Love in the Time of Zika*

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Abstract

We study how perceived costs of having children shape fertility, marriages, and women's labor supply. Brazil's 2015 disclosure of Zika's fetal risk raised perceived costs of pregnancy, though adults were unaffected. Linking administrative birth and marriage records to labor-force surveys, we compare areas using three exposure measures: publicized cases, mosquito suitability, and Google searches. Births fell 6.2% in exposed areas, without rebounding. Women's employment rose 1.6pp and earnings 5.5%. Divorces rose 22.3% and marriages 5.8%. Together, these persistent shifts in births, work, and relationships suggest initial adjustments to childbearing costs sustain lower fertility, with implications for persistent fertility declines worldwide.

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1 Introduction

Individual childbearing decisions have lasting consequences for women. Motherhood is associated with persistent earnings penalties, occupational shifts, and wider gender pay gaps (Adda et al., 2017; Kleven et al., 2019; Cortés and Pan, 2023; Machado et al., 2024). Fertility, childrearing, and household obligations shape marriage, marital stability, and family formation (Vuri, 2003; Dahl and Moretti, 2008; Jena et al., 2011; Jayachandran and Voena, 2026; Gobbi et al., 2026; Doepke et al., 2023; Bau, 2021; Bau et al., 2026). Yet we know less about what happens when fertility declines across a population, reshaping labor markets and household structure in ways that may help sustain the decline. Across the world, fertility has fallen sharply and often stayed low, while female labor-force participation has risen. Brazil is emblematic of this transition: total fertility fell from over six births per woman in the 1960s to well below replacement level today, while women's labor-force participation rose from about 20 percent in the 1970s to over 50 percent today (World Bank, 2025). Do fewer births relax time and mobility constraints enough to raise women's employment and earnings? Do they alter marriage, divorce, and household structure? And can these adjustments make the initial decline in births persist?

We leverage the geography and timing of Brazil's Zika epidemic to identify the consequences of a sudden increase in the perceived cost of having children. Zika spread rapidly through Brazil in 2015-16. Infection during pregnancy posed severe risks to fetal development, but almost no health risk to adults (Brasil et al., 2016; Mlakar et al., 2016; Haby et al., 2018; Codeço Coelho et al., 2017). Exposure to the virus and public concern about the fetal health risks varied sharply across locations and time. The immediate response was to delay or avoid pregnancy. Yet the shock may also have prompted families to reconsider life decisions. Couples could reassess whether to marry or remain together, and whether their preferences over children and household responsibilities are compatible (Jayachandran and Voena, 2026; Voena, 2015; Ashraf et al., 2026). Women could revise decisions about employment and career investments. These responses may then feed back into subsequent fertility: Stronger labor market attachment can raise the opportunity cost of a later birth, while marriage, divorce, and re-partnering alter both childbearing preferences and family arrangements within which children are born. A temporary increase in the cost of pregnancy may therefore place women and families on new trajectories that sustain lower fertility even after the health risk has faded.

These interdependent choices highlight how fertility, work, and family formation are jointly determined. Women with stronger labor-market preferences may delay or forgo childbearing, marry later, or select different partners. Women with stronger preferences for children may marry earlier or reduce their labor supply (Rosenzweig and Wolpin, 1980; Doepke and Kindermann, 2019; Goldin, 2026). Moreover, most existing evidence concerns an individual family having an additional child, often in high-income contexts. To understand the consequences and *persistence* of *aggregate* fertility *declines*, we need variation across markets rather than individual families, reductions rather than new births, and enough time to observe whether fertility remains low as work and family-formation adjust. The sudden but geographically uneven spread of Zika provides precisely this type of variation, allowing us to trace how higher child costs propagate through aggregate fertility declines, local labor and marriage markets, and subsequent childbearing.

Perceived fetal risks led women to delay or avoid pregnancies, sharply lowering fertility in exposed regions (Marteleto et al., 2017, 2020; Marteleto and Dondero, 2021; Lautharte and Rasul, 2026; Rangel et al., 2020; Ryu, 2020). We combine administrative birth records with three measures of Zika exposure: publicized local case prevalence, environmental suitability for the *Aedes aegypti* mosquito, and Google search intensity for "Zika." We contribute to the childbearing literature in three ways. First, we move from individuals' fertility to aggregate fertility shocks operating across local labor and marriage markets. Second, rather than additional birth events we study fertility reductions, which is the margin relevant to worldwide birth-rate declines. Third, we trace the dynamics of adjustment after the initial shock, examining whether missing births are postponed or persist as women's employment, earnings, and relationship choices change.

We find three main results. First, fertility fell sharply in high-exposure areas nine months after Brazil's national health emergency declaration. Across exposure measures, births fell by 6.2% in affected areas, with timing consistent with pregnancy avoidance rather than termination. But no rebound followed, resulting in 5% fewer babies born between declaration and the end of 2019. The decline was concentrated among women without children, with 21.7% fewer new mothers over the same period. These missing births were foregone, rather than postponed.

Second, women's labor-market outcomes improved in high-exposure areas. We find that women's employment rose an average of 1.5 percentage points. This increase began roughly nine months after the fertility shock, tracking the gestational window. This timing supports the interpretation that the labor-market effects are closely related to changes in fertility. Monthly earnings increased by an average of 43.6 reais, roughly 5.5% of mean pre-epidemic earnings for the group, with gains emerging gradually. Employment and earnings gains persisted, suggesting that avoided births changed women's labor-market trajectories rather than only their short-run time constraints. These patterns provide an aggregate counterpart to individual child penalties and show the effects of fertility reductions rather than birth events: when births fall across exposed labor markets, women's employment and earnings rise.

Third, family formation also changed in high-exposure areas. We find that divorces increased, on average, by 22.3% after Zika, and marriages by 5.8%. The fertility response, therefore, extended beyond births to relationship formation and dissolution. One interpretation is that reduced fertility and stronger labor-market attachment changed women's outside options and bargaining power within relationships, enabling some women to exit unsatisfactory unions or form new matches (Jayachandran and Voena, 2026).

The coexistence of persistently missing births with changes in work and relationships is consistent with a dynamic process in which choices made after the initial cost shock alter the conditions governing subsequent childbearing. Because these choices of partners, children, and careers, are not repeated static choices, and are made at critical life-cycle stages, a temporary shock can have long-lasting effects. By avoiding pregnancy, women may stay at work, and couples reassess childbearing plans and preference compatibility, putting them on new trajectories with lower fertility. To our knowledge, we are among the first to use Zika to study marriage and divorce, and one of the few to link an aggregate fertility shock to changes in both labor and marriage markets in a middle-income country.

Our analysis lies against the backdrop of long-run changes in women's economic roles and family formation. Female labor-force participation has risen globally, but remains below men in virtually all countries. Gender earnings gaps have narrowed but remain large (Goldin and Mitchell, 2017; Bertrand et al., 2010; Blau and Kahn, 2017). Brazil follows these patterns, while its fertility, marriage, and divorce patterns have shifted markedly (Morchio and Moser, 2026; Danzer and Zyska, 2023; Bassi and Rasul, 2017; La Ferrara et al., 2012). Our findings suggest that aggregate fertility declines can do more than reduce births mechanically: by changing women's work and relationship choices, they alter the conditions shaping later fertility decisions, and so temporary changes in fertility may have persistent consequences.

In the child-penalty literature parenthood is a key point where labor-market gender gaps widen. Administrative evidence from high-income countries shows that earnings trajectories are steady before the first child, but after childbirth women's earnings and hours fall and occupational choices shift toward more flexible or family-compatible work (Angelov et al., 2016; Sieppi and Pehkonen, 2019; Cortés and Pan, 2023). Evidence from developing and middle-income countries is similar, with motherhood associated with greater labor force exit, informality, and earnings penalties (Agüero and Marks, 2011; Cáceres-Delpiano, 2012; Heath, 2017; Berniell et al., 2021; Agüero et al., 2020; Kleven et al., 2019). A separate literature increasingly highlights the importance of intra-household bargaining, preference alignment, and women's power in determining whether children are born, and marriages occur or persist (Jayachandran and Voena, 2026; Goldin, 2026; Gobbi et al., 2026; Siow, 1998; Lee and McKinnish, 2018). We integrate and extend these literatures by tracing how labor-market and family adjustments unfold after a shock to child-bearing risk nudges families off their original path.

Together, these contributions help us understand why aggregate fertility declines have lasting consequences, as the effects of fewer births need not mirror additional children. When many women in the same place forgo or delay a birth at once, the effects can reach beyond those who avoid a pregnancy: employers who expect fewer young women to take leave may hire and pay them differently, a thinner flow of new mothers may shift bargaining at home and in the market, and marriage and divorce may respond to changes in the perceived cost of children. Because such channels operate on all women of childbearing age, they can make the aggregate response larger (or smaller) than the sum of individual child penalties. Magnified aggregate responses can explain why fertility remains low after the initial decline fades. Our findings therefore speak to broader debates on demographic transitions, gender inequality, and family formation.

2 Background: Zika, fertility, marriage, and work

2.1 The Zika Epidemic

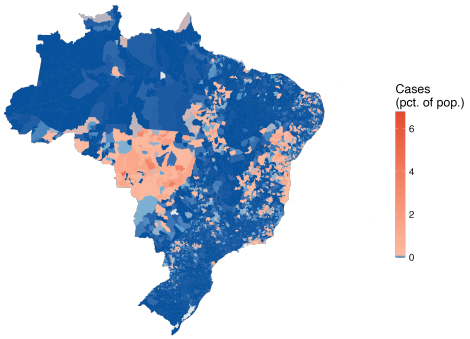
Zika induces mild, short-lived symptoms in adults. Roughly 80 percent of infected people are asymptomatic; the rest experience mild colds, and serious complications are rare. However, when women are infected during pregnancy, the disease can be devastating to fetuses. Adverse outcomes are 30 to 40 percentage points higher among exposed than unexposed fetuses, and brain abnormalities are common. In one Rio de Janeiro study, 42% of live babies born to Zika-positive women had "grossly abnormal clinical and/or brain imaging," and four of those had

microcephaly (Brasil et al., 2016).

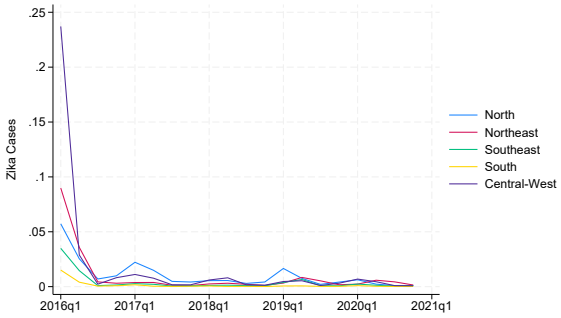
The first Zika case was confirmed in May 2015 and, as with early symptoms confined to adults, Zika was initially considered benign. Specialists first reported a correlation between Zika and microcephaly in October of 2015, and Brazil's Ministry of Health declared a national public health emergency in November 2015. This marked the first widespread awareness of Zika's fetal risk. In December 2015, the Ministry launched a national plan that included an informational campaign targeted at women of childbearing age, and a website and mobile app with municipality-level case prevalence (Secretaria de Vigilância em Saúde, Ministério da Saúde, 2016). The World Health Organization declared an international public health emergency in February 2016.

Figure 1: The Geographic and Temporal Spread of Zika Cases

(a) Map of Zika Cases



(b) Zika Cases by Region over Time



Notes. Zika case data are from the SINAN. The map in Panel 1a shows Zika case load per capita by municipality. Municipalities in blue are below the 90th percentile in case incidence, while those in red are at or above the 90th percentile. The five geographic regions shown in Panel 1b are the official regions defined by IBGE.

Clinical and demographic evidence documents that Zika posed severe fetal risk and generated fertility responses. Early medical studies linked maternal Zika infection to microcephaly and other serious congenital abnormalities, including evidence of Zika present in fetal brain tissue (Brasil et al., 2016; Mlakar et al., 2016; Haby et al., 2018; Codeço Coelho et al., 2017). As information about these risks spread, births fell sharply in high-incidence areas, largely because households delayed or avoided pregnancy (Marteleto et al., 2017; Lautharte and Rasul, 2026; Rangel et al., 2020). Hence, recent research uses Zika as a natural experiment, exploiting geographic variation to study fertility and household behavior (Marteleto et al., 2017, 2020; Marteleto and Dondero, 2021; Lautharte and Rasul, 2026; Rangel et al., 2020; Ryu, 2020).

Figure 1 indicates substantial variation in Zika prevalence across time and space. The Northeastern state of Pernambuco was the original epicenter of the Zika outbreak. When official case reports began in early 2016, however, per-capita cases were highest in the Central-West region, a less densely-populated landlocked agricultural area. Cases were lowest in the temperate South, and in the Southeast (which includes Rio de Janeiro and São Paulo). Reported cases peaked nationwide in early 2016, but fell to near zero by early 2017 (with some exceptions), and remained there thereafter.

This geographic and temporal variation, combined with the government's distinct localized

messaging, lets us study the effect of the fetal health shock on fertility, and labor and marriage markets. The virus' mild symptoms in adults make it unlikely that personal health risk drives these responses; but concern for the child's health and its cascading implications encourage potential parents to adjust life choices. Our identification strategy captures the salience of these fetal health risks by leaning on Brazil's public health response. We define treated municipalities as those that the government highlighted as high-risk areas, where the national information campaign targeted messaging regarding the fetal health risk.

2.2 Fertility, Women's Work, and Family Formation

Fertility has fallen steadily worldwide over the past several decades. In the 1950s, the global average total fertility rate (number of children per woman over her lifetime) was roughly five, but by 2023 it was 2.3. Brazil mirrors this trend: its TFR fell from about 6.05 in 1960 to 3.0 in 1991, 1.9 in 2010, and 1.6 in 2023 (World Bank, 2025). Existing literature attributed Brazil's decline, as in other countries, to family choices in response to economic and cultural changes around them (Danzer and Zyska, 2023; Bassi and Rasul, 2017; La Ferrara et al., 2012). Thus, Brazil's trajectory mirrors the global trend of a dramatic demographic shift with long-term implications for women and families.

Concurrently, female labor force participation has increased worldwide in recent decades, although women still participate at substantially lower rates than men. Around 49% of women globally are in the labor force, reflecting rising educational attainment and ongoing constraints from child care and social norms. Brazil reflects these patterns, as female female participation rose from about 20% in the 1970s to about 53% recently, versus roughly 73% for men (World Bank, 2025). The remaining gap may reflect unequal household responsibilities, and continued barriers to formality (Morchio and Moser, 2026; Machado et al., 2024; Khanna et al., 2025). While Brazilian women are more educated than men, they work in different industries (Figure A4): men are in construction, transport and agriculture, while women are in hospitality, education, and social services. From 2012 to 2019, men's earnings were flat while women's rose, mainly in the middle of the distribution (Figure A5), narrowing the gender pay gap, which still exceeded 30 percentage points in 2019.

Marriage patterns globally have also shifted markedly in recent decades, with most countries experiencing later marriage, fewer marriages, and rising divorce (Herre et al., 2020). Divorces have become more common (albeit with variation across contexts), reflecting legal reforms that simplified the process and broader social changes (Herre et al., 2020; OECD, 2024). Brazil exhibits similar trends. Over the past two decades, divorces have risen sharply, and the average duration of marriages has fallen. Cohabitation, legally recognized in Brazil, has increased. These trends may indicate both greater acceptance of separation and changing gender norms (Instituto Brasileiro de Geografia e Estatística, 2023; Esteve et al., 2016). Together, they point toward a gradual decoupling of family formation from traditional marriages and more diverse household structures.

Changes in fertility, women's work, and marriage likely affect time use, particularly the extent to which childcare and household responsibilities constrain labor supply. Figure A6 shows the share of individuals reporting they were unable to work due to childcare or household

duties, by age group and gender. After the Zika onset, younger women report notably less often that childcare or housework prevented them from working, while older women, who had likely completed fertility, show no comparable change. Younger men exhibit a modest increase in reports of childcare-related work constraints, although the scale is considerably smaller than that for women. These patterns are consistent with fertility declines reducing childcare-related barriers to women's labor supply, while only marginally altering men's time allocation.

3 Data Description

3.1 Zika Exposure

We combine a common temporal shock (the November 2015 public health emergency) with cross-sectional variation in local Zika exposure. Our preferred exposure measure is publicized local case prevalence. We obtain municipality-level case counts from *Sistema de Informação de Agravos de Notificação* (SINAN) and calculate cases per capita in the 016Q1 (Ministério da Saúde, 2020). Government reports repeatedly used maps with discrete incidence categories to publicize the geographic concentration of Zika and highlight high-prevalence municipalities (Ministry of Health of Brazil, 2017, Chapter 3, Figure 1, reproduced in Figure A1b). We use the 90th percentile of per-capita cases to approximate the distinction these maps made salient. Our resulting map closely resembles the government's distinct cutoffs and geographic patterns. We therefore interpret this measure as capturing not only realized local prevalence, but also whether the government publicly identified an area as high-risk.

Reported case prevalence may reflect local surveillance and medical infrastructure as well, generating differential trends in fertility, labor-market outcomes, or family formation. We examine pre-epidemic trends and estimate the same specifications with two complementary exposure measures that do not rely on reported case counts.

Our second measure, Zika suitability, captures predetermined geographic variation in environmental suitability for the *Aedes aegypti* mosquito, the primary Zika vector (Faria et al., 2017; Messina et al., 2016). Unlike reported cases, suitability does not depend on diagnosis, reporting, or behavior. It therefore provides a more plausibly exogenous measure of transmission risk, although it does not capture whether residents perceived that risk as salient (or localized government messaging). We classify municipalities above the 90th percentile of suitability as high exposure (Appendix Figure A2a).

Our third measure uses Google search activity to capture local awareness and concern about Zika. The index measures the share of Google searches for "Zika" (Google Trends, 2018).[1] Unlike mosquito suitability, this measure captures whether residents sought information about the epidemic, although may reflect local characteristics correlated with internet access. We classify a geography as high exposure if it recorded any Zika-related searches during the fourth quarter of 2015 (Appendix Figure A3a).

The three measures capture complementary dimensions of Zika exposure. Publicized case prevalence combines realized incidence with government-generated salience, the mosquito suitability measures underlying transmission risk, and Google searches capture active information

[1] We thank Hal Varian for personally sharing the disaggregated Google search data.

seeking. As exposure may be correlated with local characteristics, we examine pre-trends and control for baseline demographic differences. Despite their distinct sources and limitations, the three measures produce similar main results.

3.2 Primary Outcomes

We measure municipal-level births using the administrative *Sistema de Informações Sobre Nascidos Vivos* (SINASC), which records every birth in Brazil, including the municipality of maternal residence and delivery (Ministério da Saúde, 2023). We collapse this data to the municipal level by mothers' municipality of residence, and merge it with Zika exposure. This way, we create a monthly, municipal-level dataset of all births alongside Zika exposure.

Employment and earnings are from the *Pesquisa Nacional por Amostra de Domicílios Continua* (PNAD-C), a nationally representative rotating panel quarterly household survey (Instituto Brasileiro de Geografia e Estatística, 2024). These data also identify the respondent's state of residence and type of municipality, allowing us to aggregate our measures of Zika exposure to 146 distinct "estratos."[2] We then link each respondent to their region's Zika measure, yielding an individual-level quarterly dataset.

We obtain annual divorce and monthly marriage counts by municipality from *Sistema de Estatísticas Vitais* (System of Vital Statistics). These comprehensive administrative records cover all marriages and divorces, nationwide. We use the highest available frequency: annual for divorces and monthly for marriages (Instituto Brasileiro de Geografia e Estatística, 2023).

4 Estimation Strategy

Across outcomes, we use an event-study difference-in-differences design that compares changes in areas with high and low Zika exposure around Brazil's November 2015 emergency declaration. We measure exposure in three complementary ways. First, publicized case prevalence captures realized incidence and its local salience. Using available case data, we replicate the classification used in government maps to identify areas with elevated prevalence. Second, mosquito suitability captures predetermined geographic variation in transmission risk. Third, Google search activity captures where residents actively sought information about Zika. Because these measures capture different combinations of transmission risk, realized prevalence, and public awareness, consistency across them strengthens the interpretation of the results.

We estimate the effect of Zika exposure on fertility using monthly birth counts:

$$Births_{m,t} = \gamma_m + \delta_t + \sum_{t=Jan.2015}^{Sep.2015} \left(\alpha_t \times \text{Treated}_m\right) + \sum_{t=Nov.2015}^{Dec.2018} \left(\beta_t \times \text{Treated}_m\right) + \varepsilon_{m,t}, \quad (1)$$

where m indexes regions and t indexes months. $Births_{m,t}$ is the number of births to women ages 20–34. For each exposure measure, Treated_m identifies areas classified as having high Zika

[2]The PNAD-C identifies: (i) different types of municipalities within each state (capitals, metros neighboring the capital, municipalities in other metros, and other municipalities) that serve as survey stratum, (ii) 26 state capitals, (iii) 26 states excluding their capitals, and (iv) the federal district (national capital). We construct 146 disaggregated regions at the stratum level using the municipality categories where every municipality is fully contained in a PNAD-C region. We also construct 53 "PNAD-C regions" identified by categories (i) through (iii), and use these for robustness.

exposure. Area fixed effects, γ_m, absorb time-invariant differences across locations, while year-by-month fixed effects, δ_t, absorb shocks common to all locations in each month. The coefficients α_t and β_t therefore trace monthly differences between high- and low-exposure regions relative to October 2015, the month before the emergency declaration.

We next estimate the reduced-form effect of Zika exposure on individual quarterly employment and earnings:

$$L_{i,j,q} = \gamma_j + \delta_q + \sum_{q=2014q1}^{2015q3} \left(\alpha_q \times \text{Treated}_j\right) + \sum_{q=2016q1}^{2018q4} \left(\beta_q \times \text{Treated}_j\right) + \varepsilon_{i,j,q}, \tag{2}$$

where i indexes women (ages 20–34), j indexes the 146 estrato regions, and q indexes year-by-quarters. $L_{i,j,q}$ denotes employment or earnings in a reference month for woman i. For each exposure measure, Treated_j identifies regions classified as having high Zika exposure. Region fixed effects, γ_j, absorb time-invariant differences across regions, while quarter fixed effects, δ_q, absorb shocks common to all regions. The coefficients α_q and β_q trace quarterly differences in labor-market outcomes between women in high- and low-exposure regions relative to the fourth (omitted) quarter of 2015.

Finally, we estimate the reduced-form effect of Zika exposure on family formation and dissolution. Marriages are observed monthly at the estrato level, and divorces annually at the municipality level:

$$M_{m,k} = \gamma_m + \delta_k + \sum_{k=2014}^{2015} \left(\alpha_k \times Treated_m\right) + \sum_{k=2017}^{2023} \left(\beta_k \times \text{Treated}_m\right) + \varepsilon_{m,k}, \tag{3}$$

where m indexes geographic area and k indexes time periods. $M_{m,k}$ denotes the number of marriages or divorces across all age groups. For each exposure measure, Treated_m identifies areas classified as having high Zika exposure. Area fixed effects, γ_m, absorb time-invariant differences across areas, while time fixed effects, δ_k, absorb shocks common to all areas. The coefficients α_k and β_k trace differences between high- and low-exposure areas relative to the omitted time period.

Across specifications, α describes differences between high- and low-exposure areas before the emergency, while βs describe how those differences changed after. Estimates are relative to October 2015 for fertility and marriages, 2015Q4 for labor-market outcomes, and 2015 for divorce.[3] Standard errors are clustered at the level of exposure assignment: municipality for fertility and divorces, and the PNAD-C region for marriage and labor-market outcomes.

Interpreting the βs as effects of Zika exposure requires that high- and low-exposure areas would have followed similar trends in the absence of the epidemic and that no other contemporaneous changes differentially affected high-exposure areas. The pre-period α coefficients provide evidence consistent with parallel trends. The design also assumes limited spillovers between areas, since migration, information diffusion, or transmission across areas could expose the

[3]We exclude Pernambuco, as its infection peak occurred prior to the emergency declaration. Pernambuco is often considered the epicenter, and some studies that estimate birth outcomes consider it to be the only treated area. However, the epidemic began there early-to mid-2015, and our identification relies on fertility responses relative to public health announcements/awareness. So we omit it, but including Pernambuco as treated produces similar results (see Appendix Figure A15).

comparison group to Zika. Differential migration is less concerning given the rapid conception response in the monthly birth data,[4] while other spillovers would make our estimates relative exposure effects and attenuate differences between groups.

The response timing helps distinguish potential channels. Direct health or economic effects should appear soon after the emergency declaration. Effects operating through pregnancy may emerge during the final trimester, while effects associated with avoided births should become most visible around the expected date of birth (nine months after the declaration). We examine whether changes in employment, earnings, marriage, and divorce follow the timing implied by the initial fertility response. Over longer horizons, however, influence may run both ways: subsequent changes in work and family formation may help sustain the fertility decline.

5 Results

5.1 The Impact of Zika on Fertility

Figures 2a, 2c, and 2d show Zika's impact on total births, estimated with specification (1). Each coefficient measures the difference between high- and low-Zika exposure municipalities in monthly births among women aged 20-34, relative to October 2015. Estimates below zero represent fewer babies born in high Zika areas. Figure 2b aggregates the estimates using our preferred treatment variable, Zika cases, to describe cumulative fertility adjustments.

We add three vertical reference lines to each panel. The first (red) line marks our omitted month, October 2015, immediately before the emergency declaration. We then plot a line nine months after, corresponding to typical gestational periods. A final line is placed nine months after cases fall back to near-zero, indicating the end of the epidemic. Then, as Zika became endemic at low rates, births may return to prior levels—or even overshoot them—as parents resume postponed childbearing.

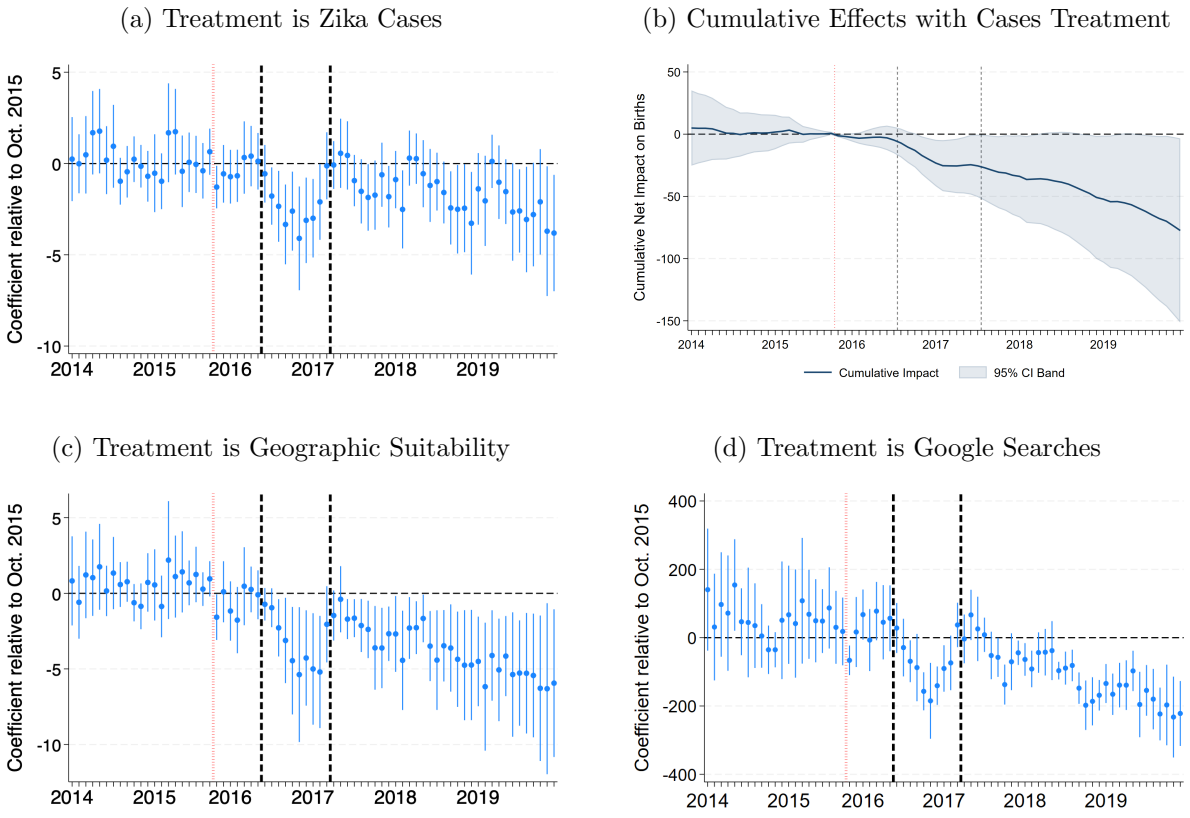
We see relative fertility declines in high-exposure municipalities beginning nine months after the declaration. Pre-declaration coefficients are not statistically different from zero, supporting the parallel trends assumption. Coefficients in months 1-8 following the declaration are small and not different from zero, suggesting minimal in-utero pregnancy terminations. There is, however, a large statistically significant decline in births beginning nine months after the declaration, on average of about 6.2% (2.61 births per month over an average of 42 births per month pre-2016). Fertility remains low for six months before recovering in April 2017, then slightly declines again. These patterns are seen across exposure measures – Zika cases (Figure 2a), suitability (2c), or awareness (2d).

Births in high-exposure areas remain relatively lower after the epidemic ends. The cumulative estimates in Figure 2b suggest that there is no "rebound" or "overshooting" of births, in aggregate. These cumulative estimates suggest 4.8% fewer babies were born in high-Zika areas between October 2015 and December 2016, and 5.6% fewer babies between October 2015 and December 2019. Declines in births to *new* mothers are even larger, with 15% fewer babies by December 2016, and 21.7% fewer by December 2019.[5] Thus, women are reducing rather than

[4] We do not detect meaningful impacts on migration in difference-in-differences specifications.

[5] Estimates derived by dividing the cumulative treatment effect (Figure 2b), by cumulative births in low-Zika areas over the same period. For new mothers we use Figure A10b.

Figure 2: Monthly Impact of Zika Virus on Births



Notes. The specifications in Panels 2a-2c are run at the municipality level and include year-by-month and municipality fixed effects. Standard errors are clustered at the municipality level. The specification in Panel 2d is run at the estrato level and includes year-by-month-by-state-by-capital and estrato fixed effects. Standard errors are clustered at the estrato level. The sample is restricted to women ages 20-34. The outcome is births per month measured at the specified geographic level. Panel 2b measures the cumulative effects on births with the Zika cases treatment. The red dotted line marks the omitted period: October 2015, the last month before the declaration of the national emergency. The first black vertical line marks nine months after the declaration of the national emergency, to allow for the lagged fertility response. The second black vertical line marks nine months after the end of the epidemic. Births data are from the SINASC, 2014-2019, Zika cases data are from the SINAN, geographic suitability data for the Aedes aegypti mosquito are from Messina et al. (2016), and Google search data are from Google Trends data.

delaying fertility, and fewer women are becoming mothers. The pregnancies that did not occur in the year following the declaration had still not occurred by the end of 2019, so there were fewer infants and toddlers in high-Zika municipalities.

We show robustness to treatment thresholds in Appendix B.2, estimating the effects with alternative treatment definitions. Panel A7b shows the estimates when we define treatment as being above other percentiles of the respective exposure. Panel A7c estimates effects using continuous treatment measures. In Figure A11, we show robustness to mother's age with estimates for women in different age groups (20–29, 30–39). Figure A10 shows robustness of the cumulative fertility results to treatment definition, birth parity, aggregate age group, and the inclusion of Pernambuco in the sample.

5.2 Zika's Impact on Women's Work

Figure 3: Quarterly Impact of the Zika Virus in the Labor Market



Notes. All specifications include year-by-month and PNAD-C region (state-by-capital or estrato) fixed effects. Standard errors are clustered at the specified geographic level and outcomes are measured at the individual level. "Employment" is a binary indicator of whether the individual reported any work in the reference month. "Monthly Earnings" are defined as all earnings from the main, second, and other jobs in the reference month. The omitted period (red dotted line) is 2015q4, the quarter of the declaration of the national health emergency. The black lines mark nine months following the declaration of the national health emergency and nine months following the end of the epidemic.

We now turn to the corresponding consequences for the labor market, focussing on the group most exposed to the fertility declines (women aged 20-34).

Figure 3, presents coefficients from Equation 2, and shows meaningful and sustained increases in women's labor-force participation and earnings after Zika. The outcomes are employment in the reference period (Panel 3a), and monthly earnings (Panel 3b). The positive and significant coefficients following the emergency declaration suggest that women's employment increases by 1.55 percentage points between the 2016Q4 and 2019Q4, in high-Zika areas. Women's earnings increase by 5.4% (43.6 reais) over the period, peaking at 12.4% (100 reais) in 2019Q3. These employment and earnings increases persist through 2019 and beyond, perhaps

as cumulative births are lower, suggesting a potential structural change in women's earnings capacity.

Maternity leave and employment protection may shape the timing of these changes. Formal-sector women receive fully-paid maternity leave (four months in the private, six in the public sector) and five months of employment protection. The observed increases in employment between 2016Q4 and 2017Q4 are consistent with fewer women taking maternity leave then. The longer-term increases in employment beginning in 2018 may reflect fewer women leaving the laborforce once maternity benefits are exhausted, and fewer selective firings once protections end. The earnings effects should appear only after benefits and protections expire, and in Figure 3b gains begin in 2017Q2 (consistent with the nine-month fertility window and five-month employment protection for mothers). These decisions of individual mothers may have larger aggregate consequences, as employers hire more women if they expect fewer maternity leaves.

This employment response is meaningful in magnitude. The child penalty literature provides a benchmark, since the response is concentrated among women without prior children. The estimated 21.7% cumulative decline in first children between October 2015 and December 2019 translates to 6,075 fewer new mothers aged 20-34 per estrato. The estimated 1.55 percentage point increase in employment implies an additional 2,682 employed women aged 20-34 in that same area.[6] This implies 0.44 additional female workers for every avoided first birth. Kleven et al. (2025) estimate a scaled child penalty in employment for Brazil of 0.368, with an unscaled penalty of about 25 percentage points. Our estimate exceeds this, for several possible reasons. First, women who avoid pregnancy after learning about fetal risk need not resemble the average new mother; if they are more attached to the labor market, they face larger penalties. Second, women leaving a union have reason to work whether or not they avoided a birth; so some of the response may run through household dissolution rather than fertility.[7] Third, men may also have increased labor supply with fewer children. Finally, and unlike the private penalty borne by an individual mother, part of the response may operate through labor demand. Employers bear the cost of paid maternity leave and cannot dismiss a worker from the confirmation of pregnancy until five months after birth. A fall in the expected fertility of women aged 20-34 lowers the expected cost of employing women in this group, not only those who avoid a birth, and can raise hiring across the group – an aggregate response larger than the sum of individual penalties.

The earnings response combines entry into work and gains in earnings among workers. 60% of the estimated earnings increase reflects entry alone; the remainder reflects a 1.9% rise in average earnings among employed women.[8] This intensive-margin increase combines changes in earnings for incumbent women with changes in workforce composition, since women drawn into employment after an avoided first birth need not resemble incumbents. A positive intensive margin is notable because a pure labor supply increase would, if anything, lower equilibrium

[6] We calculate these numbers at the estrato level, which is the smallest geographic area identifiable in the PNAD. Per estrato, there are on average 173,000 women aged 20 to 34 (2010 census) and 27,995 births to new mothers of that age between October 2015 and December 2019 (SINASC).

[7] Indeed, Kleven et al. (2025) find a marriage penalty in Brazil larger than the child penalty.

[8] The entry share applies the 1.55 percentage point rise in employment to conditional mean earnings of 1,690 reais. The remainder is a 1.9% rise in average earnings among employed women.

wages. It is, however, consistent with a labor-demand shift: perhaps as the expected cost of employing young women falls with their expected fertility, employers may compete for them, raising pay for those already working.

We show robustness of our employment and earnings results in Appendix B.3. Figures A12 and A13 show alternative definitions of treatment (Panels A through C), and controlling for differential time trends by municipality-level demographics (Panel D). Figure A14 includes state-by-year fixed effects to account for regional. Further, employment increases only begin nine months after the declaration, supporting the hypothesis that the labor-market impacts of Zika are not direct, but are related to the corresponding fertility decline.

5.3 Zika's Impact on Family Formation

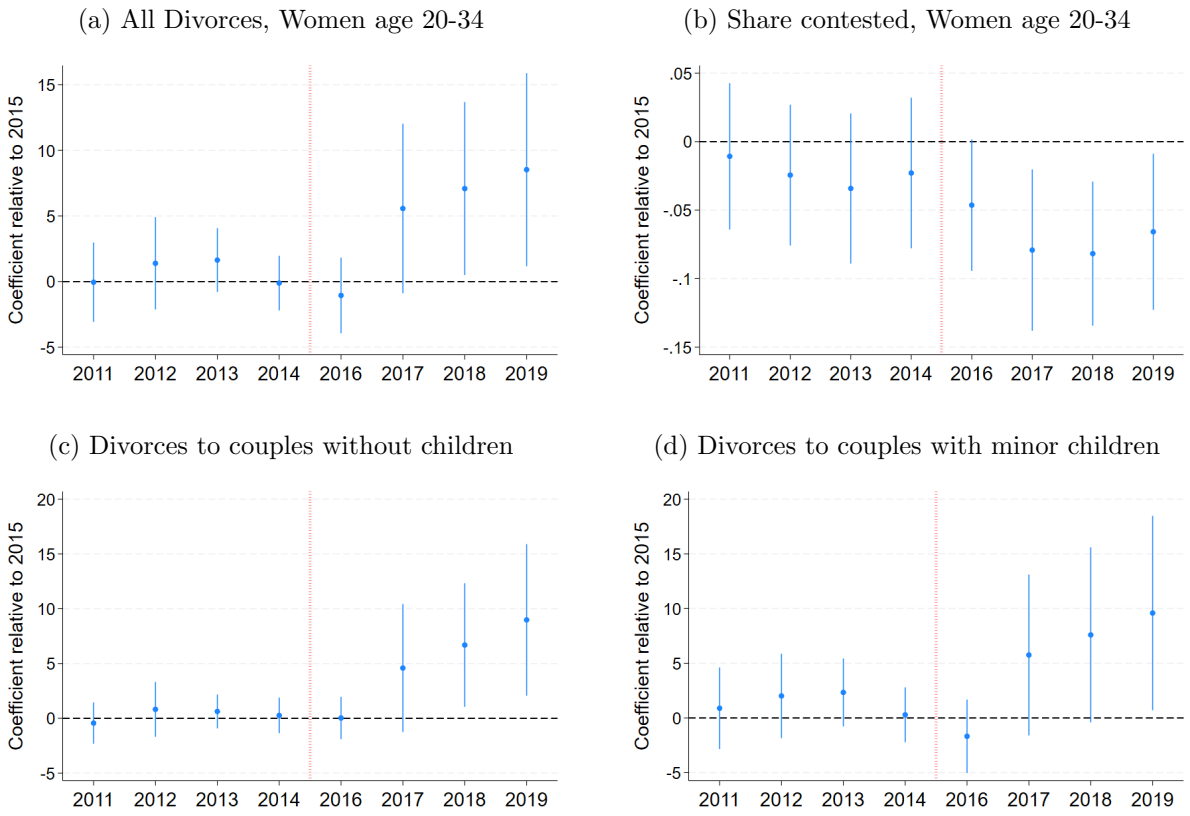
Next, we turn our focus to divorces, marriages, and preferences for fertility by gender. Changes in fetal risk may make fertility preferences, career decisions, and intra-household bargaining more salient. These may, in turn, affect family dissolution and formation based on how preferences between partners were aligned.

First, we examine divorces. Figure 4 shows a widespread increase in divorce in high-Zika intensity areas among women between the ages of 20 and 34, following the declaration of the national emergency. Figure 4a presents the estimated coefficients from Equation 3 when the outcome is the number of divorces among women aged 20-34 in a municipality each year. Divorces to women between the ages of 20 and 34 began to rise in 2017 and continued to rise through 2019, reaching levels roughly 38 percent (8.5 divorces annually per municipality over an average of 22.4 divorces prior to 2015) higher in high-intensity Zika areas relative to low-exposure Zika areas at the peak. Between 2016 and 2019, divorces rose by 22.3 percent, on average. This increase in divorces is driven by uncontested divorces (Figure 4b): the share of divorces that were contested was, on average, 21 percent lower in high-intensity Zika areas relative to low-intensity areas between 2016 and 2019. The increase occurred among couples with and without existing children (Figures 4c and 4d), although the average percentage increase among couples without existing children (36.3 percent) was higher than that among couples with children (18.13 percent). Appendix B.4 shows robustness to the Zika virus's effect on divorces by using alternative treatment definitions and including a set of controls shown in Figure A15.

Next, we turn to family formation through marriage. Figure 5a suggests a moderate, but lagged, increase in marriages following the declaration of the national health emergency. The left panel presents coefficient estimates from Equation 3, estimated at the estrato level and including state-by-year fixed effects, where the outcome variable is the number of marriages per month in each estrato. Between October 2015 and December 2019, marriages were, on average, 5.8 percent higher each month in high-Zika areas relative to low-Zika areas than prior to the national emergency. The right panel aggregates these monthly estimates to measure the cumulative increase in marriages over this time period. There were an average of 1,978, or 10 percent, more marriages in the hardest hit areas between October 2015 and the end of 2019 than there would have been absent the epidemic.

One interpretation of our results on marriage and divorce is that reduced fertility and improved labor market opportunities enhanced women's ability to exit or delay certain unions by

Figure 4: Annual Impact of the Zika Virus on Divorce



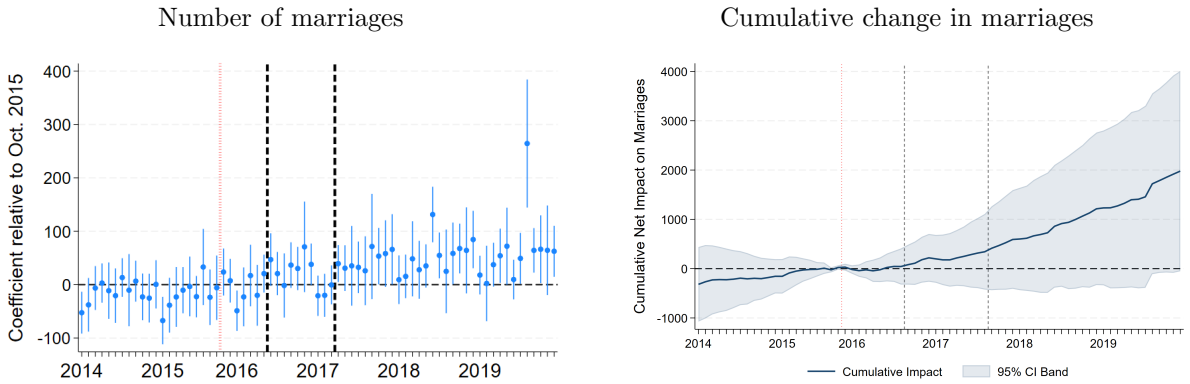
Notes. All specifications are run at the municipality level and include year and municipality fixed effects. Standard errors are clustered at the municipality level. The outcome is the number of divorces among the stated group in Panels 4a, 4c, and 4d, and the share of divorces involving women age 20-34 that are contested in Panel 4b. The average number of pre-Zika divorces in high Zika-intensity municipalities was 22.3 among women age 20-34, 13.93 among couples without children, and 26.08 among couples with minor kids. On average, 31.45 divorces involving women 20-34 were contested in high Zika-intensity areas prior to the epidemic.

improving their outside option (Kleven et al., 2025; Jayachandran and Voena, 2026; Mazzocco, 2007; Voena, 2015). Alternatively, reduced fertility could have a direct effect on marital unions. Some unions formed prior to the national health emergency may have been with the express objective of having children; when the epidemic encouraged these partners to re-evaluate having children, they may also have re-evaluated marriage and employment (Coles and Francesconi, 2011; Siow, 1998; Díaz-Giménez and Giolito, 2013; Becker et al., 1977; Lee and McKinnish, 2018).

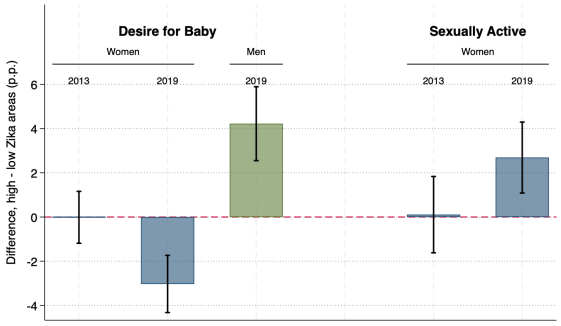
The rise in both divorces and marriages is consistent with the Zika shock making fertility preferences more salient within relationships and prompting conversations about household responsibilities that may otherwise have been difficult or socially costly. These conversations may have led to a re-shuffling of partnerships. By making pregnancy avoidance more publicly legitimate and the potential time costs of caring for children more starkly obvious, the shock may also have increased women's effective control over fertility decisions, especially for women who had reservations about childbearing but faced pressure from partners, families, or social

Figure 5: Marriage and Fertility Preferences

(a) Monthly Impact of the Zika Virus on Marriage



(b) Fertility Preferences



Notes. The left figure in Panel 5a shows the results from specification 3 when the outcome is number of marriages among women age 20-34 within an estrato each month. The specification includes year-by-month, estrato, and state-by-month fixed effects, and the omitted period is October 2015. The right figure in Panel 5a aggregates those estimates over time to create a measure of the cumulative change in marriages following the declaration of the national emergency. Panel 5b links PNS data to our treatment measures at the estrato level, presenting the difference in means within treated minus non-treated areas for the indicated binary variables. The bars on the left show the gap in high − low-Zika areas in percentage points of the specified demographic group that reported not using contraception with the goal of having a child, where the demographic groups are women age 20-34 in 2013; women age 20-34 in 2019; and men age 20-34 in 2019. The right panel shows the percentage point gap in high − low-Zika areas of women 20-34 that were sexually active in 2013 and 2019.

norms (Gobbi et al., 2026; Bau and Fernandez, 2022; Jayachandran and Voena, 2026).

Figure 5b presents descriptive evidence, using the *Pequisa Nacional da Saude*, showing how women's reproductive behavior and fertility preferences evolved in low- and high-Zika intensity areas following the epidemic. While women between the ages of 20 and 34 are more likely to be sexually active in high-Zika areas relative to low-Zika areas following the epidemic, they are less likely to eschew contraception with the goal of having a baby. One potential mechanism underlying this pattern is that women feel more comfortable talking to their partners about fertility preferences and contraception. The right figure in Panel 5b suggests that these conversations may have uncovered contrasting preferences between men and women: though

women in high-Zika areas were less likely than their counterparts in low-Zika areas to be trying for a child in 2019, that pattern was reversed for men. In such an environment, couples who discovered mismatched preferences over childbearing may have been more likely to separate, while couples with aligned preferences may have been more willing to formalize unions once more open discussion surfaced their compatibility regarding childbearing.

6 Conclusion

Our findings demonstrate that the Zika epidemic led to a measurable fertility decline in Brazil. The resulting cumulative reduction in births was accompanied by persistent increases in women's labor market earnings and employment, as well as notable adjustments in marriage and divorce. Together, these results contribute to our broader understanding of fertility, labor supply, and family formation by providing evidence that increased childbearing costs influence fertility, women's employment and relationship dynamics, in ways that cement the original fertility decline. Unlike previous studies that focus on long-run fertility transitions or policy-driven fertility shifts, our paper leverages a sharp and plausibly exogenous public health shock to isolate the childbearing-, labor- and marriage-market effects of a sudden increase in health-related fetal risk. With this, we offer rare and credible insight into the dynamics between fertility choices, family formation, and women's economic trajectories.

These findings have important implications for understanding ongoing and future demographic change. If initial fertility declines driven by a health shock can meaningfully increase women's labor force participation and earnings, more persistent fertility declines (such as those observed across Europe, East Asia, and Latin America) may have even larger cumulative effects on women's lifetime labor supply, earnings potential, and economic independence. In many middle- and high-income countries, fertility rates have already fallen below replacement, and concerns about population aging, shrinking labor forces, and fiscal sustainability are increasingly central to policy debates. At the same time, falling fertility may enhance women's participation in paid work, accelerate the closing of gender gaps, and reshape intra-household bargaining, with downstream effects on marriage, divorce, and household structure.

Our evidence also suggests that fertility reductions are not simply delayed births that eventually "catch up," but may translate to fewer births overall. If this is indeed the case, then long-run demographic change may not only shrink cohorts entering the labor market, but may also permanently shift women's economic roles. In contexts where childcare costs are high, and the motherhood penalty is large, fertility declines may further increase women's employment and earnings, contributing to long-run gender convergence.

These results also help interpret the broader consequences of the sustained fertility declines now underway across much of the world. Much of the existing literature has focused on individual-level fertility shocks that identify how an additional child affects women's labor supply. In contrast, we study a setting in which fertility declines at the cohort and geographic level, resulting in fewer births in the aggregate. Our findings show that when fertility falls at this broader scale (as seen worldwide), women's observed labor market trajectories shift upward, with sustained increases in employment and earnings. At the same time, family formation responds measurably, with changes in both marriage and divorce rates following the

fertility decline. Taken together, these results suggest that aggregate fertility transitions may be accompanied by persistent changes in women's employment and earnings outcomes, as well as adjustments in the timing and structure of family formation, even over relatively short horizons.

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Appendix

A Zika Data and Measurement

We consider three measures of the intensity of the Zika virus: Zika cases per capita, environmental suitability for the mosquito that carries the Zika virus, and an index that measures the frequency of Zika-related Google searches relative to all Google searches within a municipality. We refer to these measures as Zika cases, Zika suitability, and Zika searches. Each measure begins as a continuous variable; in this appendix, we first describe that continuous variable, and then how we select the threshold that defines "high" Zika intensity versus "low" Zika intensity for each measure.

A.1 Zika Cases

Zika case data, separately reported by municipality, are available from SINAN between 2016 and 2020. The highest measured frequency of non-zero case incidence occurred in the first quarter of 2016, when 2,353 out of 5,570 municipalities reported positive Zika cases. In the second quarter of 2016, only 1,857 municipalities reported non-zero case incidence. Figure 1b in the main text shows that this temporal pattern held across geographic regions.

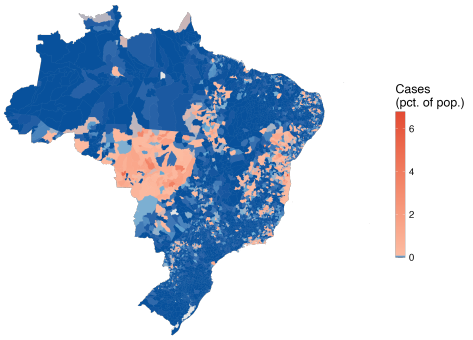
As a time-invariant measure of Zika exposure, we use reported cases as a percent of population in the peak quarter of 2016q1. Figure 1a in the main text presents this measure, with the municipalities facing the lowest exposure in dark blue and those facing the highest exposure in dark red. We also consider different methods of determining a time-invariant measure of cases, such as the case incidence reached in each municipality in 2016q2, or the highest case incidence attained within each municipality throughout the period. We find a strong correlation between these various measures and choose cases as a percent of the population in 2016q1 for clarity of interpretation.

Figure A1 shes light on the criteria we used to select the threshold at which a municipality was considered "high-intensity" versus "low-intensity," according to the cases measure. Figure A1a reproduces Figure 1a from the main text, showing our time-invariant measure fo Zika exposure. We juxtapose this with Figure A1b, which shows a map that was released during the epidemic by the Brazilian government as part of their national information campaign to spread awareness about and combat Zika. The government repeatedly released such maps using these exact discrete incidence categories to publicize the geographic concentration of Zika and highlight municipalities with especially high case prevalence. The color selection and thresholds they chose emphasized municipalities with more than 300 cases per thousand inhabitants as high-risk. We use the 90th percentile of our time-invariant cases to approximate this threshold; municipalities in a red hue in Figure A1 are above the 90th percentile while municipalities in a blue hue are below. Figure A1c shows the CDF of our time-invariant measure of Zika cases, including all municipalities that reported non-zero cases. The red line represents the salience threshold at the 90th percentile of this distribution, which is the threshold we use to distinguish whether a municipality suffered high- or low-Zika intensity. We show robustness of our results to this choice of threshold.

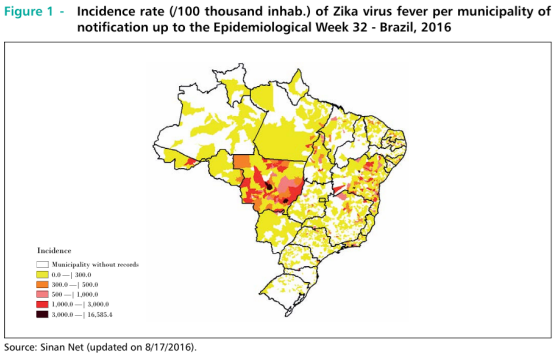
To aggregate geographically to the 53 regions available in the PNAD-C, defined by states

Figure A1: Threshold for Zika Cases Selection emphasizes Salience

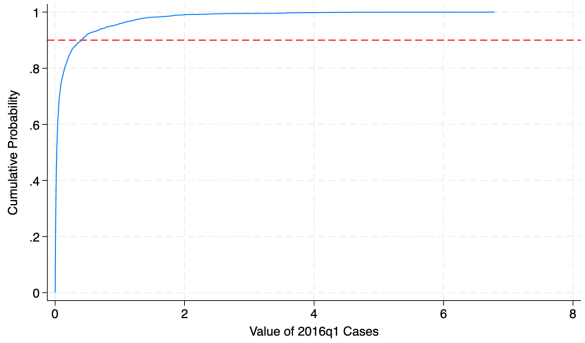
(a) Map of Authors' Measure of Zika Cases



(b) Map from Brazilian Government



(c) CDF of Municipal-level Zika Cases



Notes. Zika case data are from the SINAN. The map in Panel A1a shows Zika case load per capita by municipality. Municipalities in blue are below the 90th percentile in case incidence, while those in red are at or above the 90th percentile. Panel A1b is a map of cases released by the Brazilian government as part of its national information campaign to combat the spread of Zika (Secretaria de Vigilância em Saúde, Ministério da Saúde, 2016, Figure 5) (Ministry of Health of Brazil, 2017, Chapter 3, Figure 1). Figure A1c shows the cdf of our Zika cases measure over municipalities, highlighting the 90th percentile cutoff.

and their capitals, we calculate a time invariant measure of case incidence within a region as a percent of the aggregate population across all municipalities within a region. We then classify regions with high-Zika intensity using the same threshold that we do for municipalities: a region is high-intensity when its case incidence is higher than the 90th percentile of all municipalities with non-zero case incidence.

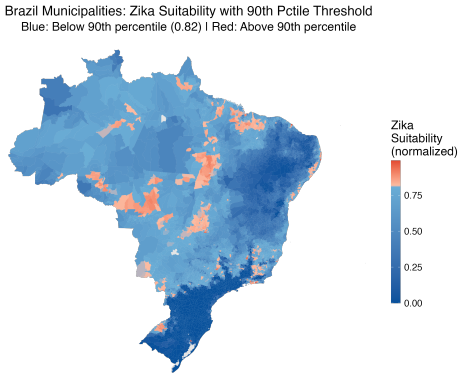
A.2 Environmental Suitability for Aedes Aegypti Mosquito

Gridded geographic data on land suitability for the Aedes aegypti mosquito is available as a raster dataset. We aggregate the raster data to the municipality level, by overlaying shape files with municipality boundaries in 2015 and calculating the mean suitability of the grid cells within each municipality, weighting cells from the raster by their relative area within each municipality. This allows us to get a municipality level average suitability measure. We use this municipality-level suitability for treatment assignment. In the map below, blue areas have the lowest geographic suitability for the Zika-carrying mosquitoes, while red areas have the highest suitability. The color changes from blue to red at the 90th percentile of Zika suitability – the

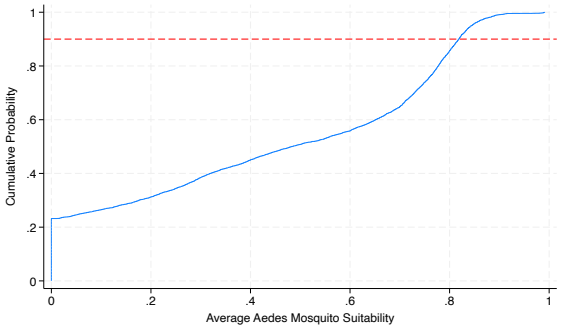
threshold we use to distinguish high-Zika intensity areas from low-Zika intensity areas. Figure A2b shows the distribution of Zika suitability. The red horizontal line lies at the 90th percentile cutoff that we define to be the treatment threshold. We choose this cutoff at the point where the CDF flattens out so that high-Zika intensity areas have not only the highest, but also similar susceptibility to the virus. We show robustness of our results to this choice of threshold.

Figure A2: The Geographic Spread of Environmental Suitability

(a) Zika Suitability



(b) CDF of Municipal-level Zika Suitability



Notes. The map in Panel A2a shows normalized Zika suitability by municipality. Municipalities in blue are below the 90th percentile in suitability, while those in red are at or above the 90th percentile. Panel A2b shows the cdf of municipalities, highlighting the 90th percentile cutoff.

A.3 Google Searches

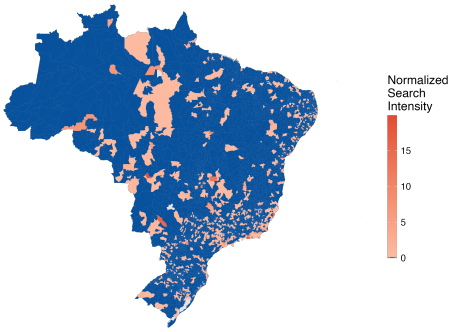
We use a municipality-level index measuring the frequency of Google searches that include the word "Zika," relative to all Google searches (Google Trends, 2018). Figure A3 shows that Zika search intensity reaches its peak in the fourth quarter of 2015, driven by searches in November of 2015–consistent with the timing of the declaration of the state of national emergency in November 2015. Accordingly, we consider municipal-level search intensity in the fourth quarter of 2015 as our time-invariant measure of Google search intensity.

Concerns may arise that this search measure reflects access to internet more than it does concern about Zika. We therefore conduct robustness checks limited to the 1,042 municipalities that ever report any search for Zika, as we are thus sure that these municipalities have access to the internet. The results look broadly the same when we limit the sample in this way, alleviating the concern that our findings are driven purely by access to technology.

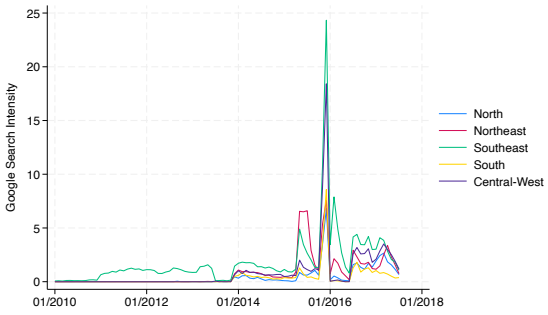
To aggregate geographically to the 53 regions available in the PNAD-C, defined by states and their capitals, we calculate a time invariant measure of google searches by averaging the search index 2015q4 across all municipalities within the region.

Figure A3: The Geographic and Temporal Incidence of Google Searches

(a) Map of Google Searches



(b) Google Searches by Region over Time

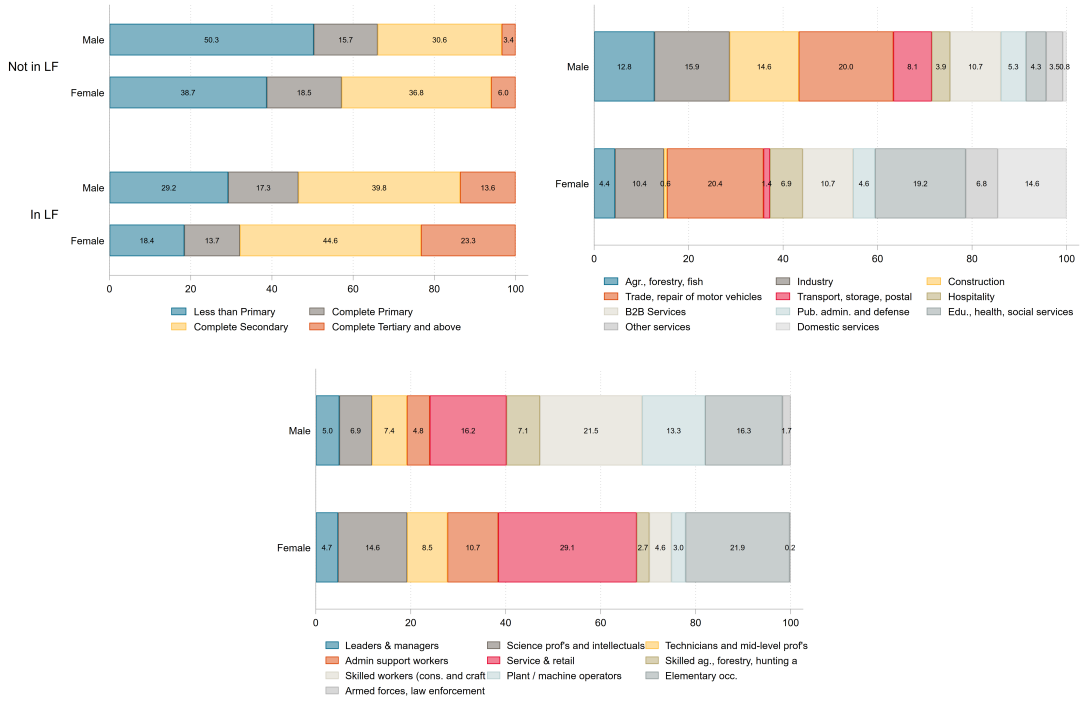


Notes. Google Search data come from Google Trends. The map in Panel A3a shows relatively prevalence of Zika searches by municipality. Municipalities in blue are those with zero searches in 2015q4, while those in red experienced non-zero searches for Zika in that quarter. The five geographic regions shown in Panel A3b are the official regions defined by IBGE. Panel A3b plots average monthly searches for Zika by region normalized by population.

B Additional Figures and Robustness

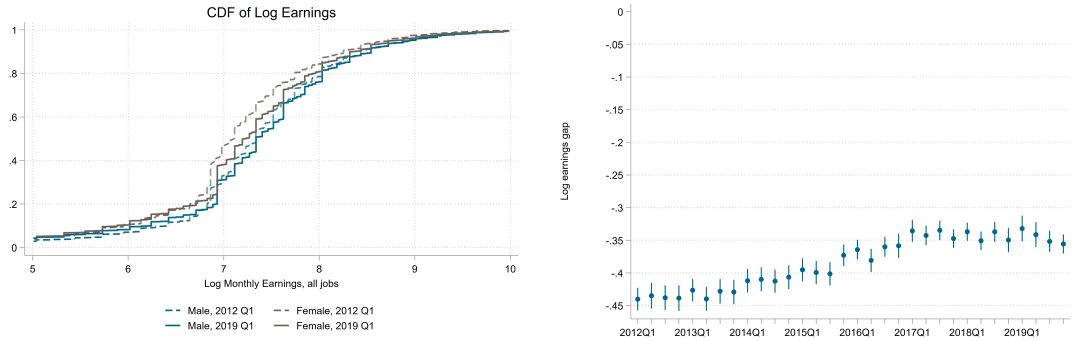
B.1 Descriptive Background

Figure A4: Women and Men in the Workforce: Education, Industry, and Occupation



Notes. Data from PNAD-C. Includes all individuals 15-49 from pooled 2016 waves.

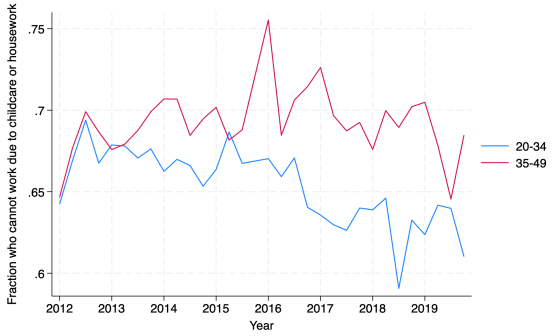
Figure A5: Women's Earnings and the Gender Pay Gap



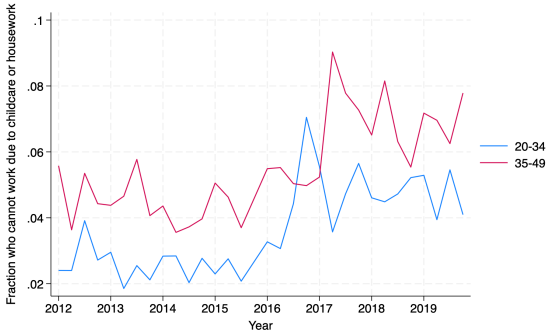
Notes: Left panel shows unconditional log earnings of men and women in 2012q1 and 2019q2. Right panel shows regressed log earnings on education, age, age squared, fully interacted occupation and industry FEs, stratum FEs, and survey wave FEs. Plotted coefficients are the interaction of female and year-quarter indicators. SEs clustered by stratum and survey wave. Source: PNAD-C.

Figure A6: Fraction of People Not Working who Cannot Work due to Childcare or Housework by Age Group & Gender

(a) Women



(b) Men

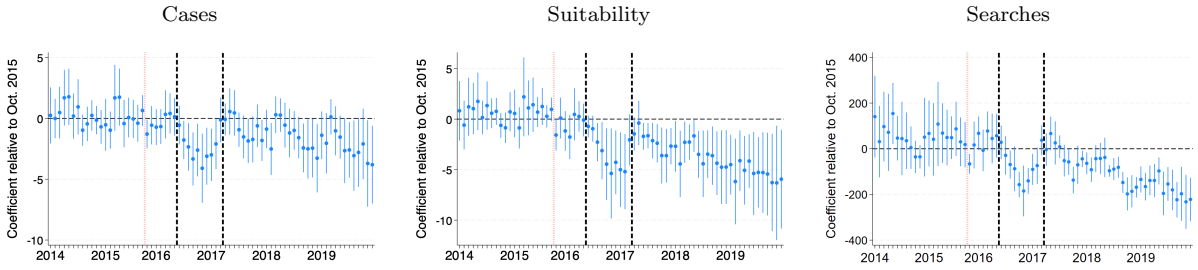


Notes. Sample is restricted to people ages 20-49 who are not working. Among the sample of people who are not working, we measure the share of this population who cannot work in the following week, if offered a job, due to childcare or housework obligations, PNAD-C, 2012-2019.

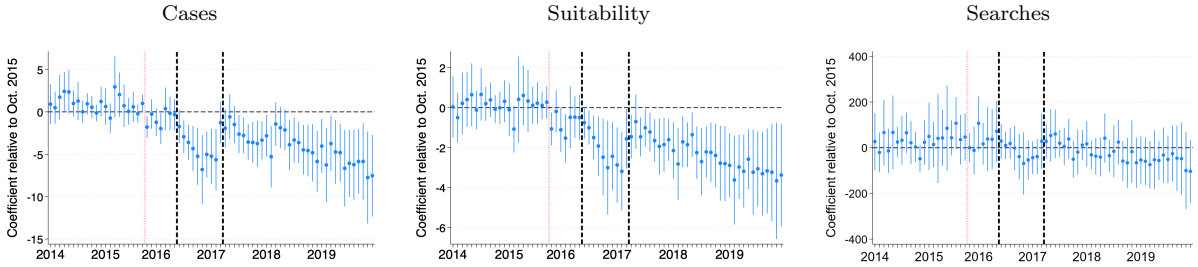
B.2 Zika's Effect on Fertility

Figure A7: Zika Impact on Monthly Births, Various Treatment Measures

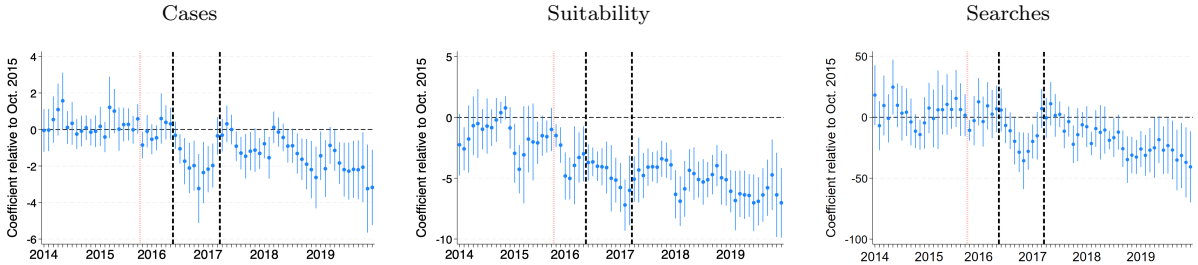
(a) Binary Indicator, Threshold 90th percentile



(b) Binary Indicator, Threshold 75th percentile



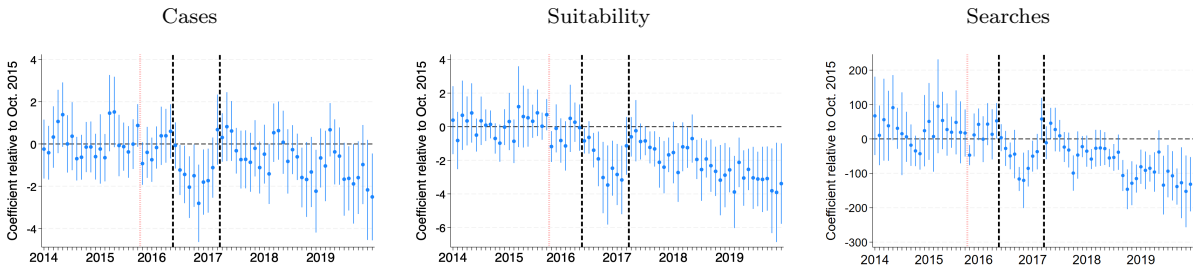
(c) Continuous Treatment Measure



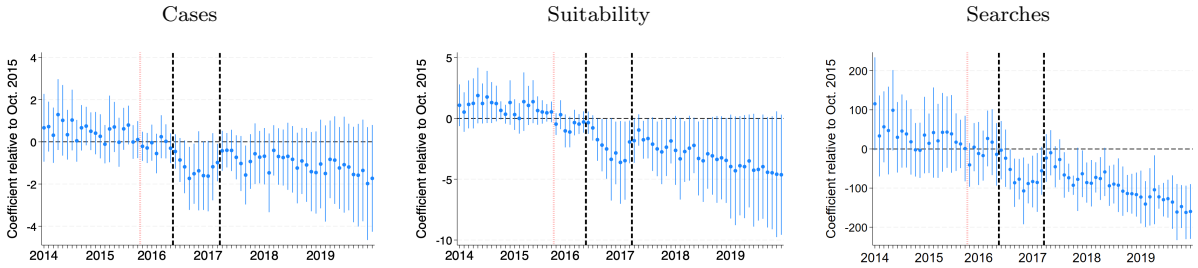
Notes. This figure compares the results from the fertility regressions using three alternative measures of high Zika intensity: a binary indicator with a threshold at the 90th percentile, a binary indicator with a threshold at the 75th percentile, and a continuous treatment measure. Searches regressions are estimated at the estrato level, while the rest are estimated at the municipality level.

Figure A8: Zika Impact on Monthly Births, By Mother's Age Group, 10 year groups

(a) Mother Aged 20–29

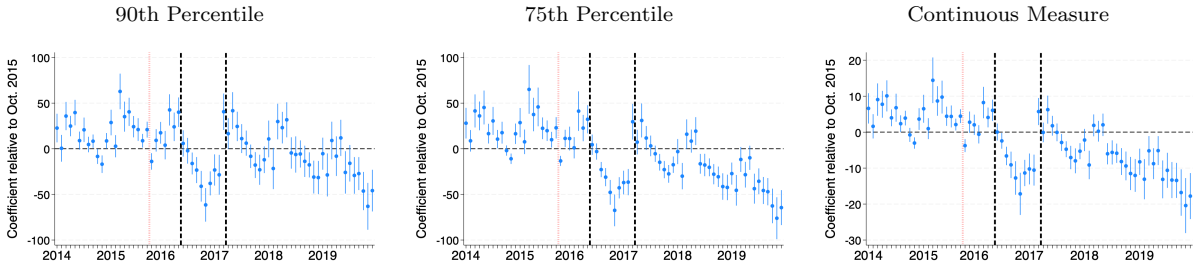


(b) Mother Aged 30–39



Notes. This figure compares the results from the fertility regressions using our preferred binary measure of Zika intensity (municipalities above the 90th percentile), estimated separately for mothers aged 20–29 (Panel A8a) and 30-39 (Panel A8b) at the onset of the epidemic, using SINASC data. Searches regressions are estimated at the estrato level, while the rest are estimated at the municipality level.

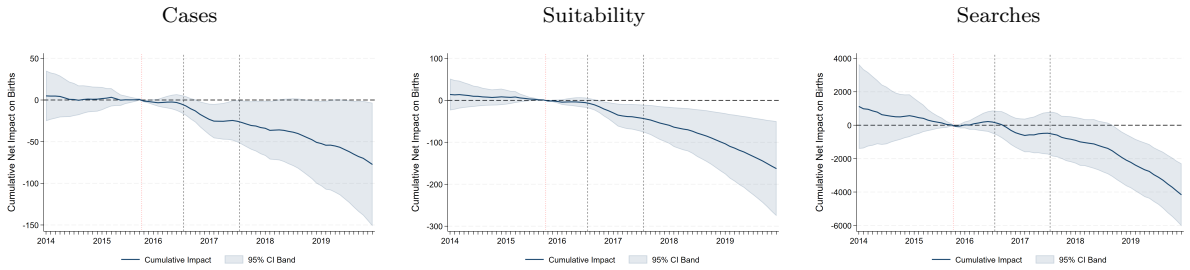
Figure A9: Zika Impact on Monthly Births, Google Searches at the Municipality Level



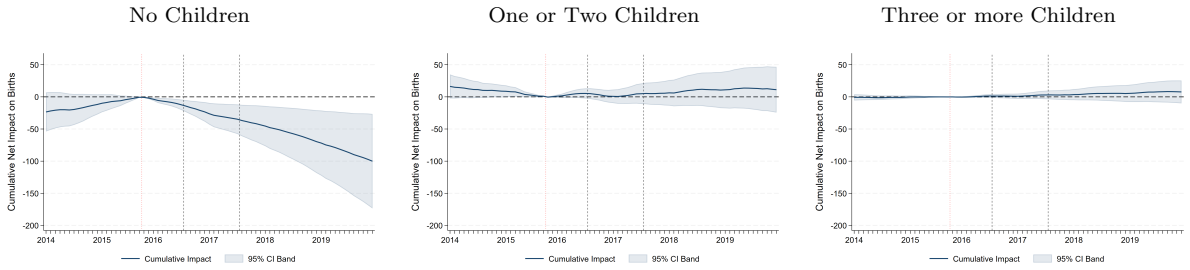
Notes. This figure compares the results from the fertility regressions using at the three threshold estimates in A7 and the Google Search measure at the municipality level.

Figure A10: Zika Impact on Cumulative Fertility

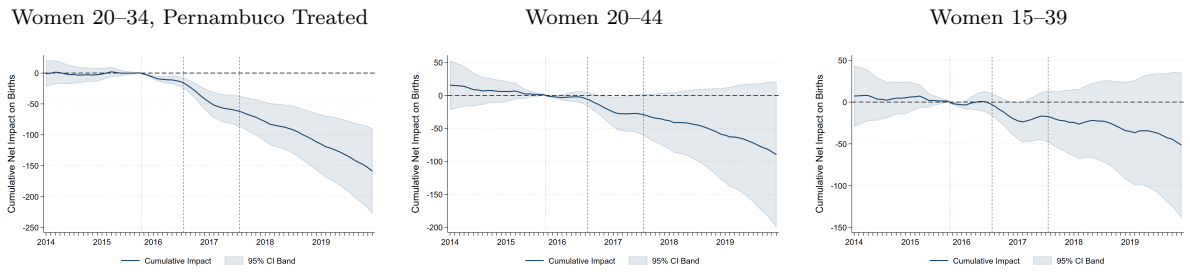
(a) Women 20–34



(b) Birth Parity



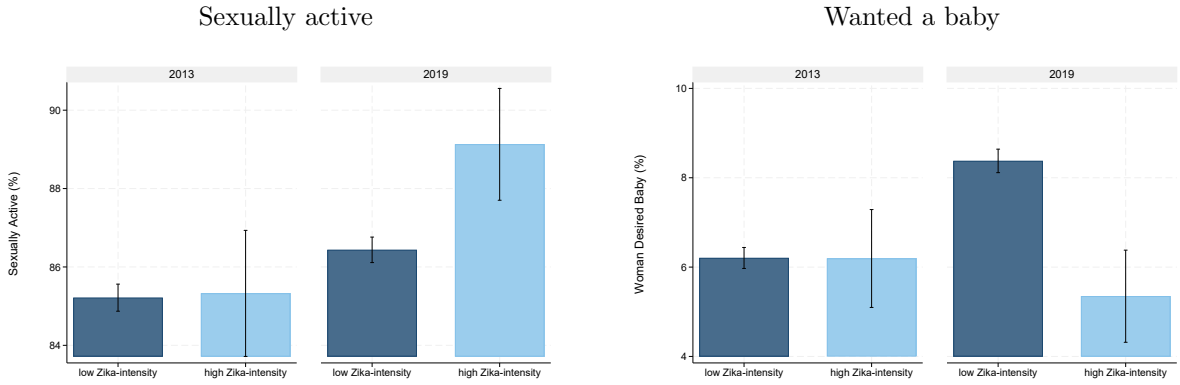
(c) Robustness: Pernambuco Treatment and Age Group (Cases Treatment)



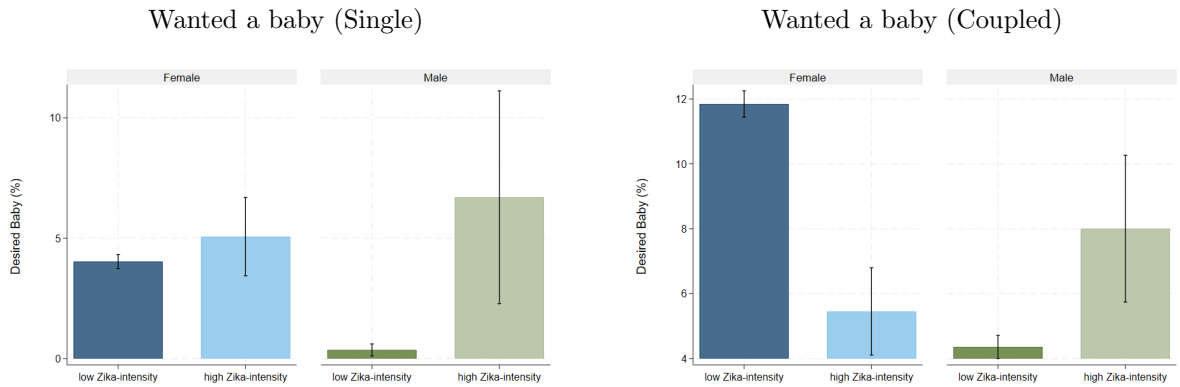
Notes. This figure plots event study estimates of the impact of Zika on cumulative fertility using birth records from the SINASC. Panel A10a shows results for women ages 20–34 in 2015 with Pernambuco omitted from the sample, using three alternative treatment measures of high Zika intensity: confirmed cases, ecological suitability, and Google searches, each defined as a binary indicator for municipalities above the 90th percentile. Panel A10b uses the preferred case-based 90th-percentile treatment measure, and shows results for women between the ages of 20 and 34 in 25 at different birth parities. Panel A10c uses the cases treatment, and the first figure plots the regression estimates on an alternative sample including Pernambuco (classified as treated). The second and third figures in Panel A10c show the estimates on cumulative fertility for women ages 20–44 and 15–44 respectively, and omit Pernambuco from the sample.

Figure A11: Fertility Preferences in High- and Low-Zika Areas

(a) Women, age 20-34, pre- and post-Zika



(b) Fertility preferences for men and women in 2019

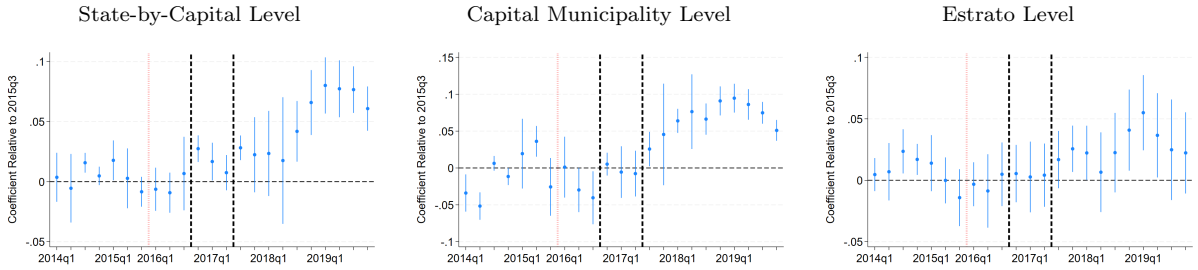


Notes. Panel (a) sheds light on how women's preferences changed in high Zika intensity areas relative to low Zika intensity areas between 2013 and 2019. In high Zika intensity areas, women were relatively more sexually active but less likely to want a baby. Panel (b) compares fertility preferences among men and women between ages 20 and 34 in 2019, in high- and low-intensity areas. Among single people as well as those in a union, men are more likely than women to want a baby in high Zika intensity areas.

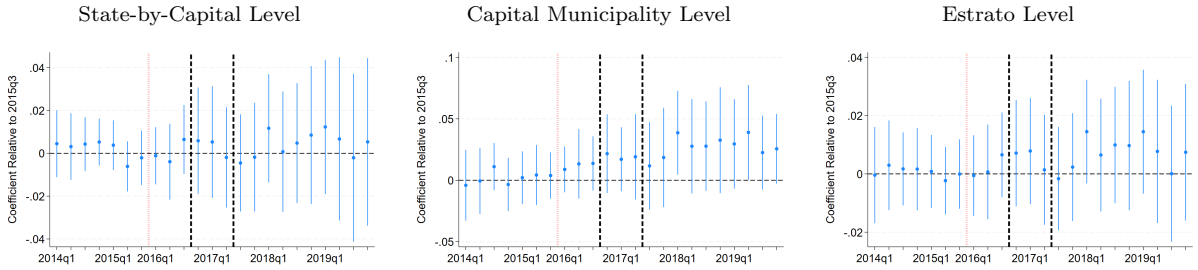
B.3 Labor-market Effects

Figure A12: Zika Impact on Employment Status, Robustness

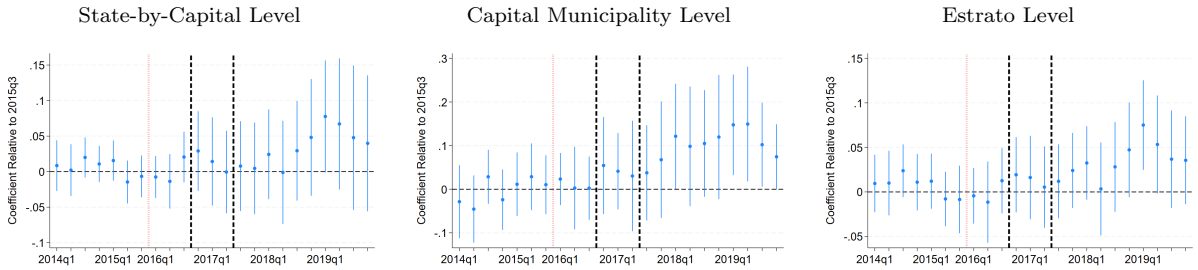
(a) Binary Indicator, Threshold 90th percentile



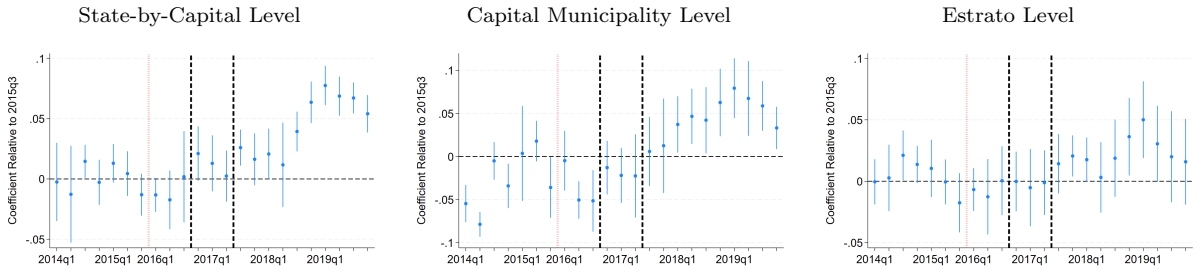
(b) Binary Indicator, Threshold 75th percentile



(c) Continuous Treatment Measure



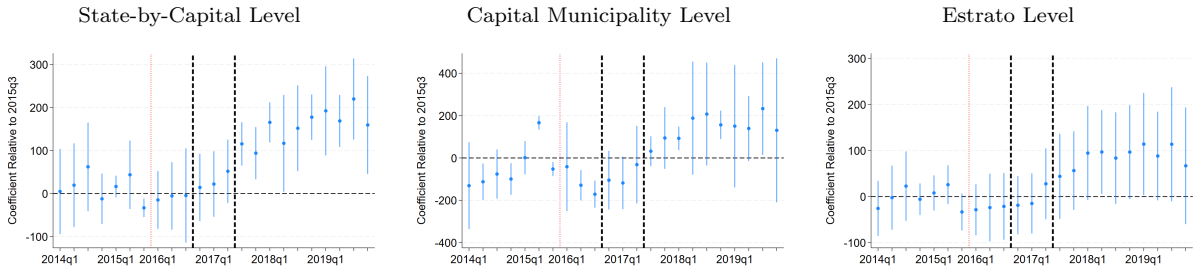
(d) Binary Indicator, Threshold 90th Percentile, With Controls



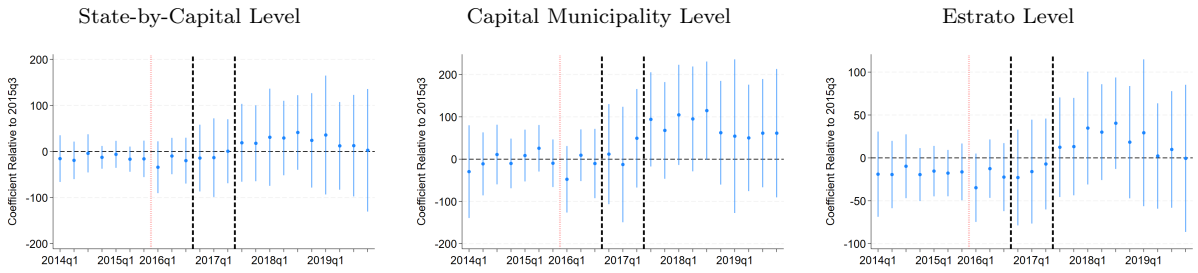
Notes. This figure shows robustness of employment labor regressions. Panels A12a through A12c use three measures of high-intensity Zika at each level of geographic variation available in the PNAD-C: our preferred binary measure with a threshold at the 90th percentile, a binary measure with a threshold at the 75th percentile, and the continuous measure. Panel A12d controls for time-by-demographic interactions for each municipality's educational structure, age structure, rural composition, and average monthly income, as measured in the 2010 census.

Figure A13: Zika Impact on Monthly Income, Robustness Across Treatment & Controls

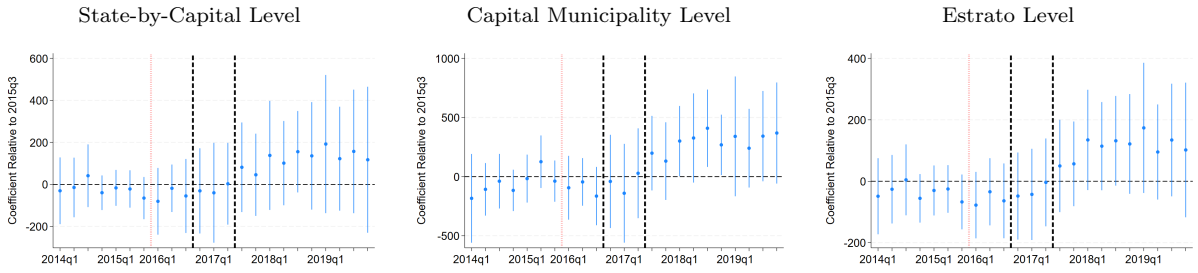
(a) Binary Indicator, Threshold 90th percentile



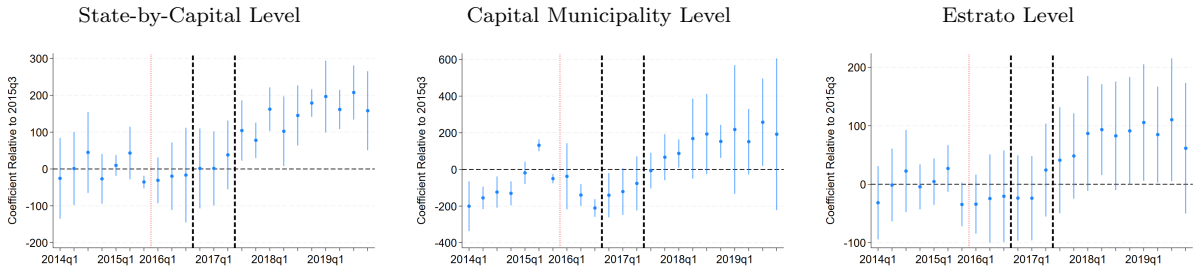
(b) Binary Indicator, Threshold 75th percentile



(c) Continuous Treatment Measure

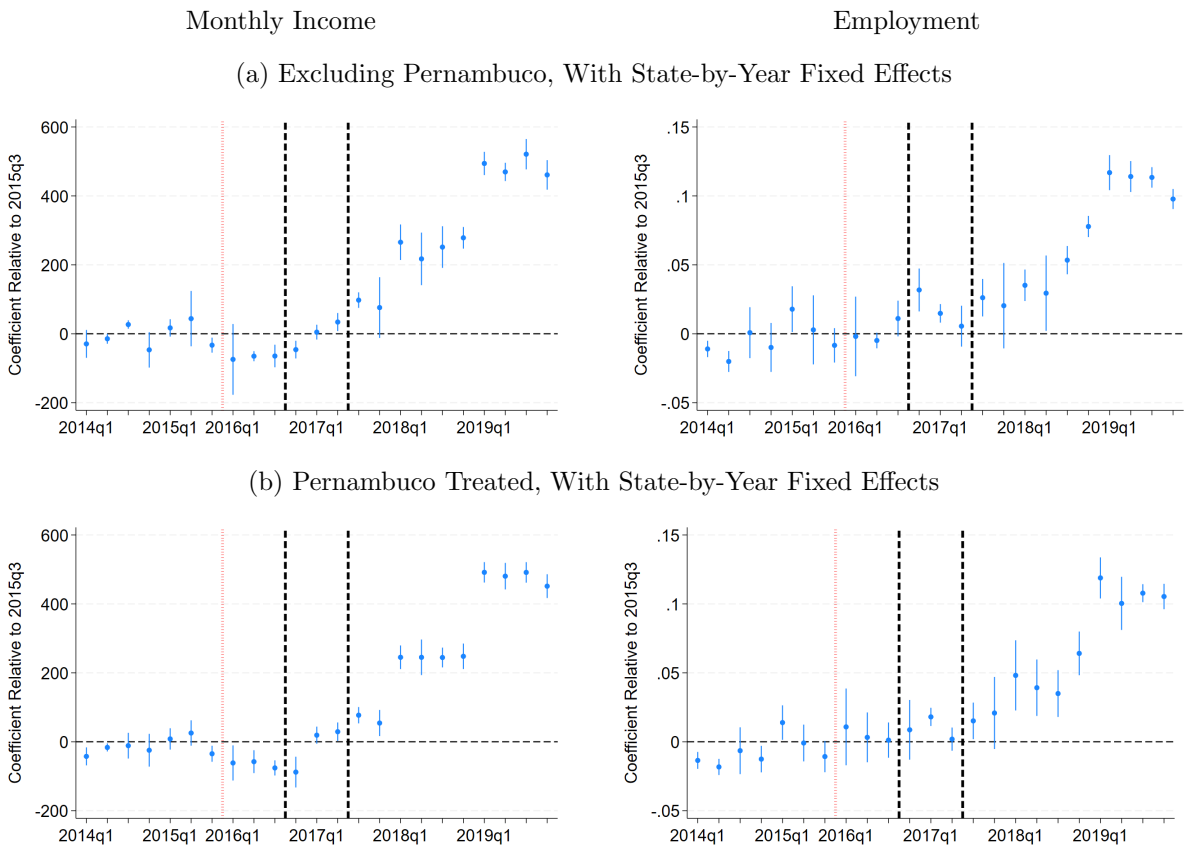


(d) Binary Indicator, Threshold 90th Percentile, With Controls



Notes. This figure shows robustness of monthly income labor regressions. Panels A13a through A13c use three measurements of Zika intensity at each level of geographic variation in the PNAD-C: our preferred binary measure with a threshold at the 90th percentile, a binary measure with a threshold at the 75th percentile, and the continuous measure. Panel A13d controls for time-by-demographic interactions for each municipality's educational structure, age structure, rural composition, and average monthly income, as measured in the 2010 census. Educational structure is the share of 20–34 year-olds who completed upper secondary schooling; age structure is the population share aged 20–34; rural composition by the share of the population living in rural areas; and average monthly income is reported directly in the 2010 census.

Figure A14: Zika Impact on Labor Outcomes, State-by-Year Fixed Effects and Pernambuco

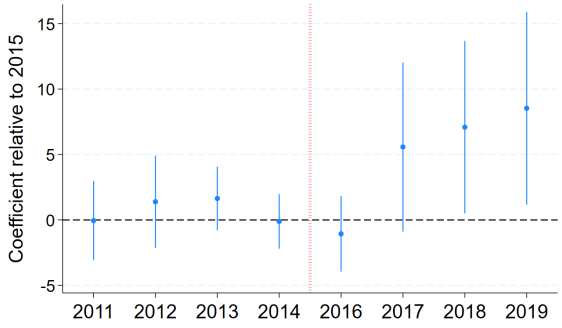


Notes. This figure shows the robustness of the labor results to including state-by-year fixed effects and to the classification of Pernambuco, using the preferred binary measure of high Zika intensity (municipalities above the 90th percentile). The left column reports estimates for monthly income and the right column for employment. Panel A14a omits Pernambuco from the sample and adds state-by-year fixed effects. Panel A15 classifies Pernambuco as treated and adds state-by-year fixed effects. All regressions are run at the state-by-capital level of aggregation.

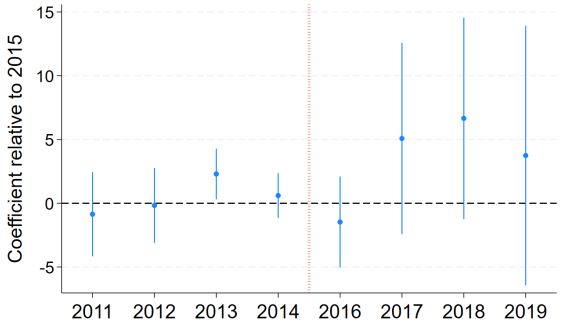
B.4 Zika's Effect on Marriage and Divorces

Figure A15: Zika's Impact on Divorce, Robustness

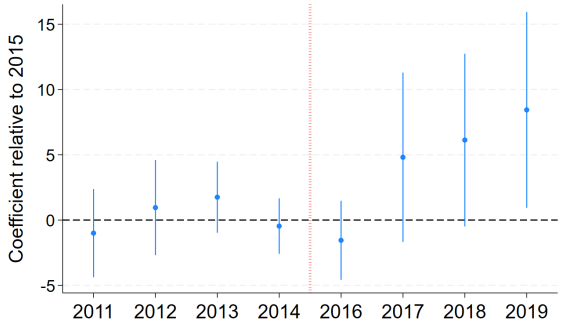
(a) Binary, Threshold 90th percentile



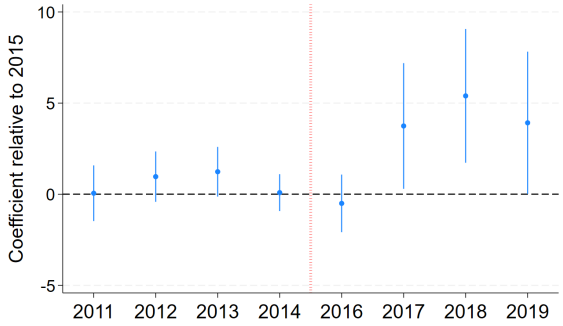
(b) Binary, Threshold 75th percentile



(c) Binary, Threshold 90th Percentile, Controls



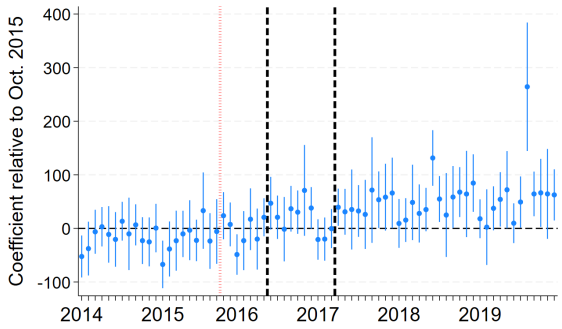
(d) Continuous Treatment Measure



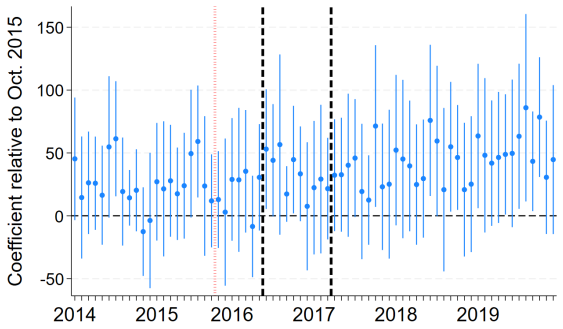
Notes. Panels A15b, A15b, and A15d vary the definition of high Zika intensity (binary indicator at the 90th percentile, binary indicator at the 75th percentile, and a continuous measure). Panel A15c uses the preferred binary 90th percentile definition and controls for differential time trends by estrato-level demographics by including time-by-demographic interactions for each municipality's educational structure, age structure, rural composition, and average monthly income, as measured in PNAD-C 2014. Educational structure is measured by the share of 20–34 year-olds who completed upper secondary schooling; age structure by the population share aged 20–34; rural composition by the share of the population living in rural areas; and average monthly income is reported directly in the 2010 census.

Figure A16: Zika's Impact on Marriage, Robustness

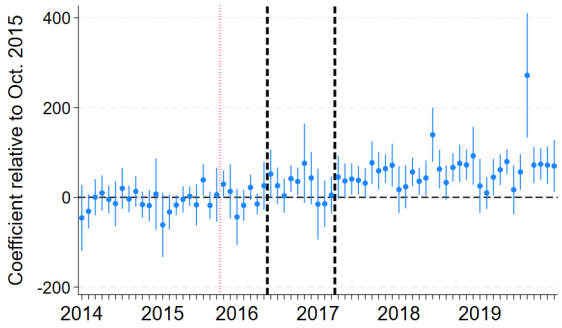
(a) Binary Indicator, Threshold 90th percentile



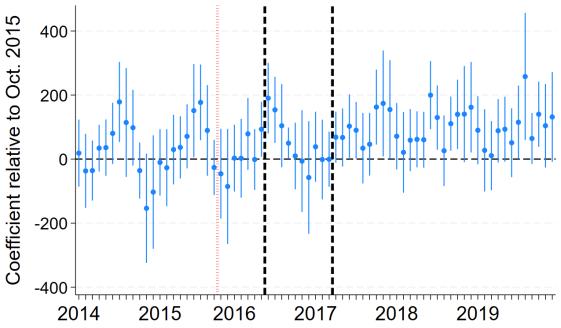
(b) Binary Indicator, Threhold 75th percentile



(c) Binary, Threshold 90th Percentile, Controls



(d) Continuous Treatment Measure



Notes. Panels A16b, A16b, and A16d vary the definition of high Zika intensity (binary indicator at the 90th percentile, binary indicator at the 75th percentile, and a continuous measure). Panel A16c uses the preferred binary 90th percentile definition and controls for differential time trends by estrato-level demographics by including time-by-demographic interactions for each municipality's educational structure, age structure, rural composition, and average monthly income, as measured in PNAD-C 2014. Educational structure is measured by the share of 20–34 year-olds who completed upper secondary schooling; age structure by the population share aged 20–34; rural composition by the share of the population living in rural areas; and average monthly income is reported directly in the 2010 census.