When Protection Fails: Effects of Military Bases on Sexual Violence in Colombia*

Felipe Parra Sakina Shibuya
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Abstract

Sexual violence committed by soldiers is ubiquitous across the world. This paper investigates the impact of military base presence on sexual violence, fertility, and child support disputes in Colombia, a nation with a recent experience of large-scale growth in military base presence. Using a dataset constructed from diverse sources, we track military base locations across Colombian municipalities from 1998 to 2016. Employing an event-study approach, we identify the causal effects of military bases on host communities. Our findings reveal that the presence of military bases significantly increases sexual violence, with a 72% rise in registered cases over the course of 16 years after the introduction of a military base. Despite this increase in sexual violence, we find no significant changes in fertility or child support disputes. These results are not driven by changes in population or security conditions. This study advances the literature on conflict-related sexual violence and the broader consequences of military base presence on local populations.

*Parra: University of Wisconsin-Madison. parraescobar@wisc.edu. Shibuya: University of Wisconsin-Madison. Corresponding author. sshibuya2@wisc.edu. We are indebted to Laura Schechter for continued guidance on this project. We thank Juliana Londoño, Corina Mommaerts, Priya Mukherjee, Fernanda Rojas-Ampuero, and Maria Fernanda Rosales-Rueda for helpful comments and discussions. We also thank participants at the Agricultural and Applied Economics (AAE) department workshops and seminars, PacDev 2024 and SITE 2024. We are grateful to Paola Corredor for her assistance in data collection. We also benefitted from research travel grants from the AAE and the Graduate School at the University of Wisconsin-Madison. All errors are our own.

1 Introduction

War and sex are inextricably linked, a connection that extends beyond the use of sexual violence as a weapon against combatants and civilians on the enemy side. Media reports from Colombia reveal multiple cases where soldiers of the country's army sexually assaulted female civilians, often minors, during the half-century-long armed conflict and the subsequent peacetime since 2016 (Reuters, 2020; Oquendo, 2020; Turkewitz, 2020). Recognizing the weight of the issue, the Colombian government has recently established a special judicial committee to handle conflicted-related sexual violence committed by all parties, including the public forces (JEP, 2023a).

Sexual abuse and violence by soldiers are common worldwide. Examples range from Union soldiers' sexual assaults on civilian women in the South during the American Civil War to government soldiers' raping of civilian women in their homes and internal refugee camps in the Democratic Republic of Congo (Barber and Ritter, 2015; Human Rights Watch, 2014).[1] While individuals of any sex, sexual orientation, and gender identity can be affected, women and girls are disproportionately the victims of known sexual violence in conflict and post-conflict settings[2] (Cohen et al., 2013).

This paper addresses the question: *What are the consequences of soldier presence for host community women?* We conduct our analysis in the context of Colombia, a country with a long history of civil conflict, where army soldiers have been accused of sexual violence against civilians. First, we examine the effects of soldier presence on sexual violence. We then investigate fertility and child support disputes, as consequences of sexual violence may manifest as changes in these outcomes. Understanding the relationship between soldier presence and sexual violence is particularly important because recent studies have shown that female victims can face lasting economic consequences (Sabia et al., 2013; Adams-Prassl

[1] Bastick et al. (2007) provide a comprehensive summary of countries with civil conflicts in which soldiers of official forces commit sexual violence against civilians.

[2] Annual reports analyzing cases of conflict-related sexual violence globally from 2019 to 2023 consistently show that over 94% of victims are female (United Nations Secretary-General, 2020, 2021, 2022, 2023, 2024).

et al., 2024; Adams et al., 2024).

To estimate the causal effects of soldier presence, we address two significant empirical challenges. The first is the scarcity of comprehensive data on soldier presence across time and space.[3] We overcome this limitation by constructing a novel dataset on military base presence in Colombia. This dataset is compiled from diverse sources, including newspaper articles, the army's organizational charts,[4] historical records, congressional reports, and legislative documents. Our dataset provides a unique perspective, indicating the presence of army bases at the municipality-year level from 1998 to 2016. It's worth noting that our dataset differs significantly from the military structure dataset constructed by Acemoglu et al. (2020). While their dataset indicates brigade jurisdictions (each encompassing multiple municipalities), our dataset tracks the specific municipality locations of army brigade and battalion headquarters. This granular approach provides a more precise measure of military presence.

Second, the causal identification of the effects of base presence is difficult because military bases were placed non-randomly according to the Colombian government's wartime strategies and the dynamics of the war. We take advantage of the temporal and geographical variation in the introduction of military bases during the massive military expansion from 2000 to 2016. Specifically, we take an event-study approach with three specifications to identify causal effects of military base presence. The first specification is the classical two-way fixed effects model with municipality and year fixed effects to account for both time-invariant municipality characteristics and yearly trends in the outcomes. The second specification modifies the first method by including division jurisdiction-year fixed effects, instead of year fixed effects to control for the aggregate economic and conflict dynamics that affect both the presence of military bases and the outcomes.

The OLS estimations do not effectively address the staggered introduction of military

[3]We requested complete historical records on the location of army bases from the Ministry of Defense, but our request was denied.

[4]While our official request was denied, some snippets of official records are available online, particularly on the Internet Archive's Wayback Machine (`https://web.archive.org/`).

bases (de Chaisemartin and D'Haultfœuille, 2022; Goodman-Bacon, 2021). Thus, the third specification uses the de Chaisemartin and D'Haultfœuille (dCdH) estimation to account for the variation in the timing of military base introduction (de Chaisemartin and D'Haultfœuille, 2024). Our analysis of the pre-treatment trends reveals that the OLS estimations tend to overestimate the effects of military base presence on sexual violence. This is due to the negative weight issue, which stems from the comparison between the switchers (which change from not having a military base to having one) to the non-switchers (which already have a base). Our preferred methodology is the dCdH estimation.

We find evidence that the presence of military bases increases the rate of sexual violence per 100,000 people, based on cases registered at the Colombian Office of the Attorney General. Our analysis indicates that the presence of military bases increases the number of sexual crime cases by 72% over the course of 16 years after the base year, relative to the control mean. Furthermore, bases with more drafted soldiers, rather than highly trained, well-paid, volunteer soldiers, seem to drive this increase in sexual violence. While we find a statistically significant increase in registered cases of sexual violence, we find no evidence of an increase in indictments. This discrepancy hints, first, that increased reporting does not necessarily lead to increased prosecution. Second, increased state presence in the form of military bases may not affect local judicial capacity to prosecute sexual crimes. Despite the increase in sexual violence, we find no evidence of change in fertility and child support disputes.

The increase in sexual violence could be attributable to changes in population and security conditions, both of which could also be altered by the presence of military bases. Furthermore, the uptick in sexual violence could also be due to the presence of non-state armed actors, rather than army soldiers. To address these concerns, we conduct a series of mechanism checks. We find no change in population and security due to the presence of military bases. However, we lack the data to directly measure the presence of non-state armed actors. Therefore, we cannot provide a direct test of the hypothesis that the increase in

sexual violence is due to the presence of non-state armed actors, rather than official soldiers. It is now known that some units in the army have closely worked with illegal paramilitary groups to combat left-wing guerilla groups, implying that base presence can coincide with paramilitary soldier presence. Therefore, we cannot rule out the possibility that the increase in sexual violence is due to the presence of paramilitary soldiers, rather than official soldiers.

Our paper contributes to two strands of literature. First, we extend the literature on the drivers of conflict-related sexual violence by causally linking the presence of state armed forces to sexual violence. In examining the determinants of conflict-related sexual violence, political scientists have described sexual crimes by state actors.[5] Cohen and Nordås (2014) compiled data on conflict-related sexual violence across the world from 1989 to 2009, revealing that state actors are more frequently reported as perpetrators of wartime sexual crimes than non-state armed actors such as insurgency groups. Similarly, Leiby (2009) also reports that the great majority of sexual violence cases in Guatemala and Peru are attributed to the public forces. Our paper builds on these findings by providing causal estimates of the impact of state military base presence on sexual violence.

Second, this paper contributes to the literature on the effects of military bases by focusing on sexual violence, an area that has been largely overlooked. While most studies on base placement come from military science and strategic studies, offering qualitative explorations of political, social, and environmental effects, economic research has primarily examined the impact of base closures on local economies in the U.S. and Europe. These studies have generally found no significant effects (Andersson et al., 2007; Paloyo et al., 2010), although Zou (2018) observed a decline in civilian employment in German communities following American base closures. Booth (2003) provides valuable insights by examining the effects of military bases on women's wages; however, the interpretation of the results may be

[5]Nordås and Cohen (2021) provide a comprehensive review of the political science literature on this topic. Two recent economics studies have expanded the understanding of the causes of conflict-related sexual violence. Guarnieri and Tur-Prats (2023) attribute the intensity of sexual violence to gender norms in 33 ethnic civil wars in Africa from 1989 to 2009. Fourati et al. (2022) use the volatility in international gold prices to explain how armed groups use sexual violence to extract labor from local communities for mining labor-intensive resources such as gold.

influenced by omitted variable bias and reverse causality. While historians have examined the consequences of military bases, particularly those of foreign origins, on the sex trade, economics studies on this topic are rare. Among the few economics studies, Brodeur et al. (2017) use structural estimation to link U.S. military presence to the expansion of Thailand's sex industry. Our paper contributes to this literature by examining the effects of the presence of soldiers on civilians where they both belong to the same nation, and by focusing on sexual violence.

The remainder of this paper is structured as follows: Section 2 describes the military expansion in Colombia that began in 2000, leading to the establishment of numerous new military bases. Section 3 presents a conceptual framework outlining the mechanisms through which military base presence could affect sexual violence, fertility, and child support disputes. Section 4 details our data sources and construction method, and describes the municipalities in our sample. Section 5 discusses our empirical strategy for identifying the causal effects of military base presence. Section 6 presents our results and discusses their robustness. Finally, Section 7 concludes with a summary of our findings and their implications.

2 Context

2.1 The Colombian Conflict: Military Expansion in the 2000s

From the end of the 1990s to the beginning of the 2000s, Colombia faced confrontations with numerous armed groups. In response, President Andrés Pastrana rekindled the country's relationship with the United States to receive military support; notably, this shift aligned with U.S. policy trajectories in the War on Drugs (Ruiz, 2001). From 2000 onward, U.S. military support to Colombia, primarily to counter narcotics, swelled under the banner of Plan Colombia. In 2002, President Álvaro Uribe continued military expansion under his Democratic Security Policy, targeted at augmenting the state's influence in areas experiencing the

presence of non-state armed actors.[6]

Through Plan Colombia, the United States provided helicopters, weapons, ammunition, vehicles, and training to modernize the Colombian Army and increase its readiness for unconventional guerilla warfare (GAO, 2008). The material and financial assistance drastically amplified the prowess of the Colombian armed forces, particularly the army –the country's largest military branch –by increasing both its size and the capacity of its personnel. Between 2000 and 2008, the size of ground forces increased by 50% as a result of the U.S. support of over US$104 million (GAO, 2008).

The army added new brigades and battalions to accommodate this expansion, building new bases all across the country. Once the government authorized the establishment of a new base, soldiers were deployed almost immediately to the area, without waiting to build a physical facility. Given the great need for new military bases due to the intensity of the war in the 2000s, soldiers initially camped in the area designated for the new base, while they worked on missions, which often included building the new facility. Figure 1 illustrates this expansion. The number of municipalities with military bases increased from 69 municipalities in 1998 to 145 municipalities in 2016. This expansion is spread all across the country, as shown in Figure A1.

We define the term *military base* to mean the physical main center of either a brigade or battalion. To further explain the nature of brigades and battalions, we first briefly discuss the organizational structure of the Colombian National Army, and then describe the soldiers staffing these units.

2.2 National Army of Colombia

At the top of the army hierarchy are the commander and second commander of the army in Bogotá, who directly preside over ten *divisions*.[7] Each division typically has two to five

[6]Figure A2 plots U.S. military aid through the State and Defense Departments, highlighting a pronounced rise from 2000 over a 15-year span.

[7]Figure A3 shows the organization of the Colombian National Army during our analysis period.

brigades. A brigade usually consists of two to five *battalions*. A battalion typically consists of about five companies. Each company is generally staffed with around 800 soldiers. This indicates that a brigade base can have anywhere between 8,000 and 20,000 soldiers, while a battalion base can have around 4,000 soldiers on the premises.

There are two different kinds of brigades (standing and mobile) and two different kinds of battalions (standing and counterinsurgency). These units vary in terms of the types of soldiers and strategic purposes, as explained in the rest of this subsection. We use these differences in our statistical analysis to explore the potential heterogeneity of the effects of military base presence and their mechanisms.

Standing brigades and battalions Standing brigades and battalions are military units commonly present in regular armies. These units have a fixed location and territorial jurisdiction that rarely varies over time. These brigades and battalions are mainly staffed with conscripted soldiers, known as *basic soldiers*, who serve a mandatory minimum of 18 months up to 24 months.[8] Members of these units are usually assigned to protect roads, electrical systems, and other infrastructure that could be targeted by non-state armed actors. In addition, these brigades and battalions carry out counterinsurgency operations locally, which are mostly conducted by basic soldiers (Dávila, 1999).

Mobile brigades and counterinsurgency battalions Mobile brigades and counterinsurgency battalions specialize in guerrilla warfare. They are the main human resources that the army uses to fight against non-state armed actors. These units are predominantly staffed by *professional soldiers* who, after completing the mandatory 18 months of military service, receive substantial and periodic training and are provided with significant compensation and health benefits, serving for up to 20 years (Human Rights Watch, 1993). Because of the dif-

[8]Colombia's conscription system requires all male citizens aged 18 to 24 to serve in its armed forces, with some exceptions. Female citizens may participate voluntarily (Suarez, 2023). This means that the great majority of soldiers at the military bases considered in this analysis are young men.

ferences in age and training, professional soldiers typically are better educated than drafted soldiers.

The reinforcement of the army through increasing mobile brigades and counterinsurgency battalions is the centerpiece of the military restructuring that took place during the period under study. The army needed well-trained and disciplined soldiers to confront guerrilla and paramilitary groups in unconventional combat settings in the mountains and jungles of Colombia. As a result, soldiers in these units often move between battle zones for extended periods.

Basic and professional soldiers As described above, there is a substantial difference between the basic and professional soldiers staffing the two broad categories of military units. Both soldier types are deployed to and reside on various military bases across the country. Both basic and professional soldiers can be transferred to multiple bases during their terms. However, professional soldiers, being more highly trained, tend to be transferred more frequently depending on military needs. This section explains the key differences between these soldier categories and describes their deployment and compensation patterns.

Professional soldiers normally go through an operational cycle. They start with a three-week training period before being deployed to the field. These trainings are not conducted on their bases but at various training centers. After this phase, soldiers are sent to conduct military operations for three to four months. The deployment period is followed by a rest phase of three weeks, during which soldiers usually go back to their places of origin to visit their parents, families, and friends.

Meanwhile, basic soldiers follow a different pattern of field deployment. The compulsory military service starts with a training phase of 10 weeks, followed by a specialization period spanning 6 to 8 weeks. After this training period, basic soldiers rest for two weeks, during which they are allowed to leave the military base. Once they return, soldiers are deployed to the field for a period ranging from 12 to 14 months. During this time, basic soldiers

follow the same operational cycle as professional soldiers. According to current and retired army officers, military units usually assign basic soldiers to the protection of fixed positions (i.e., military bases and infrastructure such as roads and electrical grids). Their operational cycle finishes with an adaptation-to-civilian-life phase, where they take technical courses to facilitate their reintegration into the labor force.

Both basic and professional soldiers follow a strict set of disciplinary rules while living on military bases. Naturally, their movement in and out of the bases is restricted. All soldiers must obtain permission from their superiors to leave their bases, which is granted only in special circumstances, as officers expect soldiers to attend to personal matters during their rest periods. Meanwhile, soldiers are allowed to invite guests to their bases on Sundays, if local security conditions permit. Guests are not limited to immediate families; therefore, soldiers can invite their sexual partners. Army officers mentioned that sometimes non-single professional soldiers are allowed to visit their partners outside their bases and are not limited to the regular Sunday on-base visit.

The most important difference between these two categories of soldiers, in terms of this project, is compensation. Just on the basis of monthly compensation, professional soldiers are paid over 800% more than basic soldiers.[9] Furthermore, professional soldiers, as employees of the army, receive a comprehensive package of benefits, including seniority bonus, annual service bonus, vacation bonus, Christmas bonus, travel allowances, vacation entitlement, severance pay, housing benefits, family subsidy, and burial expenses.[10] Because they also receive uniforms and necessities while living on the bases, much of these earnings are disposable income, especially when they are single.

To illustrate the difference in compensation, we compare the approximate annual compensation of hypothetical basic and professional soldiers in 2010, with a legal minimum monthly wage of US$7.22 (Datosmacro, 2022). The basic soldier's annual compensation was

[9]Table A1 provides a comparison of compensation by soldier class.
[10]TableA2 describes these benefits in detail.

approximately US$215.[11] Meanwhile, the annual total compensation for the professional soldier, inclusive of annual service, vacation, and Christmas bonuses, was about US$2,231 if single, and US$2,311 if married.[12] In summary, professional soldiers earn approximately 10 times more than basic soldiers.

While we unfortunately do not have data on the composition of army soldiers by rank, the 2007 Ministry of Defense report provides some insight. In 2007, the report states that professional soldiers represented about 39% of the army's soldiers, while the remaining composition included regular soldiers (48%), village soldiers (12%), and bachelor soldiers (1%), all of which are categorized as basic soldiers (Ministry of Defense of Colombia, 2007). Clearly, the basic soldier class dominates in number, though the professional soldier class had a significant presence.

3 Conceptual Framework

The introduction of a military base in a municipality can be characterized as the arrival of a group of young men who are visible outsiders in uniforms, associated with the central government through their membership in the army, and who have a regular, albeit small, monthly cash inflow. Their presence can affect host community women through various channels, including non-consensual and consensual sexual relations, which can then manifest as changes in sexual violence, fertility patterns, and child support disputes. This section describes the mechanisms through which base presence can influence these outcomes.

Non-consensual sexual relations Sexual violence can increase with the presence of soldiers. This can occur either when such violence is used strategically as a weapon of war and a means to assert power, or as a result of the lack of discipline within the military forces

[11] US$17.92 * 12 months = US$215.04.

[12] If single, US$165.29 (monthly salary) * 12 months + US$82.65 (annual service) + US$82.65 (vacation) + US$82.65 (Christmas) = US$2,231.43. The annual family subsidy of US$79.34 is added if the professional soldier is married.

(Nordås and Cohen, 2021).

Demographic change Base presence can induce demographic changes through migration and alterations in sex ratios. Job creation may attract migrants from other municipalities, who then have children. For example, in the American context, Zou (2018) finds that the contraction of military personnel increases outward migration and discourages inward migration due to civilian job losses.

Changes in sex ratios can influence local dating markets. Using exogenous variation in immigrant sex ratios, Angrist (2002) estimates that a higher male-to-female ratio leads to higher marriage rates and lower female labor force participation among children of existing immigrants.

Furthermore, demographic changes may affect crime and sexual violence rates. In China, a male-skewed sex ratio triggered by the one-child policy has contributed to increased rates of violence and property crimes (Edlund et al., 2013). Conversely, in Rwanda, a female-leaning sex ratio imbalance due to the 1994 genocide likely contributed to a decline in female bargaining power, leading to increased domestic violence against women (La Mattina, 2017).

Security effects Base presence was intended to improve security in various parts of the country. Changes in actual and perceived security levels can, in turn, affect local people's reproductive preferences and the crime environment. Economic theory suggests that mortality can affect fertility by changing the cost of producing a surviving child (Becker, 1992). High mortality may necessitate higher fertility to increase the probability of having a surviving child.

Meanwhile, intensified conflict may indicate the presence of individuals with violent intentions, other than soldiers. There also may be perceived opportunities for criminal activities due to the resulting chaos, potentially leading to increased sexual violence.

Economic Effects Establishing a military base can be thought of as a public work. While we know that soldiers moved in quickly to a newly established base with tents and temporary housing, more permanent buildings were often built later on. While soldiers, especially drafted soldiers, work on the construction as well as maintenance of base facilities, local people are often hired for such tasks. Moreover, the base creates demand for local goods and services to sustain the soldiers.

By increasing local income through job creation and economic activities, base presence can affect fertility, though theories are ambiguous about the direction of this relationship (Jones et al., 2008). On one hand, higher income may increase the demand for children as normal goods. On the other hand, it can potentially decrease fertility as the opportunity cost of parents' time increases, leading them to prefer fewer and "high-quality" children (Becker, 1992). Empirical literature on the topic generally suggests a positive causal relationship between men's income and fertility (Doepke et al., 2023).

In the U.S. context, where military bases have a more significant presence in host communities than in Colombia, Zou (2018) finds that a reduction in military personnel led to an average loss of 1.2 civilian jobs for each loss of a military person. However, it is crucial to emphasize that the Colombian context during our study period differed dramatically from the U.S., as Colombian communities existed in the volatile environment of armed conflict.

4 Data

One of the key contributions of this paper is the development of a unique municipality-level dataset on the presence of military bases. This dataset, crafted from national and local newspaper articles, covers the period between 2000 and 2010, and has been expanded through additional research up to 2016. In analyzing fertility, we utilize comprehensive birth certificate data spanning from 1998 to 2016.

4.1 Treatment Data: Military Bases

We obtain the data on military base presence from national and local newspaper articles published between 2000 and 2010.[13] We obtained these articles from the newspaper database called Digital Press Archive, offered by the Popular Research and Education Center/Program for Peace (Cinep/PPP). The database provides access to over 700,000 digitized publications from 10 national and regional press sources since 1997, categorized into five groups: 1) church and conflict, 2) politics and government, 3) drug trafficking, 4) society and culture, and 5) ecology and environment. A sub-category, armed conflict and actions for peace, makes the database particularly relevant for this project. We used two keywords to narrow our search for relevant articles; brigade (*brigada*) and battalion (*batallón*). Thus, our military base data come from approximately 11,000 scanned newspaper articles that contain the words brigade and/or battalion, published from January 1, 2000 to December 31, 2010. We then used Google Cloud Vision to detect texts in the scanned articles. We used the combination of ChatGPT and human detection to construct a municipality-year panel dataset that indicates the geographical and temporal existence of brigades and battalions, as shown below. We describe this process in detail in Appendix A.4.

4.2 Outcome Data

In this section, we discuss the sources of the outcome data and the construction of the outcome variables. Table A4 provides an overview, including the available years for each data source, and the years that overlap with the treatment data years and therefore are used in the current paper.

Fertility Data We sourced our fertility data from Colombia's complete set of birth certificates, provided by the National Department of Statistics (DANE). This dataset includes

[13]The ideal source for this information would be a legislative document detailing the opening or closure of military units. We requested these documents from the Ministry of Defense of Colombia, but our requests were denied multiple times.

detailed information on births, maternal and paternal attributes, and miscarriages from 1998 to 2022. To estimate pregnancy rates across Colombian municipalities, we used these data from 1998 to 2016 to first obtain the *number of conceptions*. We define the date of conception by subtracting 10 months before the date of delivery, the average gestation period in Colombia.[14] We then divide the number of conceptions by age-appropriate population to obtain pregnancy rates.

The availability of maternal and paternal characteristics is more comprehensive for completed pregnancies but limited for pregnancies that ended in fetal death. In particular, we do not observe fathers' age or pregnancy history for unsuccessful pregnancies. Thus, we only count successful pregnancies for those analyses that use these data. However, we believe this does not limit the regression exercises in any substantial way, since unsuccessful pregnancies constitute only 3.7% of the whole data.

Demographics Data We use the population projection data calculated by the DANE based on the National Census of Population and Livelihood *Censo Nacional de Población y Vivienda*. The population data are available from 1995 to 2026 by age and sex. We use these data from 1998 to 2016 in our analysis and also calculate the sex ratio.

Sexual Violence and Child Support Lawsuits Data We obtained the data on sexual crime and child support lawsuits recorded between 2000 and 2021 from the Office of the Attorney General of Colombia, which collects information on all lawsuits in the country through its mandate to investigate crimes, prosecute offenders, and review judicial processes. A case is registered in the institution's system when either an investigation is opened by the office itself or a person reports an incident to a police station or the Attorney General's Office. There are two types of cases in this administrative database. *Registered* cases, or

[14]The average gestation period is based on vital statistics showing that approximately 98% of pregnancies last longer than 9 months but less than 10 months. Additionally, the national average gestation length in Colombia is 38.82 weeks, or 9.71 months (Pinzón-Rondón et al., 2015).

procesos in Spanish, are those where the office acknowledges the existence of such reported cases. *Indicted* cases, or *indiciados*, are those for which suspects are formally accused by the office.

The 2000-2010 dataset that we received was already aggregated by the specific law violated (related to sexual crimes and child support) by year and municipalities where crimes were reported to have occurred. These data only contain the number of cases per law per municipality per year. Unfortunately, we do not have any further information about these cases, such as the sex of the denouncers and the accused. We then counted the numbers of registered and indicted cases of all sexual crimes and child support violations in this dataset for each municipality in each year. The 2009-2021 dataset that we obtained was also aggregated, but by specific law violated. We took this dataset and counted the numbers of registered and indicted cases of sex crimes and child support violations for each year and municipality of the event. In addition to the counts of sex crime and child support cases, we also calculated the cases per 100,000 inhabitants by dividing the counts by the annual municipal population.

There are two things to note about the judicial data on sexual crimes. First, we believe that the data from the Attorney General's Office is the most comprehensive for this context, though sexual crimes are notoriously under-reported in many contexts, including the current context of the Colombian armed conflict. There are other data sources on sexual crimes in Colombia, such as diagnostic records from the Ministry of Health, which have reported doctors' assessments of potential sexual violence since 2004. However, we were not granted access to the data before 2009, and chose to use the judicial dataset because it has the broadest temporal coverage and does not suffer from under-reporting any more than other data sources.

Second, we consider the sexual crime outcomes as "women-related" in this particular context, because the overwhelming majority of known sexual crime cases involve women as victims. Investigations conducted by Colombian government agencies concluded that 85-

89% of reported cases of sexual violence involved women and girls (JEP, 2023b; Amnesty International, 2011). At least one of these investigations also analyzed the data from the Attorney General's Office used in this paper. Therefore, we believe that the great majority of sexual crime cases counted in our dataset also involved women and girls.[15]

Violence and Security We obtained the number of cases of homicide, intimidation, terrorism, kidnapping, and forced displacement from 1993 to 2019 from the Conflict and Violence module of the Municipality Panel dataset compiled by the Center for Economic Development Studies at the University of Los Andes. We combine the data from 1998 to 2016 with the population data to calculate the rate of each of these forms of violence per 100,000 inhabitants.

4.3 Characteristics of Municipalities in the Sample for Analysis

Table A3 presents the number of unique municipalities included in our analysis for each year from 1998 to 2016, ranging from 1,089 to 1,111 municipalities. As of 2024, Colombia comprises a total of 1,123 municipalities. Our study excludes certain areas for specific reasons:

1. We omit the municipalities of San Andrés and Providencia, which are small islands in the Caribbean Sea, because they had no army brigade or battalion during our study period.

2. We also exclude the seven major cities: Barranquilla, Bogotá, Bucaramanga, Medellín,

[15] We acknowledge that sexual violence impacts people across all gender identities and sexual orientations, not just women. Gender and sexual minorities face targeted violence that is even less likely to be captured in official crime registries. This is partially due to the relatively small population size of these groups, but also due to widespread under-reporting stemming from stigma around non-traditional sexuality and gender expressions. While we do not have data to quantify this, we are aware that such cases against gender and sexual minorities were perpetrated by non-state armed groups, in particular, during the conflict (Colombia Diversa et al., 2015). The official statistics on sexual violence are likely an underestimate, especially for those whose identities lie outside of the male/female binary categories.

Cali, Cartagena, and Cúcuta. These cities are outliers in terms of population size and have a large number of military institutions, including many specialized units that differ significantly from standard brigades and battalions in terms of soldier composition and function.

These exclusions ensure that our analysis focuses on municipalities that are more representative of the typical Colombian context and have comparable military presence.

Table 1 describes the basic characteristics of all municipalities in the sample for analysis in the earliest year of data availability, before the large-scale military expansion occurred. It compares the average characteristics of municipalities that had at least one military base during the analysis period to those that have never had a military base. Point estimates show these differences, and p-values indicate their statistical significance.

On average, municipalities with base presence exhibit several distinct characteristics compared to those without bases. They are larger in size, situated at a lower altitude, and have substantially larger populations. The total, female, and male populations of municipalities with bases are almost twice as large as those of municipalities without bases. However, there is no meaningful difference in the sex ratio between the two groups.

The data also reveal significant disparities in violence levels. The mean homicide rate is about 70% higher in municipalities with bases, while the mean kidnapping rate is 160% higher. Additionally, municipalities with bases show higher rates of forced displacement.[16]

These statistically and economically meaningful differences between municipalities with and without bases are expected, because military bases are never randomly assigned. This exercise confirms the necessity of carefully constructing an appropriate comparison group. We explain our approach in section 5.

[16]Forced displacement is an involuntary movement of people from their home due to conflict, violence, or human right violations.

5 Empirical Strategy

The main identification challenge is that the location and timing of military base introduction are not exogenous to unobservable municipality characteristics. Military units are placed strategically, and in the context of Colombia's conflict, they are particularly positioned for counterinsurgency. To address this issue, we leverage the longitudinal nature of the municipality panel data, employing an event-study approach to estimate the effect of military units on sexual violence, fertility, and child support disputes.

Therefore, we estimate:

$$y_{it} = Base_i \times \sum_{\substack{m=-4 \\ m\neq -1}}^{7} \mathbb{1}(t - t_i^* = m)\beta_m + \alpha_i + \eta_t + \epsilon_{it} \tag{1}$$

where y_{it} is an outcome in municipality i in two-year period t; $Base_i$ is a binary variable indicating whether municipality i has had at least one military base between 1998 and 2016; $\mathbb{1}(t - t_i^* = m)$ is the time relative to the military base introduction period t_i^*; α_i is the municipality fixed effects; η_t is the year fixed effects; and ε_{it} is a time-variant unobserved term at the municipality level. The omitted group is $m = -1$, the period before the military base introduction. We cluster the standard errors at the municipality level.

We conduct our analysis at the two-year period level by aggregating the number of sexual crimes, births, and child support disputes in each municipality over two years. This is because sexual violence and disputes over child support at the municipality level are relatively rare. Aggregating every two years helps detect changes in these outcomes. For the indicator of military base presence, we consider a municipality to be treated in a two-year period if it has at least one military base in at least one year. We split the analysis timeline from 1998 to 2016 into 10 two-year periods, with the first period spanning from 1998 to 1999, and the last period containing only 2016. Therefore, the maximum number of periods a municipality can be treated is 10.

Estimating Equation 1 mitigates potential bias from time-consistent municipality char-

acteristics that affect the number of conceptions and yearly trends in the outcome. However, reproductive outcomes can be influenced by aggregate economic and conflict dynamics that vary across time and geography. For instance, increased economic activities may make people more or less willing to have children, while exacerbated conflict intensity may affect these decisions due to security concerns and instability. Moreover, the Ministry of Defense likely considered factors such as conflict intensity and economic relevance when determining the allocation of military bases. Failure to account for these factors could lead to omitted variable biases.

To address geographically and temporally variant economic and conflict dynamics, we include army division jurisdiction-year fixed effects, δ_{dt}, and estimate the following equation with OLS:

$$y_{it} = Base_i \times \sum_{\substack{m=-4 \\ m\neq -1}}^{7} \mathbb{1}(t - t_i^* = m)\beta_m + \alpha_i + \delta_{dt} + \epsilon_{it}. \tag{2}$$

A division in the Colombian Army is a class of units that presides over the brigades within its hierarchy. Each division is assigned a portion of Colombian territory for which it is responsible. For consistency, we use the 1999 division classification throughout the period of analysis. In 1999, there were five divisions collectively responsible for the security of Colombia's entire land territory. Again, the omitted category is $m = -1$, and standard errors are clustered at the municipality level.

The parameters of interest are β_m for $m \geq 0$, which capture the average effect of military base presence on the outcome in the mth period after the base introduction. We hypothesize that the presence of a military unit, on average, leads to an increase in sexual violence, fertility, and child support disputes, in municipalities with military units compared to those without.

OLS estimation may not produce unbiased estimates of military base effects, because it may fail to account for variation in treatment timing. In our context, municipalities receive

military units at different times, and treatment timing is potentially endogenous to municipality characteristics. To mitigate this challenge, we use the dCdH estimator (de Chaisemartin and D'Haultfœuille, 2024). This estimator does not require the treatment to be all-absorbing, unlike other recent difference-in-differences (DID) estimators, and accommodates treatment with non-random variation in treatment timing. Because a municipality can lose a military base before the end of the period of analysis, this estimator is suitable for our treatment allocation. We visualize the treatment duration for each municipality in Figure A4. Standard errors are also clustered at the municipality level for this estimation method.

All three approaches require two assumptions for successful estimation of military base effects: parallel trends and no anticipation. As Table 1 suggests, municipalities with bases likely have different trends than those without. To address this concern, in addition to using different combinations of fixed effects in the OLS estimation and using the dCdH estimation, we will exclude the never-treated municipalities, because not-yet-treated municipalities are intuitively better control units. In the following section on results, we will investigate the pre-treatment trends on all the outcomes to see if the parallel trends assumption can be plausibly met. Additionally, the non-random variation in treatment timing can contribute to failing to satisfy the parallel trends assumption. As the timing of military base introduction was largely determined by the conflict dynamics, we will inspect the pre-treatment trends on the security measures in the following section. Furthermore, we believe that the immediate deployment of soldiers after the decision to establish a new base allows us to satisfy the no-anticipation assumption. By estimating β_m for $m < 0$, we will check whether the pre-trends are sufficiently balanced across the treated and control groups to plausibly satisfy these assumptions.

As described in Section 2, army units are diverse. Therefore, we consider the following categories of military base presence:

1. Whether a municipality has at least one military base (standing brigade, standing battalion, mobile brigade, or counterinsurgency battalion)

2. Whether a municipality has at least one standing unit (standing brigade or standing battalion with drafted soldiers)

3. Whether a municipality has at least one counterinsurgency unit (mobile brigade or counterinsurgency battalion with professional soldiers)

The first category is the broadest, encompassing all types of military units. The second one focuses on the presence of standing units which are largely staffed with drafted soldiers. The third one indicates the presence of counterinsurgency units that are mostly operating with professional soldiers. In our sample for analysis, 64.3% of the treated municipalities have at least one standing unit with drafted soldiers, 33.5% have at least one mobile/counterinsurgency unit with professional soldiers, and 2.2% have both. To explore the heterogeneity by standing and counterinsurgency units, we estimate the effect of standing or counterinsurgency units on the outcomes of interest, controlling for the presence of the other type of unit.

The municipality-level data on sexual violence and child support disputes contain a large number of observations with zeros, around 35% for registered cases and 55% for indicted cases. In economics, it is common to transform skewed outcomes using the natural logarithm or inverse-hyperbolic sine (IHS) to achieve normally distributed residuals. However, we chose not to transform our outcomes, and deal with the mass of zero issue by simply aggregating the outcome data by two years. We make this choice because recent studies have shown that these transformations can be problematic when the outcome includes a significant number of zeros. Mullahy and Norton (2024) demonstrate that, in linear regressions, estimates from transformed data with few zeros are similar to those from scaled linear probability models. However, when the data contain many zeros, estimates can vary significantly depending on the parameters chosen for the logarithm or IHS transformation. Furthermore, Chen and Roth (2023) suggest that estimates from transformed outcomes with a high proportion of zeros cannot be straightforwardly interpreted as percentage changes, complicating standard interpretation.

6 Results

This section presents the results of the analysis. First, we present the estimated effects of military bases on sexual violence, fertility, and child support disputes in subsection 6.1. Second, we explore explanations other than the presence of military bases in subsection 6.2. Third, we investigate possible heterogeneity along the lines of mother's marital and partnership status in subsection 6.3. Fourth, we estimate the spillover effect of military bases into neighboring municipalities in subsection 6.4.

6.1 Main Results

Effects on Sexual Violence Figure 2 shows the results on the number of sexual violence cases per 100,000 inhabitants. As described in section 4.2, *registered* cases are those where the Office of Attorney General acknowledges the existence of reported cases, while *indicted* cases are those for which suspects are formally accused by the office.

First, we find that the dCdH estimation shows a more balanced pre-trend, especially in the two years before base introduction in either type of case, whereas the OLS estimations show some indication of a positive pre-trend. This difference in the pre-base introduction estimates suggests that the OLS estimates are inflated because they suffer from the negative weight issue, which stems from the comparison between the switchers (which change from not having a base to having one) to the non-switchers (which already have a base) (de Chaisemartin and D'Haultfoeuille, 2022). In fact, the OLS estimates of post-treatment effects are also much higher than the dCdH estimates. Therefore, we focus on the dCdH estimates in the following discussion.

Second, the dCdH estimation shows that military bases might have led to an increase in sexual crime rates. More specifically, we find that the number of registered cases per 100,000 inhabitants increases by about seven cases in years 2 and 3 and years 4 and 5 after base introduction, although the increase in years 0 and 1 is not statistically significant. This

initial increase then subsides after years 6 and 7 for the remainder of the period of analysis. Meanwhile, we find no evidence of a change in indictments.

Table 2 shows the total average effects across 16 years for registered and indicted cases following base introduction, computed with the dCdH estimator. A total average effect is a weighted sum of all the two-year period effects, where the weights are proportional to the number of observations in each period (de Chaisemartin and D'Haultfoeuille, 2022). According to the dCdH estimation, registered case rates increased by 16 cases per 100,000 inhabitants, which is statistically significant at the 5% level. This increase implies that base presence led to a 72% increase in registered sexual violence cases relative to the control mean of 22 cases per 100,000 inhabitants over the course of 16 years.

We next disaggregate the effects by base types in terms of dominant soldier characteristics. As discussed in sections 2 and 5, army bases can be broadly categorized into 1) standing units and 2) counterinsurgency units. Standing units are composed of drafted soldiers who are typically less educated and receive only a small monthly stipend, while counterinsurgency units are composed of professional soldiers, who are more educated, better trained, and receive a regular salary with generous benefits.

Figures 3 and 4 present the results for standing bases with drafted soldiers and counterinsurgency bases with professional soldiers, respectively. We find that the earlier results are driven by municipalities that have bases with more drafted soldiers. The data show that the presence of standing units with more drafted soldiers increases registered cases, especially in the first eight years (first four two-year periods) after the base introduction. We do not find strong evidence of a change in indicted cases, although there are marginally significant positive effects in the first two years due to the presence of standing units with drafted soldiers.

We have learned that the presence of military bases, particularly standing units with drafted soldiers, has led to an initial increase in sexual violence, which eventually subsides. The temporal dynamics may suggest that soldiers, especially less-trained drafted soldiers,

misbehave in the early years of base existence, but the situation improves as their superiors learn to manage the bases better.

Now that we have seen that military bases increase sexual violence, we examine whether this increase translates into an increase in fertility and child support disputes.

Fertility The previous section shows that military base presence leads to a non-negligible increase in sexual violence. Because rapes can result in unintended pregnancies, this section investigates potential effects of military bases on fertility. Figure 5 shows the results on the conception rates per 1,000 women by women's age groups, estimated with the dCdH method. The conception rate is the number of conceptions per age group divided by the female population of the corresponding age group.

First, we note that the pre-base introduction fertility trends, for the most part, do not statistically differ between municipalities with and without base presence. The pre-treatment estimates are generally similar across the specifications.

Second, we find no evidence that military base presence caused a statistically significant change in conception rates across all age groups. We also find no statistically significant total effects over 16 years after the base introduction in Table 3. Finally, the null results are consistent when we estimate effects by type of bases according to soldier composition. We find no evidence that bases with more drafted or professional soldiers change fertility in any age group (Figures 6, A6, A7, and A8).

Effects on Child Support Disputes Another potential consequence of increased sexual violence is an increase in child support disputes. Unwanted pregnancies due to sexual violence can lead to disputes over child support, if victims are able to identify perpetrators. While the previous section on fertility found no evidence of an increase due to military base presence, this section nonetheless investigates the potential effects on child support disputes.

Figure 7 presents the results on the number of child support disputes recorded by the judicial system per 100,000 inhabitants. As with sexual violence, child support disputes are

counted in terms of registered or indicted cases. Our analysis provides no evidence that military bases increase child support disputes in either registered or indicted cases, but it hints that they might have led to a decrease during the first five years of the base introduction. We also find no statistically meaningful total effects on registered cases over 16 years after the base introduction; however, we find some, albeit weak, evidence that base presence might have led to a decrease in indicted cases (Table 4). We do not find any evidence that the presence of standing units with more drafted soldiers affects the outcome differently (Figures A9 and A10).

6.2 Mechanisms

This section explores potential mechanisms, other than the presence of army soldiers, through which the presence of military bases may lead to increased sexual violence. We focus on changes in security and demographic changes, as potential drivers. We also discuss the potential channel of the presence of other armed actors.

Change in Security The increase in sexual violence that we observe may be due to changes in security levels in municipalities with military bases. Municipalities with military bases may have higher levels of crime and violence, not just sexual violence, which may be why the army has placed bases there. To investigate this possibility, we examine the effects of military base presence on various forms of violence.

Figure 8 shows the estimated effect of military base presence on cases of homicide, intimidation, terrorism, kidnapping, and forced displacement per 100,000 people. First, we learn that there is no strong evidence for pre-treatment differences across the treated and not-yet-treated municipalities, which support the satisfaction of the parallel trends assumption. Second, we find no statistically significant changes in these outcomes due to base presence. These results imply that there are no meaningful differences in actual, and possibly perceived, security levels between places with and without army bases.

Additionally, we believe that the null effects on intimidation, kidnapping, and forced displacement indicate that the estimated changes in sex crimes and child support disputes are unlikely due to changes in reporting, as the data on intimidation, kidnapping, and forced displacement are largely based on reporting. If military base presence increases people's willingness to report incidents of sexual violence to the authorities, it should also increase their willingness to report incidents of other forms of violence.

Migration and Demographic Change Increased sexual violence may also be due to demographic changes in municipalities with military bases. For instance, military bases may attract migrants, changing the demographic composition and potentially leading to increased sexual violence.

Figure 9 presents the estimated effects of military bases on municipality population counts by sex. One important note about the population data is that they likely do not reflect soldiers because they are estimated based on the census. This implies that the results should be interpreted as the changes in *civilian* population. We do not find evidence that base presence affects either female or male civilian population.

Presence of Other Armed Actors The presence of state soldiers can coincide with the presence of other armed actors, who are fighting either against or with the official state forces. Fighters of non-state armed organizations, rather than army soldiers, may commit sexual violence. While we cannot conduct statistical analysis due to lack of data on the presence of non-state armed actors, we note that the Colombian conflict has been characterized by the presence of both left-wing guerrilla groups and right-wing paramilitary organizations.

We speculate that the increase in sexual violence in municipalities with military bases may also be attributed to the presence of right-wing paramilitary organizations, rather than left-wing guerrilla groups. This is because some units in the government forces are known to have worked closely with right-wing paramilitary organizations, including conducting joint military operations (Human Rights Watch, 2001; Eva, 2002). Furthermore, it is well-documented that many cases of human rights violations, including sexual violence, are at-

tributed to paramilitary groups (Commission for Truth, 2022). This close, albeit illegal, relationship between the state forces and paramilitary groups may hint that at least part of the increase in sexual violence is due to the presence of paramilitary fighters.

6.3 Heterogeneity: Single-mother Pregnancy

While we so far find no statistically meaningful changes in fertility caused by the presence of army bases, we believe that women in host communities are heterogeneous and may be affected differently by base presence. Although the characteristics of individual host community women are largely unobserved, the vital statistics data allow us to learn some characteristics about women who give birth. We believe that single women can react to, and be affected by, the presence of military bases differently than women who are in a marriage or partnership. To examine this, we calculate the base effect on single mothers, through two estimations: one on single-mother conception, and another on non-single mother conception.[17]

Figure A11 presents the effect of base presence on the number of conceptions per 1,000 women age 10 to 39, estimated with dCdH approach. We do not see statistically significant evidence that military bases affect fertility differently by marital status. We also find no evidence for each of the age groups 10-19, 20-29, and 30-39 (Section A.3.6).

6.4 Spillover Effects

As mentioned in Section 2, soldiers from any brigade or battalion can be deployed outside their bases, implying potential spill-over effects in surrounding municipalities. Therefore, we estimate the following equation with OLS:

$$y_{it} = \beta D_{it} + \sum_{r=\{25,50,75,100\}} (\gamma_r N_{itr}) + \alpha_i + \delta_{dt} + \epsilon_{it} \tag{3}$$

[17]Non-single mothers are those who are legally married, in common-law marriages, and widowed.

where D_{it} is a dummy variable indicating the presence of at least one army base in municipality i at period t, and N_{itr} representing whether municipality i is not treated but has at least one treated municipality within a 25, 50, 75, or 100 km radius of its population center. We also include municipality and division-year fixed effects, α_i and δ_{dt}, respectively. The standard errors are clustered at the municipality level. We can only conduct this analysis with OLS, because the dCdH estimator accommodates only one policy variable at a time. This makes it hard to calculate heterogeneous effects along multiple distance thresholds.

Table 5 presents the estimates of γ_r, which is the spill-over effect of military bases on neighboring municipalities. We do not find that the treatment spills over to neighboring municipalities without bases.

7 Conclusions

Our analysis reveals that registered cases of sex crimes per 100,000 inhabitants increase by about 72% of the control mean over the period of 16 years after the introduction of military bases. However, this increase does not necessarily translate into an increase in fertility and child support disputes. We also find that the uptick in sexual violence is driven by municipalities which have bases with more drafted soldiers, who are younger, and have less education, training, and pay.

We do not find evidence that the change in sexual violence is driven by changes in security and demographics due to base presence. Our data on sexual violence do not allow us to directly attribute increased sexual violence to army soldiers or non-state armed actors. However, given the well-documented cooperation between the public forces and right-wing paramilitary groups, it is possible that the increase in sexual violence was committed by members of paramilitary forces.

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8 Figures

Figure 1: Expansion of the National Army between 1998 and 2016

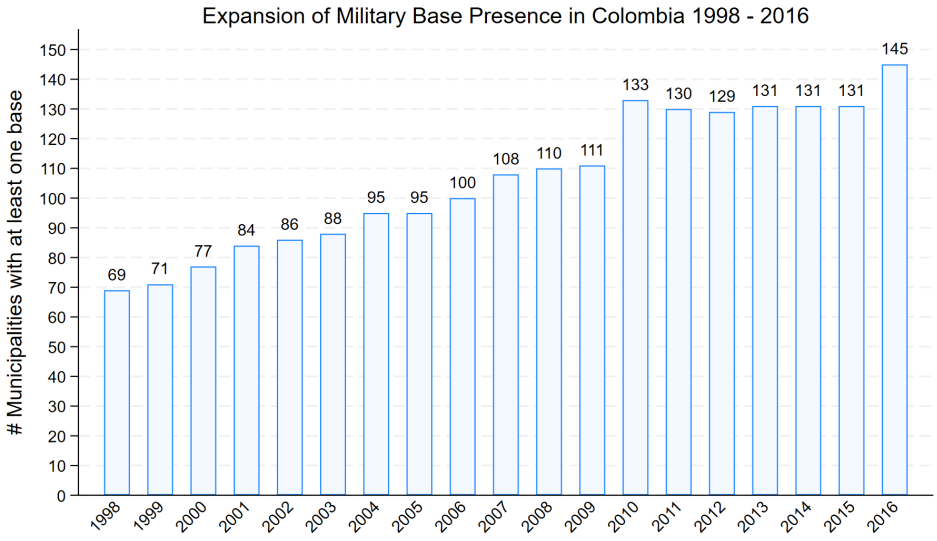
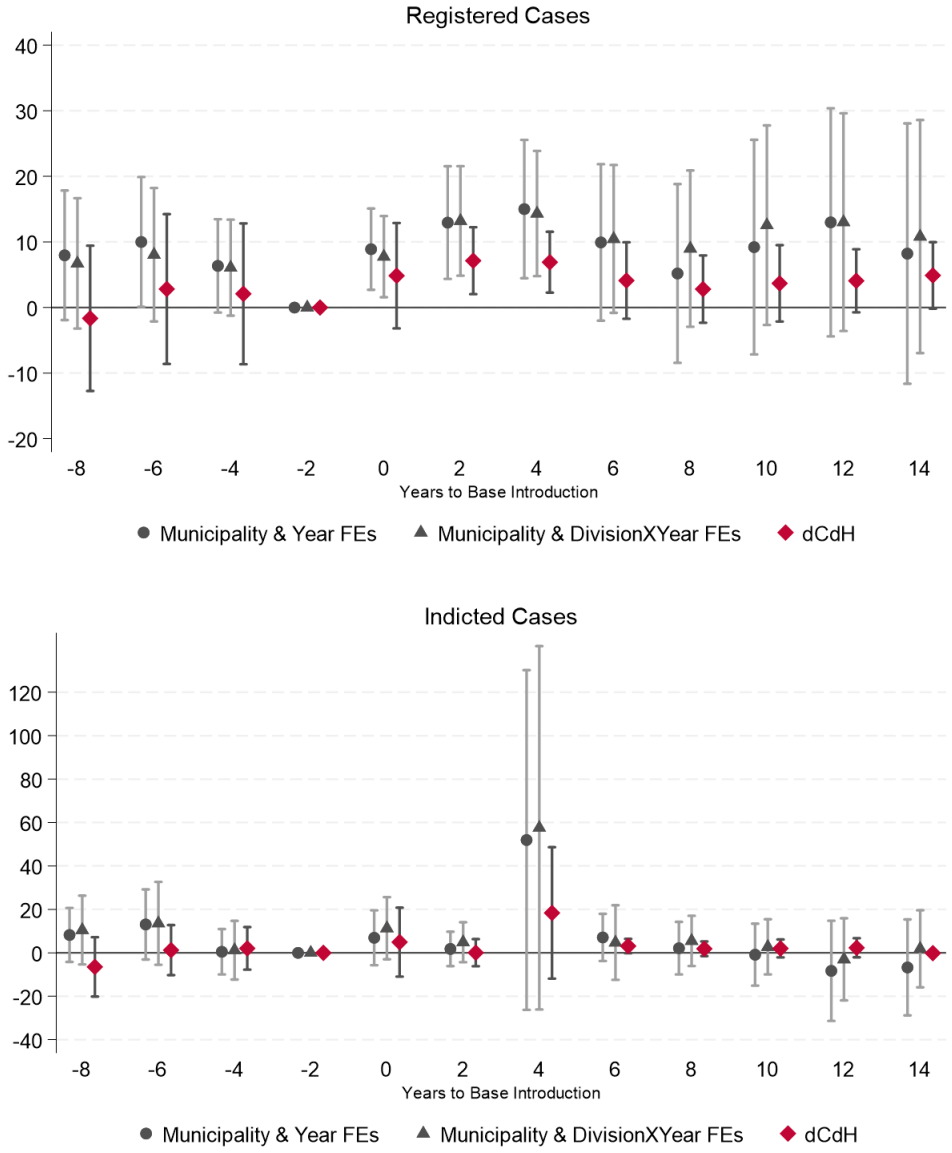
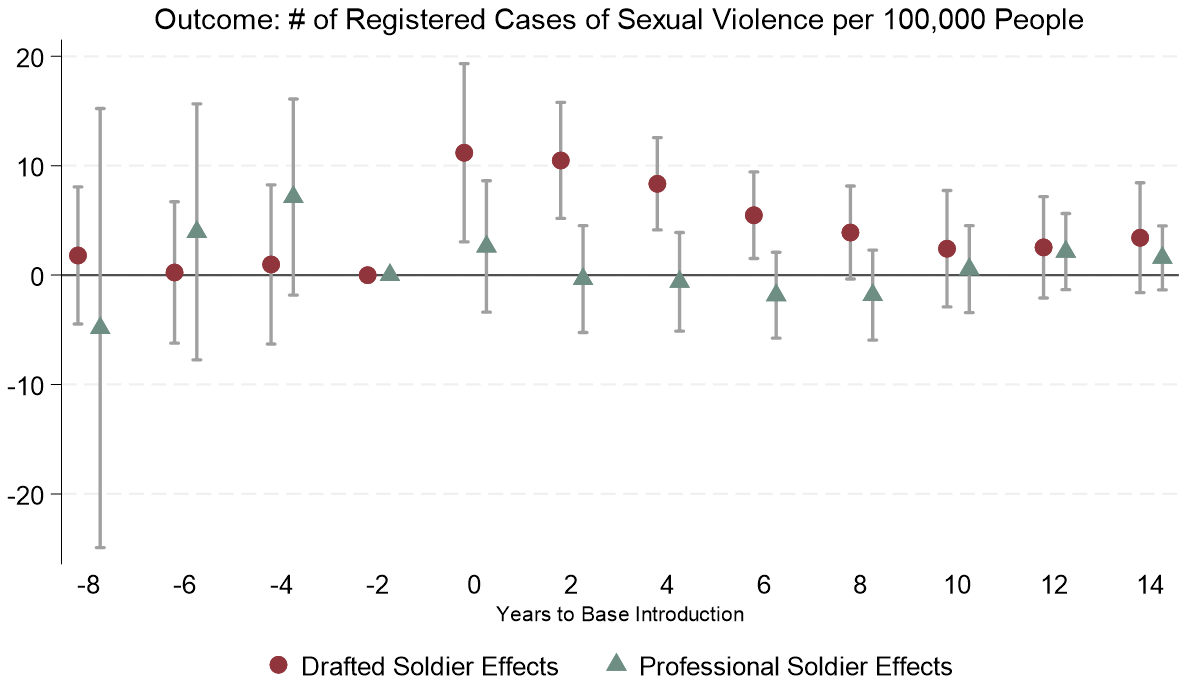


Figure 2: Effects on Sexual Violence
Outcome: Number of Cases per 100,000 Inhabitants



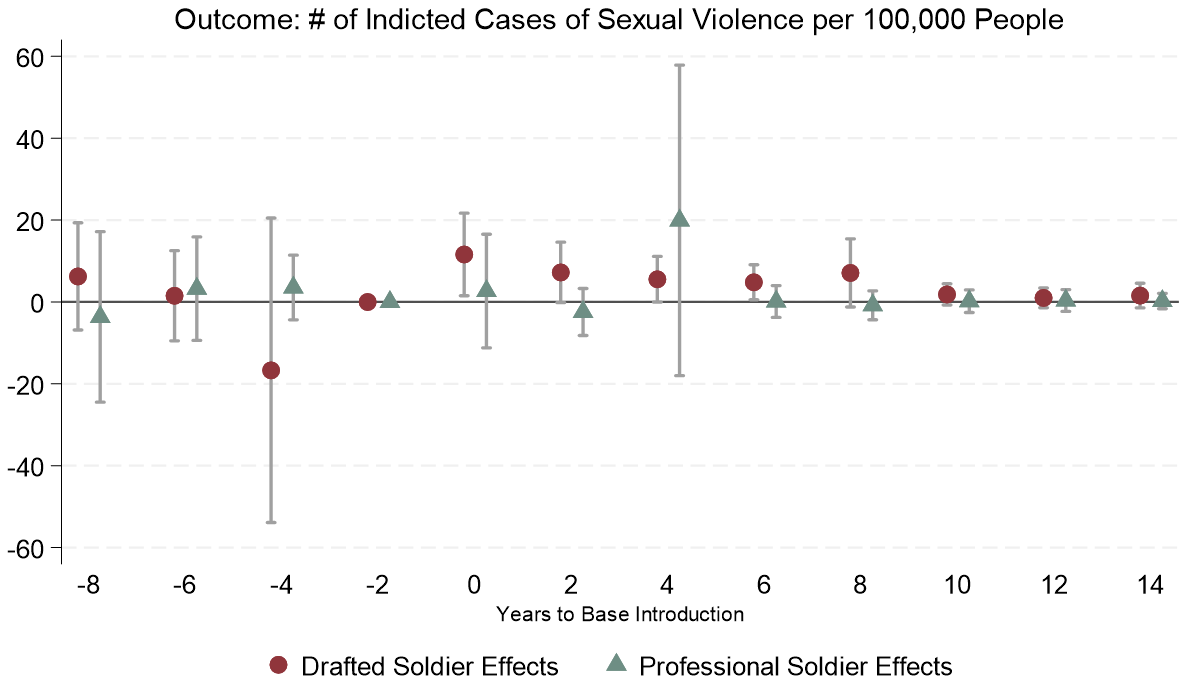
Note: These graphs plot the estimated coefficient of each two-year period relative to the period in which a military base was introduced. The *Municipality & Year FEs* and *Municipality & DivisionXYear FEs* estimates are calculated with OLS, while the *dCdH* estimates are calculated with the de Chaisemartin and D'Haultfœuille estimator (de Chaisemartin and D'Haultfœuille, 2024). The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure 3: Effects on Sexual Violence by Base Type (Registered Cases)



Note: These graphs plot the estimated coefficient of each two-year period relative to the period in which a military base was introduced, and are computed with the de Chaisemartin and D'Haultfœuille estimator (de Chaisemartin and D'Haultfœuille, 2024). *Drafted soldier effects* refer to the estimated coefficients on an indicator variable for each period in which a municipality has at least one standing unit with more drafted soldiers. *Professional soldier effects* refer to the estimated coefficients on an indicator variable for each period in which a municipality has at least one counterinsurgency unit with more professional soldiers. Drafted soldiers are typically less educated and only given a small monthly stipend. Professional soldiers, who are more educated, better trained, and receive a regular salary with generous benefits. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

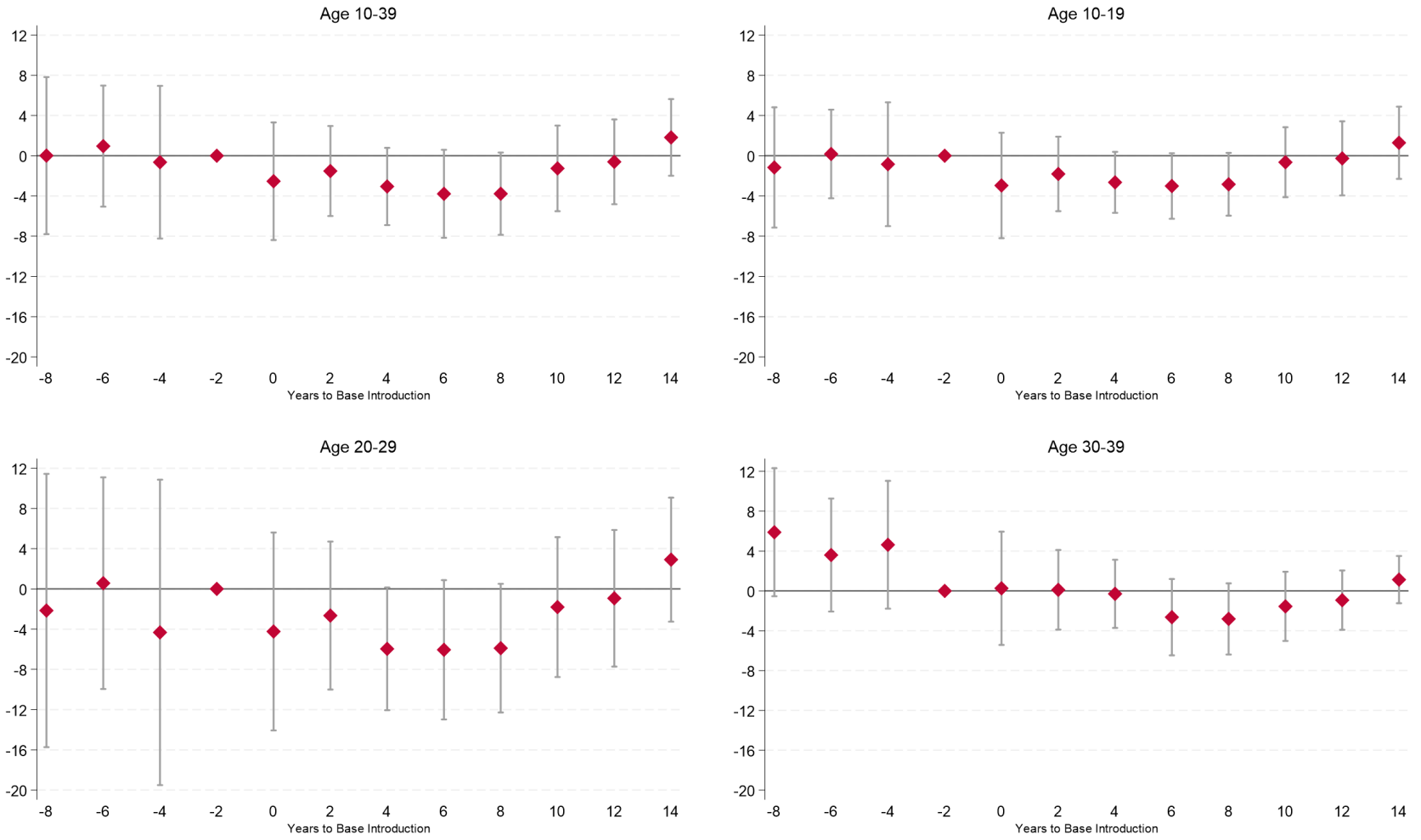
Figure 4: Effects on Sexual Violence by Base Type (Indicted Cases)



Note: These graphs plot the estimated coefficient of each two-year period relative to the period in which a military base was introduced, and are computed with the de Chaisemartin and D'Haultfœuille estimator (de Chaisemartin and D'Haultfœuille, 2024). *Drafted soldier effects* refer to the estimated coefficients on an indicator variable for each period in which a municipality has at least one standing unit with more drafted soldiers. *Professional soldier effects* refer to the estimated coefficients on an indicator variable for each period in which a municipality has at least one counterinsurgency unit with more professional soldiers. Drafted soldiers are typically less educated and only given a small monthly stipend. Professional soldiers, who are more educated, better trained, and receive a regular salary with generous benefits. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure 5: Effects on Fertility

Outcome: Number of Conceptions per 1,000 Women by Mothers' Age Groups

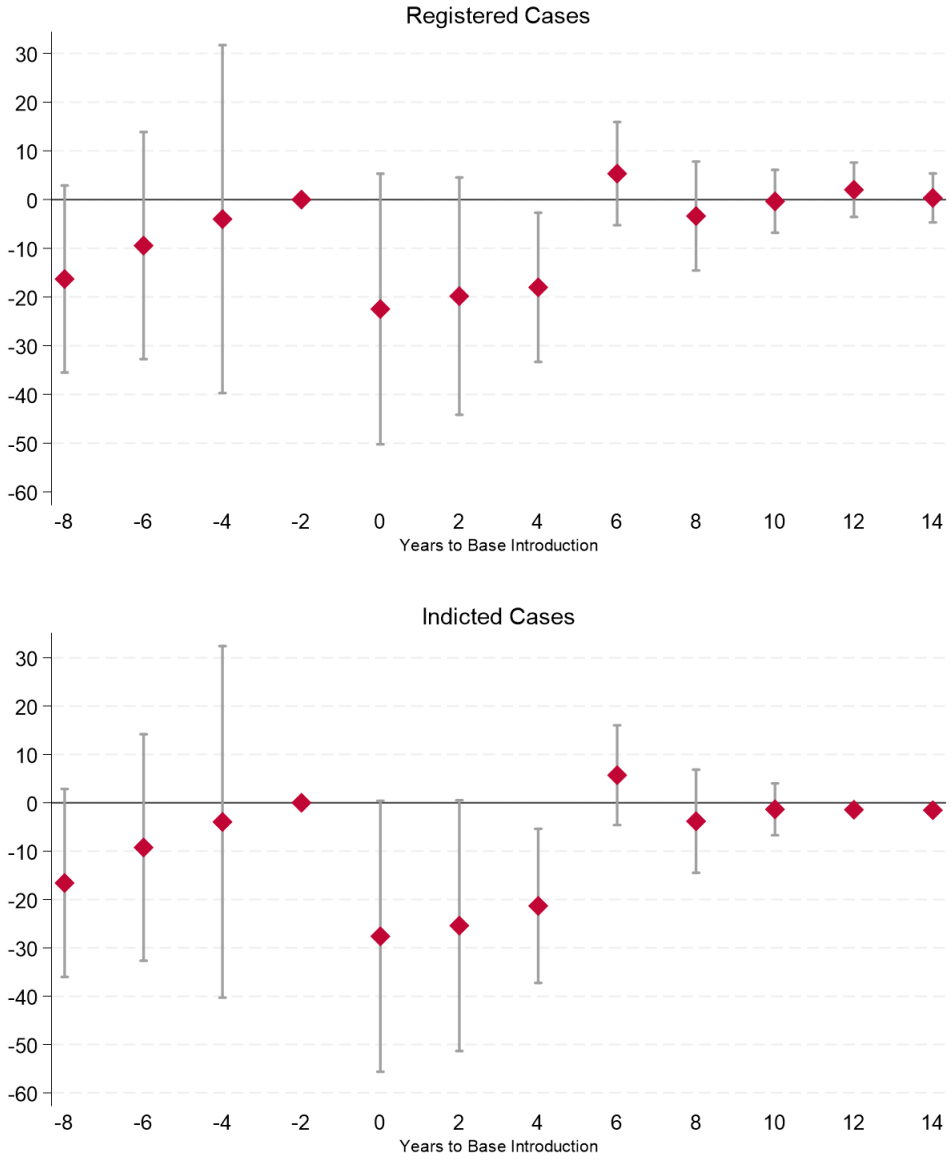


The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure 6: Effects on Fertility by Base Type

The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

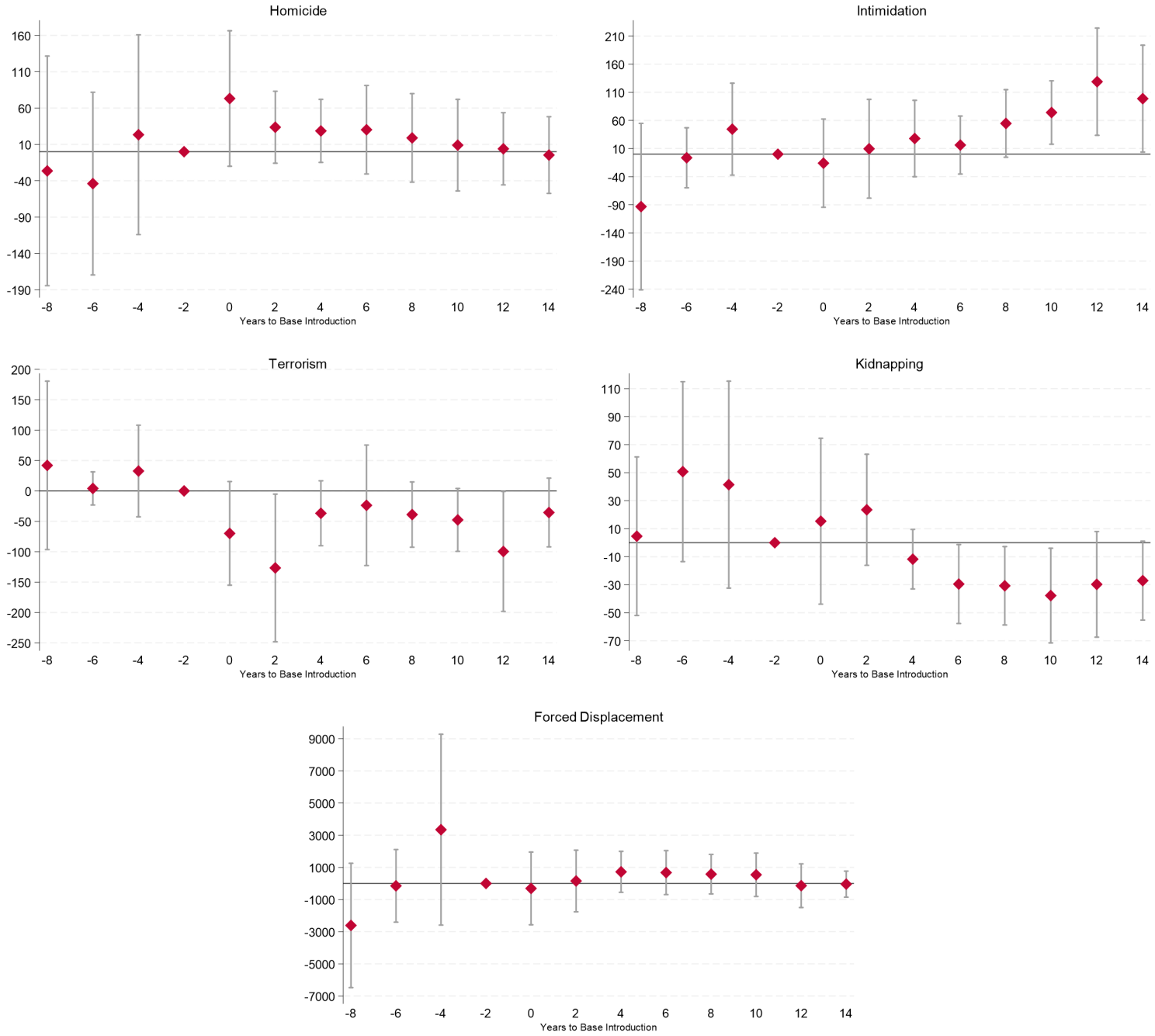
Figure 7: Effects on Child Support Disputes
Outcome: Number of Cases per 100,000 Inhabitants



The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

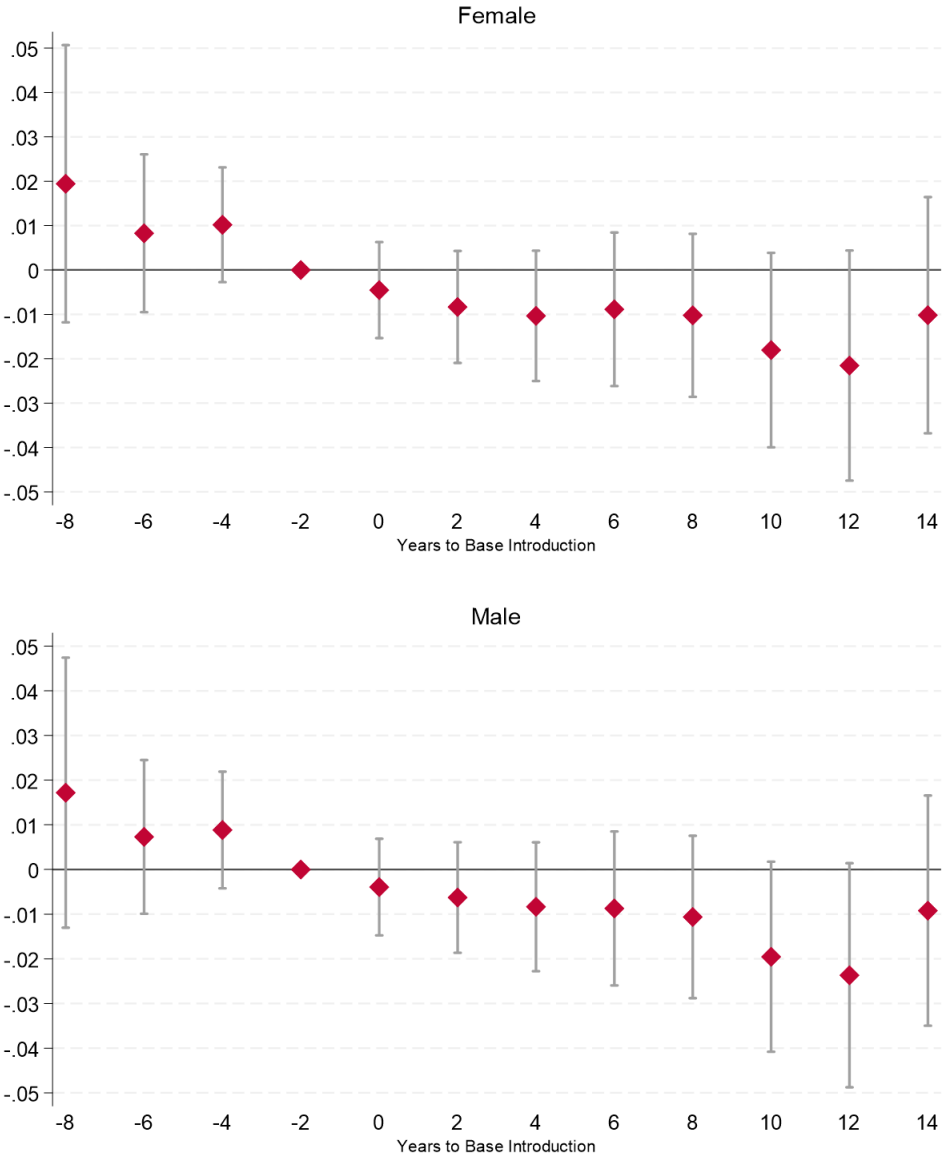
Figure 8: Effects on Security

Outcome: Cases per 100,000 Inhabitants



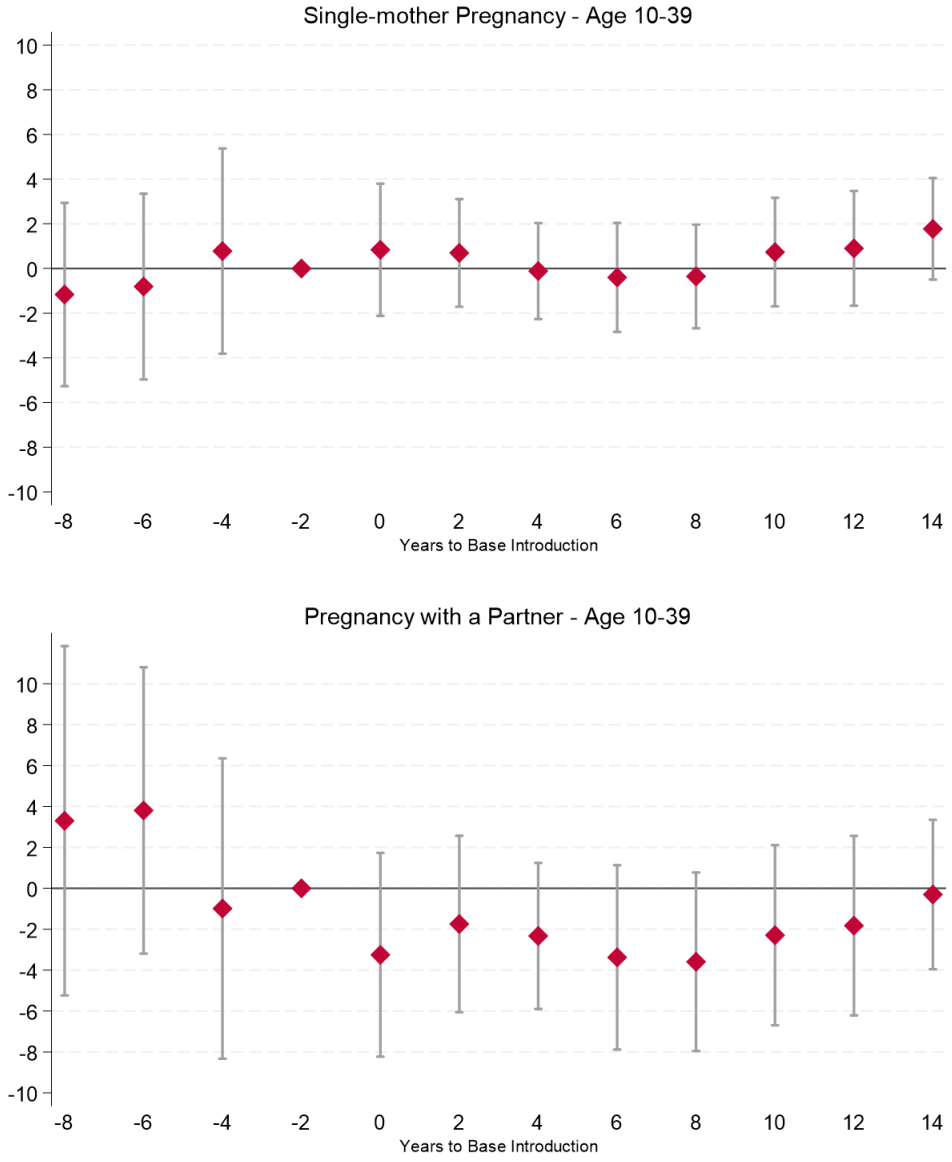
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure 9: Effects on Population
Outcome: Log Municipality Population Counts by Sex



The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure 10: Effects on Single-mother Fertility
Outcome: Number of Conceptions per 1,000 Women by Mothers' Age 10 - 39



These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

9 Tables

Table 1: Pre-Expansion Municipality Characteristics

	Year	Control Mean	Difference	p-value
Area (km^2)	-	602.21	2,743.20	0.00
Altitude above the sea level (meters)	-	1,215.04	-427.71	0.00
Real GDP per capita (million peso constant 2010)	2000	10.75	0.26	0.83
Total population	1998	17,964.98	40,570.43	0.00
Female	1998	8,961.65	20,936.97	0.00
Male	1998	9,003.33	19,633.46	0.00
Sex ratio (Female:Male)	1998	0.95	0.01	0.40
Cases of violence per 100,000 inhabitants				
Homicide	1998	161.51	118.26	0.00
Intimidation	1998	52.92	38.36	0.17
Terrorism	1998	14.87	43.97	0.33
Kidnapping	1998	40.14	81.60	0.00
Forced displacement	1998	1,307.38	483.52	0.19

Note: There are 1,104 municipalities in the analysis. Each year indicates the earliest year in which the data for each variable is available. Altitude and area sizes are constant across years. Difference is the estimated coefficient of the indicator that a municipality has ever had at least one military base in the anlaysis period in the regression of each characteristic.

Table 2: Average Total Effects on Sexual Violence (dCdH)
Outcome: Number of Cases per 100,000 Inhabitants

	Registered	Indicted
	(1)	(2)
Has Army base	16.399**	16.254
	(7.174)	(10.335)
Obs.	1,224	1,224
Control mean	22.44	14.31

Note: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors in parentheses clustered at the municipality level. The de Chaisemartin and D'Haultfœuille estimator calcuates the *average total effect*, which is the weighted sum of the effects of all periods. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Table 3: Average Total Effects on Fertility (dCdH)
Outcome: Number of Conceptions per 1,000 Women

	Mothers' Age Groups			
	10-39	10-19	20-29	30-39
	(1)	(2)	(3)	(4)
Has Army base	-7.359	-6.126	-12.327	-3.802
	(6.268)	(4.976)	(10.022)	(5.206)
Obs.	1,224	1,224	1,224	1,224
Control mean	128.06	88.28	204.50	103.52

Note: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors in parentheses clustered at the municipality level. The de Chaisemartin and D'Haultfœuille estimator calcuates the *average total effect*, which is the weighted sum of the effects of all periods. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Table 4: Average Total Effects on Child Support Disputes (dCdH)
Outcome: Number of Cases per 100,000 Inhabitants

	Registered	Indicted
	(1)	(2)
Has Army base	-21.901	-29.530*
	(17.587)	(17.191)
Obs.	1,224	1,224
Control mean	66.47	59.22

Note: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors in parentheses clustered at the municipality level. The de Chaisemartin and D'Haultfœuille estimator calcuates the *average total effect*, which is the weighted sum of the effects of all periods. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Table 5: Effects on Fertility (Spill-over Analysis) - Rate Outcomes

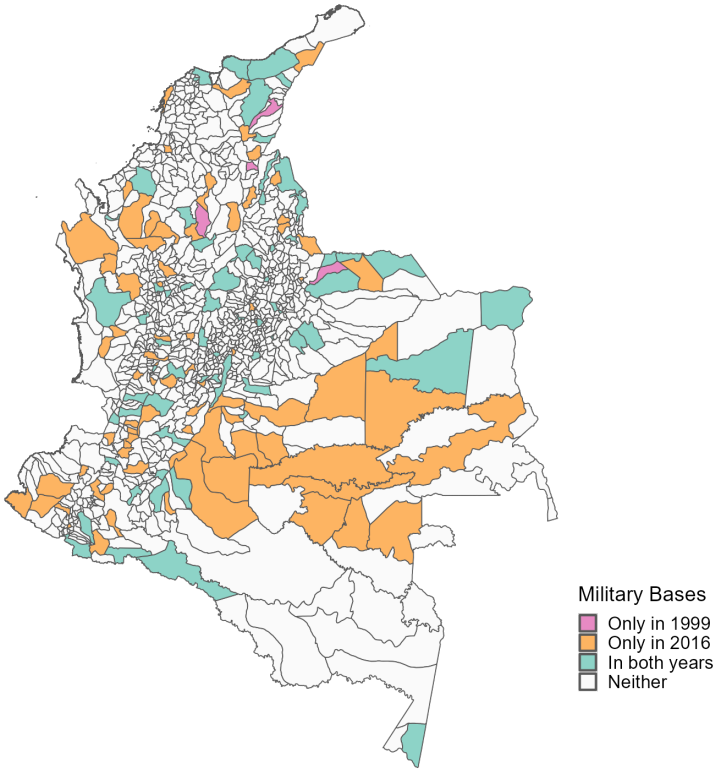
	Conceptions per 1,000 Women by Mothers' Age				
	Age 10-49	Age 10-19	Age 20-29	Age 30-39	Age 40-49
	(1)	(2)	(3)	(4)	(5)
Panel A: Municipality and Year FEs					
If at least one Army base	-2.954	-0.319	-10.709	-5.492	0.586
	(6.305)	(4.244)	(14.042)	(6.817)	(1.152)
Has treated muni. in 25 km	-1.845	-1.894	-2.720	-3.402	-0.625
	(3.321)	(2.730)	(6.526)	(2.952)	(0.833)
Has treated muni. in 50 km	2.068	1.244	3.674	2.144	0.034
	(4.854)	(4.233)	(8.879)	(4.127)	(0.803)
Has treated muni. in 75 km	6.554	4.290	15.458	5.154	1.193
	(6.105)	(5.016)	(12.117)	(6.114)	(2.227)
Has treated muni. in 100 km	-9.058	-3.149	-25.458	-10.028	-0.577
	(7.600)	(4.841)	(18.107)	(8.085)	(2.480)
Panel B: Municipality and Division X Year FEs					
If at least one Army base	-3.108	-0.124	-11.516	-5.455	0.306
	(6.022)	(4.103)	(13.547)	(6.471)	(1.228)
Has treated muni. in 25 km	-3.261	-3.041	-5.605	-4.408	-0.789
	(3.162)	(2.594)	(6.263)	(2.915)	(0.837)
Has treated muni. in 50 km	1.547	1.100	3.035	1.423	0.085
	(4.619)	(4.061)	(8.499)	(3.991)	(0.849)
Has treated muni. in 75 km	7.525	4.960	16.740	5.861	1.350
	(5.957)	(5.072)	(11.468)	(6.161)	(2.191)
Has treated muni. in 100 km	-9.159	-3.235	-25.893	-9.555	-0.881
	(6.965)	(4.706)	(16.559)	(7.572)	(2.424)
Obs.	2,903	2,903	2,903	2,903	2,903
Control Mean	55.55	45.00	103.84	52.48	8.90

Note: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors in parentheses clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierachy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. *Has treated muni. in X km* indicates that a municipality has at least one treated municipality within the Xkm radius of its population center. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

A Appendix

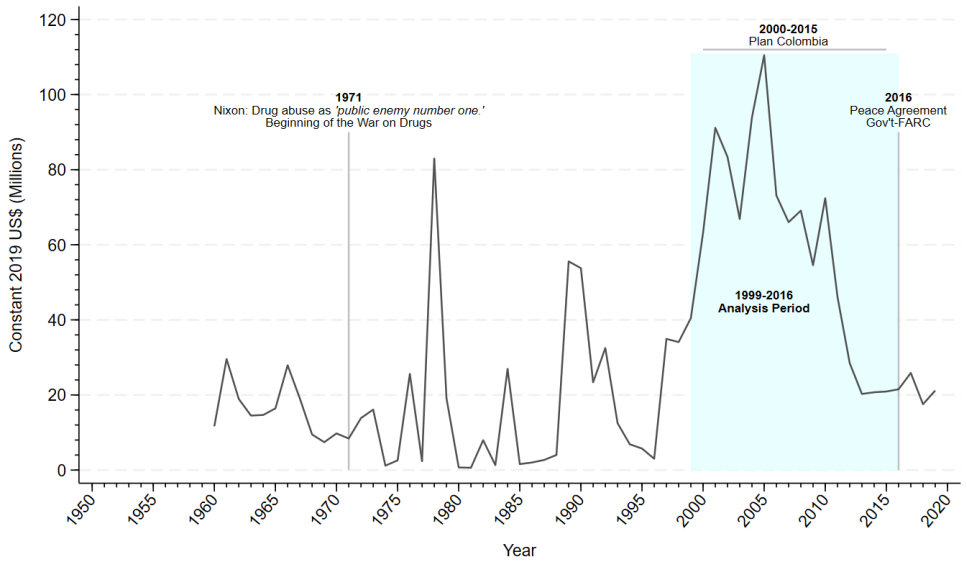
A.1 Map

Figure A1: Geographical Distribution of Military Bases 1999 - 2016



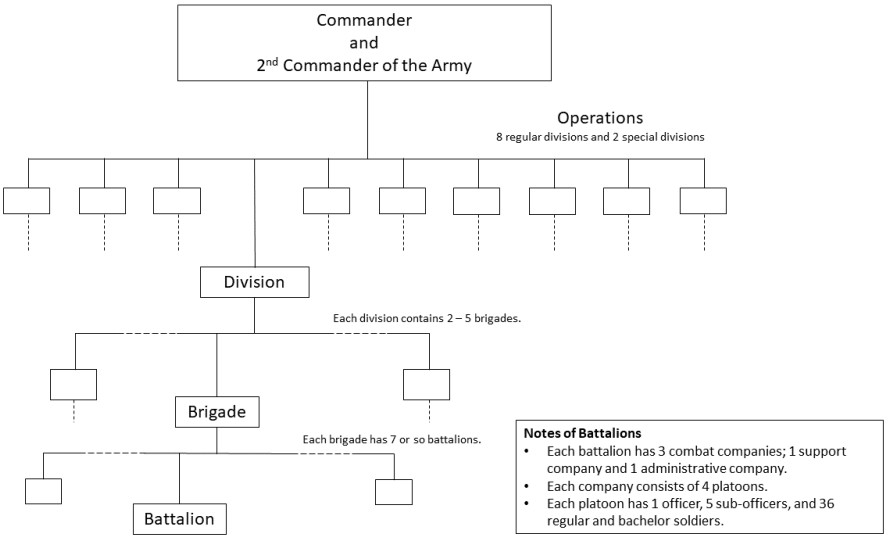
A.2 Graphs

Figure A2: U.S. Military Assistance to Colombia



Source: U.S. Overseas Loans and Grants (Greenbook), USAID

Figure A3: The Organization of the Colombian National Army



Note: The presented organization chart reflects the organization during the analysis period.

Figure A4: Military Base Presence and Duration

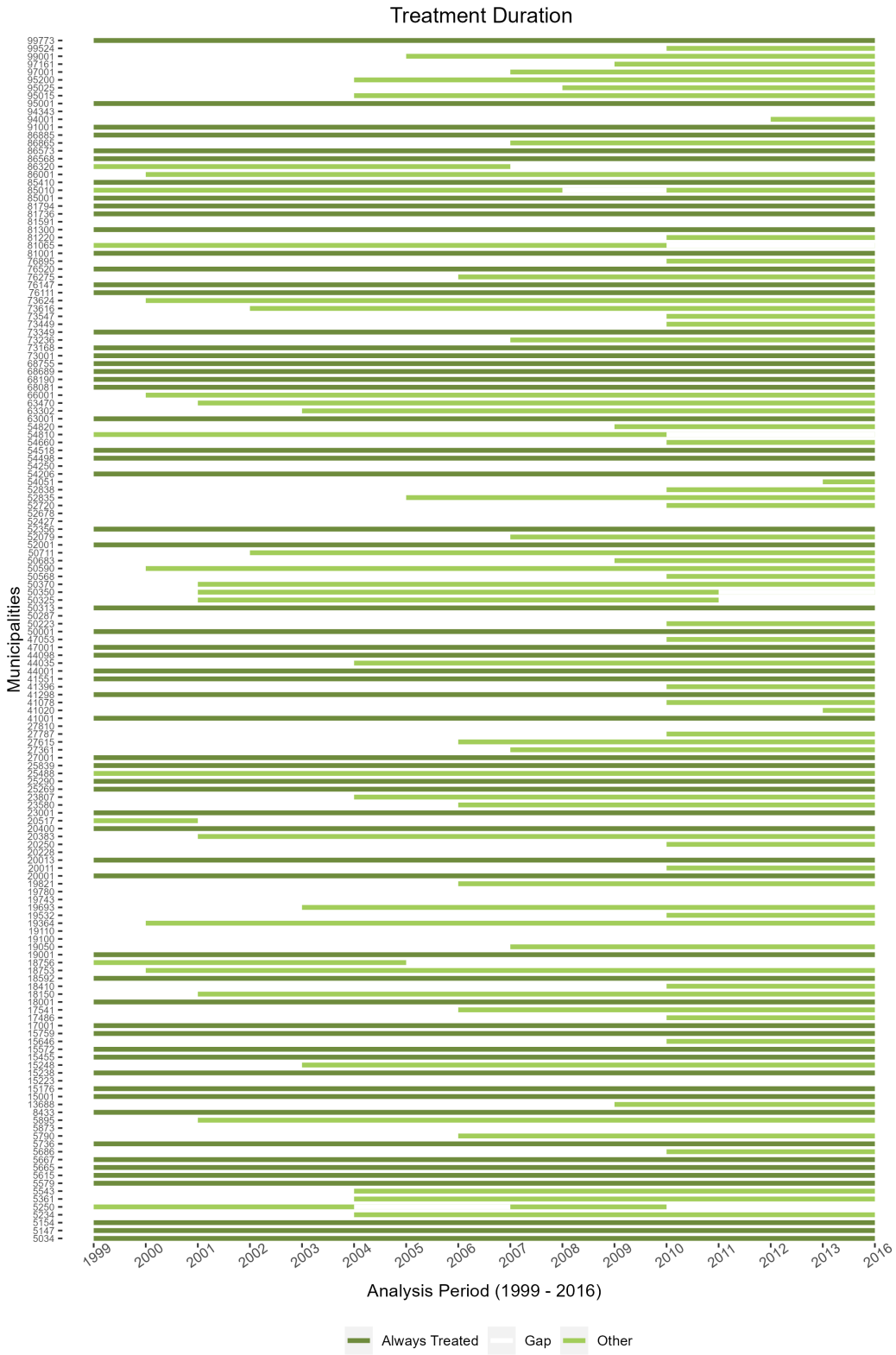
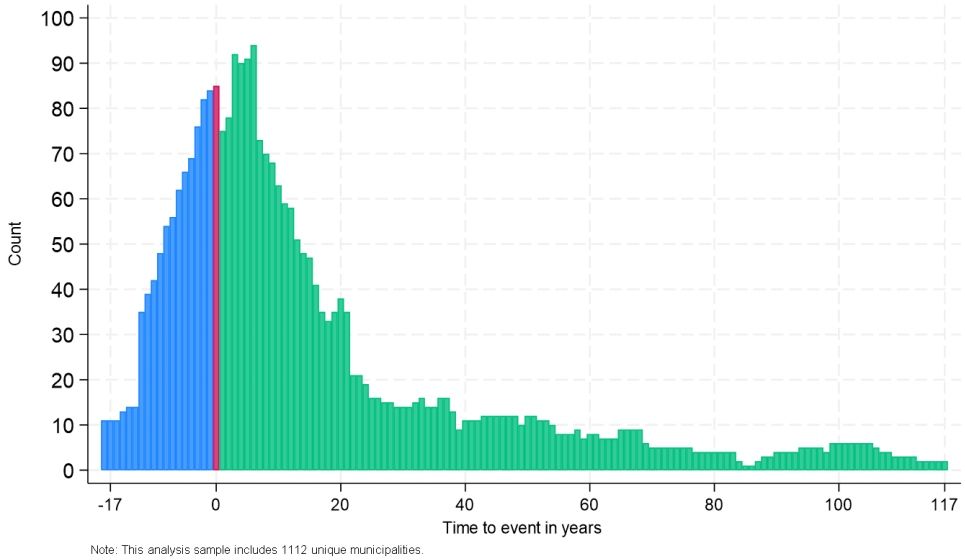


Figure A5: Time to Treatment



A.3 Tables

A.3.1 Colombian Army Soldiers

Table A1: Monthly Compensation by Soldier Categories

	Basic Soldiers	Professional Soldiers	% Difference
2000	US$9.20	US$83.48	807.06
2001	US$10.11	US$91.79	807.52
2002	US$10.93	US$99.17	807.53
2003	US$11.74	US$106.56	807.55
2004	US$12.66	US$114.90	807.54
2005	US$13.49	US$122.44	807.58
2006	US$14.43	US$130.95	807.57
2007	US$15.34	US$139.20	807.57
2008	US$16.32	US$148.12	807.56
2009	US$17.57	US$159.48	807.56
2010	US$17.92	US$165.29	822.16

Source: Authors' calculation based on Decrees 1794 and 2724 of 2000, 2737 of 2001, 745 of 2002, 3552 of 2003, 4158 of 2004, 923 of 2005, 407 of 2006, 1515 of 2007, 673 of 2008, 737 of 2009 , 1530 of 2010, and the yearly minimum wage from Datosmacro (2022). Values in Colombian pesos (COP) are converted to the U.S. dollar (USD) values using the 2023 average conversion rate of COP 4,362 to USD 1.

Note: The compensation for conscripted soldiers are called bonus (*bonificación* in Spanish), which is meant to as an allowance to supplement the supply of uniforms, and basic necessities including food and hygiene products. Conscripted soldiers can receive a 40% increase in their monthly bonus if their performance is exceptional. Meanwhile, the compensation for professional soldiers is a salary, and determined as 140% of the legal minimum wage. Volunteer soldiers, as professional soldiers were known before 2000, who have already served before December 31, 2000 receive the 160% of minimum wage.

Table A2: Benefits for Professional Soldiers

Benefit	Description
Seniority bonus	After two years of service, a professional soldier is entitled to a monthly seniority bonus equal to 6.5% of their basic salary. This bonus increases by 6.5% for each additional year of service, up to a maximum of 58.5%.
Annual service bonus	Soldiers are entitled to an annual service bonus equivalent to 50% of their basic monthly salary plus the seniority bonus. This is paid in the first 15 days of July each year.
Vacation bonus	Soldiers receive a vacation bonus equal to 50% of their basic monthly salary plus the seniority bonus for each year of service. This is calculated for vacations accrued from February 1 of the year following the decree's enactment.
Christmas bonus	A Christmas bonus equivalent to 50% of the basic salary earned in November, plus the seniority bonus, is paid in December each year.
Travel allowances	Soldiers are entitled to travel allowances for individual transfers within the country and for individual service commissions.
Vacation entitlement	Soldiers are entitled to 30 calendar days of paid vacation for each year of service.
Severance pay	Soldiers are entitled to severance pay equivalent to one basic salary plus the seniority bonus for each year of service, which is annually liquidated and deposited in a designated fund.
Housing benefits	Soldiers can participate in housing plans and programs offered by the Military Housing Promotion Fund and other entities.
Family subsidy	Married soldiers or those in a marital union are entitled to a monthly family subsidy equal to 4% of their basic monthly salary plus the seniority bonus.
Burial expenses	The Ministry of Defense covers the burial expenses of soldiers who die in active service or while receiving a pension, up to eight times the legal minimum monthly wage.

Source: Degree 1794 of 2000

A.3.2 Municipality Characteristics

Table A3: Number of Unique Municipalities by Year

Year	N. Unique Municipalities
1998	1,089
1999	1,099
2000	1,104
2001	1,105
2002	1,107
2003	1,104
2004	1,106
2005	1,105
2006	1,104
2007	1,109
2008	1,107
2009	1,109
2010	1,108
2011	1,109
2012	1,110
2013	1,111
2014	1,110
2015	1,111
2016	1,111

Note: The analysis sample excludes the seven major cities which are Barranquilla, Bogotá, Bucaramanga, Medelliín, Cali, Cartagena, and Cucuta.

A.3.3 Data Overview

Table A4: Overview of the Outcome Data

	Data Description	Link	Years Available	Years Used in This Paper
Fertility	Birth certificate data from the Vital Statistics	https://www.datos.gov.co/widgets/kk5w-ugzm	1979 - 2022	1998 - 2016
Demographics	Population projection based on the National Census of Population and Livelihood	https://www.dane.gov.co/index.php/estadisticas-por-tema/demografia-y-poblacion/proyecciones-de-poblacion	1995 - 2026	1998 - 2016
Sexual violence and child support	Lawsuit data by the Office of Attorney General	-	2000 - 2021	2000 - 2016
Violence and security	The Conflict and Violence module of the Municipality Panel compiled by the Center for Economic Development Studies	https://datoscede.uniandes.edu.co/es/catalogo-de-microdata	1993 - 2019	1998 - 2016
Education	Census of Educational Establishments by the Ministry of Education	https://microdatos.dane.gov.co/index.php/catalog/EDU-Microdatos	2004 - 2022	2004 - 2016

A.3.4 Additional Results on Fertility

Figure A6: Effects on Fertility by Base Type

The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure A7: Effects on Fertility by Base Type

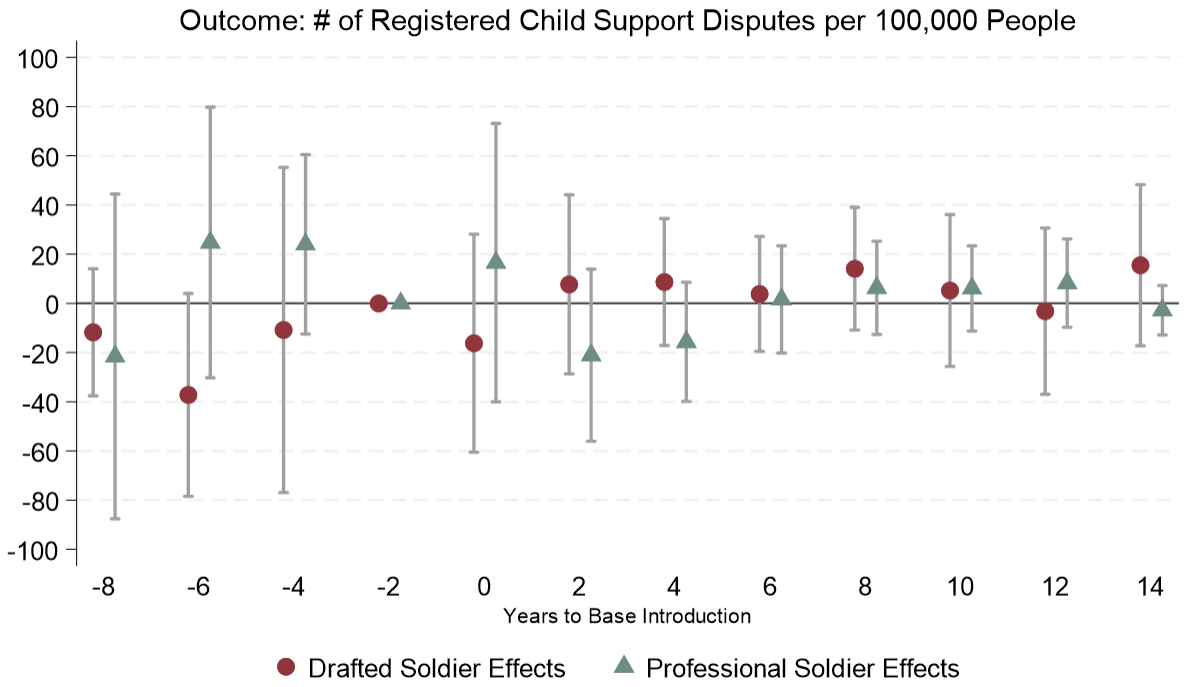
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure A8: Effects on Fertility by Base Type

The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

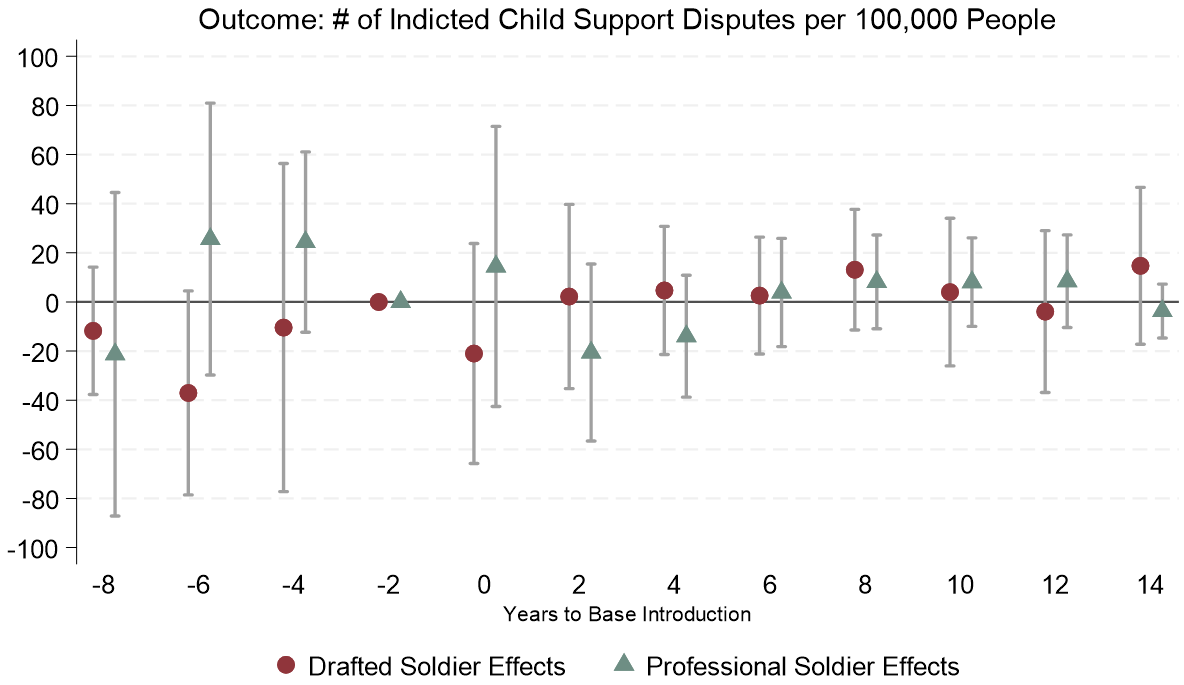
A.3.5 Additional Results on Child Support Disputes

Figure A9: Effects on Child Support Disputes by Base Type (Registered Cases)



The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

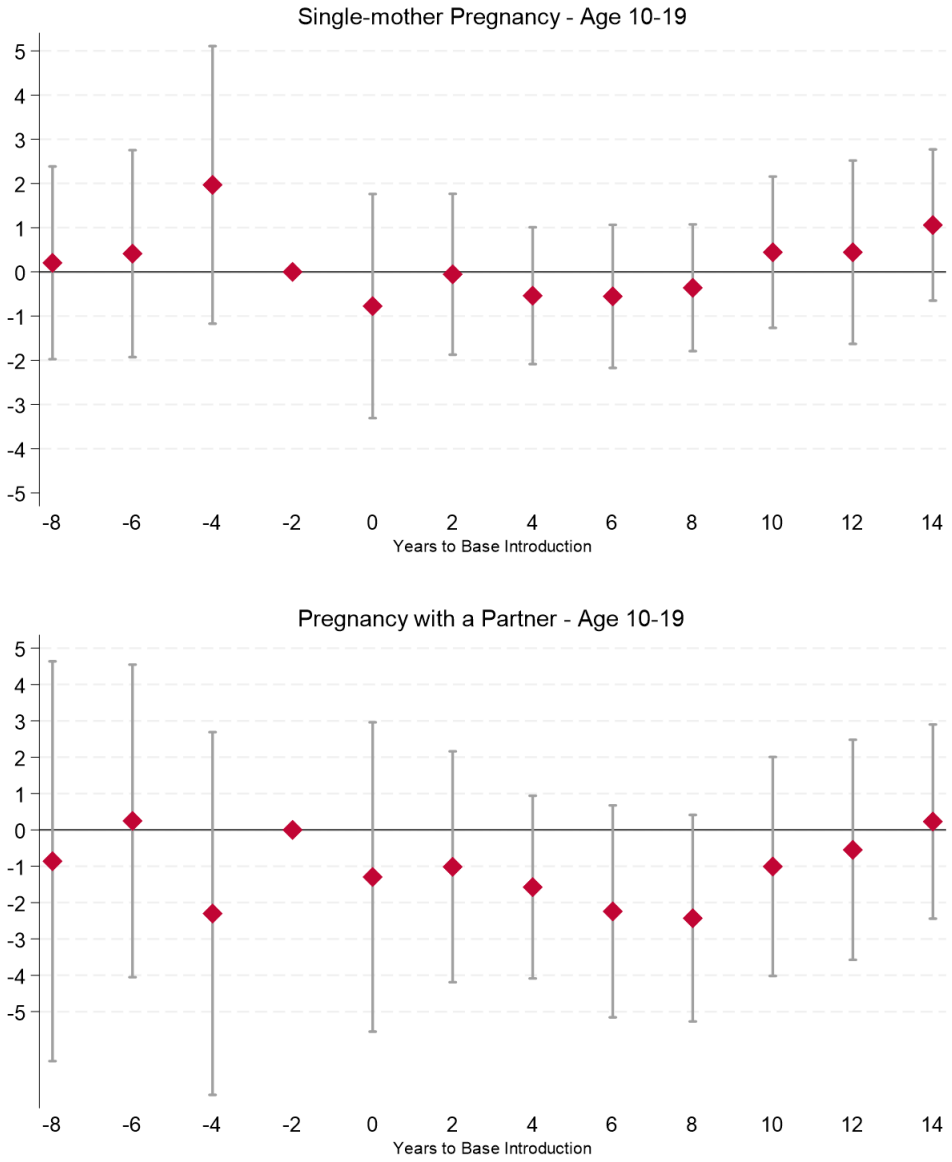
Figure A10: Effects on Child Support Disputes by Base Type (Indicted Cases)



The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

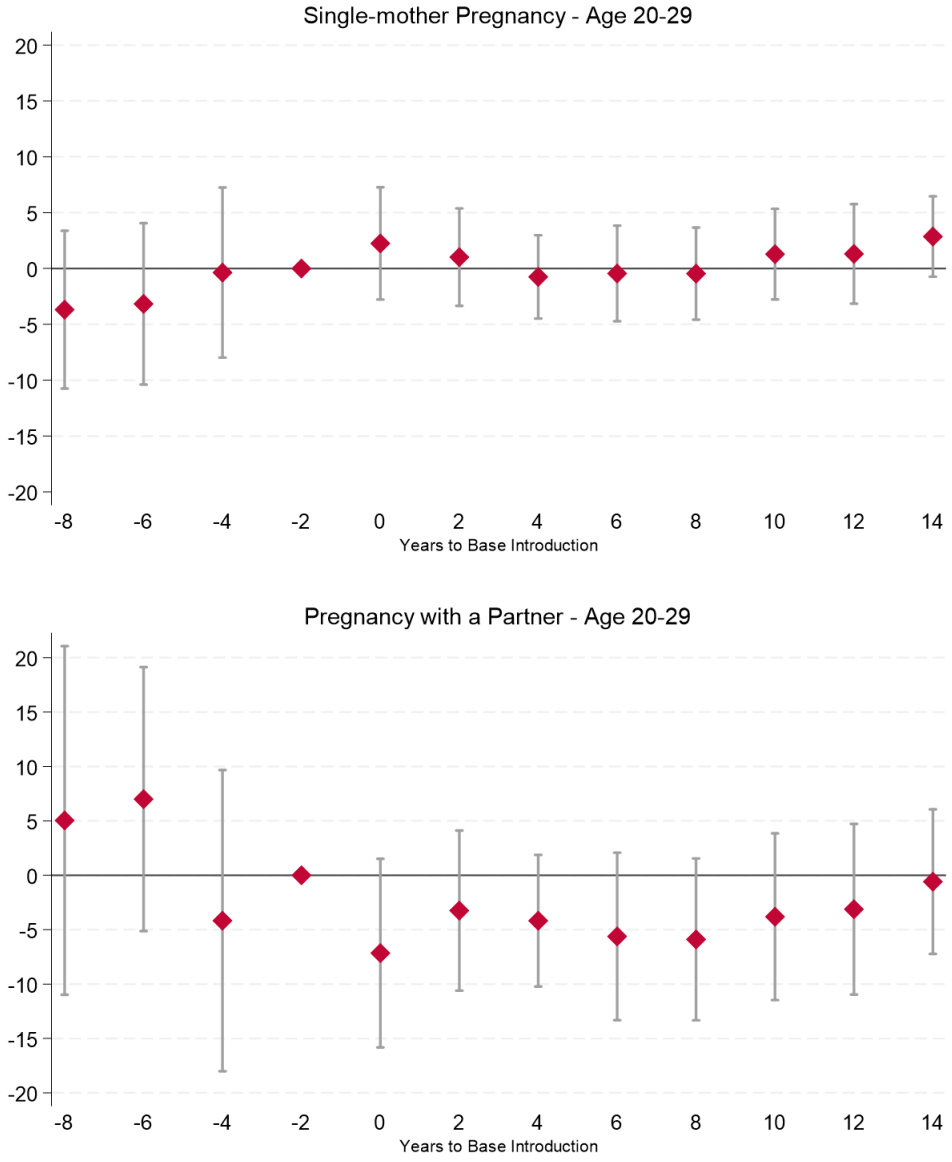
A.3.6 Additional Results on Single-mother Fertility

Figure A11: Effects on Single-mother Fertility
Outcome: Number of Conceptions per 1,000 Women by Mothers' Age 10 - 39



These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

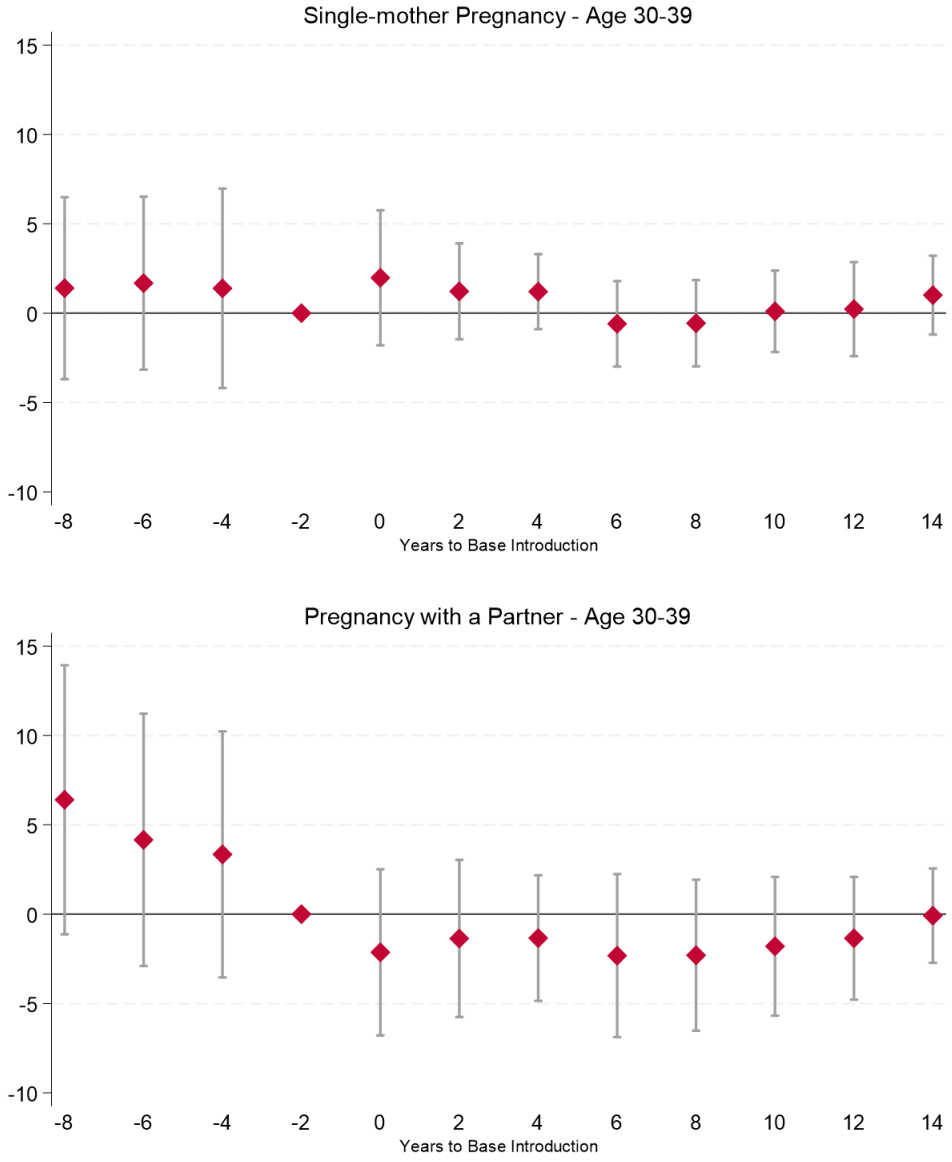
Figure A12: Effects on Single-mother Fertility
Outcome: Number of Conceptions per 1,000 Women by Mothers' Age 20 - 29



These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

Figure A13: Effects on Single-mother Fertility

Outcome: Number of Conceptions per 1,000 Women by Mothers' Age 30 - 39

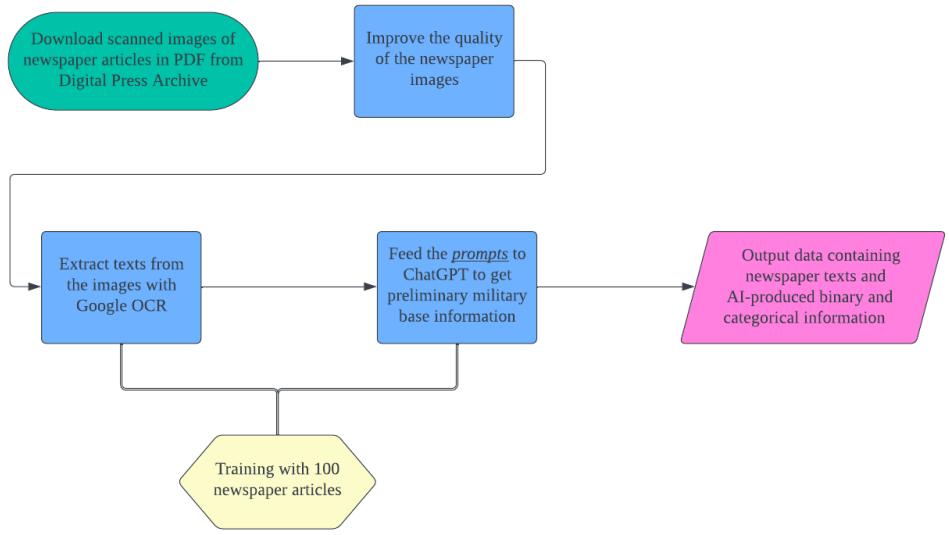


Note: These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

A.4 Construction of the Military Base Data

As the data on military base locations were not made available, we constructed them from newspapers published in Colombia from 2000 to 2010. Figure A14 provides an overview of this data cleaning process, and we describe it in detail in the following.

Figure A14: Process to Extract Text from Newspaper Images



A.4.1 Text Data Extraction from Newspaper Images

The first step is to collect newspapers published in Colombia from 2000 to 2010 related to military units. To do so, we downloaded relevant newspaper articles from the Digital Press Archive, a newspaper database provided by the Popular Research and Education Center/Program for Peace (Cinep/PPP). The database offers over 70,000 digitized publications from 10 national and regional newspapers since 1979, categorized into five groups; 1) church and conflict, 2) politics and government, 3) drug trafficking, 4) society and culture, and 5) ecology and environment. We use two keywords in Spanish, *brigada* (brigade) and *batallón* (battalion), to restrict our search, which has yielded about 11,000 articles published from January 1, 2000 to December 31, 2010. All the digitized materials are scanned images of newspaper articles in the PDF format with a range of image quality.

The second step is to improve the quality of the article images. We processed all the scanned newspaper articles to smooth, reduce noise, and binarize the images, and adjust contrast.[18]

[18]Image binarization is a process to convert a gray-scale image to a binary (black and white) image that can be used to identify the foreground of the image. This process helps extract texts from noise in the

The third step is to read the improved article images with Google Cloud Vision, which can detect text data from images using Optical Character Recognition (OCR) and machine learning. Since texts in newspaper articles are organized in irregularly shaped chunks and font sizes (as opposed to, for example, texts in an academic paper in paragraphs), detecting texts in proper orders that form sentences can be challenging. Therefore, we used the manually extracted data from 100 articles to train a machine learning model more suitable to detect texts from newspaper articles. This step created an initial text dataset containing the texts from all newspaper articles.

The final step is to use ChatGPT 3.5 to get basic information about each newspaper article using the text data from the previous step. To optimize this process, we again used the training dataset from the same 100 articles to train ChatGPT to accurately obtain information of interest. More specifically, we wanted to ChatGPT to extract names, locations (municipalities and department), and activation and deactivation dates of military bases. The prompt we gave ChatGPT is found in Box A.4.2 below. We use the AI-extracted data to inform and speed up the later treatment variable creation, not necessarily to take the data to directly create the treatment variables without manual inspection of the content of the relevant newspaper articles.

A.4.2 Prompt for ChatGPT

Please note that this journalistic article from Colombia has been extracted using OCR software, which could result in spelling errors, incomplete words and incorrect word separation. Your task is to correct these errors and normalize the words according to the spelling rules standard before continuing with information extraction.

The article is: *ArticleText*

Now that the article has been corrected, perform the following tasks consistently:

1. Identify and list all mentions of departments only in Colombia and save them in the "departments" field

2. Identifies and lists all mentions of locations in Colombia, such as Capital district (Bogotá), tourist district (Cartagena de Indias), municipalities, townships, paths, towns and rural areas that appear in the article. It also includes any relevant Colombia-only locations in the field called "municipalities".

articles.

3. For the departure of insurgent forces, take into account guerrillas, self-defense or paramilitary groups and drug trafficking groups.

4. Includes in the list of army units only those that are mentioned in the article, covering names of commands, battalions, divisions, brigades, Companies, Platoons and Squads. The names of these units may consist of personal names, Roman numerals, or ordinal numbers, as II Brigade, II Brigade, José María Battalion and Seventh Brigade. You do not generically include the army, national army, insurgent forces or names of generals.

5. Identify and list all the government institutions mentioned in the following article. Institutions to consider include the Ombudsman's Office, Attorney's Office, Prosecutor's Office, mayor's offices and governorships.

6. To identify the department (Save it in *ColumnName*) and/or municipality, township or vereda (Save it in *ColumnName*) headquarters of the newspaper:

   (a) Search on this line: *ArticleText*

   (b) If nothing is found, search in the first 100 characters

   (c) If neither is found, look to see if the word after the title is a location. The title is *ArticleText*

   (d) If neither is found, look to see if the last word of the text is the name of a location.

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7. Includes the list of units of the national navy only those that are mentioned in the article, including marine infantry, coast guard commands, Naval Operations Command, surface units.

8. Includes to the list of air force units only those that are mentioned in the article, covering Air Combat Command (CACOM), Air Combat Group (GAC), squads.

9. Make sure you don't include duplicates in your lists, even if an item is mentioned multiple times in the article. Do not include anything that is not present in the article.

10. Check if the article contains information on the creation (foundation) and/or deactivation (Closing or dismantling) of formal Colombian military units (battalions, divisions, brigades, companies, bases) and not temporary ones

11. In case you find founded Colombian military units, extract the date of creation, the name of the unit and the text where its creation is specified (No more than 20 words). Returns the information in *ColumnName*.

12. In case you find deactivated Colombian military units, extract the creation date, the name of the unit and the text where its deactivation, dismantling or closure is specified (No more than 20 words), only the paragraph or phrase where this was specified. Return the information on *ColumnName*.

13. In case you cannot find the name of a created or disabled drive, it returns an empty record. And it only returns military units or divisions from Colombia.

14. You should not show the corrected article. Just the JSON

15. Only show data found in the text of the article. Do not make inferences or add locations that are not explicitly mentioned in the content of the article and make sure they are from Colombia.