Migration, forced displacement and fertility during civil war: a survival analysis*

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Abstract

The civil war in Burundi (1993-2005) caused a mass flow of refugees into neighboring countries as well as a large number of internally displaced persons. The aim of this study is to explore to what extent migration during the conflict impacted fertility. Using retrospective data on birth and residential histories at the woman-year level from a survey conducted in August 2002 on the field, we examine the impact of war and migration on the probability of the *first pregnancy* interval and on the subsequent *spacing* between them. We adopt a parametric survival regression model to predict the hazard ratio of having a first pregnancy or a higher order one on a sample of 4,783 Burundian women. Our results suggest that the risk of an additional conception is higher in years of forced displacement of the mother, whereas it is lower in the case of residence in the forced displacement site. We do not find a statistically significant effect different from no migration in the years in which mothers voluntarily migrated.

Keywords: fertility, displacement, migration, civil war, Burundi, internally displaced persons, refugees.

JEL codes: C25, C41, I15, J13, N37, N47.

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1 Introduction

Armed conflict and the associated displacement of significant groups of the population may upset normality in every aspect of society, including its reproductive regime (Agadjan and Prata 2002). Theoretically, armed conflict can both imply a reduction and increase in fertility, and there is empirical evidence for both. However, the relationship between war and fertility is complex and multidimensional, and depends on variations in the *location* and *intensity of warfare*, on various *types of displacement*, and on the *resilience* of different population groups. In this paper, we analyze the impact of war and displacement on reproduction, exploiting the case of Burundi, a country which was plagued by civil war in the years 1993 to 2005, and of which half the population has been displaced at least once during this period (Verwimp and Van Bavel 2014).

Based on a unique survey data with individual migration and fertility histories, we analyze how the probability of *first pregnancies* and *spacing* between higher order pregnancies[1], reflect temporal and geographic variation in terms of exposure to war and associated displacement. We further consider the extent to which different socio-economic and demographic characteristics (controls) condition the fertility responses to conflict and displacement. We keep as a metric that of hazard ratios, namely odds of the hazard of an increment in an explanatory variable to the baseline hazard rates of the same (categorical) variable, recalling that we postulate for the hazard a Weibull distribution which is a strong and non testable parametric assumption.

Our findings, based on the partial maximum likelihood estimation of survival regressions in close connection to a multinomial probit, indicate that, for first conceptions, the effect of *forced* migration is quite different than *voluntary* migration. In the year of moving, forced displacement increases the probability of a first pregnancy by 25%, whereas in case of voluntary migration it decreases it by 32%. Residence in the forced displacement site, on the other hand, increses the probability of a first pregnancy by 17%, whereas in the case of residence in the new migration site the probability increases by 47% compared to no migration. Being married has the usual high effect on reducing the spell length by a factor of 6 both for first conceptions and for spacing between them. We do not formulate a stochastic sequential fertility choice model besides the reduced form one, as in Heckman and Willis (1974).

Turning to the spacing between subsequent pregnancies beyond the first, we find that the risk of an additional conception is higher in a year the woman is forcibly displaced, whereas it is lower in the case of residence in the forced displacement site. voluntary migration seems to have a statistically significant impact (compared to no movement) on reducing the time spell of an additional pregnancy of 38%. The control variables (education, religion, wealth as measured at the onset of the conflict, marriage status) have the usual effect, namely that a higher level of education reduces the likelihood of a parity if compared to no education as well as a higher level of initial household wealth. In terms of religious beliefs, adhering to islam is associated with a higher risk of early pregnancies if compared to catholicism or protestantism.

The remainder of the paper is structured as follows: section 2 provides a brief literature review and a theoretical framework for studying the relationship between war, displacement and fertility, section 3 outlines our micro level study, section 4 presents the data, section 5 the econometric model, section 6 provides the analysis and discusses the results, and section 7 concludes.

[1] As measured in years and excluding ties.

2 The impact of civil war and displacement on fertility

To date, relatively little systematic research has addressed how *armed conflict* and *displacement* jointly affect fertility outcomes. Caldwell (2004) reviews a body of literature demonstrating that economic shocks tend to have a negative short-term effect on fertility. As noted by Urdal and Che (2013), armed conflicts may be expected to have similar short-term effects on fertility. According to Newman and and McCulloch (1984) the demography literature has emphasized the uncertain nature of the biological process while the econometric literature has emphasized the behavioural side of reproduction in non conflict settings. Relatedly, Heckman and and Willis (1974) estimate a stochastic model of reproduction focusing on birth intervals, tested by looking at the time from marriage to the first birth, finding no significant effect of the education of the female or male. However, the age at marriage and the age at first birth are closely related. In their data, the effect on fertility may be mainly on the age at marriage (data based on the 1965 Princeton National Fertility Study).

In general, there are many direct mechanisms through which armed conflict can impact fertility in different ways. First, civil war may affect fertility *negatively* due to the mobilization of militia and other military reserves and the conscription of new recruits. This in turn implies both *delayed marriages* and *disruption* of marital fertility due to the separation of couples. Violent conflict can also lead to an increase in the age at marriage and to an increase in the *proportion of women that never marry.* On the one hand, war may cause increased mortality among men, typically unmarried young men. The females born in the same or slightly younger birth cohorts may find it difficult to find a husband as the younger males usually prefer younger brides. In many developing countries, unmarried women occupy non-enviable positions in the household, often the household of a sibling. Late marriage or *single status* will decrease the fertility of these women. In each month, beyond the subsistence of a war, "a couple's contraception decision is assumed to reflect expected utility maximizing choices in which the costs of contraception are balanced against the utility associated with each possible fertility outcome weighted by the probability of that outcome"[2]

Analogous is the case of women who lost their husbands in the war. At the same time, during war or in periods of increased insecurity, it is rare that women marry at young age. This may be linked to the need to provide labour on the farm or to generate income. If, for example, the husband or the oldest son of the household are recruited by the army or a rebel group, the mother/wife faces the difficulty to manage the household, the farm and potential other income generating activities all by herself. Other children and family members may need to stay in the farm to help her. The household may even attempt to recruit new members to replace the loss of male labour (Fafchamps and Quimsbuing, 2006). Consequently, after the war's end, we might observe a spike in marriages which will affect the transition to the five states postulated by Perrin and Sheps (1964 p. 33), namely that in each month a woman is in one of the five possible states of S_0 - nonpregnant and fecundable, S_1 - pregnant, S_2 - temporarily sterile due to the anovulation following an abortion or miscarriage, S_3 - temporary sterile period following a still birth, S_4 - temporary sterile period following a live birth.

Third, in war zones, the psychological stress and strain of carrying out daily activities may reduce the *frequency of marital intercourse.* Furthermore, conflict-related stress can have a negative effect on both semen quality and the menstrual cycle, which in turn increase the risk of infertility. Fourth, conflict may also lead to a temporary decline in the number of planned births due to the expected negative impacts of conflict on the economy. A fifth mechanism linking conflict to

[2] Heckman and Willis (1974).

reduced fertility is related to the *disruption of commerce* and *food supply* that may occur during wartime. Furthermore, military presence may divert resources away from the civilian population, exacerbating existing food shortage. It is well documented that undernutrition significantly hampers female reproductive ability (Abu-Musa et al. 2008). Finally, warfare may generate *migration* and *refugee flows*, often resulting in the separation of couples for longer time periods.

A number of studies have documented significant reductions in fertility during conflict, including Agadjanian and Pratas (2002) on Angola; Blanc (2004) on Eritrea; Caldwell (2004) in general on fertility transition; and Lindstrom and Berhanu (1999) on Ethiopia. However, in some instances, the end of a conflict is associated with a *fertility increase* (e.g. Caldwell, 2004).

On the other hand, long-lasting armed conflicts could also be expected to have the opposite effect on fertility behviour (Iqbal, 2010; Urdal & Che, 2013). Among the more proximate channels linking conflict and increased fertility through temporary migration, are shortages in access to *family planning* and *abortion services* due to the temporal shutdown of health clinics. Second, the demand for children may decrease as a result of the *closing of schools*, which in turn implies that the cost of children rearing declines, as their value as labour participants increases (Bardhan and Udry, 1996). Hence, parents may prefer short-term income from many children (extensive margin) over long-term return from fewer, educated children (intensive margin)[3].

Finally, a third mechanism linking conflict exposure to increased fertility throughout displacement is the desire to replace lost children and combatants. In other words, such *mortality effects* may either arise when the loss of a child causes replacement of that child, or when broader expectation in society about future mortality causes hoarding. Nobles et al. (2015) refer to the former as *replacement fertility* by individual women and to the latter as *population-rebuilding* in the context of conflict or other disasters with high overall death tolls. Women who undergo violence from militia members may be subject to raping and thus increase the number of children they would otherwise have in case of no war.

For example, Schindler and Brück (2011) in a study of conflict and fertility in Rwanda, found evidence for a strong *replacement effect*. Relatedly, despite not resulting from conflict as such, Nobles et al. (2015) found that mothers who lost one or more children in the 2004 Indian Ocean tsunami were more likely to bear additional children after the tsunami (a natural disaster). Also, they found support for the so-called *population rebuilding* mechanism, whereby women without children before the tsunami also initiated family-planning earlier after the tsunami.

As discussed above, there are several potential mechanisms linking conflict and displacement to fertility in different ways, and it is likely that the relationship is complex and multidimensional. For example, it is not unlikely that different population groups and segments of society will react to conflict in different ways. For example, better-educated and more affluent people should be both more willing and able to control their fertility behavior in response to war (Agadjanian and Prata 2002: 218). Further, Verwimp and Van Bavel (2004) in a study on fertility of refugees in Rwanda, found that refugee women had higher fertility than other women.

However, reproductive health in general, and fertility behaviours in particular, may vary a lot in refugee situations depending on the overall conditions in the camps, the length of the stay, the access to health care and so on. In a comparative study of more than 600,000 people living in 52 post-emergency phase camps in six countries (Thailand, Myanmar, Nepal, Ethiopia, Uganda, and Tanzania), Hynes et al. (2002) found better reproductive health outcomes[4] among refugees and internally displaced populations in these camps compared to the populations in their respective

[3]See also Rosenzweig and Wolpin (1980).

[4]Lower fertility, lower neonatal mortality, lower maternal mortality, and higher birth weight.

host country and country-of-origin. They attribute their findings to better access of camp residents to preventative and curative health care services, and to food and nonfood items, as well as improvements in water supply and sanitation.

We may not necessarily expect conflict to have the same effect on fertility for refugees in camps as compared to refugees outside camps. In general health conditions are likely to be worse for refugees that concentrate outside camps as these may not benefit from public services or international aid. Hence it is also likely that access to family planning will be higher in the camps, leading to potential lower fertility for refugees in camps than other refugees.

2.1 A micro-level study

Hence, in order to fully capture the relationship between conflict, displacement and fertility, we need temporally and spatially disaggregated data on conflict, combined with detailed data on individual-level migration and fertility histories. This is indeed the main contribution of our paper. In addition to the above discussion related with forced displacement due to civil war, we describe three possible causal mechanisms linking voluntary migration to fertility.

(*i*) A *selection* effect refers to the tendency for migrants to self-select for individual characteristics that are associated with lower or higher than average fertility compared to non-migrants at the origin. Migrants indeed often differ from non-migrants on observable socio-economic characteristics such as education, age at marriage and occupation, which have an impact on reproductive choices. Selectivity may also occur on the basis of unobserved heterogeneity in preferences, such as the propensity to postpone childbearing, openness to change or fertility aspirations (on the behavioural side) and unobserved mother-specific fecundity (on the biological side). In the absence of a comparable selection effect into forced displacement, one would not expect the same results for the fertility of forcefully displaced women as one would expect for voluntary migrants.

(*ii*) *Disruption* effect in childbearing through spousal separation or a desire to delay childbearing until after the move could also prevail. Such a mechanism would lower the fertility of migrants compared to non-migrants. The impact of disruption therefore, would be found in the timing of a woman's fertility and the impact may last only within a short duration. The disruption effect has been studied most often in the context of temporary migration. Sharma (1992), for example, explored the impact of *temporary spousal separation* on fertility in Tanzania and concluded that any relationship between migration and fertility is reflected only in cumulative fertility and that disruption was not a major factor driving temporary fertility. A high level of disruption could lead couples to make up for lost fertility by spacing births more closely after migration as well as delaying the age at which childbearing is interrupted.

It is necessary, therefore, to distinguish the potential effects of migration on cumulative fertility versus those on immediate fertility. White et al. (1995) found that a residential move reduced the likelihood of childbearing in the year of occurrence, providing evidence for a disruption effect. However, Goldstein et al. (1997) examined migrant fertility under very restrictive state policy regarding mobility and family planning in a Chinese province. They found, on the one hand, that rural-urban migrants tended to have later first births, which the authors attributed to the disruption, despite it could also be explained invoking a selection effect. On the other hand, they discovered that temporary migrants had a slightly higher chance of (first) birth in a year. Disruption effect may also be modified by gender and the purpose of migration (Lindstrom and Saucedo 2000). If women migrate for marriage then disruption may not be observed, but rather a short-term spike in fertility might be.

(*iii*) *Adaptation* to the fertility regimes of the destination is the third explanatory mechanism linking migration to fertility, which we postulate. The adaptation theory has its roots in both sociological and economic theories explaining determinants of fertility (Findley 1980). Rural women moving to urban areas may adapt to the prevailing social norms of having less children or may find a job thereby increasing the opportunity costs of conception. This may be similar to a situation in an IDP camp where the availability of family planning services may reduce fertility.

2.2 Background on war and displacement in Burundi

The latest episode of civil war in Burundi began in October 1993, when paratroopers from the Tutsi-dominated army in a failed coup d'état assassinated the first democratically elected president. This was followed by large-scale massacres in the countryside, with peasant supporters of the president killing Tutsi and Hutu who supported the old regime, and the army killing all Hutus in sight in an operation to 'restore order. In a matter of days, 100,000 people lost their lives in what the UN calls a genocide (UN 1996). The massacres were followed by the spread of violence and warfare throughout the country, with several Hutu rebel factions opposing the regular government (Tutsi) army. This marked the beginning of one of the most brutal and bloody civil wars in recent history (Uvin 1999).

In August 2000, several rebel groups signed the Arusha peace agreements with the still Tutsi dominated Burundian government. This had little effect on the security situation in the field since the two major rebel groups, CNDD FDD and FNL, were not involved in the peace talks. In 2003, the new president (Hutu) announced a one-sided cease fire and allowed the largest rebel group CNDD FDD to descend from the hills and march victoriously on Bujumbura. Rebel leader Nkurunziza was incorporated in the government and rebel combatants were integrated in army and police forces. The intensity of the civil war decreased dramatically and in 2005 Nkurunziza was elected as the new president. One rebel group (FNL) remained outside the peace process and continued murdering and pillaging, as a result of which pockets of insecurity still existed in the country. Human Rights Watch 1998, 2003 describes the Burundian war as a war against civilians.

Civilians were widely used as proxy targets, with both sides (rebel groups and the regular army) targeting civilians deemed supportive of the other group. Direct battles between the army and the rebel forces were relatively rare despite the duration of the war. Both sides of the conflict engaged in massive looting of civilian property and massive human rights violations. Civilians had to flee battle zones, lost wealth and livestock and were put in camps in often deplorable conditions. Displaced individuals and families were prone to attacks, deprivation, bad sanitation and housing conditions and malnutrition. In their strategy to avoid open confrontation with the army, rebel groups were very mobile and obliged villagers to supply food and to carry food and weapons over hilly areas with them. They also requested contributions in cash. Upon return home displaced people would found their land occupied by neighbours or strangers.

3 Data and sampling

Data from the *Énquete Sociale et Demographique de Santé de la Reproduction*[5] are employed for the analysis. This nationally representative survey was conducted by the United Nations Population Fund Agency to fill in the information gap generated between the end of the civil war and the

[5]Referred hereafter as ESDSR (2002).

previously collected census data in 1990, prior to the onset of the conflict. The ESDSR (2002) data-set is based on a *two stage stratified cluster sample survey*, designed to be representative of the population at the national level, as well as at the rural, urban and refugee camps level. The survey questionnaires were structured in an *individual bulletin*, collecting information on both men and women aged more than 12, as well as children aged less than 12, jointly with a *rugo sheet*, collecting socio-demographic information at the household level.[6]

The time-to-event panel data-set used for the analysis is the result of a merge of different STATA data files from an household survey conducted at the end of August 2002. In particular, a micro-level right-censored data-set containing fertility histories of 4,783 mothers is merged with a panel data-set containing the migration histories of the same group of individuals. The resulting data-set is shaped in *survival time* format, namely with two time columns allowing to study the length of yearly intervals occurring between subsequent *births* as well as between subsequent *places of residence*. To each of them is associated a dummy variable defining the occurrence of a birth, with the subsequent health outcomes of the child (still-births, infant survival, distinguished by gender) and a wide variety of covariates (both *time-varying* and *time constant*).

The ESD (2002) survey was collected on 7,119 households, of which 3,181 were located in 40 refugee camps, 2,820 in 100 rural hills, 1,118 in 28 urban locations, with a total of 32,805 persons interviewed[7]. The general information obtained from the individual bulletins for both men and women pertain to *demographic characteristics*, namely year of birth, gender, marital status, year of marriage, year of separation (if any), nationality, religion; *socio-economic features* such as schooling, educational level, occupational status, assets held (number of cows, sheeps, chickens, land tenure) by the household, health status, notably survived to the conflict, or, if not, causes of death (political-military crisis, AIDS/HIV or other), localization of parents or children; *fertility aspirations*, that is, number of children desired by the persons aged higher than 12 years old; *residential history*, meaning locations ever resided in, and *migratory history* since the onset of the conflict in 1993, regarding simple moves; finally, *reproductive health awareness*, that is, awareness of the risks of contracting the HIV/AIDS disease.

Table 1 describes the main variables used in the analysis. In particular, we may notice that, on average, the mothers interviewed were 24 years old, about one third of them were forcefully displaced at least once during the nine years of the war and their average level of education is near to the completion of primary schooling. Slightly more than half of the women interviewed has resided at least once in a refugee camp between 1993 and 2002 (67.1%). Additionally, by far, half of the mothers (51.3%) have been married during the years of the civil war. On average, the mothers in the sample have moved at least once, regardless the reason for displacement. Concerning their religious orientation, most of them are catholic and protestant. Only a very small share (1.1%)experienced a still birth.

Geographically, the data is collected around each of the 168 primary sampling units, corresponding to the communities where the survey respondents lived at the time of the data collection. A *household* is defined as group of individuals living under the same *roof* and sharing the same *budget*[8]. The average number of *persons* per household is 4.52 in the whole country, 5.08 in refugee camps, 5.01 in urban areas, and 4.45 in rural areas (ESDSR 2002). Sampling in rural and urban areas' has been achieved throughout an enumeration performed by the National Institute of

[6]A *rugo* is a local Burundian institution, characterized as a group of households sharing the same farming activity, and a common chief, amounting to patriarchial family.

[7]The overall population inhabiting the country reached 6.8 million people, at the time of the survey.

[8]To avoid double counting due to people absent from the household.

Statistic and Economic Studies on the number of households located in rural sub-hills and in urban areas. This enumeration was grounded on a set of sheets filled in by communal officiers based on the information provided by the *hills' chiefs* and the *boroughs' chief*, themselves informed by the *nyumbakumi*[9] and the *roads' chiefs*.

In a *first degree stratification*, a randomization was performed across 30 strata, based on *urban areas*, *rural hills* and *refugee camps*. In a *second degree sampling*, five regions were considered as *rural areas*, notably the North-Western region (Bubanza, Bujumbura rural and Cibitoke), a Central-Western region (Kayanza, Muramvya and Mwaro), a North-Eastern region (Kirundo, Muyinga and Ngozi), a Central-Eastern region (Canzuko, Gitega, Karuzi and Ruyigi), and a Southern region (Bururi, Makamba and Rutana). Two strata only were considered for the *urban zones* (Bujumbura town and secondary urban agglomerates).

Interviewees in refugee camps were sampled in a two stage procedure. First, 40 camps were selected from the universe of refugee camps and second, 90 household per camp were randomly selected to be interviewed. A theoretical figure of 3,600 refugee households translated into 3,181 household effectively surveyed. Concerning *rural areas*, a three stage sampling was carried out. 100 randomly selected hills were assigned to the 17 provinces as a function of the total number of households. In each hill, 28 households were interviewed. To a theoretical figure of 2,800 households, corresponded an empirical one of 2,820. Nonetheless, whenever necessary, the bias arising from an unequal number of households per *rugo* is corrected by ponderation coefficients.

Concerning sampling in urban areas, the enumerators attributed 28 urban areas to two strata, 26 in the capital and 2 in the towns of Gitega and Ngozi, as a function of the total number of households. There have been randomly selected 40 households each of the 28 urban areas, each mother was assigned a sampling weight, representing the inverse of the probability of that observation being drawn in each sampled location.

We have data on number of births, number of kids alive, disaggregated by gender, number of still births, all measured per woman on an annual basis, as well as number of boys and girls perished, mothers' age both at the date of conception and of the survey. The control variables are categorical variables, namely *education*, taking values 0 for no education, 1 for at least some primary education and 2 for at least some secondary education; *religion*, with 1 being catholic, 2 stands for protestant, 3 for muslim and 4 for other; an *a proxy for assets* held by the household (tropical livestock unit as of 1993) which varies continuously; and *married year* where 1 means unmarried and 2 married.

For the migration variable, we distinguish between forced displacement and voluntary migration on the one hand and between the year in which the displacement or migration took place and the year(s) of residence in the new site. This two-by-two, granular distinction is what makes the data and the analysis we present here unique compared to other migration and displacement data on the African continent.

Figure 1 presents two features of the data. First the survey sites, 168 in total, in green color the rural ones, in blue color the urban ones and in red color the camp sites. The black arrows represent the typical displacement/migration trajectory of a woman in our survey. She is displaced/migrates more than once (including to places who will not be survey sites) before she ends up in a survey site and is registered in our survey. The different places she migrated to/was displaced in as well the duration of her stay in each of the sites are registered in the data we use.

Figures 2 and 3 show the patterns of some statistics related to survival shape of our data. In

[9] In the Great Lakes African Region, the *nyumbakumi* is a local traditional institution, referring in Kishwahili to a social group composed by ten houses. Elected, he takes up the managing responsibility over a broad range of issues affecting the household's every day life such as security of humans, animals and crops.

particular, those graphs present the Kaplan-Meier survival and failure estimates and the Nelson-Aelen cumulative hazard and the smoothed hazard estimates. For single failures (i.e. onset of fertility), survival probabilities are lower for urban residents than for rural or camp residents. Nonetheless, this trend seems to invert for higher values of the analysis time, with rural and refugee areas residents showing a lower probability of survival, i.e. a shorter time spell to first conceptions. The estimated cumulative hazard appears to be lower for refugee camp residents. As for multiple failures, the survival probability is always lower for urban than for rural citizens.

4 Econometric Method and Estimation

We assume that hazard ratios of occurrence of first pregnancies (*starting*) and ratios of higher conceptions (*spacing*) have a parametric proportional hazards form distributed with the Weibull shape, with spatially correlated random effects[10]. Observations are censored, meaning that some of the mothers in the sample exit the *risk set* of fertility prior the end of the observation period (year 2002), while others still remain fertile even after the end of the survey. We have to account for this fact while formulating the likelihood function whose maximization leads to the estimated parameters of the models. In other words, some *conception intervals* are *open*, since the mother might to eventually experience another conception beyond the survey time[11].

The regressors, both time varying and time constant, affect the waiting time (expressed in *mother - year* metric) from zero to one pregnancy, from one to two, and so on, and the waiing time represents the dependent variable in the our regressions. Two possible metrics can be chosen to fit parametric survival regression models to the data, namely proportional hazards (PH) and accelerated failure time (AFT). We choose to adopt the proportional hazard metric as it is more easily adapted to interpreting results of a survival model characterized by relatively constant or monotone hazards patterns, which may not be exempt from criticism:

$$\begin{aligned}\lambda(t|x_{ij}) =&\lambda_0(t)\exp\{\beta_1 \times DISPL\_ANY_{ijt} + \beta_2 \times AGE_{ijt} + \beta_3 \times AGE^2_{ijt} + \\ &+\beta_4 \times EDUC_{ij} + \beta_5 \times RELIGION_{ij} + \beta_6 \times WEALTH_{ij} + \\ &+\beta_7 \times MARRIED_{ij}\} \end{aligned} \tag{1}$$

Therefore, we opt for a multiplicative specification of the baseline hazard of the event occurring at a given time with respect to the explanatory variables which enter linearly. t is survival time until first or higher order gestations or censoring time for individual $i = 1, ..., 4,783$ residing in village $j = 1, ..., 168$[12] and for all $t = 1967, ..., 2002$[13]; $\lambda_0(.)$ represents the baseline hazard (or *systematic* part of the hazard rate, regardless the covariates), assumed to have a Weibull form, due to the flexibility peculiar of such a distribution to adapting to many possible functional forms of the "true" data generating process.

[10] We interpret the random - effect as a form of community level heterogeneity, also referred to as shared frailty, in the survival analysis literature.

[11] Each woman is assumed to be in the *risk set* of fecund age she is older than 12 and younger than 46. This is a somewhat stringent assumption in that does not allow for randomness in the age at menarche (Newman, 1983).

[12] Also referred as secondary sampling unit (Deaton 1997). Primary sampling units are considered to be rural, urban or internally displaced refugee camp areas.

[13] At a secondary stage of the analysis, a narrower estimation window, coinciding with the decade of the civil war, will temporally restrict the sample.

We recall that a continuous, positive random variable X has the Weibull distribution with *parameters* $\alpha > 0$ and $\beta > 0$ if and only if has pdf $f(x) = \alpha\beta^{-\alpha}x^{\alpha-1}\exp(-[x/\beta]^{\alpha})I(x > 0)$ (Mukhopadhyay, 2000). By varying the values for α and β one can generate interesting shapes for the associated probability density function.

To equation (1), a shared frailty term peculiar for each community (or *unsystematic* part, since it comes from unobserved randomness within the population) is again introduced in a multiplicative way to the hazard rate[14]

$$\begin{aligned}\lambda(t|x_{ij}) =& \lambda_0(t)\omega\exp\{\beta_1 \times DISPL\_ANY_{ijt} + \beta_2 \times AGE_{ijt} + \beta_3 \times AGE^2_{ijt} + \\ &+\beta_4 \times EDUC_{ij} + \beta_5 \times RELIGION_{ij} + \beta_6 \times WEALTH_{ij} + \\ &+\beta_7 \times MARRIED_{ij}\} = \lambda_0(t)\{\beta\mathbf{X} + \underbrace{W_j}_{\text{frailty}}\}\end{aligned} \tag{2}$$

where ω collects the differences in the hazard of the event typical of each stratum as in Chin et al. (2011), and we let it vary freely across clusters[15]. Including W_j permits the estimation of a different hazard rate (or derived quantities, such as the cumulative survivor function) for each spatial cluster in the sample, therefore controlling for *unorbserved site level heterogeneity.*

The second peculiarity of the regression model is the assumption of non-independence of the frailty term W_j's across strata, contrarily to the usual heterogeneity inclusion. In fact, frailties are hypothesized to be autocorrelated across clusters. This implies that the primary samplinf units in proximity to each other are characterized by a more similar fertility hazard than those farther away. As in Chin et al. (2011), the vector $\mathbf{W} \in \mathbf{R}^J$ is assumed to be distributed as a multivariate inverse Normal distribution with mean zero and exponential variance covariance matrix, and $d_{ii'}$ is the distance between primary sampling units i and i'. It turns out that the correlation between the two primary sampling units depends on their distance, and it reduces with the increase in distance among them.

Firstly, we estimate a parametric Weibull survival model to explain first pregnancies (*starting*) in STATA 13, via partial maximum likelihood methods to account for right censoring, including both time constant and time varying regressors. The former includes a dummy variable for religious beliefs, one for educational attainment as of 1993 and an indicator of household asset holding (tropical livestock unit in 1993)[16]. The latter contains mother's age (with a rescaled value of 0 representing 12 years old) and current marital status.

Secondly, to explain the distance between higher order pregnancies (*spacing*),excluding ties, a model analogous to the previously described one is estimated, including also a dummy variable for the likelihood of a previous still birth.

[14]An assumption is made to allow for the distribution of the frailty terms not being independent across the sites/communities on which they are assumed to vary. This assumption is induced both by the literature (Chin et al. 2011) and by computational needs.

[15]Bhalotra and Van Soest (2008), in studying the determinants of infant and child mortality in Uttar Pradesh, allowed for a *subject* specific frailty term.

[16]Tropical livestock unit is a convenient measure of caloric intake developed by the Food and Agriculture Organization for quantifying a wide range of different livestock types and sized in a standardized manner. Exchange ratios are established with a number of common livestock varieties: 1 TLU = 1.0 camels, 0.7 cattle, 0.1 sheep/goats. The measure is based on basal metabolic rate: energy expenditure per unit of time, i.e. kcal/weight per day, varying as a function of a fractional power of body weight. Under resource driven grazing conditions, the average voluntary feed intake amongst species is remarkably similar, about 1.25 maintenance requirement (1.0 for maintenance, .25 for production). Source: `http://www.fao.org/Wairdocs/ILRI/x5443E/x5443e04.html`.

5 Results

We start in table 2 with one binary variable indicating whether or not the woman was ever displaced, thereby not distinguishing between forced and voluntary migration. The former two columns are concerned with the study of first pregnancy events, the second column including a spatial random effects. The latter two columns deal with pregnancies of order higher than the first to study *spacing behavior*, with the fourth including a frailty term to account for unobserved community level heterogeneity. The table displays the results of running a parametric survival regression model with an underlying Weibull distribution for the baseline hazard function.[17]

Any form of displacement with respect to no displacement raises the risk of having a parity by 25%. As for the covariates directly related to the displacement we notice the importance of the company of the women during her displacement. If she is alone, she has an increased risk of 14%, while if she is with her entire household she runs an increased risk of 26.5%. Importantly, the fact of being married or not in a given year has a very high effect on the hazard of having a first birth. In the Weibull, the age of the mother (a time varying covariate) has a significantly negative impact on the hazard ratio. This might be explained by the fact that the Weibull's hazard one is not constant $\lambda(t) = \gamma\alpha t^{\alpha-1}$, for further details, please see the appendix). As for the other covariates, being of Muslim faith doubles the probability of having a first birth, while ending secondary school decreases the probability by 13% if compared to no schooling. Pre-war household wealth, proxied by the number of tropical livestock units as of 1993, does not seem to have a statistically significant effect on the probability of having a first birth. The introduction of a site specific heterogeneity does not alter the results significantly.

As for higher order pregnancies are concerned, we present the results in the third column of table 2. Here, any type of displacement reduces the length of a first conception by 11%, while being alone while displaced reduces the risk by about 20%. Primary education and in particular secondary education strongly diminish the risk, while being muslim still has an effect, although smaller compared to the first conceptions. Being married increases fertility behavior after the first child. The number of children that died prior to the birth increased the risk of having a subsequent child by 19%, a factor we could of course not include in the single model. These results call for a more profound analysis of the type of displacement, which we turn to now.

During civil war as well as peace, women and men make decisions about where they will live. Such choices have to be distinguished from forced displacement, which unfortunately is frequently observed during civil war. We are lucky to have a survey which registered the two types of displacement and can hence distinguish their effect on fertility. As before, the former two columns do so for the first pregnancies, the latter two column for higher order conceptions. As voluntary migration may be endogenous to the desire to become pregnant, often linked to marriage in Burundi (see Verwimp and Van Bavel 2004), we first exclude all voluntary migration from the analysis and compare the effect of civil war induced forced displacement on fertility with women who were never displaced. Results in table 3 show a 20% shortening of the time spell to a first pregnancy when the women is forcibly displaced. When the forced displacement takes part with her entire household, it increases the risk of 29.5%, while being married has by far the largest effect. Adhering to muslim faith has a large positive effect as before while the effect of primary education is on the margin of

[17] The dependent variable is $\lambda(t|\mathbf{x})/\lambda_0(t|\mathbf{x})$, the hazard ratio of first and higher order parities, defined as the ratio between the hazard function and the baseline hazard function for each individual in the sample (Newman 1983). A hazard ratio higher than one implies that a marginal increase in the underlying value of an explanatory variable has the effect of shortening the time spell to the event under consideration. Baseline values for the displacement dummy is no displacement, for education is no education, for religion is catholic, for tropical livestock unit is zero.

statistical significance.

Continuing to higher order pregnancies, we notice in the second column of table 3 almost no effect of being forcibly displaced (8.5%) as well as no effect of the company during displacement. As before, education has a negative effect, in particular secondary education. The death of children as well as Muslim faith keep the above effects.

Our data allow us to distinguish between the year in which the displacement occurred (*moving*) versus the other years in which the women spent some time in her displaced residence (*residence*). We will separate the two on a year-by-year basis to find out if the actual movement has a different impact compared to residence.

Results in the first column of table 4 point out that the year in which the women actually moved carries a higher risk for first birth compared to the year in which she resides in the displacement site (28% vs 17%), while both are higher than no displacement. We also find here that the company matters: being forcibly displaced with one's entire household increase the probability for a first birth by 23%. Other variables as before. In the case of multiple births, we present results in column 3 of table 4. It turns out, on the contrary than in the single failure case, that the risk of having an additional conception increases by 8% in the year in which the forced displacement takes places (*moving*), whereas the risk goes up by 8.7% in the years in which the women resides in the forced displacement site (*residence*). Both effects are statistically significant at the 1% level. We do not observe an effect of the company of the women during displacement. The interpretation/discussion of the observed effect will follow after we deal with voluntary migration.

Realizing that voluntary migration is a choice which may be endogenous to fertility choices, we want to compare the effect (not to be interpreted as a causal effect here, but rather as a correlation) here with no displacement, thereby excluding forced displacement. Column 1 in table 5 presents the results for the first birth. We find a strong positive effect of 32% for voluntary migration. In case the migration takes place with the entire household an additional effect of 26% is observed. Education does not seem to matter, while the effect of marriage remains the strongest shortening the legth of the spell to first pregnancy by about 7 times - and the association with Muslim faith also remains strong.

Moving to higher order pregnancies in column 3 of table 5, the effect of voluntary migration on raising the risk of occurrence of the event increases to 36%, jointly with the positive effect (9%) of having migrated alone. This shows that voluntary migration and fertility are particularly correlated for the first child. As before in the case of multiple births, the education variables retain their importance, together with the number of children who died (+2.7%) and the fact of being married or not.

As for table 4, table 6 makes the distinction between the year in which the migration took place (*moving*) and the years in which the women resided in the migration site (*residence*). The result is very different from that obtained for forced displacement: in the year that the voluntary migration takes place, the women has a 32% lower chance to become pregnant (compared to 28% higher chance in the year of forced displacement). While residence in the migration site increase the probability of a first birth by 47% (as compared to 17% for forced displacement). Clearly, only a much higher degree of planning and control over one's fertility can explain these results. While this is confirmed by the 31% increase in case of migration with the entire household, a caveat needs to be made as also migration alone increase the probability by 26%.

Turning to higher order pregnancies, primary and secondary education have little effect, non statistically significant, on reducing the risk of the event. The effect of *moving* and *residing* is much less outspoken, with the former statistically not significant and at the 25.2% only. Also, the sign of the effect is the opposite from the forced displacement case: a voluntary move reduces the probability of an additional child, while a voluntary residence increases it substantially by about 55%. Other variables are as before.

Table 7 brings all of the above together in one table. We compare the two displacement types (forced vs voluntary) as well as the year of the movement with the years of residence in the new site, no displacement remaining our baseline. Column 1 presents the results for the first pregnancies. In line with the above, the effect of forced displacement is opposite to voluntary migration: in the year of moving, forced displacement increases the probability of a first birth by 25% whereas in case of voluntary migration if decreases by 25%. Residence in the forced displacement site on the other hand increases the risk with 15% whereas residence in the new migration site increases it with 62%. Being married has the usual high effect - increasing the risk of a first conception by a factor of six if compared to no marriage - and the company of the women while being displaced also has an impact on the risk.

Turning to higher order pregnancies, the risk of an additional conception is higher in a year in which the women is forcibly displaced whereas it is lower in the case of residence in the forced displacement site. Voluntary migration has a similar effect on the spell length to the failure event (compared to no displacement of course). The other variables have the usual effect.

Finally table 8 considers the effect of having been displaced or having resided both for voluntary and forced reasons in a refugee camp. A forced displacement is associated with an 18% shorter time spell to first pregnancy (column 1 row1), forced residence type of migration with a shorter time spell of 22%. Turning to voluntary migration instead, a camp displacement has the effect of raising the risk by 31% whereas for voluntary residence in camp the risk of a first conception goes up by 42%. Secondary education slightly reduces the risk or increase the time spell to the event, with islamic faith still doubling the risk or halvening the time to first pregnancy. Wealth has a non significant effect on such risk and the results do not change with the inclusion of a site specific random effect.

For higher order pregnancies, a forced displacement in a refugee camp has the effect of letting the hazard ratio grow by 29%, a forced residence instead by 26%. Concerning voluntary movement and residence, they produce opposite effects, the former reducing the risk of 17%, the latter increasing it by 69.5%. Migrating with the whole household increases the risk by about 30%, being married sixtuplicates the risk.

6 Conclusions

We studied the effect of forced displacement in Burundi on fertility outcomes for a sample of women interviewed in a nationwide survey at the end of the year 2002. The secondary data arising from the survey allowed us to construct a panel of retrospective fertility histories with mother-year observations, dating back until the seventies. We merged the panel with information on historical residences for the subjects surveyed. We employ thereafter methods of survival analysis to analyze the data and attempt to draw conclusive evidence on which causal mechanism drives the changing patterns in fertility due to civil conflict through internal migration and village level violence. An important assumption which we postulate in this sense is the one of exogeneity of war shock on unobserved individual mother's characteristics. This may not be exempt from criticism. Weakening such an assumption would undermine the causal interpretation which has been given to the model estimates.

We chose parametric Weibull regression models à la Cox, as a suitable functional forms to describe an analyze the stochastic process of subsequent births which mothers experienced. In particular, we distinguished a *starting* fertility behavior (age at which a woman firstly chooses or happens to have a first birth) from a *spacing* behavior (which we define as the average distance, in years, between higher order conceptions). We made an assumption regarding the size of the risk set of the right censored data set, namely that women enter their fertile period at a fixed age (12) and exit from it at another fixed age (46). It could be argued that such an assumption is simplistic, in that it does not allow for randomness in the beginning of the menarche period, neither in its end. We furthermore do not formulate nor apply any framework to the analysis of *stopping* behavior. There exists theoretical models, such as the one proposed in Perrin and Sheps (1964) that formulate state space formulations of human reproduction, and let appropriate empirical specification derive from them. But this is beyond the scope of this empirical investigation.

We addittionslly introduce a shared frailty term (to capture unobserved heterogeneity at the site level). This does change remarkably the results. We used both time invariant covariates, such as educational level and religious belief, and time varying ones, such as age of the mother and whether or not she was married in a given year. The focal effect of interest here, our local average treatment effect, derived from the displacement questions in the survey. Forced displacement would correspond to exposure to treatment, while absence of displacement would correspond to the control group. voluntary migration is also studied, not as another form of treatment (because it is most likely endogenous), but as a correlation, and for reason of comparison with forced displacement.

We also distinguish between the year in which the actual displacement took place and the years in which the woman resided in the new site. The findings, as already mentioned, should be distinguished for *single conception*, allowing to draw conclusions on starting behavior and for *higher order conceptions*, enabling the micro empirical researcher to say something sensed on spacing between subsequent births. voluntary migration is correlated with a higher risk of higher order pregnancies in the order of 70% while residing in the new site, but with a 20% lower risk in the year moving to the new site.

Forced displacement on the other hand increased the risk in the years of movement as well as while in residence, but at a lower extent than in the case of voluntary migration. This may suggest that the mechanism driving migrant fertility is planned family formation: the representative woman tends not to become pregnant in the year of migration, which always carries other types of risk and uncertainty, but once settled in her new residence, she exhibits an increased probability of conception.

On the side of multiple event study, that is, of time distancing between subsequent conceptions of higher order (second, third, fourth child, say) there does seem to be any statistically significant correlation with voluntary migration anymore, the women following the fertility trajectory similar to the non-displaced. The forcibly displaced women on the other hand demonstrate higher probability of an additional birth in the years of movement, and lower while in residence in the displacement site. Presumably, this double observation is related to the very nature of forced displacement: it goes hand in hand with insecurity, violence, poverty and so on. This can result in an unwanted birth (in the years of movement) and in a desire to reduce fertility while residing in a hostile environment.

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A Definition of some relevant variables

These are the meanings of the main categorical variables used along the survival analysis which are related to the various forms of migration considered thoughout the article.

$$\texttt{displ\_any} = \begin{cases} 0 & \text{if no displacement;} \\ 1 & \text{if some displacement of any type} \end{cases}$$

$$\texttt{forced\_volun} = \begin{cases} 0 & \text{if no displacement;} \\ 1 & \text{if forced displacement;} \\ 2 & \text{if voluntary migration} \end{cases}$$

$$\texttt{moving\_residing} = \begin{cases} 0 & \text{if no displacement;} \\ 1 & \text{if forced displacement;} \\ 2 & \text{if forced residence;} \\ 3 & \text{if voluntary migration;} \\ 4 & \text{if voluntary residence} \end{cases}$$

$$\texttt{new\_camp} = \begin{cases} 0 & \text{if no displacement in camp;} \\ 1 & \text{if forced displacement in camp;} \\ 2 & \text{if voluntary migration in camp;} \\ 3 & \text{if forced residence in camp;} \\ 4 & \text{if voluntary residence in camp} \end{cases}$$

$$\texttt{educ} = \begin{cases} 0 & \text{if no education at all;} \\ 1 & \text{if at least some primary education completed;} \\ 2 & \text{if at least some secondary education completed} \end{cases}$$

$$\texttt{religion} = \begin{cases} 1 & \text{if catholic;} \\ 2 & \text{if protestant;} \\ 3 & \text{if muslim;} \\ 4 & \text{if other} \end{cases}$$

$$\texttt{company} = \begin{cases} 0 & \text{if no displacement;} \\ 1 & \text{if migrated or displaced alone;} \\ 2 & \text{if migrated with some household member;} \\ 3 & \text{if migrated with all household members;} \\ 4 & \text{if migrated with numerous other households} \end{cases}$$

Table 1: Description of the analysis dataset.

VARIABLE	MEANING	MEAN	STD.DEV.	MIN	MAX
n_gross	numb. of births	4.48	0.04	1	18
displ_any	as before	.286	.242	0	1
forced_volun	as before	.407	.395	0	2
moving_residing	as before	.746	.735	0	4
new_camp	as before	.671	.734	0	4
age	women's age	23.79	8.27	12	47
educ	schooling	.821	.565	0	2
religion	religious belief	1.437	.691	1	4
tlu'93	wealth proxy	2.377	5.807	0	214
married	wedding status	.513	.270	0	1
n_stil_birth_y	numb. of still births	.011	.030	0	.333

Note: This descriptive table is at the women-year level, the analysis will be conducted at the women-year level as well. The standard deviations are expressed as a between measure.

Table 2: Effects of any displacement on time to first and higher order pregnancies

Dep. var. haz. ratio	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
Any Displacement	1.245***	1.248***	1.106***	1.129***
	(.060)	(.067)	(.014)	(.021)
Age	.316***	.019***	.052***	.011***
	(.017)	(.000)	(.009)	(.002)
Age^2	1.009***	1.049***	1.028***	1.047***
	(.000)	(.000)	(.002)	(.001)
Primary education	1.005	.917**	1.040***	.950***
	(.039)	(.035)	(.013)	(.011)
Secondary education	.987	1.020	.878***	.803***
	(.060)	(.070)	(.032)	(.026)
Protestant	1.135**	1.069*	1.109***	1.041**
	(.049)	(.042)	(.014)	
Muslim	2.168***	1.882***	1.345***	1.285***
	(.191)	(.136)	(.025)	(.022)
Other	1.063	.963	1.135***	1.096**
	(.180)	(.129)	(.025)	(.038)
tlu93	1,001	1.002	1.000	.999*
	(.003)	(.003)	(.001)	(.001)
Married	6.554***	6.482***	1.354***	1.352***
	(.438)	(.251)	(.030)	(.032)
Migrated alone	1.137**	1.156**	.894	1.155**
	(.061)	(.078)	(.024)	(.078)
Migrated with some hh member	1.140*	1.153*	1.095**	1.153*
	(.144)	(.156)	(.033)	(.156)
Migrated with the entire household	1.265**	1.294	1.016	1.294**
	(.104)	(.102)	(.013)	(.102)
Migrated with numerous households	1	1	1	1
	-	-	-	-
No. still births			1.189***	1.221***
			(0.024)	(.026)
Number of obs.	42108	42108	95100	95100
Number of subj.	4627	4607	4637	4616
Number of cluster	168	168	168	168

Table 3: Effects of forced displacement on time to first and higher order pregnancies

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
Forced displacement	1.202**	1.379***	1.085***	1.100***
	(.080)	(.138)	(.014)	(.025)
Age	.024***	.029***	.065***	.013***
	(.006)	(.001)	(.010)	(.002)
Age^2	1.046***	1.044***	1.026***	1.045***
	(.003)	(.004)	(.002)	(.001)
Primary education	.942*	.932*	1.029**	.930**
	(.036)	(.041)	(.014)	(.012)
Secondary educ	1.039	1.031	.876**	.780**
	(.071)	(.070)	(.037)	(.034)
Protestant	1.147***	1.084*	1.103***	1.041**
	(.048)	(.050)	(.017)	(.015)
Muslim	2.101***	2.044***	1.339***	1.312***
	(.194)	(.166)	(.026)	(.024)
Other	.945	1.013	1.130***	1.075*
	(.156)	(.150)	(.039)	(.046)
tlu93	1.000	.997	1.000	.999*
	(.003)	(.003)	(.001)	(.001)
Married	7.725***	8.704***	1.448***	1.465***
	(.468)	(.402)	(.040)	(.040)
Migrated alone	1.050	.551**	.938*	.957
	(.169)	(.203)	(.055)	(.061)
Migrated with some hh member	.974	.700*	1.086**	1.176***
	(.184)	(.233)	(.032)	(.044)
Migrated with the entire household	1.295**	1.162	1.013	1.047*
	(.133)	(.177)	(.015)	(.029)
Migrated with numerous households	1	1	1	1
	-	-	-	-
No. still births			1.208***	1.262***
			(.030)	(.033)
Number of obs.	37957	36091	80427	83084
Number of subj.	4374	4315	4387	4573
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of forced displacement arising from a Weibull survival regression model. Baseline values for education and religion are no education and catholicism. Baseline value for forced displacement is no migration. Specification (2) is the same as (1) except for the presence of a frailty term distributed as an inverse Gaussian shared at the site level. Specifications (3) and (4) display the effect of displacement and other covariates on thelikelihood of higher order parities. Standard errors are in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Effects of forced moving and residing on time to first and higher order pregnancies

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
Forced movement	1.282**	1.302**	1.079***	1.145***
	(.106)	(.113)	(.015)	(.025)
Forced residence	1.170**	1.188**	1.087***	1.084**
	(.072)	(.082)	(.015)	(.026)
Age	.338***	.025***	.065***	.013***
	(.018	(.001)	(.010)	(.002)
Age^2	1.008***	1.046***	1.026***	1.045***
	(.000)	(.000)	(.002)	(.001)
Primary education	1.017	.928**	1.029**	.931***
	(.041)	(.039)	(.014)	(.012)
Secondary education	1.007	1.016	.875**	.776***
	(.072)	(.079)	(.037)	(.033)
Protestant	1.135**	1.076*	1.102***	1.041**
	(.049)	(.046)	(.017)	(.015)
Muslim	2.165***	2.086***	1.340***	1.300***
	(.220)	(.160)	(.025)	(.024)
Other	1.000	.925	1.130***	1.070**
	(.183)	(.134)	(.039)	(.046)
tlu93	.999	1.000	1.000	.998*
	(.003)	(.003)	(.001)	(.001)
Married	7.894***	7.780***	1.448***	1.450***
	(.515)	(.336)	(.040)	(.039)
Migrated alone	1.013	.991	.937*	.951
	(.146)	(.163)	(.055)	(.064)
Migrated with some household member	.917	.931	1.087**	1.161***
	(.164)	(.177)	(.032)	(.043)
Migrated with the whole household	1.231**	1.234**	1.013	1.046*
	(.125)	(.125)	(.015)	(.028)
Migrated with numerous households	1	1	1	1
	-	-	-	-
No. still births			1.207***	1.255***
			(.030)	(.033)
Number of obs.	37957	37957	80427	80427
Number of subj.	4372	4348	4387	4362
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of forced displacement arising from a Weibull survival regression model. Baseline values for education and religion are no education and catholicism. Baseline value for moving_residing is no migration. Specification (2) is the same as (1) except for the presence of a frailty term distributed as an inverse Gaussian shared at the site level. Specifications (3) and (4) display the effect of displacement and other covariates on the likelihood of higher order parities. Standard errors are in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Effects of voluntary migration on time to first and higher order pregnancies

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
voluntary migration	1.317***	1.361***	1.367***	1.151***
	(.112)	(.131)	(.129)	(.031)
Age	.323***	.021***	.326***	.014***
	(.018	(.001)	(.017)	(.002)
Age^2	1.009***	1.048***	1.010***	1.045***
	(.000)	(.001)	(.000)	(.001)
Primary education	1.001	.927**	.968	.959**
	(.042)	(.039)	(.035)	(.015)
Secondary education	1.009	1.052	.948**	.813***
	(.065)	(.079)	(.061)	(.027)
Protestant	1.160**	1.103**	1.207***	1.068***
	(.057)	(.047)	(.046)	(.018)
Muslim	2.056***	1.785***	2.070***	1.320***
	(.178)	(.141)	(.169)	(.029)
Other	1.218*	1.101	1.365**	1.120**
	(.180)	(.155)	(.170)	(.044)
TLU93	.998	.999	.997*	.999*
	(.003)	(.003)	(.003)	(.001)
Married	7.258***	7.209***	7.322***	1.516***
	(.545)	(.310)	(.556)	(.048)
Migrated alone	1.063	1.056	.960	.865
	(.146)	(.111)	(.089)	(.029)
Migrated with some household member	1.421*	1.389*	1.271	1.012***
	(.378)	(.295)	(.325)	(.062)
Migrated with the whole household	1.258**	1.290**	1.311**	.975*
	(.140)	(.172)	(.158)	(.033)
Migrated with numerous households	1	1	1	1
	-	-	-	-
No. still births			2.721***	1.213***
			(.147)	(.031)
Number of obs.	37470	37470	36899	76785
Number of subj.	4409	4389	4387	4362
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of voluntary migration arising from a Weibull survival regression model. Baseline values for education and religion are no education and catholicism. Baseline value for moving_residing is no migration.Specification (2) is the same as (1) except for the presence of a frailty term distributed as an inverse Gaussian clustered at the site level. Specifications (3) and (4) displaythe effect of displacement and other covariates on the likelihood of higher order parities. Standard errors in brackets.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Effects of voluntary movement and residence on time of first and higher order pregnancies

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
Voluntary movement	.676**	.688**	.748**	.687**
	(.097)	(.096)	(.091)	(.087)
Voluntary residence	1.473***	1.515***	1.555***	1.493***
	(.138)	(.131)	(.135)	(.149)
Age	.325***	.018***	.180***	.002***
	(.018	(.005)	(.024)	(.000)
Age^2	1.051***	1.051***	1.012***	1.087***
	(.000)	(.005)	(.001)	(.001)
Primary education	1.001	.932*	.989	.934**
	(.043)	(.041)	(.079)	(.039)
Secondary education	1.023	1.113*	.978	1.111*
	(.067)	(.072)	(.099)	(.081)
Protestant	1.149**	1.109**	1.216**	1.054*
	(.058)	(.048)	(.101)	(.045)
Muslim	2.042***	1.995***	1.94***	1.729***
	(.178)	(.179)	(.359)	(.130)
Other	1.209*	1.129	2.249**	1.185*
	(.178)	(.162)	(.727)	(.163)
TLU93	.999	.999	1.012*	.998
	(.003)	(.003)	(.010)	(.003)
Married	7.389***	7.250***	2.511***	8.015***
	(.558)	(.501)	(.279)	(.347)
Migrated alone	1.259**	1.323**		1.172*
	(.128)	(.124)	-	(.128)
Migrated with some household member	1.355*	1.418*	.908**	1.295*
	(.378)	(.398)	(.160)	(.283)
Migrated with the whole household	1.316**	1.376**	1.234**	1.552***
	(.172)	(.183)	(.115)	(.214)
Migrated with numerous households	1	1	1.060	1
	-	-	.097	-
No. still births			2.003***	2681***
			(.184)	(.191)
Number of obs.	39117	39117	3164	38536
Number of subj.	4583	4562	1276	4562
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of voluntary displacement and residence arising from a Weibull survival regression model.. Baseline values for education and religion are no education and catholicism. Baseline value for main regressor is no migration. Specification (2) is the same as (1) except for the presence of a frailty term distributed as an inverse Gaussian shared at the site level. Specifications (3) and (4) display the effect of displacement and other covariates on the likelihood of higher order parities Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Effects of voluntary movement and residence as well as forced movement and residence on time of first and higher order pregnancies

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
Forced movement	1.250**	1.253**	1.292***	1.137***
	(.095)	(.103)	(.097)	(.094)
Forced residence	1.150**	1.134**	1.262***	.950*
	(.067)	(.073)	(.078)	(.066)
Voluntary movement	.751*	.777**	.829**	.698***
	(.089)	(.079)	(.071)	(.072)
Voluntary residence	1.621***	1.712***	1.695***	1.571***
	(.113)	.079)	(.126)	(.119)
Age	.317***	.018***	.319***	.008***
	(.017)	(.000)	(.016)	(.000)
Age^2	1.009***	1.050***	1.010***	1.064***
	(.000)	(.000)	(.000)	(.001)
Primary educ	1.005	.920**	.963*	.936**
	(.039)	(.036)	(.033)	(.036)
Secondary educ	.998	1.032	.928*	1.034
	(.061)	(.071)	(.057)	(.071)
Protestant	1.134**	1.071*	1.178***	1.026
	(.052)	(.042)	(.042)	(.041)
Muslim	2.167***	1.874***	2.140***	1.792***
	(.191)	(.136)	(.184)	(.128)
Other	1.083	.966	1.344**	1.169*
	(.177)	(.129)	(1.157)	(.153)
TLU93	1.001	1.002	.999	1.000
	(.003)	(.003)	(.002)	(.003)
Married	6.593***	6.532***	6.717***	6.664***
	(.449)	(.254)	(.459)	(.258)
Migrated alone	1.137*	1.137	1.031	1.187**
	(.091)	(.091)	(.075)	(.096)
Migrated with some household member	1.104	1.104	1.119	1.376**
	(.153)	(.153)	(.147)	(.191)
Migrated with the entire household	1.278**	1.270**	1.299**	1.542***
	(.116)	(.102)	(.117)	(.126)
Migrated with numerous households	1	1	1	1
	-	(-)	-	-
No. still births			2.514	2.662***
			(.132)	(.164)
Number of obs.	42072	42072	41223	41223
Number of subj.	4609	4607	4629	4607
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of voluntary and forced displacement as well as residence arising from a Weibull survival regression model. Baseline values for education and religion are no education and catholicism. Baseline value for moving_residing is no migration. Specification (2) is the same as (1) exceptt for the presence of a frailty term distributed as an inverse Gaussian shared at the site level. Specifications (3) and (4) display the effect of displacement and other covariates on the likelihood of higher order parities. Standard errors are in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Effects of forced displacement and residence as well as voluntary migration and residence in a refugee camp on time of first and higher order parities

Indep. vars.	STARTING (1)	STARTING (2)	SPACING (3)	SPACING (4)
forced displacement in camp	1.179**	1.209**	1.299***	.979
	(.072)	(.083)	(.082)	(.073)
Forced residence in camp	1.218**	1.159**	1.270**	1.091*
	(.083)	(.089)	(.083)	(.085)
Voluntary migration in camp	1.307***	1.339**	1.391***	1.263**
	(.105)	(.120)	(.119)	(.115)
Voluntary residence in camp	1.421***	1.477***	1.443***	1.322**
	.108	.120	.108	.109
Age	.316***	.019***	.319***	.009***
	(.017	(.000)	(.016)	(.000)
Age^2	1.009***	1.049***	1.009***	1.064***
	(.000)	(.000)	(.000)	(.001)
Primary educ	1.005	.918**	.962*	.934*
	(.038)	(.035)	(.034)	(.036)
Secondary educ	.981	1.014	.915*	1.021
	(.061)	(.069)	(.058)	(.070)
Protestant	1.144**	1.076*	1.183***	1.029
	(.050)	(.043)	(.041)	(.041)
Muslim	2.158***	1.879***	2.138***	1.794***
	(.191)	(.136)	(.184)	(.127)
Other	1.066	.969	1.351**	1.179*
	(.178)	(.129)	(.156)	(.154)
TLU93	1.000	1.002	.999	1.000
	(.003)	(.003)	(.002)	(.003)
Married	6.561***	6.471***	6.679***	6.597***
	(.444)	(.251)	(.455)	(.255)
Migrated alone	1.030	1.021	.939	1.070
	(.067)	(.083)	(.063)	(.088)
Migrated with some household member	1.114	1.115	1.136*	1.415**
	(.148)	(.155)	(.141)	(.196)
Migrated with the entire household	1.250**	1.269**	1.279**	1.514***
	(.104)	(.102)	(.107)	(.124)
Migrated with numerous households	1	1	1	1
	-	(-)	-	-
No. still births			2.548***	2.688***
			(.130)	(.165)
Number of obs.	42072	42072	41223	41223
Number of subj.	4627	4607	4627	4607
Number of cluster	168	168	168	168

Note: specification (1) displays the impact on hazard ratios of forced displacement and residence, voluntary migration and residence arising from a Weibull survival regression model. Baseline values for education and religion are no education and catholicism. Baseline value for moving_residing is no migration. Specification (2) is the same as (1) except for the presence of a frailty term distributed as an inverse Gaussian shared at the site level. Specifications (3) and (4) display the effect of displacement and other covariates on the likelihood of higher order parities. Standard errors are in brackets *** p<0.01, ** p<0.05, * p<0.1

conflict/analysis/graphs/arrowsmap.pdf

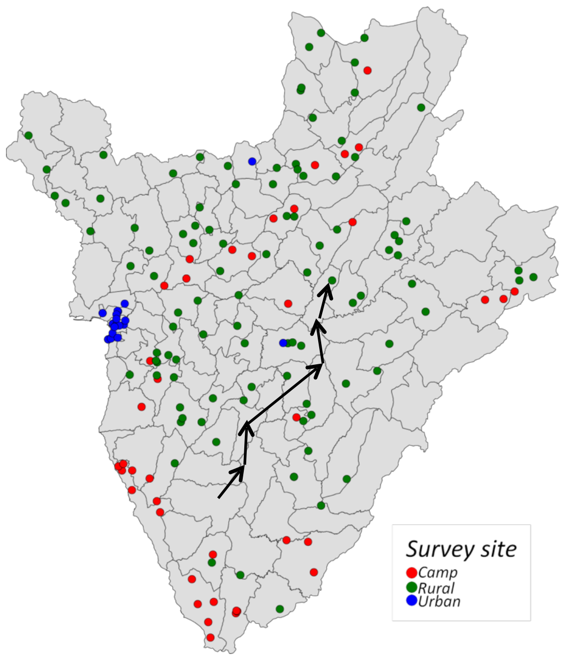

Figure 1: Migration patterns across the country during the war. Thanks to Karim Bhagat for having created the map.

conflict/analysis/graphs/graph1.pdf

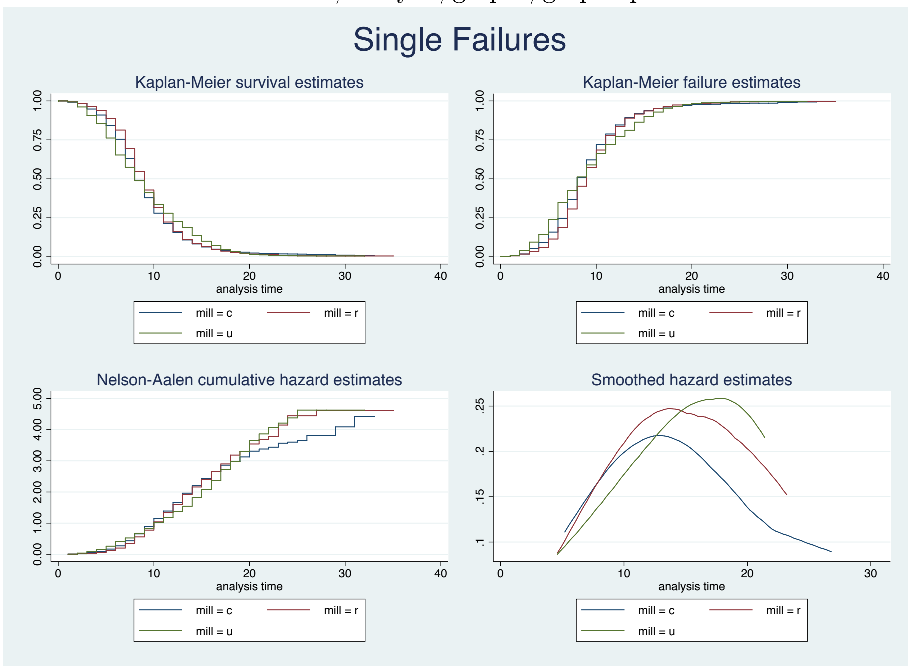

Figure 2: Survival $S(t)$, failure $F(t)$, cumulative hazard $\Lambda(t)$ and hazard rate $\lambda(t)$ plotted for single failures i.e. for *starting* fertility behaviour for camp, rural and urban areas.

conflict/analysis/graphs/graph2.pdf

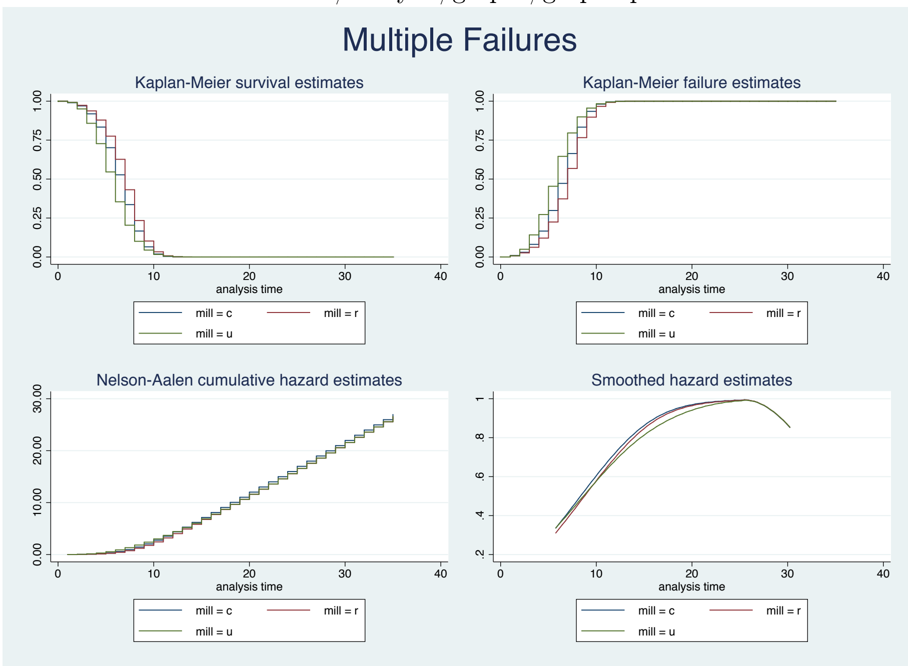

Figure 3: Survival $S(t)$, failure $F(t)$, cumulative hazard $\Lambda(t)$ and hazard rate $\lambda(t)$ plotted for multiple failures, i.e. for *spacing* fertility behaviour for camp, rural and urban areas.