Agricultural and
Applied Economics
UNIVERSITY OF WISCONSIN-MADISON

Taylor Hall
427 Lorch Street
Madison, WI 53706

Department of Politics, Governance, and Economics   October 27, 2024
School of International Service
American University

Dear Hiring Committee Members,

I am writing to apply for the position of the Assistant Professor at the School of International Service (SIS) at American University. I am an applied microeconomist who integrates rigorous empirical methods to address pressing issues related to gender, conflict, and economic development. I will complete my Ph.D. in Agricultural and Applied Economics at the University of Wisconsin-Madison in May 2025. As a SIS alumna, I am enthusiastic about the opportunity to join your faculty as an Assistant Professor and contribute to the SIS's vibrant research community.

My job market paper, "Effects of Military Bases on Women in Colombia," co-authored with Felipe Parra, investigates the causal impacts of military base presence on sexual violence, fertility, and child support disputes in rural Colombia. Using a novel dataset constructed from various sources and employing an event-study approach, we leverage the temporal and geographical variation in military base placements driven by Colombia's military expansion from 2000 to 2016. This allows us to identify the causal effects of military interventions, revealing a 72% increase in registered cases of sexual violence over 16 years. This research contributes to understanding the unintended consequences of state security interventions and provides critical insights for policymakers working in conflict-affected settings.

In addition to my focus on conflict and gender dynamics, my broader research agenda explores the economic barriers women face in labor markets. In a project in Pakistan's garment sector, I analyze how social norms affect employers' decisions to hire women. This research, supported by funding from the International Growth Centre (IGC) and Private Enterprise Development in Low-Income Countries (PEDL), aims to develop policy interventions to increase female labor force participation, particularly in environments constrained by traditional gender norms.

In the coming years, I will expand my research on gender disparities and conflict in developing economies. In Colombia, I will investigate the broader social impacts of military interventions, including effects on reproductive rights and educational outcomes. In Pakistan, I will focus on identifying scalable solutions to increase female labor force participation by addressing entrenched social norms. I am committed to securing funding from a diverse range of public, private, and non-profit sources, and will use external funding to support research assistants on my projects.

Thank you for considering my application. I can be reached by telephone at +1 (917) 969-5420, and by email at sshibuya2@wisc.edu.

Sincerely,

Sakina Shibuya

SAKINA SHIBUYA

427 Lorch St, Taylor Hall, Madison, WI, USA 53706

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Department of Agricultural & Applied Economics, University of Wisconsin-Madison

EDUCATION

University of Wisconsin, Madison   *2019 - 2025 (Expected)*
Ph.D., Agricultural and Applied Economics

American University   *2014*
M.A., International Development

University of California, Los Angeles   *2009*
B.A., History with a Minor in Political Science

RESEARCH FIELDS

Development Economics, Applied Microeconomics, Gender Differences in the Economy

REFERENCE

Professor Laura Schechter (Advisor)   **Professor Corina Mommaerts**
Department of Economics   Department of Economics
University of Wisconsin, Madison   University of Wisconsin, Madison
lschechter@wisc.edu   cmommaerts@wisc.edu

Professor Priya Mukherjee   **Professor Ross Milton (Teaching Only)**
Department of Agricultural & Applied Economics   La Follette School of Public Affairs
University of Wisconsin, Madison   University of Wisconsin, Madison
priya.mukherjee@wisc.edu   rtmilton@wisc.edu

CITIZENSHIP AND US WORK AUTHORIZATION

Japanese citizen with U.S. permanent residency

JOB MARKET PAPER

When Protection Fails: Effects of Military Bases on Sexual Violence in Colombia
with Felipe Parra

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 15 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.

ONGOING PROJECTS

Understanding Constraints in Hiring Women in Pakistan
with Zunia Tirmazee and Hana Zahir

74% of the employers in our survey think women are at least as good as, if not better than, men at on-site production jobs in the garment manufacturing industry in Pakistan. Yet, most factories still do not hire many women on factory floors. While much research has been conducted into the constraints women face in obtaining out-of-home employment, this paper instead investigates: What deters firms from hiring women? We utilized unique firm survey data, complemented by a hypothetical-choice methodology and a behavioral game, to examine the economic and non-economic costs of hiring women. Our study observes how monetary incentives can influence compliance with social norms related to gender segregation. Preliminary results suggest that the willingness to comply with these norms are not as relevant as expected, and costs of hiring women, especially the cost of providing safe transportation to women may be more salient to firms' decision to hire women.

Watch Your Step: The Economic and Behavioral Responses of Rural Households to Landmines during Conflict
with Felipe Parra

Antipersonnel landmines, though intended to target combatants, disproportionately impact civilians, disrupting economic activity and altering household decision-making processes. This paper examines how rural households in Colombia adjust their labor market decisions and healthcare-seeking behavior in response to recent and nearby landmine events, using detailed spatial data on landmine events combined with longitudinal household survey data. Our findings show that individuals engage less in risky labor activities following recent landmine events, but these responses are heavily influenced by liquidity constraints. Specifically, liquidity-unconstrained individuals are 28% less likely to work in occupations other than agricultural day labor, particularly in agriculture, and 12% less likely to spend time on agricultural tasks in their own fields. These households hire additional agricultural workers after landmine exposure, substituting external labor for their own. In contrast, liquidity-constrained individuals are 45% more likely to engage in agricultural day labor to compensate for income losses stemming from reduced non-agricultural employment. Moreover, landmine events deter both adults and children from seeking formal preventative medical care. This study highlights the differences in responses between liquidity-constrained and unconstrained individuals to shifts in perceived security during conflict.

The Effects of Internally Displaced Peoples on Consumption and Inequality in Mali
with Jeremy Foltz (Revise and Resubmit at the Journal of African Economies)

A series of civil conflicts in Mali has generated more than 346,000 internally displaced people (UNHCR,2020). This study estimates the effect of conflict-generated internal displacement on consumption, poverty, and inequality in host communities. Using comprehensive nationwide household survey data this study finds that wealth at the commune and household level is non-decreasing in internally displaced people (IDP) hosting communes relative to non-IDP host communes. We also find some partial evidence of increasing consumption at the household level although inequality and poverty at the commune level remain the same. The evidence suggests a fairly successful hosting and aid process in Mali for IDP in terms of mitigating economic disruption for host communities.

POLICY PAPERS

Middle East and Central Asia: A Survey of Gender Budgeting Efforts   2016
with Lisa Kolovich

Working Paper/16/151. International Monetary Fund. Link.

Trends in Gender Equality and Women's Advancement   2016
with Janet Stotsky, Lisa Kolovich and Suhaib Kebhaj

Working Paper/16/151. International Monetary Fund. Link.

BOOK CHAPTER

Middle East and Central Asia   2018
with Lisa Kolovich

Chapter 6 in *Fiscal Policies and Gender Equality*. International Monetary Fund. Link.

GRANTS AND FELLOWSHIPS

SurveyCTO Data Collection Grant Runner-up	One-year subscription worth $2,376, 2022
Short-term Resident Fellowship, Lahore School of Economics	$6,300, 2022
Early-career Researchers Grant, IGC	£20,000, 2022
Exploratory Research Grant (Scale-up), PEDL CERP	£36,000, 2022
Exploratory Research Grant, PEDL CERP	£4,000, 2021
Doctoral Research Travel Grant, UW-Madison	$1500 each, 2021, 2022

CONFERENCE

NBER Summer Institute (Gender)	2022, 2023, 2024
Empirical Studies of Conflict (ESOC)	Oct. 2024
NEUDC	Nov. 2024
PacDev at Stanford University (Gender)	2024
Stanford Institute for Theoretical Economics (SITE)	2024

TEACHING EXPERIENCE

University of Wisconsin, Madison   Fall 2021

TA for *Introduction to Statistical Methods for Public Policy Analysis* taught by Professor Ross Milton

SERVICE AND LEADERSHIP

University of Wisconsin, Madison   2020 - 2022
Taylor-Hibbard Club

Student research colloquium organizer and webmaster for the graduate student association.

University of Wisconsin, Madison   2020 - 2021
Department Committee on Justice, Equity, Diversity, and Inclusion

Served as one of the two student representatives.

SKILLS AND LANGUAGES

Computer Languages	Stata, R, LaTeX, SurveyCTO (fluent);
	MATLAB, QGIS, ArcGIS, Qualtrics (intermediate);
	Python (beginner)
Languages	English (fluent), Japanese (native)

RESEARCH AND PROFESSIONAL EXPERIENCE

International Finance Corporation (IFC)   July 2024 - Present
Research Assistant

Impact evaluation of various IFC's investments in telecommunications and finance.

World Bank, African Gender Innovation Lab   Jan. - June 2024
Research Assistant

Various projects on women's labor force participation and entrepreneurship in East Africa.

University of Wisconsin, Madison   Sept. 2019 - Aug. 2021, Jan. 2022 - May 2022, Jan. - Dec. 2023
RA for Professor Jeremy Foltz

Various projects on climate change, conflict, agriculture, and internal migration in Mali.

World Bank, Development Research Group   June. - Dec. 2022
RA for Professor Thomas Fujiwara, Dr. Martin Kanz, and Professor Priya Mukherjee

Subsidies and voters' behaviors.

World Bank, Development Research Group   Sept. 2016 - May, 2019
RA at Development Impact Evaluation Unit (DIME)

Evaluation of agricultural projects in Rwanda.

International Monetary Fund   Nov. 2014 - Aug. 2016
Research Analyst, Research Department

Macroeconomics and gender inequality.
Co-authored a working paper and a book chapter.

American University   Sept. - Dec. 2014
RA for Professor Maria Floro

Gender and climate change.

University of California, Los Angeles   Feb. 2008 - June 2009
RA for Professor Michael Thies

Japanese election data set construction.

The Bank of Tokyo Mitsubishi UFJ   Apr. 2010 - Jul. 2012
Associate Corporate Officer, Sapporo Branch

Managed relations with 30 small and medium sized companies.
Conducted loan feasibility tests, and administered loans.

Permanent Mission of Japan to the United Nations   Aug. 2009 - Feb. 2010
Short-term Advisor, Economic Section

Assisted diplomats in multilateral negotiations.
Wrote internal reports and translated official letters.

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

Felipe Parra   Sakina Shibuya

(Job Market Paper)

October 25, 2024
(Click here for the latest version.)

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.

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

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[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

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[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

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[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

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[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-

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[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

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[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

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[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

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[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

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[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,

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[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.

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[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:

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

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[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

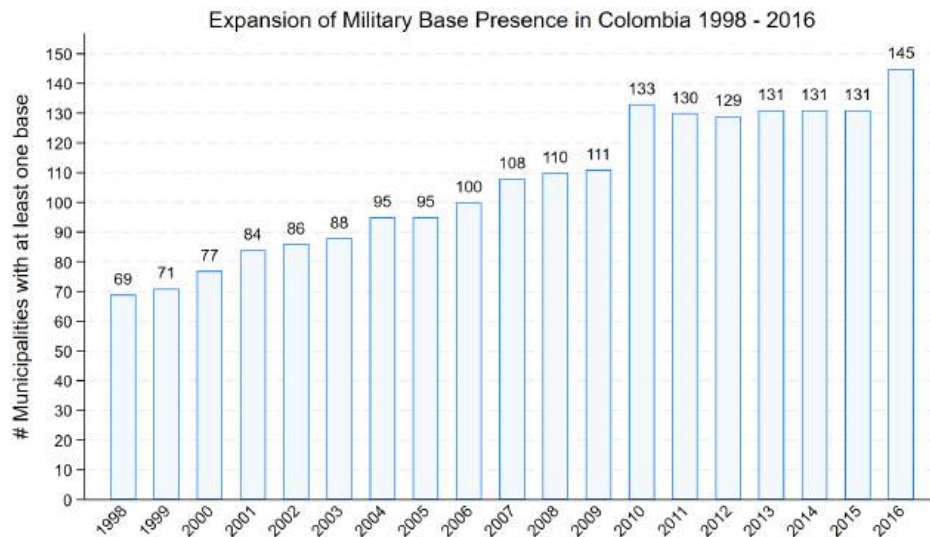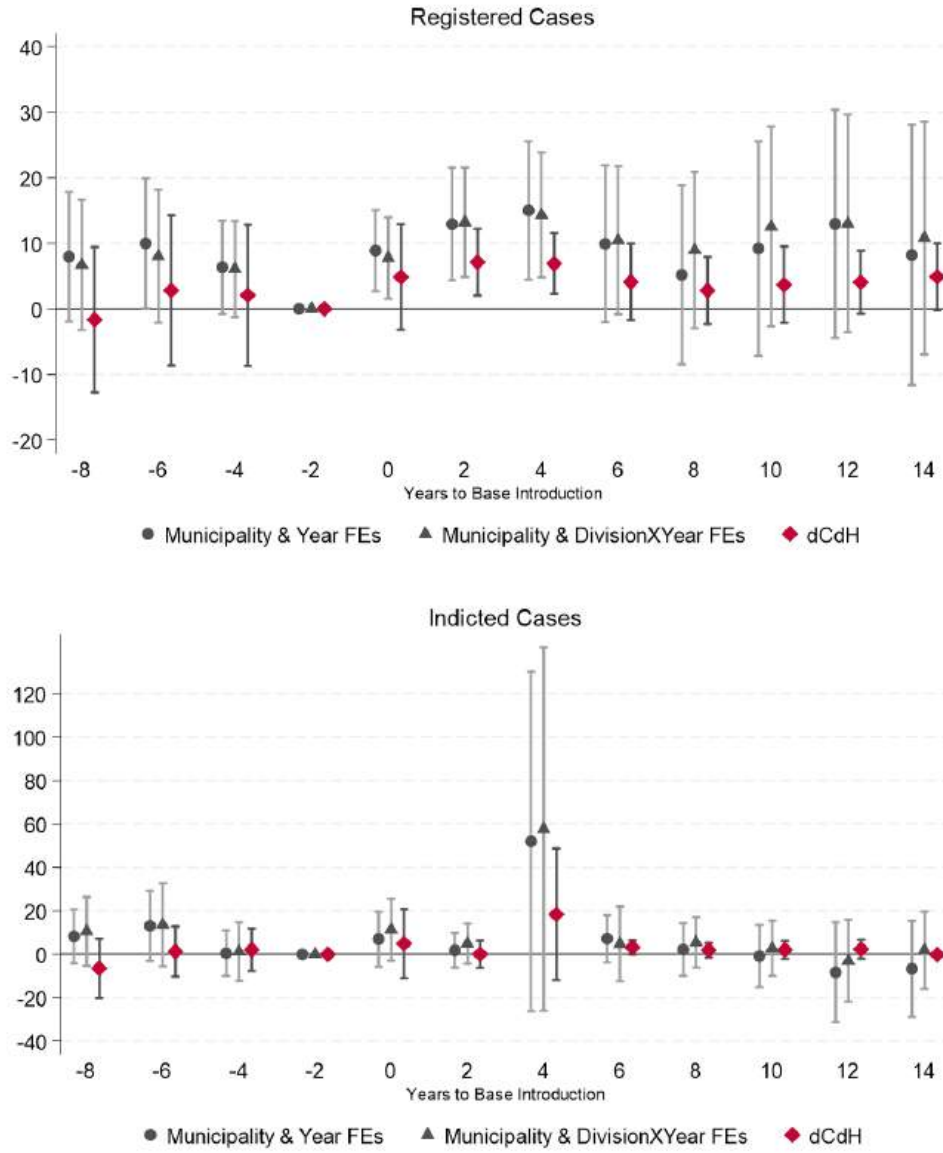Figure 1: Expansion of the National Army between 1998 and 2016

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.

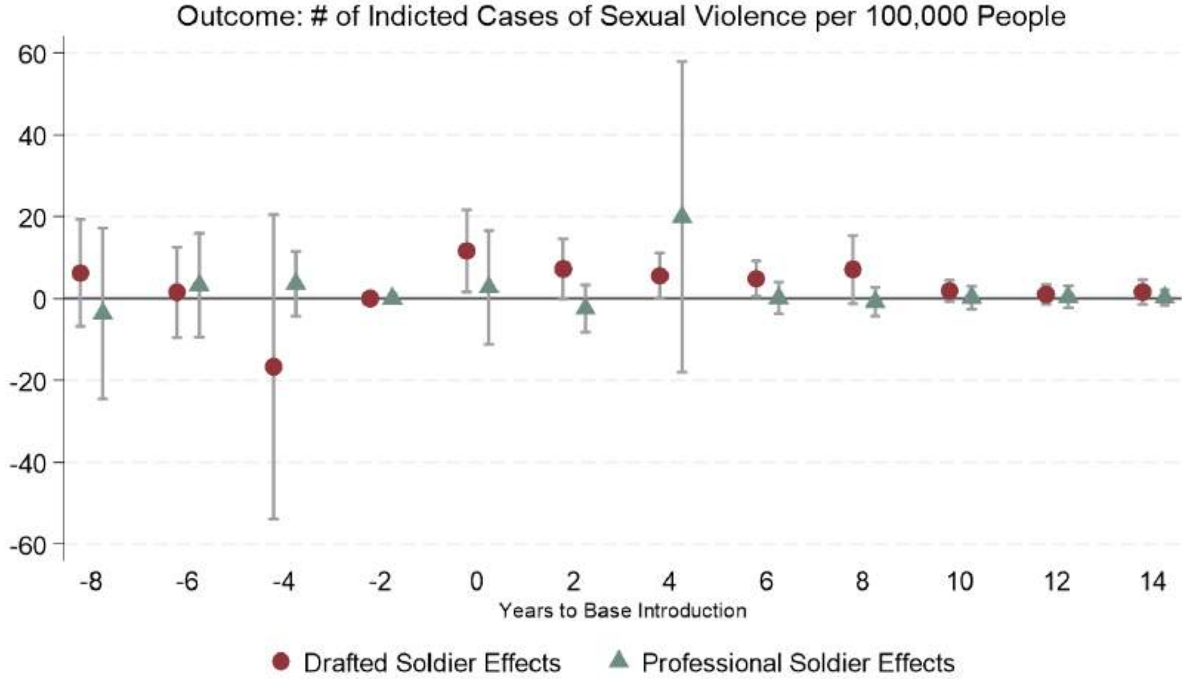Figure 3: Effects on Sexual Violence by Base Type (Registered Cases)

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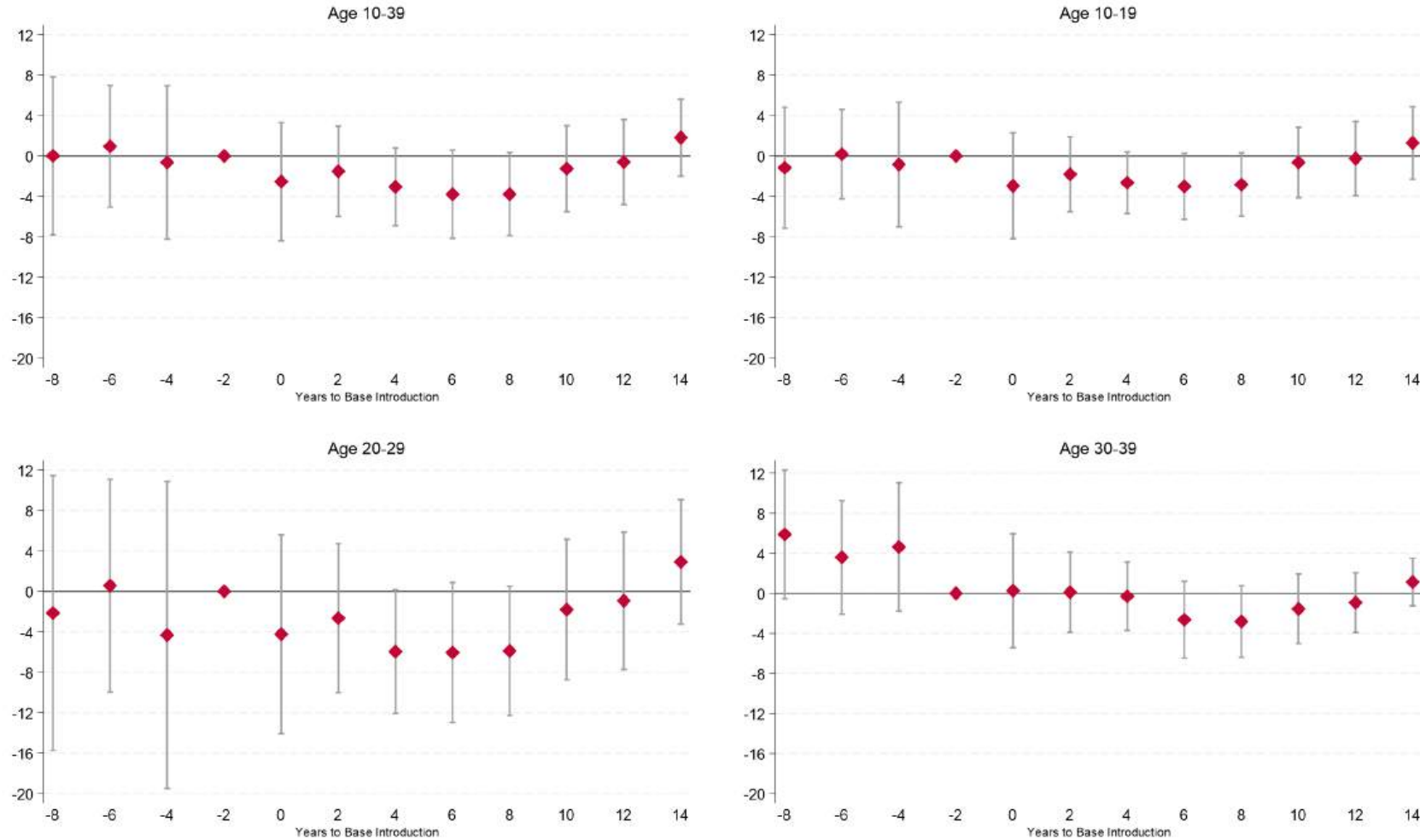
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes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

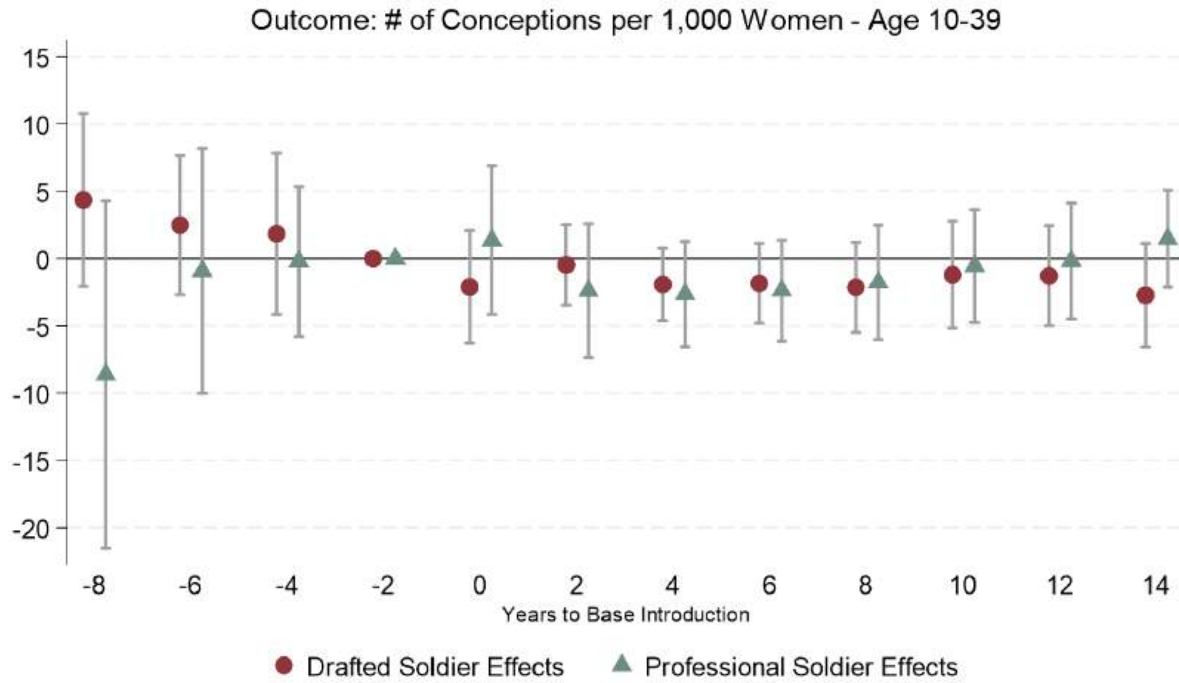## Figure 6: Effects on Fertility by Base Type

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
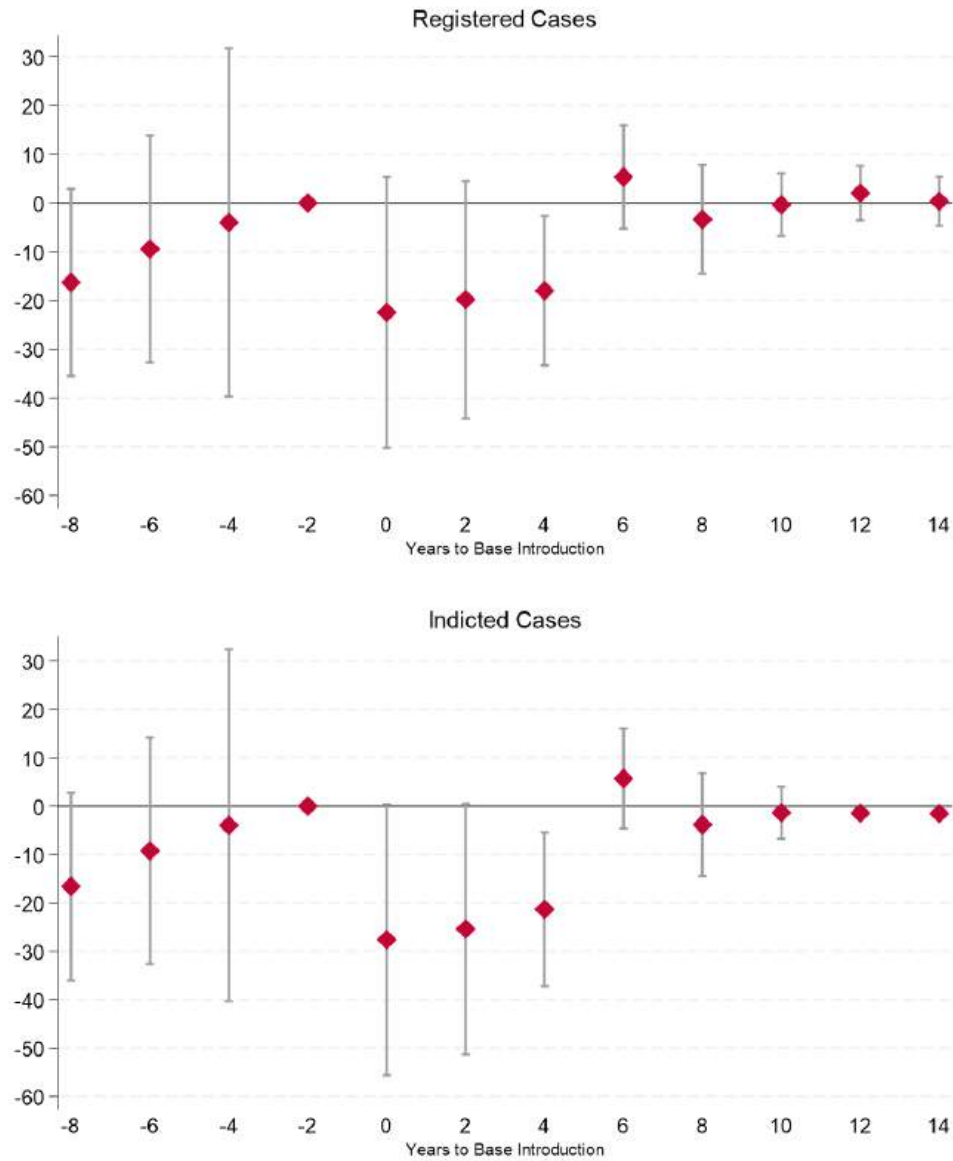Outcome: Log Municipality Population Counts by Sex
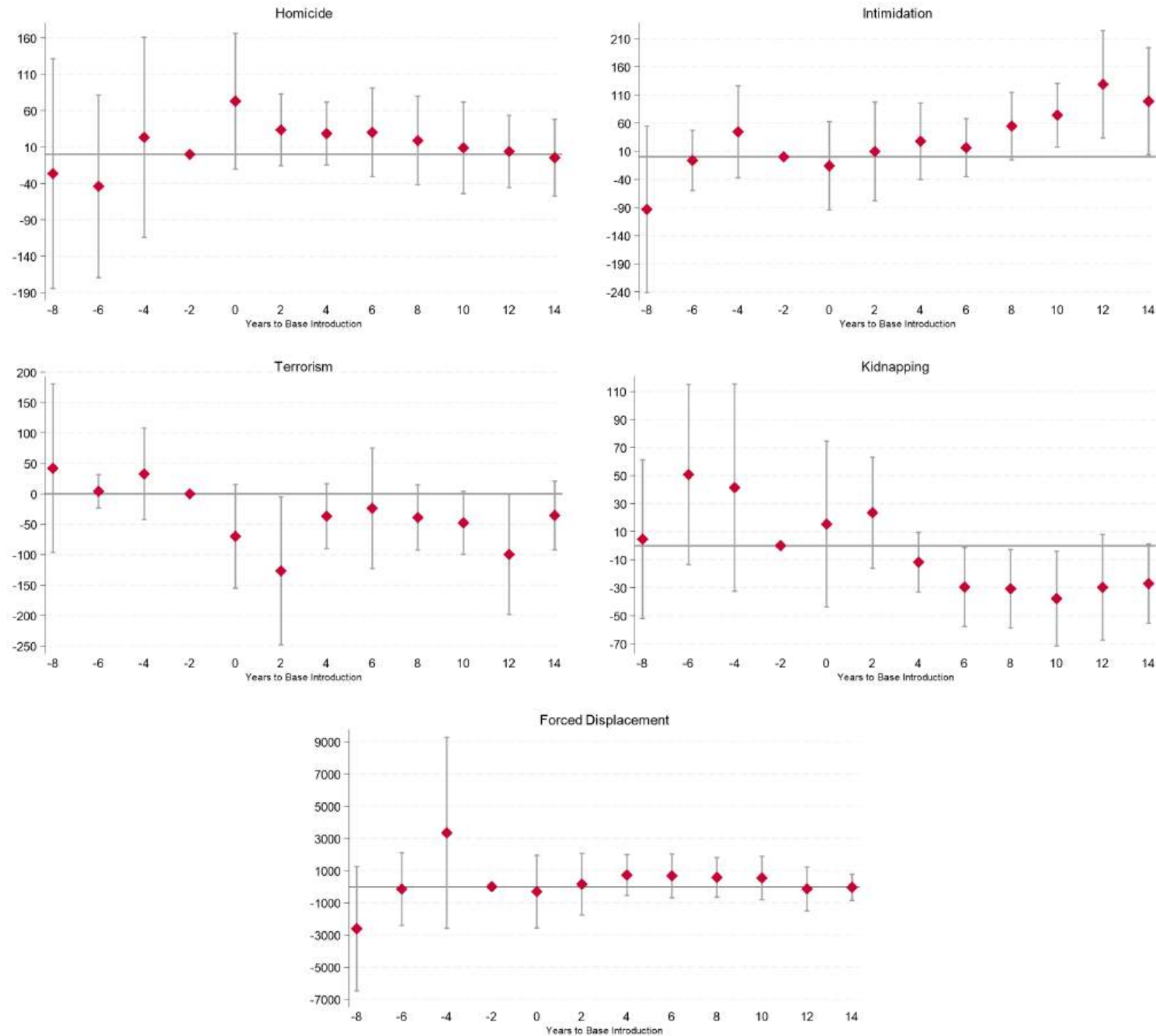
Female

Male

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
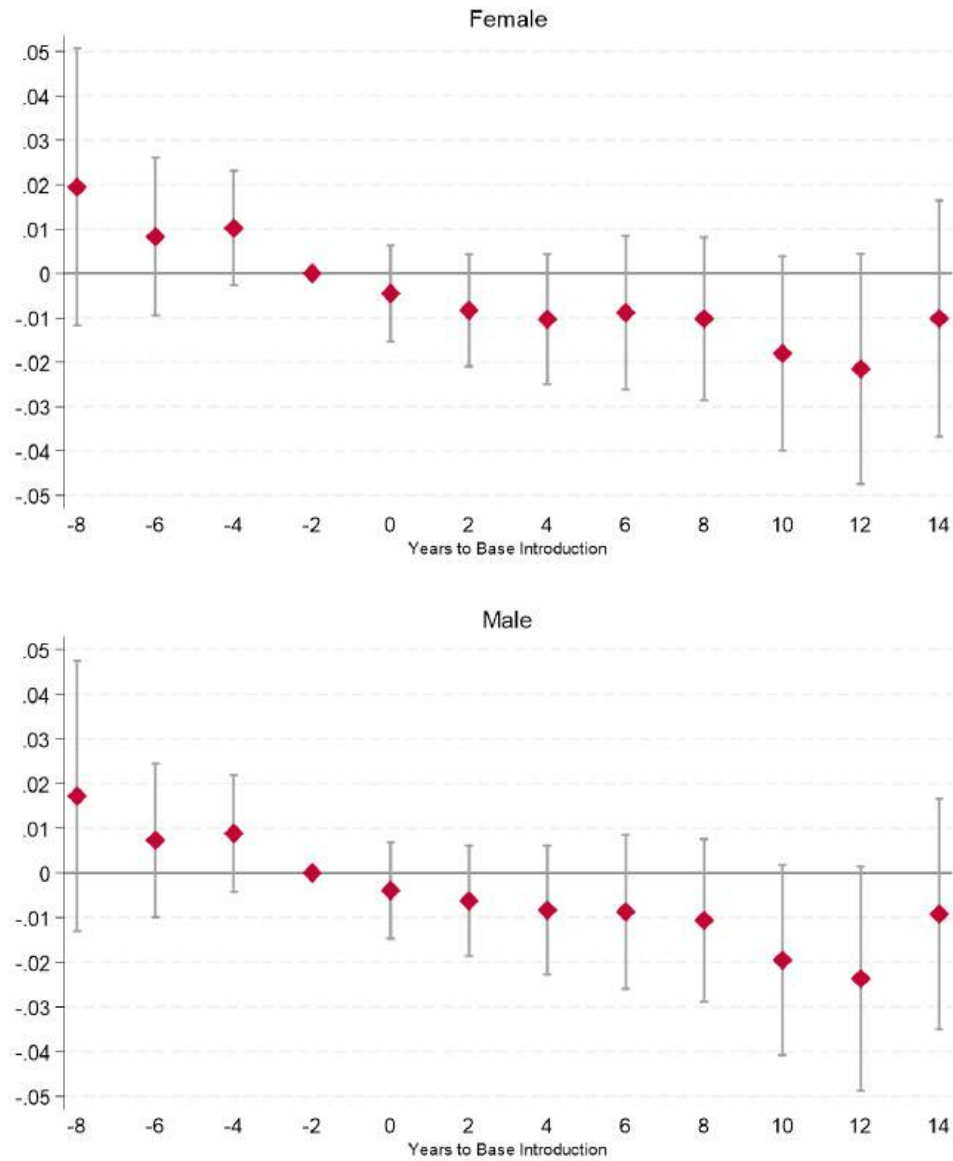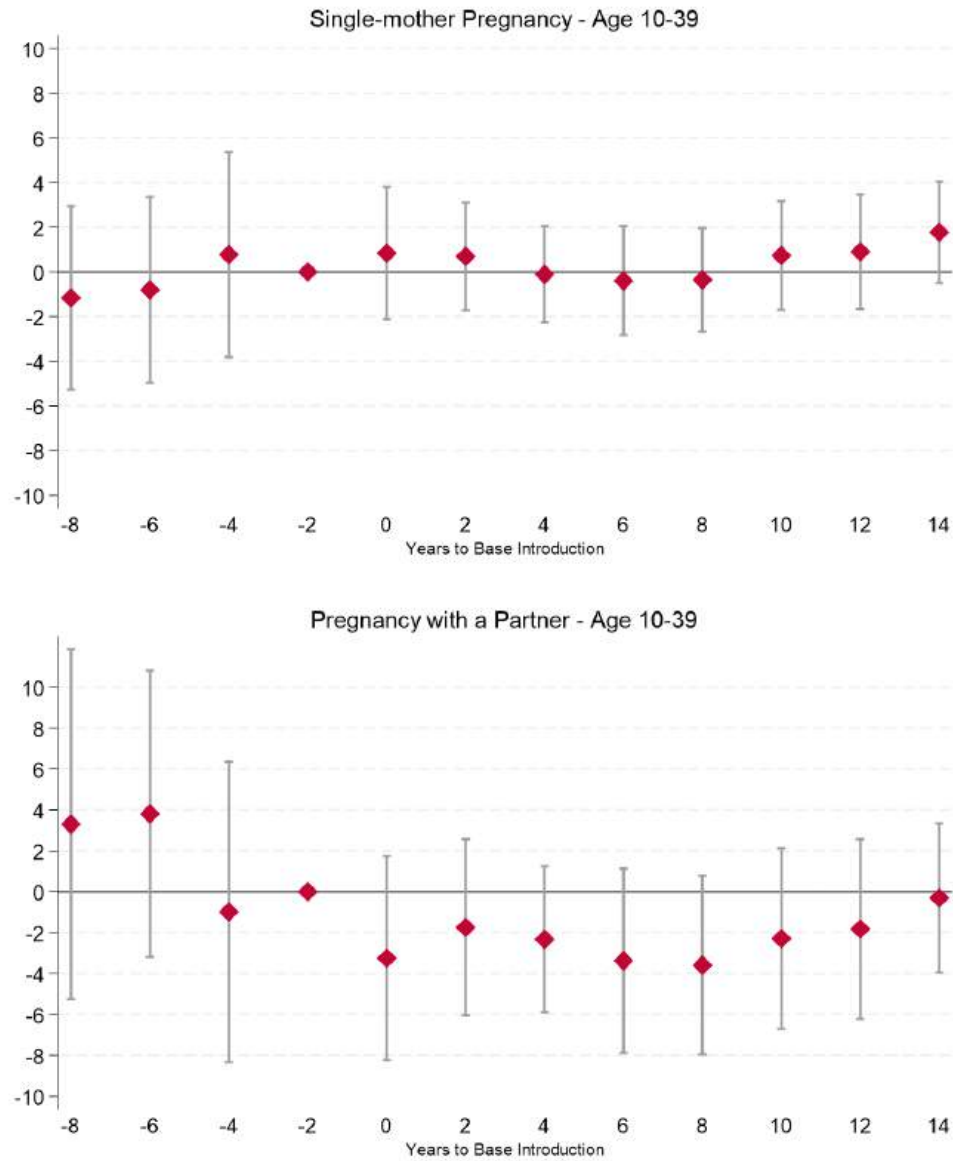Outcome: Number of Conceptions per 1,000 Women by Mothers' Age 10 - 39

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
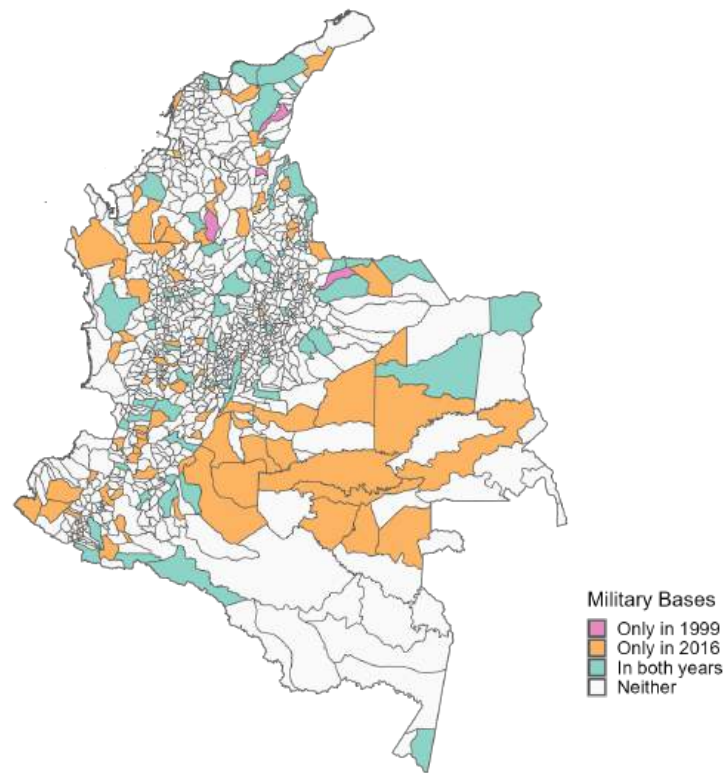
A.2 Graphs

Figure A2: U.S. Military Assistance to Colombia
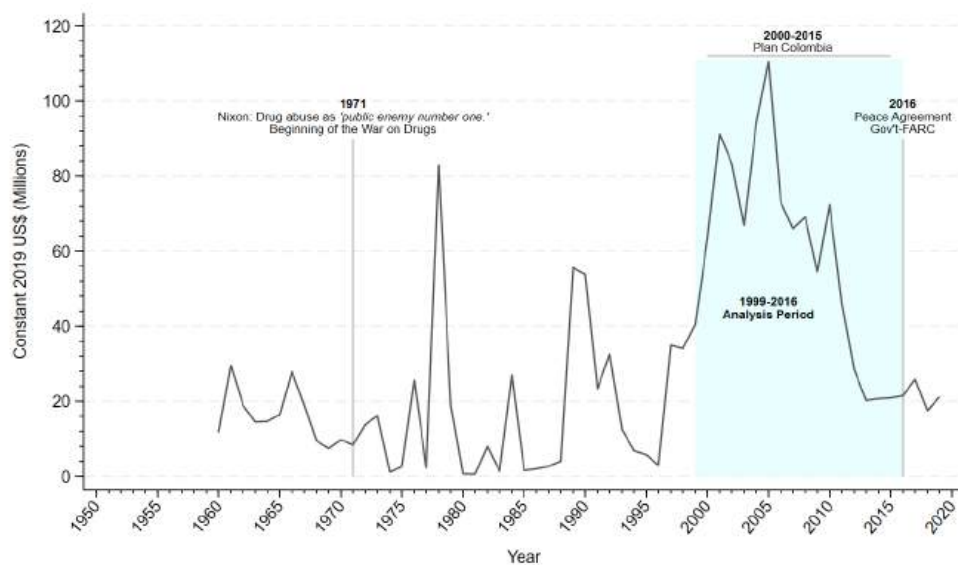
Source: U.S. Overseas Loans and Grants (Greenbook), USAID

Figure A3: The Organization of the Colombian National Army
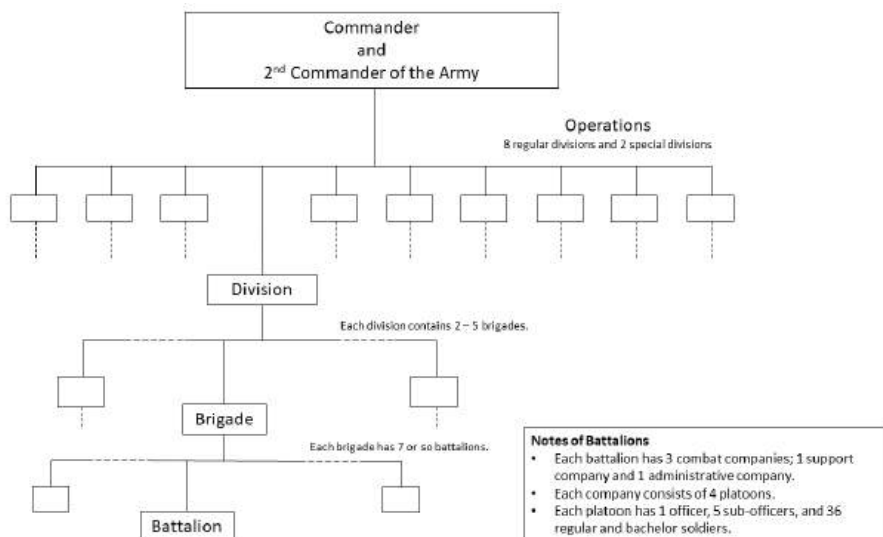
Note: The presented organization chart reflects the organization during the analysis period.

Figure A4: Military Base Presence and Duration
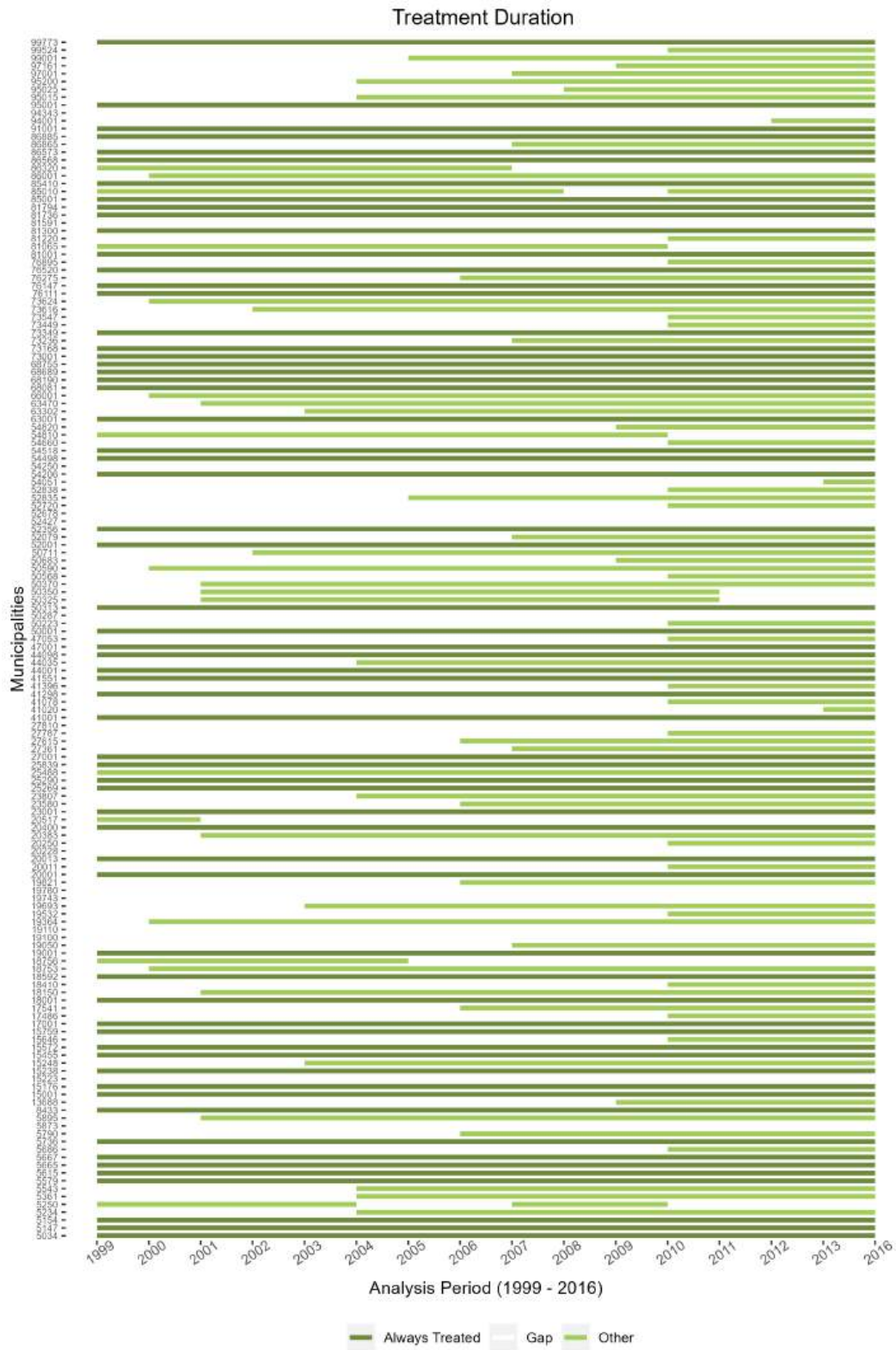
Figure A5: Time to Treatment

Note: This analysis sample includes 1112 unique municipalities.
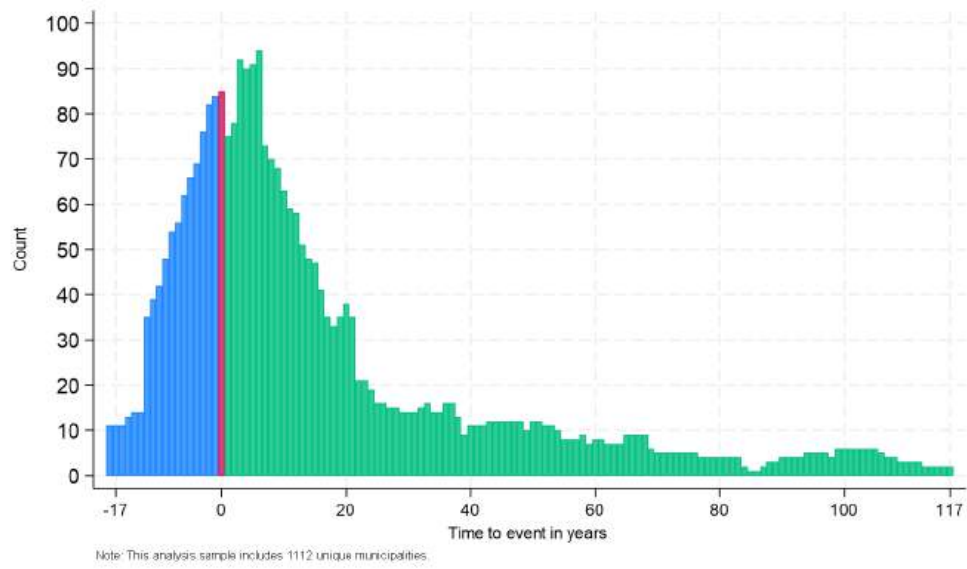
A.3 Tables

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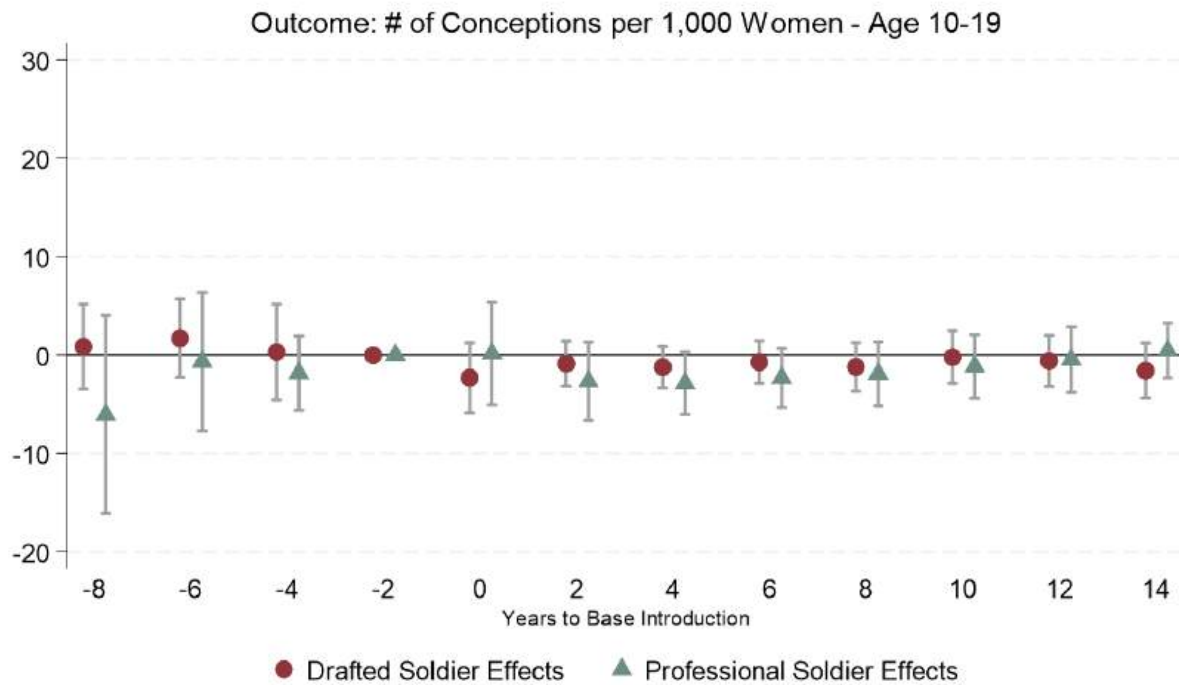
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes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

Figure A7: Effects on Fertility by Base Type

Outcome: # of Conceptions per 1,000 Women - Age 20-29

● Drafted Soldier Effects   ▲ Professional Soldier Effects

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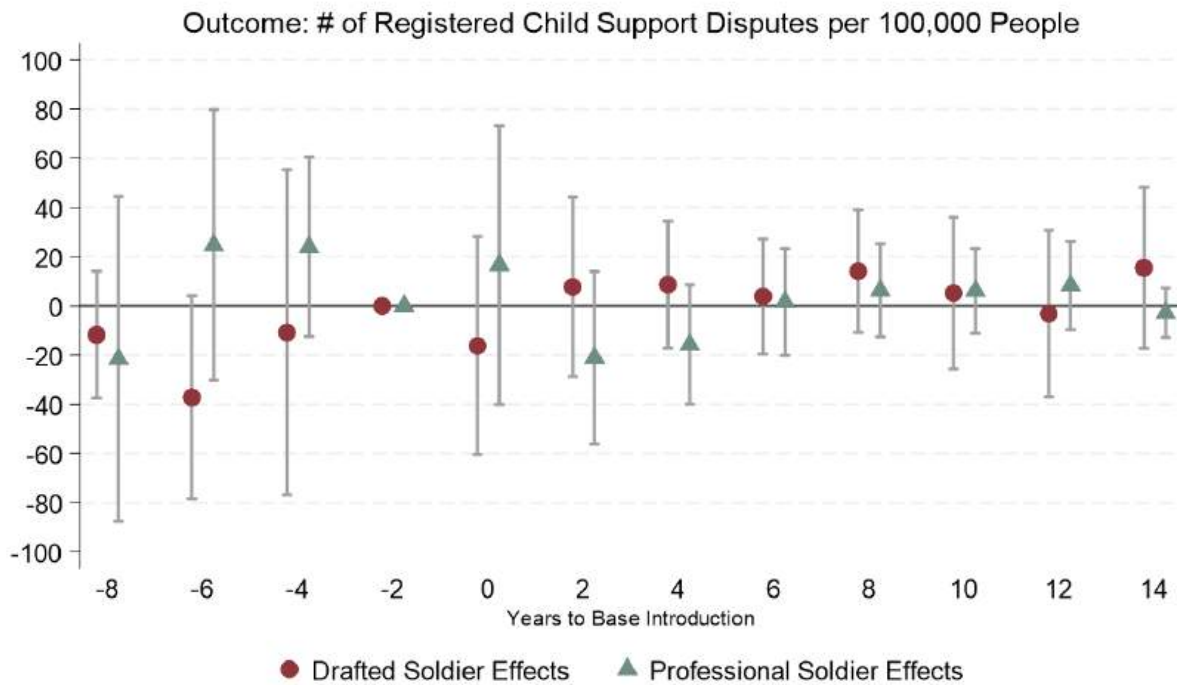
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes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

Figure A10: Effects on Child Support Disputes by Base Type (Indicted Cases)
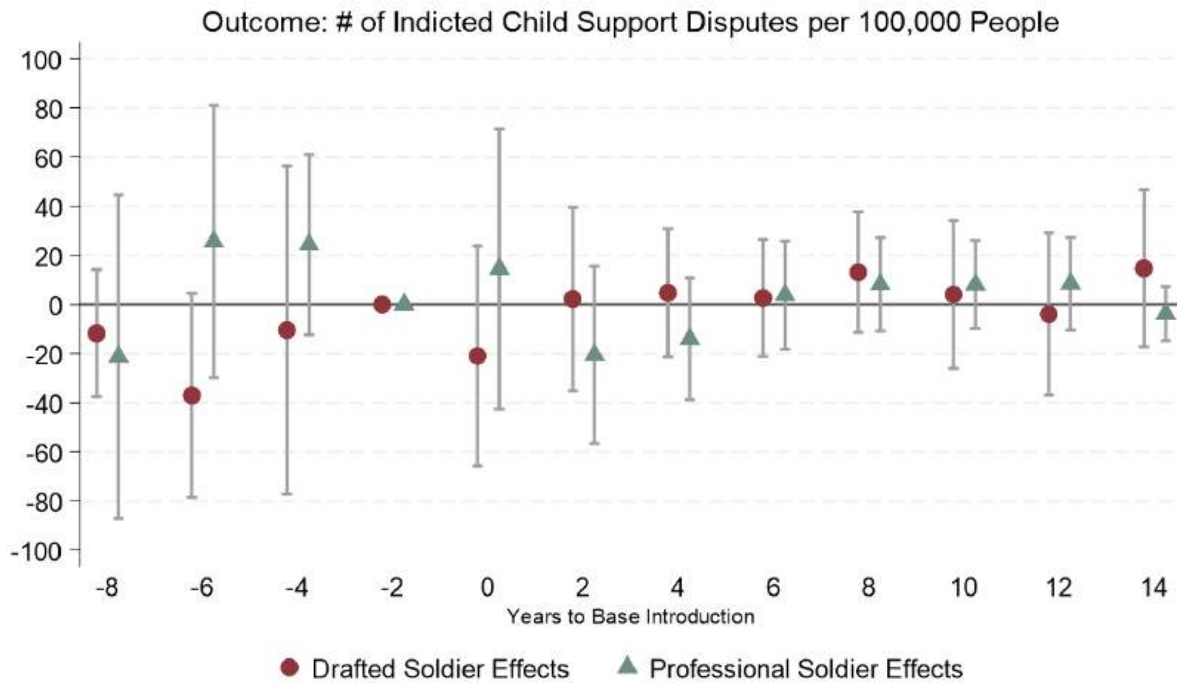
The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. A *division* in the Colombian Army is a larger unit within its hierarchy that govern brigades and battalions, and is assigned parts of the country as its jurisdiction. This analysis sample includes 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
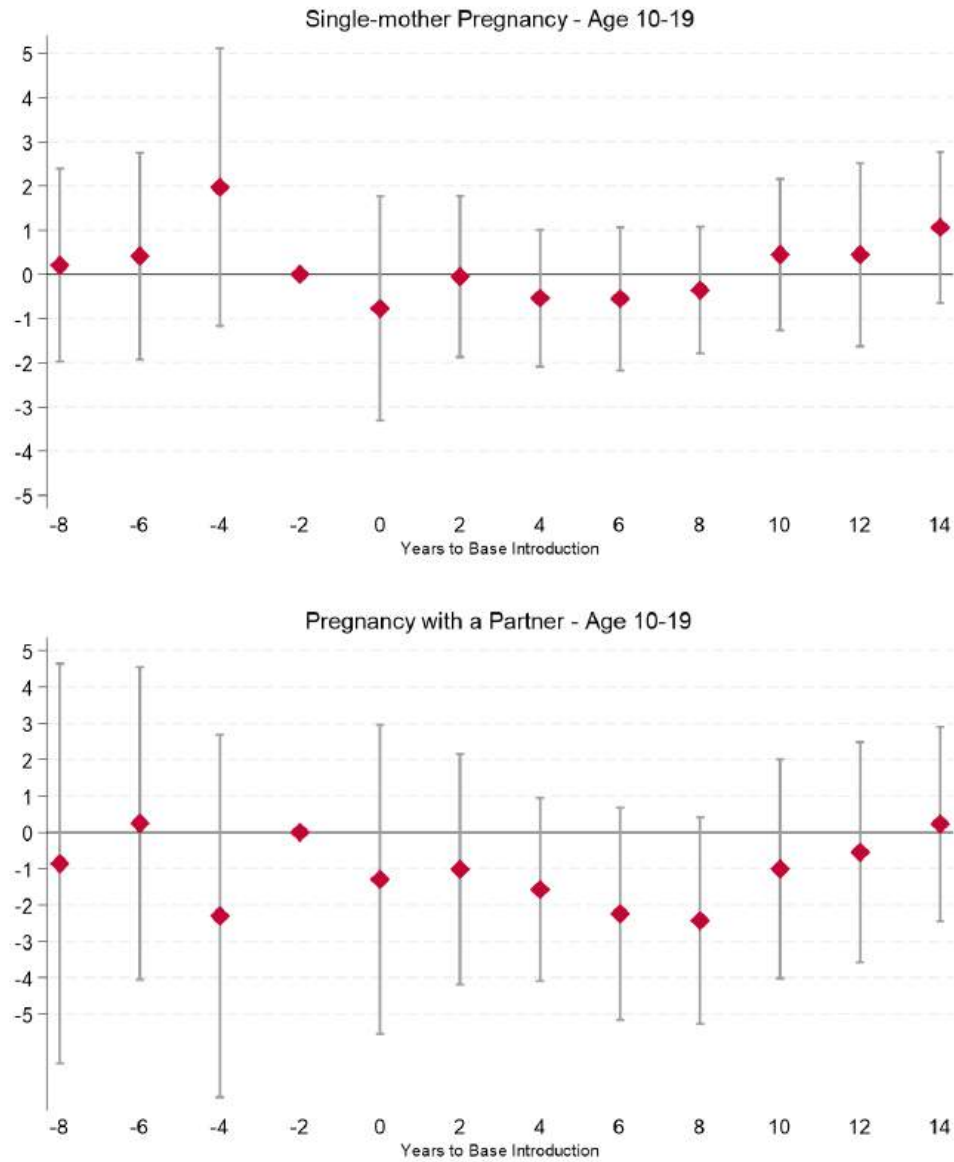
These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the

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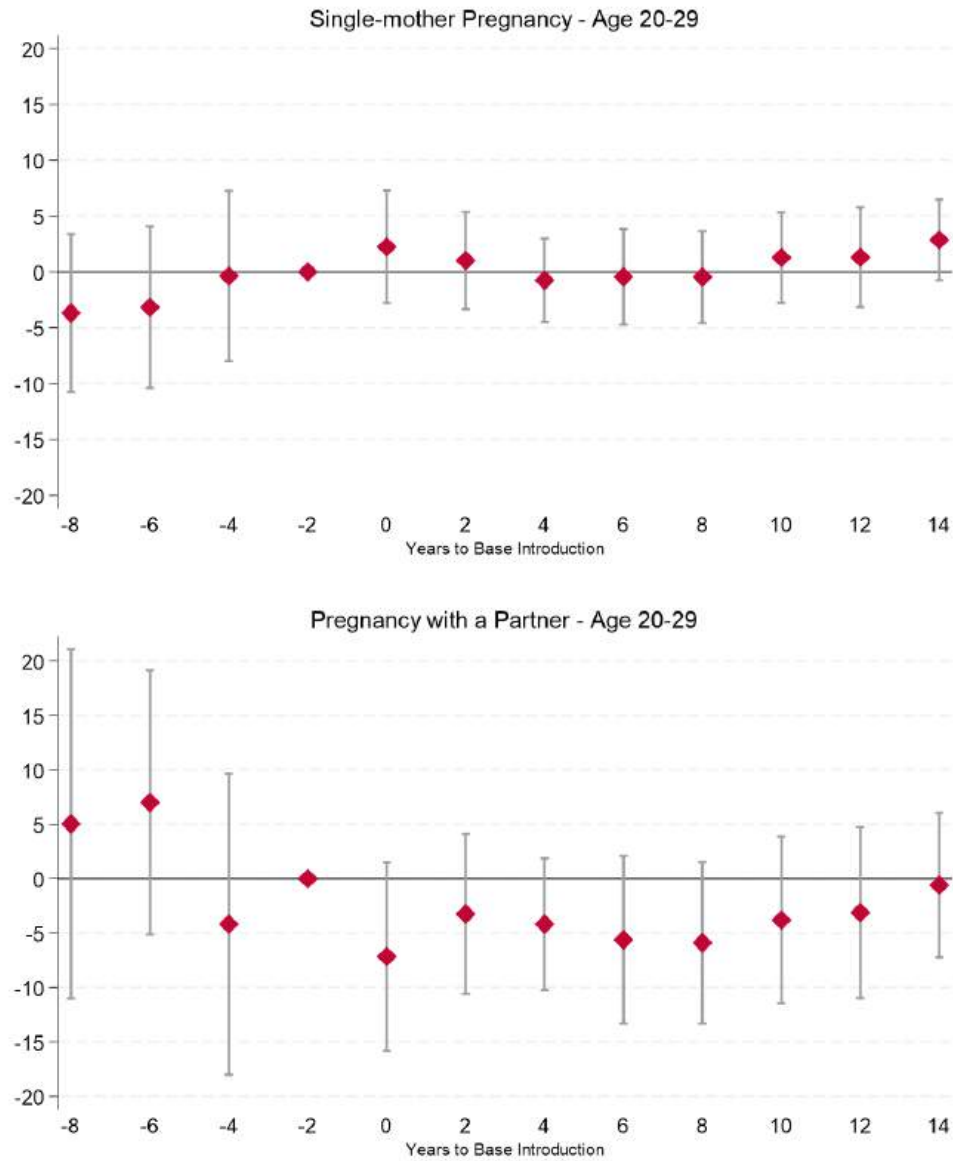
These plots show dCdH estimates. The lines are the 95% confidence intervals. Robust standard errors are clustered at the municipality level. This analysis sample includes 153 unique municipalities and excludes 959 never-treated municipalities.

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.

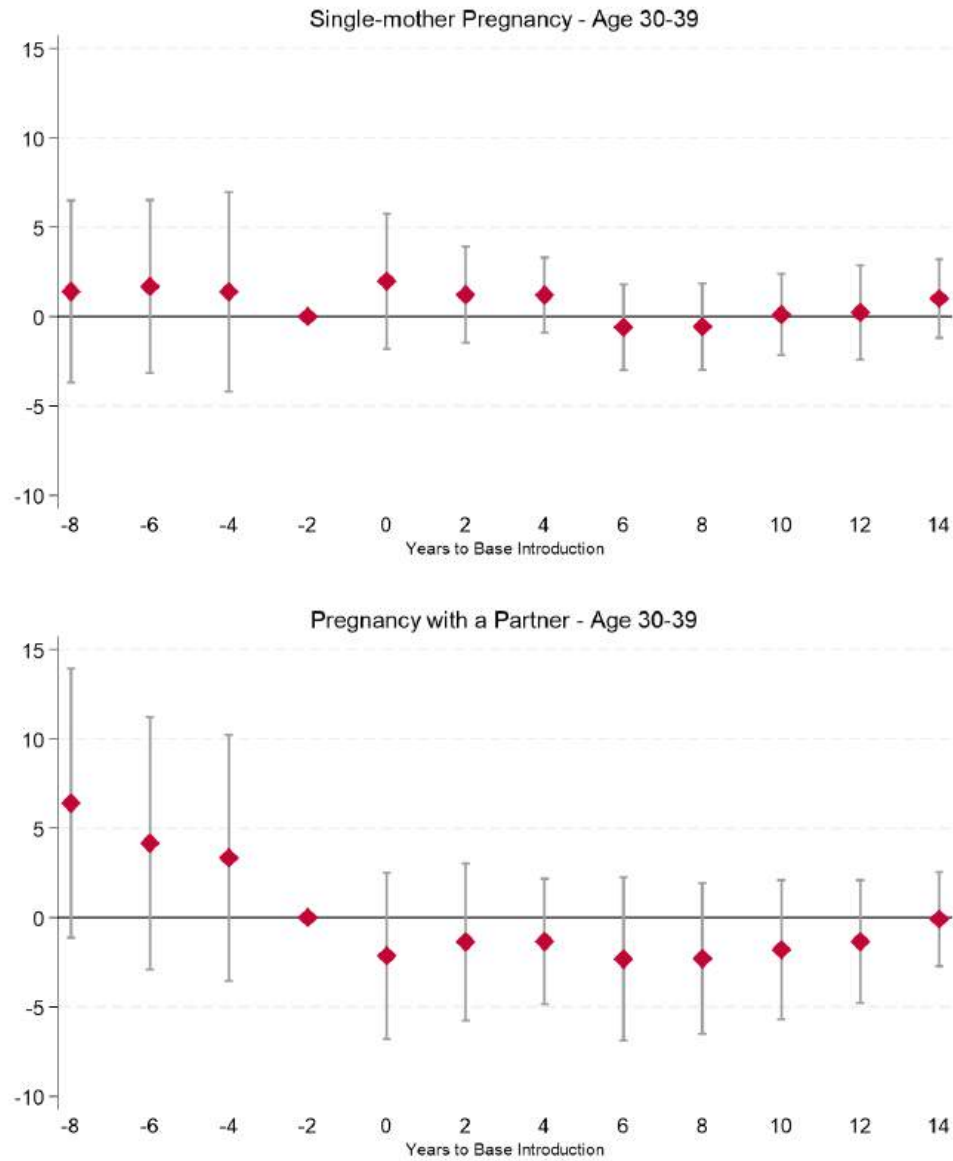## A.4 Construction of the Military Base Data

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
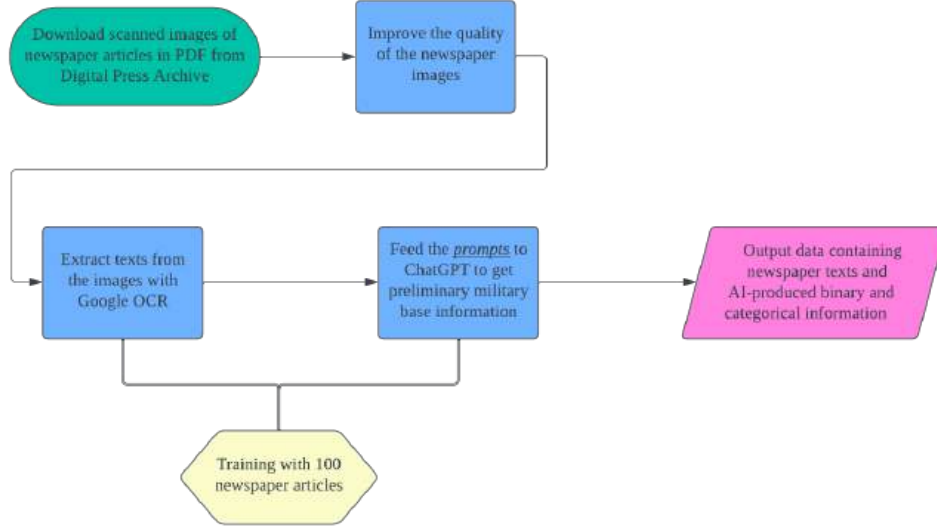
A.4.1 Text Data Extraction from Newspaper Images

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]

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[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: *Article Text*

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".

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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.

   %begintcolorbox[colback=white,colframe=black]

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.

Watch Your Step:

The Economic and Behavioral Responses of Rural Households to Landmines During Conflict [*]

Felipe Parra   Sakina Shibuya

(Job Market Paper)

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Abstract

Antipersonnel landmines, though intended to target combatants, disproportionately impact civilians, disrupting economic activity and altering household decision-making processes. This paper examines how rural households in Colombia adjust their labor market decisions and healthcare-seeking behavior in response to recent and nearby landmine events, using detailed spatial data on landmine events combined with longitudinal household survey data. Our findings show that individuals engage less in risky labor activities following recent landmine events, but these responses are heavily influenced by liquidity constraints. Specifically, liquidity-unconstrained individuals are 28% less likely to work in occupations other than agricultural day labor, particularly in agriculture, and 12% less likely to spend time on agricultural tasks in their own fields. These households hire additional agricultural workers after landmine exposure, substituting external labor for their own. In contrast, liquidity-constrained individuals are 45% more likely to engage in agricultural day labor to compensate for income losses stemming from reduced non-agricultural employment. Moreover, landmine events deter both adults and children from seeking formal preventative medical care. This study highlights the differences in responses between liquidity-constrained and unconstrained individuals to shifts in perceived security during conflict.

1 Introduction

Antipersonnel landmines are commonly used in warfare worldwide[1]. These weapons are favored by state and non-state armed actors globally for their cost effectiveness and efficiency in incapacitating enemy forces. Despite targeting combatants, civilians constitute the majority of casualties. In 2022, landmines contaminated at least 60 countries, with civilians accounting for approximately 85% of victims (International Campaign to Ban Landmines, 2023). Colombia, enduring over three decades of contamination amid a 60-year conflict, exemplifies this tragedy, with 61% of the 12,152 documented victims being civilians (United Nations Mine Action Service, 2022).

The effects of landmines extend beyond the physical harm these devices can cause. In areas affected by landmine contamination, fear permeates daily life, causing individuals to avoid activities that increase their risk of encountering these devices. This disruption hinders economic activity and alters household decision-making processes. Over time, the behavioral changes driven by landmine threats have led to significant long-term effects, such as reduced educational attainment (Lekfuangfu, 2022; Merrouche, 2011), poorer health outcomes (Arcand, Rodella-Boitreaud and Rieger, 2015; Camacho, 2008), and increased poverty (Merrouche, 2008; Takasaki, 2020). However, little is known on how the fear induced by landmines influences household decision-making, particularly during periods of active conflict.

In this paper, we investigate the impact of landmine related events, namely landmine explosions and selective removals carried out by the army during military operations[2], on households' labor market decisions and healthcare-seeking behavior amid conflict. Our analysis focuses on Colombia, where non-state armed actors have extensively placed landmines on agricultural land, along walking paths, and near roads. Households may reduce agricultural labor and commuting in response to these events, as such activities could increase the risk of encountering landmines. First, we analyze how recent landmine events occurring within a certain distance of households' residences affect their labor allocation between agricultural day labor (hereafter referred as *jornalero*[3]) and other types of occupations. Second, recognizing that households' reaction to landmine events may depend on their ability to manage

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[1]Antipersonnel landmines are presently used in at least 13 conflict-affected countries across Sub-Saharan Africa, Southeast Asia, Europe, the Middle East, and Latin America (International Campaign to Ban Landmines, 2023).

[2]The main objective of the army during military operations is to remove landmines that obstruct troop movements. As a result, some landmines may remain in place following these demining efforts.

[3]A *jornalero* is an individual who works directly in the production of agricultural goods. These workers are paid a fixed amount or a piece rate. These jobs tend to offer lower wages and are more sporadic compared to both agricultural and non-agricultural non-*jornalero* jobs.

drops in income, we assess whether these responses vary according to liquidity constraints. We estimate heterogeneous effects by land ownership, which serves as a strong predictor of access to credit markets in rural areas. Third, we explore whether landmine events deter preventative healthcare-seeking, given that health centers in Colombia are typically located in municipal capitals, far from most rural households.

We use restricted spatial data from the Colombian Longitudinal Survey, collected every three years from 2010 to 2016. The survey includes households from regions in Colombia with varying levels of conflict intensity prior to the signing of the 2016 peace agreement, allowing us to capture household behavior while the conflict was ongoing. We combine this data with publicly available administrative records of landmine events dating back to 1990. The precise location and date of each explosion and military demining operation enable us to determine whether a landmine event occurred near a household's residence before the survey was administered.

The primary challenge in identifying the causal effect of landmines on economic behavior arises from the correlation between conflict intensity and the location and timing of landmine events. Non-state armed actors frequently deploy landmines to safeguard their troops, protect strategic assets, and hinder official forces' movements. In addition, the use of landmines tends to increase during periods of heightened conflict. Consequently, landmine events are more likely to occur in areas contested by armed groups and during times of intensified conflict. As a result, landmine events are correlated with both observed and unobserved characteristics of the areas where households reside.

To address this challenge, we leverage a unique aspect of antipersonnel landmines: their presence is known only to the installers. We argue that, conditional on the level of landmine contamination and conflict intensity in a given area, the occurrence of landmine events can be considered plausibly exogenous, as these events are sudden and unpredictable for both civilians and military personnel. Since an area's landmine contamination is unobserved, we account for this by exploiting the longitudinal nature of the household data and incorporating a rich set of fixed effects in our estimations. First, we include individual fixed effects to account for the initial level of landmine contamination near households and individuals' prior beliefs about landmine presence. Second, we introduce year fixed effects to control for nationwide changes that affect all individuals simultaneously, such as shifts in conflict dynamics, economic trends, and national policies. Third, we incorporate a detailed set of baseline and municipality characteristics, interacted with year fixed effects, to address region-specific conflict dynamics that vary according to the unique attributes of each municipality.

Our analysis shows that households reduce agricultural labor on their farms and elsewhere and seek less preventative healthcare following recent and nearby landmine events. However,

these responses highly depend on whether households face liquidity constraints. We find that landowners—who are less likely to face liquidity constraints—are 28% less likely to work in non-*jornalero* jobs, primarily in agriculture, following a landmine event occurring within 5 km of their residence in the six months preceding the planting season. This reduction in labor activity leads to a 19% decline in labor income. Additionally, landowners are 12% less likely to spend any time working on their plots in agricultural tasks. As a result, landowning households hire more *jornalero* workers to replace the agricultural labor they stop doing.

Landmine events similarly discourage exposed individuals from seeking preventative healthcare. Our findings indicate that adults are 12% less likely to visit a formal medical professional without being sick following a landmine event in the six months prior to the planting season. Children also show a lower likelihood of visiting formal medical providers, though estimates are less precise. In contrast, exposed adults are more likely to seek alternative medicine, possibly due to the closer proximity of alternative medicine providers, which reduces travel distances and lowers transportation costs. While the presence of landmines may deter individuals from traveling longer distances, the decline in preventative healthcare visits may also be driven by efforts to avoid additional expenses during periods of reduced income.

In contrast to the responses of unconstrained households, liquidity-constrained individuals engage in agricultural labor to navigate situations with reduced income. We find that non-landowners—who are more likely to face liquidity constraints—work 38% fewer hours in non-*jornalero* jobs, particularly in wholesale and retail trade, possibly due to a decline in the demand for goods and services caused by reduced travel and income. To compensate for the resulting loss in labor income, non-landowners engage in *jornalero* jobs, with a 45% higher likelihood of working in these occupations following a landmine event in the six months preceding the planting season. Additionally, non-landowners continue working in agricultural tasks on the plots they have access to, while also increasing their hiring of *jornaleros* to work alongside them. Consequently, non-landowners intensify agricultural production on their plots, as evidenced by an increase in the area dedicated to mixed crops (i.e., a combination of both perennial and seasonal crops within the same space).

Finally, our analysis suggests that individuals become inured to repeated landmine exposure, as they do not respond to new events if they were exposed in the past. We find that individuals who had not experienced a landmine event between 2002 and 36 months before the planting season in the survey year are 28% less likely to work in non-*jornalero* jobs if they encounter new landmine events in the six months before the planting season. In contrast, those who were previously exposed to landmines do not change their participation in these types of jobs when faced with new events during the same time window.

Our paper contributes to several strands of the literature. First, it extends the research

on the effects of landmines on individuals by focusing on recent, individual-level exposure to landmines. Prior studies have primarily examined the long-term impacts of landmine presence after hostilities have ended, identifying negative consequences for education (Lek-fuangfu, 2022; Merrouche, 2011), health (Arcand, Rodella-Boitreaud and Rieger, 2015), and poverty (Merrouche, 2008; Takasaki, 2020). In contrast, we use data collected in conflict zones before the 2016 peace agreement, enabling us to observe household behavior during wartime. One exception is Camacho (2008), who examines the impact of landmine explosions occurring at different gestation periods on birth weight. A key limitation of previous studies is their reliance on landmine exposure data aggregated at the geographical unit level, which overlooks variations in exposure among individuals within the same area. We address this limitation by using geocoded data for both landmine events and household locations, allowing us to identify whether an event occurred near a household's residence. Our paper closely relates to Vargas et al. (2024), who analyze how landmine explosions affect voting behavior in Colombia. By using geocoded data, they identify explosions near polling stations in the days before an election and find a reduction in turnout. Our work builds on this by examining additional outcomes of economic interest, such as labor market decisions and healthcare-seeking behavior.

Second, our paper contributes to a recent strand of research studying the local economic effects of demining campaigns (Chiovelli, Papaioannou and Michalopoulos, 2024; Prem, Purroy and Vargas, 2024). While these studies use geocoded data on the location of demining operations, they do not examine individual responses to these clearance efforts. Instead, they focus on outcomes within a specified distance, such as nightlight intensity, standardized test scores, and forest loss. Our study contributes to this literature by investigating how rural residents react to events where the presence of landmines becomes salient, providing insights into the mechanisms driving the results observed in these studies.

Third, our paper expands the literature on the economic and political effects of unexploded ordnances. Much of this research has focused on the long-term impacts of aerial bombing campaigns during the Vietnam War and the resulting unexploded ordnances on economic development (Miguel and Roland, 2011; Riaño and Valencia Caicedo, 2024) and agricultural production (Lin, 2022). An exception is the work by Dell and Querubín (2017), which examines the effects of bombing raids during the war on state capacity and support for the insurgency at that time. We build on this by investigating different outcomes after a specific type of unexploded ordnance—landmines—becomes salient.

Finally, we contribute to the broader literature on individual responses to violent shocks by identifying exposure at a more granular level. Measuring such shocks during conflict is challenging, and some studies have relied on self-reported accounts of violent events.

However, this approach can introduce measurement error, as respondents may fail to recall events accurately, overlook certain incidents, or misclassify others as conflict related. A larger body of research has employed aggregate measures of violence to assess its impact on individuals' risk preferences (Brown et al., 2019), education (Brown and Velásquez, 2017; Brück, Di Maio and Miaari, 2019), agricultural production (Adelaja and George, 2019), consumption (Rockmore, 2017), and housing and commodity prices (Besley and Mueller, 2012; Bove and Gavrilova, 2014). We build on this literature by focusing on individual-level exposure to violent shocks, which reveals the heterogeneity in experiences masked by aggregate measures. Two notable exceptions are Callen et al. (2014) and Blumenstock et al. (2024), who use geocoded data on violent events to study the effect of these shocks on risk preferences and mobile money usage in Afghanistan. Our contribution lies in studying the impact of recent and nearby violent shocks on economic outcomes that have been less extensively studied.

The rest of the paper is organized as follows. Section 2 describes the Colombian armed conflict and the use of landmines by armed actors. Section 3 presents a conceptual framework to understand how farmers respond to landmine events and derives several testable hypotheses. Section 4 discusses the empirical strategy, by describing the landmine events records and household data, as well as the identification strategy that we use to estimate the effect of landmines on rural households' behavior. Section 5 presents the results, and section 6 explores several mechanisms. Finally, section 7 concludes.

2 Background

Before we proceed further into our analysis, we provide more contextual information about Colombia's conflict and landmines.

2.1 Colombian armed conflict

Colombia has been in one of the world's longest armed conflicts since the mid-1960s. This long-standing, low-intensity conflict involves the Colombian state and various insurgency groups, some of which have roots in peasant uprisings at the beginning of the conflict, though today entangled with drug production and trafficking and terrorism. The war is extremely violent and chaotic, involving not only fights between the states and guerrilla groups, but also conflicts among various insurgent groups (Sweig, 2002). It is estimated that at least 220,000 people were killed between 1958 and 2012, of which 80% is civilian (Centro Nacional de Memoria Histórica, 2016). While the Colombian government and the Revolutionary Armed

Forces of Colombia (FARC, by its Spanish acronym), a major insurgency group, have reached a peace agreement in 2016, the conflict persists.

2.2 Use of improvised landmines

While the war has persisted for over half a century, the wide use of improvised anti-personnel landmines is a relatively new phenomenon that started in the 1990s. Figure 1 shows the evolution of the number of landmine explosions since 1990. Guerrilla groups drastically increased their use of hand-made mines by the end of the 1990s, as it can be seen in a rise in the number of explosions. A dramatic decrease in the number of explosions that starts around 2006 is related more to a decrease in the intensity of the conflict than to a reduction in the use of this weapon. They continued installing them until 2013 when the peace talks with the Colombian government started.

Figure 1: Landmine related events and analysis period
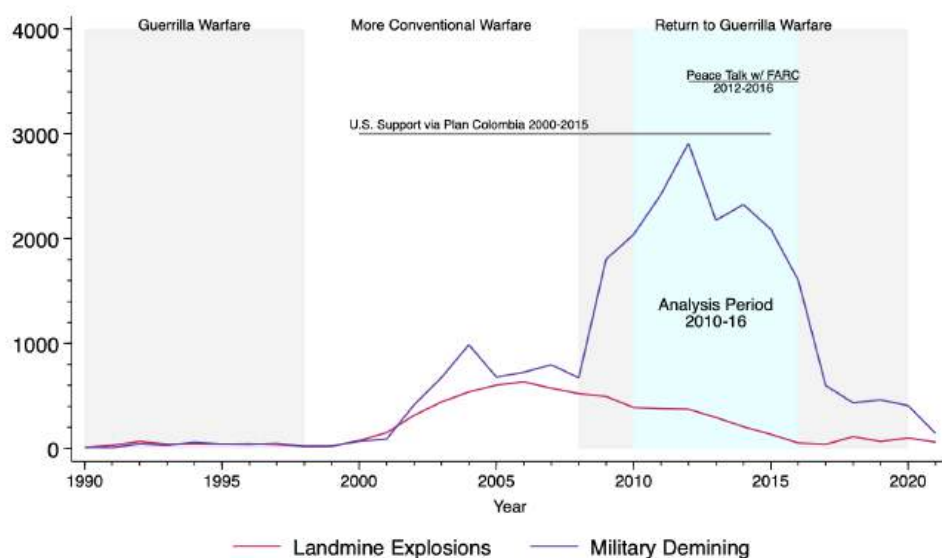
There are two main non-governmental militia groups that used these inexpensive explosive devices: FARC and the National Liberation Army (ELN) (Centro Nacional de Memoria Histórica, 2016). These insurgency groups used hand-made landmines to compensate for the lack of military capacities relative to the government forces, and curb the advancement of their opponents.

Improvised landmines that these groups used were easy and inexpensive to produce, and very difficult to detect. Figure 2 provides examples of improvised anti-personnel landmines typically used by insurgency groups. Such landmines can be made with common household

materials such as plastic soda bottles that can easily be found even in a very remote area of the country. One estimate suggests that such landmines can be produced and laid for USD 3 to 30 (ReliefWeb, 2001).

Figure 2: Examples of Improvised Anti-Personnel Landmines in Colombia

Artisanal landmine

Minefield in Valle del Cauca

Landmines are incredibly difficult to find once they are installed. They contain minimal metals, which make it extremely hard to locate with metal detectors which is a common tool used for landmine identification (ReliefWeb, 2017). While landmines are commonly placed underground, they are sometimes installed on trees in order to affect different parts of the body.

2.3   Placement of landmines

Learning about the purpose and strategies of landmine installation gives us a sense of the proximity to landmines with which rural Colombian households have lived, even though

landmines were not installed to harm civilians, rather to slow down the Colombian military advancement. As such, landmines were manufactured so that they would severely injure members of the military in lieu of killing them. By injuring soldiers rather than killing them, insurgency groups can increase the high cost of the war, for the government would have to care landmine-affected soldiers who are often severely mutilated and require long-term support. Landmines also exerted an enormous moral and psychological effect on the official forces.

To obstruct the State's military advancement into their territories in rural Colombia, guerrillas installed landmines in footpaths, near their valuable assets including coca fields, and near camps (Centro Nacional de Memoria Histórica, 2016, 2017). In rural Colombia where vegetation is thick and the availability of walk paths is limited, footpaths that state soldiers use are often those villagers use. These roads go through farming plots, and pass even near houses (lower photo in Figure 2). Guerrillas also often use local schools for meetings and resting at night, as school buildings are often the only large structures in rural villages.

Insurgents kept track of the exact locations of landmines that they installed in order to avoid injuring their own members (Centro Nacional de Memoria Histórica, 2017). Such knowledge was kept in secret for obvious military strategic reasons; however, guerrillas have occasionally told villagers approximate landmine locations. Villagers often found such knowledge inadequate, because keeping one safe requires exact locations, and only knowing approximate location makes the whole area unusable, thus unproductive (Monitor and Cluster, 2018).

2.4 Military demining operations

Given the significant harm caused by landmines on military operations, official forces developed methods to protect troops from stepping on them. One such method involved assigning a team of five soldiers who were trained in mine removal to accompany each squad. These teams, known as Explosives and Demolition Groups (EXDE), were equipped with dogs and metal detectors to locate and remove mines.

The procedure for detecting and removing mines used by the EXDE group was as follows: when the group suspected the presence of a minefield, they would first use a trained dog to locate potential mines. The locations identified by the dog were then confirmed using a metal detector. Any mines found were either removed or detonated safely. The EXDE group also recorded the coordinates of each mine's location and the number of mines removed or destroyed.

Insurgent groups employed tactics to evade detection by demining efforts, such as masking

the scent of explosive substances with coffee, and avoiding the use of metallic materials. This can be seen in the increase of demining operations during military actions following the planting of mines by guerrillas in the late 1990s, peaking around 2013. However, after 2015, there was a significant decrease in military demining operations as humanitarian demining efforts increased following the conclusion of peace talks.

The peace agreement signed between the Colombian government and FARC marks a new period in terms of the use of landmines. While the agreement led to the bilateral and definite ceasefire, and ended the use of landmines by FARC, it also included the disclosure of existing landmine locations to the Colombian government, which then provided the information to humanitarian demining operators among others. Villagers were gradually informed of exact landmine locations after the historic peace agreement. Thus, this study focuses on the period before 2016, as it investigates the role of uncertainty around landmine locations.

3   Conceptual Framework

Landmine pose a significant threat to life, instilling fear in individuals exposed to them and discouraging participation in activities that may increase the likelihood of encountering these devices. Consequently, in response to new landmine events, individuals may avoid activities such as agricultural labor—either on their own farms or in other households' fields—and non-agricultural work outside their home. Armed actors often place landmines on agricultural land, walking paths, and next to roads, meaning that working in fields and commuting brings individuals into close proximity with these hazards. However, in the presence of liquidity constraints, some individuals may be compelled to engage in risky labor activities as a means of compensating for the income losses caused by landmine exposure.

Our argument is based on the idea that individuals form beliefs about the level of landmine contamination in the area where they live, as they are unaware of the precise locations where non-state armed actors have installed these devices. This belief is expressed as a subjective probability of encountering landmines during daily activities. An individual's subjective probability depends on his knowledge of past landmine events. Specifically, someone who knows of previous landmine occurrences nearby is likely to believe that future landmine events will occur. Conversely, individuals unaware of such events in their vicinity consider future occurrences unlikely. As a result, individuals update their beliefs about landmine presence when they witness a new landmine event.

Consequently, in response to recent exposure to landmine events, individuals adjust their labor market decisions in two key ways. First, they tend to avoid agricultural labor—whether on their farms or elsewhere—and non-agricultural work outside their home, as non-state

armed actors often place landmines in agricultural fields, walking paths, and near roads. This avoidance mechanically leads to a decline in labor income. Second, exposed households may opt to hire agricultural workers for their plots, enabling them to reduce their own involvement in farm labor while maintaining agricultural production.

Nevertheless, labor market responses may differ in the presence of liquidity constraints. Liquidity-constrained individuals are unable to reduce their labor income without taking alternative actions, as this would lower their income, leaving them with two possible options. First, they may decide not to avoid risky labor activities. Second, these individuals may decide to engage in risky jobs in case income obtained from other activities declines after landmine events. For example, landmine events can reduce income in some households, which may in turn lead to a drop in local demand for goods and services. Individuals working in sectors providing such goods and services may then supply less labor to these economic activities and seek work in areas with higher demand. One such option might be agricultural day labor, as neighboring farmers exposed to landmines may prefer to hire external labor to replace their own in their fields.

Individuals' responses to new landmine events also vary based on their prior beliefs about landmine presence. The information provided by each new event diminishes as an individual's perceived likelihood of encountering landmines increases. Specifically, individuals who already expect landmine events to occur do not gain much new information from observing another event. In contrast, individuals who believe such events are unlikely obtain substantial new information with each occurrence. Given these differences in belief updating, individuals familiar with past landmine events are less likely to alter their behavior in response to new events, while those previously unaware of past landmine activity are more inclined to react as previously described.

Predictions

Our framework implies several predictions that we test empirically. First, in the absence of liquidity constraints, individuals respond to new landmine events by reducing both agricultural labor—whether on their own farm or elsewhere—and non-agricultural labor conducted outside their home. However, when liquidity constraints are present, individuals primarily reduce labor in industries facing a decline in demand following landmine events or in jobs located in areas perceived to be more contaminated. In such cases, liquidity-constrained individuals tend to increase work in jobs with higher demand—such as agricultural labor—to maintain their labor income unchanged.

Second, since liquidity-unconstrained individuals reduce their agricultural labor in response to new landmine events, they hire agricultural workers to replace their own labor,

aiming to maintain agricultural production unchanged. In contrast, liquidity-constrained individuals, who do not reduce their own agricultural labor, may hire agricultural workers solely to intensify production rather than as a substitution for their own labor.

Third, individuals without previous exposure to landmines respond to new events by reducing agricultural labor and non-agricultural labor conducted outside of home. Additionally, they are more likely to hire agricultural workers. Conversely, individuals with previous exposure to landmines do not respond to new landmine events.

4   Empirical Strategy

4.1   Data

To estimate the effects of landmine presence on farmers' behavior, we combine the administrative data on landmine explosions and military demining operations, and the longitudinal data from a survey that tracks households in rural Colombia.

Landmine Related Events Data

The data on landmine explosions and military demining operations used in this study was obtained from the Office of the High Commissioner for Peace (OACP). The dataset spans from 1990 to the present and includes information on the date, location, and number of civilian and military casualties for landmine explosions, as well as the number of ordnance removed or destroyed during military demining operations.

The OACP has been recording both landmine accidents and incidents[4] in the Information Management System for Mine Action (IMSMA) daily since 2002, which is the United Nations' preferred information system for managing data in UN-supported programs. Most information is sourced from local authorities, the national civil defense, national park rangers, and the armed forces. The agency also conducts interviews with survivors and affected civilians to supplement the data. For the period from 1990 to 2001, the OACP established a baseline using information from both government and non-government sources, such as newspapers and mass media. Additionally, IMSMA logs details on all demining operations conducted by the Army during this time.

The data includes the latitude and longitude coordinates for each event. The coordinates of military demining events are accurate as they were taken with GPS devices. However, the coordinates for explosions do not always correspond to the exact locations where the

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[4]Landmine accidents are undesired events which results in harm, whereas a landmine incident is an event that gives rise to an accident or has the potential to lead to an accident.

events occurred. Some explosions are recorded in the OACP dataset because of reported by victims or unharmed civilians. In such cases, the coordinates were often approximated to the township of the municipality where the incident occurred, as the exact location was not always known. This may pose a problem, as events approximated to the municipality's township can introduce measurement error. Households close to townships could be mistakenly considered affected by landmines, whereas some households exposed to landmine events could be treated as unexposed.

We conclude that the concern for measurement error is small. Figure 3 illustrates the number of landmine-related events recorded by the method of location recording in the municipalities where the surveyed households reside, as well as in the neighboring municipalities. The graph shows that, for the analysis period, we know the exact location of the majority of events.

Figure 3: Landmine related events and location type in surveyed and neighboring municipalities

Notes: Blue indicates the years in which ELCA data were collected, while green represents the years in which landmine exposure is considered
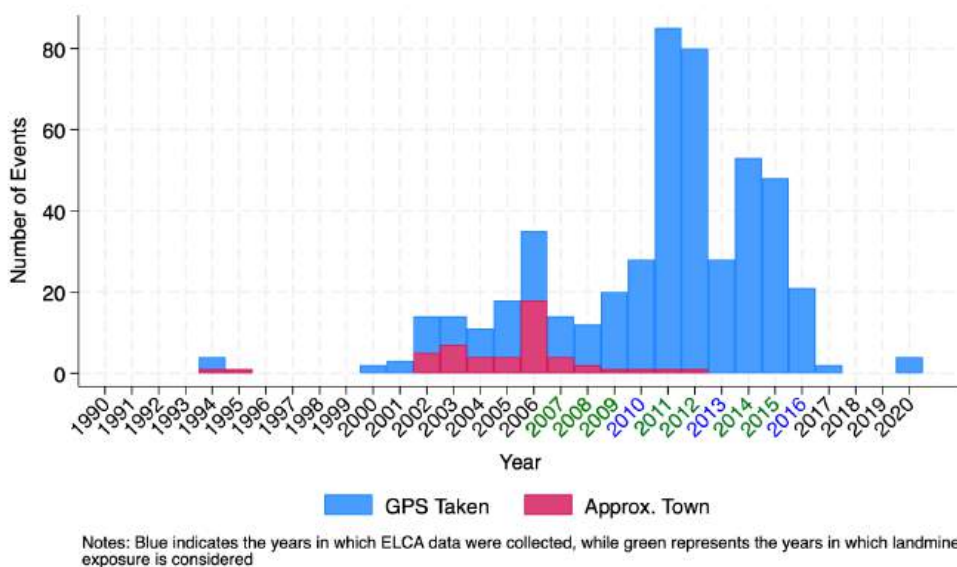
Household Panel Data

The Longitudinal Survey of Colombia (ELCA) is a study that tracks households and individuals over time, collecting data in 2010, 2013, and 2016. The survey is representative of urban areas in Colombia and representative of four specific micro-regions of the country at the rural level. ELCA originally targeted 4,578 rural households, comprising 8,365 adults (i.e., household heads and their spouses) and 4,411 children under nine years old. The original rural sample was located in 224 villages (*veredas* in Spanish), across 17 municipalities. The data includes household and individual characteristics, including access to and use of

medical services, land ownership and use, hours spent on agricultural tasks on family and non-family farms, hours spent on non-agricultural wage labor, and crop choices. ELCA contains household GPS locations which can be accessed with permission on a secure server and dates when the surveys were administered.

We conduct the empirical analysis on a balanced panel of households who stayed in the rural area of the same municipality for all three rounds. Additionally, we exclude households where the household head changed due to the household splitting between rounds, but keep households where the household head remained the same even if the household split. Moreover, we remove from the analysis households with no follow-up subjects in all three rounds. We conclude with a sample of 3,215 households, accounting for 5,518 adults. For the children's sample, we consider individuals who appear in at least two consecutive rounds, resulting in a sample of 2,888 children from 1,763 households.

Treatment Variable Construction

We combine the household GPS coordinates with the locations of landmine-related events to identify which households were exposed during different time windows. To do so, we first construct a 5 km-radius buffer centered at the residence of each household in ELCA. We then indicate if there is any landmine event within the buffer which took place before the household was interviewed. For all three rounds, the surveys were administered between March and July, which coincided with the first planting season of the year from February to May. Based on this timeline, we define four different time windows.

Figure 4 illustrates the four treatment windows overlaid with the calendar months. First, we define the pre-survey window, which extends from March 1 to the date of the survey interview, varying by household. Next, we establish two periods during which households make most of their planting decisions. *Pre-planting window 1* spans from September of the year before the household is surveyed to February of the survey year, while *pre-planting window 2* covers the period from March to August of the same year. Finally, *history window* extends from February of the year preceding the survey to March three years before the household's survey interview. Any landmine events occurring within this timeframe are considered part of the household's historical exposure.

Table 1 presents the proportion of observations in the individual sample exposed to landmine events across all four time windows. The regions surveyed by ELCA were not heavily affected by landmines compared to other parts of the country. In our individual analysis sample, less than 10% of the observations experienced a landmine event in any of the four time windows. Among those affected, the average number of events experienced ranged between one and two across the specified periods. Therefore, our results provide

Figure 4: Planting Seasons and Landmine Exposure

insights into how individuals exposed to landmines react in contexts with medium- or low-intensity conflicts and should be interpreted with caution when extrapolating to contexts with high-intensity conflicts.

Table 1: Proportion of individuals exposed to landmine events

	Prop. of obs. exposed	No. of obs. exposed	No. of events (exposed obs.)
Before survey	0.011	190	1.51
(0-6] months	0.049	815	1.29
(6-12] months	0.022	371	1.15
(12-36] months	0.078	1291	2.02
Since 2005 until 36 mos.	0.119	1973	2.89
Observations	16554		

Notes: Observations correspond to the total number of individuals in the sample times the three rounds in the survey. An observation is considered to be exposed to landmine events if an event occurred within 5 km of the individual's residence in the time period specified.

Outcome Variable Construction

We investigate the effect of landmine exposure on farmers' labor market decisions, healthcare seeking for preventative reasons, and land use. We use the ELCA data to construct the relevant outcome variables.

To examine the impact of landmine events on labor market outcomes, we construct five different measures. First, we assess whether farmers worked outside their farm in the past week. Specifically, we consider jobs in the private and public sector, agricultural day labor (*jornaleros*), domestic work, and self-employment. We then consider two categories based on this outcome: whether farmers work as (1) *jornaleros* or (2) any other job. Notice that these categories are non-mutually exclusive as a farmer can be a *jornalero* and also work in

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a different job. Additionally, we also know the number of hours per week farmers work in non-*jornalero* jobs. Finally, we explore whether households hire agricultural workers in the past 12 months.

In addition to these outcomes, we also analyze how exposure to landmines impacts income derived from these labor sources. We calculate the income earned by each farmer in all jobs conducted outside the household's farms in the past month. To do this, we first add the income received in all non-*jornalero* jobs, which is reported by the respondents in the survey. We then calculate the income received from *jornalero* jobs. In 2013 and 2016, respondents reported how much they earned working in this type of job, so we sum these amounts. However, in 2010, farmers only reported how many days per month they worked as *jornaleros*. In this case, we use the daily wage paid to *jornaleros* in the village from the community survey and multiply it by they number of days each farmer worked in this type of job in the month before being surveyed[5].

Table 2 shows some summary statistics for the labor market outcomes described above. It is not uncommon for farmers to work outside their farms; 40% of the sample held jobs outside their fields. Most of the farmers worked either as *jornaleros* (20% of the sample) or in non-*jornalero* jobs (23%). Among those engaged in other occupations, they typically held positions in agriculture, wholesale and retail trade, construction, transportation, food preparation, and manufacturing. Additionally, farmers spent an average of 38 hours working in these types of occupations. In terms of income derived from these sources, farmers earn less when working as agricultural daily laborers compared to other occupations. Specifically, farmers earn, on average, 45% more when working in other occupations than as agricultural daily laborers. Note that some farmers did not receive any monetary payment for their work either as agricultural daily laborers or in other occupations, suggesting that they may be compensated with in-kind payments. Finally, nearly one-third of the households in the sample employed workers to assist with agricultural production on their farms.

We also construct distinct measures using ELCA's land and agricultural production module. First, we identify land ownership by looking at farmers' response to whether they claim ownership, either formal or informal, to at least one plot. We then determine whether households have access to land; in addition to ownership of a plot, we consider households with renting or sharecropping agreements to have access to land. We also examine the amount of land farmers allocate to agricultural production. Specifically, we categorize this into four different types: land cultivated with perennial crops, seasonal crops, or mixed crops (i.e., a combination of perennial and seasonal crops within the same portion of land), and land

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[5]The ELCA community survey was not completed in 24 out of the 224 villages in 2010. For these villages, we substituted the missing daily wage data for *jornaleros* with the average wage from other villages within the same municipality.

Table 2: Summary statistics for labor market outcomes

	Obs.	Mean	Std. Dev.	Min.	P25	P50	P75	Max.
If worked off-farm	16530	0.397						
Income Earned[a,b]	6519	409.88	459.09	0	145	316	550	12626
If worked (No Ag. Day Labor)	16530	0.232						
Income earned[a,b]	3797	444.66	536.64	0	130	326	652	12626
Hours worked per week[a]	3829	38.42	22.21	1	20	40	50	156
If worked (Ag. Day Labor)	16530	0.195						
Income earned[a,b]	3199	307.47	247.69	0	137	272	435	7501
If hired agricultural labor	9639	0.335						

[a] Statistics reported for observation who work in the type of job indicated in the heading of the section.
[b] Amounts reported in thousands of COP (December 2018 base)

devoted to livestock raising. Additionally, we create two broader categories of land use: land devoted to agricultural production, which encompasses all four categories previously listed, and land allocated to cultivation, which includes only the land with perennial, seasonal, and mixed crops. Finally, we look at households' sales from their fields' agricultural production. We have information on the revenue households received from selling the last harvest of each crop they cultivated. For crops that the household had not yet harvested, we recorded zero revenue. Similarly, we calculate the revenue household obtained from selling livestock and animal products they produced over the past 12 months.

Table 3 shows summary statistics of the land outcomes described above. Land ownership is prevalent, with more than two-thirds of the sample owning land. Similarly, access to land is highly widespread, with nearly 90% of the sample having some form of access to land. In terms of size, landowners own an average of 3 hectares, while landholders have access to a very similar amount of land. Additionally, the size of landholdings varies significantly across the sample, ranging from 3 square meters to 126 hectares, with a median size of one hectare. Farmers typically utilize the land they have access to for agricultural production, allocating an average 2 hectares for this purpose. Most of this land is devoted to cultivations, particularly perennial crops, with a median allocation of 0.05 hectares. Although households do not usually allocate land to livestock raising, we observe some large landholdings dedicated to this purpose.

We also use information from ELCA's time use module to examine how much time farmers spend working in agricultural jobs in their fields. Specifically, we calculate the time each farmer allocates to this activity from the time they wake up until they retire for the night in a typical day of the week prior to being surveyed. Given the substantial number of zeros,

Table 3: Summary statistics of land ownership, access, and use

	Obs.	Mean	Std. Dev.	Min.	P25	P50	P75	Max.
Land ownership	9639	0.69						
Hectares owned[a]	6619	2.95	5.41	0.0007	0.32	1.28	3.25	111
Access to land	9639	0.89						
Hectares with access to[a]	8619	2.98	6.07	0.0003	0.32	1.09	3.20	126
Ag. Production (hectares)[a]	8619	2.07	4.50	0.00	0.15	0.75	2.20	101
Cultivations (hectares)[a]	8619	0.93	1.70	0.00	0.05	0.38	1.00	40
Perennial crops (hectares)[a]	8619	0.45	1.20	0.00	0.00	0.01	0.35	21
Seasonal crops (hectares)[a]	8619	0.28	0.98	0.00	0.00	0.00	0.25	40
Mixed crops (hectares)[a]	8619	0.20	0.83	0.00	0.00	0.00	0.00	23
Livestock raising (hectares)[a]	8619	1.14	4.01	0.00	0.00	0.00	0.64	100

[a] Statistics reported for observation who work in the type of job indicated in the heading of the section.

we construct four binary variables to indicate whether farmers spent more time than some predetermined thresholds.

Finally, we examine some activities farmers typically conduct outside their farms and home. One such activity is seeking for healthcare, which usually makes farmers leave their farms and travel to the closest town. We identify if farmers visited a medical professional over the past 12 months without being sick and for preventative reasons. We look at five different medical professionals for household heads and their spouses: general practitioner or any specialist (e.g., gynecologist, urologist, cardiologist, etc.), dentist, optometrist, family planning services, and alternative medicine (e.g., homeopaths, acupuncturist, etc.). Similarly, we also identify if children 0 to 9 years old in 2010 seek medical assistance for preventative care in the past 12 months. We consider the same categories as for adults, with the exception of family planning services, and we include visits to pediatricians.

Seeking healthcare for preventative reasons is common among farmers; 66% of the sample visits a medical professional, excluding those specializing in alternative medicine, over the past 12 months. Most farmers see general practitioners or specialists (60%), followed by visits to dentists (40%) and optometrists (13%). Among children, healthcare seeking is even more widespread; 83% of the sample visits a medical professional not specializing in alternative medicine over the past 12 months. Most children see general practitioners or specialists (76%), followed by dentists (58%), pediatricians (23%), and optometrists (13%).

4.2 Main Identification Strategy

The main identification threat in estimating the effect of landmines on economic activities of rural Colombian households is the potential correlation between conflict intensity and landmine installation. Non-state armed actors installed landmines to attack official forces and, to protect strongholds and strategic assets, such as camps and coca fields. Therefore, the timing and location of landmine placement are endogenous to the characteristics of households and individuals inhabiting in these areas.

However, the timing of landmine explosions and military demining, which reveal the existence of landmines to nearby inhabitants, is essentially random, conditional on a place's landmine contamination and conflict intensity. This randomness occurs because neither farmers nor military personnel know the exact location of these devices ex-ante.

To address this endogeneity concern, we exploit the longitudinal nature of the ELCA household survey and incorporate a rich set of fixed effects in our analysis. First, we include individual fixed effects to control for time-invariant farmer characteristics, such as the baseline level of landmine contamination new residences and individuals' prior beliefs about landmine presence. Second, we incorporate year fixed effects, which account for nationwide changes in conflict dynamics. Finally, we include interactions between a battery of 2005 municipality characteristics and year fixed effects to control for municipality-specific trends in conflict intensity. These baseline characteristics include population density, distance to the department's capital, average altitude, homicide rate per 100,000 inhabitants, and an indicator of whether landmine events occurred in the municipality between 1990 and 2005.

Our econometric model is specified as follows. Let y_{ihmt} be an outcome for individual i of household h residing in municipality m at year t; E^S_{hmt} be an indicator of whether household h had a landmine event between March 1 of year t and the date h was surveyed (*pre-survey window*); $E^{(0-6]}_{hmt}$ is an indicator of whether household h had a landmine event 0 to 6 months before March 1 of year t (*pre-planting window 1*); $E^{(6-12]}_{hmt}$ is an indicator of whether household h had a landmine event 6 to 12 months before March 1 of year t (*pre-planting window 2*); $E^{(12-36]}_{hmt}$ is an indicator of whether household h had a landmine 12 to 36 months before March 1 of year t (*history window*); ϕ_i and θ_t are individual and year fixed effects, respectively; $x_m \times \theta_t$ is an interaction term between a 2005-level municipality characteristic x_m and year fixed effects; and ε_{ihmt} is an error term. We estimate the following equation by OLS where standard errors are clustered at the village level:

$$y_{ihmt} = \beta_1 E^S_{hmt} + \beta_2 E^{(0-6]}_{hmt} + \beta_3 E^{(6-12]}_{hmt} + \beta_4 E^{(12-36]}_{hmt} + \phi_i + \theta_t + \sum_{x_m \in X_m} (x_m \times \theta_t) + \varepsilon_{ihmt} \quad (1)$$

For the household level analysis of agricultural labor hiring, we use household fixed effects instead of individual fixed effects, maintaining the village-level clustering standard errors.

5 Results

In this section, we present the estimated effects of landmine events on farmers' labor market decisions and use of health care services. We also show heterogeneous effects by differing levels of previous exposure to landmine events.

5.1 Effects of landmine events on labor market outcomes

We begin by investigating how landmine events influence individuals' labor market decisions. We estimate the effects of landmine events on five labor market outcomes. The first outcome is whether individuals worked outside the household's agricultural fields in the last week. The second outcome is whether individuals had non-*jornalero* jobs. The third outcome is the number of hours worked on this type of jobs per week. The fourth outcome is whether individuals worked as *jornaleros* in the past week. The fifth and final outcome is whether households hired *jornaleros* in the past 12 months. It is important to note that the second and fourth outcomes do not necessarily sum to the first outcome, as an individual can engage in both types of jobs simultaneously.

Table 4 presents the estimated effect on the labor market outcomes described above. First, we find that landmine events do not seem to affect whether individuals work outside their agricultural plots (column 1). However, we observe that farmers reduce their work in non-*jornalero* jobs soon after the landmine events, but increase it after a substantial amount of time has passed since the events. Column 2 shows that individuals reduce the probability of working in non-*jornalero* jobs by 3.8 percentage points if they experienced landmine events in the 0 to 6 months pre-planting window. Conversely, they increase this probability by 4.5 percentage points if the exposure happened during the 12 to 36 months period. Similarly, column 3 shows that individuals decrease the number of working hours in non-*jornalero* jobs by 2.7 hours if they were exposed to landmine events in the six months before the planting season, but increase it by 1.9 hours if the exposure occurred in the 12 to 36 months pre-planting window. The reduction in these occupations is primarily driven by a decline in agricultural jobs[6]. Individuals reduce their agricultural work in these occupations

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[6]Table A1 presents the estimated effect of landmine events on hours worked in the past week in *jornalero* and non-*jornalero* jobs, disaggregated into agricultural and non-agricultural jobs. For this analysis, we only consider the last two rounds of the household survey (2013 and 2016) because respondents reported the number of hours worked in the past week for each job, as well as the economic activity associated with

by 1.9 hours if they experienced landmine events in the 0 to 6 months pre-planting window, but increase it by 2.3 hours if exposed during the 12 to 36 months period (table A1, column 1). In contrast, there is no change in the time worked in non-agricultural jobs following landmine exposure (table A1, column 2). These results suggest that individuals reduce off-farm labor, particularly in agriculture, after landmine events, likely because this activity increases the risk of encountering landmines, as armed actors typically install these ordnances on agricultural land.

On the contrary, column 4 implies that individuals initially increase their work as *jornaleros*. Our estimation shows that individuals increase the probability of working as *jornaleros* by 3.1 percentage points if exposed in the six months before the start of the planting season. As a result, we observe that exposed individuals tend to take on more agricultural work outside their household farms where they earn lower wages, while reducing their involvement in more profitable off-farm agricultural work (i.e., in non-*jornalero* jobs). This behavior suggests the presence of liquidity-constrained individuals who continue engaging in risky activities to smooth their labor income. In the next section, we explore the existence of these regimes by examining the heterogeneous effects of landmines by land ownership.

Turning to the labor hiring outcome in column 5, results somewhat mirror the effect on agricultural day labor in column 4. Our estimation shows that individuals are 21.2 and 7.2 percentage points more likely to employ agricultural daily workers if exposed during the pre-survey window and the 0 to 6 months pre-planting window, respectively. We also find that individuals decrease the probability of hiring agricultural workers by 8.5 percentage points if they experienced landmine events in the 6 to 12 months pre-planting period, which matches the direction of the coefficient on agricultural day labor in column 4. This suggests that agricultural workers hired in response to landmine events may be performing the tasks that exposed individuals perceive as risky due to the potential presence of landmines.

In the conceptual framework, we suggest that one of the reasons why individuals may hire agricultural workers after experiencing landmine events is to replace their own work on their fields with external labor. Table 5 explores this hypothesis by estimating the effects of landmine events on whether farmers spend more than 0 to 4 hours per day on agricultural tasks on their own plots. We find that recently exposed individuals are less likely to spend any time on their own farms. Individuals are 5.2 and 4.6 percentage points less likely to spend non-zero number of hours on their own farms if exposed in the 0 to 6 months and 6 to 12 months pre-planting windows, respectively (column 1). The estimates are similar when the time threshold is one hour or more (column 2), but the effects diminish and disappear for the

each job. In contrast, in 2010, respondents only reported the total number of hours worked off-farm in all occupations different from *jornalero*, which does not allow us to disaggregate the number of hours worked by economic sector.

Table 4: Effects of landmine events on labor market outcomes

	(1) If Worked Off-Farm	(2) If Worked (No Ag. Day Lab.)	(3) Hrs. Worked (No Ag. Day Lab.)	(4) If Worked (Ag. Day Lab.)	(5) If Hired Ag. Labor
If event before survey	0.024	0.005	0.688	0.018	0.212***
	(0.040)	(0.039)	(2.126)	(0.041)	(0.058)
If event in (0-6] months	0.012	-0.038*	-2.743***	0.031*	0.072**
	(0.021)	(0.022)	(0.909)	(0.017)	(0.028)
If event in (6-12] months	0.005	0.005	0.986	-0.006	-0.085*
	(0.031)	(0.029)	(1.778)	(0.027)	(0.048)
If event in (12-36] months	0.027	0.045**	1.864**	-0.004	0.034
	(0.026)	(0.018)	(0.739)	(0.022)	(0.038)
Dep Var Mean	0.397	0.232	8.827	0.195	0.335
Sample	Ind.	Ind.	Ind.	Ind.	HH
# Units	5510	5510	5510	5510	3213
# Clusters	224	224	224	224	224
Observations	16530	16530	16530	16530	9639

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. In columns 1 through 4, sample includes household heads and their spouses when they have one. In column 5, sample include households these individuals belong to. Hours worked per week excluding agricultural daily laborers winsorized at the top 1%. All specifications include individual/household and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

time threshold of two and four hours (columns 3 and 4). This result suggests that households hire agricultural workers after landmine exposure to avoid performing agricultural activities on their fields, which increases their likelihood of encountering landmines, while attempting to maintain their agricultural production. Additionally, we observe this behavior among individuals who work for shorter periods of time on their plots. Farmers who work more intensively on their fields continue to do so even after experiencing landmine events.

The results so far indicate that, after a considerable amount of time has passed since the landmine events, exposed individuals increase their work in occupations other than agricultural daily labor. This behavior may suggest that individuals consider that the likelihood of encountering landmines while conducting certain activities declines over time. We explore this hypothesis by estimating heterogeneous effects of previous exposure to landmine events on labor market outcomes. Specifically, we construct an indicator of whether individuals and households experienced landmine events from 2002 until 36 months before the start of the planting season preceding the survey interview, and interact this indicator with binary variables denoting whether individuals were exposed to landmines during the different time windows.

Table 6 presents the estimated heterogeneous effects of previous exposure on the labor market outcomes described above. We observe that the results documented so far are primarily driven by farmers without previous exposure. Column 2 shows that farmers reduce

Table 5: Effect of landmine events on time spent in agricultural jobs in household's farms

	Time spent in ag. jobs in HH's farms			
	(1)	(2)	(3)	(4)
	> 0 hr	≥ 1 hr	≥ 2 hr	≥ 4 hr
If events before survey	0.004	-0.009	0.016	0.017
	(0.044)	(0.037)	(0.038)	(0.042)
If events in (0-6] months	-0.055**	-0.052**	-0.035	-0.010
	(0.024)	(0.024)	(0.026)	(0.020)
If events in (6-12] months	-0.045**	-0.046*	-0.063**	-0.026
	(0.022)	(0.028)	(0.025)	(0.025)
If events in (12-36] months	-0.025	-0.024	-0.013	-0.018
	(0.026)	(0.026)	(0.027)	(0.026)
Dep Var Mean	0.455	0.424	0.364	0.258
# Individuals	5485	5485	5485	5485
# Clusters	224	224	224	224
Observations	16455	16455	16455	16455

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes household heads and their spouses when they have one. Outcome variables indicate whether the individual spent any time, at least one hour, two hours, or four hours per day in agricultural jobs in the household's farms and businesses. All specifications include individual and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

the probability of working in non-*jornalero* jobs by 6.4 percentage points if exposed to a landmine event in the six months prior to the start of the planting season and did not experience any exposure since 2002. Conversely, landmine events over the same period do not seem to affect whether farmers work in this type of occupations if they experienced landmine events since 2002. Similarly, column 3 shows that farmers without exposure since 2002 decrease the number of hours worked in this type of jobs by 3.6 hours if they experience a landmine event in the 0 to 6 months pre-planting window. In contrast, landmine events within this time window do not impact the number of hours worked in these occupations by farmers with exposure since 2002.

Similarly, column 5 shows that households without exposure since 2002 increase the probability of hiring agricultural workers by 25.6 and 6.6 percentage points if they experienced a landmine event in the pre-survey and 0 to 6 months pre-planting periods, respectively. Conversely, households with exposure since 2002 who experienced a landmine event in the six months before the start of the planting season are as likely to hire agricultural workers as households with previous exposure but who did not experience events during that time window. Nevertheless, we observe farmers with exposure since 2002 increasing the probability of hiring agricultural workers by 18.5 percentage points (55%) if they experience landmine events during the pre-survey window.

These findings suggest that individuals may become inured to landmine events after

repeated exposure. Individuals who have encountered landmines in the past may not alter their current perception of the landmine contamination level in their surroundings after a recent event. Consequently, these individuals do not react to new events, as they have likely adapted to dealing with these devices, given their current perception of the likelihood of encountering landmines. In contrast, farmers without previous exposure may alter their perception of landmine contamination in their surroundings, leading them to significantly modify their behavior to avoid encountering landmines during their daily activities.

Table 6: Heterogeneous effects of landmine events on labor market outcomes by previous exposure since 2002

| | (1) | (2) | (3) | (4) | (5) |
	If Worked Off-Farm	If Worked (No Ag. Day Lab.)	Hrs. Worked (No Ag. Day Lab.)	If Ag. Day Lab.	If Hired Ag. Labor
If events before survey	0.054	-0.002	-0.529	0.018	0.256**
	(0.076)	(0.041)	(2.340)	(0.077)	(0.104)
If events in (0-6] months	-0.011	-0.064**	-3.577***	0.029	0.064*
	(0.027)	(0.027)	(1.013)	(0.020)	(0.038)
If events in (6-12] months	0.018	0.061	3.683	-0.047	-0.138**
	(0.052)	(0.050)	(2.722)	(0.036)	(0.065)
If events in (12-36] months	0.037	0.025	0.764	0.004	0.063
	(0.049)	(0.029)	(1.196)	(0.031)	(0.047)
If events since 2002 until 36 mos.	0.008	0.033	1.441	-0.028	-0.041
	(0.032)	(0.022)	(0.877)	(0.026)	(0.031)
If events since 2002 until 36 mos. × ...					
... If events before survey	-0.023	0.040	2.818	-0.011	-0.070
	(0.077)	(0.045)	(2.636)	(0.066)	(0.135)
... If events in (0-6] months	0.070*	0.097***	3.428**	-0.013	-0.004
	(0.038)	(0.037)	(1.471)	(0.030)	(0.053)
... If events in (6-12] months	-0.009	-0.080*	-4.066	0.065*	0.091
	(0.052)	(0.047)	(2.774)	(0.037)	(0.099)
... If events in (12-36] months	-0.035	-0.007	0.181	0.000	-0.026
	(0.058)	(0.039)	(1.507)	(0.038)	(0.047)
Linear combs. (If events in time window + If events since 2002 until 36 mos. × If events in time window)					
Before survey	0.030	0.037	2.289	0.007	0.185**
(0-6] months	0.059*	0.034	-0.149	0.016	0.060
(6-12] months	0.009	-0.018	-0.383	0.018	-0.047
(12-36] months	0.002	0.017	0.945	0.004	0.037
Dep Var Mean	0.397	0.232	8.827	0.195	0.335
Sample	Ind.	Ind.	Ind.	Ind.	HH
# Units	5510	5510	5510	5510	3213
# Clusters	224	224	224	224	224
Observations	16530	16530	16530	16530	9639

Notes: Standard errors clustered at the village level in parenthesis. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Last four regressors refer to interactions with indicator of whether household experienced landmine events since 2002 until 36 months prior to March 1 of year the household was surveyed. Linear combinations correspond to the estimate of the sum of uninteracted plus interacted term of the same time period. Sample includes household heads and their spouses when they have one. Hours worked per week excluding agricultural daily laborers winsorized at the top 1%. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

Thus far, our findings indicate that individuals reduce their engagement in agricultural work following landmine exposure, both on their own plots and on other households' farms, likely perceiving these activities as risky due to the common practice of armed actors placing landmines on agricultural land. Specifically, individuals reduce work in agricultural occupations, other than day labor, outside their farms and hire more agricultural workers, while spending less time on their fields in response to recent landmine events. However, despite the risks, individuals tend to increase their participation in agricultural day labor after landmine exposure, even though this work offers lower wages compared to other agricultural activities outside the households' fields. We interpret this as evidence of liquidity constraints, where individuals continue to engage in risky labor activities to secure enough income to smooth their consumption. Additionally, it appears that individuals may become inured to repeated landmine exposure, as their response to new events seems to diminish with prior exposure.

5.2 Heterogeneity by liquidity constraints

The results from the previous section suggest the presence of liquidity-constrained individuals. Wealthier individuals—those with higher income, asset holdings, and borrowing capacity—may be more willing to reduce any type of off-farm labor they perceive as increasing their likelihood of encountering landmines. In contrast, poorer individuals—who have lower income, fewer assets, and limited borrowing capacity—may face liquidity constraints, leading them to increase off-farm labor after landmine exposure, despite the risks, in order to compensate for potential reduction in income.

We test for the presence of liquidity-constrained individuals by estimating heterogeneous effects by land ownership, as land is the primary asset contributing to wealth in rural areas and is crucial for accessing credit markets. We classify households into landowners, defined as those who owned at least one plot in 2010, and non-landowners, defined as those farmers who did not own any land in that year.

Table 7 presents the estimated heterogeneous effects on labor market outcomes. First, we observe that landowners reduce their work in non-*jornalero* jobs soon after experiencing the landmine events, but increase it after a substantial amount of time has passed since the events. Column 2 shows that landowners reduce the probability of working in these occupations by 4.2 percentage points if they experienced landmine events during the six months prior to the start of the planting season before the survey interview. Conversely, they increase this probability by 4.6 percentage points if the exposure happened 12 to 36 months preceding the start of the pre-survey planting season. Similarly, column 3 shows that landowners decrease the number of hours in non-*jornalero* jobs by 2.6 hours per week

(29%) if they were exposed in the 0 to 6 months pre-planting period, but increase it by 1.7 hours (20%) if the exposure took place in the 12 to 36 months pre-planting window.

Landowners' reduction in off-farm occupations is primarily driven by a decrease in agricultural labor. We find that landowners reduce non-*jornalero* agricultural work by 2 hours per week (a 57% decrease relative to the mean) if exposed to landmines in the 0 to 6 months pre-planting window, but increase it by 2.9 hours (an 83% increase relative to the mean) if they experienced events in the 12 to 36 months period (table A2, column 1). In contrast, landowners' non-agricultural off-farm work does not show a response to landmine exposure (table A2, column 2). This result suggests that landowners, who may not face liquidity constraints, reduce agricultural off-farm labor after exposure due to the increased risk of encountering landmines associated with such activities.

Similarly, non-landowners reduce their participation in occupations other than agricultural daily labor after exposure, specifically in terms of the intensive margin, while the extensive margin remains unchanged. Column 2 shows that non-landowners exposed to landmines in the 0 to 6 months pre-planting period are as likely to work in these occupations as their counterparts who were not exposed during the same window. Nevertheless, column 3 shows that non-landowners decrease the number of hours worked in these occupations by 3.4 hours (a 38% decrease relative to the mean) if exposed in the six months before the start of the planting season.

In contrast to landowners, non-landowners' reduction in off-farm labor is primarily driven by non-agricultural activities. We find that non-landowners decrease non-agricultural work by 4.1 hours per week (a 64% decrease relative to the mean) if they experienced landmine events in the 0 to 6 months pre-planting window (table A2, column 1). Conversely, non-landowners do not alter their non-*jornalero* agricultural work in response to new landmine events (table A2, column 2). Given that non-agricultural off-farm jobs can be conducted at home or elsewhere, this result suggests two potential reasons for the observed decrease. First, non-landowners may perceive these jobs as risky due to the need to commute, which increases the likelihood of encountering landmines. Second, the demand for goods and services provided through these types of jobs declines following landmine events, leading non-landowners to allocate less time to these activities.

We observe the opposite behavior with agricultural day labor: non-landowners are more likely to engage in this type of work after landmine exposure, while such events do not affect landowners' likelihood of working in this occupation. Column 4 shows that non-landowners increase the probability of working as *jornaleros* by 8.8 percentage points (a 45% increase relative to the mean) if they experienced a landmine event in the 0 to 6 months pre-planting period. This result suggests that non-landowners turn to agricultural day labor—an

occupation that carries similar risks than other forms of agricultural work but offers lower pay—to compensate for the income loss resulting from the decline in non-agricultural labor.

Finally, both types of farmers hire more agricultural labor after exposure to landmine events. Column 5 shows that landowners increase the probability of hiring agricultural workers by 16.2 and 5.6 percentage points (a 48% and 17% increase relative to the mean) if exposed to landmines in the pre-survey and 0 to 6 months pre-planting windows, respectively. Likewise, non-landowners are 46 and 13.5 percentage points (a 137% and 40% increase relative to the mean) more likely to hire agricultural workers if exposed to landmine events during the same respective time windows.

Labor income mechanically mirrors the changes in off-farm labor induced by landmine exposure. Landowners' income from working outside the household's farms decreases after recent landmine events, especially because there is a drop in income obtained from non-*jornalero* occupations. Specifically, landowners' off-farm labor income earned in the past month declines by 19% if they were exposed to landmine events in the six months prior to the start of the planting season, primarily due to a reduction of 33% in income obtained from working in non-*jornalero* jobs (table A5, columns 1 and 2). Conversely, non-landowners' off-farm labor income remains unchanged after recent exposure, mostly because their *jornalero* income increases while the income obtained from other occupations decreases. In particular, non-landowners earn 49% more as *jornaleros*, whereas their income from other occupations decreases by 47% (table A5, columns 2 and 3).

These findings suggest that individuals' responses to landmine events are influenced by their wealth, which affect their ability to reduce income-generating activities that increase the likelihood of encountering landmines. Landowners, who are wealthier and less likely to face liquidity constraints, reduce their engagement in agricultural non-*jornalero* occupations, even if this results in a decline in their off-farm labor income. As landowners possess a highly valuable asset in rural areas, which provides them access to credit markets, for example, they are better equipped to manage a reduction in such activities. In contrast, non-landowners are more likely to be liquidity constrained, limiting their capacity to navigate situations with reduced income. Non-landowners are often excluded from formal credit markets, which restricts their borrowing capacity and makes it difficult for them to cope with lower income if they reduce off-farm work. As a result, exposed non-landowners tend to work more as agricultural day laborers—a job that entails similar risks to other types of agricultural work but offers lower wages.

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Table 7: Effect of landmine events on labor market outcomes by land ownership

	(1) If Worked Off-Farm	(2) If Worked (No Ag. Day Lab.)	(3) Hrs. Worked (No Ag. Day Lab.)	(4) If Worked (Ag. Day Lab.)	(5) If Hired Ag. Labor
If events before survey	0.046	0.007	1.577	0.037	0.162***
	(0.047)	(0.040)	(1.992)	(0.048)	(0.060)
If events in (0-6] months	-0.008	-0.042*	-2.576**	0.012	0.056*
	(0.021)	(0.025)	(1.063)	(0.018)	(0.031)
If events in (6-12] months	-0.009	0.009	0.489	-0.031	-0.060
	(0.036)	(0.033)	(1.710)	(0.029)	(0.062)
If events in (12-36] months	0.037	0.046**	1.739*	0.004	0.050
	(0.027)	(0.021)	(0.940)	(0.022)	(0.038)
Non-owner × ...					
... If events before survey	-0.101	0.005	-5.190	-0.104	0.298*
	(0.083)	(0.084)	(3.272)	(0.091)	(0.174)
... If events in (0-6] months	0.079*	0.018	-0.819	0.076*	0.079
	(0.044)	(0.044)	(1.797)	(0.040)	(0.055)
... If events in (6-12] months	0.080	-0.028	3.491	0.148**	-0.179
	(0.079)	(0.090)	(3.012)	(0.057)	(0.151)
... If events in (12-36] months	-0.046	-0.010	0.440	-0.033	-0.068
	(0.051)	(0.048)	(2.241)	(0.045)	(0.047)
Linear combs. (If events in time window + Non-owner × If events in time window)					
Before survey	-0.055	0.012	-3.613	-0.067	0.460***
(0-6] months	0.071	-0.024	-3.395**	0.088**	0.135**
(6-12] months	0.071	-0.019	3.980	0.117**	-0.239**
(12-36] months	-0.009	0.037	2.178	-0.029	-0.018
Dep Var Mean	0.397	0.232	8.827	0.195	0.335
Sample	Ind.	Ind.	Ind.	Ind.	HH
# Units	5510	5510	5510	5510	3213
# Clusters	224	224	224	224	224
Observations	16530	16530	16530	16530	9639

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. In columns 1 through 4, sample includes household heads and their spouses when they have one. In column 5, sample include households these individuals belong to. Hours worked per week excluding agricultural daily laborers winsorized at the top 1%. Households classified on whether they owned land when they were surveyed in 2010. Linear combinations correspond to the estimate of the sum of uninteracted plus interacted term of the same time period. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

5.3   Effects on healthcare seeking behavior

Accessing healthcare services in Colombia often involves traveling to population centers. In order to obtain medical assistance, individuals travel to the municipal capitals, as health facilities are usually located in these urban centers[7]. Since commuting to these places can increase individuals' chances of being affected by landmines, they would decrease their visits to medical professionals. To explore this possibility, we estimate the effects on landmine events on the use of medical care by adults and children in this section.

Table 8 presents the estimates for household heads and their spouses on the probability of seeking medical assistance for preventative care (i.e., visits to medical professionals without being sick). We find that farmers decrease the use of formal medical care (columns 1 to 5) after recent exposure to landmine events, but increase the use of alternative medicine (column 6). Adults who experienced a landmine event just before being surveyed are 8.2 percentage points (a 12% decrease relative to the mean) less likely to visit a formal medical professional at least once a year[8]. Adults especially reduce the probability of visiting general practitioners or specialists, dentists, and optometrists by 9, 15.5, and 5.9 percentage points, respectively, if they were exposed to landmines during that same period. Moreover, adults partially resume their healthcare seeking behavior some time after experiencing a landmine event. In particular, adults who experienced a landmine event in the 6 to 12 and 12 to 36 month pre-planting windows are 9.1 and 5 percentage points (a 23% and 12% increase relative to the mean) more likely to seek dental care, respectively. We do not observe adults resuming their visits to general practitioners/specialists and optometrists.

On the contrary, farmers exposed to landmine events increase the likelihood of seeking alternative medicine by 1.8 and 2.9 percentage points (a 60% and 97% increase relative to the mean) if exposed to landmines in the 0 to 6 and 12 to 36 month pre-planting windows. This may be because providers of alternative medicine tend to be residents of their communities, hence are more physically accessible, while providers of formal medicines are less likely to be members of their communities, and more likely to be situated farther away from rural villages.

The effects seen on adults are partially observed in children. Table 9 presents the estimates for children who were 0 to 9 years old when surveyed in 2010 because this is the only cohort the survey follows. We find that children who experienced a landmine event before

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[7]According to ELCA community survey, only 9% of surveyed villages had a health center in 2010, and in 86% of them, patients with serious illnesses were taken to medical centers in the municipal capital.

[8]Since we do not know the number of visits and the dates when they took place, it is possible that some of these visits occurred before the landmine events. To account for this, we estimate an alternative specification using yearly time windows, with the first one ending on the survey date. Table A3 shows the results for this alternative specification, which remain consistent to those obtained in the preferred specification.

Table 8: Effect of landmine events on adults' healthcare seeking

	Sought medical assitance for preventative care in the past 12 months					
	(1) Any Non Alternative	(2) GP/ Specialist	(3) Dentist	(4) Optometrist	(5) Family Planning	(6) Alternative Medicine
If event before survey	-0.082*	-0.090*	-0.155***	-0.059**	-0.020	0.020
	(0.048)	(0.051)	(0.051)	(0.026)	(0.022)	(0.017)
If event in (0-6] months	-0.037	-0.043*	-0.050*	-0.022	0.019	0.018**
	(0.030)	(0.026)	(0.026)	(0.018)	(0.014)	(0.008)
If event in (6-12] months	0.043	0.043	0.091**	0.008	0.018	0.005
	(0.045)	(0.045)	(0.038)	(0.023)	(0.016)	(0.014)
If event in (12-36] months	0.010	0.046	0.050**	-0.007	0.005	0.029***
	(0.029)	(0.030)	(0.025)	(0.015)	(0.019)	(0.011)
Dep Var Mean	0.658	0.605	0.400	0.132	0.091	0.030
# Individuals	5484	5484	5484	5484	5484	5484
# Clusters	224	224	224	224	224	224
Observations	16452	16452	16452	16452	16452	16452

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes household heads and their spouses when they have one. All specifications include individual and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

the survey are 16.3 percentage points (a 28% decrease relative to the mean) less likely to visit a dentist. Similarly, children exposed during the same time window reduce the probability of visiting general practitioners or specialists by 10.6 percentage points (a 14% decrease relative to the mean). Although this estimate is statistically insignificant, we might be underpowered to detect the effect. Similar to adults, children seem to resume visits to general practitioners in the medium run, nevertheless, the effect is statistically insignificant but we might be underpowered to observe an effect[9]. Unlike adults, who may postpone their visits to medical practitioners, seeking preventative care for children is crucial for their development and health status (Chung et al., 2006; Hakim and Bye, 2001; Hakim and Ronsaville, 2002). Landmines discourage parents and guardians from taking their children to formal medical care, which may have pervasive consequences for their development.

6   Mechanisms

Our analysis thus far suggests that wealthier, land owning individuals work less in agricultural non-*jornalero* jobs following recent exposure to landmine events, while non-land owning individuals decrease their non-agricultural work but increase their involvement in *jornalero*

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[9]Table A4 shows the estimates of an alternative specification using yearly time windows, with the first one ending on the survey date. Results are robust to the ones obtained in the preferred specification.

Table 9: Effect of landmine events on children's healthcare seeking

	Sought medical assitance for preventative care in the past 12 months					
	(1) Any Non Alternative	(2) GP/ Specialist	(3) Dentist	(4) Optometrist	(5) Pediatrician	(6) Alternative Medicine
If event before survey	-0.067	-0.106	-0.163**	-0.090	-0.057	-0.002
	(0.085)	(0.080)	(0.075)	(0.055)	(0.076)	(0.019)
If event in (0-6] months	0.015	-0.043	-0.047	-0.002	0.015	-0.007
	(0.028)	(0.034)	(0.041)	(0.021)	(0.026)	(0.005)
If event in (6-12] months	-0.002	0.009	0.053	0.109**	0.037	0.021***
	(0.053)	(0.053)	(0.063)	(0.047)	(0.028)	(0.006)
If event in (12-36] months	0.029	0.044	-0.024	0.013	-0.015	0.018
	(0.038)	(0.037)	(0.044)	(0.028)	(0.028)	(0.011)
Dep Var Mean	0.836	0.759	0.583	0.133	0.231	0.011
Individual FE	2813	2813	2813	2813	2813	2813
# Individuals	224	224	224	224	224	224
# Clusters	8170	8170	8170	8170	8170	8170

Notes: Standard errors clustered at the village level in parenthesis. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes children who were 0 to 9 years old in 2010 and were followed in at least the first two rounds. All specifications include individual and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

labor. Additionally, both landowning and non-landowning households hire more agricultural labor in response to landmine events. Finally, we find that exposed adults and children seek less preventative healthcare after experiencing landmine events. In this section, we explore several underlying mechanisms.

6.1 Reduced demand and supply for non-agricultural occupations

Goods and services produced in non-agricultural occupations may experience a decline in demand following landmine exposure, leading individuals to reduce the amount of time they spend on those jobs. This effect is more pronounced in certain economic sectors. For example, exposed individuals may demand less accommodation and food services outside their homes due to reduced mobility after experiencing landmine events. This behavior results in lower income for workers and business owners in this sector, prompting them to decrease the amount of work they devote to these activities.

We empirically test this hypothesis by estimating the impact of landmine exposure on the number of hours worked in the past week in off-farm paid jobs across various economic activities. Table 10 presents the estimates of the heterogeneous effects by land ownership of landmine events on time allocated by individuals to different non-agricultural economic sectors. We find that non-landowners' reduction of non-agricultural work primarily comes from a decrease in the time spent in wholesale and retail trade. Specifically, non-landowners

decrease by 1.1 hours (a 69% decrease relative to the mean) work in wholesale and retail trade if they experienced a landmine event in the 0 to 6 months pre-planting period (column 3).

To better understand the types of jobs non-landowners engage in less frequently, we analyze the activities individuals perform in the wholesale and retail trade sectors by examining the job descriptions provided by respondents in the survey. First, many individuals primarily manage their own stores, which are usually located in or near their homes, selling groceries and beverages. Second, individuals also sell their agricultural produce, either at their farm or by traveling to nearby market centers. Third, individuals sell products from printed catalogs, which they can do from their homes, or may require them to travel to meet potential clients. Finally, individuals work as salespeople in stores and businesses located in market centers.

Given the activities conducted by individuals in the wholesale and retail trade sector, two potential mechanisms may explain why non-landowners reduce their participation in this particular economic sector. First, the presence of landmines might negatively affect local consumption, as exposed individuals may experience a decline in income or choose to visit nearby shops and urban settlements less frequently. Consequently, local demand for various goods may decrease as markets in low- and middle-income countries tend to be localized (Jensen and Miller, 2018). This severely impacts the wholesale and retail trade sector due to the nature of the activities individuals conduct in this field. For instance, store owners may receive fewer customers, leading to reduced revenue. In response, individuals may allocate less time to these jobs as they earn less income from them. Second, some activities in wholesale and retail trade require farmers to travel, increasing their likelihood of encountering landmines. Therefore, to avoid this risk, farmers may spend less time on these activities.

Table 10: Effect of landmine events on hours worked in non-agricultural economic activities

	Hours worked in paid off-farm jobs in the past week							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing	Construction	Wholesale & Retail Trade	Transportation	Accommodation & Food Services	Education	Health	Domestic Work
If events before survey	0.175	-0.137	2.515*	0.572	-1.417*	0.423	-0.112	-0.450
	(0.397)	(0.916)	(1.430)	(0.458)	(0.793)	(0.333)	(0.128)	(0.307)
If events in (0-6] months	-0.507	-0.303	0.537	0.652	-0.070	0.134	-0.103	-0.118
	(0.314)	(0.546)	(1.169)	(0.623)	(0.430)	(0.194)	(0.083)	(0.188)
If events in (6-12] months	-0.790*	0.690	-1.789	-0.006	1.128**	0.389	0.024	0.121
	(0.441)	(0.585)	(1.210)	(0.222)	(0.500)	(0.358)	(0.079)	(0.133)
If events in (12-36] months	0.066	0.875*	-0.811	-0.043	-0.207	0.064	-0.051	0.088
	(0.267)	(0.472)	(0.650)	(0.190)	(0.419)	(0.142)	(0.052)	(0.140)
Non-owner × ...								
... If events before survey	0.065	-2.595	-4.740**	-1.168*	-0.192	0.000	0.072	0.049
	(0.484)	(2.202)	(1.970)	(0.701)	(2.004)	(0.354)	(0.058)	(0.621)
... If events in (0-6] months	1.062	-0.024	-1.663	-1.280*	0.300	0.402	0.067	0.132
	(0.768)	(0.933)	(1.347)	(0.692)	(1.095)	(0.366)	(0.054)	(0.774)
... If events in (6-12] months	0.962*	-0.282	6.684***	-0.543	-1.590	-0.661*	0.008	-0.798
	(0.497)	(1.085)	(1.383)	(0.494)	(0.975)	(0.378)	(0.066)	(0.568)
... If events in (12-36] months	-0.162	-1.204	2.176**	-1.002*	-0.112	-1.071	0.069	-0.967
	(0.328)	(0.917)	(0.981)	(0.558)	(1.130)	(0.688)	(0.054)	(1.267)
Linear combs. (If events in time window + Non-owner × If events in time window)								
Before survey	0.240	-2.732	-2.226	-0.596	-1.609	0.423	-0.040	-0.401
(0-6] months	0.555	-0.328	-1.126*	-0.628	0.230	0.536	-0.036	0.015
(6-12] months	0.172	0.408	4.895***	-0.549	-0.462	-0.272	0.032	-0.677
(12-36] months	-0.095	-0.329	1.365	-1.045*	-0.319	-1.008	0.018	-0.879
Dep Var Mean	0.519	1.005	1.624	0.792	0.497	0.314	0.226	0.663
# Units	5510	5510	5510	5510	5510	5510	5510	5510
# Clusters	224	224	224	224	224	224	224	224
Observations	11020	11020	11020	11020	11020	11020	11020	11020

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Outcome variables correspond to hours worked by individuals in the past week. Sample include household heads and their spouses when they have one. Only the last two rounds of the household survey (2013, 2016) are considered. All specifications include individual/household and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

6.2 Replacing own labor in their fields with external labor

We previously argued that, on average, individuals may hire agricultural workers to replace their own labor in their fields after landmine exposure. Table 11 presents the estimates of the heterogeneous effects by land ownership on whether farmers spend more than 0 to 4 hours per day on agricultural tasks on their own plots.

Table 11: Effect of landmine events on time spent in agricultural jobs in household's farms by land ownership

	Time spent in ag. jobs in HH's farms			
	(1) > 0 hr	(2) ≥ 1 hr	(3) ≥ 2 hr	(4) ≥ 4 hr
If events before survey	-0.048	-0.043	0.001	0.009
	(0.048)	(0.050)	(0.047)	(0.036)
If events in (0-6] months	-0.073***	-0.066***	-0.052**	-0.013
	(0.024)	(0.023)	(0.026)	(0.020)
If events in (6-12] months	-0.041	-0.043	-0.067**	-0.030
	(0.027)	(0.032)	(0.029)	(0.025)
If events in (12-36] months	-0.023	-0.025	-0.011	-0.023
	(0.026)	(0.026)	(0.026)	(0.025)
Non-owner × ...				
... If events before survey	0.276***	0.186	0.087	0.038
	(0.102)	(0.118)	(0.099)	(0.121)
... If events in (0-6] months	0.088	0.068	0.074*	0.015
	(0.059)	(0.055)	(0.044)	(0.034)
... If events in (6-12] months	-0.049	-0.038	0.008	0.024
	(0.063)	(0.069)	(0.046)	(0.104)
... If events in (12-36] months	0.008	0.013	-0.004	0.026
	(0.054)	(0.054)	(0.051)	(0.058)
Linear combs. (If events in window + Non-owner × If events in window)				
Before survey	0.228**	0.143	0.088	0.047
(0-6] months	0.015	0.002	0.022	0.002
(6-12] months	-0.090*	-0.080	-0.058	-0.007
(12-36] months	-0.016	-0.012	-0.015	0.003
Dep Var Mean	0.455	0.424	0.364	0.258
# Units	5485	5485	5485	5485
# Clusters	224	224	224	224
Observations	16455	16455	16455	16455

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes household heads and their spouses when they have one. Outcome variables indicate whether the individual spent any time, at least one hour, two hours, and four hours per day in agricultural jobs in the his/her household's farms and businesses. Individuals classified based on whether they belong to a household that does not own land when surveyed in 2010. Linear combinations correspond to the estimate of the sum of uninteracted plus interacted term of the same time period. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

We observe landowners reduce the time they spend working on agricultural jobs in their fields after recent landmine exposure, whereas non-landowners continue working on their fields with the same intensity despite experiencing landmine events. Column 1 shows

landowners are 7.3 percentage points (a 16% decrease relative to the mean) less likely to spend a positive amount of time working on agricultural tasks in their field if exposed to landmine events in the six months before the start of the planting season. Conversely, non-landowners who experienced landmine events in the 0 to 6 months pre-planting period are just as likely to spend any time working on agricultural jobs in their fields as their counterparts without exposure in that same period. The estimates are similar when the time threshold is set at one or two hours (columns 2 and 3), but the effects become null for both landowners and non-landowners when the threshold is four hours. Similar to the overall result, this suggests landmines do not affect individuals who work intensively in their fields but rather impact those who visit their plots less frequently.

6.3   Intensified production for non-landowners

Our findings indicate that both landowning and non-landowning households increase their hiring of agricultural workers after landmine exposure. However, the underlying reasons for this increase seem to differ between the two groups. Landowners appear to hire agricultural workers to replace their own labor in their fields with external labor, whereas non-landowners continue working on their fields themselves while also hiring additional workers. A possible reason for this behavior among non-landowners is their desire to intensify agricultural production on their land to compensate for the reduction in income they face following landmine events.

We explore this mechanism empirically by estimating the heterogeneous effects of landmine events by land ownership on land allocated to different agricultural uses. Table 12 presents the landmine effect on the size of areas allocated to five different types of agricultural production. Non-landowners allocate more land to certain types of agricultural production after recent landmine exposure. Specifically, we find that non-landowners increase land devoted to mixed crops by 0.3 hectares (a 191% increase relative to the mean) if they experienced landmine events during the pre-survey window (column 4). Additionally, non-landowning households who experienced landmine events in the 0 to 6 months pre-planting period increase the area with perennial crops by 0.06 hectares (an 18% increase relative to the mean), although we might be underpowered to detect a statistically significant effect (column 2). Recall that non-landowning households exposed to landmine events during those same periods are more likely to hire agricultural workers and do not reduce the time they spend working on their fields. This suggests that non-landowners expand their cultivated area after recent landmine exposure, which requires the hiring of additional agricultural workers to manage the increased cultivated land.

Table 12: Heterogeneous effects of landmine events on land use by land ownership

	Number of hectares allocated to				
	(1)	(2)	(3)	(4)	(5)
	Cultivations	Perennial	Seasonal	Mixed	Livestock Raising
If events before survey	-0.002	-0.215	0.091	0.098	0.096
	(0.167)	(0.346)	(0.078)	(0.206)	(0.256)
If events in (0-6] months	-0.117*	-0.110	0.028	-0.003	-0.063
	(0.065)	(0.069)	(0.034)	(0.038)	(0.122)
If events in (6-12] months	-0.022	0.044	-0.038	0.015	-0.211
	(0.075)	(0.226)	(0.064)	(0.165)	(0.172)
If events in (12-36] months	0.085	0.075	0.004	-0.013	-0.201*
	(0.091)	(0.075)	(0.040)	(0.052)	(0.111)
Non-owner × ...					
... If events before survey	0.555**	0.360*	0.008	0.185	0.362
	(0.268)	(0.200)	(0.100)	(0.302)	(0.428)
... If events in (0-6] months	0.206**	0.176**	0.029	-0.003	0.162
	(0.087)	(0.071)	(0.049)	(0.059)	(0.190)
... If events in (6-12] months	-0.391**	-0.329**	-0.022	-0.066	0.136
	(0.168)	(0.138)	(0.077)	(0.190)	(0.222)
... If events in (12-36] months	0.028	-0.047	0.022	0.070	0.088
	(0.130)	(0.078)	(0.045)	(0.096)	(0.222)
Linear combs. (If events in time window + Non-owner × If events in time window)					
Before survey	0.553	0.146	0.098	0.283**	0.458
(0-6] months	0.089	0.066	0.057	-0.006	0.098
(6-12] months	-0.413**	-0.285	-0.060**	-0.051	-0.075
(12-36] months	0.112	0.028	0.026	0.057	-0.112
Dep Var Mean	0.785	0.368	0.218	0.148	0.889
# Units	3213	3213	3213	3213	3213
# Clusters	224	224	224	224	224
Observations	9639	9639	9639	9639	9639

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes household heads and their spouses when they have one. Outcome variables indicate whether the individual spent any time, at least one hour, two hours, and four hours per day in agricultural jobs in the his/her household's farms and businesses. Individuals classified based on whether they belong to a household that does not own land when surveyed in 2010. Linear combinations correspond to the estimate of the sum of uninteracted plus interacted term of the same time period. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

6.4 Other channels

Individuals exposed to landmines may attempt to minimize the distance they travel for daily activities, as armed actors often place landmines on walking paths and near roads, increasing the risk of encountering them during commutes. This behavior can significantly affect activities conducted outside the home, such as working off the household's farm or seeking healthcare. Specifically, after landmine exposure, individuals may reduce their participation in jobs that require commuting and instead prefer work that is closer to home. Additionally, exposed individuals might avoid visiting healthcare professional, as medical centers are often

located in populated areas and municipal capitals.

Unfortunately, we cannot empirically test whether individuals actually reduce their movement in response to landmine events, as the survey data does not provide information on how far and how frequently individuals travel. However, other studies have investigated the impact of landmine events on individuals' movement. For example, Vargas et al. (2024) explores how landmine explosions in Colombia affect people's mobility using raster data from Facebook, which tracks daily movement from June 2021 to March 2022. The study finds that individuals reduce their mobility in the days following a landmine explosion but return to pre-explosion mobility levels within five weeks. These findings suggest that individuals initially reduce their movement after landmine exposure, potentially leading to a decrease in activities typically conducted outside the households' home.

7 Conclusion

This study provides new insights into how rural Colombian households adjust their economic activities and healthcare-seeking behaviors in response to landmine events. We estimate the effects of landmine events on labor market decisions, and analyze heterogeneity along land ownership and previous exposure. We also investigate the landmine effects on the use of medical services for adults and children.

Our findings reveal a complex pattern of adaptation to the persistent threat of landmines. First, farmers reduce work in non-*jornalero* occupations, leading to a decrease in labor income for landowners but not for non-landowners. Farmers without land ownership, who may not be able to afford a decrease in income, increase their work in agricultural day labor after exposure, thereby stabilizes their labor earnings. However, it is unclear why non-landowners make this transition from other occupations outside the household's farm to agricultural daily labor. It may be possible that non-landowners choose to work more as *jornaleros* because this may involve traveling shorter distances, as nearby farmers might be hiring them. Another possibility is that the goods and services produced in these occupations might be less in demand in local markets after exposure, prompting non-landowners in those occupations to seek alternative sources of income to stabilize their earnings. Regardless of the mechanisms, farmers with fewer assets, lower wealth, and limited borrowing capacity are unable to reduce income-generating activities after exposure. Consequently, they must continue some of these activities, despite the risk of encountering landmines.

Another example of the inequality in adaptation to the threat of landmines is observed in hiring behavior. We find that farmers, regardless of land ownership, increase their hiring of agricultural workers shortly after experiencing landmine events. However, the reasons for this

increase differ between landowners and non-landowners. Landowners, who reduce their own agricultural labor after exposure, appear to hire external workers to replace their labor. In contrast, non-landowners, who continue to work on their fields despite landmine events, may increase hiring to intensify agricultural production on their farms. This behavior suggests again that poorer farmers are driven to seek alternative sources of income to compensate for reduced earnings caused by landmine events.

Landmines also have pervasive effects on farmers' well-being, as they diminish their healthcare-seeking behavior. Adults significantly reduce their use of formal medical services following landmine events, partially substituting these services with alternative medicine. Children also experience a decrease in visits to medical professionals, which could have detrimental effects on their development.

In conclusion, this research contributes to a more nuanced understanding of how rural households navigate their lives with landmine exposure. Future research could investigate more aggregate analysis of the effects of landmine presence on the rural labor market.

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Appendix A. Additional tables

Table A1: Effect of landmine events on hours work in the past week

	Hours worked in the past week		
	(1) Agriculture (No Ag. Day Lab.)	(2) Non-Agric. (No Ag. Day Lab.)	(3) Ag. Day Labor
If event before survey	0.404	0.568	2.969*
	(2.394)	(1.803)	(1.673)
If event in (0-6] months	-1.929*	-0.484	0.841
	(1.072)	(1.101)	(0.992)
If event in (6-12] months	-0.085	0.434	-1.527
	(1.636)	(1.481)	(1.316)
If event in (12-36] months	2.299***	-0.184	1.620
	(0.805)	(0.796)	(1.218)
Dep Var Mean	3.504	6.305	5.853
# Units	5510	5510	5510
# Clusters	224	224	224
Observations	11020	11020	11020

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Outcome variables correspond to hours worked by individuals in the past week. Sample include household heads and their spouses when they have one. Only the last two rounds of the household survey (2013, 2016) are considered. All specifications include individual/household and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

Table A2: Effect of landmine events on hours worked in the past week by land ownership

	Hours worked in paid off-farm jobs in the past week		
	(1) Agriculture (No Ag. Day Lab.)	(2) Non-Agric. (No Ag. Day Lab.)	(3) Ag. Day Labor
If events before survey	-0.843	2.696	3.471*
	(2.906)	(1.712)	(1.764)
If events in (0-6] months	-2.040*	0.601	-0.762
	(1.211)	(1.349)	(1.106)
If events in (6-12] months	0.531	-0.271	-3.152**
	(1.919)	(1.271)	(1.300)
If events in (12-36] months	2.903***	-0.402	2.315*
	(0.834)	(0.891)	(1.279)
Non-owner × ...			
... If events before survey	5.501*	-10.227**	-4.530
	(3.113)	(4.628)	(4.420)
... If events in (0-6] months	0.211	-4.652**	7.326***
	(1.902)	(2.027)	(2.168)
... If events in (6-12] months	-4.484	4.916	10.094***
	(2.773)	(3.710)	(3.110)
... If events in (12-36] months	-3.208*	0.770	-2.643
	(1.666)	(2.268)	(2.141)
Linear combs. (If events in time window + Non-owner × If events in time window)			
Before survey	4.658**	-7.531	-1.059
(0-6] months	-1.828	-4.052**	6.565***
(6-12] months	-3.953	4.645	6.942*
(12-36] months	-0.305	0.368	-0.328
Dep Var Mean	3.504	6.305	5.853
# Units	5510	5510	5510
# Clusters	224	224	224
Observations	11020	11020	11020

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Outcome variables correspond to hours worked by individuals in the past week. Sample include household heads and their spouses when they have one. Only the last two rounds of the household survey (2013, 2016) are considered. All specifications include individual/household and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

Table A3: Effect on landmine events on healthcare seeking using yearly time windows

	Sought medical assitance for preventative care in the past 12 months					
	(1) Any Non Alternative	(2) GP/ Specialist	(3) Dentist	(4) Optometrist	(5) Family Planning	(6) Alternative Medicine
If event in (0-12] months	-0.034	-0.034	-0.035	-0.024	0.018	0.018***
	(0.026)	(0.024)	(0.026)	(0.017)	(0.013)	(0.007)
If event in (12-24] months	0.036	0.061*	0.048**	0.019	0.004	0.013
	(0.034)	(0.033)	(0.024)	(0.017)	(0.019)	(0.008)
If event in (24-36] months	0.027	0.027	0.048*	-0.006	0.015	0.016
	(0.028)	(0.029)	(0.029)	(0.016)	(0.017)	(0.018)
Dep Var Mean	0.658	0.605	0.400	0.132	0.091	0.030
# Individuals	5484	5484	5484	5484	5484	5484
# Clusters	224	224	224	224	224	224
Observations	16452	16452	16452	16452	16452	16452

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes household heads and their spouses when they have one. All specifications include individual and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

Table A4: Effect of landmine events on children's healthcare seeking using yearly windows

	Sought medical assitance for preventative care in the past 12 months					
	(1) Any Non Alternative	(2) GP/ Specialist	(3) Dentist	(4) Optometrist	(5) Pediatrician	(6) Alternative Medicine
If event in (0-12] months	-0.000	-0.042	-0.044	0.008	0.003	0.001
	(0.024)	(0.029)	(0.037)	(0.021)	(0.024)	(0.005)
If event in (12-24] months	0.052	0.081*	0.068	0.080***	-0.009	0.016**
	(0.042)	(0.043)	(0.046)	(0.029)	(0.026)	(0.007)
If event in (24-36] months	0.053	0.027	-0.056*	-0.039	-0.000	-0.009
	(0.036)	(0.030)	(0.034)	(0.044)	(0.017)	(0.017)
Dep Var Mean	0.836	0.759	0.583	0.133	0.231	0.011
Individual FE	2813	2813	2813	2813	2813	2813
# Individuals	224	224	224	224	224	224
# Clusters	8170	8170	8170	8170	8170	8170

Notes: Standard errors clustered at the village level in parenthesis. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. Sample includes children who were 0 to 9 years old in 2010 and were followed in at least the first two rounds. All specifications include individual and year fixed effects and municipality characteristics at baseline interacted with year FE. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

Table A5: Heterogeneous effects of landmine events on labor income and agricultural sales by land ownership

	Income earned in the past month			Sales last harvest/12 months	
	(1) Off-Farm Work	(2) No Ag. Day Labor	(3) Ag. Day Labor	(4) Crops	(5) Livestock & Animal Prods.
If events before survey	10.30	2.67	9.42	692.51	-63.44
	(17.801)	(17.831)	(13.066)	(733.916)	(217.285)
If events in (0-6] months	-28.91***	-30.99***	1.80	46.50	-220.17
	(10.788)	(9.878)	(6.346)	(184.222)	(203.880)
If events in (6-12] months	-14.13	-3.70	-8.74	-245.47	-167.05
	(11.504)	(11.131)	(6.200)	(306.827)	(166.456)
If events in (12-36] months	30.21***	23.74**	6.38	11.81	117.74
	(10.279)	(9.700)	(5.922)	(121.616)	(181.514)
Non-owner × ...					
... If events before survey	11.67	17.02	-10.35	1485.63	179.56
	(37.953)	(36.053)	(37.784)	(1653.568)	(242.956)
... If events in (0-6] months	15.41	-13.17	26.69*	-221.84	-126.16
	(24.189)	(22.487)	(14.361)	(296.308)	(271.592)
... If events in (6-12] months	29.97	-12.41	40.78	-665.64	-214.65
	(36.016)	(25.263)	(25.644)	(1109.342)	(222.364)
... If events in (12-36] months	24.03	18.20	2.55	562.39	201.73
	(24.473)	(22.114)	(13.150)	(397.304)	(250.495)
Linear comb. p-values					
Before survey	21.97	19.69	-0.94	2178.14	116.12
(0-6] months	-13.50	-44.16**	28.48**	-175.34	-346.33
(6-12] months	15.84	-16.10	32.03	-911.10	-381.69***
(12-36] months	54.24**	41.93**	8.93	574.20	319.47
Dep Var Mean	153.33	93.45	57.87	1107.84	1230.53
Sample	Ind.	Ind.	Ind.	HH	HH
# Units	5489	5489	5489	3210	3210
# Clusters	224	224	224	224	224
Observations	16467	16467	16467	9630	9630

Notes: Standard errors clustered at the village level in parentheses. Independent variables indicate if household experienced a landmine event within 5 km from its residence in the specified windows. In columns 1 and 2, sample includes household heads and their spouses when they have one. In column 3 and 4, sample include households these individuals belong to. All monetary values are expressed in thousands of Colombian Pesos base December 2018 and winsorized at the top 1%. Households classified on whether they owned land when they were surveyed in 2010. Linear combinations correspond to the estimate of the sum of uninteracted plus interacted term of the same time period. Baseline municipality characteristics include average altitude, population density in 2005, distance to the department's capital, homicide rate in 2005, and indicator of landmine events between 1990 and 2005. *** 1%, ** 5%, * 10%

As an economics instructor, my goal is to empower students to master the analytical tools of economics and foster a deep understanding of how incentives shape human behavior. I am committed to making these concepts accessible and relevant to all students, regardless of their backgrounds in socio-economics, race, gender, culture, or religion. I strive to ensure that economics resonates with diverse perspectives and serves as a useful foundation for any future career path. My teaching philosophy is grounded in the belief that economics offers powerful insights into understanding the world, and it is my responsibility to create an inclusive learning environment where all students, regardless of their prior knowledge or experience, can engage meaningfully with these tools and apply them confidently.

In my teaching career, I have focused on creating inclusive and engaging learning environments where students feel confident in their ability to grasp complex concepts. In my role as a teaching assistant for "Introduction to Statistical Methods for Public Policy Analysis" at the La Follette School of Public Policy at the University of Wisconsin-Madison, I developed all teaching materials to supplement lectures, tailoring them to meet the needs of students with varying levels of statistical and mathematical proficiency. This course introduced public policy master's students to basic probability and statistics, as well as introductory econometrics, enabling them to conduct simple policy evaluations using Stata by the end of the semester.

To engage students from diverse backgrounds, I employ a variety of teaching strategies. I emphasize intuitive explanations and avoid jargon to make technical concepts more approachable. Recognizing that students learn in different ways, I present the same concepts through multiple methods, whether by using visual aids, working through problems step-by-step, or connecting theory to real-world examples. I find that using a tablet to solve exercises and annotate slides in real-time enhances student engagement, as it allows for color-coding and dynamic interaction. After each session, I provide type-set solutions for students to review, ensuring that they have clear, accessible materials to support their learning. Student evaluations consistently highlight the effectiveness of these methods, with feedback noting that my approachability and clarity made complex statistical concepts more understandable. I provide the overview of this course evaluation and highlights from student feedback in the next page.

Beyond the classroom, I have led and facilitated numerous training sessions for development practitioners, policymakers, enumerators, and researchers, particularly in developing countries. These experiences have been instrumental in refining my ability to adapt to various learning environments. For instance, during a summer school on program evaluation and statistical coding in Rwanda, I faced significant variations in students' numeracy and literacy skills, as well as technical challenges such as power cuts and computer malfunction. These challenges required flexibility and creativity in my teaching methods, reinforcing the importance of adapting content to meet the needs of diverse audiences. These teaching opportunities have been particularly rewarding, as they allow me to connect with individuals working on the frontlines of development, applying economics in real-world contexts.

I strive to be an educator who inspires students to use the analytical tools of economics to make sense of the world around them. I was fortunate to have a professor during my master's studies whose course on applied econometrics and policy evaluation transformed my academic path and motivated me to pursue a doctoral degree in applied economics. I hope to have a similar impact on my students, encouraging them to pursue research careers

or to apply economic principles in the private, public, and non-profit sectors. My aim is not only to teach economics but to help students see its real-world relevance and applicability, regardless of their career paths.

Evidence of Teaching Effectiveness

The following table summarizes evaluations of my teaching experience at the University of Wisconsin-Madison. These evaluations were completed at the end of the Fall 2021 semester for the course PA 818: Introduction to Statistical Methods for Public Policy Analysis.

	PA 818 Fall 2021 Intro. Statistical Methods for Public Policy Analysis		
	Section 1	Section 2	Section 3
Share of lectures well prepared 1 (Almost none) 5 (Almost all)	4.4	4.88	4.86
Willingness to help 1 (Unwilling) 5 (Extremely willing)	4.8	4.93	4.71
Helpfulness 1 (Of no help) 5 (Extremely helpful)	4.2	4.53	4.43
Felt comfortable to approach 1 (Not at all) (Extremely comfortable)	4.4	4.6	4.43
Overall performance 1 (poor) to 5 (excellent)	4.4	4.38	4.43
Responses/enrollment	5/10	15/21	7/20

Student Feedback Highlights:

"She used color-coded handwritten slides, and slides that had the math worked out for us to go back and review. This was extremely helpful. ...I was extremely happy with the presentation of slides, in the time-limited Thursday discussion group."

"For me, Sakina sitting down and going over certain ideas repeatedly was essential. She reviewed the same concepts over and over again until I understood them."

"Sakina did a great job at working through examples/problems that situated a lot of the content from lecture in more approachable contexts. Sakina uses language that makes a lot of statistics content more approachable and graspable."

"The ability to translate what was said in lecture to someone like me who didn't fully understand was extremely helpful. Going through the specific homework questions during office hours, was really helpful for me to understand and solidify what we learned in the larger lecture."

"She consistently presented helpful and clear lessons and went above and beyond to answer questions and help with any confusion."

"Often, I felt like I would enter discussion section not understanding what was happening in the class at all and leave feeling much more confident."

"I had no issues whatsoever asking Sakina either to re-explain the concept, or to ask for additional help either after class or for a different time to chat. Moreover, Sakina was friendly, polite, and professional in a way that engendered great confidence in her TA ability. It was obvious that she cared for each of us, and for each of our success."

Non-Academic Teaching Experience

I have also gained extensive non-academic teaching experience, leading training sessions on statistical coding and data visualization for faculty, government officials, and development practitioners. These experiences have broadened my teaching portfolio and enhanced my ability to teach complex concepts to non-specialist audiences.

- Statistical coding and GitHub training for faculty members at the Lahore School of Economics (2022)

- Summer school on program evaluation and statistical coding for university students and development practitioners in Rwanda (2018)

- Short courses on statistical coding and data visualization for Rwandese government officials (2018)

- R and Stata coding training sessions at the Development Impact (DIME) group at the World Bank (2017-2019)

- Enumerator training for agricultural household surveys in Rwanda for DIME (2017, 2018)

PUB AFFR 818 303

📅 **2021 Fall** 👤 **MILTON, Ross (Course Section Director)** 👤 **Shibuya, Sakina (Instructor)**

Survey: Course Evaluations La Follette School

Survey	Term	Start Date	End Date	Students	Responses	Response Rate
Course Evaluations La Follette School	2021 Fall	📅 2021-12-01	📅 2021-12-16	20	7	35%

Questions		PUB AFFR 818 303			
	Avg	**StDev**	**Median**	**Mode**
Was the method of conducting this class appropriate to its size and topic? **Scale (1 - 4) 1 =** It made little difference **4 =** Completely appropriate at all times **Type:** Multi-Choice, Single Answer		**3.57**	*0.49*	**4**	**4**
About what proportion of the class sessions have you attended? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer		**4.71**	*0.45*	**5**	**5**

Questions	PUB AFFR 818 303			
What proportion of those lectures or discussions which you did attend was the instructor prepared to lead class effectively? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	4.86	0.35	5	5
Please review the course syllabus to help answer the following four questions. What proportion of the lectures or discussions were relevant to the course subject matter? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	5	--	5	5
Compared to your experience in other classes, how useful were the assigned readings in this one? **Scale (1 - 5) 1 =** Not at all useful **5 =** Extremely useful **Type:** Multi-Choice, Single Answer	3.14	0.99	3	3
Were the objectives of this course clearly laid out and explained early in the course, either separately or in conjunction with review of the syllabus? **Scale (1 - 4) 1 =** The objectives were neither defined nor eventually clarified **4 =** The objectives were exceptionally well defined **Type:** Multi-Choice, Single Answer	3	0.76	3	3
With reference to the previous question, how well did the lectures and readings of this course meet the objectives defined for it? **Scale (1 - 4) 1 =** Very poorly **4 =** Extremely well **Type:** Multi-Choice, Single Answer	3	0.76	3	3
How does this course compare with other La Follette School courses in terms of difficulty? **Scale (1 - 5) 1 =** Much less difficult **5 =** Much more difficult **Type:** Multi-Choice, Single Answer	4.29	0.7	4	5,4

Questions	PUB AFFR 818 303			
Taking into account the size of this class, how willing was your professor to consult with you on an individual basis (either in the office, after class, etc)?	4.71	0.7	5	5
Scale (1 - 5) 1 = Unwilling 5 = Extremely willing				
Type: Multi-Choice, Single Answer				
Please rate the effectiveness of these contacts.	4.43	1.05	5	5
Scale (1 - 5) 1 = Of no help 5 = Extremely helpful				
Type: Multi-Choice, Single Answer				
How comfortable did you feel approaching the professor with questions or concerns?	4.43	1.05	5	5
Scale (1 - 5) 1 = Not at all comfortable 5 = Extremely comfortable				
Type: Multi-Choice, Single Answer				
How often did you experience or witness microaggressions from the instructor during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group."	1.14	0.35	1	1
Scale (1 - 5) 1 = Never 5 = Always				
Type: Multi-Choice, Single Answer				
How often did you experience or witness microaggressions from other students during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group."	1.29	0.7	1	1
Scale (1 - 5) 1 = Never 5 = Always				
Type: Multi-Choice, Single Answer				

Questions	PUB AFFR 818 303			
Do you feel grading or other evaluation you have received to date (whether harder or easier than expected) was fair in the sense of being careful, thoughtful, and neither arbitrary nor capricious? **Scale (1 - 5) 1 =** It was unfair **5 =** Yes, it was exceptionally fair **Type:** Multi-Choice, Single Answer	4.29	0.88	5	5
How often did this course cause you to challenge and think through your beliefs and assumptions? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	2.71	0.7	3	2,3
Taking into consideration the responses you have been making above, how would you rank the overall performance of this professor using the scale below: **Scale (1 - 5) 1 =** Poor **5 =** Excellent **Type:** Multi-Choice, Single Answer	4.43	1.05	5	5
What is your affiliation with the La Follette School? **Scale (1 - 5) 1 =** Enrolled in the Master of Public Affairs (MPA) or Master of International Public Affairs (MIPA) program **5 =** Other (Special student in the Division of Continuing Studies etc) **Type:** Multi-Choice, Single Answer	1	--	1	1
How often did you feel your comments and questions in this class were respected by your instructor? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	4.71	0.7	5	5
How often did you feel your comments and questions in this class were respected by other students? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	4.57	0.49	5	5

Questions	PUB AFFR 818 303			
During this course, did you ever feel expected to represent the point of view of a group/s with which you identify (e.g. your race, ethnicity, age, gender, sexual orientation, disability, religion, political ideology, socioeconomic status, country of origin, etc.)? **Scale (1 - 3) 1 =** Yes **3 =** Unsure **Type:** Multi-Choice, Single Answer	2	0.53	2	2
How often did this course encourage you to think critically about issues related to personal identity? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	2.43	0.9	2	2

Please comment on specific interactions or reasons that influenced your answers for the question above.
Type: Text/Memo

PUB AFFR 818 303

- Sakina is absolutely wonderful - very willing to talk through questions and able to do so in a way that is clear and concise and accessible to someone who hasn't taken a math course in a long, long while.
- The TA was more than willing to sit with us and walk through our questions.

Please comment on specific interactions or reasons that influenced your answer for the question above.
Type: Text/Memo

PUB AFFR 818 303

- Nothing comes to mind.

Please comment on specific interactions or reasons that influenced your answer for the question above.
Type: Text/Memo

| PUB AFFR 818 303 |
- Nothing comes to mind.

Please comment on the instructor's teaching methodology, providing specific examples of what helped you learn and ideas for changes that would contribute to your learning in the course.
Type: Text/Memo

| PUB AFFR 818 303 |
- 1. I wish lectures were recorded and provided to us 2. Review materials (ie practice exams) would have been very helpful 3. Homework was often confusing 4. Lecture slides were sometimes unclear and inconsistent
- The TA was always prepared to sit down with us, and often showed us simplified, streamlined solutions in STATA which provided the same outcome.
- Excellent TA, keep up the good work!!
- Very helpful with homework and wanted us to succeed. Overall a hard-working TA helping teach a math-heavy course to non-math people (generalization).
- Sakina has made this course more bearable. She breaks down lecture content very well and explains topics in a way that is more palatable than lecture. I would definitely not have made it through this course as well without her as the TA
- Great job- always more helpful and understandable than lecture!

Please comment on specific readings that you consider as particularly satisfactory or unsatisfactory.
Type: Text/Memo

| PUB AFFR 818 303 |
- The textbook was not very helpful.
- Nothing comes to mind.

PUB AFFR 818 301

📅 2021 Fall   **👤 MILTON, Ross (Course Section Director)**   **👤 Shibuya, Sakina (Instructor)**
Survey: Course Evaluations La Follette School

Survey	Term	Start Date	End Date	Students	Responses	Response Rate
Course Evaluations La Follette School	2021 Fall	📅 2021-12-01	📅 2021-12-16	10	5	50%

Questions		PUB AFFR 818 301			
		Avg	**StDev**	**Median**	**Mode**
Was the method of conducting this class appropriate to its size and topic? **Scale (1 - 4) 1 =** It made little difference **4 =** Completely appropriate at all times **Type:** Multi-Choice, Single Answer		3.2	1.17	4	4
About what proportion of the class sessions have you attended? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer		5	--	5	5
What proportion of those lectures or discussions which you did attend was the instructor prepared to lead class effectively? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer		4.4	0.8	5	5

Questions	PUB AFFR 818 301			
Please review the course syllabus to help answer the following four questions. What proportion of the lectures or discussions were relevant to the course subject matter? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	4.8	0.4	5	5
Compared to your experience in other classes, how useful were the assigned readings in this one? **Scale (1 - 5) 1 =** Not at all useful **5 =** Extremely useful **Type:** Multi-Choice, Single Answer	3.4	1.5	3	5,3
Were the objectives of this course clearly laid out and explained early in the course, either separately or in conjunction with review of the syllabus? **Scale (1 - 4) 1 =** The objectives were neither defined nor eventually clarified **4 =** The objectives were exceptionally well defined **Type:** Multi-Choice, Single Answer	3.2	0.75	3	4,3
With reference to the previous question, how well did the lectures and readings of this course meet the objectives defined for it? **Scale (1 - 4) 1 =** Very poorly **4 =** Extremely well **Type:** Multi-Choice, Single Answer	3	0.89	3	2,4
How does this course compare with other La Follette School courses in terms of difficulty? **Scale (1 - 5) 1 =** Much less difficult **5 =** Much more difficult **Type:** Multi-Choice, Single Answer	4.2	0.4	4	4
Taking into account the size of this class, how willing was your professor to consult with you on an individual basis (either in the office, after class, etc)? **Scale (1 - 5) 1 =** Unwilling **5 =** Extremely willing **Type:** Multi-Choice, Single Answer	4.8	0.4	5	5

Questions	PUB AFFR 818 301			
Please rate the effectiveness of these contacts. **Scale (1 - 5) 1 =** Of no help **5 =** Extremely helpful **Type:** Multi-Choice, Single Answer	4.2	*0.98*	**5**	**5**
How comfortable did you feel approaching the professor with questions or concerns? **Scale (1 - 5) 1 =** Not at all comfortable **5 =** Extremely comfortable **Type:** Multi-Choice, Single Answer	4.4	*0.8*	**5**	**5**
How often did you experience or witness microaggressions from the instructor during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group." **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	1	*--*	**1**	**1**
How often did you experience or witness microaggressions from other students during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group." **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	1.2	*0.4*	**1**	**1**
Do you feel grading or other evaluation you have received to date (whether harder or easier than expected) was fair in the sense of being careful, thoughtful, and neither arbitrary nor capricious? **Scale (1 - 5) 1 =** It was unfair **5 =** Yes, it was exceptionally fair **Type:** Multi-Choice, Single Answer	4.2	*0.98*	**5**	**5**
How often did this course cause you to challenge and think through your beliefs and assumptions? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	2.6	*1.36*	**2**	**2**

Questions	PUB AFFR 818 301			
Taking into consideration the responses you have been making above, how would you rank the overall performance of this professor using the scale below: **Scale (1 - 5) 1 =** Poor **5 =** Excellent **Type:** Multi-Choice, Single Answer	**4.4**	*0.8*	**5**	**5**
What is your affiliation with the La Follette School? **Scale (1 - 5) 1 =** Enrolled in the Master of Public Affairs (MPA) or Master of International Public Affairs (MIPA) program **5 =** Other (Special student in the Division of Continuing Studies etc) **Type:** Multi-Choice, Single Answer	**1**	--	**1**	**1**
How often did you feel your comments and questions in this class were respected by your instructor? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**5**	--	**5**	**5**
How often did you feel your comments and questions in this class were respected by other students? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**4.6**	*0.8*	**5**	**5**
During this course, did you ever feel expected to represent the point of view of a group/s with which you identify (e.g. your race, ethnicity, age, gender, sexual orientation, disability, religion, political ideology, socioeconomic status, country of origin, etc.)? **Scale (1 - 3) 1 =** Yes **3 =** Unsure **Type:** Multi-Choice, Single Answer	**2.2**	*0.4*	**2**	**2**
How often did this course encourage you to think critically about issues related to personal identity? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**1.8**	*1.17*	**1**	**1**

Please comment on specific interactions or reasons that influenced your answers for the question above.

Type: Text/Memo

PUB AFFR 818 301

- Sakina worked tirelessly on making sure we were in the loop on any changes. She expanded and changed her office hours constantly to work with students. I found Sakina to be more accommodating than most TAs at UW-Madison.
- Sakina is incredibly approachable, respectful, kind and great at answering questions in a way that does not feel patronizing or unhelpful.
- Willing to change office hours to help

Please comment on specific interactions or reasons that influenced your answer for the question above.

Type: Text/Memo

PUB AFFR 818 301

- Didn't see anything

Please comment on specific interactions or reasons that influenced your answer for the question above.

Type: Text/Memo

PUB AFFR 818 301

- There was a specific student who seemed to target the teaching assistant by telling her about grammatical errors on her slides or how she was pronouncing certain words.

Please comment on the instructor's teaching methodology, providing specific examples of what helped you learn and ideas for changes that would contribute to your learning in the course.

Type: Text/Memo

- Sakina was very helpful at reviewing the concepts in class and always was willing to stay later to explain things as well as extend office hours.
- For me, Sakina sitting down and going over certain ideas repeatedly was essential. She reviewed the same concepts over and over again until I understood them. I still never totally understood what was happening in this class - my lack of previous stats course work showed throughout, but Sakina tried her hardest to help me.
- Sakina did a great job at working through examples/problems that situated a lot of the content from lecture in more approachable contexts. Sakina uses language that makes a lot of statistics content more approachable and graspable. I can't imagine doing as well as I had in this course without the discussion section and office hours.
- It was helpful to go through problems together as a group.
- I wish that as we went into a new topic Professor Milton had outlined more specifically the types of problems he would want us to do and the relevant equations. While all this information was available, putting together what we needed to do for assessment or what a question on the homework was actually asking us to do mathematically involved piecing together materials from lecture and discussion section. I would have liked to spend less time figuring out what I should be doing and more time doing it.

Please comment on specific readings that you consider as particularly satisfactory or unsatisfactory.
**Type:** Text/Memo

- Nice job!

PUB AFFR 818 302

Survey	Term	Start Date	End Date	Students	Responses	Response Rate
Course Evaluations La Follette School	2021 Fall	📅 2021-12-01	📅 2021-12-16	21	16	76%

Questions		PUB AFFR 818 302			
	Avg	*StDev*	*Median*	*Mode*
Was the method of conducting this class appropriate to its size and topic? **Scale (1 - 4) 1 =** It made little difference **4 =** Completely appropriate at all times **Type:** Multi-Choice, Single Answer	**3.75**	*0.43*	**4**	**4**
About what proportion of the class sessions have you attended? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	**5**	--	**5**	**5**
What proportion of those lectures or discussions which you did attend was the instructor prepared to lead class effectively? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	**4.88**	*0.33*	**5**	**5**

Questions	PUB AFFR 818 302			
Please review the course syllabus to help answer the following four questions. What proportion of the lectures or discussions were relevant to the course subject matter? **Scale (1 - 5) 1 =** Almost none (10%) **5 =** Almost all (90%) **Type:** Multi-Choice, Single Answer	**4.94**	*0.24*	**5**	**5**
Compared to your experience in other classes, how useful were the assigned readings in this one? **Scale (1 - 5) 1 =** Not at all useful **5 =** Extremely useful **Type:** Multi-Choice, Single Answer	**3.73**	*0.93*	**4**	**3**
Were the objectives of this course clearly laid out and explained early in the course, either separately or in conjunction with review of the syllabus? **Scale (1 - 4) 1 =** The objectives were neither defined nor eventually clarified **4 =** The objectives were exceptionally well defined **Type:** Multi-Choice, Single Answer	**3.63**	*0.48*	**4**	**4**
With reference to the previous question, how well did the lectures and readings of this course meet the objectives defined for it? **Scale (1 - 4) 1 =** Very poorly **4 =** Extremely well **Type:** Multi-Choice, Single Answer	**3.44**	*0.5*	**3**	**3**
How does this course compare with other La Follette School courses in terms of difficulty? **Scale (1 - 5) 1 =** Much less difficult **5 =** Much more difficult **Type:** Multi-Choice, Single Answer	**4.13**	*0.7*	**4**	**4**
Taking into account the size of this class, how willing was your professor to consult with you on an individual basis (either in the office, after class, etc)? **Scale (1 - 5) 1 =** Unwilling **5 =** Extremely willing **Type:** Multi-Choice, Single Answer	**4.93**	*0.25*	**5**	**5**

Questions			PUB AFFR 818 302	
Please rate the effectiveness of these contacts. **Scale (1 - 5) 1 =** Of no help **5 =** Extremely helpful **Type:** Multi-Choice, Single Answer	4.53	*1.02*	5	5
How comfortable did you feel approaching the professor with questions or concerns? **Scale (1 - 5) 1 =** Not at all comfortable **5 =** Extremely comfortable **Type:** Multi-Choice, Single Answer	4.6	*0.71*	5	5
How often did you experience or witness microaggressions from the instructor during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group." **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	1	--	1	1
How often did you experience or witness microaggressions from other students during this course? Microaggressions are defined as, "a statement, action, or incident regarded as an instance of indirect, subtle, or unintentional discrimination against members of a marginalized group." **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	1.25	*0.75*	1	1
Do you feel grading or other evaluation you have received to date (whether harder or easier than expected) was fair in the sense of being careful, thoughtful, and neither arbitrary nor capricious? **Scale (1 - 5) 1 =** It was unfair **5 =** Yes, it was exceptionally fair **Type:** Multi-Choice, Single Answer	4.69	*0.46*	5	5
How often did this course cause you to challenge and think through your beliefs and assumptions? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	2.25	*1.09*	2	3

Questions	PUB AFFR 818 302			
Taking into consideration the responses you have been making above, how would you rank the overall performance of this professor using the scale below: **Scale (1 - 5) 1 =** Poor **5 =** Excellent **Type:** Multi-Choice, Single Answer	**4.38**	*0.7*	**4.5**	**5**
What is your affiliation with the La Follette School? **Scale (1 - 5) 1 =** Enrolled in the Master of Public Affairs (MPA) or Master of International Public Affairs (MIPA) program **5 =** Other (Special student in the Division of Continuing Studies etc) **Type:** Multi-Choice, Single Answer	**1**	*--*	**1**	**1**
How often did you feel your comments and questions in this class were respected by your instructor? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**4.88**	*0.33*	**5**	**5**
How often did you feel your comments and questions in this class were respected by other students? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**4.44**	*0.86*	**5**	**5**
During this course, did you ever feel expected to represent the point of view of a group/s with which you identify (e.g. your race, ethnicity, age, gender, sexual orientation, disability, religion, political ideology, socioeconomic status, country of origin, etc.)? **Scale (1 - 3) 1 =** Yes **3 =** Unsure **Type:** Multi-Choice, Single Answer	**1.88**	*0.33*	**2**	**2**
How often did this course encourage you to think critically about issues related to personal identity? **Scale (1 - 5) 1 =** Never **5 =** Always **Type:** Multi-Choice, Single Answer	**1.63**	*0.93*	**1**	**1**

Please comment on specific interactions or reasons that influenced your answers for the question above.

Type: Text/Memo

PUB AFFR 818 302

- pass
- I was somewhat comfortable
- Sakina always laid out the previous two lectures a little more clearly and concisely in her weekly discussion, and her office hours are always very helpful.
- Sakina is so wonderful to learn from. She does a brilliant job making Prof. Milton's assignments understandable. I had no issues whatsoever asking Sakina either to re-explain the concept, or to ask for additional help either after class or for a different time to chat. Moreover, Sakina was friendly, polite, and professional in a way that engendered great confidence in her TA ability. It was obvious that she cared for each of us, and for each of our success.
- When I came to office hours it was difficult to get one-on-one help, because there were always multiple students there asking for help at once. Oftentimes, office hours were conducted more like a class, where a lecture was given, rather than an opportunity to have a one-on-one conversation with the TA.
- Office hours and this discussion session were the reason I stayed afloat during this course. They were extremely helpful!
- No complaints, the instructor went above and beyond to make herself available for questions outside of class, even staying a bit later during office hours.
- Very helpful and I appreciated your approach to this class.
- I can honestly say that Sakina is major reason why I'm doing reasonably well in Stats. Sakina has done a really good job of taking the lecture PowerPoints and turning them into something more digestible and understandable on a basic level. She is well prepared for her discussion sections, and has been super helpful in office hours!
- Sakina was always there to help even if it was the most basic question.
- I didn't reach out often, but both the professor and the TA were both extremely willing to communicate about the happenings in the class and be helpful around those interactions.

Please comment on specific interactions or reasons that influenced your answer for the question above.

Type: Text/Memo

- no
- N/A
- N/A
- None that stand out!
- Sakina was extremely self-aware, and really understood how to curb mansplaining, elevate women's voices, and help individuals talk through concepts that they may even have trouble articulating themselves. The best TA I had this semester, Sakina was always cheery, always approachable, and knew how to interact with each of us to validate our views and abilities.
- n/a
- I didn't notice anything that could be called a microagression.
- The TA was very nice and respectful to all.

Please comment on specific interactions or reasons that influenced your answer for the question above.
Type: Text/Memo

- no
- N/A
- n/a
- None that stand out!
- I say never, because I didn't notice anything. However, if there was an instance, it just means I missed it.
- There is a certain group of males who talk down to women, and who make going to the Sewell grad room an uncomfortable experience. I do not want to be around those men, who "know everything." While Sakina had nothing to do with that, I often felt that discussions were the only time where we could see a graduate student woman of color respond to those males in a confident, assertive, manner.
- N/A

Please comment on the instructor's teaching methodology, providing specific examples of what helped you learn and ideas for changes that would contribute to your learning in the course.
Type: Text/Memo

PUB AFFR 818 302

- Sakina provides a helpful summation of the information we learned in lecture and she is always willing to explain concepts in different ways in order to accommodate different styles of learning.
- I thought Sakina was great and did a very good job of leading discussion. My only comment is to not make the slides so late in the evening
- I truly believe that without the help of the TA I would have struggled much more than I already did in this class. Every discussion was incredibly useful in clearing up questions and helping give us the tools to answer homework questions which I felt were not addressed during lecture.
- Her discussion session were very helpful to make the material from the week easier to understand. Some mistakes were made in formulas that caused confusion, but she always corrected her mistakes and gave a clear explanation, many times with pages written out, saying what the write formula was
- Sakina was a great TA. I learned more in discussion than in lecture. I believe it would not have been possible to do the HW if it were not for the discussion section where the fundamental topics and concepts were discussed.
- Sakina was an amazing TA who I feel really went above and beyond for our success. Her office hours were extremely helpful, and her discussion sections and slides were really really key to me understanding the material presented in lecture. Often, I felt like I would enter discussion section not understanding what was happening in the class at all and leave feeling much more confident. Thank you Sakina!
- Sakina has been a really great TA this semester! Again, her PowerPoint slides have been super helpful to reference for homework and for studying purposes. She's very approachable for questions, and I think as the semester went on her office hours became more and more popular to the point where we had to move locations to accommodate the number of people. There were a few times though where she explained things incorrectly which lead to a large confusion on a topic, but when that happened she was really good at sending out an email to correct herself and better explain the topic. All in all, Sakina was a great TA and I'm bummed to learn she won't be the PA 819 TA next semester...but excited about whats next for her and her PhD!
- The discussion went really fast. This wasn't the TAs fault.... the class is just incredibly fast-paced.
- The teaching methodology was great. I felt it was very organized and methodic, which helped me understand how to complete the homework and study for the exams that were taken in class. The ability to translate what was said in lecture to someone like me who didn't fully understand was extremely helpful. Going through the specific homework questions during office hours, was really helpful for me to understand and solidify what we learned in the larger lecture. The one thing I was worried about is how late some of the materials were created. Were they getting any rest?!
- The examples from discusison were particularly helpful in clarifying the concepts discussed in lecture and the homeworks. Office hours were similarly useful and I felt that she went above and beyond to make herself accessible to students.
- Sakina was an amazing teaching assistant. She consistently presented helpful and clear lessons and went above and beyond to answer questions and help with any confusion.
- The professor was incredibly knowledgeable about everything we discussed. However, I think that maybe the biggest weakness of the lectures was that they didn't do enough reminding/summarizing past content in order to understand new content. I think that there were times where it was assumed that we understood previous content, but many people in the room were not comfortable with the underlying assumptions/background that it was really hard to grasp the new content. I have a little bit of statistical background, so I could usually keep up with some of the topics. But I could see times where the exercises used to explain a concept were not sticking with myself and other students because we didn't easily grasp the previous assumptions well enough. I know that you can't account for everyone not keeping up, but I think a little more time summarizing the key concepts in simple terms before diving into new content would go a long way. Especially because many students don't have quantitative backgrounds. Maybe it would also be beneficial for the homeworks to include a very simplistic set of questions at the beginning to have people calculate simple outputs before diving into questions that require both computation and application?

- Sakina's slides and handwriting, were superior to Prof. Milton's. Sakina did not scribble like Prof. Milton, or overload the slides with math that was unnecessary. Instead she used color-coded handwritten slides, and slides that had the math worked out for us to go back and review. This was extremely helpful. She always repeated that her slides would be posted onto Canvas in very short order, which they always were. I was extremely happy with the presentation of slides, in the time-limited Thursday discussion group.

Please comment on specific readings that you consider as particularly satisfactory or unsatisfactory.

Type: Text/Memo

PUB AFFR 818 302

- N/A
- I really like the textbook, and I really appreciated the real-world examples used throughout the course. I think a strength was how the course tied the core content to understandable real world examples.
- n/a
- The textbook was useful in helping me understand concepts covered in lecture and discussion.
- No readings assigned!
- I will say, that Sakina even recorded her discussion during Fall break, extremely kind to do so. Also, Sakina kept us far more updated on Canvas about issues related to the discussion, the homework, and clarifications, that Prof. Milton rarely did.
- discussion slides were extremely clear and helpful, I used these more than the slides from lecture
- The book at times was helpful. Other than that, any articles provided was just a nice supplement.

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