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Cost of Introducing Multi-Party Elections: Impact of the 1992 Ethnic Violence on Child Health in Kenya

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ABSTRACT

By exploiting ethnic violence resulting from the introduction of Kenya's first multi-party electoral system in 1992, we examine the impact of exposure to the violence on child health. The results suggest that prenatal exposure to the violence increased the probabilities of low birth weight and premature birth by 18.9% and 5.1%, respectively. In addition, an extra month of in utero exposure to the violence reduced birth weight by 94 grams. The results of our findings reaffirm the significance of the nine months in utero as one of the most critical periods in life shaping future health, economic and education trajectories.

Keywords: Kenya, election, ethnic violence, child health, *in utero*, maternal stress, birth weight

JEL classification: I15, J13, O15

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1. Introduction

After Independence, many African countries adopted single-party elections which were used by authoritarian regimes to obtain public legitimacy (Golder & Wantchekon, 2004). However, from the early 1990s followed by the end of the Cold War, multiparty democracy was introduced in an effort to end decades of authoritarian single party rule, to encourage constitutional reforms and to uphold human rights (Dercon & Gutiérrez-Romero, 2012; Klaus & Mitchell 2015). The political transition to democracy in many African countries raised the question whether democracy helps in improving the well-being of these nations. Existing studies found that being in democratic countries for a longer time resulted in better health (Besley & Kudamatsu, 2006) and changing an incumbent president in multiparty elections is more likely to decrease child mortality (Kudamatsu, 2012) [1].

It seems that introducing democracy results in better health outcome to some extent. However, multiparty elections have failed to be implemented properly[2] hence have been marked by- violent attacks (Straus & Taylor, 2009)[3], most of which are ethnically instigated (Bekoe, 2010; Collier, 2009; Snyder, 2000). Such election-related ethnic violence is responsible for enormous economic losses as well as psycho-social consequences. Although previous studies focus more on the positive impact of democracy, enough attention has not been paid to the cost of introducing

[1] The mechanism by which democracy can improve welfare of the people is through better service delivery and provision of public goods (Persson & Tabellini, 2009). New evidence emerges that democratic transition does not have the same impact on the rich and the poor and has affected the poor negatively (Ramos, 2014; Ross, 2006; Blimpo et al., 2013).

[2] During the 1975-2011 periods, 80% of African polls were disrupted by violence, bribery, intimidation or inequitable government interference, compared to 40% in non-African countries (Bishop & Hoeffler, 2014).

[3] Out of 213 cases of elections in Africa from 1990 to 2007, 19 percent resulted in violence.

democratic elections in general and particularly on ethnic violence associated with introduction of multiparty elections in ethnically diverse societies. Thus, this study examines the impact of election-related ethnic violence on one of the most important welfare measures; child health.

In recent years, epidemiologists and economists have found empirical evidence suggesting that shocks *in utero* have negative effects on child health which in turn can have long-run effects on education, income and health in adulthood. These studies are informed by the fetal origins hypothesis proposed by Barker (1995) whereby he provided evidence to support the proposition that circumstances *in utero,* particularly nutrition lead to chronic degenerative diseases such as coronary heart disease, blood pressure, and diabetes in adulthood.[4] Economists have expounded on this hypothesis by investigating a wider range of fetal shocks out of which they have found significant impacts in later life such as reduced test scores, labor productivity, income, health, and education attainment (Aizer et al., 2009; Behrman & Rosenzweig, 2004; Case et al. 2011; Islam et al., 2015; Lee, 2014; Leon, 2012; Mansour & Rees, 2012; Akresh & de Walque, 2008; Akresh et al., 2012; Shemyakina, 2011; Ichino & Winter-Ebmer, 2004; Minoiu & Shemyakina, 2012). Consequently, if circumstances in pregnancy affect an individual's outcomes in adulthood, emphasis should be placed on identifying conditions that can affect prenatal health and development.

[4] From a biological perspective, maternal stress during pregnancy results in changes in adrenal cortisol, adrenaline and noradrenaline hormones produced in the adrenal glands thus stimulating the production of Corticotrophin Releasing Hormone (CRH) which in turn reduces the length of the gestation period, thus contributing to low birth weight and premature birth. CRH levels increase throughout the second and third trimesters (Wadhwa et al., 1998; Wadhwa et al., 2004; Hobel et al., 1999; Eskenazi et al., 2007; Torche, 2011).

Existing studies examining the impact of maternal stress on early childhood health outcome show that stress emanating from exposure to conflict or violence situations worsens birth outcomes. [5] Despite decades of ethnically and politically instigated unrests, however, their negative effects on child health have not been adequately investigated. [6] By exploiting exposure to ethnic violence resulting from Kenya's first multi-party elections in 1992 as an exogenous source of maternal stress, we therefore aim to contribute to a growing literature on the effects of disruption of life *in utero* through maternal stress on birth outcomes

The first episode of ethnic violence in Kenya coincided with the introduction of multi-party democracy in the early 1990s. When western donors decided to freeze aid in 1991, Arap Moi, the president of Kenya, agreed to constitutional changes allowing multiparty elections in December 1992 (Ajulu, 1998). The 1991/1992 violence lasted the longest time and is particularly significant due to its sporadic nature and was viewed as a serious threat to the unity of the country and rule of law.[7] The violence took place mainly in Kenya's Rift Valley region, where the opposition had a strong presence and because the objective of the violence was to ensure that communities supporting the opposition parties did not register as voters and if registered would not be able to vote (Kimenyi & Ndung'u, 2005). The economic consequences of the violence were devastating

[5] Prenatal shocks analyzed in relation to birth outcomes are: September 11 terrorist attack in New York (Eskenazi et al., 2007); terrorist attacks in Colombia (Camacho, 2008); homicides in rural Brazil (Koppensteiner & Manacorda, 2013); 2007 post-election violence in Kenya (Bell et al., 2012); Eritrea-Ethiopian conflict (Akresh et al., 2012); Rwandan civil war (Akresh et al., 2011); Burundian civil war (Bundervoet et al., 2009); Guatemalan civil war (Chamarbagwala & Moran, 2011).

[6] The exception is Bell et al. (2012) which investigated the impact of the 2007 post-election violence in Kenya on birth weight. There are, however, methodological limitations.

[7] The 1992 violence lasted from October 1991 up to the December 1992 elections and beyond throughout 1993.

and in areas affected by the ethnic violence, there must be a negative impact on people, especially on pregnant women and infants.

By utilizing the exogenous variations of timing of the pregnancy and location of each child, we identify whether he or she was exposed to ethnic violence in utero. After careful analyses, we find that prenatal exposure to the violence increased the probabilities of low birth weight and premature birth by 18.9% and 5.1%, respectively. In addition, an extra month of in utero exposure to the violence reduced birth weight by 94 grams. The results of our findings reaffirm the significance of the nine months in utero as one of the most critical periods in life shaping future health, economic and education trajectories.

The rest of the paper is organized as follows. Section 2 gives a background, triggers and consequences of ethnic and political violence in Kenya. Section 3 explains the data source and presents descriptive statistics. Section 4 explains the estimation strategy while Section 5 discusses the results and robustness checks. Section 6 provides policy implications and concludes.

2. Background

2.1. Triggers of the 1991/1992 Ethnic violence

Central to ethnic violence in Kenya is the issue of land ownership. The epicenter of the violence; Rift Valley region, is the most fertile part of Kenya occupying 40% of agricultural land. This area was referred to as “white highlands” during the British colonial rule and was originally home to pastoralists’ ethnic groups of Kalenjin, Maasai, Samburu, and Turkana. The colonial government introduced land regulations between 1899 to 1915 by forcefully confiscating the most productive farm land in the Rift Valley and reserving it for the white settlers. This led to the dislocation and disinheritance of thousands of Kenyans who had lived in the Rift Valley. Since the pastoralist communities did not have agricultural experience, the white settlers migrated thousands of Kikuyu, Kisii, Luhya, and Luo squatters to Rift Valley to provide sharecropper labour in the early 1900s hence overcome the cheap labour shortage for their farms (Nyukuri, 1997; Oyugi, 1997; Kimenyi and Ndung'u, 2005).

At independence in 1963, land issues were still not resolved. Kenyans who were previously squatter labourers in Rift Valley were now able to buy land individually or communally through cooperatives. Unlike the original inhabitants; Kalenjin and Maasai who were pastoralists, the squatter Kikuyu were experienced farmers and took advantage of the opportunity to purchase land. With financial assistance from President Kenyatta, many Kikuyu bought land in the Rift Valley in the 1960s and 1970s and migrated from their crowded Central region which was too small to support their growing population.[8] Since then, land grievances have always fueled ethnic violence (Oyugi, 1997; Human Rights Watch,1993; Kimenyi & Ndung'u, 2005).

Once multi-party democracy was introduced, attacks on Kikuyu and other immigrant ethnic groups living in Rift Valley were justified as taking back what was rightfully entitled to the indigenous ethnic groups and a move to end political and economic domination of the Kikuyu. Residents in areas where there were many supporters of the opposition parties were forced to

[8] The Kikuyu lost much of their ancestral land to the settler farmers. They are the largest ethnic group comprising of 21% of the population yet concentrated in one of the smallest regions.

relocate so that they could not been registered to vote in the displaced areas (Human Rights Watch, 1993; Oyugi, 1997; Nyukuri, 1997; Ndegwa, 1997; Kimenyi & Ndung'u, 2005). That is why violence took place mainly in Rift Valley and in the period before the elections.[9] Although the first incident of ethnic violence was reported on October 29th 1991, the violence occurred intensively for five months prior to the general elections from July 1992, to after the elections until July 1993. The districts with serious violence are Nakuru, Kericho, Nandi, and Uasin Gishu in Rift Valley region (Kimenyi & Ndung'u, 2005).

2.2. Consequences of the violence

The aftermath of the violence was displacement, injuries, death and loss of property. There was heightened insecurity as civilians took law into their hands by targeting the perceived enemies. This resulted into indiscriminate loss of lives across all the ethnic groups, physical injuries and psychological trauma (Human Rights Watch, 1993; Nyukuri, 1997; Kimenyi & Ndung'u, 2005). It is estimated that 1500 people lost lives while 300,000 others were displaced (Human Rights Watch, 1993; Nyukuri, 1997; Oyugi, 1997; Ndegwa, 1997). The 1991/1992 violence lasted the longest time and is particularly significant due to its sporadic nature and was viewed as a serious threat to the unity of Kenya and rule of law.[10] By the election date on December 29, 1992, many eligible voters had lost property, title deeds, and national identification cards which would have

[9] The 2007 elections resulted in ethnic violence in Kenya. The difference from the 1993 election violence is the timing and cause of violence. The 2007 violence occurred after the election results were announced hence was a protestation against the alleged rigging of results.
[10] The 1992 violence lasted from October 1991 up to the December 1992 elections and beyond throughout 1993.

enabled them to register as voters. This disruption was a major obstacle to achieving free and fair elections.

The economic consequences of the violence were devastating. The parliamentary committee established to investigate the causes and impact of the violence reported that by September 1992, the overall damage was estimated at about $ 5 million[11]. These figures were much higher by the end of 1993 (Ndegwa, 1997). While on a fact finding mission in the most affected parts of the Rift Valley region, Human Rights Watch (1993) reported that a majority of the agricultural farms were abandoned and attempts by the owners (immigrants to Rift Valley) to resume cultivation were thwarted by the Kalenjin (native ethnic group) who stole their crops and grazed their cattle in the farms. This led to severe food shortages not only in Rift Valley but the rest of the country[12]. For instance, maize production in 1992 was 390,000 tons below average. In addition, Food and Agriculture Organization (FAO) reported that the victims in Rift valley alone required 7,200 tons of cereals and 1,080 tons of others foods in emergency aid for that year (Daily Nation 14th May 1993 and 23rd May 1993 cited in Nyukuri, 1997). In addition to the economic losses, the psycho-social consequences of the 1992 violence were enormous. Approximately 1,500 lives were lost and 300,000 families displaced. The victims of the clashes were abused, injured and left impoverished (Nyukuri, 1997; Kimenyi & Ndung'u, 2005).

3. Data and Descriptive Statistics

[11] By September 1992, more than 700 lives were lost, 54,000 displaced, 9,400 houses destroyed and 3,000 heads of livestock were stolen.
[12] Kenya's staple food is maize which is largely grown in Rift Valley region.

3.1. Data

To estimate the impact of *in utero* exposure to the ethnic violence from Kenya's 1992 elections on birth outcomes, we use data from the 1993 Kenya Demographic and Health Survey (KDHS) conducted by the National Council for Population and Development (NCPD) and the Central Bureau of Statistics, Kenya. The KDHS forms part of the worldwide Demographic and Health Surveys (DHS) program designed to collect data on maternal and child health, fertility and family planning.

The nationally representative survey contains information on 7,540 women between 15-49 years. Although the DHS sample includes women aged 15-49 years, only those who have children aged 0-5 years are used in this study. This accounts for 72% of the whole sample. For our analysis, we define all children born in Rift Valley as affected by the violence, because although not everyone was a target, one does not have to be directly subjected to conflict to suffer the consequences (Islam et al., 2015). Living in a violent environment or fear of victimization and retaliation from an aggrieved party can be traumatizing, especially if there is loss of loved ones or neighbours. An example of this is the retaliation by the Kikuyu against the Kalenjin (Human Rights Watch, 1993).

The child sample contains children born between March 1988 and July 1993 (aged 0-5 years during data collection). For *in utero* exposure, children born in and before July 1992 were considered not exposed to the violence. Three sets of exposure variables are used in the analyses: The first exposure variable (born during violence) is a dummy variable taking one if a child was born during the violence and zero otherwise. This captures the impact of the shock for children born during the high intensity period regardless of the length exposed. The second exposure variable (*in utero*) is the number of months *in utero* during the violence. This estimates the possible different effect of exposure (1-9 months) among the affected children. The third set contains three dummy variables namely whether a child was exposed for 1-3 months, for 4-6 months, and for 7-9 months. The third measure allows for estimating the possible different effects of the violence depending on the timing of the pregnancy. This is an important measure for capturing the effects of the violence during the early pregnancy period as well.[13]

3.2. Descriptive Statistics

Panel A of Table 1 compares child characteristics in the full sample and between those in the violent region (Rift Valley) and non-violent regions (other regions). There are significant age differences with Rift Valley children slightly younger than those in other regions. There are however no gender or birth order differences between Rift Valley and other regions.

In Panel B, we show parental characteristics. On education status, 25.5% of mothers in Rift Valley have no education compared to 17.4% in other regions. Similar results are reported for husband or partner's education: 26.7% of the men in Rift Valley have no education in comparison

[13] An increasing number of studies show that exposure to prenatal stress in the first and second trimesters have a greater reduction in the gestational period than in the third trimester. Glynn et al. (2001) found out that first trimester exposure to the 1994 earthquake in Northridge California was associated with the greatest reduction in gestational period. Second trimester exposure had smaller impact while exposure in the third trimester was statistically insignificant. Mansour & Rees (2011) used the 2004 Palestinian Demographic and Health Survey to show that deaths caused by Israeli security forces during the first trimester were positively correlated to probability of low birth weight. These trimester estimates are however possible when the exposure period is acute such as the September 11th terrorist attacks, earthquakes and exposure during the month of Ramadhan (Almond & Mazumder, 2011). Our analysis focuses on before and after the general elections. This longer period of one year means that it is difficult to accurately distinguish the impact of the violence at each period due to overlap between trimesters.

with 16.7% in other regions. Another notable difference is in the number of months of malaria exposure in pregnancy.[14] This is particularly important because malaria is one of the leading causes of infant mortality worldwide and in Kenya accounts for 20% of all deaths in children under 5 years (Pathania, 2014). In pregnancy, it increases the probability of infant mortality through low birth weight with higher risks faced by children in malaria epidemic areas who in utero experience worse conditions (Kudamatsu et al., 2012). The epidemiological climate of Rift Valley is less conducive for the spread of malaria as evidenced by less than a month's exposure in pregnancy compared to 5.5 months in other regions.

From Panel C on household characteristics, Rift Valley has younger household heads and a lower proportion of female heads. However, the distance to hospital is further by approximately 10 kilometers. This could have hampered access to prenatal health care services in Rift Valley. On ethnicity, only Kalenjin (native) have a higher concentration in Rift valley compared to other ethnic groups.

[14] The number of months a pregnant mother was exposed to malaria one year before birth is constructed by following Kudamatsu et al. (2012). Using rainfall and temperature data (1987-1993) from the Kenya Meteorological Department, we make a binary variable for a given month in a given year for each weather station if they satisfy the following 4 conditions: First, average monthly rainfall during the past 3 months is at least 60mm. Second, rainfall in at least one of the 3 months is at least 80mm. These 2 conditions ensure the availability of vector breeding site and survival. Third, no day in the past 12 months had temperatures below 5 degree Centigrade as the vector dies under cold conditions. Fourth, average temperature in the past 3 months exceeds 19.5 degree Centigrade plus one standard deviation to allow the parasite to be infectious inside the vector body before it dies. For malaria endemic regions such as Western and Nyanza, mothers are exposed for up to 10 months while in epidemic areas such as the Rift Valley, they are exposed for just a month.

Table 2 presents descriptive statistics of main outcome variables namely; birth weight, whether a child was born with low birth weight (less than and equal to 2500g),[15] prematurely (gestation period is less than 37 weeks), and infant mortality (whether a child died before reaching one year of age). Panel A shows birth weight separately for Rift Valley and other regions. There are no significant differences in birth weight between Rift Valley and other regions for children born before or during the violence on average.

In Panel B, we replace birth weight with an indicator of low birth weight. The full sample has a low birth weight incidence of 15.6% with no differences across regions. Low birth weight in Rift valley increases to 20% during the violence period and 15% in other regions. The difference becomes significant for those who were exposed to violence for 1-3 months in utero. This suggests that the exposure to violence, especially in the first 3 months of the pregnancy, may contribute to lower birth weight.

Panel C on premature birth shows that there are statistically significant differences between Rift Valley and other regions as marked by a substantial increase in the proportion of premature births in Rift Valley from 2.2% before the violence to 7.5% during the violent period. Finally in Panel D, we compare infant mortality rates between Rift Valley and other regions. The results are somehow unexpected: infant mortality declined in Rift Valley during the violence. This is probably because regional health risks such as the spread of HID/AIDS and malaria prevalence

[15] Although the World Health Organization (WHO) defines low weight as below 2500g, survey estimates of low birth weight in developing countries are biased with heaping at multiples of 500g. DHS in particular records birth weight from mothers by using health records if available and by recall if records are unavailable. Consequently, many of the children heaped at 2500g probably weigh less than that and should therefore be classified as low birth weight (Blanc & Wardlaw, 2005; Channon et al., 2011) .

are not controlled for when comparing the mean differences.[16] Thus, in following sections, we conduct regression analyses controlling for these factors affecting infant mortality.

4. Empirical Identification Strategy

Our empirical approach exploits the possible unexpected increase of stress levels among pregnant women due to exposure to the ethnic violence. Our empirical models are as follows;

(1) $y_{imtd} = \beta_0 + \beta_1(R_d \times E_{tm}) + \beta_x X_{idt} + \alpha_t + \delta_m + \pi_e + \omega_d + \alpha_t \times \omega_d + \varepsilon_{imtd}$

where y is the outcome variable; birth weight, premature birth, or infant mortality of child i born in month m and year t in region d. The interaction term $(R_d \times E_{tm})$ identifies children born in the affected region (R_d) during the exposed period July 1992-December 1992 (E_{tm}), X_{idt} are parental, child, and household characteristics, $\alpha_{t,}$ are year of birth fixed effects, $\delta_{m,}$ are month of birth fixed effects, π_e are ethnicity fixed effects to control for differences across ethnic groups residing in the affected region, and ω_d are region fixed effects to control for geographical and development

[16] The indirect and direct costs of AIDS increased from 2-4% in the early 1990s which coincides with the violence period. The National Aids Control Council reported that there were between 250,000-300,000 AIDS orphans by 1994. Differences in regional HIV prevalence rates of Nyanza (18.3%), Nairobi (11.9%), Central (7.6%) and Rift Valley (6.9%) contributed to higher mortality rates in those regions (Omariba, 2005; Wafula et al., 2012; National Council for Population and Development, Central Bureau of Statistics, Office of the Vice Presient and Ministry of Panning and National Development, & Macro International Inc, 1994). Infant mortality rates in Central, Rift Valley and Nairobi are 31, 45 and 44.4 deaths per 1000 live births respectively which are below the 1993 national average of 61.7 deaths per 1000 births. In addition, 3 out of 4 Kenyans are at risk of contracting malaria and is responsible for one third of outpatient treatments (Internews, 2014; KEMRI, 2015). Nyanza, Western and Coast regions with high infant mortality rates also have high malaria prevalence rates with transmission all year round. The Rift Valley highlands on the other hand only have seasonal transmissions (Internews, 2014).

differences across regions, $\alpha_t \times \omega_d$ controls for differences in time and regions, βs are coefficients to be estimated, and ε is error term.

In the second specification, "month of exposure to the violence" (M) is used instead of an indicator variable for whether a child was exposed *in utero* or not. Specification (2) measures the severity of the violence based on the number of months of in utero exposure.

(2) $y_{imtd} = \beta_0 + \beta_1(R_d \times M_{tm}) + \beta_x X_{idt} + \alpha_t + \delta_m + \pi_e + \omega_d + \alpha_t \times \omega_d + \varepsilon_{imtd}$

The third specification contains three interaction terms based on the timing of the exposure.

(3) $y_{imtd} = \beta_0 + \beta_1^1(R_d \times T_{tm}^1) + \beta_1^2(R_d \times T_{tm}^2) + \beta_1^3(R_d \times T_{tm}^3) + \beta_x X_{idt} + \alpha_t + \delta_m + \pi_e + \omega_d + \alpha_t \times \omega_d + \varepsilon_{imtd}$,

where T^1 is an indicator variable taking one when a child was exposed to violence for 1-3 months; T^2 is an indicator variable taking one when a child was exposed to violence for 4-6 months; and T^3 is an indicator variable taking one when a child was exposed to violence for 7-9 months.

Birth weight records are missing for 3,223 children representing 53% of the total sample. This is because 55% of all Kenyan children were born at home and only 11.6% of them had birth weight information.[17] As it is unlikely that birth weight records are missing randomly, estimations of the impact of the violence on birth weight and low birth weight based only the sample with birth weight information are likely to be biased. Since availability of birth weight records is dependent on whether a child was delivered at a hospital/clinic or at home, using sub-sample with birth weight tends to suffer from selection bias.

[17] In contrast, 88.3% of the children delivered in clinics have birth weight records.

To correct this selection bias associated with the place of delivery, we employ the Heckman selection model. Our selection variable identifying a child as delivered at home, hospital or clinic is a dummy variable indicating whether a mother received tetanus toxoid injection during pregnancy or not. Medically, tetanus toxoid has no direct effect on fetal growth but is given to reduce the risk of the child contracting tetanus during birth (Mwabu, 2008). We assume that mothers who take the injection are also likely to be motivated to invest in good nutrition and behaviors which promote fetal growth and development thus decrease the risk of death. Such a mother is also most likely to choose the safer hospital or clinic delivery over home delivery. For the analyses of premature birth and infant mortality, the dependent variables are dummy variables. Thus, we rather apply Probit model.[18]

5. Estimation Results

5.1. Violence on Birth weight

Columns (1) - (3) of Table 3 present the estimated impact of exposure to ethnic violence on birth weight by Heckman model.[19] All specifications control for region, month of birth, year of birth, ethnicity and the interaction of region and year of birth fixed effects. The estimated coefficient in column (1) is negative but not statistically significant. However, an additional month of *in utero* exposure to the violence in Rift Valley is associated with 94 grams reduction in birth weight (column 2). Column 3 shows that the timing and length of the exposure matter: Although exposure to violence for 1-3 months had no impact on birth weight, birth weight decreases when

[18] We run Linear Probability Model as well, but the results are qualitatively and quantitatively similar.
[19] The results of first stage regression are provided upon request.

the exposure period exceeds 4 months and the impact increases when the exposure period is longer than 6 months (551 grams and 836 grams less than those not exposed in utero for more than 6 months and more than 9 months, respectively). The results in Table 3 show that for children born in Rift Valley, the longer a child was exposed in utero, the worse their birth weight outcomes.

In Columns (4) to (6), the dependent variable is replaced with an indicator for the probability of low birth weight. Column (4) shows that children who were exposed to the violence in utero have an 18.9 percentage points likelihood of being born with low birth weight. Column (5) indicates that an extra month of in utero exposure to the violence increased the probability of low birth weight by 7.5 percentage points. Column (6) shows that those who were exposed for 1-3 months, 4-6 months, and 7-9 months in utero have higher probability of low birth weight by 19.6, 45.6, and 58.2 percentage points, respectively.

We thus find evidence that exposure to pre-natal maternal stress has a negative impact on a child's birth weight. Indeed, our estimates exceed those reported in previous studies. Mansour & Rees (2012) found that prenatal exposure to the 2001-2004 Israeli-Palestinian conflict in the 1st, 2nd, and 3rd trimesters increased probabilities of low birth weight by 0.9%, 0.3% and 0.14%, respectively. Both Lauderdale (2006) and Eskenazi et al. (2007) report that in utero exposure to the September 11th 2001 New York attacks were associated with 1.50 and 1.44 increased odds of low birth weight, respectively. These findings suggest that exposure to the ethnic violence in Kenya had worse outcomes.[20]

5.2. Violence on Premature Birth and Infant Mortality

The estimation results for premature birth and infant mortality are presented in columns (7) to (12) of Table 3. We find a positive and significant impact of in utero exposure to the violence, meaning that *in-utero* exposure increased probability of preterm births. The results from columns (7) and (8) show that children born in Rift Valley during the high intensity period had higher probability of preterm birth by 5.1% than unexposed children. In addition, an extra month in utero increased the probability of preterm births by 0.7% although the estimates are not significant. In column 9, only those who were exposed to the violence for 1-3 months in utero increased the probability of preterm birth (5.4%). These results are an indication of the impact of stress in shortening the gestation period, thus increasing the fraction of births most vulnerable to poor health and slowed physical and cognitive development. Compared with other studies,[21] the 1992 violence in Kenya seemed more serious in terms of premature birth.

In columns (10) – (12), we find that none of the exposure variables increased the probability of infant mortality. Thus, Kenya's electoral violence had impact on birth weight and preterm birth, but it did not increase infant mortality. The probability of infant mortality increases when

[20] The results from OLS are similar to Heckman. The OLS results are provided upon request.
[21] The first trimester exposure to stress from the 2005 Chilean earthquake increased the probability of preterm births by 8% (Torche, 2011). Likewise, preterm births for Arabic named women after September 11th 2001 terrorist attack in New York increased by 1.1 percentage point.

children are born as multiple births, as first born, to unmarried mothers, and when parents did not attain formal education.

5.3. Robustness Checks

5.3.1. Selective Migration due to the Violence

One may argue that some of the affected groups migrated to other areas to minimize the negative effects. Consequently, the composition of children would be altered resulting in overestimation of the effects if wealthier and healthier women had migrated from Rift Valley to other regions since the onset of the clashes, and in underestimation if poorer and less healthy mothers had migrated from Rift Valley to other regions.

It is documented that the affected population tended to move to temporary camps within Rift Valley (Nyukuri, 1997). It is known that people in Rift Valley moved to their ethnic ancestral regions to seek refuge (Human Rights Watch, 1993). In non-Rift Valley regions, those who lived in the current residence for less than two years might have migrated from Rift Valley due to the violence. Thus, to obtain conservative estimates of the impact of the violence on child health, we redefine the affected as those who lived in Rift Valley for more than two years or those who lived in non-Rift Valley regions for less than two years. The same regression models are used (Heckman model for birth weights, and Linear Probability model for low birth weight, premature birth, and infant mortality).

The estimation results in Appendix Table 1 show that even in this conservative definition of the affected group, we obtain qualitatively and quantitatively similar results (see Table 3). This indicates that our results are robust even after redefining the affected group.

5.3.2. Selective Fertility due to the Violence

Our estimation results can be due to the fact that women who had children during the violence period were systematically different from others. For example, if those who were less healthy and less educated in the violent region and who could not avoid being pregnant had a child during the violence, the coefficient of the interaction term becomes negative in our regression analyses on health outcomes. Thus, in our final robustness checks, we compare characteristics of women in the violent region who had children during the violence and the other women whose children were included in our main child-level analyses. We regress women's characteristics such as years of education, fertility choice (number of children ever had, mother's age at child birth), height (long-term health measure), and household's characteristics such as household head's age and female headedness, on an indicator variable for if they had a child during the violent period.[22]

Results in Appendix Table 2 shows that there are not any significant differences between women who had children in Rift Valley during the violence period and women from non-affected regions, except in height. This suggests that taller (healthier) women in the violence region tended to have a child during the violence, which causes downward bias of the interaction term. Thus, our

[22] We run OLS. Other controls are violence region dummy, a dummy variable if woman had child who were born during the violence, current age of woman, ethnic group dummies.

estimates are considered to be a lower bound of the impact of the violence and it is likely that the violence affected pregnant women and their children even more seriously.

5.4. Mechanism

The estimation results so far indicate that the 1992 Kenya's electoral violence resulted in negative health outcomes. Now a question is the mechanism. One possibility is the disruption of access to health services during the violence, which made it impossible for pregnant mothers to access prenatal care. Prenatal care in general includes nutritional and health checks which help fetal growth and development. One important prenatal care recommended to pregnant women is tetanus vaccination during the pregnancy since it reduces the risk of child's death after birth (Mwabu, 2008).

Appendix Table 3 shows the percent of children whose mothers took antenatal care and tetanus injection during the pregnancy, separately for location (violence and non-violence region) and timing of birth (exposed or non-exposed to the violence). The percent of children whose mothers took antenatal care and tetanus injections in the violence region is lower than the other regions (the difference for antenatal care is not significant). Especially, the percent of women who took the tetanus injection and whose children were born during the violence is much lower than that before the violence. This declining trend was, however, found also in non-violence regions. Since the comparison of the means is inconclusive, we examine whether mothers' behavior of taking prenatal care and tetanus injection changed due to the violence by applying the same estimation model as above.

The results are shown in Table 4 where a dummy variable if women visited prenatal care during the pregnancy is a dependent variable in columns (1)-(3) while a dummy variable of taking tetanus injection during the pregnancy is a dependent variable in column (4)-(6). There is no significant impact of the violence on behaviour to take prenatal care and tetanus injection, regardless of exposure variables. This therefore means that worse health outcomes of children during the violence period are not due to the disruption of access to health care services. Although we cannot directly rule out the other pathways that influenced children's health outcomes in this time period because of data limitation, maternal stress resulting from exposure to ethnic violence (as postulated by Fetal Origin Hypothesis) is a plausible mechanism on how the exposure to violence resulted in the worse health outcomes.

6. Conclusion

This study investigated the impact of prenatal exposure to maternal psychological stress on birth weight by exploiting a region and time specific population wide stressor; pre-election ethnic and political violence as an exogenous source of stress. We found that exposure to prenatal stress negatively affected the health of the exposed children. The results of our analysis show that children born during the five months preceding the December 29th 1992 general elections and after throughout to July 1993 had increased probabilities of low birth weight and premature birth by 18.9 percentage point and 5.1% respectively. In addition, an extra month of in utero exposure to violence decreased birth weight by 94 grams and increased the probability of low birth weight by 7.5 percentage point. The findings are consistent with the hypothesis that prenatal exposure to conflict or violence affects birth outcomes through stress. Comparing our findings with the results of the existing studies reveals that exposure to the 1992 ethnic violence had a greater impact.

Our findings reveal important child, parental, and household determinants of birth outcomes. We find that boys have better birth outcomes than girls with the differences very significant. Although much has been done to reduce the impact of gender related vulnerabilities, more needs to be done to ensure that girls are adequately shielded from the negative consequences of all shocks. We also found that first born children face increased risk of worse birth weight outcomes in the event of exposure to shocks. We therefore recommend increased attention to care for women and especially those pregnant with their first child. In addition, health care policies for response during conflict or emergency situations should incorporate commitment to provision of nutritional supplements, prenatal care and psychological support for pregnant women as prerequisites for the funding and support of any program

Ethnically and politically instigated conflicts are unfortunately a common phenomenon in Kenya, Africa and other developing economies. It is therefore important to understand the health, education and economic consequences of such events which derail human and economic development efforts. A wide range of observational and experimental evidence strongly supports the correlation between growth and development during fetal and early life and health in later life. This therefore reinforces the increasing awareness that investment in the health and education of people especially during pregnancy is of utmost importance.

Consequently, healthcare interventions should be replicated to pregnant mothers especially those vulnerable to shocks emanating from exposure to other forms of conflicts, discrimination, economic conditions or natural disasters. These efforts can be successful if the outcome of a pregnancy is considered in terms of maternal and neonatal health, growth and cognitive development of a child, productivity and health in adulthood and the health of the future generations.

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Table 1. *Descriptive Statistics by Affected Region and Period*

	Full Sample		Other regions (non-violent)		Rift Valley (violent)		Difference	T value [a]
	Mean	SD	Mean	SD	Mean	SD		
Panel A: Child characteristics								
Observations	6115		4589		1526			
Male child	0.499	0.500	0.495	0.489	0.514	0.536	-0.019	-1.08
Single birth	0.972	0.164	0.974	0.156	0.966	0.195	0.008	1.05
First born child	0.202	0.402	0.206	0.396	0.190	0.421	0.016	1.12
Age in years	2.000	1.400	2.019	1.364	1.925	1.507	0.094	2.32**
Mother's age at child's birth	26.12	6.734	26.072	6.600	26.290	7.190	-0.218	-0.77
Panel B: Parental Characteristics								
Mother's Educational level								
No education	0.192	0.394	0.174	0.371	0.255	0.468	-0.081	-2.02**
Primary level	0.594	0.491	0.602	0.479	0.564	0.532	0.038	0.96
Secondary level	0.211	0.408	0.222	0.407	0.172	0.405	0.050	1.71*
Higher education	0.004	0.059	0.002	0.045	0.009	0.010	-0.007	-1.47
Father's Educational level								
No education	0.188	0.391	0.167	0.365	0.267	0.475	-0.100	-3.75**
Primary level	0.490	0.500	0.501	0.489	0.451	0.534	0.050	1.73*
Secondary level	0.309	0.462	0.321	0.457	0.268	0.475	0.053	2.01**
Higher education	0.011	0.108	0.011	0.102	0.014	0.127	-0.003	-0.47
Mother's Marital Status								
Currently married	0.850	0.357	0.847	0.353	0.863	0.369	-0.016	-1.05
Never married	0.074	0.262	0.068	0.245	0.077	0.290	-0.009	-0.81
Formerly married	0.076	0.265	0.083	0.270	0.050	0.235	0.033	3.20**
Months of Malaria risk in Pregnancy	4.390	3.980	5.551	3.654	0.189	0.496	5.362	49.62**
Panel C: Household Characteristics								
Age of household head	40.261	13.601	40.710	13.672	38.610	12.923	2.100	3.16**
Female household head	0.282	0.450	0.300	0.449	0.216	0.442	0.084	3.56**
Land ownership	0.862	0.345	0.859	0.340	0.871	0.360	-0.012	-0.47
Distance to hospital	20.290	17.54	18.148	15.456	28.011	22.548	-9.863	-3.86**
Rural residence	0.873	0.333	0.865	0.334	0.900	0.323	-0.035	-1.19
Lived in the same region for many years	0.962	0.191	0.096	0.184	0.959	0.212	-0.086	0.88
Ethnicity								
Kalenjin	0.133	0.339	0.008	0.085	0.587	0.529	-0.579	-11.63**
Kamba	0.144	0.351	0.182	0.378	0.007	0.091	0.175	7.83**
Kikuyu	0.160	0.367	0.161	0.360	0.157	0.391	0.004	0.09
Kisii	0.067	0.251	0.076	0.260	0.035	0.198	0.041	1.9*
Luhya	0.178	0.382	0.200	0.391	0.100	0.321	0.100	3.73**
Luo	0.127	0.333	0.152	0.352	0.037	0.201	0.115	6.48**
Meru/Embu	0.072	0.258	0.091	0.282	0.000	0.000	0.091	6.38**
Mijikenda/ Swahili	0.063	0.244	0.081	0.267	0.000	0.000	0.081	7.55**
Somali	0.002	0.050	0.003	0.052	0.001	0.037	0.002	1.07
Taita/Taveta	0.007	0.082	0.090	0.090	0.000	0.000	0.090	5.08**
Others	0.045	0.206	0.036	0.182	0.076	0.284	-0.040	-1.4

Notes: Sampling weights are used in calculating all the means. . [a] The t-value tests whether means for Rift Valley and Other Regions are statistically different or not. * Significant at 10 percent;** significant at 5 percent.

Table 2. *Health Outcomes by Affected Region and Period*

Characteristics	Full sample		Other regions (non-violent)		Rift Valley (Violent)		Difference (non-violent – Violent)	T Value
	Mean	SD	Mean	SD	Mean	SD		
Panel A: Birth weight (kg)								
Observations	2651		2108		543			
Birth weight	3.282	0.747	3.281	0.737	3.285	0.791	-0.004	-0.06
Born before violence (not exposed in utero)	3.290	0.754	3.29	0.743	3.288	0.802	0.002	0.04
Born during violence	3.241	0.710	3.235	0.704	3.268	0.733	-0.033	-0.27
Diff. between before and during violence	0.049 (1.10)		0.055 (1.16)		0.020 (0.18)		-0.004	-0.04
Not exposed in utero	3.296	0.752	3.295	0.741	3.299	0.799	-0.004	-0.08
1-3 months exposure in utero	3.253	0.726	3.291	0.673	3.119	0.884	0.172	0.80
4-6 months exposure in utero	3.119	0.776	3.106	0.790	3.196	0.678	-0.090	-0.44
7-9 months exposure in utero	3.210	0.626	3.190	0.646	3.300	0.489	-0.110	-0.72
Panel B: Birth weight<=2.5kg								
Birth weight<=2.5kgs	0.156	0.363	0.157	0.359	0.151	0.377	0.006	0.26
Born before violence	0.155	0.362	0.158	0.360	0.142	0.369	0.016	0.75
Born during violence	0.159	0.366	0.150	0.355	0.198	0.410	-0.048	-0.82
Diff. between before and during violence	-0.004 (-0.022)		0.008 (0.32)		-0.056 (-1.04)		0.064	0.89
Not exposed in utero	0.153	0.360	0.156	0.358	0.139	0.365	0.017	0.77
1-3 months exposure in utero	0.168	0.376	0.126	0.330	0.314	0.481	-0.188	-1.76*
4-6 months exposure in utero	0.225	0.420	0.218	0.414	0.268	0.45	-0.050	-0.37
7-9 months exposure in utero	0.135	0.343	0.148	0.353	0.07	0.271	0.078	0.90
Panel C: Premature birth								
Observations	6064		4551		1513			
Premature birth	0.036	0.187	0.038	0.186	0.032	0.189	0.006	0.96
Born before violence	0.034	0.180	0.037	0.184	0.022	0.158	0.015	2.49**
Born during violence	0.050	0.218	0.043	0.198	0.075	0.278	-0.032	-1.64*
Diff. between before and during violence	-0.017 (-2.03)**		-0.006 (-0.69)		-0.053 (-2.75)**		0.047	2.24**
Not exposed in utero	0.034	0.181	0.037	0.185	0.022	0.159	0.015	2.51**
1-3 months exposure in utero	0.06	0.239	0.036	0.183	0.121	0.338	-0.085	-2.06**
4-6 months exposure in utero	0.045	0.208	0.043	0.199	0.054	0.240	-0.011	-0.33
7-9 months exposure in utero	0.045	0.207	0.046	0.207	0.038	0.205	0.008	0.24
Panel D: Infant Mortality								
Observations	6115		4589		1526			
Infant mortality	0.058	0.234	0.066	0.243	0.03	0.183	0.036	4.71**
Born before violence	0.057	0.231	0.063	0.238	0.033	0.194	0.030	3.42**
Born during violence	0.064	0.244	0.078	0.264	0.015	0.13	0.063	4.44**
Diff. between before and during violence	-0.007 (-0.66)		-0.015 (-1.18)		0.018 (1.74)*		-0.033	-1.38
Not exposed in utero	0.057	0.232	0.063	0.238	0.033	0.193	0.030	3.56**
1-3 months exposure in utero	0.057	0.231	0.073	0.257	0.015	0.125	0.058	3.01**
4-6 months exposure in utero	0.098	0.298	0.116	0.315	0.030	0.181	0.086	2.29**
7-9 months exposure in utero	0.039	0.194	0.049	0.212	0	0	0.049	3.17**

Sampling weights are used in calculating all the means. . [a] The t-value is for testing whether means of Rift Valley and Other Regions are statistically different or not. * Significant at 10 percent;** significant at 5 percent.

Table 3. *Impact of Ethnic Violence on Birth weight, Premature Birth, and Infant Mortality*

	Birth weight (kgs)			Low birth weight (<=2.5kg)			Premature birth			Infant mortality		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Rift Valley× Born during violence	-0.176			0.189**			0.0514**			0.0165		
	(-1.30)			(2.36)			(2.71)			(0.51)		
Rift Valley× Months of Exposure		-0.0939**			0.0748**			0.0066			0.00823	
in Utero		(-2.03)			(2.85)			(1.34)			(0.81)	
Rift Valley×1-3 months in utero			-0.273			0.196*			0.0536**			-0.00787
			(-1.44)			(1.89)			(2.75)			(-0.22)
Rift Valley× 4-6 months in utero			-0.551*			0.456**			0.0476			0.0529
			(-1.88)			(2.46)			(1.51)			(1.07)
Rift Valley× 7-9 months in utero			-0.836**			0.582**			0.0648			0
			(-2.45)			(2.86)			(1.25)			(0.00)
Male child dummy	0.0736**	0.0736**	0.0737**	-0.0260*	-0.0260*	-0.0256*	-0.0073	-0.00718	-0.00706	-0.00426	-0.00423	-0.00437
	(2.24)	(2.24)	(2.24)	(-1.70)	(-1.71)	(-1.68)	(-1.44)	(-1.42)	(-1.40)	(-0.69)	(-0.69)	(-0.70)
Single birth dummy	0.714**	0.714**	0.714**	-0.361**	-0.361**	-0.361**	-0.067**	-0.0677**	-0.0663**	-0.0933**	-0.0935**	-0.0948**
	(7.65)	(7.66)	(7.67)	(-5.79)	(-5.81)	(-5.81)	(-4.59)	(-4.69)	(-4.53)	(-6.98)	(-6.55)	(-6.65)
First born dummy	-0.0964**	-0.0952**	-0.0948**	0.0329	0.0320	0.0326	0.0252**	0.0251**	0.025**	0.0214**	0.0214**	0.0216**
	(-2.14)	(-2.11)	(-2.10)	(1.21)	(1.24)	(1.21)	(3.32)	(3.30)	(3.30)	(2.09)	(2.08)	(2.08)
Mother's Age at Child's Birth/100	-0.0875	-0.112	-0.0603	-0.711	-0.669	-0.715	-0.391	-0.39	-0.384	0.004	-0.096	-0.405
	(-0.04)	(-0.05)	(-0.03)	(-0.63)	(-0.60)	(-0.64)	(-1.15)	(-1.14)	(-1.13)	(-0.93)	(-0.93)	(-0.94)
Mother's Age at Child's Birth	0.113	0.119	0.109	0.0937	0.0853	0.0946	0.000081	0.0807	0.0796	0.0884	0.0883	0.0875
squared/1000	(0.30)	(0.32)	(0.29)	(0.47)	(0.43)	(0.48)	(1.39)	(1.38)	(1.37)	(1.22)	(1.22)	(1.24)
Mother's education: No Education	0.0614	0.0707	0.0559	-0.0643	-0.0731	-0.0634	-0.098**	-0.100**	-0.0979**	0.404**	0.404**	0.403**
	(0.25)	(0.28)	(0.22)	(-0.48)	(-0.55)	(-0.47)	(-2.63)	(-2.67)	(-2.64)	(13.28)	(10.32)	(11.02)
Primary level	0.141	0.152	0.137	-0.0984	-0.108	-0.0972	-0.090**	-0.0916**	-0.0902**	0.425**	0.425**	0.424**
	(0.57)	(0.61)	(0.55)	(-0.80)	(-0.87)	(-0.79)	(-2.47)	(-2.50)	9-2.49)	(15.72)	(11.28)	(11.67)
Secondary level	0.177	0.187	0.172	-0.124	-0.134	-0.123	-0.075**	-0.076**	-0.0746**	0.396**	0.397**	0.395**
	(0.72)	(0.75)	(0.69)	(-1.06)	(-1.12)	(-1.05)	(-2.12)	(-2.14)	(-2.13)	(12.55)	(10.63)	(11.31)
Father's education: No Education	0.0775	0.0755	0.0764	0.0679	0.0701	0.0682	0.021	0.0202	0.0217	0.06	0.0602	0.06
	(0.58)	(0.57)	(0.58)	(0.83)	(0.88)	(0.84)	(0.67)	(0.65)	(0.70)	(1.29)	(1.29)	(1.27)
Primary level	0.0502	0.0456	0.0475	0.0668	0.0710	0.0672	0.0248	0.024	0.026	0.0487	0.049	0.0482
	(0.42)	(0.39)	(0.40)	(0.88)	(0.97)	(0.89)	(0.83)	(0.80)	(0.88)	(1.08)	(1.08)	(1.05)
Secondary level	0.0660	0.0615	0.0621	0.0496	0.0534	0.0513	0.0191	0.0185	0.0205	0.0454	0.0457	0.045

	(0.58)	(0.54)	(0.55)	(0.72)	(0.78)	(0.75)	(0.64)	(0.62)	(0.69)	(1.00)	(1.01)	(0.98)
Mother marital status:												
Currently Married	0.0325	0.0320	0.0316	-0.0210	-0.0211	-0.0205	0.00769	0.00755	0.00755	-0.0293**	-0.0292**	-0.0294**
	(0.39)	(0.39)	(0.38)	(-0.55)	(-0.55)	(-0.53)	(0.66)	(0.65)	(0.65)	(-2.45)	(-2.42)	(-2.42)
Never Married	-0.0958	-0.0994	-0.0981	0.0306	0.0330	0.0308	0.0109	0.0109	0.0115	-0.228	-0.0226	-0.023
	(-0.96)	(-1.00)	(-0.99)	(0.54)	(0.59)	(0.54)	(0.67)	(0.66)	(0.70)	(-1.23)	(-1.21)	(-1.22)
Months of Malaria Exposure	-0.436	-0.415	-0.401	0.530	0.523	0.518	-0.104	-0.096	-0.108	0.0287	0.0678	0.0706
in Pregnancy/100	(-0.46)	(-0.44)	(-0.42)	(1.23)	(1.21)	(1.20)	(-0.72)	(-0.66)	(-0.76)	(0.31)	(0.31)	(0.32)
Female Household Head	-0.0246	-0.0248	-0.0248	0.0123	0.0123	0.0123	0.0004	0.0002	0.0002	-0.0069	-0.0069	-0.0069
	(-0.59)	(-0.60)	(-0.60)	(0.61)	(0.61)	(0.61)	(0.06)	(0.00)	(0.04)	(-0.90)	(-0.90)	(-0.89)
Age of Household Head/1000	-0.327	-0.342	-0.308	-0.211	-0.195	-0.212	0.0401	0.0513	0.0363	-0.181	-0.179	-0.177
	(-0.24)	(-0.25)	(-0.22)	(-0.31)	(-0.29)	(-0.31)	(0.19)	(0.24)	(0.17)	(-0.79)	(-0.78)	(-0.76)
Land ownership dummy	0.0492	0.0496	0.0498	0.00333	0.00324	0.00271	-0.011	-0.0112	-0.0111	-0.00447	-0.00443	-0.00453
	(1.12)	(1.14)	(1.14)	(0.13)	(0.14)	(0.11)	(-1.40)	(-1.42)	(-1.41)	(-0.45)	(-0.45)	(-0.45)
Distance to Hospital(km)/1000	0.630	0.666	0.718	-0.292	-0.311	-0.073	0.139	0.188	0.136	0.287	0.282	0.280
	(0.54)	(0.57)	(0.62)	(-0.59)	(-0.63)	(-0.75)	(0.85)	(0.87)	(0.82)	(1.41)	(1.42)	(1.41)
Constant	2.413**	2.410**	2.413**	0.653**	0.654**	0.651**	-3.515**	-3.509**	-3.528**	-8.751**	-8.761**	-8.641**
	(5.58)	(5.57)	(5.61)	(3.06)	(3.10)	(3.07)	(-4.17)	(-4.16)	(-4.19)	(-9.51)	(-9.45)	(-9.23)
Region fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year of birth fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Month of birth fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ethnicity fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Region*year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5922	5922	5922	5922	5922	5922	6009	6009	6009	6025	6025	5962

Notes: t statistics in parentheses. *significant at 10%; **significant at 5%. Columns (1) – (6) are estimated by Heckman Selection model (OLS in the 2nd stage) and figures are coefficients. Columns (7) – (12) are estimated by Probit model and figures are marginal effects.

Table 4. *Impact of Violence on Antenatal Care and Tetanus Injection (Linear Probability Model)*

	Antenatal Care			Tetanus Injection		
	(1)	(2)	(3)	(4)	(5)	(6)
Rift Valley × Born during violence	0.0412			0.00659		
	(0.57)			(0.08)		
Rift Valley × Months of Exposure in Utero						
		0.00250			0.00164	
Rift Valley× 1-3 months in utero		(0.24)			(0.11)	
Rift Valley× 4-6 months in utero			0.0227			0.00969
			(0.44)			(0.18)
Rift Valley× 7-9 months in utero						
			0.0420			0.0261
Observations	5217	6011	6011	5133	5923	5923

Notes: t statistics in parentheses. *siginificant at 10%; **siginificant at 5%. The sample includes all children 0-5 years. All regressions include controls for child characteristics such as sex, single birth, birth order and mother's age at child birth. Parental characteristics include mother and father's education level, mother's marital status, and months of malaria exposure in pregnancy. Household characteristics include sex and age of the household head, land ownership, and distance to hospital as well as region, year of birth, month of birth, ethnicity, and region-year fixed effects.

Table A1. Impact of Violence on Birth weight, Premature Birth, and Infant Mortality (Conservative Definition of the Affected)

	Birth weight (kgs)			Low birth weight (<=2.5kg)			Premature birth			Infant mortality		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Rift Valley × Born during violence	-0.310			0.215**			0.035**			0.019		
	(-1.51)			(3.61)			(2.69)			(0.92)		
Rift Valley × Months of Exposure in Utero		-0.0974*			0.207**			0.0058**			0.0019	
		(-2.00)			(3.97)			(2.04)			(0.42)	
Rift Valley× 1-3 months in utero			-0.162			0.457			0.0423**			0.0054
			(-0.62)			(2.50)			(2.56)			(0.19)
Rift Valley× 4-6 months in utero			-0.403			0.0671			0.0373*			0.0508
			(-1.10)			(3.74)			(1.73)			(1.62)
Rift Valley× 7-9 months in utero			-1.043**			0.272			0.044*			
			(-3.48)			(2.83)			(1.66)			
Observations	5922	5922	5922	5915	5915	5915	6009	6009	6009	6060	6060	6060

Notes: Figures are coefficients in columns (1)-(6) while they are marginal effects in columns (7)-(12). z and t statistics in parentheses. *siginificant at 10%; **siginificant at 5%. The sample includes all children 0-5 years. All regressions include controls for child characteristics such as sex, single birth, birth order and mother's age at child birth. Parental characteristics include mother and father's education level, mother's marital status, and months of malaria exposure in pregnancy. Household characteristics include sex and age of the household head, land ownership, and distance to hospital as well as region, year of birth, month of birth, ethnicity, region-year fixed effects.

Table A2. Characteristics of women with children born during the violence

	Mother's Characteristics				Household's characteristics	
	Highest year of education	Number of children	Height in centimeters	Mother's age	Female Household Head	Age of Household Head
	(1)	(2)	(3)	(4)	(5)	(6)
Rift Valley* Has a child born during violence	-0.0710	0.0639	2.005**	0.729	0.00822	1.352
	(-0.18)	(0.22)	(2.58)	(0.93)	(0.20)	(1.08)
Rift Valley	-0.558*	0.302*	0.480	-0.157	-0.0801**	-2.009**
	(-1.78)	(1.81)	(0.82)	(-0.43)	(-3.21)	(-2.61)
Has a child born during violence	0.212	-0.0807	-0.251	-1.990**	-0.0647**	0.0679
	(1.47)	(-0.62)	(-0.62)	(-5.88)	(-2.95)	(0.10)
Constant	5.605**	4.091**	159.0**	28.96**	0.330**	41.33**
	(50.73)	(58.67)	(552.37)	(164.21)	(22.90)	(92.48)
Observations	3925	3925	3713	3925	3925	3918

Notes: t statistics in parentheses *significant at 10%; **significant at 5%.

Table A3. Antenatal Care and Tetanus Injection by Affected Region and Period

Characteristics	Full sample		Other regions (non-violent)		Rift Valley (Violent)		Difference (non-violent – Violent)	T Value
	Mean	SD	Mean	SD	Mean	SD		
Panel A: Antenatal Care								
Observations	6065		4551		1513			
Birth weight	0.945	0.228	0.095	0.218	0.936	0.262	0.011	0.87
Born before violence (not exposed in utero)	0.948	0.222	0.95	0.212	0.939	0.258	0.014	0.92
Born during violence	0.931	0.254	0.933	0.245	0.924	0.281	0.01	0.37
Diff. between before and during violence	-0.017 (-1.67)*		0.017 (1.49)		0.015 (0.74)		0.002	1.48
Not exposed in utero	0.947	0.224	0.949	0.214	0.938	0.26	0.011	0.95
1-3 months exposure in utero	0.914	0.281	0.915	0.276	0.911	0.295	0.004	0.08
4-6 months exposure in utero	0.942	0.234	0.941	0.232	0.945	0.241	-0.004	-0.1
7-9 months exposure in utero	0.95	0.218	0.954	0.207	0.936	0.262	0.018	0.46
Panel B: Tetanus Injection								
Observations	5977		4480		1497			
Infant mortality	0.911	0.285	0.916	0.272	0.894	0.331	0.022	1.53
Born before violence	0.919	0.273	0.922	0.262	0.907	0.313	0.015	1.09
Born during violence	0.874	0.332	0.885	0.314	0.838	0.389	0.047	1.65*
Diff. between before and during violence	0.045 (3.86)**		0.037(2.81)**		0.069 (2.92)**		-0.032	-0.38
Not exposed in utero	0.918	0.274	0.922	0.262	0.905	0.315	0.017	1.19
1-3 months exposure in utero	0.871	0.335	0.89	0.309	0.824	0.394	0.066	1.18
4-6 months exposure in utero	0.885	0.319	0.902	0.294	0.82	0.22	0.082	1.45
7-9 months exposure in utero	0.86	0.345	0.856	0.346	0.875	0.351	-0.019	-0.38

Sampling weights are used in calculating all the means. . [a] The t-value is for testing whether means of Rift Valley and Other Regions are statistically different or not. * Significant at 10 percent;** significant at 5 percent.