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Transitory shocks and long-term human capital accumulation: the impact of conflict on physical health in Peru

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Transitory shocks and long-term human capital accumulation: the impact of conflict on physical health in Peru*

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Abstract

The recent literature on human capital highlights the importance of investments during the first few years after birth as a determinant of economic outcomes later in life, including labour productivity. This paper assesses the relationship between conflict exposure –a transitory, aggregate, shock– and early nutrition. The relationship between conflict exposure and human capital outcomes can be put into doubt due to the endogenous nature of conflict. In this paper I use a rich dataset that permits me to trace the intensity of a country-specific, large-scale, conflict across regions and over time at the monthly frequency over a 20-year period. I use this data to link conflict exposure prevalent around the time of birth to child-level outcomes of birth cohorts born over an analogous time period. The identification strategy exploits differences in the intensity of exposure between siblings in turn determined by year-month of birth. Results show that, on average, early exposure to conflict did not have an effect on infant mortality but had large negative effects on short-term nutritional outcomes, particularly for the poor. These results suggest that, unless compensatory investments were at place, the Peruvian conflict might have had long-term effects on human capital accumulation through a nutritional channel.

JEL: I12, J24, J13, O15,
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1 Introduction

Armed conflict is an extensive phenomenon in the developing world. In recent times, conflicts have taken place in areas as diverse as Central and South America, East Central Europe and sub-Saharian Africa (Buhaug and Gates 2002; Gleditsch et al. 2002). Some studies such as Collier (1999), Collier and Hoeffler (1998), Miguel et al. (2004), among others, have analyzed the economic causes of war as well as its effects on economic growth, with a focus on physical capital and aggregate investment. More attention has been given recently to study the impact of conflict on the accumulation of human capabilities[1]. During episodes of armed conflict both household and community economic activities are disrupted and the provision of public services is likely to be affected (Adam-Ghobarah et al. 2004). This can lead to sub-optimal levels of investment in basic health and education compared to non-conflict or low-intensity conflict scenarios.

The motivation that drives this study is that disinvestments in human capital during the first few years of life can have long-lasting implications (see Strauss and Thomas (2007), Cunha et al. (2006) and Grantham-McGregor et al. (2007) for comprehensive reviews). Deficits in early nutrients negatively affect the process of acquisition of skills during childhood, lead to lower educational attainment and to lower labour market productivity (Alderman et al. 2006; Glewwe et al. 2001; Maluccio et al. 2009). This suggests that, even if post-conflict household income returns to pre-conflict levels, war can compromise the rate of return of later investments in human capital for those affected early in life.

This paper assesses the impact of the internal armed conflict that took place in Peru between the early 80s and the mid 90s on early child development. Specifically, the aim is to test whether exposure to violence stemming from this conflict led to an increase in infant mortality, and, conditional on surviving, to a decrease in the nutritional status of those children affected by conflict around birth. Issues related to the timing of exposure, differential effects according to household characteristics and the effects of conflict on access to health services are addressed.

A difficulty in the study of the impact of conflict on household and individual outcomes is the endogenous nature of conflict. Given that poverty and inequality can simultaneously act both as a trigger for conflict and as a driver of higher mortality and poor nutritional outcomes, results linking the two phenomenon are likely to be spurious. One way to partially overcome this identification problem is to exploit differences in violence exposure levels within a country. For instance, Chamarbagwala and Morán (2010) and Leon

[1]The term human capabilities refers to the stock of skills and health accumulated over the life cycle. See Cunha et al. (2010).

(2009) exploit differences in the intensity of conflict over time to study the impact of war on educational attainment. Another study, more directly related to the analysis presented here, exploits variation in violence timing across regions to identify the impact of conflict on early nutrition in Burundi (Bundervoet et al. 2009). The implementation of these strategies is quite data intensive: both reliable estimates of conflict levels over time and/or across regions within a country as well as outcomes from several birth cohorts observed at comparable age-periods is required. In the case of Bundervoet et al., the extent to which the authors can properly identify the effect of conflict on nutritional status is severely limited by the fact that the exposed and non-exposed cohorts are observed at different age-periods. In their analysis, the non-exposed cohort was younger (below 2 year-old on average) than the exposed cohorts (above 3 year-old on average) at the time of the survey. As it is well known in the nutrition literature based on extensive evidence from developing countries, among infants, very young children are well protected from nutritional insults, which reflects in better physical health compared to their older counterparts (see Martorell 1999, pg. 289). It follows that the non-exposed children were likely to be healthier in absence of the conflict simply by virtue of being younger.

This study implements an arguably ideal approach to identify the effect of conflict on early physical health. It does so by taking advantage of a rich dataset that enables us to trace the temporal and geographical evolution of the intensity of the armed conflict that took place in Peru between 1980 and 2000, with month-level precision. This information is used to link conflict intensity prevalent around the time of birth (between the 12 months before birth and the 24 months after birth) to child-level outcomes of birth cohorts born between 1970 and 1998 as observed in repeated cross-sections from the Peru Demographic and Health surveys. In the case of the analysis of nutrition, child outcomes are observed since 1986. The advantage of using repeated cross-sections is that several birth cohorts are observed at comparable age periods. Estimates of the average impact of conflict on infant mortality and nutritional status are obtained after adding several layers of fixed effects, including maternal fixed effects; i.e., the analysis compares children born from the same mother.

It is argued that the temporal and geographical evolution of the conflict is unlikely to be correlated with regional inequality trends. Nevertheless, to deal with potential endogeneity due to unobservable region-level time-variant characteristics, estimations further control for region-level linear trends and region-level gross domestic product per capita. Results are also reported for sub-samples of regions grouped according to their level of development in the pre-conflict period[2] and to whether they were affected by

[2]Below the national average access to basis services according to the 1981 National

high-levels of violence[3] –in the latter case, identification is obtained conditional on exposure.

Based on this strategy, findings lead to the conclusion that the conflict did not have an effect on infant mortality. On the other hand, on average early exposure to conflict is found to be associated to lower nutritional outcomes as proxied by height-for-age Z-scores. The result is remarkably consistent across all the proposed specifications. In the preferred specification, a one percent increase in conflict-intensity leads to a decrease in height-for-age Z-scores equivalent to 0.18 of a standard deviation, which for a 5 year-old child implies being 0.8 centimeters smaller than the median reference child; what is more striking, comparing children in the two extremes of the early-life conflict exposure distribution, children at the top of the conflict intensity distribution are found to be on average 0.8 standards deviations smaller compared to those born in periods of no violence or very low violence, which translates into a slowdown in growth of 3.4 centimeters. Additional evidence is provided to argue that the results are unlikely to be driven by sample selection due to selective migration.

In the second part of the analysis different aspects are studied to elucidate the linkages between conflict exposure and child outcomes. Evidence strongly suggests but does not allow us to conclude that the second year of life was the key year of exposure. This result holds after controlling for conflict intensity levels in adjacent years –i.e., before the child was conceived, and after the second year of life.

In terms of who suffered the most, *ceteris paribus* it is found that children born in households with better educated mothers suffered less from conflict exposure. On the other hand, complementary evidence suggests that in areas afflicted by high-intensity conflict access to health services was altered: sometimes for worse (higher probability of a child being delivered at home), but sometimes for better (increase in vaccination rates).

The evidence presented here represents a contribution to the empirical literature on the impact of transitory shocks on human development. While the analysis only deals with short-term implications, an extensive body of research suggests that, unless costly compensational investments were in place, early-life exposure to the Peruvian armed conflict could have had large effects on subsequent human capital formation through a nutritional channel.

This document is organized as follows. Section 2 describes characteristics of the country and of the conflict pertinent to this study. Section 3 motivates the nature of the empirical analysis with a diff-in-diff example of the conflict

Census.

[3]Above the national average in per capita terms.

impact on infant mortality rates. Section 4 lays out in detail the empirical strategy. Section 5 presents the data used for the analysis. Section 6 reports the main results, robustness checks and provides a discussion and interpretation of the findings. Section 7 presents additional results that inform on the pathways of the conflict. Section 8 concludes.

2 The country and the conflict

In Peru, a country inhabited by 28 million people, almost half of the population is classified as poor and close to one out of five as extremely poor, i.e., they cannot satisfy a minimum level of caloric intake.[4] The country is divided in three climatic zones: the Amazonian jungle in the east, the Highlands in the centre and the Pacific Coast in the west. The highest rates of poverty and extreme poverty are observed in the rural side of the country, especially in the Highlands -inhabited by Quechua and Aymara speakers- and in the Amazonian jungle (see table 1).

The last two decades of the twentieth century proved to be a turbulent time in the history of the country. At the beginning of the 80s, Peru was making its transition to democracy after 12 years of military dictatorship. During President Garcia's first period (August 1986 - July 1990) the country underwent one of its worst economic crises in modern history, with a decrease in gross domestic product of 19.8% and an overall increase in consumer prices of 5,210%[5]. This was followed by a period of market-oriented reforms during President Fujimori's first period (August 1990 - July 1995), which marked the economic recovery of the country.

On top of the economic turbulence, although arguably related to it, during the 80s Peru experienced an unprecedented surge of violence due to the rise of two insurgent groups: the Shining Path and the Tupac Amaru Revolutionary Movement (SP and TARM, respectively). SP, the largest of the two groups, started its activities in 1980, followed by TARM two years later. Both organizations were small in absolute and relative terms.[6] Neverthe-

[4]As in Sanchez (2008), I follow the consumption-based poverty definition established by the Peruvian Bureau of Statistics (INEI), according to which a person living in a household whose expenditure per capita is not enough to acquire a basket of basic goods is considered as poor (i.e., below the poverty live). Analogously, a person unable to satisfy a minimum amount of caloric intake (as defined by a daily caloric norm) is considered as extremely poor. The caloric norm range between 2,133 and 2,232 calories a day per capita depending on the geographical area.

[5]Own calculations based on official figures provided by the Peruvian Institute of Statistics (Instituto Nacional de Estadística e Información).

[6]At its peak, SP had no more than 2,900 militant members, although it was supported by a larger base of around 18,000 non-militant members that collaborated with them. No more than 5,000 of these members were armed (CVR 2003, Tome II, Chapter 2, pg. 14;

Table 1: Peru: poverty indicators

Area	Poverty rate (%)	Extreme poverty rate (%)	Proportion of Population (%)
Total	45	16	100
By area of residence			
Urban	31	5	72
Rural	69	37	28
By natural region			
Coast	29	3	52
Highlands	63	33	38
Jungle	57	22	10
By domain: highlands			
Urban Coast	30	3	-
Rural Coast	49	14	-
Urban Highlands	40	10	-
Rural Highlands	77	47	-
Urban Jungle	50	18	-
Rural Jungle	62	25	-
Lima City	24	1	-

Source: INEI 2006. Table taken from Sanchez (2008)

less, both groups proved to be a threat to the State. In the early 80s, the aim of SP was to start a so called 'popular war' by gaining the support of the peasant population. To achieve this, it first tried to create a vacuum of power in towns located in the countryside in the southern Highlands.[7] Their methods included: selective killing of democratically-elected representatives (e.g., town majors) and members of the police force; sabotage of elections; bombing of public and private buildings (police stations, bank agencies, town councils, but not schools or health centers); destruction of electric towers. In 1983, the government sent the National Army to the south of the country to fight these groups, eventually forcing them to retire to other areas of the country (center Highlands and the Amazonian jungle). The intensity of the conflict greatly reduced in late 1986. In 1989, there was a second rise of violence, as SP reorganized and brought the war to major cities across the country. Although the conflict did not stop there, the virtual defeat of SP came in 1992-93 after its main leaders were captured and the Army intensified its interventions in the Highlands and in the Amazonian Jungle. The violence however did not stop until well into the late 90s.

and, Tome II, Chapter 2, Appendix 1)

[7]This was supposed to be followed by a process of indoctrination, which never fully materialized.

Because the most intense part of the armed conflict took place in the rural Highlands, Quechua and Aymara speakers were the groups with the highest exposure to violence. There is no evidence of large-scale displacement due to the conflict, except in some specific communities. The issue of possible selective migration is discussed in section 5.2.

The chronology of the conflict can be summarized in the following five subperiods (CVR 2003, Tome I, Chapter 1.4): (a) May 1980 - December 1982: the rise of SP; (b) January 1983 - June 1986: the rise of TARM and the beginning of the armed conflict, with the Army fighting the insurgent groups in the southern Highlands, in the regions of Ayacucho, Huancavelica and Apurimac; (c) June 1986- March 1989: conflict intensity reduces, focus of the violence translates to the center Highlands and the Amazonian Jungle; (d) March 1989 - September 1992: an exacerbation and geographical expansion of the conflict, including major cities; and (e) September 1992 - onwards: a decline in the activities of the insurgent groups. Figure 2 in the appendix shows the geographical evolution of the conflict across these five periods.

3 Empirical motivation

To motivate the essence of the empirical analysis, table 2 compares the evolution of infant mortality rates of two birth cohorts: those born before 1982 (row a); and, those born between 1983 and 1986 (row b). As an illustration, the analysis is restricted to Huancavelica (column 1) and Ayacucho (column 2). Both regions shown similar trends in mortality before the conflict (see figure 4). Furthermore, both regions were affected by high-levels of violence, yet Ayacucho was affected earlier and with a higher intensity. Given that by 1983-1986 the level of violence in Huancavelica was relatively small compared to that observed in Ayacucho,[8] this region is used as a control group in this comparison. Although average mortality reduced in both groups between 1976-1982 and 1983-1986, the reduction was less pronounced in Ayacucho compared to Huancavelica, corresponding to periods when Ayacucho was affected by high-intensity violence. The difference in the difference between both groups across the two periods is found to be statistically significant. While informative, this comparison does not exploit the quality of the information available nor does it deal with possible sources of endogeneity that can still afflict pure diff-in-diff strategies.

[8] A total of 2319 human right violations were reported in Ayacucho between 1983 and 1986. During the same period, 265 cases were reported in Huancavelica.

Table 2: Infant mortality by group-averages in Ayacucho and Huancavelica

		Huancavelica	Ayacucho	Difference
		(1)	(2)	(2)-(1)
(a) Born between	Mean	0.2214	0.1416	-0.079
1976-1982	s.e.	0.012	0.010	0.016***
	n	1444	1447	
(b) Born between	Mean	0.1614	0.1245	-0.036**
1983-1986	s.e.	0.012	0.011	0.016
	n	935	827	
Difference	Mean	-0.059***	-0.017***	-0.042*
(b) - (a)	s.e.	0.017	0.015	0.023

4 Methodology

To trace the impact of the armed conflict on child outcomes, the empirical specification is as follows,

$$H_{ijt} = \alpha_t + \delta_k + \kappa_{jt} Trend + \beta D_{jt} + \Gamma X_{ijt} + \Lambda Z_{jt} + \epsilon_{jt} + \mu_{it} + \eta_{ijt} \quad (1)$$

where H_{ijt} is a health outcome of child i born in region j in period t; α_t represents characteristics common to all children born in period t (the birth-cohort fixed effect); δ_k stands for place of birth fixed effects[9]; $\kappa_{jt} Trend$ is a linear time trend specific to the region of birth; D_{jt} is the armed-conflict intensity variable that is region and time (year and month of birth) specific; X_{ijt} is a vector that controls for child exogenous characteristics (sex, and, if the outcome is early nutrition, age in months),[10] Z_{jt} is a vector of region-specific, time-varying, controls; ϵ_{jt} and μ_{it} are time-varying, region-level and individual-level unobservable characteristics, respectively; and, η_{it} is an error component, assumed to be i.i.d. In this specification, β measures both the direct as well as the indirect effect of D_{jt} on H_{ijt}. Note that most of the effects are likely to be indirect, i.e., conflict is likely to affect both the supply of public services and household income, which, in turn, can affect the provision of inputs used to produce H_{ijt} (e.g., food, medicines).

Equation 1 is the OLS equivalent of a difference-in-difference estimation for the continuous variable case, with the addition of a region-specific linear time trend to partially capture differential time-trends across regions. This

[9] Town of birth is observable in the mortality analysis. Only region of birth is observable in the nutritional analysis. In the latter case, $j = k$

[10] Maternal education and other household characteristics are not controlled for in the baseline specification as they could have been compromised by exposure to war.

methodology is akin to that used to study the effects of policy changes (or health crisis: e.g., infectious diseases) that are measured at the cluster level but that arguably have an impact at the individual level. For instance, Almond (2006) used this approach to study the impact of the 1918 Influenza pandemic in the US. Similarly, Duflo (2001), tested the impact of a school construction programme in Indonesia by exploiting differences in exposure to treatment across regions and between birth cohorts. Earlier studies using a similar methodology applied to the effects of famine on infant mortality include Razzaque et al. (1990) and Stein et al. (1975).

The birth-cohort fixed effects take into account differences across cohorts that are purely due to year of birth – children that were born in the late 80s and in the 90s benefited from better health services compared to those born in the 70s, which is reflected in a substantial reduction in average infant mortality rates between the 70s and the 80s as shown in table 3. Similarly, the inclusion of place of birth fixed effects in the estimation controls for time-invariant characteristics in the location of birth that might be correlated to both the intensity of the armed conflict and the child outcomes. This matters because, with the exception of Lima, the country capital, those regions that were more severely affected by the armed conflict were also the poorest regions in the country.[11] The baseline specification uses region of birth fixed effects for the nutritional analysis and town of birth fixed effects for the mortality analysis. In addition, the preferred specification uses household (maternal) fixed effects for both outcomes.

In estimating the coefficients of interest, β, endogeneity is still possible if violence intensity is correlated to time-varying unobservable region characteristics. An obvious source of endogeneity arises from differences in region-level inequality trends, only imperfectly captured through the inclusion of region-specific linear time-trends and gross domestic product regional trends. Inequality trends can act both as a trigger of political violence and as a determinant of the outcomes of interest. To a certain extent this is not considered to be a problem in this study because the way the conflict evolved over time and across regions was driven by strategic considerations of the guerrilla groups on how to surrender the capital of the country and by the dynamics of the confrontation between the main actors of the conflict, both of which can be taken as orthogonal to inequality trends –for instance, moving the conflict from the countryside to the cities was planned by the Shining Path; retreating to the Amazonian Jungle was a consequence of the Army taking control of the southern Highlands–. Nevertheless, to account for potential remaining endogeneity induced by time-varying region-level

[11] As explained in section 2, the Shining Path intentionally started its efforts to create vacuums of power in the regions of Ayacucho, Apurimac and Huancavelica, the poorest regions of the country, because it was from there that they expected to gather local support to start the ‘popular war’.

unobservables, region-level annual gross domestic product per-capita during the year of birth (Z_{jt}) is included and results are reported for groups of regions that are fairly comparable in terms of exposure to war and pre-conflict characteristics. Regions are grouped on the basis of both pre-conflict characteristics and levels of conflict exposure. In particular, sub-samples are defined that contain: (a) only the less-developed regions as measured by the 1981 National Census; and, (b) only those regions affected by levels of per-capita violence above average. It turns out that (b) is a sub-sample of (a). The exact definition of these sub-samples is reported in the next section, after the data is presented.

Going back to the equation, the two outcomes of interest are infant mortality (denoted as P_{ijt}, where P_{ijt} takes the value of one if the child was alive after age 2 and 0 otherwise) and, conditional on surviving, early nutritional status, denoted as $N_{ijt}|(P_{ijt} = 1)$. The equations of interest can then be defined as follows,

$$P_{ijt} = \alpha_{P,t} + \delta_{P,k} + \kappa_{P,jt} Trend + \beta_P D_{jt} + \Gamma_P X_{ijt} + \Lambda_P Z_{jt} + \epsilon_{P,jt} + \mu_{P,it} + \eta_{P,ijt} \tag{2}$$

and

$$N_{ijt}|(P_{ijt} = 1) = \alpha_{N,t} + \delta_{N,j} + \kappa_{N,jt} Trend + \beta_N D_{jt} + \Gamma_N X_{ijt} + \Lambda_N Z_{jt} + \epsilon_{N,jt} + \mu_{N,it} + \eta_{N,ijt} \tag{3}$$

The conflict intensity variable is defined differently according to the outcome. In the case of nutritional status (N_{ijt}), the period of exposure comprises the *in utero* period and the first 24 months after birth. Evidence suggests that this is a sensitive period for nutrition investments[12]. While the third year of life is also considered to be part of this sensitive period, its inclusion would require to further restrict the sample to children above 36 months at the time of the interview, which considerably reduces sample size. The third year is therefore not considered as part of the period of exposure in the baseline model, but it is added in complementary regressions.

When the outcome of interest is infant mortality (P_{ijt}), the conflict variable is defined as the total conflict exposure between the 12 months before birth

[12]The inclusion of the *in utero* period is consistent with the evidence linking intrauterine nutrition intake to adult health (Behrman and Rosenzweig 2004). Such linkage is thought to be related to the way the fetus adapts to poor nutrition (organ adaptation), which, while efficient to raise survival probabilities during periods of food scarcity, brings complications later in life when nutrition intake stabilizes. See Godfrey and Barker (2000). Likewise, some studies have shown that nutrition intake during the first 3 years of life translates into improvements on adult health (for an extensive review see Strauss and Thomas (2007), pg. 3420-3427).

and the first 12 months after birth in the region where the child was born. While the period of exposure selected is arbitrary, it tries to be consistent with the fact that most of the observed infant mortality in Peru takes place during the first months after birth. It is intended to measure the general conflict environment surrounding the gestational period and the time of birth rather than to exactly measure the level of violence to which a child was exposed while alive.

5 Data

Between 2000 and 2002, the Peruvian Truth and Reconciliation Commission (TCR) underwent a massive project to analyze the consequences of the conflict and to quantify its impact in terms of human losses and human right violations. As part of this project, the TCR collected around 19,000 testimonies from either victims of the conflict or their relatives. It did so by installing 11 offices in different parts of the country from which testimonies were both received and actively collected by mobile teams that were meant to "visit all the regions in the country". This information was then crossed with information collected by non-profit human right organizations and the State over the 1980-2000 period. Based on this work, approximately 22,000 cases of human right violations were identified to have taken place between January 1980 and December 2000 (CVR 2003, Tome IX, Annex 2), including murder, kidnapping, forced disappearance, torture and rape, committed by either the insurgent groups or State forces. In more than 90% of the cases, it was possible to identify the date when the event took place to the precise month.

The temporal evolution of the conflict as measured by the TCR data, expressed as the total number of human right violations per year, is described in figure 3 in the appendix[13]. The data do a good job in representing the stylized facts of the conflict. They show two peaks of violence in 1983-85 and 1989-92, which is consistent with what is understood happened at the time. They also show that most of the violence took place in regions located in the Highlands (see table 8 for an split of the average conflict intensity by region).

The conflict related human rights violations were identified at the district precision and the exact month and year of the events is registered. Therefore, it is possible to link this data to stratified household surveys. The TCR data is matched to child outcomes registered in the Peru Demographic and Health

[13] I assume that prior to 1980 the number of human right violations due to the armed conflict was zero , which is consistent with the fact that SP and TARM started operating in the 80s.

Surveys (DHS) collected in 1992, 1996 and 2000.[14] These surveys provide information on the health and nutritional status of children below 5 years old born from women in their reproductive period (between 15 and 49 years of age). The surveys also contain information on the history of births of the interviewed women. By pooling the Demographic and Health surveys from 1992, 1996 and 2000 it is possible to trace the nutritional status accumulated up to the second year of life for birth cohorts born between 1986 and 1998 and the infant mortality rates of birth cohorts born between 1970 (or earlier) and 1998.

Descriptive statistics based on DHS data are reported in the table below. The first three columns report estimates that are nationally representative. Compared to 1970 figures, infant mortality rates decreased considerably between the 80s and the 90s, partially reflecting improvements in public health infrastructure. Chronic malnutrition levels also dropped during the 90s. The last column report average infant mortality and prevalence of chronic malnutrition in the pooled sample used in the estimations (not nationally representative). In the case of mortality, it is the sample average of birth cohorts born between 1970 and 1998. For chronic malnutrition, is the sample average of birth cohorts born between 1986 and 1998.

Table 3: Peru: descriptive statistics

	Early 70s	Early 90s	Late 90s	DHS Pooled sample
	(1)	(2)	(3)	(4)
Mortality rate per 1000	108	52	33	107
Chronic malnutrition (%)		37	25	34

Source: DHS official reports and own estimates.

Although in theory conflict-intensity can be imputed at the level of the district, DHS does not release the name of the districts. Therefore, at this stage the analysis is presented by matching the TCR and DHS datasets at the region level for the mortality analysis and at the macro-region level for the nutritional analysis (24 regions and 13 macro-regions).[15] While this can be seen as a limitation of the analysis, a region-level imputation of the conflict intensity is defendable on several grounds. First, from the information

[14]While DHS was also implemented in 1986, due to security concerns in that occasion the fieldwork purposively excluded the regions of Ayacucho and Huancavelica.

[15]During a brief period between the late 80s and early 90s, Peru was formally divided in 13 macro-regions instead of its traditional 24 regions. DHS 1992 is stratified at the macro-region level, whereas DHS 1996 and 2000 are stratified at the region level. Although one possibility was to use DHS 1996 and 2000 alone, DHS 1992 is important to be included in the nutritional analysis because it covers the 1987-1992 period. Therefore, I use DHS 1992, 1996 and 2000 for the nutritional analysis and DHS 1996 and 2000 for the mortality analysis.

provided by the TCR it can be deduced that the collection of testimonies was centralized at the region-level and the probability of a certain district being sampled is likely to be positively correlated with the priors that the Commission had on which were the districts most severely affected by the conflict, leading to spurious correlation because the most affected were also the poorest districts. Secondly, spatial correlation is likely to matter to understand the effects of conflict on household outcomes. For instance, violence in nearby districts would likely affect a district even if no events were reported there. In that sense, a region-level imputation is a good proxy of the general conflict-related conditions faced by a given household. Thirdly, a region-level imputation also helps to deal with possible within-region migration that could have taken place during the time of the conflict.

5.1 Measurement variables

The temporal distribution of the conflict exposure variable used for the analysis is reported in figure 3 by region. To account for the skewness of the variable in its linear form, a log-transformation is used for the estimations.[16]

Anthropometric measures are used to assess early nutritional status looking at physical height as the outcome of interest. Since physical growth faltering during the first few years of life is understood to be mainly the consequence of poor dietary habits over extended periods (see Martorell 1999, pg. 288), height can be seen as a stock variable that captures the history of nutritional investments allocated to a given child. The World Health Organization provides a growth curve reference for children between 0 and 60 months. Height can then be standardized according to this norm. The resulting variable –height-for-age Z-scores– measures the distance of a child relative to the median healthy child of the same age and sex. The average Z-score in the pooled sample is -1.39 with a standard deviation of 1.32

5.2 On sample selection

Some aspects related to the nature of the conflict and the characteristics of the survey could lead to sample selection. A first source of possible selectivity bias is that only the mortality and nutritional history of children born from women that were alive at the time of the interview can be observed. This means, first, that war orphans are not observed (DHS samples biological children), and, second, that there could be 'missing children' as a consequence of increases in adult mortality. In both cases bias in the estimation of the parameter of interest is likely to be downward, under the

[16]Where log-violence is equal to violence plus one. This is to avoid sample truncation of those children born in periods / zones of no-violence.

plausible assumption that the unobserved children were likely to be more vulnerable to the conflict because their parents were.

A second type of sample selection could arise from displacement or selective migration due to the conflict. Displacement itself is not a concern in this study. While it is documented that some specific groups of people in the Highlands and the Amazonian Jungle were forced or chose to leave their communities of origin, there are no reports of large-scale displacement due to the conflict. A related but different aspect is that of selective migration. In Peru, as in other developing countries, there has been and continues to be a process of migration from the countryside to the cities. The migration wave started in the early 60s and continued through the 80s and 90s.[17] Within this migration wave it is possible that, as violence escalated, some families might have chosen to migrate to other areas of the country. Because the conflict was more intense in the countryside, rural-urban conflict-related migration can be expected especially from the Highlands (e.g., Ayacucho) to Lima (the capital of the country) as well as within regions. Similarly, urban-urban migration is also likely to have occurred (e.g., from Huamanga, the capital of Ayacucho, to Lima). A priori, the sign of the potential selection bias is ambiguous, depending on whether those families that migrated were relatively wealthy (and, thus, with a low chance of being effectively affected by the conflict had they stayed) or, rather poor families (who would not have migrated in absence of the conflict but that had a high chance of being affected had they stayed).[18] In the former case the resulting bias would likely be upwards, whereas in the latter case it would be downwards. In section 6.2, I present results that can be used to learn about the profile of the conflict-migrants and use this information to substantiate a robustness check of the results.

6 Results

6.1 Main results

Main results to test the conflict effect on nutritional status are presented in table 4 below, with height-for-age Z scores as the dependent variable and log-conflict intensity between 12 months before birth and the 24 months

[17] In 1962, 52% of the population lived in rural areas. This proportion reduced to 42% in 1970, 36% in 1980 and 31% in 1990 according to the Peru National Institute of Statistics.

[18] The assumption that on average wealthy families were less likely to be affected stems from the characteristics of the Peru war. While wealthy families were "class enemies", the guerrilla groups were relatively small in number to target them specifically. It is more plausible to think that the conflict affected the population indirectly, by disturbing community activities, trade and access to public services. In that sense, wealthy families had more alternatives to buffer against these events.

after birth as the regressor of interest. Results are reported for the national sample.

Table 4: Dependent variable: Height-for-age Z-scores
Birth cohorts included: 1986-1998

	OLS1	OLS2	OLS3
	(1)	(2)	(3)
Log-Conflict intensity -12 to 24m	-.166	-.166	-.176
	(0.024)***	(0.024)***	(0.053)***
	(0.029)***	(0.029)***	(0.03)***
	(0.022)***	(0.022)***	(0.053)***
Child's age	-.016	-.016	-.038
	(0.0009)***	(0.0009)***	(0.005)***
	(0.001)***	(0.001)***	(0.005)***
	(0.0006)***	(0.0006)***	(0.005)***
Child is male	-.066	-.066	-.081
	(0.016)***	(0.016)***	(0.029)***
	(0.016)***	(0.016)***	(0.034)**
	(0.016)***	(0.016)***	(0.029)***
Regional GDP per capita		0.0003	0.0004
		(0.0008)	(0.001)
		(0.0006)	(0.0008)
		(0.0007)	(0.001)
Obs.	24912	24912	9731
R^2	0.143	0.143	0.255
Year of birth fixed effects	Yes	Yes	Yes
Region of birth fixed effects	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes
Household fixed effects	No	No	Yes

Notes: Three types of robust standard errors are reported: clustered at the region/year-of-birth level (first row), at the region level (second row) and at the household level (third row); *, **, *** denote significance at 10%, 5% and 1% levels.

Results can be contextualized as follows. In the preferred specification that controls for region linear trends and exploits within-household variation (column 3), keeping other factors constant, a one percent increase in conflict exposure reduces average height-for-age Z-score by about 17.6% of a standard deviation. For a 5 year-old child, this represents a loss of approximately 0.8 centimeters compared to the median well-nourished child. Because of the inclusion of several layers of fixed effects, the estimated effect is identified purely on the basis of how the intensity of the conflict changed as the guerrilla groups moved across different regions over time. As previously argued, the geographical and temporal evolution of the conflict was a consequence of the dynamics of the confrontation between the State and the guerrilla groups together with plans by the second group to gradually overtake the capital of the city. These events are arguably orthogonal to time-variant regional characteristics.

In table 9 in the appendix, the treatment variable is re-expressed as a categorical variable. This is done in order to unveil possible non-linearities in the conflict effect. The categories are defined as follows: (1) non-conflict is an independent category; (2) the rest of the distribution is split in quintiles; (3) the top quintile is further disaggregated in a bottom, middle and top groups (tertiles). The difference between those children never exposed to violence and those in the top of the highest quintile arising from the estimation is striking: the latter group is 0.84 standard deviations smaller (table 9, column 1), which for a 5 year-old implies a loss of around 3.4 centimeters. Differences are significant not only between children exposed to violence compared to those never exposed, but also, conditional on exposure, deficits in height-for-age are observed across all the conflict exposure quintiles.

Results assessing the impact of conflict on infant mortality are presented in table 5, using a linear probability model for whether the average child is alive after the first 24 months of life (the dependent variable is 1 if the child is dead two years after birth, 0 otherwise). Although different alternatives have been tested, here for simplicity results are only reported for those households that never moved from their localities of origin, as only for them exposure to conflict can be imputed with precision.[19] Judging from the results, there is no evidence of an impact of conflict on infant mortality. Table 14 reports results re-expressing the conflict variable in categories to unveil possible non-linearities, but this specification gives no additional insights. Additional estimations not reported here show that the result is the same when focusing on the same period that the one used for the nutritional analysis (birth cohorts born between 1986 and 1998) or when including in the estimations those families that migrated.

Taken literally, findings indicate that the conflict had an effect on nutritional status but not on infant mortality. There are at least three possibilities that could explain this differential effect. First, conflict compromised nutritional investments on the child, but not so much as to alter the probability of survival.[20] Secondly, the result could be reflecting underlying differences

[19]In the case of DHS 1992, 1996 and 2000, the surveys do not identify the long-term place of residence of those families that lived in a different locality five years before the time of the interview (a locality can be a town, a district or a specific area within a town/district). This means that, in the case of infant mortality estimates, calculated on the basis of retrospective information up to 20 years before the time of the interview, conflict intensity estimates around birth can only be imputed with certainty to birth cohorts born in families that have always lived in the same region or that moved within 5 years before the interview. In this version of the paper, results are reported only for this group of households (non-migrated sample).

[20]Poor nutritional intake is associated to mortality directly as well as indirectly, the

Table 5: Dependent variable: Infant mortality (1 if child died before age 2, 0 otherwise

Birth cohorts included: 1970-1998

	Full sample		
	(1)	(2)	(3)
Log-conflict int. -12 to 12m	-.0009	-.0009	-.001
	(0.002)	(0.002)	(0.002)
Child is male	0.012	0.012	0.011
	(0.003)***	(0.003)***	(0.003)***
Regional GDP per capita			-.00007
			(0.00005)
Obs.	53040	53040	51106
R^2	0.063	0.064	0.01
Year of birth fixed effects	Yes	Yes	Yes
Town of birth fixed effects	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes
Household fixed effects	No	No	Yes

Notes: robust standard errors, clustered at the town level; *, **, *** denote significance at 10%, 5% and 1% levels.

in the relevant inputs associated to height-for-age and infant survival. In particular, neonatal mortality –of high prevalence in Peru– is closely related to the availability of health infrastructure, whereas by its nature height-for-age is related mainly to home-based investments. As such, the result could be indicating that the conflict did not significantly affect access to health services, an idea that is further explored in section 7. Third, the non-result for mortality could be driven by attenuation bias due to measurement error associated with the retrospective recollection of the history of births or by downward bias due to conflict-related adult mortality.

6.2 Robustness check and other considerations

Some aspects pertinent to the identification of the conflict effect are discussed here. A first consideration is that not all regions in the country were affected by violence and regional patterns in nutrition and mortality rates are likely to differ between conflict and non-conflict regions. While it is argued that the temporal spread of violence had more to do with the dynamics of the confrontation between the State and the guerrilla groups, as a robustness check results are reported for sub-samples of regions that are similar in terms of pre-conflict characteristics and in violence exposure.

latter by reducing resistance to infectious diseases. (see Scrimshaw et al. 1986, pg. 13).

In looking for an adequate counterfactual, one possibility is to focus only on those regions that were among the less developed before the conflict, as measured by access to basic services in the early 80s –according to the 1982 National Census–, defined as having an indicator of access to basic services below the national average.[21] Another alternative is to focus on those regions that were affected by relatively high levels of violence. If high-violence is defined as having a number of human right violations per year per capita above the national average,[22] the resulting sub-sample is virtually a subset of the less developed regions defined before.[23] See details of the sub-samples in table 8. When the outcome of interest is infant mortality, results are reported for both sub-samples. In the analysis of height-for-age results are reported for a sub-sample that resembles the second sub-sample,[24] labeled as the high-intensity conflict sub-sample in the tables.

As shown in table 6, the negative impact of conflict on height-for-age is still observed in the defined sub-sample using the preferred specification (column 3). Moreover, the magnitude of the coefficient is larger than that obtained initially, which could be either because households in this sub-sample were more vulnerable to the conflict or, relatedly, because the nature of the conflict itself was different in the selected regions.[25] In the case of infant mortality (table 15 in the appendix), while the coefficient of interest has now the expected sign, the point estimate is statistically not different from zero.

A second consideration (pertinent to the height-for-age analysis) is that conflict intensity in one period of time could be correlated with that of previous years. If that were the case, the results obtained could be reflecting household exposure to conflict before the time of conception that in turn have a persistent effect. To take into account this possibility, results are re-estimated controlling for conflict intensity two and three years before birth. Results (table 10 in the appendix) show a clear indication that the relevant

[21]The indicator used is an average of access to piped water, electricity and sewage system as reported in the 1981 National Census. The regions selected based on the this criteria are Amazonas, Apurimac, Ayacucho, Cajamarca, Cusco, Huancavelica, Huanuco, Madre de Dios, Pasco, Piura, Puno, San Martin and Tumbes.

[22]These regions are Apurimac, Ayacucho, Huancavelica, Huanuco, Junin, Pasco, San Martin and Ucayali.

[23]The only difference is that this sub-sample excludes Junin.

[24]Apurimac, Ayacucho, Huancavelica, Huanuco, Junin, Pasco, Cusco and Madre de Dios. Six out of these eight regions were among the most affected by violence and seven out of eight were among the less developed according to pre-conflict characteristics. Because DHS 1992 is stratified at the level of macro-regions, sub-samples 1 and 2 can not be fully identified in this case.

[25]While the variable used to proxy for conflict intensity does a good job in terms of identifying the areas and moments over time where the war was most intense, it might still fail to capture that the type of violence generated by the conflict was different in the Highlands compared to major cities in the Pacific Coast, such as Lima.

Table 6: Robustness check I: high-violence regions — Dependent variable: Height-for-age Z-scores

Birth cohorts included: 1986-1998

	OLS1	OLS2	OLS3
	(1)	(2)	(3)
Log-Conflict intensity m12 to 24	-.890	-.894	-.486
	(0.107)***	(0.105)***	(0.191)**
Child's age	-.008	-.008	-.029
	(0.002)***	(0.002)***	(0.011)**
Child is male	-.038	-.038	-.070
	(0.034)	(0.034)	(0.054)
Regional GDP per capita		-.013	-.026
		(0.006)**	(0.01)**
Obs.	6944	6944	3020
R^2	0.122	0.123	0.267
Year of birth fixed effects	Yes	Yes	Yes
Region of birth fixed effects	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes
Household fixed effects	No	No	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels. **High-violence sample**: Macro-regions Andres Avelino Caceres (Huanuco, Pasco, Junin), Inka (Cusco, Madre de Dios, Apurimac) and Libertadores (Ayacucho and Huancavelica).

effect is that of exposure between the pregnancy period and the first 24 months of life. Further issues related to timing are discussed in the next section.

A final possible concern with the results concerning height-for-age is related to sample selection. It is reasonable to think that selective migration due to the conflict could have occurred. What is less clear is the sign of the selection bias resulting from it. Bearing in mind that a rural-urban migration wave had started before the conflict and persisted through the period of study and well into the 90s, what is relevant is not the profile of the migrant families *per se*, but the extent to which families that migrated because of the conflict differ from the average migrant families. One aspect, corroborated by the data, is that on average those that migrate from the countryside to the city are significantly more educated than those that stay.[26] To elucidate to what

[26] In an unreported estimation, an increase in average years of education is found to predict an increase in the probability of migrating from the countryside to the city. The estimation controls for year of birth (to take into account secular trends in migration), includes a dummy for whether the person was more than 18 year-old at the moment of the migration and its interaction with years of education. The dummy variable controls for the fact that those that migrated at a younger age accumulated education in their new

extent the conflict migrant was different from the non-conflict migrant, I use information from the Demographic and Health Surveys (1986, 1992, 1996 and 2000) to test for differences in the educational profile of people that migrated to cities after the age of 18 between 1970 and 1995 –the cut-off age is used to partially ensure education was attained before migration and not as a consequence of it. Conflict-migrants are defined loosely as those that migrated in either 1983-86 or 1989-92, the peak periods of violence. In particular, the 1983-86 period corresponds to the highest peak of the conflict and with most of the violence taking place in the countryside, whereas in 1989-92 the conflict was less intense and more geographically spread across urban and rural areas. In addition, the 1989-92 is also associated with the worst part of the economic crisis that isolated the country. The crucial test is, then, whether the 1983-86 migrants are different.

The estimations are reported in table 13 (appendix). The data corresponds to a sample of women that migrated to cities after the age of 18, between 1970 and 1995. In column 1, the dependent variable, years of education, is regressed on two binary variables for whether migration took place in 1983-86 and 1989-92, respectively. The estimation control for year of birth –to account for secular trends in migration– and the direction of the migration movement (urban-urban, rural-urban). Column 2 further distinguishes whether those that migrated in 1983-86 and 1989-92 were rural-urban or urban-urban migrants. No differences emerge in the educational profile of the 1983-86 migrants, either on average (column 1) or when distinguishing between the type of migration (column 2). This suggests that people that migrated either from the countryside to cities or between cities between 1983 and 1986 were not significantly different compared to the average migrant in terms of their educational profile.

In the case of the 1989-92 migrants, while on average no differences arise, when looking at differential effects according to the type of migration two patterns are found: (a) the 1989-92 urban-urban migrants were more educated than urban-urban migrants from other years; (b) the 1989-92 rural-urban migrants were less educated than rural-urban migrants from other years.

While the migration to cities occurred between 1989 and 1992 can not be fully linked to the conflict because of the national economic crisis that was taking place at the time, if these results were to be taken as informative of conflict related migration, the fact that rural-urban migrants were relatively less educated (compared to those that migrated from rural areas to the cities

area of residence, whereas the interaction term allows to estimate the correlation between education and the migration decision for those that accumulated all their education before migrating. The result linking better education with an increased in the probability of migrating is obtained from this interaction term.

in other years) means that the conflict effect for rural households can be taken as a lower bound for this subgroup. Going back to the main analysis, when re-estimating the preferred specification for the sub-sample of rural households, the point estimate obtained is -0.28 (compared to -0.176 in the full sample) and it is statistically significant at the 99% level. This result gives an additional argument to claim that, at the very least, the results presented allow to identify the effect of conflict on rural households.

7 The pathways of conflict

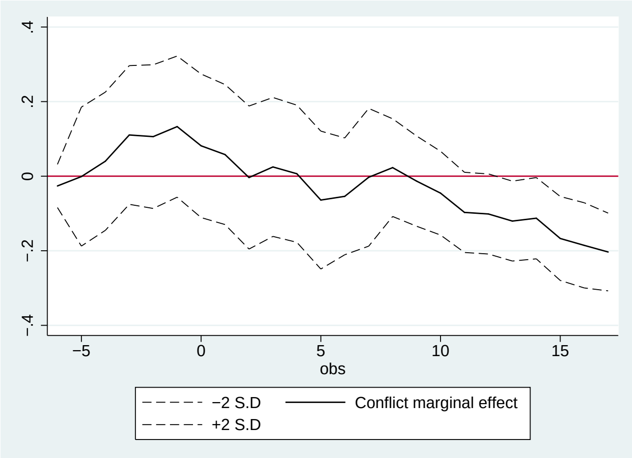
Several aspects that can help to elucidate the ways through which the conflict compromised nutrition investments are analyzed. While the pathways of conflict can only be imperfectly explored using non-purposively designed survey data, some dimensions of the conflict effect can be assessed. First, whether the effect on height-for-age was due to exposure during specific windows of time during the critical stage of early childhood. Secondly, whether some types of households were more vulnerable to the conflict. Thirdly, whether conflict exposure altered access to health services. These aspects are discussed here. In all cases, the result and model specification presented in table 4, column 3 (the preferred specification), is used as the baseline.

7.1 Timing of exposure

In all the previous estimations, implicitly the same weight has been given to all periods between the twelfth month before and the twenty-fourth month after birth. Figure 1 below reports how the conflict effect changes as different weights are given to conflict-month exposure using a rolling-window of size 12 months with 1 month steps. The horizontal axis indicates the center of the rolling-window. When it takes the value of -6 (first observation on the left), it means the moving-window is centered in month -6 (i.e., conflict exposure is defined as total exposure between month -12 and 0). In the other extreme, when in takes the value of 18 (last observation on the right), the moving-window is centered in month 18. The figure shows suggestive evidence that conflict exposure compromises nutrition only as the second year of life is approached. Only as this period is reached the coefficient becomes statistically different from zero, as informed by the confidence interval.

The idea of differential effects according to the year of exposure is explored formally in table 7 below. There, the conflict effect is unpacked to explicitly distinguish between exposure during the year before birth, the first and the second year of life. Column 1 shows the result of doing this, keeping all the other characteristics of the specification constant. In line with the

Figure 1: Impact of violence on nutrition: a timing approach



Note: the vertical axis represents the size of the conflict effect. The horizontal axis, the center of a rolling window of size 12 months with 1 month steps used to calculate the conflict effect. For instance, when the horizontal axis takes the value of 5 –middle of the graph–, the conflict effect is obtained by giving only weight to conflict intensity observed 6 months after and 6 months before the 5th month of life.

pattern shown in figure 1, results suggest that the effect of conflict on height-for-age is associated with exposure during the second year of life. The year-coefficients associated to the *in utero* period and the first year have the expected sign, but are only half as large as the coefficient associated with exposure during the second year. However, the differences across the coefficients do not stand as statistically significant, as informed by the F-test of equality of coefficients, so, while suggestive, the evidence can not be taken as conclusive.[27] If the differences in the point estimates were still to be taken as informative, this would be consistent with the notion that at very early stages the child is well protected from nutritional insults due to breastfeeding, becoming gradually vulnerable after this stage is surpassed. On the other hand, the fact that conflict during the second year of life seems to drive the result can not *per se* be taken as evidence that this is the sensitive period of exposure, because the conflict could have affected nutrition investments with lag (e.g., by affecting the household capacity to produce nutrition investments in the next year).

Columns 3 and 4 expand the specification to further account for conflict intensity during the third year of life[28] and the second and third year before

[27]Results of the Bonferroni test, not reported here, do not show any evidence of the coefficient associated to the second year of life to be significantly different from the other year coefficients on a one-by-one evaluation.

[28]For these estimations I use the original sample corresponding to children above 24

birth, respectively. It is confirmed that conflict intensity in these adjacent years do not predict changes in height-for-age. At the same time, the year-coefficients of the selected age-period remain virtually unchanged.

Results are also reported controlling for region-level gross domestic product per capita levels prevalent during each of the exposed years and interactions between these terms and conflict intensity (column 2). Because the conflict is likely to have altered the macroeconomic environment at the region level, the inclusion of year-GDP per capita levels help to disentangle the effect that the war had on height-for-age through its effect on the macroeconomic environment of the region. When these terms are included the interaction terms are not statistically significant, whereas the conflict-year coefficients remain statistically significant.

7.2 Heterogeneous effects

I tested whether the conflict effect has a differential effect according to the following characteristics: mother's years of education, household socio-economic status as measured by a standard wealth index, whether the household is located in a rural area and whether the household is located in one of the regions affected by high-intensity conflict. See table 11 in the appendix. The main result (column 4) is that the conflict effect was lower for households with better educated mothers. This effect persists after adding interactions with all the other characteristics mentioned above. For a household with average education (mother had 5.57 years of completed years of schooling) the marginal conflict effect is -0.17 whereas for a household where the mother has completed secondary schooling the effect reduces to -0.07. As such, results show that while everywhere across the country an increase in conflict intensity compromised nutritional status, this effect was higher for households from poorer backgrounds.

7.3 Access to pre-natal and post-natal services

To test whether access to health services was compromised due to the conflict, auxiliary estimations are reported using the preferred specification. The selected outcomes are: whether the child was ever vaccinated, number of antenatal visits and whether the child was delivered at home. These variables are informative of access to health services that could have been compromised either through supply or demand channels. The first pattern observed in the results (table 12 in the appendix) is that conflict intensity

months old. This means that exposure during the third year of life can only be measured imperfectly have not . While the sample could be further restricted to children above 36 months old, this considerably reduces sample size.

during the first year of life is positively associated with the (linear) probability of a child ever receiving a vaccination (columns 1 and 2). The result seems to be driven by the effect of conflict on regions afflicted by high-intensity conflict. A possible explanation is that the government could have tried to improve access to health services precisely in those areas affected by the conflict (e.g., through vaccination campaigns) so that the result could be reflecting placement effects. The number of antenatal visits was not compromised by conflict intensity during the pre-birth period. On the other hand, results show that conflict intensity around the pregnancy period influenced the (linear) probability of a child being delivered at home. While the average conflict effect is hard to grasp (it has a sign opposite to expected), looking further at the differential effects it is found that conflict only affected the probability of a child being delivered at home in high-intensity conflict regions, by increasing the probability of this event in these areas.

The fact that the conflict seemingly only compromised access to health services in high-intensity conflict areas while it affected negatively early nutritional status in households all across the country suggests that the conflict effect was not primarily mediated by its effect on access to health and nutrition related services. It is, then, likely, that the observed effect of conflict on physical health took place mainly through an income channel, that in turn compromised household investment on the child. Unfortunately, data limitations preclude us from testing this channel. Note that even though the estimations account for region-level gross domestic product per capita prevalent around the time of birth, this only deals with the general macroeconomic conditions and does not account for differential economic dynamics within the region, which can be more closely related to household income.

8 Conclusions

The results of this study show that there is a linkage between exposure to conflict and early nutrition. The richness of the data available makes it possible to deal with some of the main pitfalls of endogeneity that afflict the study of the impact of conflict on individual outcomes. The conflict-nutrition linkage is found to be robust to all the proposed specifications. As such, this study substantially improves the scope of the current evidence on the effect of conflict on early health. The evidence obtained matters because the age of exposure analyzed corresponds to a sensitive period of nutritional investments that in turn is related to later economic outcomes, including labour productivity.

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9 Appendix

Table 7: Timing issues — Dependent variable: Height-for-age Z-scores
Birth cohorts included: 1986-1998

	OLS1	OLS2	OLS3	OLS4
	(1)	(2)	(3)	(4)
(a) Log-Conflict intensity -48 to -37m				0.02
				(0.027)
(b) Log-Conflict intensity -36 to -25m				-.026
				(0.028)
(c) Log-Conflict intensity -24 to -13m				-.041
				(0.052)
(d) Log-conflict intensity -12 to -1m	-.039	-.074	-.032	-.032
	(0.03)	(0.06)	(0.031)	(0.031)
(e) Log-conflict intensity 0 to 11m	-.028	-.078	-.022	-.027
	(0.033)	(0.072)	(0.034)	(0.034)
(f) Log-conflict intensity 12 to 23m	-.060	-.093	-.063	-.067
	(0.024)**	(0.05)*	(0.024)***	(0.024)***
(g) Log-Conflict intensity 25 to 36m			0.027	0.017
			(0.026)	(0.027)
GDP per capita Year -1		0.001		
		(0.002)		
GDP per capita Year 1	0.0003	-.001	0.0004	0.0006
	(0.001)	(0.002)	(0.001)	(0.001)
GDP per capita Year 2		0.001		
		(0.002)		
GDP per capita x Conflict: year -1		0.0004		
		(0.0003)		
GDP per capita x Conflict: year 1		0.00009		
		(0.0004)		
GDP per capita x Conflict: year 2		0.00006		
		(0.0003)		
F-test of equality of coeff.				
(d)=(e)=(f)				
p-value	0.713	0.959	0.5534	0.5345
(d)=(e)=(f)=(g)				
p-value	-	-	0.0929	0.1305
(a)=(b)=...=(g)				
p-value	-	-	-	0.1089
Obs.	9731	8090	9731	9731
R^2	0.255	0.187	0.255	0.255
Year of birth fixed effects	Yes	Yes	Yes	Yes
Region of birth fixed effects	Yes	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes

Notes: Estimation also controls for child's age and gender; robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 8: Definition of sub-samples (ordered by Conflict Intensity)

Region	Climatic Zone	Conflict Intensity per year	Conflict Intensity per 1000 hab.	Average Access to Services* (0-1)	Sub-sample 1 (less dev. regions)	Sub-sample 2 (high-violence regions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ayacucho	Sierra	123.52	25.1	0.13	Yes	Yes
Huanuco	Sierra	53.16	9.5	0.13	Yes	Yes
Huancav.	Sierra	20.94	5.8	0.08	Yes	Yes
Apurimac	Sierra	20.58	5.3	0.10	Yes	Yes
Ucayali	Jungle	12.90	5.3	0.15	Yes	Yes
SanMart.	Jungle	20.90	4.5	0.21	Yes	Yes
Junin	Sierra	39.45	4.4	0.32		Yes
Pasco	Sierra	5.61	2.9	0.29	Yes	Yes
Puno	Sierra	9.06	0.9	0.12	Yes	
Cusco	Sierra	7.32	0.7	0.21	Yes	
Piura	Coast	5.81	0.6	0.27	Yes	
Ancash	Coa./Sie.	5.29	0.5	0.33		
Lima	Coast	14.94	0.3	0.75		
Ica	Coast	1.35	0.3	0.47		
Tumbres	Coast	0.29	0.3	0.35		
LaLiber.	Coast	2.74	0.2	0.42		
Cajamar.	Sierra	1.68	0.2	0.11	Yes	
Lambayeq.	Coast	1.35	0.2	0.46		
Arequipa	Sierra	0.90	0.1	0.53		
Loreto	Jungle	0.68	0.1	0.32		
Amazonas	Jungle	0.65	0.2	0.11	Yes	
M.deDios	Jungle	0.16	0.1	0.19	Yes	
Tacna	Coast	0.037	0.0	0.66		
Moquegua	Coast	0.00	0.0	0.47		
National Average			2.8	0.29		

Notes. In columns (3) and (4), conflict intensity is estimated as the total number of conflict-related human right violations occurred between 1980 and 2000. In column (5), average access to basic services by region correspond correspond to 1981 figures (source: National Census 1981.

Table 9: Non-linearities — Dependent variable: Height-for-age Z-scores
Birth cohorts included: 1986-1998

	OLS1
	(1)
No violence	
Quintile 1	-.343
	(0.246)
Quintile 2	-.426
	(0.255)*
Quintile 3	-.677
	(0.268)**
Quintile 4	-.766
	(0.283)***
Quintile 5, Bottom	-.748
	(0.298)**
Quintile 5, Middle	-.763
	(0.304)**
Quintile 5, Top	-.840
	(0.332)**
Child is male	-.081
	(0.029)***
Child's age	-.040
	(0.005)***
Regional GDP per capita	0.001
	(0.001)
Obs.	9731
R^2	0.256
Year of birth fixed effects	Yes
Region of birth fixed effects	Yes
Region linear trends	Yes
Household fixed effects	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 10: Robustness check II: adding other periods of exposure — Dependent variable: Height-for-age Z-scores

Birth cohorts included: 1986-1998

	OLS1	OLS2
	(1)	(2)
Log-Conflict intensity -48 to -25m		0.002
		(0.014)
Log-Conflict intensity -12 to 24m	-.176	-.177
	(0.053)***	(0.053)***
Child's age	-.038	-.038
	(0.005)***	(0.005)***
Child is male	-.081	-.081
	(0.029)***	(0.029)***
Regional GDP per capita	0.0004	0.0004
	(0.001)	(0.001)
Obs.	9731	9731
R^2	0.255	0.255
Year of birth fixed effects	Yes	Yes
Region of birth fixed effects	Yes	Yes
Region linear trends	Yes	Yes
Household fixed effects	Yes	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels. **High-violence sample**: Macro-regions Andres Avelino Caceres (Huanuco, Pasco, Junin), Inka (Cusco, Madre de Dios, Apurimac) and Libertadores (Ayacucho and Huancavelica).

Table 11: Heterogenous effects — Dependent variable: Height-for-age Z-scores

	OLS1	OLS2	OLS3	OLS4	OLS5	OLS6
	(1)	(2)	(3)	(4)	(5)	(6)
Log-Conflict intensity -12 to 24m	-.177	-.230	-.269	-.177	-.146	-.259
	(0.053)***	(0.061)***	(0.06)***	(0.053)***	(0.055)***	(0.079)***
Log-conflict x wealth index		0.123				0.001
		(0.062)**				(0.083)
Log-conflict x years of education			0.017			0.017
			(0.005)***			(0.006)***
Log-conflict x high-violence sample				0.018		0.042
				(0.061)		(0.082)
Log-conflict x rural					-.064	-.025
					(0.04)	(0.06)
Log-conflict x rural x subsample						0.031
						(0.087)
Obs.	9731	9731	9731	9731	9731	9731
R^2	0.255	0.256	0.257	0.255	0.255	0.257
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 12: Dependent variable: pre-natal and post-natal investments

Birth cohorts included: 1986-1998

	1 if child was ever vaccinated, 0 otherwise		Number of antenatal visits		1 if child was delivered at home, 0 otherwise	
	(1)	(2)	(3)	(4)	(5)	(6)
Log-conflict intensity 0 to 11m	0.023	0.024				
	(0.01)**	(0.02)				
Log-conflict 0 to 11m x wealth index		-.015				
		(0.025)				
Log-conflict 0 to 11m x years of education		0.0004				
		(0.002)				
Log-conflict 0 to 11m x rural		-.002				
		(0.017)				
Log-conflict 0 to 11m x high-violence region		0.053				
		(0.025)**				
Log-conflict 0 to 11m x rural x high-vio		-.029				
		(0.026)				
Log-conflict intensity -12 to -1m			-.040	-.090	-.016	-.010
			(0.059)	(0.137)	(0.008)*	(0.018)
Log-conflict -12 to -1m x wealth index				0.026		-.005
				(0.177)		(0.023)
Log-conflict -12 to -1m x years of education				0.01		0.0001
				(0.011)		(0.002)
Log-conflict -12 to -1m x rural				-.031		-.016
				(0.119)		(0.016)
Log-conflict -12 to -1m x high-violence region				-.080		0.059
				(0.16)		(0.025)**
Log-conflict -12 to -1m x rural x high-vio				0.064		-.034
				(0.165)		(0.026)
Obs.	9731	9731	8658	8658	9731	9731
R^2	0.131	0.133	0.02	0.021	0.01	0.014
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 13: Sample selection analysis — Educational profile of women that migrated to cities between 1970 and 1985

Dependent variable: years of education

	OLS1	OLS2
	(1)	(2)
Born in the countryside/town	-3.229	-3.065
	(0.095)***	(0.127)***
Migrated between 1983-86	-.027	-.003
	(0.144)	(0.204)
Born in the countryside/town x Migrated btw 1983-86		-.030
		(0.271)
Migrated between 1989-92	-.050	0.273
	(0.116)	(0.164)*
Born in the countryside/town x Migrated btw 1989-92		-.592
		(0.217)***
Obs.	6980	6980
R^2	0.184	0.185
Year of birth fixed effects	Yes	Yes
Other controls	No	No

Notes: The analysis is restricted to women age 18 or above at the moment of the migration. Robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 14: Non-linearities — Dependent variable: Infant mortality (1 if child died before age 2, 0 otherwise)

Non-migrated sample

Birth cohorts included: 1970-1998

	OLS1
	(1)
No violence	
Quintile 1	-.006
	(0.006)
Quintile 2	-.008
	(0.007)
Quintile 3	-.005
	(0.007)
Quintile 4	-.020
	(0.009)**
Quintile 5, Bottom	-.015
	(0.011)
Quintile 5, Middle 1	0.007
	(0.012)
Quintile 5, Middle 2	-.008
	(0.012)
Quintile 5, Top	-.007
	(0.014)
Child is male	0.015
	(0.003)***
Regional GDP per capita	-.00003
	(0.00005)
Obs.	53040
R^2	0.009
Year of birth fixed effects	Yes
Town of birth fixed effects	Yes
Region linear trends	Yes
Household fixed effects	Yes

Notes: robust standard errors, clustered at the region - year of birth level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 15: Dependent variable: Infant mortality (1 if child died before age 2, 0 otherwise)

Non-migrated sample

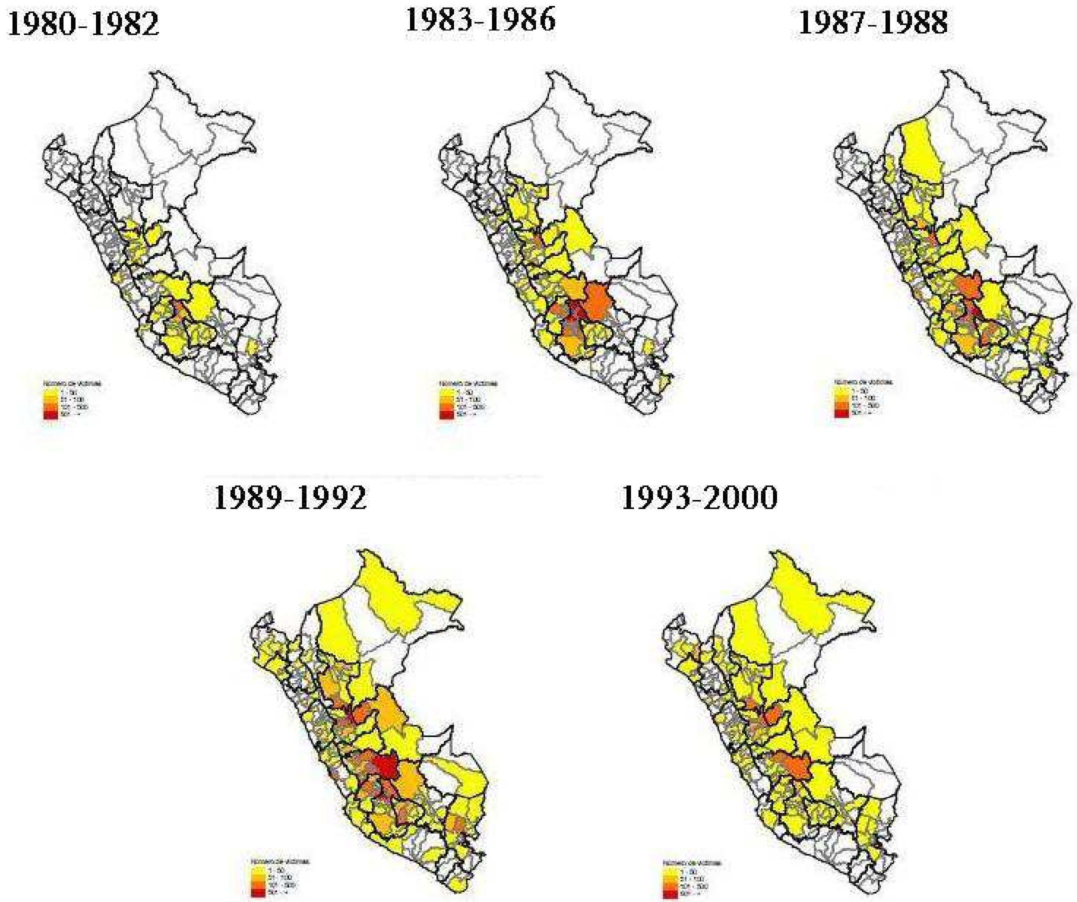
Birth cohorts included: 1970-1998

	Full Sample	Sub Sample 1	Sub Sample 2	Sub Sample 3	Full Sample	Sub Sample 1	Sub Sample 2	Sub Sample 3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log-conflict int. m-12 to 12	-.0009	0.00007	0.001	0.017	-.001	-.0004	0.002	0.013
	(0.002)	(0.002)	(0.004)	(0.011)	(0.002)	(0.003)	(0.004)	(0.015)
Child is male	0.012	0.016	0.024	0.029	0.011	0.013	0.02	0.024
	(0.003)***	(0.004)***	(0.005)***	(0.009)***	(0.003)***	(0.004)***	(0.006)***	(0.011)**
Regional GDP per capita					-.00007	-.0001	-.0005	-.0005
					(0.00005)	(0.0002)	(0.0004)	(0.001)
Obs.	53040	29663	17507	5929	51106	29003	17084	5826
R^2	0.064	0.063	0.06	0.067	0.01	0.012	0.01	0.015
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Town of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	No	No	No	No	Yes	Yes	Yes	Yes

Notes: robust standard errors, clustered at the town level; *, **, *** denote significance at 10%, 5% and 1% levels.

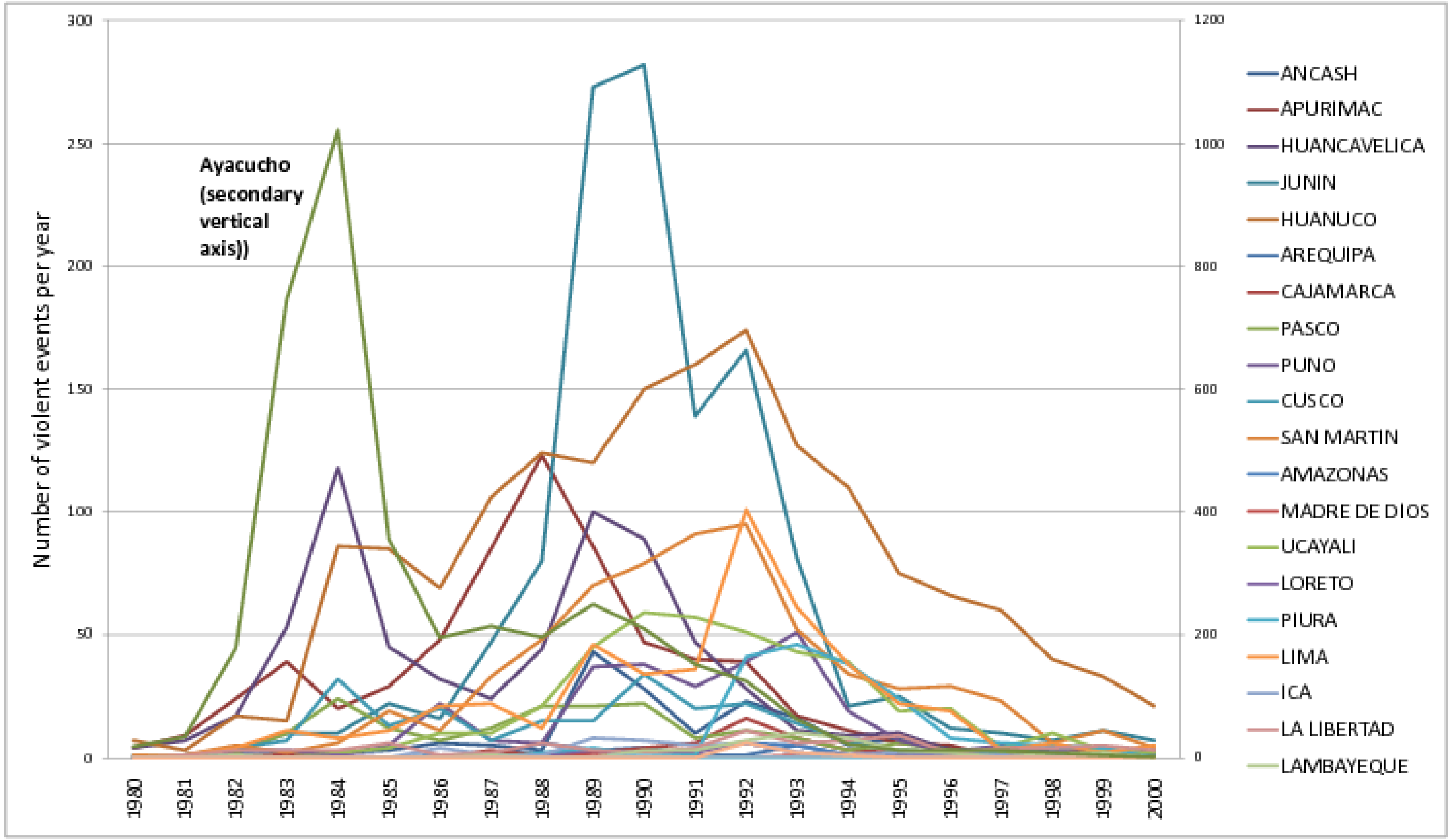
Sub-samples: **Sub-sample 1** only includes the less-developed regions (as defined by before-conflict access to basic services, see Table 1): Amazonas, Apurimac, Ayacucho, Cajamarca, Cusco, Huancavelica, Huanuco, Madre de Dios, Pasco, Piura, Puno, San Martin and Tumbes; **Sub-sample 2** only includes regions that were affected by a high level of violence between 1980 and 1995: Apurimac, Ayacucho, Huancavelica, Huanuco, Junin, Pasco, San Martin and Ucayali; **Sub-sample 3** includes Ayacucho and Huancavelica.

Figure 2: Geographical Spread of the Conflict Over Time



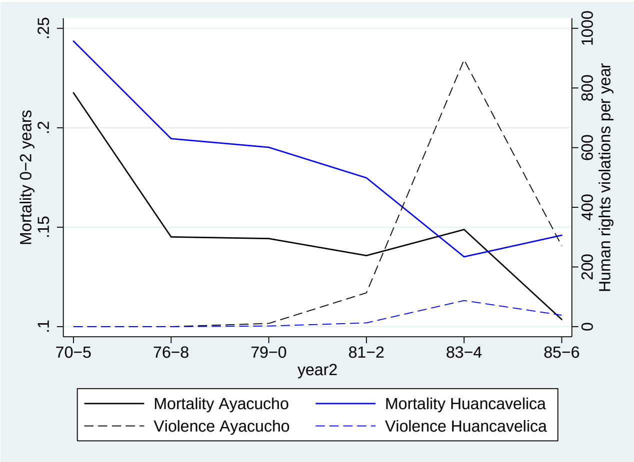
The map divides the country in its 25 regions. The darker the color of a region is, the more intense was the conflict in that area as measured by the number of people that died or disappeared in that period. The maps were extracted from the final report published by the Peruvian Truth and Reconciliation Commission.

Figure 3: Conflict Temporal Evolution by Region



Source: Government of Peru.

Figure 4: Infant mortality trends before the conflict in Ayacucho and Huancavelica



Source: DHS