

In utero exposure to Civil Conflict:
Nicaraguan War and its long term effects on
socioeconomic outcomes

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Abstract

We examine the Nicaraguan Civil conflict in the seventies that ended up with the overthrow of the Somoza dictatorship and the start of the Sandinista Revolution. Nicaragua between 1977 and 1979 experienced high rates of war confrontation. After the announcement of the Sandinista National Liberation Front (FSLN, by its acronym in Spanish) in November of 1977, the country had undergone a civil war which ended up with a range of 30,000-50,000 casualties. The escalated confrontation allows us to examine the long-term effects of the war-related conflict on the subsequent generation's socioeconomic outcomes. In particular, this paper aims to identify whether in-utero exposure to the civil conflict in Nicaragua has a negative impact on individual's labor and marriage market outcomes. We exploit the variation in timing of and geographical exposure to the civil conflict during the last year of the dictatorship. We construct novel data which combine full population information of the 2005 Nicaraguan National Census, the World Health Organization historical mortality data, and the Correlates of War. Exploiting differences across regions and across cohorts, our preliminary findings indicate that the civil conflict negatively affected those exposed to the conflict in utero. In particular, the long-term consequences of the war decreased educational attainment, formal employability, and thus reducing lifetime earnings, especially for females. The exposure to the civil conflict also seems to decrease marriage probability.

JEL Codes: I10, J24, N35.

Keywords: Fetal origin hypothesis, prenatal exposure, Nicaraguan Civil War.

1 Introduction

What are the socioeconomic consequences of in-utero exposure to civil conflict? We aim to estimate the impact of the Nicaraguan Civil War that ended up with the overthrow of the Somoza dictatorship regime in the seventies using the fetal origin hypothesis. According to [Susser and Stein \(1994\)](#), in the late 1950s, it was believed that the fetus was a perfect parasite which provided protection to any external damage. Nonetheless, as stated by [Almond and Currie \(2011\)](#), the nine months *in utero* are crucial periods in an individual's life given that the environment in which said fetus develops could affect future acquisition of skills and health.

This hypothesis is called the fetal origins hypothesis and was proposed by David Barker. It argues that the intrauterine environment and fetal malnutrition can lead to future diseases ([Barker, 1990](#)). Even though at first, Barker introduced the hypothesis as the relationship between poor nutrition, health and development in utero with later diseases, there has been studies that analysis the impact of in utero exposure to specific events such as wars, famines, and radioactive fallout [Almond \(2006\)](#); [Almond, Edlund, and Palme \(2009\)](#); [Lee \(2014\)](#). This paper contributes to the fetal origins hypothesis by examining the Nicaraguan conflict between the Somocista regime and the revolutionary forces of the country.

Nicaragua between 1977 and 1979 experienced high rates of guerrilla activities which intensified the level of casualties. In particular, Nicaragua suffered from a more intense war confrontation if we compare ratios of human loss. In Nicaragua, one of every 38 Nicaraguans died and the Nicaraguan conflict is ranked as one of most costliest in recent Latin American history ([Seligson & McElhinny, 1996](#)).¹ Even though the exact total number of casualties is still unknown, estimates suggest that the escalated conflict ended up with a range of 30,000-50,000 casualties ([Seligson &](#)

¹As a comparison, the Iran-Iraq War had a ratio of 1:60 for Iran and 1:50 for Iraq, and during the World War II, the United States ratio was 1:387 ([Seligson & McElhinny, 1996](#)).

McElhinny, 1996). The escalated confrontation allows us examine the longer-term effects of war-related conflicts of those individual who were in utero exposed to the civil conflict. Our aim of is to identify whether the *in utero* exposure to civil conflict in Nicaragua has a negative impact in individuals' outcomes.

This study is part of a vast literature that concerns with the fetal origin hypothesis (Almond, 2006; Almond & Currie, 2011; Almond, Edlund, Li, & Zhang, 2010; Lee, 2014, 2017). Nevertheless, there has been little focus on exposure to civil conflict. In the case of Nicaragua, the analysis of the civil conflict has been mostly focused on the economic impact of the insurrection. Given the little literature regarding Nicaraguan conflict, to the best of our knowledge, this is the first study that look into the Nicaraguan civil conflict where the causal link of interest is: in utero exposure during the last years of the civil conflict in Nicaragua to long-term socio-economic outcomes of individuals.

The remainder of the paper is structured as follows. In Section 2, we provide the background of the Nicaraguan civil war and describe the overthrown of the Somoza regime. We also present a review of the literature related to in utero exposure to civil conflict. Section 3 describes the empirical strategy, as well as the data and in utero indicator. In Section 4, we present the main results of the specification for different outcomes. Finally, Section 5 concludes.

2 Background

We begin by presenting a brief summary of the last years of the fight against the Somoza dictatorship. We then discuss the fetal exposure to civil conflict and identify the cohorts that are analyzed.

2.1 Nicaraguan Revolution: Fight against the Somoza dictatorship (1977-1979)

The Somoza Regime started in 1934 and ended up in 1979. The beginning of the Somozas' dictatorial regime can be traced back with the murder of Augusto César Sandino in 1934 and the strengthen of the Nicaraguan National Guard. The rise to power of the founder of the dynasty, Anastasio Somoza García, was due to several aspects: first, there was an absence of strong national bourgeoisie in Nicaragua and, second, the continued US intervention in the country (Ferrero, 2009). The main opposition to the Somoza's regime came from the strategy of the FSLN's armed struggle which since 1960s would grow until it managed to agglutinate an inter-class opposition movement that would lead to the triumph of the Sandinista Revolution (Ferrero, 2009).

Another source of opposition came from Pedro Joaquín Chamorro Cardenal who was the director of La Prensa, the main opposition newspaper in the country. These two simultaneous sources of opposition would consolidate and strengthen the fight against the Somoza's dictatorship. The Somocista Regime was a family regime with three main actors and periods: (1) Anastasio Somoza Garcia who ruled from 1937 to 1947 and 1950 to 1956, (2) Luis Somoza Debayle, son of Anastasio Somoza who ruled from 1956 and 1963, and (3) Anastasio Somoza Debayle, second son of Anastasio Somoza, who ruled Nicaragua from 1974 to 1979.

Although, the Somocista dictatorship was in power for more than 40 years, fights against the dictatorship did not intensify until the last years of the dictatorship. The final line of the struggle and of the road towards the triumph of the rebellion was clearly seen starting in 1977. with the aim of promoting a Pro-Dialogue Commission the private enterprise and the Catholic Church played also an important role, alas with failed outcomes. According to Ferrero (2009), simultaneously, the unsustain-

able situation of violence and repression increased awareness among broad sectors of society, and this produced the creation of the Group of the Twelve (El Grupo de los Doce)² which was pivotal for getting foreign and domestic support.

In January 1978, Pedro Joaquín Chamorro was assassinated. This event caused broad social rejection to the dictatorship and unleashed public anger. In particular, “The killing [of Pedro Joaquín Chamorro] launched the first mass uprising against the regime, and for the first time, people from the urban slums joined the rebellion” (Gopal, 1994, p. 67 cited in Sierakowski, 2012). For instance, business sectors and the church along with the most visceral rejection of the opposition sparked mass participation in the conflict (Ferrero, 2009; Sierakowski, 2012).

The levels of state repression started to reach very high levels of violence and, as stated by Sierakowski (2012), students movements, social and political movements such as labor unions, and christian community groups started to be more upfront during the conflict. The response of the dictatorship was more aggressive with the National Guard. This violent approach by the regime ended up being more counter-productive, radicalizing and politicizing many more people Sierakowski (2012).

The following event continued with high levels of violence. On August 22nd, 1978, the FSLN took the National Palace and the resistance was radicalized. This event fasten the insurrection and represented a heavy political blow for the Somoza regime. It also gave international relevance to the FSLN’s struggle and speed up the fall of the Somoza’s regime. By August 31st, the country was already on a general strike (Ferrero, 2009). Between September 1978 and July 1979, it is considered that the situation in the country was one of open warfare and on September 9 an unstoppable chain of popular insurrections began in the cities of Matagalpa, Masaya, Estelí, Chinandega and León (Ferrero, 2009).

²El Grupo de los Doce comprised the following members: Sergio Ramírez, Arturo Cruz, Carlos Tünnerman, Miguel D’Escoto, Joaquín Cuadra, Felipe Mántica, Ricardo Coronel, Fernando Cardenal, Emilio Baltodano, Ernesto Castillo, Carlos Gutiérrez, and Casimiro Sotelo.

As explained by Sierakowski (2012), “the September 1978 insurrection [The Final insurrection] represents a quintessential parting of waters in the narrative of revolution” (p. 259). This resulted in the conversion of difference sectors of the population to the revolutionary cause.³

On September 14, Air Force jets, or the mariposas de la muerte (butterflies of death) as they were called, began bombing guerrilla positions and homes, leaving hundreds of civilians dead and wounded. Entire families were incinerated within their homes, and the urban landscape was eviscerated through the indiscriminate bombardment from above. The psychological impact of the smoke and overwhelming noise in the sky shifted the conflict dramatically, a GPP report saying that as “the aviation had begun sporadic attacks and shootings, the population started its exodus from the city” (Sierakowski, 2012, p. 261-262).

Attacks, deaths and bombings became daily life and the protests became international with condemnation of the Somoza’s regime before the UN denouncing a genocide in Nicaragua. Other international organizations such as the Organization of American States (OAS) also raised their voices against the dictatorship. In particular, the president of the United States, Jimmy Carter, suspended all aid to Nicaragua on November 1978 (Ferrero, 2009). The confrontation intensified since January 1979. In June, Somoza unleashed the “Operación Arrase” (Surrender Operation) with Sherman tanks, aircraft and heavy artillery with many thousands of deaths. On July 17, Somoza was forced to submit his resignation and on July 19th, the Junta de Gobierno de Reconstrucción Nacional (Government Board of National

³The intensity of the repression against the people can be found in stories of young Nicaraguans: “In my experience, the repression before the insurrections was a more of an orderly repression. But from September, it wasn’t just against the leftists and the students, it was against the people (el pueblo), it became about eliminating everyone. That was their idea. As a consequence of this repression—this disorderly repression—they even bombed the houses of Somocistas!” (Sierakowski, 2012, p. 262-263).

Reconstruction) took power (Ferrero, 2009).

The exact number of casualties is still unknown but is estimated to be more than 10,000 persons killed, and 20,000 injured in the last two years of the conflict (Lacina & Gleditsch, 2005). In contrast, (Seligson & McElhinny, 1996) estimate the maximum total deaths to be 50,000 people. Other estimates indicate in Nicaragua with a total population of 2,797,000 inhabitants, 20,000 individuals were killed only in the capital Managua, and 50,000 throughout Nicaragua (Ferrero, 2009)⁴. As comparison, in countries where the Operation Condor took place, with a total population of 154,982,000, 50,000 people were killed, 30,000 disappeared and 400,000 incarcerated (Ferrero, 2009).

The Final insurrection represented the major event of the revolution against the Somoza's regime. From September 1989 to July 1979, the confrontations were highly violent with thousands of deaths. We use the start of the final insurrection and the end of the dictatorship to identify our month-of-birth cohorts which are discussed in the following sections.

2.2 In utero exposure to civil conflict

The fetal origin hypothesis emphasizes that people born or exposed to negative environment conditions experience negative effects. There are several key ideas of the fetal origin hypothesis. First, the effects are persistent. Second, health effects can remain latent and might be experienced in in the adulthood. As a third idea, the

⁴But it is necessary to point out that in Nicaragua one can not count only the victims of the year that passed from the insurrection of September 1978 until the triumph of the revolution in July 1979, when a real struggle between the entire uprising and the forces was fought. more sophisticated and harsh in the history of the regime bent on annihilating the opposition. It is essential to add the deaths that occurred in the 43 years of dictatorship in repressed demonstrations, as a result of torture in prisons, concentration camps in the mountains and in the "disappearances" of peasants since 1970. Whatever it may be the count, the number of victims in Nicaragua occupied a very prominent place, in relation to its population, even compared to the Central American dictatorships of the 1970s and 1980s, which yielded results more bloody than those of South America. Thus, in El Salvador with 4,233,000 inhabitants, the figure of 75,000 dead and missing persons was reached, and in Guatemala - with 6,204,000 inhabitants - the Mayan genocide raised that amount to 150,000 (Ferrero, 2009)

effects given by the environment conditions reflect a specific biological mechanism (Almond et al., 2010). In terms of civil conflict exposure, Lee (2014), using the Korean War, identifies that the in utero exposure to the Korean War lead to long-term negative health and economic outcomes. In the case of the Nicaraguan context, the long-term effects of the civil conflict has been not studied yet. Therefore, this is the first study to look at the civil conflict in Nicaragua and its long-term effects.

3 Empirical Strategy

3.1 Data

Our primary data set is the 2005 National Nicaraguan Census that was elaborated by the National Institute for Development Information of Nicaragua. The total census contains a total number of observation of 5,142,098 people and, to be of our knowledge, has never been used to estimate the long-term effects of the civil war. The censuses are the only source of information that contains large amount of observations and allows us to trace back the date of birth and socio-economic status of each individual. Besides its large sample, one major advantages of the censuses is that contain information of the place of birth of the individuals. Thus, linkage between place of birth and latent war can be estimated (see below Section 3.2). Unfortunately, the 2005 census do not contain any information regarding health outcomes which limits the scope of this paper. Therefore, in this paper, the major outcomes of analysis are related to education and labor market.

Table 1 presents the summary statistics of the main variables of interest. Column 1 presents the mean values for all the individuals that were born between October 1978 and September 1981. These estimates contain information for both in-utero exposed individuals and non-in-utero exposed individuals. From column 2 to 4, we present the mean values for only in-utero exposed individuals who are those born

between October 1978 and March 1980. Finally, in column 5, the values are for those people born from April 1980 to September 1981 who were not in-utero exposed to the civil conflict, we refer to this cohort as the "non in-utero exposed."

Table 1: Summary statistics of socioeconomic indicators

Variables	All	In utero exposed		Non in utero	
		All	Females		Males
	(1)	(2)	(3)	(4)	(5)
Years of education	6.940 (4.811)	6.846 (4.845)	7.132 (4.819)	6.547 (4.853)	7.020 (4.781)
Literacy	0.842 (0.365)	0.835 (0.371)	0.852 (0.355)	0.818 (0.386)	0.848 (0.359)
University graduate	0.0837 (0.277)	0.0849 (0.279)	0.0893 (0.285)	0.0802 (0.272)	0.0827 (0.275)
Self-employed	0.309 (0.462)	0.313 (0.464)	0.216 (0.412)	0.358 (0.479)	0.305 (0.460)
Weekly hours worked	48.10 (16.41)	48.15 (16.55)	46.60 (18.49)	48.86 (15.52)	48.05 (16.28)
Married	0.611 (0.488)	0.634 (0.482)	0.667 (0.471)	0.600 (0.490)	0.591 (0.492)
Single	0.326 (0.469)	0.300 (0.458)	0.229 (0.420)	0.375 (0.484)	0.348 (0.476)
Sex	0.493	0.489			0.497

Notes: Standard deviation are shown in parentheses. Literacy is a dummy variable that equals 1 if the individual knows how to write and read, and 0, otherwise. University graduate is a dummy variable that equals 1 if the individuals completed university education, and 0, otherwise. Hours indicates the weekly hours working. Married is a dummy variable that indicates if the individual is married. Likewise, single is a dummy variable that equals 1 if the individual's civil status is single and never married, and 0, otherwise. The total number of observations is 29,074 for all individuals, 15,632 for those who were not exposed in-utero, and 13,442 who were in-utero exposed.

Overall, several patterns can be deduced from the mean values in table 1. First, educational measures are lower for those individuals who were in-utero exposed, especially for males. On average males individuals have 6.5 years of education, lower than the years of education of females (7.13) and individuals who were non in-utero exposed (7.02). The same pattern arises for literacy, which indicates if a person

can both read and write. Second, in terms of labor market outcomes, both groups, in utero and non in utero, follow a similar trend. Lastly, there are more married individuals in the in-utero exposed cohort than the non in-utero cohort (63 percent to 59 percent), and the opposite arises for individuals who are single (30 percent for those in-utero exposed and 35 percent for those non in-utero exposed).

3.2 Identification Strategy

We use a similar identification strategy used in previous studies of in-utero exposure (Almond, 2006; Lee, 2014, 2017).

$$y_i = \alpha + \beta_1 \text{In utero}_i + \eta_1 \text{YOB}_i + \eta_2 \text{YOB}_i^2 + \varepsilon_i, \quad (3.1)$$

where y is the outcome of interest of individual i . In utero denotes the dummy variable that identifies individuals that were born between October 1978 and March 1980. YOB is a continuous variable that expresses the year of birth of individual i . YOB^2 is also included to control for the smoothness of the year trend. Finally, ε_i is the error term.

Additionally, we estimate equation (3.2) to look at the differential impact of those who were in states with greater guerilla activities:

$$y_i = \alpha + \beta_1 \text{In utero}_i + \beta_2 \text{SE}_s + \gamma(\text{SE}_s \times \text{In utero}_{is}) + \eta_1 \text{YOB}_i + \eta_2 \text{YOB}_i^2 + \varepsilon_{is}, \quad (3.2)$$

where we introduce the variable SE which is another indicator variable that equals 1 if state s was highly exposed to the civil conflict and 0, otherwise given that there are also factor that explain the configuration of the political consciousness and collective action of individuals. For instance, the geographic locality remains one of the fundamental variable that determines socioeconomic structure, political cultures of the state, and experiences of revolutionary/counterinsurgent violence (Sierakowski,

2012). The coefficient of interest is the interaction term: γ which takes into account those individuals who were in utero exposed to the civil conflict and were born in states with high civil conflict 1977, 1978, and 1978. Unfortunately, measures as excessive death rates or total casualties per region are difficult to estimate given the lack of reliable data for the period of analysis that could help us disentangle in more detail the intensity of the civil conflict.

4 Results

4.1 Baseline estimates

We start by presenting the results of in utero exposure to education outcomes for all the outcomes using equation (3.1). Table 2 presents the results for eight different outcomes: years of education, literacy, university graduate, self-employed, weekly hours worked, married, single, and whether a female individuals has ever given birth to a child.

First, in terms of education outcomes, being in-utero exposed to the civil conflict had negative impact on the individuals' education attainment. The in-utero cohort had .26 years of education less than the non in-utero cohort, was 1.8 percent less likely to know how to write and read, and, also, less likely to graduate from university. In the case of labor outcomes, the in-utero cohort is more likely to be self-employed but, we do not find any statistically different for weekly hours worked. Finally, for the probability of being married, single, and have ever given birth to a child, the estimates show no statistically difference between the two cohorts.

Table 2: Deviation of the birth cohorts' outcomes.

	Dependent variable:			
	Years of Education	Literacy	University graduate	Self employed
In utero	-0.262*** (0.030)	-0.018*** (0.002)	-0.003** (0.002)	0.008** (0.004)
Observations	289,950	290,740	289,950	169,930

	Dependent variable:			
	Hours	Married	Single	Child
In utero	-0.060 (0.134)	0.005 (0.003)	-0.004 (0.003)	-0.003 (0.004)
Observations	170,480	290,740	290,740	144,070

Notes: This table presents OLS estimates. Standard errors are shown in parenthesis. In utero is an indicator variable that equals 1 if a child was in utero exposed to civil conflict and was born between October 1978 and March 1980, and 0, otherwise. Literacy is a dummy variable that equals 1 if the individual knows how to write and read, and 0, otherwise. University is a dummy variable that equals 1 if the individuals completed university education, and 0, otherwise. Hours indicates the weekly hours working. Married is a dummy variable that indicates if the individual is married. Likewise, single is a dummy variable that equals 1 if the individuals civil status is single and never married. Child is a dummy variable that equals 1 if a female individuals has ever given birth to a child. All regressions control for year of birth and year of birth squared.

* Significant at 1 percent.

** Significant at 5 percent.

*** Significant at 10 percent.

In order to understand the impact of being in-utero exposed to the civil conflict, we estimate two different heterogeneity analyses. First, we explore the difference between females and males using equation (3.1) and divide the sample by gender. For this analysis, we focus only on the education measures we explored before. Table 3 presents the estimate for years of education, the probability of knowing how to write and read, and the probability of being a university graduate.

Table 3: Deviation of the birth cohorts' education measures by gender.

	Dependent variable:		
	Years of Education (1)	Literacy (2)	University graduate (3)
<i>Panel A. Females</i>			
In utero	-0.089** (0.042)	-0.002 (0.003)	-0.003 (0.003)
Observations	147,060	147,390	147,060
<i>Panel B. Males</i>			
In utero	-0.441*** (0.042)	-0.033*** (0.003)	-0.004 (0.002)
Observations	142,890	143,350	142,890

Notes: This table presents OLS estimates. Standard errors are shown in parenthesis. In utero is an indicator variable that equals 1 if a child was in utero exposed to civil conflict and was born between October 1978 and March 1980, and 0, otherwise. Literacy is a dummy variable that equals 1 if the individual knows how to write and read, and 0, otherwise. university graduate is a dummy variable that equals 1 if the individuals completed university education, and 0, otherwise. All regressions control for year of birth and year of birth squared.

* Significant at 1 percent.

** Significant at 5 percent.

*** Significant at 10 percent.

The magnitude of the in utero coefficient suggest that males were more negatively affected by being in-utero exposed to the civil conflict. For years of education, the estimate for males is statistically significant at the 1 percent level and, in comparison to the estimates of table 2, more negative (0.44 years of education lost). Likewise, females' years of education are also negatively affected but not as high as the estimate for all the individuals, and it is the only coefficient that present statistical significance. Finally, males who were in-utero exposed to the civil conflict are 3.3

percent less likely to know how to write and read.

4.2 State differences

Now, we turn to the estimates of equation (3.2) which takes into account the difference across states that had high exposure to the civil conflict. As stated before, the geographical characteristics played a significant role in both, the surge of the insurrection and the reaction of the dictatorship (Sierakowski, 2012). In particular, the region of the Segovias, northern Nicaragua, provided far out more soldiers with its rather small population Sierakowski (2012). Figure 1 presents a geographical representation of the state-level exposure to the civil conflict based on Ferrero (2009); Morley (1994); Sierakowski (2012); Susser and Stein (1994).

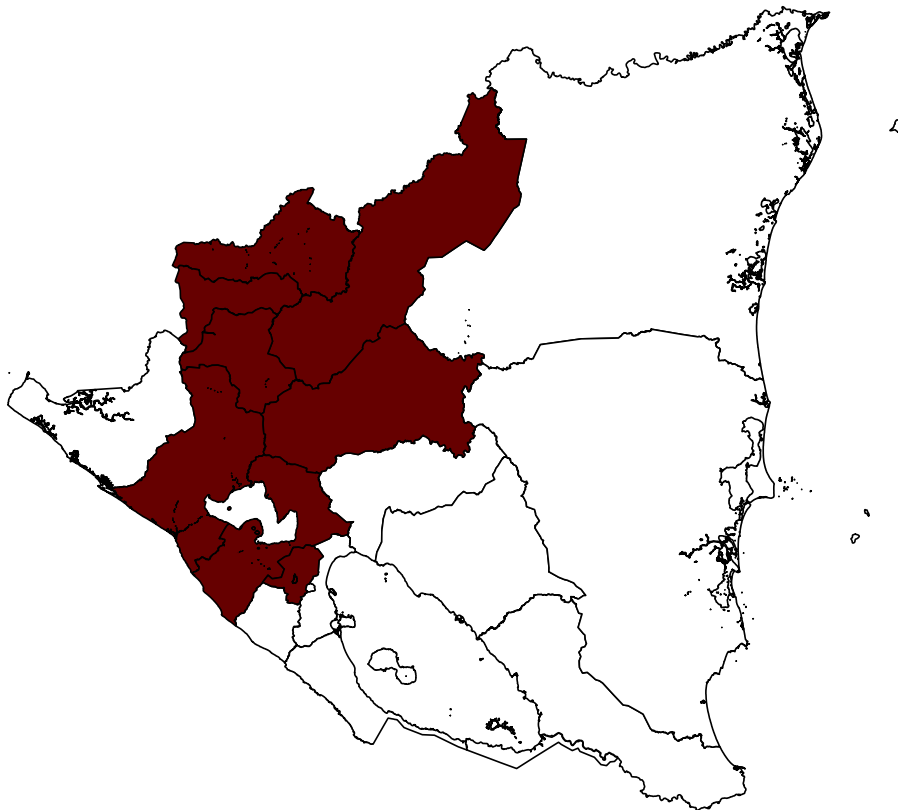


Figure 1: State-level exposure to the civil conflict.

Table 4: Deviation of the birth cohorts' outcomes with state differences

	Dependent variable:			
	Years of Education	Literacy	University graduate	Self employed
In utero	-0.116*** (0.038)	-0.010*** (0.003)	-0.004* (0.002)	0.007 (0.005)
State Exposure	1.022*** (0.025)	0.056*** (0.002)	0.031*** (0.001)	-0.048*** (0.003)
In Utero × State Exposure	-0.209*** (0.037)	-0.010*** (0.003)	0.002 (0.002)	-0.001 (0.005)
Observations	289,950	290,740	289,950	169,930

	Dependent variable:			
	Hours	Married	Single	Child
In utero	0.180 (0.171)	-0.005 (0.004)	0.005 (0.004)	-0.005 (0.005)
State exposure	1.675*** (0.115)	-0.041*** (0.003)	0.038*** (0.002)	-0.029*** (0.003)
In Utero × State Exposure	-0.308* (0.166)	0.015*** (0.004)	-0.014*** (0.004)	0.002 (0.005)
Observations	170,480	290,740	290,740	144,070

Notes: This table presents OLS estimates. Standard errors are shown in parenthesis. In utero is an indicator variable that equals 1 if a child was in utero exposed to civil conflict and was born between October 1978 and March 1980, and 0, otherwise. Literacy is a dummy variable that equals 1 if the individual knows how to write and read, and 0, otherwise. University is a dummy variable that equals 1 if the individuals completed university education, and 0, otherwise. Hours indicates the weekly hours working. Married is a dummy variable that indicates if the individual is married. Likewise, single is a dummy variable that equals 1 if the individuals civil status is single and never married. Child is a dummy variable that equals 1 if a female individuals has ever given birth to a child. All regressions control for year of birth and year of birth squared.

* Significant at 1 percent.

** Significant at 5 percent.

*** Significant at 10 percent.

Table 4 presents the estimates of equation (3.2) for all the outcomes. Results

from this estimating equation provide distinct evidence of the civil war damage. Individuals born in high-civil war conflict states and were in utero exposed to the civil conflict had larger negative impact on educational outcomes such as years of education (.20 years of education lost) and literacy (1 percent less likely to know how to write and read), both significant at the 1 percent level. For university graduate, self-employed, and the probability of ever giving birth to a child, the estimates are not statistically significant different from zero.

In addition, when we use equation (3.2), even though the estimates for weekly hours worked are statistically significant at the 10 percent level, this suggests that a negative impact on labor outcomes for those individuals who were in utero exposed and were born in high-civil war conflict states. Turning to the marriage outcomes, the in-utero times state exposure impact positive the probability of being married and negative the probability of being single. This suggest that the impact pushes individuals to attain low levels of education and, by being out of the education system, marriage opportunity increases. By being married, individuals are less likely to continue their formal education.

Finally, we use the same strategy as state before but now we divide the sample by gender. Table 5 uses equation (3.2). Panel A presents the estimates only for females, and, likewise, panel B presents the estimate only for males. In contrast to what we found in table 3, females who were in-utero exposed and were born in state with high-civil war conflict are more negatively affected to those who were not. They have on average 0.3 years less of education, and are 2.3 percent less likely to know how to read and write, both significant at the 1 percent level. On the other hand, the effect for males is not statistically different from zero and close to zero suggesting that the channel on which the civil war affected females through geography by their the place were they were born and globally for all males.

Table 5: Deviation of the birth cohorts' outcomes with state differences and by gender

	Dependent variable:		
	Years of Education	Literacy	University graduate
	(1)	(2)	(3)
<i>Panel A. Females</i>			
In utero	0.134** (0.053)	0.013*** (0.004)	-0.005 (0.003)
State Exposure	0.993*** (0.036)	0.055*** (0.003)	0.029*** (0.002)
In Utero × State exposure	-0.330*** (0.052)	-0.023*** (0.004)	0.004 (0.003)
Observations	147,060	147,390	147,060
<i>Panel B. Males</i>			
In utero	-0.377*** (0.053)	-0.035*** (0.004)	-0.003 (0.003)
State Exposure	1.054*** (0.036)	0.057*** (0.003)	0.034*** (0.002)
In Utero × State exposure	-0.079 (0.053)	0.004 (0.004)	-0.000 (0.003)
Observations	142,890	143,350	142,890

Notes: This table presents OLS estimates. Standard errors are shown in parenthesis. In utero is an indicator variable that equals 1 if a child was in utero exposed to civil conflict and was born between October 1978 and March 1980, and 0, otherwise. Literacy is a dummy variable that equals 1 if the individual knows how to write and read, and 0, otherwise. university graduate is a dummy variable that equals 1 if the individuals completed university education, and 0, otherwise. All regressions control for year of birth and year of birth squared. Panel A and B divided the sample into Females and Males respectively. All regressions control for year of birth and year of birth squared.

* Significant at 1 percent.

** Significant at 5 percent.

*** Significant at 10 percent.

5 Conclusions

The final years of the Nicaraguan civil conflict between 1978 and 1979 affected individuals who were born in-utero exposed during these years. Combining differences across regions in their exposure to the civil conflict with differences across cohorts induced by the timing of the insurrection, our preliminary findings indicate that exposure to the civil conflict affected those exposed individuals negatively. In particular, the long-term consequences of the war are lower educational attainment and higher levels of informal employability, in particular for females. The evidence presented in this paper is in line with the fetal origins hypothesis. Further work is necessary to estimate the welfare long-term impact of the civil war conflict. Nicaragua lacks of information of the civil war about casualties, and period of conflict which can offer a better understanding of the negative effects of the civil war.

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