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The Impact of Conflict on Age at Marriage and Childbirth in Rwanda

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ABSTRACT

Using Rwanda Demographic Health Survey 2005 data, we estimate a Cox proportional hazard model to identify the determinants of age at marriage and age at first child and whether these decisions were affected by conflict. We find that women living in clusters accounting for a larger proportion of sibling deaths in 1994, the year of the genocide, were more likely to marry later and have children later compared with those living in clusters accounting for a lower proportion of sibling deaths. Women living in regions with higher levels of under-five mortality were more likely to have their first child earlier compared with women living in regions with lower infant mortality. The age at marriage was probably affected by two reasons: the change in age structure and sex ratio of population following the genocide, and the breakdown of kinship in the case of women who lost their siblings.

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INTRODUCTION

Rwanda is one of the sub-Saharan African countries experiencing a stalling of the process of fertility transition. It is conjectured that in Rwanda, the genocide in 1994 slowed down the demographic transition, i.e., slowed the sharp decline in fertility that was observed over the period 1983-1992. The total fertility rate (TFR) declined from 8.5 in 1983 to 6.2 in 1992 and then marginally to 6.1 in 2005 (Rwanda Demographic and Health Survey (RDHS), 2005). The genocide not only altered the composition of the population, but also changed the social and economic fabric of the country dramatically. Over a million Tutsi and moderate Hutu civilians died and 3,000,000 were internally or externally displaced (World Bank, 2004). Following the genocide, about 2,000,000 people (mostly Hutu) fled into exile, primarily to the Democratic Republic of Congo and Tanzania. At the same time, the country became culturally diverse with in-migrants from neighboring countries (Desforges, 1999; Diamond, 2005; RDHS, 2005).

The impact of conflict and war on the demographic process and in particular on decision making by women is an empirical question. Ghobarah et al. (2003) analyzed a cross-national World Health Organization dataset to find that women and children suffer disproportionately from the long-term effects of civil war. Bundervoet and Verwimp (2005) found that civil war and economic sanctions affected the anthropometric outcomes of children living in rural Burundi. In the context of Rwanda, Verwimp and Bavel (2005) find that refugee women had higher fertility but their children also had lower chances of survival. Akresh, Verwimp, and Bundervoet (2007) find that girls born in regions of Rwanda affected by crop failure and strife have lower height-for-age z-scores.

Crisis and conflict can lead to delays in marriage and in the onset of childbearing, especially in urban areas (Foster, 1993). Studies have also documented changes in fertility in time of conflict and economic crisis (Agadjanian and Prata, 2002; Eloundou-Enyegue et al., 2000; Lindstrom and Berhanu, 1999).

We use data from the 2005 RDHS to estimate a Cox proportional hazard model to identify the determinants of age at marriage and age at first child birth. Since we observe cohort-specific differences in reproductive behavior, it is possible that there were some cohort-specific effects in terms of age at marriage. The 2005 RDHS reveals that the fertility rates are the highest for the women in the 25-34 age group. This cohort was exposed to the conflict at the beginning of their marital years or during their early childbearing years. We attempt to assess the impact on conflict by examining whether the behavior of a woman whose kinship was affected because of loss of her siblings during the genocide is different from those of a woman whose family structure was not disrupted.

BACKGROUND

While the issue of age at first marriage merits attention in its own right, it is also true that changes in the age at first marriage affect the fertility process. Marriage patterns are a key determinant of fertility. In particular, postponement in the age at marriage delays the age at which a woman has her first child and also reduces the number of years available for childbearing. There is also the caveat that if contraceptive use is high then it could offset the impact of early marriage on childbearing and hence fertility. However, in Rwanda in 2005, 99.6 percent of women age 15-19 did not use any contraception while nearly 94 percent of women age 20-24 did not use any method. Considering all women in the 15-49 age group, more than 90 percent did not use any method (RDHS, 2005). Hence, in Rwanda a change in the age at marriage has implications for fertility.

There has been a change in age at marriage in the last decade in Rwanda. The median age at first marriage increased from 19.3 years in 1992 to 19.9 years in 2000 and further to 20.1 years in 2005. Similar patterns are observed for age at first birth. The increase in the median age at marriage is in sync with worldwide trends. Worldwide it has been noticed that women with a higher level of educational attainment who participate in the workforce opt to delay their marriage, delay motherhood, and restrict family size.

There are factors specific to Rwanda affecting the age at marriage. First, a shortage of eligible men of marriageable age could have led to a marriage squeeze. There was a change in the sex ratio following the genocide, from 93 men for 100 women in 1992 to 87 men for 100 women in 2000. In 2005, for every 100 women there were only 88 men. There are also marked differences in the sex ratio across the different age categories (RDHS, 2005; RDHS, 2000). Second, the demise of a woman's siblings during the period of conflict could have affected kinship and hence affected the age at marriage.

Third, there was a fundamental change in the composition of the population because of the massacre of the Tutsi and the return of the refugees. The 1992 RDHS that had information on the ethnicity of the respondents reveals two facts relevant to this paper. Tutsi are more educated than the Hutus and Tutsi marry later compared with Hutus. In 1992, 38 percent of the Hutu population had no education as opposed to 18 percent in the case of the Tutsi. Only 9 percent of the Hutus had secondary or higher education in 1992. In contrast, the corresponding figure for Tutsis was 24 percent. Not surprisingly, the Tutsi had higher median age (21.0 years) at first marriage compared with the median age of 19.3 years in the case of the Hutu. Median age at first birth was also higher for Tutsi women (22,3 years) than Hutu women (20.7 years). The above- mentioned differences coupled with the change in composition of population could have affected the age at marriage.

Finally, in the period following the genocide, there was an increase in different indicators of child mortality. This could have affected childbearing decisions and hence the age at which a woman has her first child.

Literature Review

There is a large body of literature focusing on how individual characteristics affect the age at marriage and age at motherhood. Mensch et al. (2006) provide a comprehensive review of the literature, and analyze trends in timing of first marriage in the developing world during the past 30 years. They point out that "while marriage during the teenage years is declining in many regions of the world, substantial proportion of women are still marrying extremely early" (p. 137). They find that age at first marriage varies by place of residence and educational attainment. Women living in rural areas were likely to marry earlier than those living in urban areas. Those with 0 to 3 years of schooling were more likely to marry early than those with 8 or more years of education. Lindstrom and Brambila Paz (2001), in their study of two cohorts of Mexican women, find that increased number of years in school reduces the likelihood of marriage. They point out that education, apart from providing employment opportunity, also modernizes a woman's outlook and builds her self-confidence.

However, the positive impact of education may be more evident in countries where age at first marriage and age at first birth are relatively low. Studies have ascribed increase in age at first marriage to increase in level of education. However, whether a child goes to school depends on the quality of the schooling system and school infrastructure. The impact of educational attainment on the age at marriage is not straightforward for the following reasons. First, while South and Southeast Asia have witnessed a large increase in educational attainment, it is not true that this region has experienced the largest decline in early marriage. In fact, the largest declines have been observed in the Middle East (Mensch et al., 2006). Second, if women deciding to marry later opt to attain higher levels of education, it would imply that education is endogenous to age at marriage. However, it is also possible that education broadens a girl's perspective and gives rise to her aspirations; hence, she can choose when to get married and to whom. We will argue later that education is not a potentially endogenous variable in the context of Rwanda.

Using Demographic and Health Survey data from eight countries of sub-Saharan Africa (Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Mali, Senegal, Tanzania, and Zimbabwe), Mahy and Gupta (2001) find that girls who had attained at least secondary level education were less likely to have a child before the age of 18. In their study of Mexican women, Lindstrom and Brambila Paz (2001) find that an increase in the number of years in school reduces the likelihood of first birth. Choe et al. (2005) estimate a

proportional hazards model in order to examine the covariates of early motherhood in Nepal. In addition to place of residence and ethnicity, they also find that education plays an important role.

To explore the relationship between child mortality and age at first marriage and age at motherhood, LeGrand and Barbieri (2002) analyzed data from 21 sub-Saharan African countries. They find a strong association between lower levels of mortality and delayed marriages and motherhood.

Household or family variables also affect the age at marriage. Studies have found that children of parents with higher education are less likely to get married at an early age (Choe et al., 2005). However, there are other important family variables, including marriage characteristics of the parental generation, kin status of parents, social networks, and nature of material exchange at marriage. Yabiku (2006) has explored the role of neighbors and neighborhood in timing of marriage in south-central Nepal. These variables have not been given adequate attention in the literature due to lack of availability of data.

Finally, it is also recognized that a reduction in fertility goals stemming from a smaller desired family size could lead to a delay in marriage. However, Mensch et al. (2003) find that while age at marriage has increased, the gap between age at marriage and motherhood has declined. This is attributed to the need for women to prove fecundity.

As mentioned, the impact of level of education on age at marriage is not straightforward. A similar case can be made in the case of early motherhood. If women decide to marry late, they might opt to attain higher levels of education, thus postponing the age at which they have their first child.

DATA AND METHODS

Data

We use data from the 2005 RDHS to investigate the determinants of age at first marriage and age at first birth. The unit of analysis is an individual woman between 15-49 years and the dependent variables are age at which a woman had her first marriage and the age at which a woman delivered her first child. The 2005 data cover a total of 11,321 women in the 15-49 age group. Details on the survey procedures and sampling design are available in the main survey report (RDHS, 2005).

In addition to including the educational attainment of a woman, the place where she grew up, her religion, and her region (province) of residence as explanatory variables, we control for the age cohort to which the woman belongs. The focus is on whether the behavior of women in the age group 15-24 years and those in the age group 25-34 years is different from those in the age group 35-49 years.

Median age at first marriage increased from 19.3 years in 1992 to 19.9 years in 2000 and remained at 20.1 years in 2005. Similar patterns are observed for age at first birth. It increased from 20.8 years in 1992 to 21.2 years in 2000 and remained at 21.2 years in 2005 (RDHS, 1992; RDHS, 2000; RDHS, 2005).

Table 1 shows that almost 94 percent of women grew up in the countryside. Forty-six percent of women are Catholic adherents and close to two-fifths are Protestant. Fourteen percent of women follow the Adventist faith and barely 2 percent are Muslim. More than 23 percent of women have no education and 67 percent have completed primary education. We find that 44 percent of the women belong to the 15-24 age group and 28 percent each belong to to the 25-34 and 34-49 age groups.

Table 1: Summary statistics

	Years
Median age at first marriage	20.1
Median age at first birth	21.2
	Percent
Location grew up	
City	6.5
Countryside	93.5
Religion	
Catholic	46.3
Protestant	38.3
Adventist	13.5
Muslim	1.9
Education	
No education	23.4
Primary	67.1
Above primary	9.6
Age category	
15 to 24	43.6
25 to 34	28.3
35 plus	28.1
Province	
Kigali City	10.0
South	26.1
West	25.0
North	18.2
East	20.7

Estimated models also include average under-five mortality rates for the regions over the period 1995-2005 and also a cluster level variable reflecting the exposure of women residing in the cluster to conflict and civil war.

In order to study the impact of conflict, we focus only on women who married after the year 1994. The 2005 RDHS data do not have any information on whether and how the women or the households were affected by the events in 1994. Nor is there information on the ethnic group to which the household belongs. However, respondents were asked to list all of their siblings and whether they were alive at the time of the survey. If the sibling was not alive the respondent was asked the number of years since the death

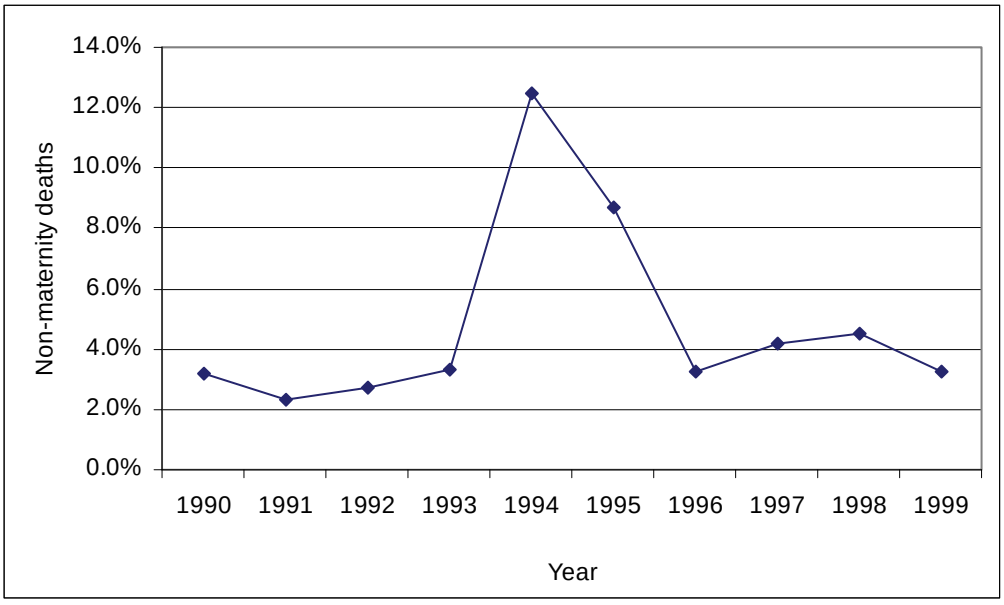
occurred. If the woman's sister age 12 years or above died, then a question was asked on whether the sister's death was maternity related.

We calculate how many of a woman's siblings died in 1994 due to causes not related to maternity. This can be interpreted as a measure of a woman's exposure to conflict. We aggregate this individual level measure to the cluster level and use it as a control in our analysis to understand whether it influences age at marriage and age at first child birth. In order to check for the sensitivity of our results, we generate this cluster level variable using sibling deaths in 1994 and also for the years 1994 and 1995.

The choice of the year 1994 is logical because there was a spike in the proportion of non-maternity related sibling deaths in 1994 (Figure 1). Since we do not have details relating to the cause of non-maternity related deaths, it is possible that not all non-maternity-related deaths were related to conflict or genocide. This is not necessarily true, however. If non-maternity-related deaths were not related to genocide, then we should not see any spike in the number and proportion of such deaths in years other than 1994. We do observe a spike in 1995, but this could be due to recall error. This is why we include sibling deaths in 1994 and 1995 as a robustness check. Since we do find an abnormal spike in deaths not related to maternity in 1994 and 1995, one can safely argue that this measure does indeed capture deaths attributable to the conflict.

Finally, while migration played an important role in altering the population structure and composition of Rwanda, we do not focus on this aspect due to lack of information on migration histories in the RDHS.

Figure 1: Share of non-maternity-related deaths in total sibling deaths by year, Rwanda 2005



Empirical Model: Age at Marriage & Age at First Child

In the literature, authors have typically estimated the Cox proportional hazard model to identify the correlates of the age at first marriage and age at first child birth. Alternatively logit models have been used where the dependent variable takes the value of 1 if the event (marriage or motherhood) occurred after a particular cut off age. For instance, Mahy and Gupta (2001) estimate a logit model in order to model the probability of girls having their first child before the age of 18. However, using standard bivariate and multivariate methods in analyzing current status data could result in biased estimates (Babalola, 2004). The two variables of interest, age at first marriage and age at first child birth, measure the length of time till the occurrence of the event. The analysis also includes women who have not yet experienced the events resulting in right censoring of the data. Hence, we use the Cox proportional hazard model. The Cox proportional hazard is defined as:

$$\theta(t, X_i) = \theta_0(t)\exp(\beta' X_k) = \theta_0(t)\lambda_i = \theta_0^*(t)\lambda_i^*$$

where t is the survival time, β is parameter to be estimates, $\theta(t, X_i)$ is the hazard rate at survival time t for individual i with fixed covariates (X), θ_0 is the baseline hazard function that is dependent on t but not X, and λ is person specific non-negative function of covariates X (Jenkins, 2005). The Cox method allows estimation of the slope coefficients without specifying the functional form of the baseline hazard function.

We include the following variables in order to model the determinants of age at marriage. We include location where the woman grew up (city, countryside), her religion (Catholic, Protestant, Adventist, Muslim), education of the woman (no education, primary schooling, above primary schooling), age categories (15-24, 25-34, 35-49), under-five mortality rate, sibling mortality at the cluster level, and region dummies (Kigali City, South, West, East). We also control for the clustering in the survey design in our analysis.

We estimate three sets of models. In Model 1, the independent variables are the following: location where the woman grew up, her religion, education of the woman, and region dummies. We also use a dummy variable to identify the age cohort (15-24 years, 25-34 years, and 35-49 years) to which the woman belongs. We use this variable to capture differences across the age cohorts since we find differences in the age-specific fertility rates[1] (reproductive behavior) in the years preceding the 2005 survey. Given the cohort-specific differences in reproductive behavior, it is possible that there were some cohort-specific effects in terms of age at marriage.

In Model 2, we examine whether women with similar educational attainment across the three age cohorts have differential probabilities of being married at an earlier age. Hence, we drop the dummy

[1] The 2005 RDHS reveals that the fertility rates are the highest for the women in the age group 25-34 years (RDHS, 2005, Table 4.1, p. 38). At the time of the genocide, women in this cohort were in the age group 14-23 years. This cohort was exposed to the conflict at the beginning of their marital years or during their early childbearing years.

variable relating to age cohort and educational attainment and instead, we include interaction terms of the age cohort and the educational attainment dummies.

In Model 3, we restrict the sample to only those women who were not married in 1994. The specification for Model 3 is similar to Model 1 except that we include two additional variables. We include the average under-five mortality rates for the regions over the period 1995-2005 and also a cluster level variable reflecting the exposure of women residing in the cluster to conflict and civil war. There is evidence to suggest that post genocide there was a marked deterioration in child health outcomes. In Rwanda, in the post-genocide years (i.e., 5-9 years preceding the 2005 RDHS) there was a sharp increase in post-neonatal mortality, infant mortality, child mortality, and under-five mortality rates. Since 2001, there has been a sharp decline in childhood mortality rates (RDHS, 2005, Table 11.1, p. 158).

With the objective of capturing the death of siblings of women living in the cluster, we include two alternative cluster level measures reflecting the impact of conflict: the share of each cluster in the total non-maternity deaths in the year 1994, and the share in the years 1994 and 1995.

In order to analyze the determinants of age at which the first child was born we estimate three models. The explanatory variables for these models are identical to those used to analyze the determinants of age at first marriage.

RESULTS

Table 2 presents the results from the proportional hazard models for age at first marriage, and the results of the survival analysis for age at first child birth are reported in Table 3. The hazard rate is reported, which is the probability of occurrence of an event at a given time if it has not already occurred.

Age at First Marriage

In all the models, we find that women who grew up in the countryside are more likely to marry early compared with women who grew up in a city (Table 2). We also find that compared with Catholics, women who are Protestant, Adventist, or Muslim are likely to marry early. This is true across all models and most likely for Muslims. Those with higher levels of education are less likely to get married early. In Model 1, the effect of education on probability of early marriage is significantly smaller for those with primary and above primary level of education. In Model 3, we do not find lower education levels having any impact on age at first marriage. The effect is not significantly different between those with no education and those with primary level of education. However, the likelihood of early marriage is lower for those who have above primary level of schooling than those with no education. The results from Model 1 suggest that women in the younger cohorts (15-24 and 25-34) are less likely to marry earlier than the oldest cohort (35-49).

We find differential impact of education across the women from different age cohorts (Model 2). The reference group is those who are 35 years or older with no education. We find that women without any education in the age group 15-24 years and 25-34 years are less likely to marry early. The hazard rate for those with no education and age 25-34 years is lower compared with those in the reference group. The hazard rate for those with no education and age 15-24 years is also lower compared with those in the reference group. For every education level, we find that the women in the age group 25-34 years and 15-24 years are less likely to marry earlier compared with women in the age group 35 years and above.

In all the specifications, the coefficient on some dummies related to the regions is significant. This is not surprising for the following reasons. First, the impact of genocide across the provinces was not uniform. Second, there are differences in the poverty levels across the provinces in both 1990 and 2000. Third, there are substantial differences in the change in poverty levels over 1990-2000 across the provinces (Justino and Verwimp, 2006). Fourth, there are differences in the child mortality levels across the regions. The under-five mortality rate ranges from 124 per 1,000 live births in Kigali City to 233 per 1,000 live births in the East province. In the South, West, and North, the under-five mortality rate is lower at 178, 179, and 160 per 1,000 live births, respectively.

Table 2: Hazard ratio of the Cox proportional hazard model for age at first marriage			
Independent variables	Model 1	Model 2	Model 3
Location grew up			
City	1.00	1.00	1.00
Countryside	1.17***	1.17**	1.23**
Religion			
Catholic	1.00	1.00	1.00
Protestant	1.11***	1.11***	1.20***
Adventist	1.11**	1.11**	1.20***
Muslim	1.42***	1.44***	1.72***
Education			
No education	1.00		1.00
Primary	0.83***		0.96
Above primary	0.52***		0.61***
Age category			
Age 35-49	1.00		
Age 15-24	0.51***		
Age 25-34	0.90***		
Province[a]			
East	1.00	1.00	1.00
Kigali City	0.72***	0.72***	
South	0.72***	0.72***	0.91
West	0.85***	0.85***	1.03
North	0.98	0.97	1.33***
Education			
No education and age 35 plus		1.00	
Primary education and age 35 plus		0.91**	
Above primary education and age 35 plus		0.60***	
No education and age 25-34		0.94	
Primary education and age 25-34		0.79***	
Above primary education and age 25-34		0.52***	
No education and age 15-24		0.77***	
Primary education and age 15-24		0.43***	
Above primary education and age 15-24		0.17***	
Under-five mortality			1.04***
Cluster level sibling mortality (1994)			0.77**
Number of observations	11,010	1,1010	6,770
Note: [a]Kigali city dropped due to collinearity in Model 3. * p≤ 0.1; **p≤ 0.05; *** p≤ 0.01			

Given these four factors, it is reasonable to conjecture that there would be variations in age at marriage and hence age at first child. In Models 1 and 2 we find that residence in Kigali City, South, and West provinces lowers the likelihood of getting married early. In Model 1 it is lower in Kigali City, South and West compared with East. The hazard rates are very similar in Models 1 and 2. In Model 3, those living in the North are more likely to marry compared with those in the East.

Regional estimates of under-five mortality rate are included as controls in Model 3. The hazard rate associated with under-five mortality rate is more than 1 and statistically significant. This indicates that regions with higher under-five mortality rate are more likely to marry early. We find that women living in clusters with more sibling deaths are less likely to have early marriages. As a robustness check

we also ran an alternative specification where we included death of all siblings at the cluster level in the years 1994 and 1995. Our results remained unchanged.

We already argued why women who lost their siblings might behave differently from those women whose siblings are alive. A majority of those who were killed were Tutsi and evidence from the 1992 RDHS shows that Tutsis marry later. More importantly, kinship among women who lost their siblings was probably weakened to a significant extent, thereby hampering their efforts at finding a suitable match in the marriage market.

Age at First Birth

Table 3 shows that place of childhood residence does not seem to impact the age at first birth. We find that compared with those with no education, those with higher levels of education are less likely to have the first birth early (Model 1). Women in the age cohort 15-24 years are more likely to have their first child later compared with those in the 35-49 years cohort. However, we do not find any difference between age cohorts 35-49 and 25-34. Compared with women with no education, women who have completed primary or higher education were less likely to have their first child earlier.

Unlike in the case of age at first marriage, we find no difference in age at first child birth among women with no education across the three age cohorts (Model 2). Thus we find that while age at first marriage has increased across women with differing educational attainment, the age at first child is not different across women with no education across all age categories. Ignoring those who have no education, for every other education level, we find that the women in the age groups 25-34 years and 15-24 years are less likely to have their first child earlier compared with women in the age group 35 years and above.

We find that compared with Catholic women, Protestant and Muslim women are significantly more likely to have their first child at an earlier age. Similar to the results on age at marriage, we find significant differences across the provinces. In Models 1 and 2, compared with those living in the East, those in Kigali City, South, and West have a lower likelihood of early first birth. As observed earlier, Model 3 shows that residence in the Northern provinces increases the likelihood of early motherhood. Also, those residing in the South are less likely to have early first child birth. As in the case of age at first marriage, we find that women from regions with higher under-five mortality rates are more likely to have their first child early and women living in clusters with more sibling deaths are less likely to have their first child early.

Table 3: Hazard ratio of the Cox proportional hazard model for age at first birth			
Independent variables	Model 1	Model 2	Model 3
Location grew up			
City	1.00	1.00	1.00
Countryside	1.07	1.07	1.05
Religion			
Catholic	1.00	1.00	1.00
Protestant	1.10***	1.10***	1.15***
Adventist	1.06	1.07	1.12*
Muslim	1.87***	1.87***	2.34***
Education			
No education	1.00		1.00
Primary	0.86***		0.95
Above primary	0.56***		0.64***
Age category			
Age 35-49	1.00		
Age 15 to 24	0.74***		
Age 25 to 34	1.00		
Province[a]			
East	1.00	1.00	1.00
Kigali City	0.80***	0.80***	
South	0.72***	0.72***	0.86**
West	0.89**	0.88***	1.00
North	0.96	0.96	1.23***
Education			
No education and age 35 plus		1.00	
Primary education and age 35 plus		0.93*	
Above primary education and age 35 plus		0.62***	
No education and age 25-34		1.00	
Primary education and age 25-34		0.90**	
Above primary education and age 25-34		0.61***	
No education and age 15-24		1.09	
Primary education and age 15-24		0.63***	
Above primary education and age 15-24		0.31***	
Under-five mortality			1.03***
Cluster level sibling mortality (1994)			0.77**
Number of observations	11,010	11,010	6,770

Note: [a]Kigali city dropped due to collinearity in Model 3. * p≤ 0.1; **p≤ 0.05; *** p≤ 0.01

DISCUSSION

We find that women who grew up in the countryside have a strong association with early marriage compared with women who grew up in a city. However, place of childhood residence does not seem to impact the age at first birth. Religion also seems to have an impact on the decision to marry and have child. Protestants, Adventists, or Muslims are likely to marry early compared with Catholics. Given that the data cover the pre- and post- civil war and genocide periods, the religion variable needs to be interpreted with caution. Comparison of the 1992 RDHS and 2005 RDHS data reveal the following picture. There were fewer Catholic women (44 percent) in 2005 compared with 1992 (63 percent). The share of women who reported being Protestants and Seventh Day Adventists increased correspondingly.

We find that higher levels of education lower the likelihood of early age at marriage and age at first birth. However, when we restrict the sample to only those women who were not married in 1994, lower levels of education (primary level) are not significantly associated with entry into marriage and motherhood. This is plausible since age at marriage worldwide has generally increased. This is also consistent with the finding in the literature that women with 0 to 3 years of schooling are more likely to marry early than those with 8 or more years of education (Mensch et al., 2006).

We now address the issue of whether education is a potentially endogenous variable. From the data it is not apparent that in Rwanda there are a large number of women opting to spend more years in school and hence postponing marriage. First, the female healthy life expectancy at birth stood at 40.2 years in 2002. The average life expectancy decreased from 44.6 years in 1970-75 to 40.5 years in 1995-2000. Low levels of life expectancy will imply a reduced incentive to invest in higher levels of human capital accumulation. Second, in addition to loss of human capital in the 1990s, there was also a destruction of infrastructure, including schools (World Bank, 2004). As is well documented in the literature, improvements in school quality can improve school enrollment and grade completion. However, in Rwanda, access to good quality school infrastructure was greatly reduced. Third, we find that among the respondents, 23 percent have no education while 67 percent have only completed primary schooling. Among the 10 percent of women who have above primary level of education, women who drop out of school while in secondary school would have had a minimum of 7 years of education. Across all women, less than 5 percent of women have completed over 10 years of schooling. These women are distributed across all the age cohorts, i.e., the distribution of age at marriage is similar for women with 10 years of education and those who have completed up to secondary schooling. Considering the above facts, education is unlikely to be an endogenous variable in the above analysis.

Fertility decisions and infant mortality rates are closely linked. Regions where under-five mortality rates are high are also regions where fertility rates are high. Families have more children if they know some of them may not survive. We find that higher levels of under-five mortality increase the

likelihood of early birth of first child. LeGrand and Barbieri (2002) have pointed to the strong association between lower levels of mortality and delayed motherhood.

In Rwanda, there is evidence to suggest that the high number of male deaths led to an increase in female-headed and child-headed households (World Bank, 2004). It is plausible that women living in clusters accounting for a higher proportion of non-maternity deaths could marry later because either their social networks were destroyed or there was a shortage of men. A majority of those killed were Tutsi. Hence it is possible that the women who lost their siblings were Tutsi[2]. Also, kinship among women who lost their siblings was likely to be weakened. This would affect their ability to find a suitable match in the marriage market. Ideally one should include family contextual variables in the analysis, but we were unable to do so due to lack of availability of such information.

[2] We estimated model 1 using 1992 Rwanda Demographic and Health Survey data. Since information on ethnicity variable was available, we included this information in the analysis. We found that compared with Hutu, Tutsi were at lower risk of getting married earlier.

CONCLUSION

This paper contributes to the literature on decision making by women and reproductive behavior in times of conflict and crisis. There are documented cases of changes in fertility during periods of conflict and crises. Large casualties might lead to a destruction of kinship. The sex ratio might also get skewed if there are more male casualties. These two effects might affect the timing of marriage among women and men.

Since the Demographic and Health Surveys have information on timing of marriage and childbirth of women, we use data from 2005 RDHS to estimate a Cox proportional hazard model to identify the determinants of age at marriage of women and also the age at which women have their first child. Using the information on the number of siblings a woman lost during the period of civil war and genocide allows us to focus on crisis-induced changes in age at marriage. After controlling for individual characteristics, one key finding is that women living in clusters accounting for a larger proportion of the sibling deaths in 1994 were likely to marry later and have children later compared with those living in clusters accounting for a lower proportion of sibling deaths. Our conjecture is that among women who lost their siblings kinship was probably weakened to a significant extent, thereby affecting the timing of their marriage. Given that women were marrying later, they were having their first child at a later age. However, we find one offsetting effect. The poor health infrastructure in Rwanda probably contributed to high levels of infant mortality. We find that women living in regions with higher levels of under-five mortality were at higher risk of having their first child earlier compared with women living in regions with lower under-five mortality. We find that there are differences in the age at marriage and age at motherhood across the provinces of Rwanda. This is not surprising given that there were differences in the poverty levels across the provinces and the impact of genocide was not uniform across the provinces.

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