographics: age and racial composition (SEER, 2016) and unemployment (BLS, 2016).

3.1 Abortion access in Texas

To evaluate the effects of Texas HB2 on abortion-clinic access, we compile a database of abortion clinic operations in Texas and adjacent states (Colorado, Louisiana, New Mexico, and Oklahoma) based on a variety of sources including licensure data maintained by the Texas DSHS, clinic websites, judicial rulings, newspaper articles, and websites tracking clinic operations maintained by both advocacy and oppositional groups. Appendix B contains detailed information on abortion clinic operations in Texas. Figure 1 mentioned above, which shows quarterly trends in the number of clinics providing abortion services in Texas, is based on these data. Between July 18, 2013, when HB2 was enacted, and November 1, 2013 when its first major requirement went into effect, 18 of Texas' 42 abortion clinics shut their doors, many for good.[8]

We use the clinic operations database to construct two county-level measures of abortion access: distance to the nearest abortion provider and a measure of congestion we term the *average service population*. Distance to the nearest provider is calculated using the Stata *georoute* module (Weber and Péclat, 2016) to estimate the travel distance from the population centroid of each county (United States Census Bureau, 2016) to the nearest operating abortion clinic, including those in the neighboring states of Colorado, Louisiana, New Mexico, and Oklahoma.[9] Figure 1 illustrates that the distance the average Texas woman had to travel to reach an abortion clinic increased from 21 miles in the quarter prior to HB2 to 44 miles in the quarter immediately after. The percentage of women who had to travel more than 100 miles (one-way) to reach a clinic increased from 5 to 15 percent.[10] Figure 2 mentioned above

[8]Clinics are coded as "open" if they provided abortions for at least two out of three months in a given quarter. Hence, Figure 1 and the analysis that follow do not reflect the brief mass closures that occurred for two weeks in October 2014 when the surgical center requirement was enforced. The increase in average distance in the second quarter of 2014 is due to the closure of the sole clinic in Corpus Christi. For a few months, until the McAllen clinic re-opened in the third quarter of 2014, there was no abortion provider in south Texas.

[9]In the appendix, we also present alternative results using geodesic ("as the crow flies") distance calculated with the *geonear* module (Picard, 2010). These results are very similar to those using travel distance.

[10]These are population-weighted county averages using estimates of the populations of women aged 15-44 (SEER, 2016).

describes the spatial patterns of clinic closures occurring between Quarter 2 2013 and Quarter 4 2013 when HB2's first major requirement went into effect. The central-western region of Texas exhibits the largest increases in travel distances, in many cases in excess of 100 miles. Counties for which the nearest abortion clinic was located in a major city—Houston, Dallas, Fort Worth, San Antonio, Austin or El Paso—do not show any change because at least one clinic remained open in these places.

Access to abortion services, however, is not a function of distance alone. The number of physicians providing abortions in the state dropped from 48 to 28, largely due to an inability to obtain admitting privileges (TPEP, 2016), and one quarter of the clinics that remained open in November 2013 did so with a reduced staff (TPEP, 2013). As the number of clinics and providers shrank, wait times to obtain an abortion likely increased. The Texas Policy Evaluation Project conducted monthly telephone surveys of clinic wait times in Texas, beginning after the admitting-privileges requirement went into effect. Though the timing of this effort precludes an analysis of the immediate effect of HB2, it does reveal that wait times hit three weeks in Austin, Dallas and Fort Worth clinics (TPEP, 2015). In Dallas, wait times remained fairly stable until July 2015, when the closure of a large abortion facility in Dallas caused them to increase from 2 to 20 days.

Ideally, we would like to measure wait times as an additional proxy for abortion access, but this is impossible because, to our knowledge, no data on wait times were collected prior to the implementation of HB2. We therefore propose an alternative measure of abortion access that captures the increasing patient loads faced by a reduced number of clinics. We call this variable the "average service population." To construct it, we first assign each county c in time period t to an "abortion service region" r according to the location of the closest city with an abortion clinic.[11] The average service population is the ratio of the population of

[11]To construct the ASP measure, we combine clinics that are in different counties but the same commuting zone. For instance, the city of Austin has abortion clinics in both Travis and Williamson counties; we use the population centroid of Travis county, the more populated of the two, to construct the Austin service region. Because they are in the same commuting zone, we additionally combine Shreveport and Bossier City, Louisiana (3 miles apart), Oklahoma City and Norman, Oklahoma (20 miles apart), Sugar Land and Houston, Texas (22 miles apart), Harlingen and McAllen, Texas (35 miles apart), and El Paso, Texas and Las Cruces,

women aged 15-44 in the service region to the number of clinics in the service region:

$$Average\ service\ population_{c,r,t} = \frac{\sum_{c \in r} population_{c,t}}{number\ of\ clinics_{r,t}}. \tag{1}$$

Figure 3 depicts the service region boundaries and average service populations for the second and fourth quarters of 2013. Over this period, the sole abortion provider closed in several Texas cities: Bryan, Harlingen, Killeen, Lubbock, McAllen, Midland, San Angelo, and Waco. As a result, the boundaries of the service regions for the remaining cities expanded. Figure 4 summarizes the resulting *change* in the average service population. The average service population rose during this period for two reasons: (1) As clinics closed in small cities, women had to travel to clinics that remained in larger cities, shrinking the number and expanding the sizes of service regions; and (2) As clinics closed in large cities, there were fewer providers of abortion services. In the immediate aftermath of HB2, the average service population increased across much of Texas, including by more than 200,000 in the Dallas-Fort Worth region where distances did not change when HB2 went into effect even though several clinics closed. Clinic closures during 2014 additionally increased ASP for many regions. For example, by the fourth quarter of 2014, 8 clinics in Houston served 29 counties, up from 10 clinics serving 14 counties in 2009. As a result, the average service population increased from 108,000 to 270,000 women of childbearing age per clinic.

3.2 Abortion Rates in Texas

We use publicly available data on Texas abortions by county of residence (TDSHS, 2017). To produce these data, the Texas DSHS combines in-state abortions, which providers are mandated to report, with information on out-of-state abortions it obtains via the State and Territorial Exchange of Vital Events (STEVE) system. To construct abortion rates, we use

New Mexico (54 miles apart). We additionally combine Dallas and Fort Worth (33 miles apart), although they are not in the same commuting zone. The results are similar if we use a different rule, combining counties only if their population centroids are less than 25 miles apart.

population denominators based on annual estimates of county populations by race, gender and age from SEER (2016). We use these same population data to construct demographic control variables.

Texas abortion rates account for interstate travel so far as the Texas DSHS is able to observe abortions to Texas residents reported via the STEVE system. We contacted the state health departments in nearby and neighboring states– Arkansas, Colorado, Kansas, Louisiana, New Mexico, and Oklahoma– to inquire about their abortion reporting practices. Of these states, Kansas and Louisiana report that they collect county of residence and participate in STEVE; the remaining states do not. This lack of complete reporting of out-of-state abortions is a potential concern because failing to account for interstate travel could cause us to overstate reductions in abortions, but this is unlikely to be the case in practice. Texas is a geographically large state, and neighboring states are distant options for much of its population, both in absolute terms and relative to distances to in-state clinics. We obtained abortion counts by state of residence from state health departments, and found that very few Texas women traveled to Arkansas, Colorado, Kansas or Oklahoma to obtain abortions. In 2014, the numbers of Texas women obtaining abortions in these states were 45 in Arkansas, 48 in Colorado, 24 in Kansas (which are included in the Texas data), and 136 in Oklahoma, summing to a small fraction of the 53,882 abortions reported by the Texas DSHS (Arkansas Department of Health, 2014; Colorado Department of Public Health and Environment, 2017; Kansas Department of Health and Environment, 2015; Oklahoma State Department of Health, 2015; Texas Department of State Health Services (TDSHS), 2017).

New Mexico, where Santa Fe is the nearest city with an abortion clinic for women living in the western Texas panhandle, appears to be a more frequent destination. New Mexico ceased reporting abortions by state of residence after 2012, but it does continue to report aggregate abortions to out-of-state residents. To estimate abortions to Texas residents occurring in New Mexico, we assume that the entire increase in abortions occurring in New Mexico to out-of-state residents after 2012 was driven by Texas women and estimate that 935 Texas

women obtained abortions in New Mexico in 2014,[12] a number that are not included in our data (New Mexico Department of Health, 2017). Louisiana, where Shreveport is the nearest destination for women in some east Texas counties, also reports larger numbers of abortions to Texas women: 886 in 2014 (Louisiana Vital Records Office, 2016). Abortions occurring in Louisiana are included in our data beginning in 2013. Louisiana did not record state and county of residence for out-of-state residents until 2012, and these counts were not incorporated into the Texas abortion data until 2013.[13]

Based on total abortions to Texas residents reported by these various state health departments, we estimate that in 2014 the abortion data provided by the Texas DSHS are missing 1,164 abortions occurring in Arkansas, Colorado, New Mexico, and Oklahoma, roughly 2 percent of total abortions to Texas Residents. In subsequent sections we demonstrate that the estimated effects that we find are far too large to be explained by the small fraction of abortions occurring in neighboring states that do not participate in STEVE. We also demonstrate that we can restrict our analysis to counties where it is unlikely for women to seek abortions out of state in any year. We do so by focusing our attention on counties for which the nearest abortion clinic is always in Texas. This amounts to excluding counties in the Texas Panhandle and Northeastern Texas. This robustness check yields estimated effects quite similar to our main results. Finally, we demonstrate that the results also are robust to restricting the period of analysis to 2013 to 2015, years when abortions occurring in Louisiana are included in the data.

[12]In 2012, the last year that New Mexico reported abortions by individual state of residence, there were a total of 386 abortions to out-of-state residents, 165 of whom came from Texas and 221 of whom did not. The number of abortions to out-of-state residents increased to 793 in 2013, 1,156 in 2014, and 1,429 in 2015. We assume that the entire increase is explained by women traveling from Texas. In 2014, this produces an estimated $1,156 - 221 = 935$ abortions to Texas women.

[13]In email correspondence with the authors dated November 29, 2016, staff at the Louisiana Vital Records office advised that they began collecting information on state of residence in 2012, but cannot say when Texas began receiving this information via STEVE. In email correspondence with the authors dated January 20, 2017, staff at the Texas DSHS report that they did not receive a variable reporting state of occurrence until 2014, and so cannot say when they began receiving the Louisiana data. They note that Louisiana is included in 2014. Looking at time trends, the authors observe a sharp increase in abortions in Texas counties on the Louisiana border in 2013, and infer that this is the year Louisiana abortions began to be included in the counts of abortions to Texas residents.

3.3 Births Rates in Texas

We use restricted-use natality files provided by the National Center for Health Statistics from 2009–2015. These data consist of a record of every birth taking place in the United States over this time period. For our analysis of county-year level data, we assign births to the year of conception assuming a nine month gestational period. This approach results in incomplete data on births conceived in 2015; thus, we restrict our analysis to births conceived in 2009–2014 after using the 2015 natality file to construct our measure of teen births conceived in 2014. To construct birth rates, we use population denominators based on annual estimates of county populations from SEER (2016). We also present results estimated at the county-quarter level using various leads for the birth outcome.

4 Empirical Strategy

We estimate the effects of access to abortion clinics using a generalized difference-in-differences design, which exploits within-county variation over time while controlling for aggregate time-varying shocks. The identifying assumption underlying this approach is that changes in outcomes would have been the same across Texas counties in the absence of differential changes in access to abortion clinics. We provide empirical support for the validity of this assumption in the next section.

Given the discrete nature of abortions, and because we encounter cells with zero abortions when looking at some subgroups, we operationalize this strategy with a Poisson model.[14] In particular, our approach to estimating the effect of changes in abortion access on the abortion

[14]Like linear models, the Poisson model is not subject to inconsistency caused by the incidental parameters problem associated with fixed effects. While the possibility of overdispersion is the main theoretical argument that might favor alternative models, overdispersion is corrected by calculating sandwiched standard errors (Cameron and Trivedi, 2005). Moreover, the conditional fixed effects negative binomial model has been demonstrated to not be a true fixed effects model (Allison and Waterman, 2002).

rate corresponds to the following equation:

$$E[AR_{ct}|\boldsymbol{access_{ct}}, \alpha_c, \theta_t, \boldsymbol{X_{ct}}] = exp(\boldsymbol{\beta access_{ct}} + \alpha_c + \theta_t + \boldsymbol{\gamma X_{ct}}) \quad (2)$$

where AR_{ct} is the abortion rate for residents of county c in year t; $access_{ct}$ is a measure (or set of measures) of access to abortion clinics for residents of county c in year t; α_c are county fixed effects, which control both observed and unobserved county characteristics with time-invariant effects on abortion rates; θ_t are year fixed effects, which control for time-varying factors affecting abortion rates in all Texas counties in the same manner; and X_{ct} can include time-varying measures of county characteristics such as demographics and access to family-planning clinics. Because Poisson models are more typically thought of as considering counts, not rates, we note that this model can be expressed alternatively as estimating the natural log of the expected count of abortions while controlling for the relevant population and constraining its coefficient to be equal to one. All of the standard-error estimates we report allow errors to be correlated within counties over time. We have also examined standard-error estimates that instead cluster on initial abortion service regions—they are typically very similar or smaller than those that we report.

As we discussed above, we consider multiple measures of access to abortion clinics. To correspond with the abortion data, which is available for each year, our access measures are annual averages based on the quarterly data described in Section 3.[15] We begin by considering the distance to the nearest clinic from the county population-weighted centroid. In some sense, this allows us to provide an answer to the question: does distance-to-clinic matter to abortion rates? We then consider the degree to which different distances have different—potentially non-linear—impacts by evaluating the effect of having the nearest clinic within 50–100 miles, 100–150 miles, 150–200 miles, or 200+ miles away (versus having a clinic within 50 miles). The choice of these distance bins is admittedly arbitrary, so we also estimate polynomial

[15]A series of specifications in the Appendix use quarterly birth data. For these specifications, we measure access at the quarterly level.

specifications in distance and demonstrate that these produce substantively similar results. Together, these models allow us to provide answers to the questions: Over what ranges is distance an important enough factor that it influences abortion rates? And how big is this impact for different distances?

We also consider abortion-clinic congestion by evaluating the effects of the "average service population," which measures the number of people each clinic is expected to serve in each "service region" described previously. This allows us to determine the degree to which clinic closures affect abortion rates though congestion as well as distance. It is particularly relevant to understanding the effects in areas where the existence of multiple clinics is such that a closure does not have any meaningful impact on the distance a woman has to travel for an abortion but is expected to increase congestion.

5 Results

5.1 Establishing the Validity of the Research Design

The primary goal of our paper is to estimate of the *causal* effects of abortion-clinic access on abortions provided by medical professionals. The identifying assumption underlying our differences-in-difference strategy is that proportional changes in abortion rates would have been the same across Texas counties in the absence of differential changes in access to abortion clinics. This assumption implies that the changes in abortion rates for counties with small changes in access provide a good counterfactual for the changes in abortion rates that would have been observed for counties with larger changes in access if their access had changed similarly.

As a first approach to assessing the identifying assumption, we categorize counties into four groups based on their changes in distance-to-nearest-clinic between the second quarter of 2013 (before HB2) and the fourth quarters of 2013 (after HB2). One group consists of counties with no increase in distance-to-nearest-clinic over this time period. The other three

groups of counties are in terciles based on the amount that their distance-to-nearest-clinic increased over the same period. As we show in Figure 5, the average distance-to-nearest-clinic was flat at 19 miles from 2009–2013 for the first group of counties, before increasing to 26 miles in subsequent years. The trend is very similar for the lowest-tercile group with increases in distance-to-nearest-clinic in 2013: the average distance-to-nearest-clinic was flat at 22 miles from 2009–2012 before it increased slightly in subsequent years to 28 miles. For the middle-tercile group, the average distance-to-nearest-clinic was also flat at approximately 22 miles from 2009–2012 before it increased to an annual average of 50 miles in 2013 and 115 miles in 2014. For the upper-tercile group, the average distance-to-nearest-clinic was similarly flat at approximately 27 miles from 2009–2012 before it increased to an annual average of 77 miles in 2013 and 223 miles in 2014.

The main point we want to emphasize from Figure 5 is that distance-to-nearest-clinic was extremely flat for all four groups prior to 2013. As such, we can use pre-2013 years to evaluate the credibility of the common trends assumption. Towards this end, Figure 6 plots the log of the abortion and birth rates over time for each of the four groups. Mirroring national trends, Figure 6 demonstrates that abortion rates were steady from 2009 to 2010 before falling from 2010 to 2013 for all four groups of Texas counties. More importantly, log abortion rates for the four groups track one another fairly closely over this period of time. That is, from 2009 to 2012, log abortion rates were changing very similarly for counties that would subsequently experience a major increase in distance-to-nearest-clinic and counties that would subsequently experience smaller (or no) increases. Our identification strategy assumes this would have continued to be the case in subsequent years in the absence of HB2.

Panel B of Figure 6 shows that birth rates were declining in Texas from 2009 through 2011, again mirroring national trends. This decline arrests after 2011, consistent with evidence from Lu and Slusky (2016b) and Packham (2016) that cuts to Texas family-planning programs caused an increase in births. Again, however, the most important point here is that the trends in births rates were similar across counties prior to the year in which they experience

differential shocks to abortion access.

In addition to providing support for the validity of our identification strategy, Figure 6 also provides some visual evidence of the effects of distance on abortion and birth rates. In particular, counties experiencing the greatest increase in distance exhibit correspondingly greater decreases in abortion rates. Some readers may also note that distances decreased somewhat for the top two terciles between 2014 and 2015 and also that that there is a corresponding "rebound" in the abortion rate. This could be taken as further evidence that abortion rates respond to changes in distance to clinics. That said, the magnitude of the rebound in abortion rates is such that it could reflect that the effects of the earlier, larger, increases in distance are short lived. We explore this possibility in our econometric analysis Section 5.5.[16] Figure 6 shows no evidence of an increase in births corresponding to the decrease in abortions. This also is consistent with the results of our econometric analysis, and we discuss possible interpretations.

To provide further evidence in support of our research design, Appendix Figures A1 and A2 show that these aggregate trends in abortion and birth rates are also present if we focus on teenagers, women in their 20s, or women in their 30s. Moreover, Appendix Figure A3 presents similar plots for county demographics (race, ethnicity, age), the unemployment rate, and the number of family planning clinics. For the most part, these graphs indicate that the HB2-induced changes in distance-to-nearest-clinic were unrelated to trends in these county

[16]We have also investigated the counties underlying this variation in greater detail. They are all in South Texas. Prior to HB2, four cities in South Texas had licensed abortion clinics: San Antonio, Corpus Christi, McAllen, and Harlingen. The clinics in McAllen and Harlingen both closed on November 1, 2013 when the admitting privileges requirement went into effect, causing Corpus Christi– which is about 150 miles away from both locations– to become the nearest destination for women seeking abortions at a licensed clinic. The associated county-level abortion rates fell by 64 percent for McAllen and by 56 percent for Harlingen between 2012 and 2014. In June of 2014, the sole provider of abortion services in Corpus Christi– who commuted there from San Antonio to provide abortion services two days a month– announced that he was retiring for health reasons (Meyer, 2013; Stoeltje, 2014b). As a result, San Antonio became the closest abortion destination for women in McAllen, Harlingen and Corpus for three months, until September 2014 when the Fifth Circuit Court of Appeals carved out an exemption from the admitting-privileges requirement for the McAllen clinic, allowing it to re-open in September. When the McAllen clinic re-opened, abortion rates in McAllen and nearby Harlingen increased to nearly their pre-HB2 levels. Meanwhile, in Corpus Christi, where the part-time clinic had closed, abortion rates fell by 12 percent.

characteristics.[17] Moreover, there is no evidence in these figures that changes in demographic, unemployment rates, or family planning clinics could explain the large decline in abortions in 2014 for those counties with the greatest increase in distance-to-nearest-clinic.

As a second approach to assessing the credibility of our identifying assumption, we examine more-disaggregated trends in outcomes and covariates prior to the enactment of HB2. Ideally, we would be able to demonstrate common trends across all counties in the state, which would actually support a stronger identification assumption than our empirical strategy requires.[18] However, county-level often fluctuate too much from year to year to be able to discern trends from time-series plots. For this reason we instead present plots based on data aggregated to the 16 abortion service regions in Quarter 2 of 2013 (before HB2).[19]

The upper panel of Figure 7 illustrates trends in abortion for each of these groupings of Texas counties. The trends in look quite similar prior to 2013, diverging only as the policy change takes place. One might note that abortion rates increase between 2012 and 2013 for Texas counties for which an out-of-state clinic is the nearest destination—this is due to the fact that Louisiana abortion statistics are included in the abortion counts beginning in 2013, an issue that we discuss and address at several points in this paper. There is also perhaps a bit of evidence that the counties around Austin may be on a flatter trend, which we address in our analysis by examining the robustness of our main results to their exclusion.

The lower panel of Figure 7 is similar but focuses on birth rates. As with abortion rates, this figure shows that trends are quite similar across Texas prior to 2013. It also shows no sign that birth rates diverge from trend in subsequent years for any areas of Texas, suggesting that the apparent impacts on abortions do not lead to detectable impacts on births.

[17] The most notable aspect of these graphs is that the number of family planning clinics fell most in counties that experienced no increase in distance-to-nearest-clinic; however, the number of family clinics fell by roughly half for all groups of counties between 2011 and 2014.

[18] Recall, our identifying assumption is that that the changes in abortion rates for counties with small changes in access provide a good counterfactual for the changes in abortion rates that would have been observed for counties with larger changes in access if their access had changed similarly.

[19] See Panel A of Figure 3 for a map of these regions. We combine the Oklahoma City/Norman, Oklahoma and Shreveport/Bossier City, Louisiana service regions into a single "out of state" region for the purposes of Figure 7. This is because only 3 rural counties with small populations are in the Oklahoma service region, and the rates are noisy.

5.2 The Causal Effects of Distance-to-Nearest-Clinic

Having provided evidence to support the key identifying assumption underlying our difference-in-differences research design, we now present estimates of the causal effects of access to abortion clinics that are based on this research design. We begin in Column 1 of Table 2 with estimates from the baseline model, controlling only for county fixed effects and year fixed effects. When we use distance-to-nearest-clinic (in hundreds of miles) as the measure of access (Panel A), the resulting estimate indicates that a 100 mile increase in the distance-to-nearest-clinic reduces the abortion rate in a given county by 19 percent.[20] This estimate is statistically significant at the one-percent level.

Across columns 2 through 4 of Table 2, we consider the robustness of these estimates to the inclusion of time-varying county control variables. Column 2 presents estimates based on a model that additionally controls for demographics (race, ethnicity, age). Specifically, the demographic control variables include the fraction of the 15-44 female population in each each five year grouping and the fraction of each of these age groups that is non-Hispanic white, non-Hispanic black, or Hispanic (versus other race/ethnicity). This leads to slightly larger estimates of the effects of distance-to-nearest-clinic. Column 3 presents estimates that additionally control for economic conditions using the unemployment rate. The inclusion of this control variable has no impact on the estimated effects.

Finally, Column 4 presents estimates based on a model that additionally controls for access to family planning services. Our approach to controlling for family planning follows Packham (2016) who evaluates the effects of Texas' decision to cut funding to family planning clinics by two-thirds in 2012. In particular, we control for whether a county had a publicly funded family planning clinic prior to the funding cut interacted with the time period after the funding cut occurred (post-2012). The inclusion of this control variable has little impact on the estimate or its precision. The linear estimate in Column 4 of Panel A suggests that a 100 mile increase in distance causes a 22 percent reduction in the abortion rate. In Appendix

[20]Percent effects are calculated as $(e^{\beta} - 1) \times 100\%$.

Table A1 we show that alternative approaches to controlling for access to family planning produce similar results. In particular, the estimates are nearly identical if we control for family planning support using the variable just described, with a variable indicating that the county had a family planning clinic in the given year, with a variable for the number of family planning clinics in the county in the given year, or with a variable for the number of family planning clinics per capita in the county in the given year.

As we noted above, the effects of distance may not be linear, in which case the estimate reported in Panel A could be misleading. In order to investigate this possibility, in Panel B we consider distance-to-nearest-clinic across five categories: less than 50 miles (omitted), 50–100 miles, 100–150 miles, 150–200 miles, and 200 or more miles. The results in Panel B are quite similar regardless of the set of control variables included (Columns 1-4). The point estimates in Column 4 of Panel B imply that having the nearest abortion clinic 50–100 miles away, as opposed to less than 50 miles away, reduces abortion by a statistically-significant 19 percent. The estimated effects of greater distances indicate that a distance of 100–150 miles reduces abortion rates by 30 percent, a distance of 100-150 miles reduces abortion rates by 44 percent, and a distance of 200 or more miles to the nearest abortion clinic reduces abortion rates by 43 percent, where all estimated effects are relative to having a clinic within 50 miles. The estimated effects of being 150–200 miles versus greater than 200 miles from the nearest clinic are not statistically distinguishable from one another.

The thresholds used to establish the distance categories in Panel B of Table 2 are admittedly arbitrary. As an alternative approach, we also estimate a model controlling for the same set of control variables as in Column 4 of Table 2 with a cubic specification of the distance-to-nearest clinic. Figure 8 presents the estimated percent changes in the abortion rate. These are quite similar to those for the spline specifications in Panel B of Table 2, again showing large effects of increasing distance from a base of 0 to 150 miles and little additional effect of increasing distance beyond 200 miles.

The appendix produces several additional robustness checks for the results in Table 2.

Table A2 reports an alternative set of estimates using geodesic ("as the crow flies") distances rather than travel distances, and Table A3 reports results using estimated travel times. The results are substantively the same regardless of which of these three measures of access one chooses. For instance, comparing the results in Column 4 of Panel A, the abortion rate is estimated to decrease by 22 percent ($p < 0.001$) for a 100 mile increase in travel distance, by 27 percent ($p < 0.001$) for a 100 mile increase in geodesic distance, and by 16 percent ($p < 0.001$) for a 1 hour increase in travel time.

Appendix Table A4 presents alternative estimates of the results in Table 2, using an alternative to the Poisson model to evaluate log birth rates. Specifically, this table presents weighted least squares estimates applied to a measure of log abortion rates constructed using the inverse hyperbolic sine function.[21] Suppressing subscripts, the outcome variable we use in this analysis is $ln(\frac{abortions+\sqrt{abortions^2+1}}{population})$ which has the advantage of being defined even when zero births are observed. The estimates reported in Appendix Table A4 are similar to those reported in Table 2—in both magnitude in magnitude and statistical significance—while providing some evidence of even larger effects at 200 or more miles (49 percent versus 43 percent).

To address any concerns that pre-existing trends (shown in Figure 7) were perhaps a bit different for counties in Austin's Q2 2013 abortion service region, in Appendix Table A5 we show that the results are very similar if we exclude such counties from our analysis. Also motivated by Figure 7, which revealed a sharp divergence from trend for counties in a Q2 2013 out-of-state abortion service region when the abortion data begins to include abortion statistics from Louisiana, in Appendix Table A6 we show that the results are also very similar if we omit such counties from our analysis.

[21] As weights we use the population of females aged 15-44.

5.3 Congestion

We now consider the degree to which abortion-clinic closures may also affect abortion rates through congestion effects, using the "average service population" measure described in detail above. In order for us to be able to separately identify the effects of this measure of access and the distance measures evaluated in the previous section, there must be independent variation across these two measures. As we noted in Section 3, such variation is expected because closures in areas where some clinics remained open increase congestion without affecting distance-to-nearest-clinic whereas closures in areas where no clinics remained open increase both congestion and distance-to-nearest-clinic. This is evident from a comparison of figures 2 and 4, which depicted changes in the two measures across different Texas counties. We also illustrate this point in Figure 9, which plots county-level changes in the average service population against county-level changes in distance-to-nearest-clinic. There is a positive relationship between changes to these measures of abortion-clinic access but the relationship is not strong and there is substantial independent variation.

Table 3 presents the results from our models that simultaneously evaluate the effects of distance-to-nearest-clinic and our measure of congestion. Across all of the specifications, the estimates routinely indicate that increases in congestion reduce abortion rates. Specifically, the estimates imply that a 100,000 person increase in the average service population reduces a county's abortion rate by 7 percent.[22]

We also note that the estimated effects of distance-to-nearest clinic are slightly smaller in Table 3 relative to those reported in Table 2. Given the positive relationship between the distance and congestion variables shown in Figure 9, this is not surprising. Intuitively, it implies some of the reductions in abortion rates we previously attributed to increased distance based on Table 2 should instead be attributed to increased congestion. Nonetheless, the estimated effects of distance remain large and statistically significant, and continue to demonstrate substantial non-linearities. They imply that, relative to having an abortion

[22] A 100,000 person increase is about 1.5 standard deviations based on the 2009 distribution.

clinic less than 50 miles away, having a clinic 50–100 miles away reduces abortions by 15 percent, having a clinic 100–150 miles away reduces abortions by 25 percent, and having a clinic 150–200 miles away reduces abortions by 40 percent. As in Table 2, the estimated effects of being 150–200 miles versus more than 200 miles away from the nearest clinic are not statistically distinguishable from one another.

5.4 Addressing Interstate Travel

As discussed in Section 3.2, abortion surveillance practices vary in neighboring states. Summing up abortions to Texas residents in states not participating in STEVE, we estimated that the 53,882 abortions to Texas residents reported by the Texas DSHS (2017) in 2014 may be missing up to 1,164 abortions in Arkansas, Colorado, Oklahoma, and New Mexico. Using the same approach for the following year, the 2015 abortion counts may be missing up to 33 abortions in Arkansas, 46 in Colorado, 1,208 in New Mexico, and 131 in Oklahoma, summing to 1,418 abortions.

Might these abortions obtained in other states explain our results? Based on our estimated models, if access to abortion clinics had remained at pre-HB2 levels, Texas women would have had 122,315 legal abortions in 2014–2015 rather than the 107,830 observed in the abortion surveillance data, an estimated reduction of 14,485 abortions due to HB2.[23] This estimated effect is far in excess of the 2,582 abortions we are potentially missing in nearby states during this two year period.

To additionally explore whether the estimated effects of access are in part picking up unobserved interstate travel to obtain abortions, we test the sensitivity of our main results to the exclusion of counties where such travel is most likely. In our first such test, we eliminate the entire Texas Panhandle region from the sample because this region includes counties for

[23]This estimate is based on our measures of abortion-clinic access in 2012 and the results of the estimated model whose coefficients are shown in Table 3, Panel B, Column 4. We note that the total number of abortions in Texas fell by more than this number over this time period, which is not surprising in light of the long-run decline observed across the United States. Our estimates abstract away from any nationwide or statewide changes abortion to focus on the changes caused by differential changes in clinic access, as measured by driving distance and average service populations.

which New Mexico or Oklahoma abortion clinics were the nearest abortion destination in the later years in the sample.[24] Our second test eliminates all counties in Texas for which an out-of-state clinic is ever the closest destination for an abortion during the study period. This rule causes us to eliminate 56 out of Texas' 254 counties, all of them in the Panhandle region and Northeastern Texas. Because these counties are primarily rural, they account for only 5.4 percent of the population of women of childbearing age. Estimates based on these restricted samples are presented in Columns 2-3 of Table 4. They are quite similar to the estimates produced using the full sample (Column 1), indicating that unobserved interstate travel to obtain abortions is not a significant driver of our main results.

5.5 Analysis Using Different Time Windows

In this subsection, we consider estimates that rely on different time windows for the analysis. We do so with three main objectives. First, we want to verify that our estimates are robust to focusing on a narrower window of time around around HB2's enactment. Our main results use data from 2009–2015, and thus use variation in access generated by closures induced by HB2 in addition variation in access generated to closures (and openings) taking place at other times. We would be less confident in the validity of these estimates if they are not robust to an approach that restricts the degree to which the latter source of variation contributes to the estimates. Our second objective is to consider the robustness of the estimates to using years in which we consistently have data on abortions occurring in Louisiana, which are included beginning in 2013. Our third and final objective is to examine whether the estimates differ if we focus on "later post-HB2 years" in order to speak to whether the immediate and longer-run effects differ.

The results of these analyses are shown in Columns 4-6 of Table 4. Columns 4 and 5 focus on a narrower window around HB2 than our main analyses. Specifically, Column 4 reports estimates that use data from 2012 to 2014, while Column 5 reports estimates based

[24]More specifically, we identify the Panhandle as counties in Texas Public Health Region 1 as defined by the Texas DSHS.

on data from 2012 and 2015, omitting the year most clinics closed and the subsequent year. The estimates in each of these columns continue to indicate significant effects of increasing distance. That said, the estimates are smaller in magnitude when 2015 is the only fully post-HB2 year included in the analysis (Column 5), which does suggest that the immediate effects of increases in distance may be larger than the effects after a period of time, as individuals and clinics learn and make adjustments. We also note that the estimated effect of congestion—as measured by the average service population—is smaller in magnitude and less precise in Column 4.

Finally, Column 6 reports estimates that solely use data from 2013 through 2015, which corresponds to the set of years in which abortions taking place in Louisiana are reported in the data. The variation across these three years is driven in part by the fact that 2013 is only partially affected by the closures precipitated by HB2 and also in part by subsequent clinic openings. The estimated effects of distance based on this variation are quite similar to our main results; however, the estimated effect of the average service population is again weaker as it was in Columns 4.

5.6 Heterogeneity by Ethnicity and Distance to Mexico

As access to abortion clinics decreased in Texas, substantial anecdotal evidence suggests that many women sought to self-induce abortions by accessing an abortafacient sold over-the-counter at Mexican pharmacies under the brand name Cytotec (Eckholm, 2013; Hellerstein, 2014).

The FDA protocol for medical abortions requires the administration of two drugs: Mifepristone, which blocks the effects of progesterone, and Misoprostol, which induces uterine contractions. Taken together, this combination is more than 95 percent effective in the first trimester (Kahn et al., 2000). Taken alone, Misoprostol is about 90 percent effective (von Hertzen et al., 2007), and the World Health Organization recommends that it be used alone in environments in which mifepristone is not avialable (WHO, 2012). Misoprostol also is

marketed for the treatment of ulcers, and it is sold under the brand name Cytotec in many countries. While Cytotec is a prescription medication in the United States, in Mexico it is available over-the-counter at pharmacies.

In 2008-2009, 1.2 percent of patients at abortion clinics reported that they had used Misoprostol on their own to self-induce abortion at some point in the past Jones (2011). Rates may be higher in Texas because women can more easily travel to Mexico to obtain the drug. In 2012, prior to the enactment of HB2, 7 percent of Texas abortion patients reported that they had tried to "do something" on their own to end the pregnancy (Grossman et al., 2014). The number was higher– about 12 percent– for women living near the Mexican border. In 2014, the Texas Policy Evaluation Project surveyed 779 Texas women; 2 percent reported attempting to self-induce an abortion and 4 percent reported knowing someone else who had done so (TPEP, 2015b).

Ideally, we would be able to evaluate the effects of abortion-clinic access on self-induced abortions as well those that are provided at clinics in order to measure the degree to which women substitute the former for the latter. However, these self-induced abortions take place out of sight of public health authorities tracking legal abortions in licensed facilities, which makes a rigorous analysis along these lines impossible. In order to provide indirect evidence that speaks to this issue, we examine whether the effects on abortions provided by medical professionals are relatively large among Hispanic women and women who live close to the Mexican border as we anticipate that such women would have better access to Cytotec than the average woman.

Columns 1 and 2 of Table 5 show the estimated effects on legal abortions for non-Hispanic women and Hispanic women, respectively. These estimates are based on our richest model, which controls for county fixed effects, year fixed effects, demographics, the unemployment rate, and family planning access. The demographic control variables used when evaluating non-Hispanic women include the fraction of non-Hispanic women in each five-year age group from 15–44 and the share of each of these non-Hispanic age groups that are black or "other"

as opposed to white. The demographic control variables used when evaluating Hispanic women include the fraction of Hispanic women in each five-year age group from 15–44. These results indicate significantly larger effects of distance to the nearest for Hispanic women than for non-Hispanic women. In particular, the point estimates imply that a 100 mile increase in distance to the nearest abortion clinic reduces the abortion rate by 11 percent for non-Hispanic women and by 29 percent for Hispanic women. The estimated effect of our measure of congestion is larger in magnitude for the non-Hispanic women than for Hispanic women but the standard error estimates are relatively large and we cannot reject that the effects are the same at conventional levels.

Columns 3 and 4 of Table 5 present the results of our analysis considering whether the effects of abortion clinic access on legal abortions differs for counties near the Mexican border relative to those that are further away. We do so using data on the locations of border crossings between Texas and Mexico, calculating the travel distance from each Texas county to the nearest border crossing, and then separately analyzing counties less than 100 miles from a border crossing and those more than 100 miles from such a crossing.[25] Of Texas' 254 counties, 26 counties accounting for 11 percent of Texas' population of women of childbearing age are located within 100 miles of a Mexican border crossing. Because these counties afford relatively limited variation in clinic operations, we simply estimate the effects of (linear) travel distance to the nearest abortion clinic and its interaction with an indicator for being less than 100 miles from the Mexican border, while controlling fully for county and year fixed effects, demographics, economic conditions, and access to family planning services; we do not also to estimate models with a series of distance indicators.

The results of this analysis indicate that there are heterogeneous effects of decreasing access to abortion clinics across these two groups of counties. For Hispanic women living in counties that are more than 100 miles from the nearest border crossing, a 100 mile increase in distance to an abortion clinic is estimated to reduce the abortion rate by 22 percent.For

[25] We obtained the geographic coordinates of border crossings from the Texas Department of Transportation (TXDOT, 2017), limiting the analysis to crossings that can be accessed by pedestrians or private vehicles.

Hispanic women living fewer than 100 miles from the Mexican border, a 100 mile increase in distance to an abortion clinic is estimated to reduce the abortion rate by 50 percent. The point estimates also suggest larger effects of congestion on legally obtained abortions for Hispanic women living near the Mexican border. For non-Hispanic women, the point estimates are in the same direction as those for Hispanic women but they are very imprecise.

As a whole, the results in Table 5 provide further suggestive evidence that substitution to self-induced abortion may have been widespread. That said, we do have to acknowledge that other differences could explain why we there are larger effects of access to abortion clinics on abortions obtained at clinics for Hispanic women and those residing in counties near Mexico. One especially notable difference is that Hispanic women and those in counties near the Mexican border tend to have relatively high poverty rates.

5.7 Do the Effects on Abortions Show Up in Birth Rates?

This question naturally arises from the preceding set of results. In a mechanical sense, one might expect fewer abortions to lead to more births. It is important to note, however, that the reductions in abortions provided by medical professionals that we document could be offset by increases in self-induced abortions. Moreover, reduced access to abortion clinics could lead to changes in sexual behavior and contraceptive use, which could also offset (or more than offset) impacts on abortion.

Before presenting the estimated effects on birth rates, we note that the estimated effects on abortions provided by medical professionals documented in Table 3 (Panel B, Column 4) imply approximately 8,000 fewer abortions in 2013 and 2014 than there would have been in the absence of reductions in clinic access since 2012.[26] Given approximately 800,000 births across these years, one would anticipate that it would be difficult to distinguish between an effect of that size on birth rates from no effect at all. This point is also demonstrated by the upper panel of Appendix Figure A4, in which we plot birth-plus-abortion rates over time

[26] Most of these are expected in 2014 most of the abortion clinic closures occurred in late 2013.

using the same county groupings as in Figure 7. Though Figure 7 showed abortion rates clearly diverging from trend in some regions of Texas following HB-2, the upper panel of Figure 7 shows that these changes in abortion are too small relative to births to be visually evident when looking at births and abortions combined. In the lower panel of Figure A4 we show that this continues to be the case even if we double the influence of abortions, plotting the log of the rate of births-plus-two-times-abortions. We return to this argument below after presenting some additional estimates.

The results from our analysis of the effects of abortion clinic access on birth rates are shown in Table 6. Columns 1 to 5 show estimates in which we evaluate quarterly birth rates. Across the different columns we lead birth outcomes by zero, one, two, three, and four quarters. Column 6 shows estimates in which we evaluate yearly birth rates as a function of conditions in the year of the pregnancy, assuming a gestational period of nine months. The estimated effects of distance on birth rates are never statistically significant when distance enters into the model linearly (Panel A). In Panel B there is sometimes evidence of statistically significant effects when considering distances in the categories we used for our analysis of abortion rates. However, some of the strongest effects on birth rates are based on the analysis of quarterly birth rates as function of contemporaneous conditions (Column 1), which suggests the model is somehow misspecified since births occur at a lag. When we instead evaluate birth rates using a cubic in distance, the results of which are shown in Figure 10, these estimates are no longer statistically significant. In general, the estimates tend to not be statistically significant.[27]

Returning to the idea that the effects on abortion are too small to be detected in an analysis of birth rates, we conduct a simulation exercise to evaluate the degree to which the

[27] This conclusion is in contrast to Fischer et al. (2017), who estimate models of monthly births as a function of abortion access at the estimated 13th week of gestation and conclude that birth rates rose in response to increased distances from providers. Fischer et al.'s approach is most comparable to our estimates of the effects of abortion access on a three-quarter lead of births, which are reported in Column 4 of Table 6 and Panel D of Figure 10. This is where we see the strongest evidence that increasing distance increases birth rates. We are not inclined to put much weight on these estimates for two reasons. First, it also shows evidence that increasing distance from initially large distances *reduces* birth rates, which seems highly unlikely. Second, these estimates are substantially bit weaker when different when we evaluate births using different leads.

effects on abortions that we document are expected to influence estimated effects on birth rates. This exercise involves two steps. In the first step, we modify the yearly birth rate data in accordance with our estimated effects on abortions. In 2013 and 2014, these "simulated data" include an additional birth (lagged by one year) for each abortion that is "missing" because of reduced access to abortion clinics since 2012 (prior to HB2). The predicted effects on abortions for each county for 2012 and 2013 are based on the estimates reported in Table 3, Panel B, Column 4. In the second step, we estimate the effects on birth rates using these simulated data. If these simulated data produce significantly different estimates than the actual birth rate data, we can conclude that the HB2-induced effects on abortion access reduced abortions by a large enough magnitude to be detected in an analysis of birth rates. Otherwise, we should conclude that the effects on abortion are too small to be detected in an analysis of birth rates.

The results of this simulation exercise are shown in the final column of Table 6. Specifically, Column 7 shows the estimated effects of abortion clinic access using the Poisson model applied to the simulated birth rate dataThe estimates based on the simulated data are not much different from those based on the actual birth rate data—in both a statistical and economic sense. They are usually not different by more than half of the standard error estimates. The fact that the simulated data does not come close to producing significantly different estimates from the real data implies that the magnitude of the effects on abortion could not plausibly be detected in a similar analysis of birth rates.

These findings are different from—but not at odds with—those in Levine et al. (1999), Joyce et al. (2013), and Myers (2016) who conclude that the liberalization of abortion policies in the early 1970s substantially reduced births. There are several reasons why these results may be different in our context. First, abortion-to-birth ratios are much lower today than in the years that followed *Roe*. In 2012, the abortion ratio in Texas was 16.9 abortions per 100 births,[28] similar to that for the country as a whole (Jones and Jerman, 2017). In 1976, the

[28]Authors' calculation based on the abortion and natality data used in the analysis.

abortion-to-birth ratio was 33.1 (Sullivan et al., 1977). As such, any given percent reduction in the abortion rate will have comparatively small effects on birth rates today relative to the 1970s. Second, in the modern context women can (illegally) obtain access to relatively reliable technologies to medically self-induce abortions, especially in Texas because Cytotec can be purchased over-the-counter in Mexico. Self-induced and illegal abortions In the 1970s were mostly surgical and involved substantial risks. Third, contraceptive technology has improved since the 1970s and has become more readily available—it is possible that there is a larger impact on effective contraceptive use in our context.[29]

To summarize, even though effects of reduced abortion access on abortion rates are quite large relative to their own baselines, they are small relative to birth rates and it is unreasonable to expect to identify statistically significant effects on birth rates in this context. As such, the results of our analysis of birth rates should be interpreted with caution. It is not surprising that they are inconclusive and this should not be taken as evidence that the effects on abortions are or are not offset by other behavioral changes.

6 Discussion and Conclusion

The results of our empirical analysis demonstrate that decreases in TRAP-law-induced reductions in access to abortion clinics can have sizable effects. For women living within 200 miles of an abortion clinic, we document substantial and statistically significant effects of increasing distance to abortion providers. This finding that even small increases in distance have significant effects is is notable in light of previous Supreme Court opinions suggesting that travel up to 150 miles not be considered an undue burden.[30] Moreover, our estimates also suggest that increased travel distances is not the only burden imposed by clinic closures. Most of the specifications indicate that as fewer clinics serve larger regions, abortion rates

[29]Fischer et al. (2017) provide some suggestive evidence that reduced access to abortion has minimal impacts on retail purchases of condoms and emergency contraceptives in the modern Texas context.

[30]See Justice Alito's dissenting opinion in *Whole Woman's Health v. Hellerstedt* (2016a), with reference to *Planned Parenthood v. Casey* (1992).

decline.

Based on our estimated models, if access to abortion clinics had remained at pre-HB2 levels, Texas women would have had nearly 15,000 more abortions in 2014-2015 than were actually observed.[31] We hope that future research can address what explains these "missing" abortions. It is possible that they can be explained by more women giving birth, though our analysis of birth rates suggests that birth rate data alone are insufficient to detect the small effects implied by our estimated effects on abortion. It is also possible that some women responded to the reduction in access to abortion facilities by decreasing risky sexual behaviors and, as a result, unintended pregnancies. And though there is anecdotal evidence suggesting that many Texas women did resort to "do-it-yourself abortions" by obtaining misoprostol over-the-counter in Mexico (Hellerstein, 2014; TPEP, 2015b), data limitations will likely make it difficult to investigate this sort of behavior in any systematic fashion. However, our findings do suggest that the demand for legal abortions is particularly elastic among Hispanics and near the Mexican border, which is consistent with this anecdotal evidence.

[31] See Section 5.4 for a discussion of this calculation.

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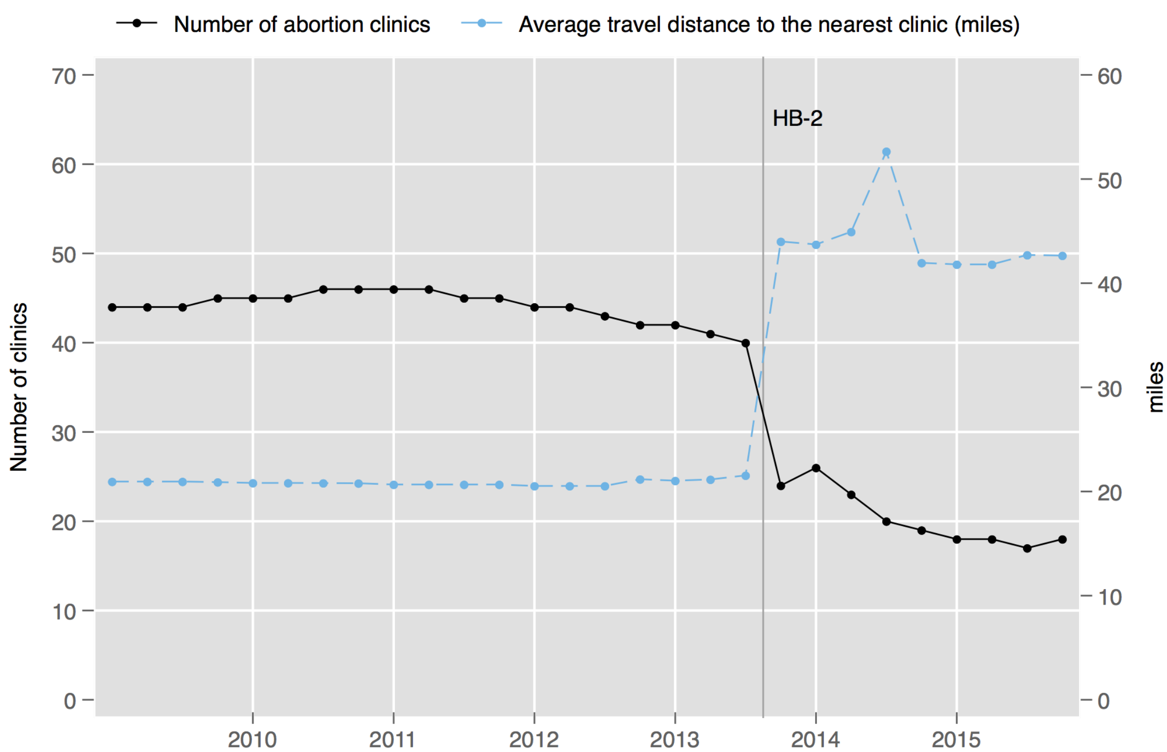
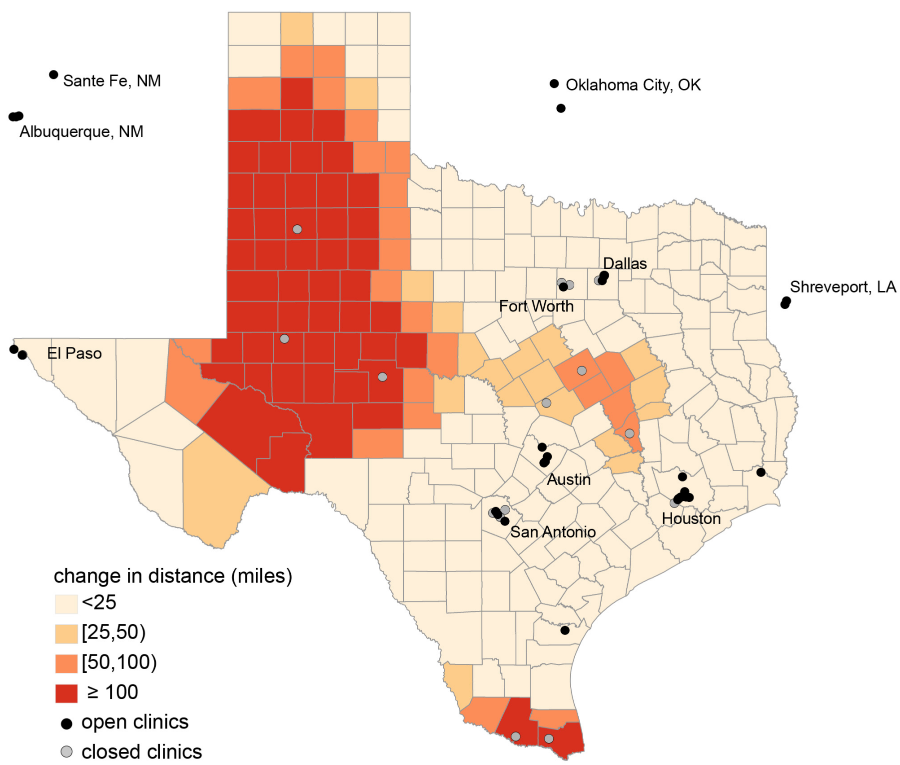
Figure 1
Abortion Clinics and Residents' Average Distance to Abortion Clinics, Texas 2009-2015



Notes: Distances are population-weighted average travel distances from county population centroids to the geographic coordinates of the nearest open abortion facility. Facility operations are measured quarterly, and a facility is considered "open" if it provided surgical or medical abortions for at least 2 months in a given quarter. Sources: The clinic operations data were compiled by the authors, annual county-level population estimates were obtained from SEER (2016), and geographic coordinates of county population centroids were obtained from the United States Census Bureau (2016).

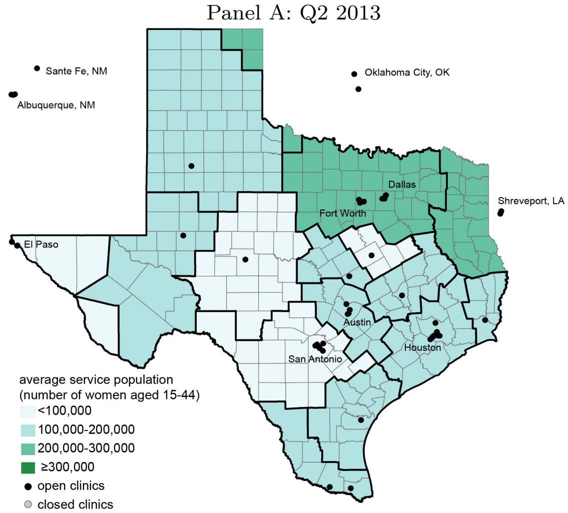
Figure 2
Change in distance to the nearest abortion clinic, Q2 2013 to Q4 2013



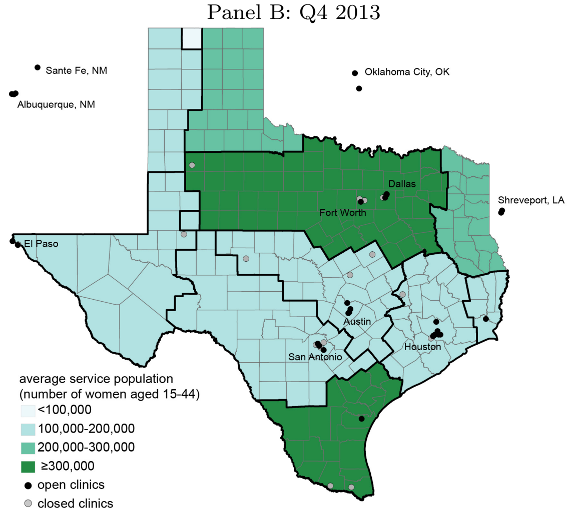
Notes: County-level change in the average distances to the nearest open abortion facility measured in Quarter 2 2013 and Quarter 4 2013. Distances are the estimated travel distances from county population centroids to the geographic coordinates of the nearest open abortion facility. A facility is considered "open" if it provided surgical or medical abortions for at least 2 months in a given quarter. Sources: The clinic operations data were compiled by the authors, annual county-level population estimates were obtained from SEER (2016), and geographic coordinates of county population centroids were obtained from the United States Census Bureau (2016).

Figure 3
Service Regions and Average Service Populations, Q2 2013 and Q4 2013

Panel A: Q2 2013



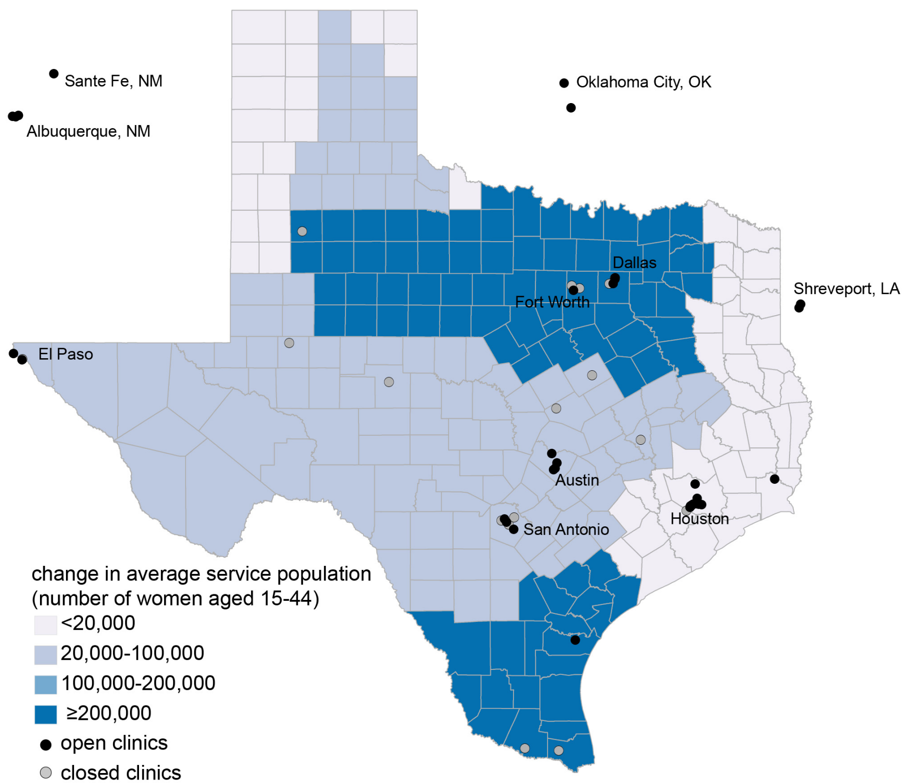
Panel B: Q4 2013



Notes: Service regions are defined annually by spatial proximity to the nearest city with an abortion clinic. These are delineated by heavy boundary lines. The Average Service Population is the total population of women aged 15 to 44 divided by the number of clinics in each service region.

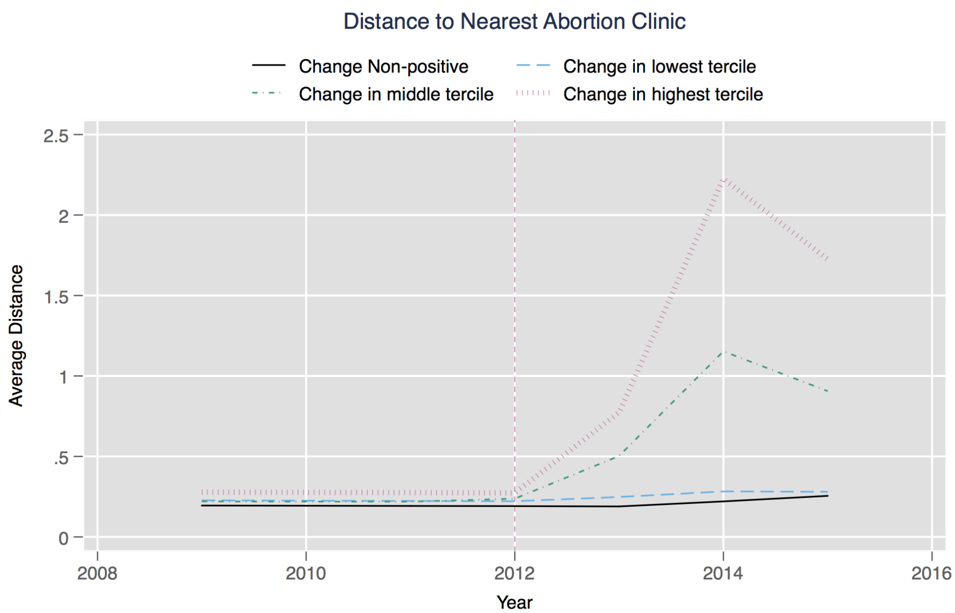
Figure 4

Change in *Average Service Population*, Q2 2013 to Q4 2013



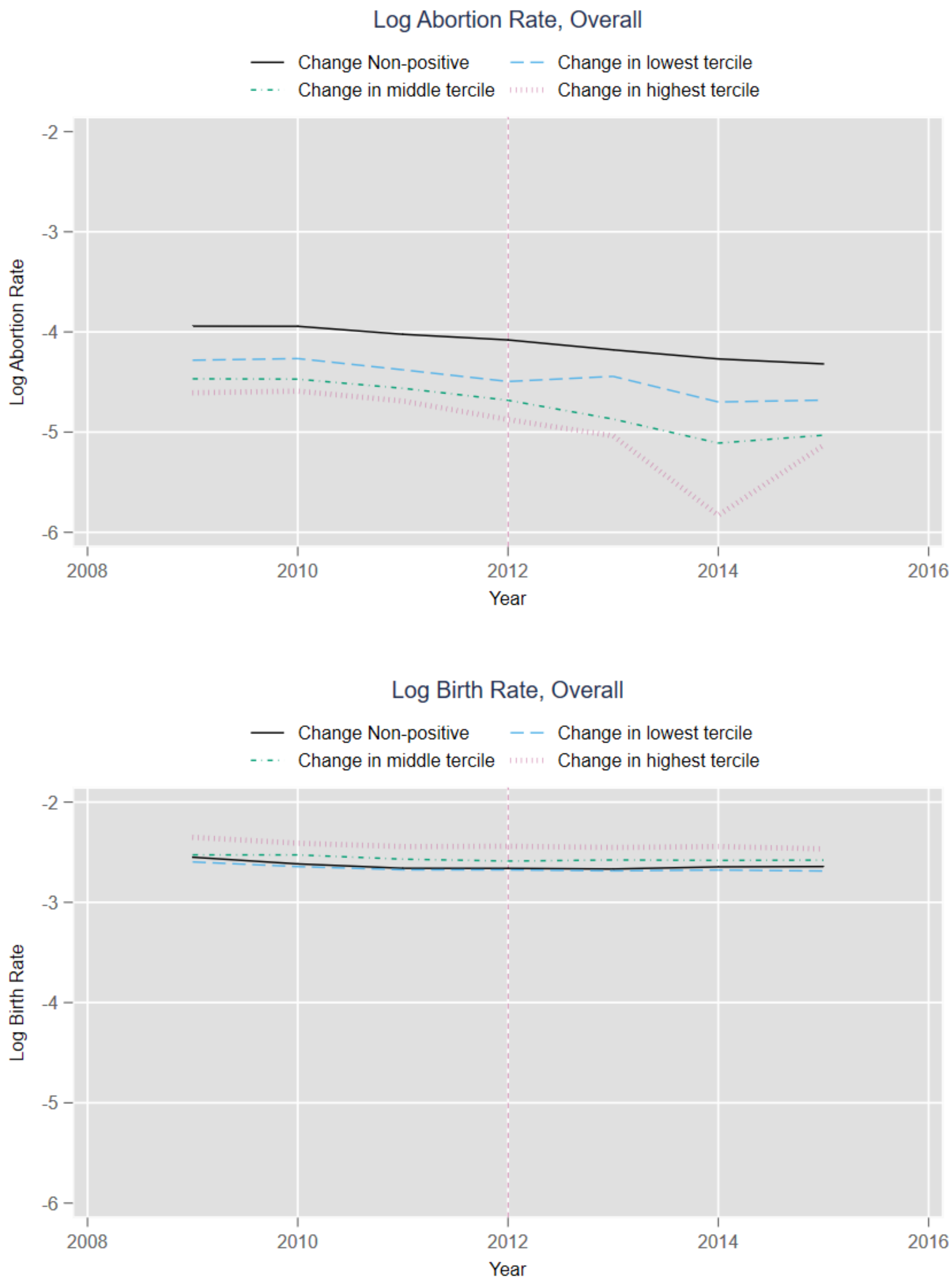
Notes: County-level change in the average service population in Quarter 2 2013 and Quarter 4 2013. The average service population associated with a county in a given year is based on the population (women aged 15-44) and the number of clinics in its abortion service region in that year. Service regions are defined annually by spatial proximity to the nearest city with an abortion clinic. Sources: The clinic operations data were compiled by the authors, annual county-level population estimates were obtained from SEER (2016), and geographic coordinates of county population centroids were obtained from the United States Census Bureau (2016).

Figure 5
Trends in distance across treatment intensity groups,
where treatment intensity is the change in distance to nearest clinic Q2 2013 to Q4 2013



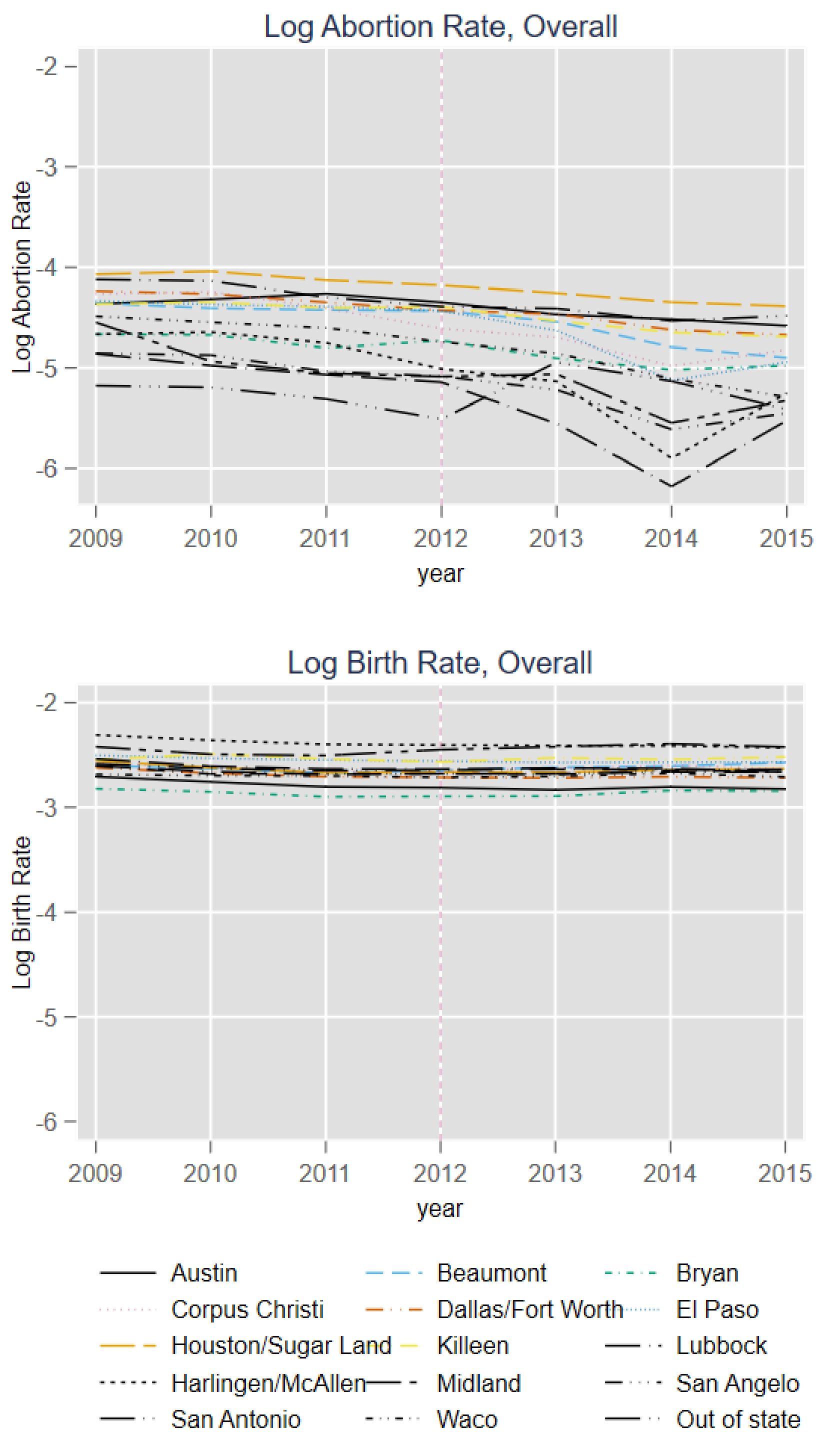
Notes: The vertical line highlights the final year of data before HB2 was enacted.

Figure 6
Trends in abortion and birth rates across treatment intensity groups, where treatment intensity is the change in distance to nearest clinic Q2 2013 to Q4 2013



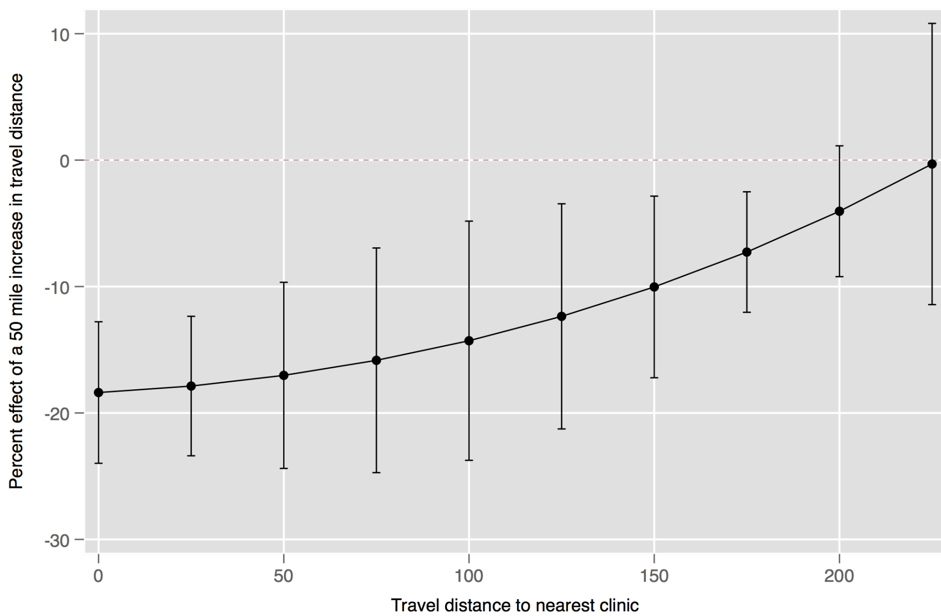
Notes: The vertical line highlights the final year of data before HB2 was enacted.

Figure 7
Trends in abortion and birth rates across service regions



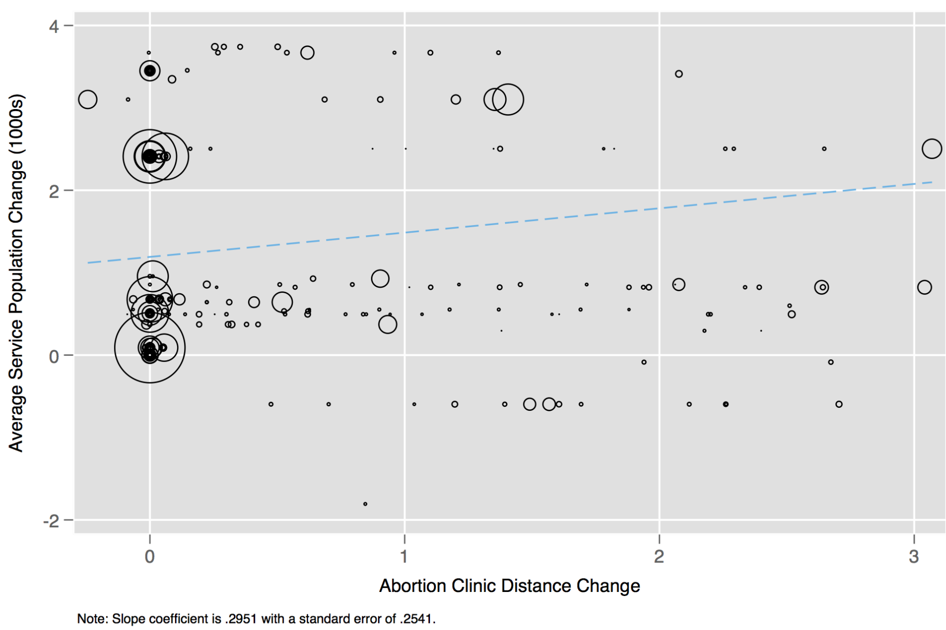
Notes: Counties are grouped into service regions using the Quarter 2 2013 service region map (See Panel A of Figure 3). The vertical line highlights the final year of data before HB2 was enacted.

Figure 8
Estimated percent effect of a 50 mile increase in distance on abortion rates
Fixed effects Poisson model with cubic specification of distance



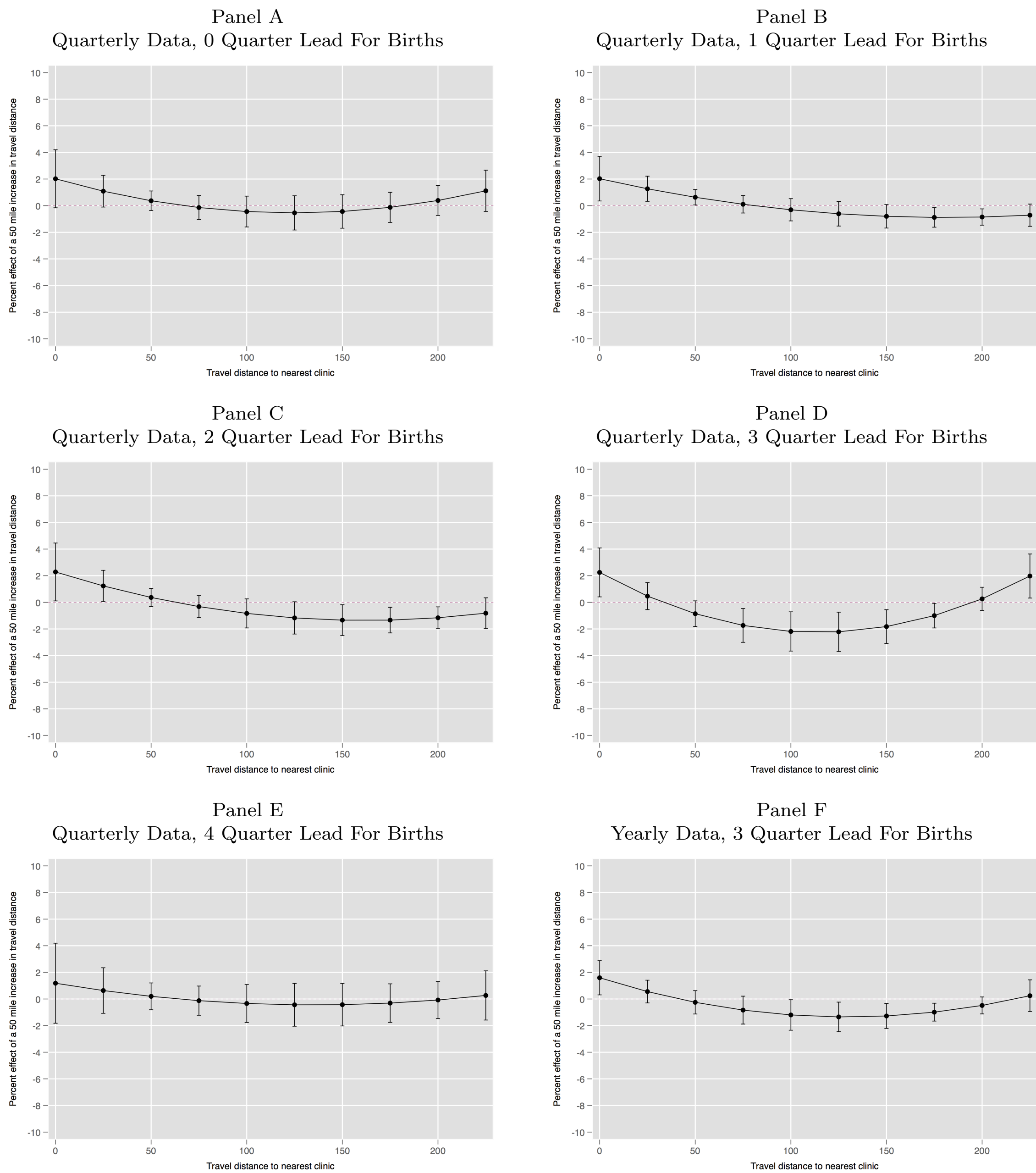
Notes: Estimated average percent effects and 95 percent confidence intervals are plotted over distance. Estimates are based on a Poisson model with a cubic specification of travel distance to the nearest abortion clinic as well as county and year fixed effects and demographic, unemployment, and family planning access controls.

Figure 9
Independent Variation in Average Service Population Measure of Access to Abortion



Notes: Population-weighted linear regression of the change in average service population on the change in distance to the nearest abortion provider. Changes are calculated between Q2 2013 to Q4 2013. See previous figures for additional definitions and sources.

Figure 10
Estimated percent effect of a 50 mile increase in distance on birth rates
Fixed effects Poisson model with cubic specification of distance



Notes: Estimated average percent effects and 95 percent confidence intervals are plotted over distance. Estimates are based on a Poisson model with a cubic specification of travel distance to the nearest abortion clinic as well as county and year fixed effects and demographic, unemployment, family planning access, and average service population controls. Estimates in Panels A through E are based on a Poisson model evaluating expected birth rates among women aged 15 to 44 as function of a cubic in travel distance, using county-quarter-level data for all Texas counties from 2009–2015. The estimates in Panel F are based on a similar model applied to county-year level data to evaluate birth rates as a function of conditions in the year of the pregnancy, assuming a gestational period of nine months, from 2009–2014. All models control for county fixed effects, year fixed effects, demographics, the unemployment rate, family planning access, and the average service population.

Table 1
Summary Statistics

Variable	2009 to 2015 mean	2009 to 2015 s.d.	2012 mean	2012 s.d.	2014 mean	2014 s.d.
Abortion rate (per 1,000 women)						
Total	11.68	5.05	11.78	4.98	9.46	4.32
Age 15 to 19	7.21	3.49	6.58	2.81	5.72	2.64
Age 20 to 29	20.22	8.64	20.35	8.34	16.36	7.44
Age 30 to 39	9.33	4.11	9.70	4.29	7.70	3.57
White	8.71	3.62	8.84	3.66	7.09	2.78
Black	22.68	10.36	22.65	11.86	19.32	6.50
Hispanic	10.71	4.65	10.78	4.29	8.28	4.29
Other	14.46	8.03	14.94	7.30	11.56	5.43
Measures of abortion access						
Distance (100s of miles)	0.29	0.49	0.21	0.34	0.46	0.70
I(distance$<$50 miles)	0.82	0.38	0.87	0.33	0.71	0.45
I(50$<$ Distance $\leq$ 100)	0.10	0.30	0.08	0.27	0.14	0.35
I(100$<$ Distance $\leq$ 150)	0.04	0.20	0.03	0.17	0.06	0.25
I(150$<$ Distance $\leq$ 200)	0.02	0.14	0.02	0.12	0.03	0.17
I(200 $<$ Distance)	0.02	0.13	$<$0.01	0.04	0.05	0.22
Average Service Population (100,000s)	1.89	0.94	1.45	0.48	2.53	0.72
Race						
White	40.04	19.02	40.05	19.04	39.20	18.65
Black	13.05	8.39	13.02	8.38	13.19	8.37
Hispanic	41.35	21.44	41.40	21.46	41.73	21.17
Other	5.56	3.93	5.53	3.89	5.88	4.14
Age distribution						
15 to 19	16.72	2.01	16.60	1.96	16.41	1.94
20 to 29	34.03	3.90	34.08	4.03	34.20	3.72
30 to 39	33.10	2.73	32.97	2.71	33.15	2.61
40 to 44	16.15	1.90	16.34	1.94	16.25	1.88
Economic conditions						
Unemployment rate	6.59	1.96	6.77	1.41	5.17	1.22

Notes: Population-weighted summary statistics calculated for Texas counties (n=254) for the pooled sample period (2009-2015) and individually for 2012 (the year prior to HB-2) and 2014 (the year after HB-2). Sources: Authors' compilation of clinic operations, annual county-level population estimates from SEER (2016), abortions by county of residence from the Texas DSHS (2017), geographic coordinates of county population centroids from the United States Census Bureau (2016), and unemployment rates from the BLS (2016).

Table 2
Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.214***	-0.256***	-0.261***	-0.261***
	(0.051)	(0.054)	(0.053)	(0.054)
Panel B: Dichotomous Measures				
I(50< Distance $\leq$ 100)	-0.140***	-0.207***	-0.206***	-0.206***
	(0.040)	(0.034)	(0.035)	(0.035)
I(100 < Distance $\leq$ 150)	-0.348***	-0.359***	-0.360***	-0.359***
	(0.132)	(0.119)	(0.117)	(0.118)
I(150 < Distance $\leq$ 200)	-0.583***	-0.579***	-0.584***	-0.584***
	(0.113)	(0.085)	(0.082)	(0.082)
I(200 < Distance)	-0.465***	-0.553***	-0.563***	-0.563***
	(0.083)	(0.092)	(0.091)	(0.091)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Estimates are based on a Poisson model evaluating expected abortion rates among women aged 15 to 44 using county-level data for all Texas counties from 2009–2015. Demographic control variables include the fraction of the 15-44 female population in each each five year grouping and the fraction of each of these age groups that is non-Hispanic white, non-Hispanic black, or Hispanic (versus other race/ethnicity). Standard errors (in parentheses) allow errors to be correlated within counties over time.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table 3
Estimated Effects of Distance to an Abortion Clinic and Average Service Population on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.199***	-0.241***	-0.245***	-0.245***
	(0.042)	(0.047)	(0.046)	(0.047)
Average Service Population (100,000s)	-0.075**	-0.076***	-0.075***	-0.075***
	(0.037)	(0.023)	(0.022)	(0.022)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.108***	-0.167***	-0.166***	-0.165***
	(0.037)	(0.035)	(0.035)	(0.035)
I(100 < Distance ≤ 150)	-0.284**	-0.293**	-0.294**	-0.293**
	(0.124)	(0.118)	(0.117)	(0.118)
I(150 < Distance ≤ 200)	-0.516***	-0.506***	-0.511***	-0.509***
	(0.105)	(0.082)	(0.079)	(0.079)
I(200 < Distance)	-0.479***	-0.559***	-0.569***	-0.567***
	(0.087)	(0.094)	(0.092)	(0.092)
Average Service Population (100,000s)	-0.069*	-0.068***	-0.068***	-0.069***
	(0.038)	(0.024)	(0.023)	(0.023)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: See Table 2. Additionally note that the average service population associated with a county in a given year is based on the population (women aged 15-44) and the number of clinics in its abortion service region in that year. Service regions are defined annually by spatial proximity to the nearest city with an abortion clinic.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table 4
Sensitivity Analysis to Years and Regions Included

		Counties excluded		Years included		
	Full Sample	Panhandle	Out-of-State Travel	2012–2014	2012, 2015	2013–2015
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Continuous Measure						
Distance (100s miles)	-0.245***	-0.255***	-0.222***	-0.318***	-0.151***	-0.220***
	(0.047)	(0.057)	(0.045)	(0.053)	(0.027)	(0.077)
Average Service Population (100,000s)	-0.075***	-0.079***	-0.072***	-0.022	-0.058**	-0.044**
	(0.022)	(0.022)	(0.023)	(0.054)	(0.026)	(0.020)
Panel B: Dichotomous Measures						
I(50< Distance ≤ 100)	-0.165***	-0.163***	-0.165***	-0.136***	-0.097*	-0.118**
	(0.035)	(0.033)	(0.035)	(0.046)	(0.051)	(0.057)
I(100 < Distance ≤ 150)	-0.293**	-0.350***	-0.337***	-0.389***	-0.118*	-0.340**
	(0.118)	(0.127)	(0.131)	(0.143)	(0.070)	(0.169)
I(150 < Distance ≤ 200)	-0.509***	-0.502***	-0.562***	-0.376***	-0.467***	-0.377***
	(0.079)	(0.090)	(0.069)	(0.085)	(0.170)	(0.108)
I(200 < Distance)	-0.567***	-0.419***	-0.437***	-0.755***	-0.411***	-0.446***
	(0.092)	(0.077)	(0.059)	(0.137)	(0.068)	(0.103)
Average Service Population (100,000s)	-0.069***	-0.071***	-0.058**	-0.024	-0.064**	-0.037*
	(0.023)	(0.023)	(0.024)	(0.054)	(0.028)	(0.022)

Notes: See notes to Table 3. All columns control for county fixed effects, year fixed effects, demographics, the unemployment rate, an indicator for the presence of a family planning clinic in the county, and this indicator's interaction with post-2012. In Column 3, the excluded counties are those for which an out-of-state abortion clinic is the nearest abortion destination at any point in the sample period.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table 5

Estimated Effects on Abortion by Ethnicity and Distance From Mexican Border

	Non Hispanics (1)	Hispanics (2)	Non Hispanics (3)	Hispanics (4))
Panel A: Continuous Measure				
Distance (100s miles)	-0.117***	-0.337***	-0.117***	-0.253***
	(0.020)	(0.070)	(0.020)	(0.038)
Average Service Population (100,000s)	-0.083***	-0.054	-0.081***	-0.001
	(0.027)	(0.037)	(0.027)	(0.044)
Distance $\times$I(<100 miles to Mexican border)			-0.055	-0.340***
			(0.167)	(0.057)
Avg Service Pop $\times$I(<100 miles to Mexican border)			-0.054	-0.059*
			(0.116)	(0.032)
Panel B: Dichotomous Measures				
I(50< Distance $\leq$ 100)	-0.067*	-0.161***		
	(0.039)	(0.042)		
I(100 < Distance $\leq$ 150)	-0.075	-0.418***		
	(0.058)	(0.154)		
I(150 < Distance $\leq$ 200)	-0.323***	-0.550***		
	(0.086)	(0.113)		
I(200 < Distance)	-0.287***	-0.808***		
	(0.051)	(0.165)		
Average Service Population (100,000s)	-0.087***	-0.056		
	(0.029)	(0.039)		

Notes: See notes to Table 3. Distance to the Mexican border is calculated as travel distance between county population centroids and the nearest Mexican border crossings that can be used by pedestrians and/or private vehicles. All columns control for county fixed effects, year fixed effects, demographics, the unemployment rate, an indicator for the presence of a family planning clinic in the county, and this indicator's interaction with post-2012.

*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table 6
Are There Effects on Birth Rates? Are Abortion Effects Detectable?

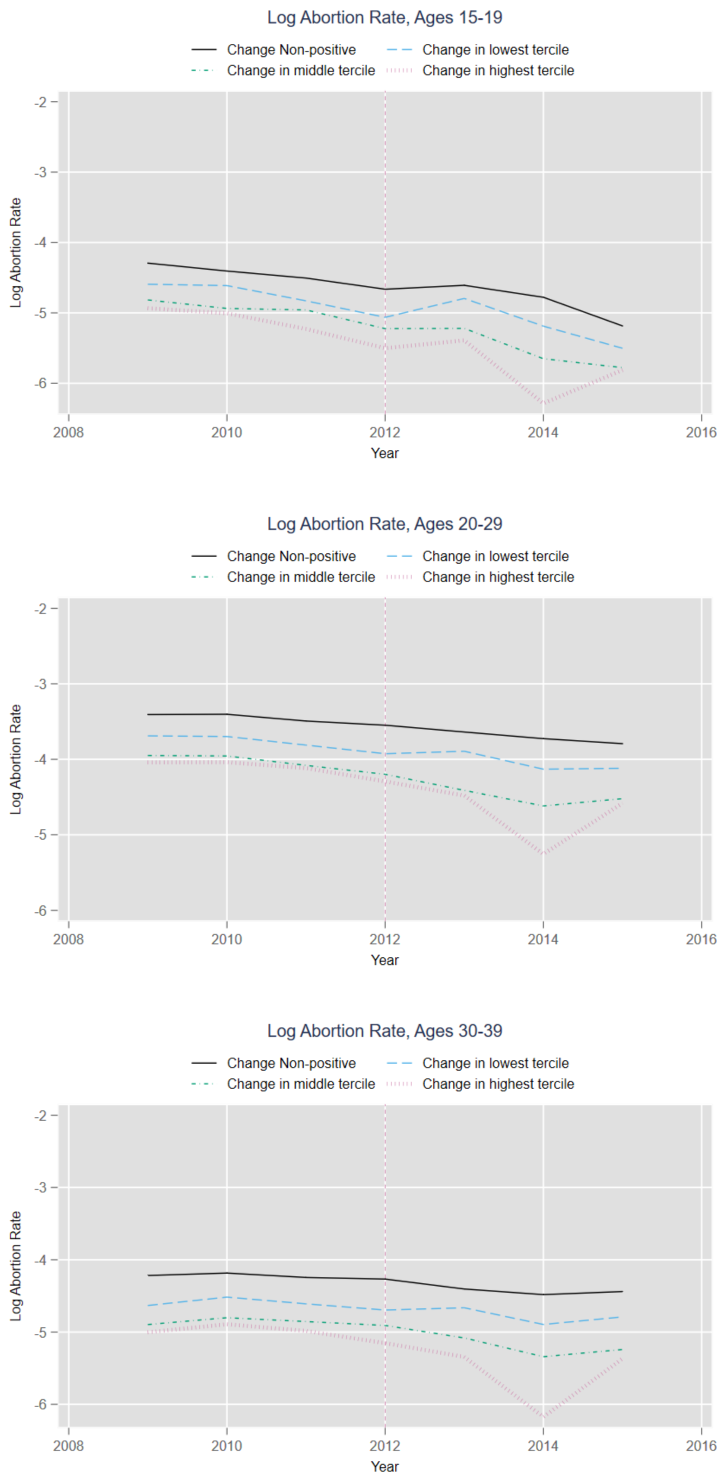
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Data:	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Annual	Simulated Annual
Quarterly Lead For Births:	0	1	2	3	4	3	3
Panel A: Continuous Measure							
Distance (100s miles)	0.004	0.001	0.001	-0.006*	-0.005	-0.001	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Average Service Population (100,000s)	-0.006**	-0.004*	0.000	0.001	-0.008***	-0.011**	-0.010**
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
Panel B: Dichotomous Measures							
I(50< Distance ≤ 100)	0.028***	0.022**	0.015*	0.016**	0.016*	0.030***	0.030***
	(0.008)	(0.009)	(0.008)	(0.007)	(0.009)	(0.009)	(0.009)
I(100 < Distance ≤ 150)	0.019***	0.010	0.007	0.007	0.009	0.024*	0.029**
	(0.006)	(0.007)	(0.007)	(0.008)	(0.008)	(0.013)	(0.013)
I(150 < Distance ≤ 200)	-0.001	-0.006	-0.003	-0.018	0.006	-0.013	-0.003
	(0.013)	(0.013)	(0.012)	(0.015)	(0.015)	(0.024)	(0.023)
I(200 < Distance)	0.007	0.002	-0.001	-0.020**	-0.014	-0.004	0.007
	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
Average Service Population (100,000s)	-0.008***	-0.006**	-0.001	-0.002	-0.010***	-0.016***	-0.015***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.005)	(0.005)

Notes: Columns 1 through 5 show estimates are based on a Poisson model evaluating expected birth rates among women aged 15 to 44 using county-quarter-level data for all Texas counties from 2009–2015. Column 6 uses county-year level data to evaluate birth rates as a function of conditions in the year of the pregnancy, assuming a gestational period of nine months, from 2009–2014. The estimate is based on a similar model but uses simulated county-year data in which we add to the number of births in each county-year the number we expect to be "missing" because of reduced access to abortion clinics since 2012 (prior to HB2), based on predictions from the abortion estimates reported in Table 3, Panel B, Column 4. All columns control for county fixed effects, year fixed effects, demographics, the unemployment rate, an indicator for the presence of a family planning clinic in the county, and this indicator's interaction with post-2012. Standard errors (in parentheses) allow errors to be correlated within counties over time.

*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

APPENDIX A: FIGURES AND TABLES

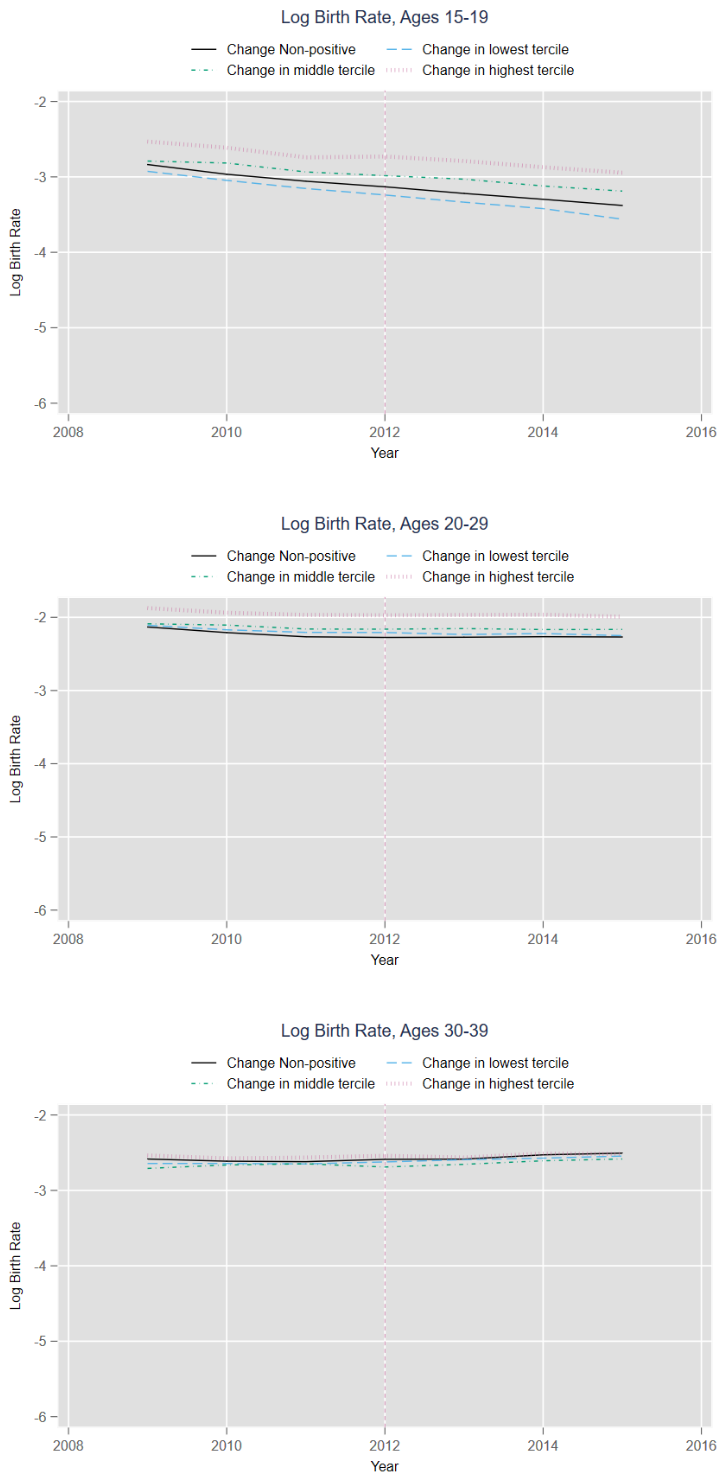
Figure A1
(Appendix) Trends in distance and abortion rates *by age* across treatment intensity groups, where treatment intensity is the change in distance to nearest clinic Q2 2013 to Q4 2013



Notes: See Figure 5.

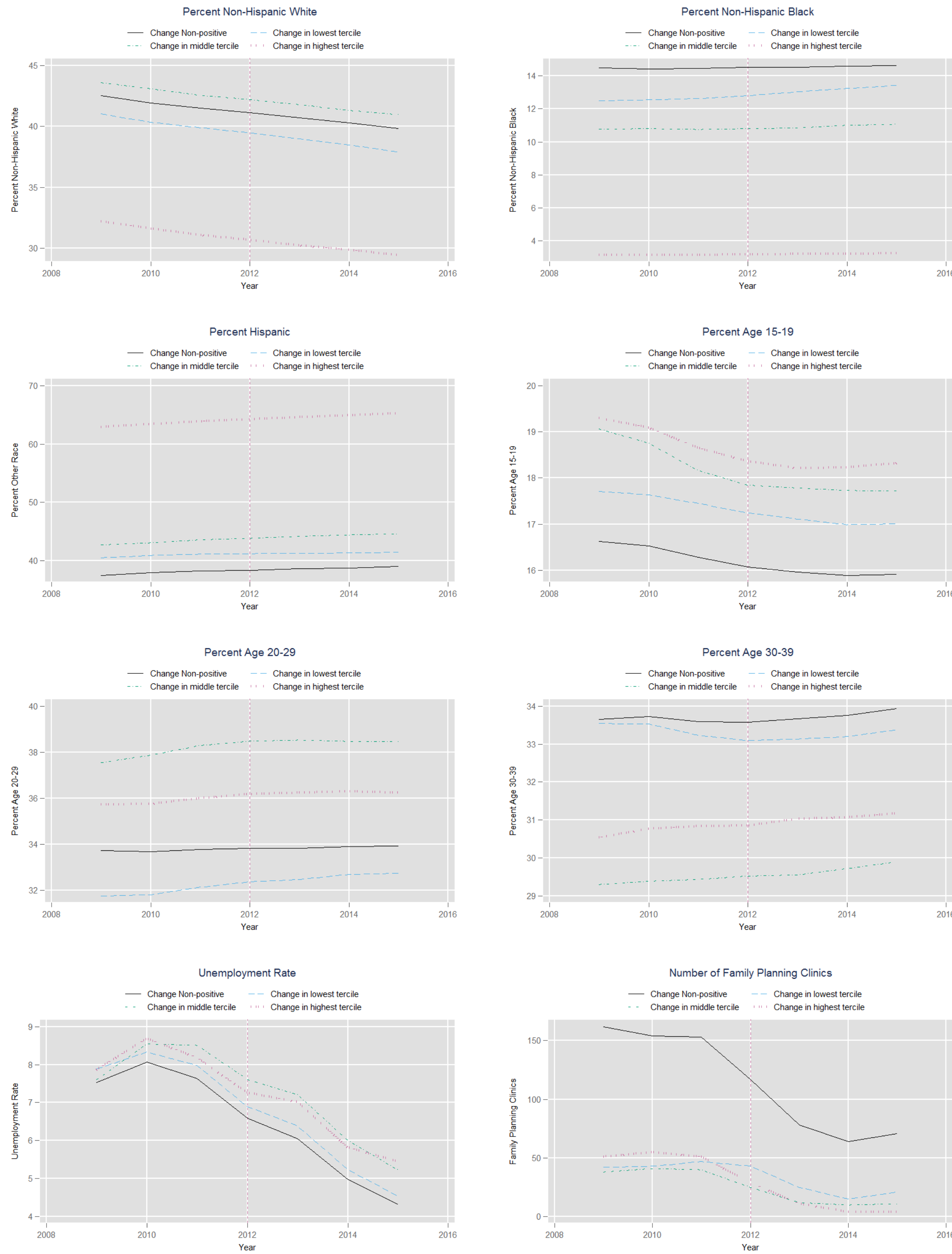
Figure A2

(Appendix) Trends in distance and birth rates *by age* across treatment intensity groups, where treatment intensity is the change in distance to nearest clinic Q2 2013 to Q4 2013



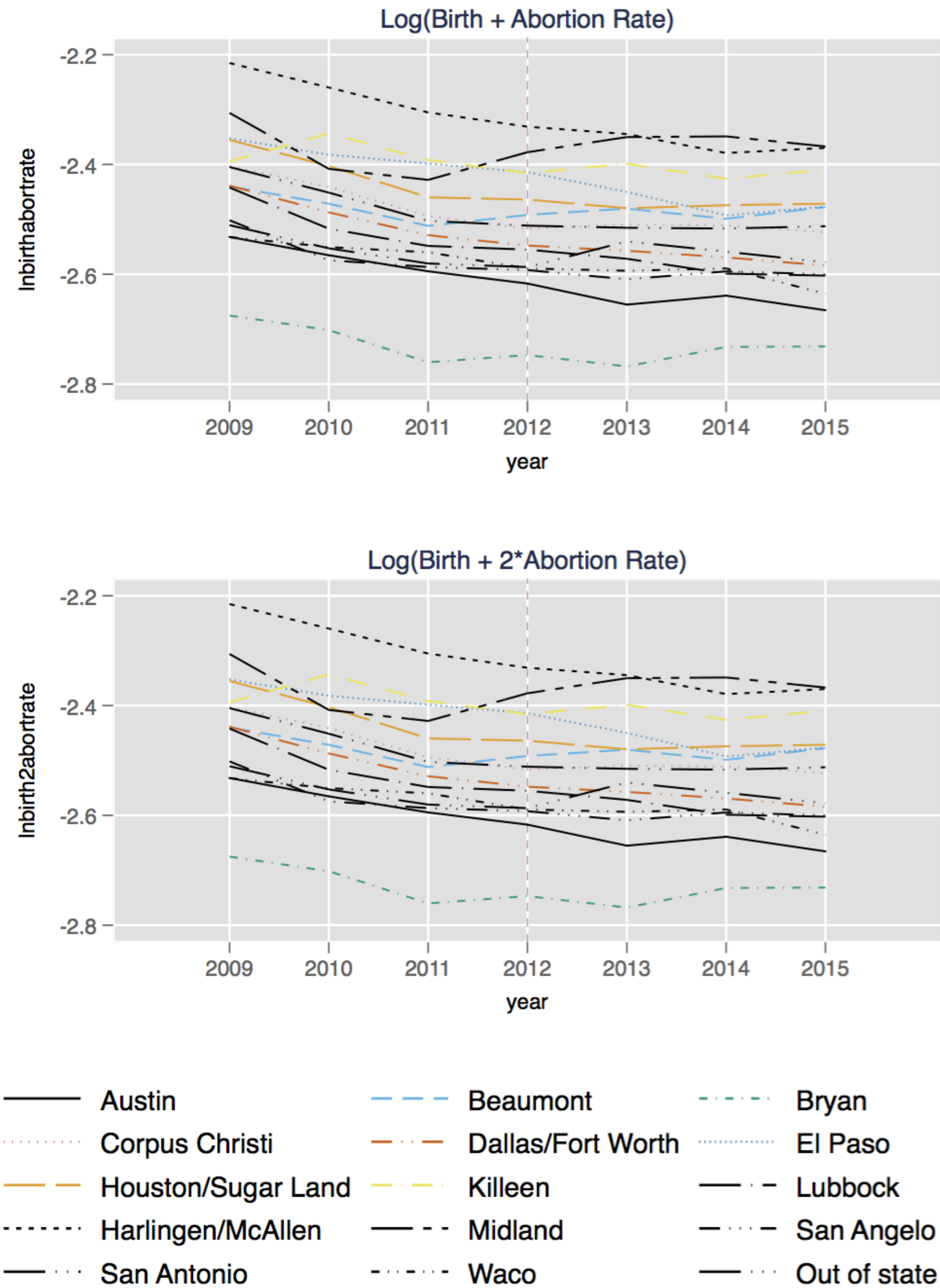
Notes: See Figure 5.

Figure A3
(Appendix) Trends in covariates across treatment intensity groups,
where treatment intensity is the change in distance to nearest clinic Q2 2013 to Q4 2013



Notes: See Figure 5.

Figure A4
Trends in birth-plus-abortion rates across service regions



Notes: Counties are grouped into service regions using the Quarter 2 2013 service region map (See Panel A of Figure 3). The vertical line highlights the final year of data before HB2 was enacted.

Table A1
(Appendix) Sensitivity of Table 2 Results to alternate Family Planning Controls
Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.261***	-0.253***	-0.258***	-0.255***
	(0.054)	(0.055)	(0.053)	(0.053)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.206***	-0.198***	-0.210***	-0.207***
	(0.035)	(0.034)	(0.035)	(0.035)
I(100 < Distance ≤ 150)	-0.359***	-0.356***	-0.358***	-0.353***
	(0.118)	(0.119)	(0.115)	(0.118)
I(150 < Distance ≤ 200)	-0.584***	-0.577***	-0.586***	-0.567***
	(0.082)	(0.084)	(0.082)	(0.084)
I(200 < Distance)	-0.563***	-0.533***	-0.554***	-0.546***
	(0.091)	(0.094)	(0.091)	(0.089)
1(family planning clinic in county in 2010) × 1(post-2011)	yes	no	no	no
1(family planning clinic in county)	no	yes	no	no
# of family planning clinics	no	no	yes	no
# of family planning clinics per capita	no	no	no	yes

Notes: Re-estimation of Table 2, Column 3 using alternate controls for access to publicly-funded family-planning clinics. All columns control for county fixed effects, year fixed effects, demographics, and the unemployment rate. See notes to Table 2.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A2
(Appendix) Sensitivity of Table 2 Results to using Geodesic Distance
Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.255***	-0.304***	-0.309***	-0.309***
	(0.061)	(0.065)	(0.064)	(0.065)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.151***	-0.225***	-0.223***	-0.222***
	(0.033)	(0.032)	(0.033)	(0.033)
I(100 < Distance ≤ 150)	-0.462***	-0.448***	-0.451***	-0.450***
	(0.131)	(0.118)	(0.116)	(0.116)
I(150 < Distance ≤ 200)	-0.261***	-0.318***	-0.326***	-0.324***
	(0.095)	(0.109)	(0.106)	(0.107)
I(200 < Distance)	-0.487***	-0.581***	-0.590***	-0.589***
	(0.092)	(0.097)	(0.096)	(0.096)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Re-estimation of Table 2 using estimated geodesic distance rather than travel distance. See notes to Table 2.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A3
(Appendix) Sensitivity of Table 2 Results to using Travel Time
Estimated Effects of Travel Time to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.144***	-0.173***	-0.177***	-0.177***
	(0.033)	(0.035)	(0.034)	(0.035)
Panel B: Dichotomous Measures				
I(1 $<$ Time $\leq$ 2)	-0.125***	-0.200***	-0.199***	-0.199***
	(0.037)	(0.034)	(0.034)	(0.034)
I(2 $<$ Time $\leq$ 3)	-0.469***	-0.487***	-0.492***	-0.492***
	(0.122)	(0.108)	(0.105)	(0.106)
I(3 $<$ Time $\leq$ 4)	-0.291***	-0.372***	-0.385***	-0.385***
	(0.094)	(0.114)	(0.112)	(0.112)
I(4 $<$ Time)	-0.447***	-0.557***	-0.569***	-0.569***
	(0.069)	(0.084)	(0.083)	(0.084)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Re-estimation of Table 2 using estimated travel time rather than travel distance. See notes to Table 2. *, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A4
(Appendix) Sensitivity of Table 2 Results to using Inverse Hyperbolic Sine Transformation
Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.237***	-0.284***	-0.289***	-0.286***
	(0.056)	(0.059)	(0.059)	(0.059)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.157***	-0.225***	-0.225***	-0.221***
	(0.040)	(0.043)	(0.043)	(0.043)
I(100 < Distance ≤ 150)	-0.366**	-0.383***	-0.385***	-0.381***
	(0.159)	(0.144)	(0.143)	(0.144)
I(150 < Distance ≤ 200)	-0.546***	-0.546***	-0.551***	-0.545***
	(0.121)	(0.088)	(0.086)	(0.086)
I(200 < Distance)	-0.575***	-0.676***	-0.685***	-0.678***
	(0.115)	(0.120)	(0.119)	(0.119)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Re-estimation of Table 2 applying weighted least squares to a measure of log abortion rates constructed using a hyperbolic sine transformation such that the outcome is $ln(\frac{count+\sqrt{count^2+1}}{population})$. See notes to Table 2. *, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A5

(Appendix) Sensitivity of Table 2 Results to using excluding counties in Austin abortion service region in Q2 2013

Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.209***	-0.258***	-0.262***	-0.261***
	(0.050)	(0.055)	(0.054)	(0.054)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.140***	-0.209***	-0.206***	-0.205***
	(0.040)	(0.036)	(0.037)	(0.037)
I(100 < Distance ≤ 150)	-0.348***	-0.356***	-0.356***	-0.354***
	(0.132)	(0.118)	(0.116)	(0.116)
I(150 < Distance ≤ 200)	-0.583***	-0.566***	-0.572***	-0.569***
	(0.113)	(0.086)	(0.082)	(0.082)
I(200 < Distance)	-0.465***	-0.560***	-0.571***	-0.568***
	(0.083)	(0.093)	(0.091)	(0.092)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Re-estimation of Table 2 using estimated travel time rather than travel distance, excluding counties in the Austin "abortion service region" prior to HB2. See notes to Table 2.
*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A6

(Appendix) Sensitivity of Table 2 Results to using excluding counties in an out of state abortion service regions in Q2 2013

Estimated Effects of Distance to an Abortion Clinic on Abortion Rates

	(1)	(2)	(3)	(4)
Panel A: Continuous Measure				
Distance (100s miles)	-0.209***	-0.242***	-0.246***	-0.249***
	(0.050)	(0.052)	(0.052)	(0.052)
Panel B: Dichotomous Measures				
I(50< Distance ≤ 100)	-0.140***	-0.185***	-0.184***	-0.186***
	(0.040)	(0.035)	(0.035)	(0.035)
I(100 < Distance ≤ 150)	-0.348***	-0.333***	-0.334***	-0.336***
	(0.132)	(0.122)	(0.121)	(0.121)
I(150 < Distance ≤ 200)	-0.583***	-0.566***	-0.571***	-0.574***
	(0.113)	(0.083)	(0.080)	(0.079)
I(200 < Distance)	-0.465***	-0.528***	-0.538***	-0.542***
	(0.083)	(0.091)	(0.088)	(0.089)
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Demographic Controls	no	yes	yes	yes
Unemployment Rate	no	no	yes	yes
Family Planning Access Controls	no	no	no	yes

Notes: Re-estimation of Table 2 using estimated travel time rather than travel distance, excluding counties in an out-of-state "abortion service region" prior to HB2. See notes to Table 2.

*, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

APPENDIX B: Abortion clinic operations in Texas and neighboring states, January 2009 through March 2017

Clinic	City	State	Dates providing abortion services
Planned Parenthood Choice	Abilene	TX	<2009-11/6/2012
Austin Womens Health Center (Brookside)	Austin	TX	<2009-present
International Health Care Solution	Austin	TX	<2009-8/31/2014
Planned Parenthood South Austin Clinic	Austin	TX	<2009-present
Whole Woman's Health Austin	Austin	TX	<2009-7/14/2014; 4/2017-present
Whole Woman's Health Beaumont	Beaumont	TX	<2009-3/11/2014
Planned Parenthood Center for Choice (Bryan)	Bryan	TX	<2009-8/31/2013
Coastal Birth Control Center	Corpus Christi	TX	<2009-6/10/2014
Fairmount Center	Dallas	TX	<2009-10/2009
North Park Medical Group/AAA Healthcare Systems	Dallas	TX	<2009-11/1/2013; 2/2017-present
Planned Parenthood Dallas/South Dallas Surgical Health Services Ctr	Dallas	TX	7/1/2014-present
Planned Parenthood of Greater Texas Surgical Health Services	Dallas	TX	<2009-6/2014
Routh St. Women's Clinic	Dallas	TX	<2009-6/15/2015
Southwestern Women's Surgery Center	Dallas	TX	9/2009-present
The Women's Center (Abortion Advantage)	Dallas	TX	<2009-11/1/2013; 2/2014-12/2014
Hilltop Women's Reproductive Center (Abortion Advisers Agency)	El Paso	TX	<2009-present
Reproductive Services	El Paso	TX	<2009-11/1/2013; 1/2014-4/2014; 9/24/2015-present
Planned Parenthood of Greater Texas Star Clinic/Southwest Fort Worth Health Center	Fort Worth	TX	5/2013-11/1/2013; 1/13/2014-present

Continued on next page

Clinic	City	State	Dates providing abortion services
West Side Clinic	Fort Worth	TX	<2009-11/1/2013
Whole Woman's Health Ft. Worth	Fort Worth	TX	<2009-11/1/2013; 12/6/2013-present
Planned Parenthood of Greater Texas Henderson Clinic	Forth Worth	TX	<2009-4/2013
Harlingen Reproductive	Harlingen	TX	<2009-11/1/2013
A Affordable Women's Medical Center	Houston	TX	<2009-2/7/2014
AAA Concerned Women's Center (Abortion Hotline)	Houston	TX	<2009-10/1/2014
Aalto Women's Center	Houston	TX	<2009-3/13/2014
Aaron women's center/Women's Pavilion	Houston	TX	<2009-8/7/2014
Crescent City Women's Center	Houston	TX	<2009-12/30/2011
Houston Women's Clinic	Houston	TX	<2009-present
Planned Parenthood Center for Choice (Gulf Freeway)	Houston	TX	11/15/2010-present
Planned Parenthood of Southest Texas	Houston	TX	<2009-1/14/2010
Suburban Women's Clinic (Medical Center) of NW Houston	Houston	TX	<2009-present
Suburban Women's Clinic of SW Houston	Houston	TX	<2009-present
Texas Ambulatory Surgery Center	Houston	TX	<2009-present
Women's Center of Houston	Houston	TX	10/4/2013-present
Killeen Women's Health Center	Killeen	TX	<2009-11/1/2013
Planned Parenthood Women's Health Center	Lubbock	TX	<2009-11/1/2013
Whole Woman's Health- McAllen	McAllen	TX	<2009-11/1/2013; 9/2014-present
Planned Parenthood Choice	Midland	TX	<2009-8/31/2013

Continued on next page

Clinic	City	State	Dates providing abortion services
Planned Parenthood Choice	San Angelo	TX	<2009-8/31/2013
A Woman's Choice Quality Health Center	San Antonio	TX	<2009-10/5/2011
Alamo Women's Clinic/ Alamo Women's Reproductive Services Clinic	San Antonio	TX	6/2015-present
Alamo Women's Reproductive Services Clinic	San Antonio	TX	<2009-5/2015
All Women's Medical Center	San Antonio	TX	<2009-8/6/2013
New Women's Clinic	San Antonio	TX	<2009-11/1/13
Planned Parenthood Babcock Sexual Healthcare	San Antonio	TX	<2009-5/2015
Planned Parenthood Bandera Clinic	San Antonio	TX	<2009-11/1/2013
Planned Parenthood Medical Center	San Antonio	TX	6/2015-present
Planned Parenthood Northeast Clinic	San Antonio	TX	<2009-11/1/2013
Reproductive Services	San Antonio	TX	<2009-7/7/2012
Whole Woman's Health San Antonio	San Antonio	TX	8/2/2010-present
Planned Parenthood Center for Choice	Stafford	TX	<2009-10/1/2013
KNS Medical PLLC INC	Sugar Land	TX	<2009-3/27/2013
Planned Parenthood of Central Texas	Waco	TX	1/1/2012-8/2013; 5/2017-present
Planned Parenthood Waco	Waco	TX	<2009-12/31/2011
Alamosa Planned Parenthood	Alamosa	CO	2009-present
Bossier City Medical Suite	Bossier City	LA	<2009-present
Hope Medical Group for Women	Shreveport	LA	<2009-present
Planned Parenthood Albuquerque Surgical Center	Albuquerque	NM	<2009-present

Continued on next page

Clinic	City	State	Dates providing abortion services
Southwestern Women's Options	Albuquerque	NM	1/2009-present
University of New Mexico Center for Reproductive Health	Albuquerque	NM	<2009-3/25/2014
University of New Mexico Center for Reproductive Health	Albuquerque	NM	4/1/2014-present
Whole Woman's Health	Las Cruces	NM	9/15/2014-present
Planned Parenthood Santa Fe Health Center	Santa Fe	NM	<2009-present
Hilltop Women's Reproductive Clinic	Santa Teresa	NM	<2009-present
Abortion Surgery Center	Norman	OK	<2009-present
Outpatient Services for Women	Oklahoma City	OK	<2009-12/2014
Trust Women South Wind Women's Center	Oklahoma City	OK	7/2016-present

Author-constructed panel of abortion clinic operations in Texas and neighboring states. Clinics are identified based on licensure data from the Texas DSHS. To identify dates of operation, we use licensure dates supplemented with accounts of clinic operations in the judicial record, news reports and on websites including Fund Texas Choice. A clinic in a neighboring state is listed only if it is the closest destination for at least one Texas county in one quarter in our dataset. "Present" is as of May 4, 2017.