Country of Women? Repercussions of the Triple Alliance War in Paraguay*

Jennifer Alix-Garcia
Oregon State University

Laura Schechter
UW Madison

Felipe Valencia Caicedo
University of British Columbia

S. Jessica Zhu
Precision Agriculture for Development

April 5, 2021

Abstract

Skewed sex ratios often result from episodes of conflict, disease, and migration. Their persistent impacts over a century later, and especially in less-developed regions, remain less understood. The War of the Triple Alliance (1864–1870) in South America killed up to 70% of the Paraguayan male population. According to Paraguayan national lore, the skewed sex ratios resulting from the conflict are the cause of present-day low marriage rates and high rates of out-of-wedlock births. We collate historical and modern data to test this conventional wisdom in the short, medium, and long run. We examine both cross-border and within-country variation in child-rearing, education, labor force participation, and gender norms in Paraguay over a 150 year period. We find that more skewed post-war sex ratios are associated with higher out-of-wedlock births, more female-headed households, better female educational outcomes, higher female labor force participation, and more gender-equal gender norms. The impacts of the war persist into the present, and are seemingly unaffected by variation in economic openness or ties to indigenous culture.

Keywords: Conflict, Gender, Illegitimacy, Female Labor Force Participation, Education, History, Persistence, Paraguay, Latin America
JEL Classification: D74, I25, J16, J21, N16

*First draft May 20, 2020. We gratefully acknowledge UW Madison's Graduate School Research Committee for financial support. We thank Daniel Keniston for early conversations about this project. We thank Siwan Anderson, Toman Barsbai, Anke Becker, Sascha Becker, Alberto Diaz-Cayeros, Jean Paul Carvalho, Fabian Drixler, Raul Duarte, Jeremy Foltz, Paula Gobbi, Pauline Grosjean, Remi Jedwab, Eduardo Montero, Bernardo Mueller, Maria Muniagurria, Emily Oster, Eleonoara Patacchini, Thorsten Rogall, Emily Sellars, Jeff Smith, Francisco Beltrán Tapia, Emilia Tjernström, Ana Tur-Prats, Diana Van Patten, Sarah Walker, Lingwei Wu, and seminar participants at ASREC, EHA, Bonn, Oslo, Melbourne, Luxembourg, La Paz, GWU, OSU, UW Madison, for comments. We thank the Latin American Public Opinion Project (LAPOP) and its supporters (USAID, IDB, and Vanderbilt University) for making some of the data available.

1 Introduction

Across the world, biased sex ratios emerge as a result of war, migration, and household choices. Men outnumber women in China and India due to a preference for sons, and in Europe as a result of the refugee crisis. Women outnumber men in parts of the Middle East due to the refugee exodus and in Mexico because of northward migration flows. Distorted sex ratios will likely continue as a result of sustained civil conflicts and general migration trends, hence it is important to investigate the short and long-run impacts of these imbalances. History provides a window through which we can understand the potential effects of current situations, as well as illuminate the causes behind existing variation in women's status across countries (Giuliano 2018).

We examine one of the largest sex ratio shocks in history, the War of the Triple Alliance (1864–1870). During the course of this war, Paraguay fought and lost against an alliance composed of Brazil, Argentina, and Uruguay. The conflict was estimated to have killed 60% of Paraguay's total population (Whigham & Potthast 1999). Some historians posit that up to 90% of Paraguay's male population died as a result, greatly skewing the sex ratio towards women. While there have been extensive qualitative discussions around both the causes and effects of this disaster, there has not been a systematic quantitative assessment of the war's legacy. We examine the impacts of these conflict-driven skewed sex ratios over a period of 150 years. We begin by documenting the extent of sex ratio skewness caused by the conflict. We then look at the immediate effects of these distorted ratios on out-of-wedlock births, education, and labor force participation. Next we explore the footprint of this dynamic today on the same outcomes as well as on gender norms. Finally, we study factors that may have broken the persistence trend (as in Giuliano & Nunn (2017) and Voigtländer & Voth (2012)).

We bring together a combination historical and modern data to shed light on these questions. We first construct a dataset of out-of-wedlock births using historical church records. We also digitize Paraguayan censuses from the late 19th century. To evaluate long-term impacts we employ microdata extracts from the Integrated Public Use Microdata Series, International (IPUMS). And, to study modern gender norms we employ the Latin American Public Opinion Project (LAPOP) AmericasBarometer surveys.

We apply two identification strategies. First, we compare outcomes of interest in Paraguay to outcomes in bordering regions of Argentina and Brazil. Second, we construct digitized maps of the conflict and calculate distance to battles and marches. We examine variation in outcomes within Paraguay in response to this measure of conflict intensity, which serves to approximate the post-war level of skewness in the sex ratio, as we show empirically.

We find that in the short run, the sex ratios among cohorts born in Paraguay before the war–and thus affected by the conflict–were high, i.e., around four women per man. As a consequence, post-war Paraguay had higher out-of-wedlock birth rates than areas across the border in Argentina and Brazil. Moreover, within Paraguay, a greater proximity to conflicts was associated with more skewed sex ratios, higher school attendance for girls, female teacher ratios, and greater shares of out-of-wedlock births.

While sex ratios returned relatively quickly to around unity, as we document, outcomes in more war-affected areas continue to differ over a century later. Compared to bordering areas in Argentina and Brazil, Paraguay has more female-headed households and more unmarried women living with a child. Within Paraguay, closeness to historical Triple Alliance War locations is associated with more female-headed households, more unmarried women living with a child, more women with primary education, and more women in the labor force. These impacts are consistent with the lore in Paraguay and the qualitative literature.[1] The scarcity of potential husbands changed women's marriage market outcomes and altered women's educational achievements.

Lastly, we attempt to uncover the mechanism and heterogeneity behind this persistence. Evidence supports gender norms as the conduit of persistence. Paraguayans residing closer to a historical march line are more likely to believe that women are not less deserving of jobs compared to men. We examine heterogeneous impacts across proxies for openness (foreign immigration) and indigenous cultural traditions (a dominance of the Guaraní language). This last source of heterogeneity is of particular interest, since historical demographers have argued that Paraguayan gender norms were distinct before the war and the effect of the war is overstated (Potthast-Jutkeit 1991). They assert that women's sexual freedom, high rates of labor force participation in agriculture, and low propensity to marry all stem from Guaraní traditions in the pre-colonial period. We find no evidence that openness or indigenous culture affect the persistence of outcomes, while cultural norms appear stronger.

1.1 Related literature

The contributions of this paper to the literature are twofold. First, while the causes and immediate effects of the War of the Triple Alliance have received substantial attention in the historical literature (Bethell 1996, Ganson 1990, Potthast 2005, Potthast-Jutkeit 1991, 1996), there are almost no examinations of its long run impact. A notable exception is Boggiano (2019) who finds that the Triple Alliance War increased intimate partner violence today.[2] In turn, we examine the impact on female-headed households, out-of-wedlock births, female labor force participation, and female educational outcomes in the short, medium and long run.

To summarize, our work differs from these other papers in three dimensions: the magnitude of the female-biased sex ratios, the time passed since the historical event, and the fact that it occurred in a developing country. In Paraguay in the immediate aftermath of the war, the sex ratio (men per woman) was around 0.3. This is almost four women for every man and implies that more than half of the women would not be able to find a spouse. The female-skewed sex ratios studied post-WWI

[1] This lore is strong – *The Economist* posits that the paternity scandal which complicated Paraguayan President Lugo's presidency in 2009 can be traced back to the Triple Alliance War (Economist 2012). Similarly, *The Guardian* states as fact that "one of the war's most lasting legacies is its contribution to the extremely strong machismo and gender violence seen in modern Paraguay." (The Guardian 2020)

[2] Some important differences between our paper and Boggiano (2019) are: 1) She uses distance to military camps as her measure of exposure to war while we use distance to march lines and battle points, 2) she finds that the effect is not due to skewed sex ratios (relative male scarcity) but instead due to loss of male life more generally (absolute male scarcity), 3) her analysis focuses within Paraguay, while we conduct both within-Paraguay and cross-border analyses.

and post-WWII are 0.7 and 0.9, respectively. Indeed, (Pinker 2011) classifies the Triple Alliance war as proportionately the most destructive anywhere in modern times. One can imagine a much larger or non-linear effect on gender norms when the majority of women cannot find a spouse compared to when the majority of women can.

The rest of the paper is organized as follows. Section 3 provides the historical background on the Triple Alliance War. Section 4 describes the data and Section 5 presents the empirical strategies. The empirical result are divided into short and medium-term impacts in Section 6 and long-term impacts in Section 7, which also contains the mechanisms. Section 8 concludes.

2 The Triple Alliance War and its aftermath

The Paraguayan War, which pitted Paraguay against Brazil, Argentina, and Uruguay, lasted from 1864 to 1870 and is considered the bloodiest inter-state war in Latin America (Bethell 1996). Estimates of the death toll in Paraguay vary from 8.7% (Reber 1988) to 87% (Washburn 1871), with a consensus figure of nearly 70% (Whigham & Potthast 1999). Even more important is the relative decimation of the Paraguayan male population, leading to extremely skewed sex ratios, which motivates the title of the paper. We document ratios of up to seven females per male. Overall, historians of Latin America agree that the conflict was the most damaging of any in the history of the region.

The conflict emerged from a perfect storm of clashing economic interests, evolving power structures, and serious misjudgment. The initial Paraguayan assault on Uruguay began as a result of Brazil's invasion of Uruguay under the pretext of protecting Brazilian settlements. The initial spark was an internal political strife between the Blanco and Colorado parties in Uruguay. Paraguay, threatened by a perceived hesitance on the part of Argentina to recognize its sovereignty and Brazil's growing economic power in the region, declared war on Brazil. When Argentina refused permission to Paraguay to cross through its territory in order to invade Uruguay, Paraguay also declared war on Argentina. Within a year, after a change of government in Uruguay to the political party aligned with Brazilian and Argentinean influence, all three neighbors had united into a Triple Alliance against Paraguay (Bethell 1996). Seemingly through sheer force of will, Solano López repeatedly led his troops into battles where they were outnumbered but managed to succeed. These successes significantly protracted the conflict, which ended only with López's death at the hands of Brazilian troops in 1870. He famously exclaimed, "I die with my country."

Though there is some debate on the nature of Solano López's motivations for entering the war, there is widespread consensus regarding its results: it lead to massive population loss and generated a substantial sex imbalance. A postwar census conducted by the victor armies found 221,079 people remaining: 106,254 women, 86,079 children, and 28,746 men (Potthast-Jutkeit 1991). Washburn (1871) puts the sex ratio at seven women for every man, Potthast (2005) puts it at four to one, and Ganson (1990) at three to one. Even a ratio of three women for every man is unprecedented.[3] This

[3]Grosjean & Khattar (2019) and Aguilar-Gomez & Benshaul-Tolonen (2018) cite ratios of one woman for every

imbalance, while severe, did not endure. The 1886 census reported a female to male ratio of 1.39 to one, and the 1899 census one of 1.16 to one (Carrasco 1905).

While the war itself took place in Paraguay, Argentina, and Brazil, the effect of the conflict on sex ratios in Argentina and Brazil was comparatively small. Even in the neighboring Corrientes Province of Argentina, where some large early battles took place, the Argentine sex ratio after the war was closer to one and a half women for every man relative to Paraguay's ratio of well over three. This is both because Paraguay's population was smaller than that of the allied countries and so a higher share of the population was involved in fighting, and because most of the allied troops did not come from the areas bordering Paraguay. Though greater in absolute numbers, the Argentinean and Brazilian troops were a much smaller share of their countries' population. The Brazilian soldiers (many of whom were freed slaves) tended to be brought from all across the nation to the remote and sparsely inhabited border locations (Bethell 1996, Whigham 2002). This is in contrast to the Paraguayan troops, who formed a much larger share of the population and came from all over the country (Bethell 1996). Capdevila (2010) describes the process of mass conscription for those 17-40 and how by the end of the war younger children from 13 onwards were also recruited.[4] This combination of factors suggests that comparisons across these borders could help to isolate the effects of skewed sex ratios from the effect of conflict more generally.

Historians believe that the war had a significant impact on the ways in which Paraguayan women engaged with society. Potthast (2005) describes the elevated level of freedom that many women enjoyed during the war. They created businesses and engaged in types of production that had been traditionally left to men, such as livestock husbandry, production of military uniforms, and nursing (Ganson 1990). After the war, more women gained access to higher education and thereafter became school teachers. Potthast-Jutkeit (1996) and Potthast (2005) argue that after the war it was believed that women needed to be well-educated since they were the ones who would be educating the citizens of the future and so elementary school enrolment for girls increased. She posits that the current high percentage of women in Paraguayan universities is "the conflict's only significant and lasting positive consequence for women."[5]

3 Data description

3.1 Demographic and norm-based measures

3.1.1 Historical data

We use baptismal records to measure out-of-wedlock childbearing. Because baptism was nearly universal in Latin America during this period, there should be no selection into baptism. For example, the text of the Anuario Estadístico de la República del Paraguay (1886) (Statistical

three or twelve men in Australia and the US West respectively, but it is more difficult to find examples of such severely female skewed imbalances, especially at the national level.

[4]Baratta (2019) also describes this harsh reality in the infamous battle of Acosta Ñu.

[5]Paradoxically, Ganson (1990) observes that there were no improvements in political equality for women due to the war.

Yearbook of the Paraguayan Republic) which describes the 1886 census uses the number of baptisms as their source for the number of births, claiming this data is the most reliable. Similarly, the 1914 Argentinean census also uses baptisms as the most reliable source of retrospective data on births. It is important to note that even out-of-wedlock children were baptized.

Church records on baptisms in the 1800s and early 1900s across South America have been digitized and are accessible on the Internet.[6] The baptismal records contain information on the date and place of baptism. In some cases, the records also include the date of birth, and in all cases the name of the mother. They then contain either the name of the father or the phrase *hijo natural*, which means that the child was born out of wedlock. These church records allow us to construct the percentage of out-of-wedlock births both before and after the conflict.

We obtained all baptism records for Paraguay, Brazil, and Argentina that were uploaded and indexed on the Internet as of 2016. For the econometric analysis, we restrict our sample to the eastern side of Paraguay (excluding Asunción and the Paraguayan Chaco, a long-disputed territory) and locations in Argentina and Brazil that are "comparable" to Paraguay. In Section 4, we discuss in more detail which years and areas of data are used in the empirical analysis.

We also exploit various censuses in our historical analysis. For Paraguay, we have census data at the municipal level from 1864 (Williams 1976), 1873 (Reber 1988), and 1886. We use this data to create population counts and education and employment outcomes. For Argentina, we employ 1895 census data to calculate population sex ratios.

3.1.2 Modern data

We extracted microdata for modern censuses through the Integrated Public Use Microdata Series, International (IPUMS). These include: Paraguay: 1972, 1982, 1992, 2002; Argentina: 1970, 1980, 1991, 2001; and Brazil: 1980, 1991, 2000 (Minnesota Population Center 2018).[7] These datasets provide us the modern outcome variables for studying the long-term impact of the war such as marriage and fertility patterns, educational attainment, and labor force participation.

3.2 Measures of conflict

To examine spatial variation in the intensity of conflict, we digitized information on the location of battles as well as the starting and ending points of marches described by Jaeggli & Bordon (2010). We geo-located the points at the centroids of modern municipalities.

Figure **??** shows the spatial distribution of battles and marches using these data. Asterisks represent battles and lines represent marches. Many, but not all, of these marches ended or began with battles. Municipalities are shaded according to the first year that a municipality had a battle within it. The conflict began outside of the boundaries of Paraguay (instigated by Paraguayans

[6] Records are available at ancestry.com. "Digitized" means that there is a photo of the record, and "indexed" means that the record has been typed up.

[7] The Brazilian data from 1970 does not include information on municipality so we can't categorize observations as being within 100km of the border.

marching into Brazil and Argentina), passed through the more populous central regions of Paraguay, and ended in the north of Paraguay. In our empirical work, we use distance to the nearest battle point, as well as distance to the nearest march line, as measures of the intensity of the war.[8] March lines are of particular importance, since soldiers were often enlisted along the way, as troops marched from one region to another (Warren 1978).

4 Empirical strategies

To investigate the impact of skewed sex ratios on outcomes of interest, we exploit two sources of variation. First, we use a cross-border discontinuity between Paraguay and neighboring municipalities in Argentina and Brazil. Second, we examine the variation within Paraguay in response to the intensity of the conflict. We use both of these strategies to examine immediate, medium-term, and long-term impacts of the conflict.

The cross-border and within-Paraguay analyses have different advantages and disadvantages. The benefit of the cross-border analysis is that it studies the impact of an extremely large difference in sex ratios. As we will show later, while the sex ratio in Paraguay just after the war was 3.5 women for every man, the same ratio in bordering areas of Argentina was 1.25 women for every man. The disadvantage is that many institutions change when crossing an international border, and so this analysis is subject to the usual caveats about cross-country analyses. We address this critique by limiting our non-Paraguayan observations to those within 100 km of the border. These bordering municipalities tend to share many cultural features with Paraguayan society, since they historically housed significant numbers of Guaraní, the dominant ethnicity in Paraguay. Crucially, they were disputed territories, that were definitely lost by Paraguay after the war. The benefit of the within-Paraguay analysis is that language, government, and other institutions are held constant within Paraguay, though we sacrifice some external validity with such analysis.

For all analyses, we drop Asunción (the capital of Paraguay) due to its special characteristics.[9] Furthermore, we remove the Paraguayan Chaco (constituted by three departments: Presidente Hayes, Alto Paraguay, and Boquerón - west of the Paraguay River) both because it was a disputed territory until the 1930s and because it is, and always was, a very sparsely populated inhospitable semi-arid region. Symmetrically, we exclude the Argentinean Chaco region, constituted by the Provinces of Chaco, Formosa, and Santa Fe west of the Paraguay River (which becomes the Paraná River further south).

Our first strategy for estimating the impact of the conflict is to select municipalities from Argentina and Brazil that have some land within 100 km of the Paraguayan border.[10] The selection includes municipalities from the provinces of Corrientes and Misiones in Argentina, and the states

[8] Distance to US Civil War march lines have also been used to estimate the impact of that war (Feigenbaum et al. 2018).

[9] The Argentinean and Brazilian capitals are too far from the border with Paraguay to be included in our sample.

[10] The precise name for what we call "municipality" is "district" in Paraguay, "department" in Argentina, and "municipality" in Brazil.

of Mato Grosso do Sul, Rio Grande do Sul, Paraná and Santa Catarina in Brazil.[11] While the war did pass through Corrientes, and it experienced some impacts from the war, as was described above, the sex ratio in this department was much less affected than neighboring areas in Paraguay. We call this the 'broad sample.'

For measuring the long-term impacts, we additionally show results with a more restricted sample which excludes areas which were contested before the war and officially became part of Argentina (Misiones) and Brazil (Mato Grosso do Sul) after the war. This restricted sample limits the comparison municipalities to the municipalities in Corrientes, Paraná, Santa Catarina, and Rio Grande do Sul that are within 100 km of the Paraguayan border.

4.1 Estimating equations

We use two main estimating equations for our cross-border analysis. For the short- and medium-run analysis, the outcome y is equal to one if the baptism is identified as out-of-wedlock for individual i, baptized in year t, in municipality m. Controls include a Paraguay dummy, P, and baptism year bin dummies B representing being baptized in 1864–1870, 1871–1880, 1881–1890, and 1891–1900 with the excluded category being a baptism before the war (1840-1861). Our preferred specification includes municipality fixed effects (δ_m):

$$y_{imt} = \alpha + \sum_t \gamma_t B_{it} + \sum_t \theta_t P_m B_{it} + \delta_m + \epsilon_{imt}. \tag{1}$$

To address spatial correlation in this regression, and in all the others discussed in this paper, we calculate two types of standard errors. We show robust standard errors clustered at the municipal level, and standard errors adjusted with spatial weights (Conley 1999) using a cutoff of 30 kilometers.[12]

All of our estimation strategies are variants on a differences-in-differences approach. Unfortunately we can not test for parallel pre-trends due to lack of data before the war. Because of this, our regressions either include municipality fixed effects or a relatively large set of controls for geographic characteristics and pre-existing conditions.

For the long-run cross-border analysis we use census data from Paraguay, Argentina, and Brazil for the 1970s, 80s, 90s, and 2000s. This leap in time from studying the medium-run effects in 1900 is due to data availability. We estimate the following linear model,

$$y_{ict} = \alpha + \beta P_c + \gamma F_{ict} + \theta P_c F_{ict} + \mathbf{X}_{ict}\rho + \nu_t + \epsilon_{it}, \tag{2}$$

where y_{ict} is the outcome for individual i in country c in time period t, F is female, and $\mathbf{X}$ are control variables. Regressions use IPUMS sampling weights. Notice that we are looking at the differential effect of the war on females compared to men. Focusing on differences across sex helps isolate the effect of skewed sex ratios from the effect of the conflict more generally. Control variables

[11] We only have information from municipalities in Corrientes province in Argentina for studying short-term impacts.
[12] We implement the spatial standard errors in Stata using acreg (Colella et al. 2019).

include age of the respondent, a binary indicator for residing in a rural area, municipality population density, the natural log of distance to Asunción, the natural log of the municipality area, and average maize productivity.

We show results in which we pool the years and include year fixed effects. When we look at each decade separately, we do not see any economically significant differences in the effects across the more modern decades. The effect appears to be rather constant across those thirty years, confirming that these shifts are slow moving.

Our second strategy examines variation within Paraguay. We exploit the distance to conflicts (march lines or battle points) to approximate the intensity of conflict and hence sex ratio skewness. We do not use the post-war sex ratios as our main explanatory variable (but as a key outcome) both due to the potential endogeneity of sex ratios and the fact that not all modern municipalities can be matched to historical municipality sex ratios.

In contrast, we can easily measure distances for all modern municipalities. We calculate the distance from the centroid of a municipality to the centroid of the nearest municipality within which there was a battle or through which a march passed, using the modern municipal boundaries.

We use two main estimating equations for our within-Paraguay analysis. The first analysis uses cohort data from the 1886 Paraguayan census and takes the form:

$$y_{mt} = \alpha + \gamma B_t + \theta D_m B_t + \delta_m + \epsilon_{im}. \tag{3}$$

The outcome variable, y_{mt}, is the sex ratio for each municipality m and birth cohort t, i.e., the number of women divided by the number of men. Being born before the war is represented by dummy variable B_t. Distance to either a battle or the march line is D_m, and parameterized as either a binary variable indicating distance less than 30 km (close to the median in the data), a linear distance, or a quadratic function of distance. We include municipal fixed effects, δ_m. The coefficient of interest, θ, is the coefficient on the interaction term which indicates the differential impact of proximity to the war on those born before the war. The assumption here is that in the absence of conflict, changes in sex ratios over time would have been similar across municipalities at varying distances from the conflict.

We also use data on students and teachers from the 1887 Paraguayan census to create student and teacher sex ratios at the municipal level. Here we estimate a cross-sectional version of Equation (3), without municipal or cohort fixed effects. Control variables include the natural log of the municipality area, the natural log of distance to Asunción, an indicator for whether 1846 population information is available for that municipality, the natural log of the total population in 1846, an indicator for whether 1864 population information is available for that municipality, and the natural log of the total households in 1864. Here identification relies on the assumption that, conditional on distance to the capital and population, differences in distance to battle and march lines are not correlated with other factors that might drive variation in teacher and student sex ratios, other than conflict-induced skewed sex ratios.

For the long-run within-Paraguay regressions we use the following estimating equation

$$y_{imt} = \alpha + \beta D_m + \gamma F_{it} + \theta D_m F_{it} + \mathbf{X}_{it}\rho + \nu_t + \epsilon_{imt} \tag{4}$$

where y_{imt} is the outcome for individual i in municipality m in time period t. Distance to conflict, D_m, is either a dummy variable for residing less than 30 km from the conflict or the linear distance to conflict. IPUMS sampling weights are used for the regressions using the IPUMS data. Control variables include age of the respondent, a binary indicator for residing in a rural area, municipality population density, the natural log of distance to Asunción, the natural log of the municipality area, and maize productivity.[13] As above, if the distance proxy for sex ratio skewness is not correlated with other factors driving modern outcomes, this estimation establishes the effect of female-skewed sex ratios on these outcomes.

5 Short- and medium-term impacts

In this section we show the immediate effect of the war on sex ratios. We proceed to look at the trends in out-of-wedlock births both immediately after the war and in the decades thereafter. Next, we look at the effects of skewed sex ratios on female educational outcomes in the decades after the war.

5.1 Sex ratios

5.1.1 Cross-border comparisons

There is scarce information on sex ratios prior to the end of conflict in 1870. However, the 1886 Paraguayan census and the 1895 Argentine census allow us to examine differences in sex ratios of individuals alive at that time, by their birth cohorts. For Argentina, we show the data separately for Corrientes–the sole neighboring province with data available during this time period–and for the rest of Argentina. The changes in the ratio of women to men across birth cohorts in the two countries is shown in Figure 1. The contrast is sharp. In Paraguay, those cohorts born in years prior to the war—particularly those most likely to be of fighting age during the war (born prior to 1855)—have ratios of women to men of 3.5. The ratio begins to decrease for the cohort born just before the war (1856-1865), although it is still high, consistent with the recruitment practices described. Cohorts from eras that should not be affected by the war, exhibit sex ratios at or near unity.

Perhaps the best comparison comes from looking at the cohort born 1836-1845. For this group, the Paraguayan sex ratio is around 3.5, the Corrientes, sex ratio is around 1.25, and the non-Corrientes, Argentina sex ratio is about 1.1. Since the Argentinean data comes from the 1895

[13]The average maize productivity comes from the FAO GAEZ layer that shows low input maize productivity from 1961-1990. We use maize because it is grown in the region and its yields are highly correlated with the yields of other staple crops.

census, Argentinean individuals born before 1816 are over eighty. Because women have longer life expectancies than men, these oldest cohorts (especially those in Argentina) should skew female even without a war. The data show that the war greatly skewed the sex ratio in Paraguay, very slightly skewed it in Corrientes, and does not seem to have much effect in the rest of Argentina. For cohorts born after the war, sex ratios in all places soon approach unity by the time of the censuses.[14]

5.1.2 Within-Paraguay comparisons

Although the overall death toll during the war was high throughout Paraguay, there was variation in the location of conflict across the country. Correspondingly, there was also variation in the resulting sex ratios in the birth cohorts most affected by the conflict. Figure 2 shows a scatterplot and locally weighted regression of the sex ratios of each municipality in 1886 and the distance to the nearest march line, for birth cohorts born before and after the war. The figure shows that for those born before the conflict the sex ratio decreases with distance. Some of the ratios are extremely high, reaching almost seven females per male. For those born after the conflict, the relationship between sex ratios and distance to war is almost flat. This supports the assertion that there were differences in the intensity of conflict which affected sex ratios within Paraguay and also that these differentially skewed sex ratios were a temporary phenomenon. It bears mentioning, however, that there is a much larger difference between the average sex ratios across the two birth cohorts than across municipalities in either era; this can be seen by the difference in the y-axis values between two subfigures.

Table 1 shows estimates of Equation (3) using the 1886 Paraguayan census data. The large positive coefficients on "born before the war" show that sex ratios within cohorts born before the war are significantly higher than those of cohorts born after the war. Moreover, greater proximity to battles or marches resulted in more skewed sex ratios. So, for example, using the results in Column (3), a person born before the war in a municipality close to the march path will have approximately three additional men for every woman in their cohort compared to someone born after the war in the same municipality. On the other hand, the cross-cohort difference in a municipality further from the march line will be only 2.5. The significant negative coefficient on the continuous measure of distance interacted with being born before the war implies that sex ratios among those born before the war are higher in municipalities closer to the conflict. This is consistent with the positive interaction term on the binary measure of being near the war (less than 30 km) interacted with being born before the war. Standard errors are clustered at the municipality level and also estimated using Conley (1999) spatially correlated standard errors with a cutoff of 30 km, for robustness. Statistical significance does not differ substantially between the two.

[14] Results from the 1873 Paraguayan census (not shown) confirm the general downward trend in Paraguayan sex ratios for cohorts born in the pre-war era.

5.2 Out-of-wedlock births

Having established that the War of the Triple Alliance did indeed skew sex ratios, and that there is variation in this outcome across municipalities, we now examine out-of-wedlock birth rates in the immediate aftermath of the conflict and how these rates vary with distance to the conflict.

5.2.1 Cross-border comparisons

We begin by comparing out-of-wedlock birth rates in Paraguay to those in Argentina and Brazil. We limit the sample to baptisms occurring between 1840 and 1900, dropping municipalities that reported their first baptism after 1840 and dropping years with fewer than ten baptisms nationally. Figure **??** shows the national share of out-of-wedlock births across the years of baptism for each country. The war period is represented by black vertical lines. Paraguay generally had a higher proportion of out-of-wedlock births than Argentina and Brazil, even prior to the conflict, consistent with the historical literature, albeit the earlier data is noisy. While there is a measurable jump in the share of out-of-wedlock births after the war, the figure gives the impression that the war exacerbated an existing trend rather than creating a new one.

Because Argentina and Brazil are large and diverse countries, we also show a comparable figure limiting the non-Paraguayan data to municipalities within 100 km of the Paraguayan border. We only have data on Argentine municipalities in Corrientes during this time period. Figure 3 suggests that Paraguay and Corrientes looked roughly similar until the mid 1850s (though again the earlier data is noisy), at which point Paraguay diverged, with the war apparently accentuating the pre-existing trend.

We also run the regression described in Equation (1) using outcomes at the individual (baptism) level. Table **??** shows the results from this estimation. In general, out-of-wedlock births increased after the war, relative to the time periods before or during the war. These increases were significantly larger in Paraguay until around 1881 and then taper off, until Paraguay's rate of out-of-wedlock births finally converges with Argentina's. For example, the coefficient on the Paraguay dummy in Column (1) tells us that, even before the war, out-of-wedlock births were 7.2 percentage points (pp) more likely in Paraguay than neighboring areas of Argentina. Just after the war this difference between Paraguay and Argentina increased by 15.2 pp for a difference of 22.4 pp. Though the differences are substantial, they also disappear after several decades.

5.2.2 Within-Paraguay comparisons

We also use the baptismal church data to examine within-Paraguay impacts of the war, exploiting variation in the distance to battle points or march lines. There are very few churches with baptismal records in the data that are located "far" (greater than 30 km) from battles and marches. Of these, there are no observations from more distant parishes after 1885. For this reason, we restrict the analysis to years prior to 1885. The regression has a similar form to Equation (3), but observations are now at the individual level.

Table **??** shows that, as in the cross-country analysis, the levels of out-of-wedlock births increased after the war relative to the pre-war era. Column (1) shows that after the war out-of-wedlock births were 18.8 pp more likely than before the war. Before the war, out-of-wedlock baptisms were less common in areas closer to where the war was to later pass (by 9.6 pp). The post-war increases in out-of-wedlock baptisms are greater in areas closer to the war path (by 7.2 pp). This points to an interesting dynamic – the war appears to have served to make illegitimacy more uniformly acceptable by driving illegitimacy rates in the areas of the country near where the war passed to levels more similar to those in areas further from the war which always had high rates of out-of-wedlock births.

5.3 Female education

5.3.1 Within-Paraguay comparisons

Next, we examine female educational outcomes. The 1887 Paraguayan census provides the number of male and female students and teachers. From this we create the student sex ratio and the teacher sex ratio in each municipality in 1887. We do not have panel data on these outcomes, so these regressions are cross-sectional at the municipality level, and control for municipality-level characteristics. We focus on education because the historical literature emphasizes an increase in female education as an effect of the war. The information on teacher sex ratios is also the only data we could find measuring female labor force participation in the 1880s. We expand on these outcomes in the long-term impact analysis.

Table **??** shows the results. The patterns are similar across both outcome variables. Higher distance to the nearest conflict or march line is weakly correlated with lower student and teacher sex ratios. In other words, in municipalities that were more affected by the war, there were a higher share of female students and a higher share of female teachers after the war. For example, Column (5) suggests that a municipality on the march line would have a teacher sex ratio of 0.5 females for every male (or two males for every female), while a municipality 20 km from the march line would have a teacher sex ratio of 0.2 (or five males for every female). This is consistent with Potthast (2005) who argued that the skewed sex ratios caused by the war led to increased education for females. Students in 1887 were all born after the war, and given that the sex ratios of the younger generation were close to unity, this result should not be a mechanical consequence of the lack of men.

5.4 Short- and medium-term summary

In sum, the within-Paraguay and cross-border results are in accord with one another. Municipalities (and countries) closer to (more affected by) the war had more skewed sex ratios immediately after the war. These sex ratios approached unity relatively quickly in the cohorts born after the war. Out-of-wedlock births increased immediately after the war in areas closer to the conflict, though the evidence on whether this effect lasted into the medium term is weaker. There is also evidence of medium-term increases in female educational outcomes, which we expand further next.

6 Long-term impacts

The previous section showed that very soon after the war the sex ratio rebounded from the reported postwar ratios of between three and seven women to one man (Potthast-Jutkeit 1991, Washburn 1871), down to 1.5 in 1886 and 1.16 in 1899 (Carrasco 1905). The 1950 census reported 1.05 women for every man, with similar ratios through 2002. In this section, we study whether the temporarily skewed sex ratios of postwar Paraguay have had long-term impacts on modern outcomes in Paraguayan society.

Following our conceptual discussion, we are interested in six modern outcome variables: female-headed household, unmarried living with a child, being literate, having completed primary education, being employed, and gender norms. The first one of these is a household-level variable while the others are individual-level variables. Literacy questions are not asked in all census years, so those regressions contain fewer observations. We limit individual-level analysis to individuals between 18 and 65 years for all outcomes except for unmarried living with a child. Unmarried living with a child means that the individual is neither married nor in a consensual union and has at least one of their own children living in the same household. In order to better capture the idea of raising a child either alone or with an unmarried partner, we limit the regressions using this outcome variable to individuals aged 18 to 45. We use this as a proxy variable for the out-of-wedlock child outcome we have in the historical data, although it is important to note that it is not equivalent. Being employed means the individual works either for others or for him or herself, in either a paid or unpaid position, and either with or without legal contract. Gender norms are measured using a Likert scale measuring opinions regarding female labor force participation.

6.1 Cross-border comparisons

We first compare modern outcomes in Paraguay with outcomes in neighboring comparison municipalities in Argentina and Brazil using Equation (2). We pool all four years of IPUMS data and include census-year fixed effects.[15] Panel A of Table 2 runs the regression using the broad sample which includes as the control group Argentinean and Brazilian municipalities within 100 km of the Paraguayan border. Panel B shows the results using the restricted sample which excludes the Argentinean provinces and Brazilian states which were contested before the war and officially became part of Argentina and Brazil after the war.[16]

The cross-border regressions reveal significant differences in the status of women in Paraguay compared to neighboring areas of Argentina and Brazil. The results are similar across the broad and restricted samples. Column (1) indicates that Paraguayan household heads are 3.6 percentage points more likely to be female in the broad sample, relative to a mean of 17 percent. Column (2) illustrates that Paraguayan men are less likely to raise a child without a partner than Argentinean and Brazilian men, but that Paraguayan women are significantly more likely to do so. In the broad

[15] When we estimate these separately for each census, we find no change in impacts across decades.
[16] As discussed in more detail in Section 4.

sample, the coefficient on the interaction term is 2.3 percentage points – over a third of the mean of the outcome variable.

For the educational outcomes in Columns (3) and (4), we find that women are less educated than men in general, but Paraguayan women have relatively less education than women across the border. This contradicts the idea that the skewed sex ratios after the war led to increases in female education. Panel B, for the restricted sample, is more in line with this traditional story.

For labor force participation, Paraguayan men are more likely to participate in the labor force compared to their neighbors in Argentina and Brazil while Paraguayan women are significantly *less* likely to participate. This is in contrast to studies finding long term increases in female labor force participation due to the World Wars in Europe, and will be in contrast to our within-Paraguay results in the next section. One explanation for this result may be that females who work on their own farms don't consider and report themselves as being employed. These issues are more relevant in a developing country context, and also more relevant in Paraguay compared to its neighbors.

6.2 Within-Paraguay comparisons

In this section, we examine whether within-Paraguay variation in modern outcomes is associated with distance from Triple Alliance battles or marches. Given the general decimation of the male population throughout the entire country caused by the war, it is plausible that the within-Paraguay effects understate the true effects.

We use Equation (4) to estimate the long-run effects within Paraguay. We use a dummy for residing less than 30 km from the march path in our preferred specification, found in Panel A of Table 3. As a robustness check, we repeat the estimation using a binary indicator for residing close to a battle point as well as linear distance to marches and battles.

The coefficient on the interaction term represents the difference between women and men living close to the conflict compared to the difference between women and men living farther away. Column (1) of Panel A in Table 3 shows that household heads residing in municipalities closer to a march line are 2.8 percentage points (or 14%) more likely to be female than those residing farther away. Column (2) shows that women living closer to the march line are significantly more likely to be unmarried and living with their child. This parallels the short-term historical finding of more out-of-wedlock children closer to the conflict.

Regarding education, while women are less likely than men to have completed primary education as seen in Column (4), this disadvantage is smaller closer to the march lines. This mirrors the within-Paraguay variation in school enrollment immediately after the war. Admittedly, the effect is more muted in Column (3), for literacy, which has largely converged in the country.

Women within Paraguay living close to historical battles or march lines are more likely to be employed than those living farther away. The results within Paraguay are consistent with the narrative that the conflict empowered women to work. Noticeably, women have significantly lower labor force participation than men (Column (5)) in Paraguay; in fact the coefficient on female (69 pp) is larger than the mean of the outcome variable (59%). This is consistent with the idea that

Paraguayan women who work on the family farm do not consider themselves to be working, for the purposes of their response to the census. The earlier cross-country results which show Paraguayan women less likely to be employed may reflect Paraguay's higher concentration of women working on their own farms. The within-country result likely reflects the true impact of the skewed sex ratios, given that it controls for national labor-market characteristics. However, it may be attenuated because there are no truly unaffected regions.

An alternative explanation for the high levels of out-of-wedlock child rearing is that much of what historians and journalists have attributed to war impacts were actually driven by particular characteristics of the Guaraní. In the pre-colonial era, single mothers and females working in agriculture were more common in Guaraní culture (Potthast-Jutkeit 1991). Panel B of Table 3 tests this hypothesis by replacing the "proximity to march" variable with a binary indicator for whether less than 44.2% of the municipality (the median in the sample) speak only Guaraní at home (as opposed to only Spanish or a mix of the two) in 1962.[17]

The empirical results are not consistent with this theory –municipalities with fewer pure Guaraní speakers do not have significantly different rates of female-headed households, single motherhood, or primary education. They have higher female literacy rates and higher female labor force participation, which is the opposite of what the characteristics of Guaraní culture would have predicted. Overall, we conclude that effects are due to the war and skewed sex ratios rather than due to Guaraní culture.[18]

6.3 Long-term summary

The within-Paraguay results comparing Paraguayans living closer to and further from a historical march line, and the cross-border results comparing Paraguayans with Argentineans and Brazilians living near the border with Paraguay are generally consistent with one another with respect to marriage and fertility outcomes. Females who live in areas that were more exposed to historical skewed sex ratios caused by the Triple Alliance War are more likely to be raising a child without a spouse and have more female household heads. In more affected areas within Paraguay, females are more likely to be educated and employed. In such areas, individuals of both sexes are more likely to believe in the value of equal labor markets. This shows that the reverberations of the conflict are still present today. This persistence is not moderated by the factors commonly hypothesized to condition the transmission of cultural norms.

7 Conclusion

In this paper, we investigate the immediate and long run impacts of the extreme sex ratio shock induced by the War of the Triple Alliance (1864-1870). We analyze previously unexplored historical

[17] Unfortunately, we do not have an earlier measure of this variable.

[18] In the next section we explore heterogeneous impacts adding the triple interaction between Guaraní-speaking and distance and also find few consistent patterns.

data and sources of conflict variation. In particular, we examine outcomes comparing Paraguay to bordering municipalities in Argentina and Brazil, as well as exploring within-Paraguay variation based on newly digitized information on the location of battles and marches during the war.

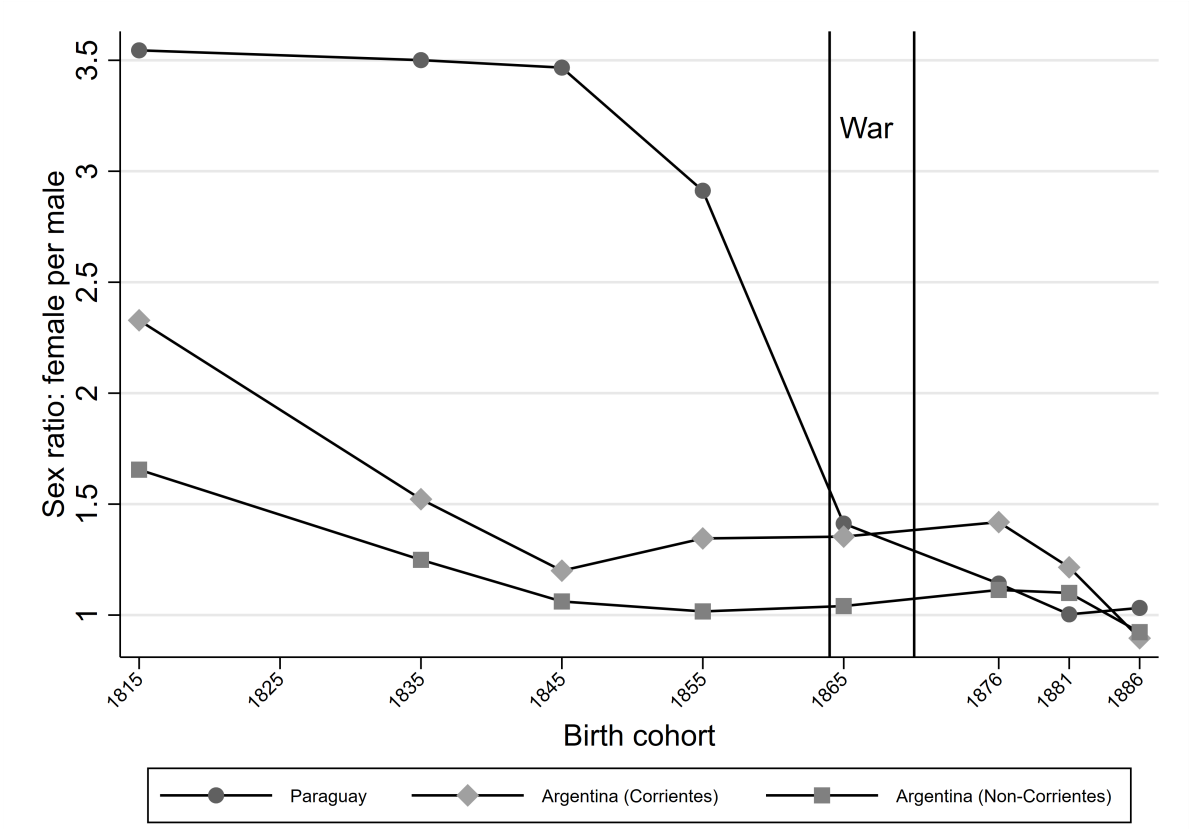
First, our data show clear evidence of significant and extremely large, albeit temporary, changes in sex ratios. These sex ratios are more severely skewed towards females than those previously analyzed in the literature. Paraguay, Brazil, and Argentina were all affected by conflict on their soil, but only Paraguay experienced extreme variation in sex ratios. Furthermore, the impacts of the war on sex ratios within Paraguay varied with distance to battles and marches. The sex ratio shock, while large, was short lived, with ratios approaching unity shortly after the conflict.

In the immediate aftermath of the war, there were higher rates of out-of-wedlock births in Paraguay compared to neighboring municipalities in Argentina and Brazil, and also in Paraguayan municipalities closer to the conflict compared to those further away. Furthermore, female to male student (and teacher) ratios were higher in Paraguayan municipalities closer to the conflict. This reflects the historical narrative that women were expected to be educated in order to help educate the next generation of men.

One hundred years later, these behaviors persist, and there is evidence that other norms may have been affected by the shock as well. Paraguay contains more female-headed households and more unmarried women living with their child than neighboring areas of Argentina and Brazil, and the same is true comparing areas within Paraguay close to the war relative to areas farther away from it. Similarly, within-Paraguay analysis suggest that the skewed sex ratios led to higher literacy rates and higher primary education completion rates. Although we have scant information on employment during the immediate aftermath of the war with which to compare, we find that Paraguayan women are less likely to be employed than those in neighboring countries, but that those more affected by the conflict within Paraguay are relatively more likely to be. The within-Paraguay results are likely to more accurately reflect the intensive impacts of the sex ratio shock, since they are estimated within the same extremely agriculture-based labor market.

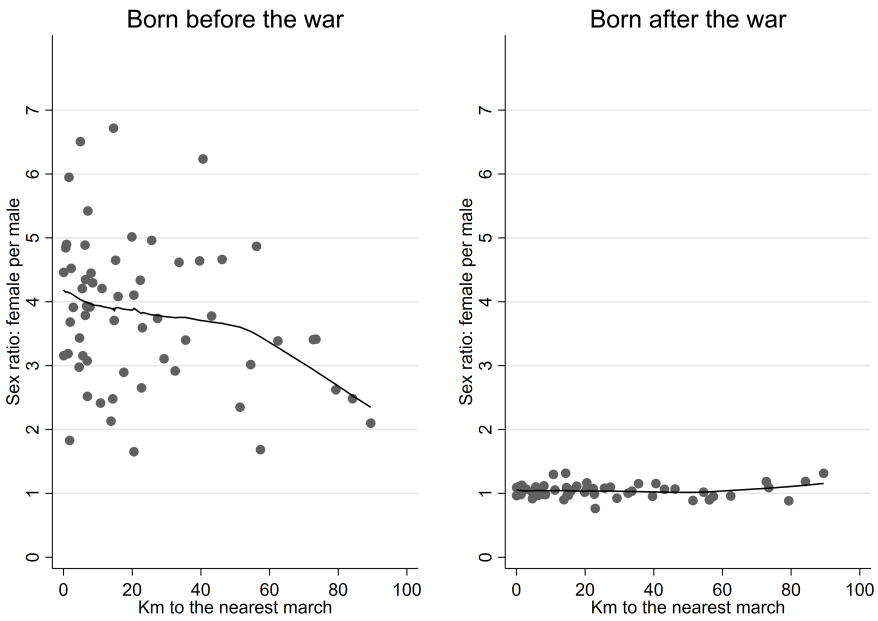
The short and long-term impacts of the conflict are consistent across time, and also with the anecdotal evidence and historical literature. What do these results mean for us today? First, they give us a deeper understanding of the roots of Paraguay's unusual standing in the region. To the extent that they are generalizable, they can inform our thinking about the present crises in the Middle East, the general migration trends of Latin America, and the multiple conflicts worldwide, situations where sex ratios are biased towards females. Our findings suggest that these events are likely to fundamentally alter gender roles. While the effects of these shifting norms on welfare are ambiguous, it is clear that they can last for generations. In more affected areas of Paraguay, women had to take on more responsibility in the household, raising children on their own and heading households, getting more educated, and entering the labor force in greater numbers, providing some silver lining in the very long run. Cognizance of the existence of these underlying dynamics may help inform the design of policies aimed to maximize the benefits and minimize the costs of these shifts, especially in the developing world.

Figure 1: Paraguayan and Argentinean population sex ratio by birth cohort



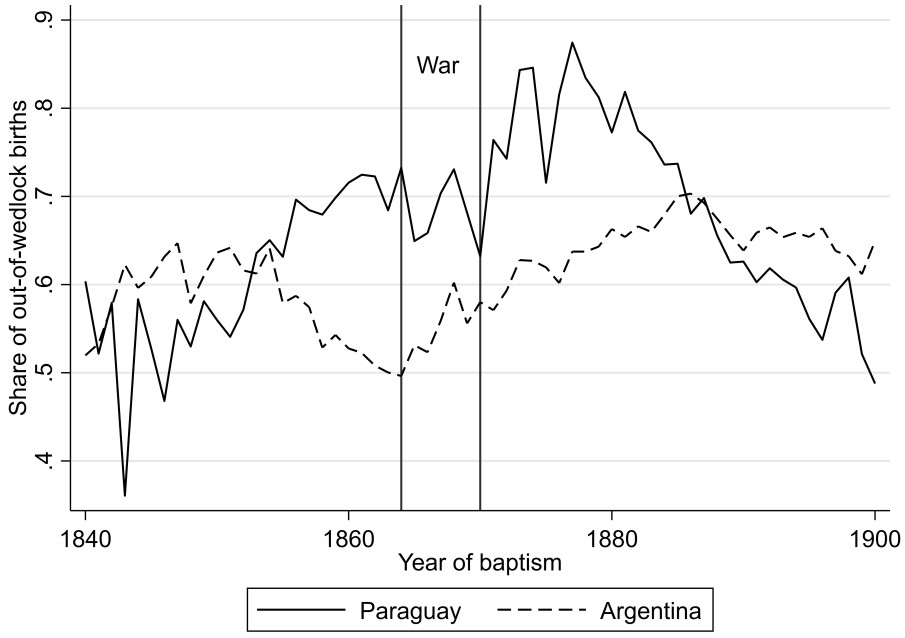
Data from Paraguay's 1886 census and Argentina's 1895 census. The year on the x-axis represents the end of the birth cohort.

Figure 2: Relationship between distance to march line and sex ratio, 1886



Data from Paraguay's 1886 census. The curves are from locally weighted regressions of sex ratio on distance to the nearest march line at the municipality level.

Figure 3: Out-of-wedlock birth rates across Paraguay and Corrientes, Argentina



Data from baptismal church records between 1840 and 1900. Sample includes all of Paraguay and Argentine municipalities within 100 km of the border.

Table 1: Within Paraguay: Short-term effects on sex ratios

	Outcome: sex ratio (female/male)					
	(1)	(2)	(3)	(4)	(5)	(6)
Born before the war	3.095***	2.923***	2.457***	3.348***	2.917***	2.352***
	(0.196)	(0.250)	(0.284)	(0.216)	(0.305)	(0.233)
	[0.233]	[0.271]	[0.373]	[0.261]	[0.284]	[0.241]
Born before × dist. to march line	-0.144***	0.058				
	(0.050)	(0.186)				
	[0.053]	[0.177]				
Born before × sq. dist. to march line		-0.027				
		(0.021)				
		[0.018]				
Born before × near march line (< 30 km)			0.426			
			(0.333)			
			[0.368]			
Born before × dist. to battle point				-0.170***	0.124	
				(0.042)	(0.158)	
				[0.043]	[0.124]	
Born before × sq. dist. to battle point					-0.031**	
					(0.014)	
					[0.011]	
Born before × near battle point (< 30 km)						0.697**
						(0.295)
						[0.255]
Observations	122	122	122	122	122	122
R^2	0.865	0.868	0.856	0.875	0.882	0.865
Mean of outcome variable	2.446	2.446	2.446	2.446	2.446	2.446

Data from Paraguay's 1886 census. Two birth cohorts for each of 61 municipalities. Sample excludes Asunción, the Paraguayan Chaco, and small municipalities where the 1886 population in either birth cohort was less than 200 people. Born before the war means born before 1856, and born after the war means born after 1865. The unit for distance variables is 10 km. Includes municipal-level fixed effects. Clustered standard errors at the municipal level in parentheses (61 clusters) and Conley standard errors in brackets. Asterisks are based on clustered standard errors: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Cross-border: Long-term effects on modern outcomes

	Demography		Education		Employment
	Female Head	Unmarried w/ Child	Literacy	Primary Edu	Employed
	(1)	(2)	(3)	(4)	(5)
Panel A: Broad Sample					
Paraguay	0.036***	-0.038***	0.030**	0.011	0.053**
	(0.009)	(0.009)	(0.014)	(0.030)	(0.021)
	[0.009]	[0.009]	[0.014]	[0.033]	[0.031]
Female		0.078***	-0.030***	-0.018***	-0.472***
		(0.003)	(0.004)	(0.004)	(0.018)
		[0.004]	[0.005]	[0.005]	[0.019]
Paraguay × Female		0.023***	-0.055***	-0.031***	-0.152***
		(0.005)	(0.005)	(0.005)	(0.029)
		[0.006]	[0.007]	[0.006]	[0.052]
Observations	410475	805618	665816	1054669	1054669
Mean of outcome variable	0.174	0.063	0.861	0.468	0.598
Paraguay + Paraguay × Female		-0.016*	-0.024	-0.020	-0.099***
		(0.008)	(0.016)	(0.031)	(0.017)
Panel B: Restricted Sample					
Paraguay	0.039***	-0.024***	0.031**	0.060**	0.044*
	(0.008)	(0.008)	(0.012)	(0.029)	(0.025)
	[0.009]	[0.008]	[0.013]	[0.030]	[0.035]
Female		0.074***	-0.036***	-0.020***	-0.474***
		(0.004)	(0.006)	(0.004)	(0.023)
		[0.004]	[0.006]	[0.004]	[0.023]
Paraguay × Female		0.027***	-0.048***	-0.029***	-0.150***
		(0.006)	(0.007)	(0.005)	(0.032)
		[0.007]	[0.008]	[0.005]	[0.053]
Observations	323796	648025	459515	848368	848368
Mean of outcome variable	0.178	0.057	0.858	0.462	0.599
Paraguay + Paraguay × Female		0.003	-0.016	0.030	-0.106***
		(0.008)	(0.015)	(0.030)	(0.017)

Data from IPUMS census in Paraguay (excluding Asunción and the Paraguayan Chaco) and neighboring municipalities in Argentina and Brazil. The broad sample in Panel A includes municipalities in Argentina and Brazil within 100 km of the Paraguay border excluding the Argentinean Chaco. The restricted sample in Panel B additionally excludes municipalities in departments which were contested before the war and officially became part of Argentina and Brazil after the war. Column (1) is limited to household heads aged 18-65; Column (2) is limited to individuals 18-45 years old; and Columns (3)-(5) are limited to individuals 18-65 years old. Control variables include age, rural, population density (i.e., population/area), log(distance to Asunción), log(municipality area), and average maize productivity. Fixed effects at the year level. Clustered standard errors at the harmonized municipal level in parentheses (122 clusters in Panel A and 98 clusters in Panel B) and Conley standard errors in brackets. Asterisks are based on clustered standard errors: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Within Paraguay: Long-term effects on modern outcomes

	Demography		Education		Employment
	Female Head	Unmarried w/ Child	Literacy	Primary Edu	Employed
	(1)	(2)	(3)	(4)	(5)
Panel A					
Near March Line (< 30 km)	0.028***	-0.003*	0.005	0.030***	-0.043**
	(0.010)	(0.001)	(0.010)	(0.011)	(0.018)
	[0.010]	[0.002]	[0.011]	[0.011]	[0.032]
Female		0.086***	-0.087***	-0.055***	-0.693***
		(0.005)	(0.004)	(0.004)	(0.035)
		[0.005]	[0.004]	[0.005]	[0.035]
Near March Line × Female		0.023***	0.003	0.010**	0.105**
		(0.005)	(0.005)	(0.004)	(0.042)
		[0.006]	[0.006]	[0.005]	[0.065]
Observations	218397	448335	192731	581584	581584
Mean of outcome variable	0.195	0.056	0.823	0.491	0.588
Near + Near × Female		0.020***	0.008	0.040***	0.062**
		(0.005)	(0.011)	(0.012)	(0.025)
Panel B					
Municipality Mostly Speak More Than Guaraní	0.014	-0.004	0.001	0.011	-0.062***
	(0.009)	(0.003)	(0.009)	(0.012)	(0.018)
	[0.008]	[0.003]	[0.009]	[0.012]	[0.027]
Female		0.099***	-0.090***	-0.050***	-0.699***
		(0.006)	(0.004)	(0.004)	(0.026)
		[0.008]	[0.005]	[0.004]	[0.026]
Female × Speak More Than Guaraní		0.005	0.013*	0.004	0.158***
		(0.007)	(0.006)	(0.004)	(0.038)
		[0.007]	[0.008]	[0.005]	[0.058]
Observations	218397	448335	192731	581584	581584
Mean of outcome variable	0.195	0.056	0.823	0.491	0.588
More than Guaraní + More than Guaraní × Female		0.001	0.014	0.015	0.096***
		(0.006)	(0.012)	(0.013)	(0.022)

Data from IPUMS census in Paraguay (excluding Asunción and the Paraguayan Chaco). Column (1) is limited to household heads aged 18-65; Column (2) is limited to individuals 18-45 years old; and Columns (3)-(5) are limited to individuals 18-65 years old. Control variables include age, rural, population density (i.e., population/area), log(distance to Asunción), log(municipality area), and average maize productivity. "Municipality Mostly Speak More Than Guaraní" indicates that the share of the municipality speaking only Guaraní at home in 1962 is below the median of that share among all municipalities. Fixed effects at the year level. Regressions use sampling weights. Clustered standard errors at the harmonized municipal level in parentheses (58 clusters) and Conley standard errors in brackets. Asterisks are based on clustered standard errors: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

References

Aguilar-Gomez, S. & Benshaul-Tolonen, A. (2018), Norms formation: The Gold Rush and women's roles. Unpublished Working Paper.

Baratta, M. V. (2019), *La Guerra del Paraguay y la construcción de la identidad nacional*, Vol. 3, Sb editorial.

Bethell, L. (1996), *The Paraguayan War (1864-1870)*, Institute of Latin American Studies, London.

Boggiano, B. (2019), Long-term effects of a war: From male scarcity to intimate partner violence. Evidence from the Paraguayan War (1864-1870). Unpublished Working Paper.

Capdevila, L. (2010), *Una guerra total: Paraguay, 1864-1870: ensayo de historia del tiempo presente*, Centro de Estudios Antropológicos de la Universidad Católica" Nuestra Señora ....

Carrasco, G. (1905), *La población del Paraguay, antes y después de la guerra: Rectificación de opiniones generalmente aceptadas...*, Talleres Nacionales de H. Kraus, Asunción.

Colella, F., Lalive, R., Sakalli, S. O. & Thoenig, M. (2019), Inference with arbitrary clustering. IZA Discussion Paper 12584.

Conley, T. G. (1999), 'GMM estimation with cross sectional dependence', *Journal of Econometrics* **92**(1), 1–45.

Economist (2012), 'The never-ending war', **405**, 45–48. December 22.

Feigenbaum, J. J., Leez, J. & Mezzanotti, F. (2018), Capital destruction and economic growth: The effects of Sherman's March, 1850-1920. Unpublished Manuscript.

Ganson, B. J. (1990), 'Following their children into battle: Women at war in Paraguay, 1864-1870', *The Americas* **46**(3), 335–371.

Giuliano, P. (2018), Gender: A historical perspective, *in* S. L. Averett, L. M. Argys & S. D. Hoffman, eds, 'Oxford Handbook on the Economics of Women', Oxford University Press, New York, NY, chapter 26.

Giuliano, P. & Nunn, N. (2017), Understanding cultural persistence and change. NBER Working Paper.

Grosjean, P. & Khattar, R. (2019), 'It's raining men! Hallelujah? The long-run consequences of male-biased sex ratios', *Review of Economic Studies* **86**(2), 723–754.

Jaeggli, A. L. & Bordon, F. A. (2010), *Guerra del Paraguay: Cartografía Explicada de la Guerra Contra la Triple Alianza, second edition*, Servilibro, Asunción, Paraguay.

Minnesota Population Center (2018), 'Integrated Public Use Microdata Series, International: Version 7.1 [dataset]'.

Pinker, S. (2011), *The Better Angels of Our Nature: Why Violence Has Declined*, Viking, New York, NY.

Potthast, B. (2005), Progatonists, victims, and heroes: Paraguayan women during the "Great War", *in* H. Kraay & T. L. Whigham, eds, 'I Die with My Country: Perspectives on the Paraguayan War, 1864-1870', University of Nebraska Press, chapter 3, pp. 44–60.

Potthast-Jutkeit, B. (1991), 'The ass of a mare and other scandals: Marriage and extramarital relations in nineteenth-century Paraguay', *Journal of Family History* **16**(3), 215–239.

Potthast-Jutkeit, B. (1996), *"Paraíso de Mahoma", o, "País de las mujeres"?: El rol de la familia en la sociedad Paraguaya del siglo XIX*, Instituto Cultural Paraguayo-Alemán, Asunción, Paraguay.

Reber, V. B. (1988), 'The demographics of Paraguay: A reinterpretation of the Great War, 1864-70', *Hispanic American Historical Review* **68**(2), 289–319.

The Guardian (2020), 'Paraguay still haunted by cataclysmic war that nearly wiped it off the map'. February 27.

Voigtländer, N. & Voth, H.-J. (2012), 'Persecution perpetuated: The medieval origins of anti-Semitic violence in Nazi Germany', *Quarterly Journal of Economics* **127**(3), 1339–1392.

Warren, H. G. (1978), *Paraguay and the Triple Alliance: The Postwar Decade, 1869-1878*, University of Texas Press, Austin, TX.

Washburn, C. A. (1871), *The History of Paraguay: With Notes of Personal Observations, and Reminiscences of Diplomacy Under Difficulties*, Vol. 1, Boston, Lee and Shepard.

Whigham, T. L. (2002), *The Paraguayan War*, Vol. 1, University of Nebraska Press, Lincoln, NE.

Whigham, T. L. & Potthast, B. (1999), 'The Paraguayan Rosetta Stone: New insights into the demographics of the Paraguayan War, 1864-1870', *Latin American Research Review* **34**(1), 174–186.

Williams, J. H. (1976), 'Observations on the Paraguayan census of 1846', *Hispanic American Historical Review* **56**(3), 424–437.