Public Disclosure Authorized

Public Disclosure Authorized

WPS4850

POLICY RESEARCH WORKING PAPER 4850

The Demographic and Socio-Economic Distribution of Excess Mortality during the 1994 Genocide in Rwanda

Damien de Walque
Philip Verwimp

The World Bank
Development Research Group
Human Development and Public Services Team
March 2009

Policy Research Working Paper 4580

Abstract

There is an extensive literature on violent conflicts such as the 1994 Rwandan genocide, but few papers examine the profiles of victims and perpetrators, or more broadly the micro-level dynamics of widespread violence. This paper studies the demographic consequences of the Rwandan genocide and how the excess mortality due to the conflict was distributed in the population. Data collected by the 2000 Demographic and Health Survey indicate that although there were more deaths across the entire population, adult males were the most likely to die. Using the characteristics of the survey respondent as a proxy for the socio-economic status of the family dead, the results also show that individuals with an urban or more educated background were more likely to die. Over and above the human tragedies, a long-term cost of the genocide is the country's loss of productive skills.

This paper—a product of the Human Development and Public Services Team, Development Research Group—is part of a larger effort in the department to understand the consequences of conflict. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at ddewalque@worldbank.org and philip.verwimp@gmail.com.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

Produced by the Research Support Team

The Demographic and Socio-Economic Distribution of Excess Mortality during the 1994 Genocide in Rwanda

Damien de Walque
The World Bank, Development Research Group
Philip Verwimp
Fund for Scientific Research – Flanders, University of Antwerp and European Centre for Advanced Research in Economics and Statistics (ECARES)
Université Libre de Bruxelles

We thank participants at the second Households in Conflict Network workshop (Antwerp, January 2007) Shannon Allen, and Deon Filmer for useful suggestions and comments. Shannon Allen provided excellent research assistance. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the view of the World Bank, its Executive Directors, or the countries they represent.

1. Introduction

This paper studies the long-term demographic consequences of the Rwandan genocide (1994) and, in particular, it analyzes how excess mortality was distributed in the population. This study complements earlier work by Verwimp (2003a, 2003b, 2004 and 2005). The analysis uses the siblings' mortality module of the 2000 Demographic and Health Survey (DHS) in Rwanda to analyze mortality during 1994. The maternal mortality module collects from female survey respondents the following information: number of brothers and sisters born from the biological mother of the respondent and, for each of the siblings; gender, survival status, age and age at death if relevant. De Walque (2005 and 2006) has used this method to analyze selective mortality during the Khmer Rouge Period in Cambodia.

We find that the excess mortality of 1994 dramatically affected the population composition of Rwanda. Adult males were most likely to die, indicating that violent deaths represented a very large share of the excess mortality. Using the characteristics of the respondent sister as a proxy for the socio-economic status of the family, we also establish that individuals with an urban or educated background were more likely to die. We consider the possibility that these two results are driven by the fact that Tutsi were especially targeted by the 1994 genocide. Indeed, we find, using the 1992 Demographic and Health Survey, that Tutsi were more likely to be educated and to live in urban areas. Since ethnic variables have not been collected in the 2000 DHS, our analysis suffers from an omitted variable bias. We try to tackle this issue by using age at marriage as a proxy for being Tutsi. Even if we can only partially address the omitted variable bias, we can conclude that the genocide represented, over and above the human tragedies, a huge

negative shock for the human capital in Rwanda, since the more educated and urban groups of the population were more likely to be victims.

The paper's objective is to increase our understanding of the micro-level dynamics of violent conflict. Firstly, by analyzing the socio-economic characteristics of the victims, we better understand the direction of the violence, which brings us closer to the intentions or motivations of the perpetrator. Secondly, the analysis also adds insights into the long-term consequences of the 1994 genocide, in particular the loss of human capital.

There is an extensive literature on the Rwandan genocide and other violent conflicts, but few papers address the profiles of victims or perpetrators, or more broadly the micro-level dynamics of the violence. Using a small sample from Northern Rwanda, André and Platteau (1998) found that land issues, land endowment and more general wealth and social status played an important role in the genocidal dynamic at the local level. Their sample was almost entirely Hutu. Kalyvas (2006) convincingly demonstrates that local participants in violence during civil war more often than not have other agendas than the macro-level narrative that is supposedly driving the conflict. Verwimp (2003b), using a small sample form southern Rwanda, shows that older and wealthy Rwandans had a higher propensity to be killed in the genocidal violence, even after controlling for ethnicity. Bundervoet (2009), in an analysis of victim profiles from the 1993 massacres in Burundi, finds that wealth in terms of livestock and human capital increased the propensity to be killed. De Walque (2005) shows that the Khmer Rouge particularly killed educated and urban residents. Akresh and de Walque (2008) found that the 1994 genocide in Rwanda had a lasting negative impact on the educational achievement of children who were of school going age in 1994. A common result from the empirical

work of the mentioned authors is that the killing of an individual, even during a massacre or genocide is not a random event. Victims are deliberately targeted, be it for their ethnicity, status, wealth, education, gender, religion or political conviction.

The paper is structured as follows. Section 2 gives a short overview of the Rwandan genocide. Section 3 presents the methodology and the data. Section 4 describes the main results while section 5 addresses the omitted variable bias caused by the absence of the ethnic variable. Section 6 concludes.

2. Short History of the Rwandan Genocide

Between April and July 1994, between 500,000 and 800,000 Tutsi (Prunier, 1995 ; Des Forges, 1999) or about 75% of the Tutsi population together with many Hutu who were known to be opponents of Habyarimana were killed by the Rwandan military (FAR), local police, national guard and militia called Interahamwe. A few years before, in October 1990, a group of rebels consisting of Tutsi refugees who had left Rwanda during the 1959-1962 revolution, together with their offspring, attacked Rwanda from Uganda. What followed was a civil war between the Rwandan armed forces (Forces Armées Rwandaises, FAR) and the rebel army (Rwandan Patriotic Front, RPF) in which the civilian population in the north of Rwanda was the main victim. While the RPF claimed to fight against the dictatorship of president Habyarimana, the latter claimed to represent the majority of the people. The battles between both armies were paralleled by peace negotiations and third party interventions. In order to understand the drama of this period, it is essential to know its history.

The ethnic composition of the population had been a major issue in Rwandan politics since the time of colonization. The Belgian colonizer had first favoured the Tutsi

ruling class because they were considered racially superior to the Hutu, who were considered a people of cultivators. In the 1950s, with the spread of anti-colonial and independence movements, the ruling Tutsi began to claim the independence of Rwanda. At that time a Hutu counter-elite was given the chance to study at catholic seminars. With Belgian military and political aid, this new elite of Hutu leaders succeeded in overturning the ruling Tutsi regime and replace it by the leadership of the *Parmehutu*, the party for the emancipation of the Hutu. Grégoire Kayibanda, a seminarian, became the first president. The ethnic divide however remained and was even strengthened. The new rulers, at the national as well as at the local level established their power by removing all Tutsi from positions of power. Ordinary Tutsi who were not associated with political power were also targets of reprisal and murder. For detailed treatment of the history of Rwanda, we refer to books written by G. Prunier (1995), C. Newbury (1988), D. De Lame (1996), F. Reyntjens (1994) and J.P. Chrétien (2000), among others.

In 1973 a group of army officers around Juvénal Habyarimana took power by a coup d'état. They were frustrated by the monopolization of power by the group around Kayibanda, whose power base was the central prefecture of Gitarama. The group around Habyarimana, originating from northern Rwanda, saw all benefits of power go to the people from Gitarama. After the coup d'état, Habyarimana became the new president. He established the MRND (Mouvement Révolutionnaire National pour le Dévéloppement), the single party whom every Rwandan was supposed to belong to by birth. Aided by high prices for the coffee, the country's main export crop, in the late 1970s and generous donor support, Habyarimana was liked, or at least not contested, by a large part of the population. He did not abolish the ethnic identity cards and he forbade officers and soldiers to marry Tutsi wives. In order to control population movements, he set up a

detailed system of registration and reporting of demographic changes at the local level. He also had every adult participate in the *Umuganda* (weekly communal labor), and institutionalized weekly animation sessions in honor of himself (Verwimp, 2003a).

A key characteristic of the Habyarimana regime was its doctrine on the relation between population and land. The president had never been an advocate of a family planning policy. On several occasions he declared that children were the wealth of every Rwandan family. Groups set up by the Ministry of the Interior attacked pharmacies that sold condoms. The president was fully supported by the Catholic Church, which was omnipresent in Rwanda. The fertility rate of Rwandan women was among the highest in the world and the average size of cultivated land per family was shrinking rapidly from 1.2 ha in 1984 to 0.9 ha in 1990 (National Agricultural Surveys, 1984 and 1989-1991). Many families had not enough land to earn a living and feed their families. In 1986, when discussing the fate of the 1959-1962 refugees, the Central Committee of the MRND said that their return was not possible because the country was overpopulated.

During the civil war preceding the genocide (1990-1994), a number of local massacres occurred in which a total of 2,000 Tutsi were killed. These massacres were not spontaneous outburst of violence from a poor peasant population but were organized by the national power elite. On April 6th, 1994 Habyarimana's plane was shot down. After that, the genocide broke out.

3. Methodology and Data Description

We use the 1992 and the 2000 Demographic and Health Surveys (DHS) for Rwanda. The 2000 survey includes a module collecting information on all the siblings of the respondent, including siblings who have died. The respondent is always an adult

female, age 15-49. We thus have information on the date of birth, the sex and - in case of death - also the date of death of all siblings of the adult female interviewed in the 2000 DHS. One advantage of the mortality module is that it greatly increases the size of the population from which mortality estimates are calculated. Using this module, we increase the number of cases in our analysis from roughly 10,000 adult females to close to 45,000 siblings of the survey respondents. In addition, compared to many studies about mortality, it is not drawn from a sample of convenience (e.g. refugees), since the DHS are administered to a randomly selected representative sample of the population.

There are however several methodological issues implied by using a sample of survivors. Even with a nationally representative sample, estimates based on a sample of survivors are potentially subject to several shortcomings (see for example, Heuveline, 1998, 2001 (a), 2001 (b) about estimates of the number of deaths during the Khmer Rouge period in Cambodia). First, the method relies on recall of past events and is therefore possibly prone to misreporting. Several tests of data quality are performed in the DHS report and there does not seem to be systematic reporting biases; the sex ratios at birth are in the internationally acceptable range suggesting that there is no serious under- or over-reporting of brothers or sisters. Similarly, the median year of birth is the same for respondents as for siblings, indicating that there is no underreporting of older siblings. When more than one respondent in the same household reported on the same sibship, only one respondent was randomly retained.

Given the way the adult mortality schedule is constructed, we miss entirely families in which only males were born and we are likely to under-represent families where a majority of males where born. But this is only likely to have an impact if we

think that mortality in the genocide was affected not only by one's own gender (which was the case, as we will show) but also by the gender composition of one's own sibship.

Another methodological issue is that for siblings from a family to have a chance to be represented in the survey, at least one of the siblings need to have survived until the date of the survey. In other words, the survey misses the families where all siblings died and is likely to over-sample families with many survivors (Gakidou and King, 2006). This means that the survival probabilities of brothers and sisters are not independent. This is, therefore, likely to lead to an underestimation of the extent of the mortality. This problem is more likely to occur during extreme mortality crises, like the genocide in Rwanda, when the deaths among siblings might be highly correlated. To account for the unequal probability of selection into the sample, we weighted the data by a factor of the inverse of the number of surviving females age 15-49 in each family. We will also not include the respondent in the counts, but only her siblings, because otherwise mortality would be further underestimated since, by definition, respondents are all survivors.

We should however keep the risk of underestimation of deaths in perspective. While it is correct that often, members of Tutsi households (parents and children living in the same dwelling) were killed at the same time, at the same place and by the same people (Verwimp, 2003), this is not the case for adult brothers and sisters who had already started their own households before the genocide. Married sisters and brothers do not live with each other but with their respective partners, thereby increasing the probability that at least one of the adult brothers or sisters survived the genocide. Given that on average Rwandan mothers gave birth to eight children in the period covered by the 1992 and 2000 DHS, it is very likely that at least one of them will have survived the genocide. With the maternal mortality module, this is precisely what we are capturing:

the death and survival of the siblings of the adult female, not of current household members.

Despite the shortcomings, the mortality estimates - derived from the siblings' data from a large representative sample – offer useful insights. Even if they might underestimate the number of deaths, they provide an accurate measure of the impact of mortality on the current population structure of Rwanda. Such data also allow the analysis to address questions about the timing and the socio-economic distribution of excess mortality that cannot be answered with other approaches like the reconstruction approach that compares population counts and distributions from one census to the other (see for the case of Cambodia, Heuveline, 2001a and 2001b).

In the siblings' data collected in a nationally representative Demographic and Health Survey, there is no direct information on the socio-economic status of the siblings. However, by using information about the respondents, it is possible to proxy the socio-economic status of the family. For example, the schooling levels of the female respondents can be considered a good indicator of the social and educational status of their family. For the type of residence, one variable indicates whether the respondent is living in a rural or an urban area. Combined with variables about migration history, this allows us, in most cases, to determine whether the family was living in a rural or an urban area in 1994. For individuals who never moved, or who moved for the last time before 1994, the current residence is the residence in 1994. For individuals who moved after 1994, the survey only records the type of residence immediately prior to the last move. If there was only one move between 1994 and 2000, this does not constitute a problem. If there have been several moves between 1994 and 2000, we cannot be certain of the type of residence in 1994, but we make the assumption that the type of residence (urban vs.

rural) immediately prior to the last move is the same type of residence than in 1994[1]. This gives us the type of residence in 1994 of the respondent sibling. We use this information, and the assumption that siblings share common characteristics and background to determine whether the other siblings have a rural or an urban background.

The Rwanda 2000 DHS has one major drawback for the present analysis: it does not contain the ethnicity of the respondent. The Government of Rwanda no longer allows the registration of ethnicity, thereby complicating our analysis. It is namely generally acknowledged that the 1994 genocide targeted mainly Tutsi. Econometrically, this is the equivalent of an omitted variable problem. A variable, ethnicity, determines the probability to die and we cannot include it in the analysis. We address this problem in Section 5.

4. Demographic and Socio-economic Distribution of Excess Mortality in 1994

Our analysis proceeds in two steps: first, we provide descriptive statistics about trends in mortality for different categories (by gender, birth cohort and socio-economic status) as illustrated in figures 1-5. In a second stage, we will verify the robustness of the findings from the descriptive trends in a multivariate regression framework.

Our results indicate that the excess mortality of 1994 dramatically affected the population composition of Rwanda. Figure 1 very simply plots, without any adjustment for the number and the age of individuals at risk in each year, the number of deaths reported among siblings in each year. It illustrates very clearly that excess mortality was heavily concentrated in 1994.

[1] As a robustness check, we also relaxed this assumption and performed the analysis on the sub-sample for which we had certainty about their rural/urban location before 1994. The results were very similar.

Mortality in Rwanda in 1994 was not only due to the genocide and the war; mass migrations, very poor health conditions and a cholera epidemic in refugee camps also contributed to the excess mortality. However, the distribution of the death probabilities by birth cohort in 1994, illustrated in figure 2, is evidence that a considerable proportion of the excess mortality is due to violent deaths, since it is not the birth cohorts most vulnerable to poor health and diseases (children and elderly adults), who experienced the highest mortality. Adults, and to a larger extent adult males, were most likely to die.

Using the characteristics of the respondent sister as a proxy for the socio-economic status of the family, figures 3, 4 and 5 establish that individuals with an urban or educated background were more likely to die. Figure 3 shows that at all ages, individuals with an urban background, i.e. siblings of women who lived in urban areas in 1994, were more likely to die in 1994. That differential increases after age 15. Figures 4 and 5 follow the same format for the educational background of individuals. Figure 4 shows that siblings of women with at least some primary education were more likely to die, at adult ages, than individuals whose sister had no education. Figure 5 is constructed in the same way and establishes that individuals who had a sister who attended secondary school were more likely to experience excess mortality. In figure 5 which compares secondary education with lower schooling achievements, the magnitude of the differential is larger and extends over all ages, even if it still peaks among adults. Figures 2 to 5 are very suggestive, but they only illustrate a univaried analysis.

In a second step, we perform a logit analyis estimating the following specification

$$E(Y_i) = P_i = L(\alpha + \beta X_i)$$

where Y_i represents the probability to die in 1994 and assumes value 1 or 0. *X* is a vector of sibling and family characteristics. The regressors of interest are the gender and dummies for the age of the sibling in 1994 and the rural and the educational background of the family. The data are weighed with the population weights provided in the DHS as well as with the inverse of the number of surviving females age 15-49 in each family and the standard errors are clustered by enumeration area.

Table 1 confirms the results from the figures in a multivariate regression framework. The three panels display marginal effects of the coefficients in the above regression. The results indicate that, controlling for age, males and people with an educated and an urban background were more likely to die in 1994. Males were 1.3 percentage points more likely to die, while individuals with a rural background are a little bit more than 3 percentage points less likely to have died. Each panel uses a different measure of education: panel A compares no education with at least some primary education (1.7 percentage point more likely to die), panel B compares at least some secondary education (4.5 percentage point more likely to have died) with lower educational achievements and panel C enters linearly the years of education (each additional year of education increases by 0.3 percentage point the probability to have died).

5. The Omitted Variable Problem

The 2000 DHS has one major drawback: it does not contain the ethnicity of the respondent. The ethnicity variable is determining the probability to die but we cannot include it in the analysis. Before using an econometric strategy to deal with this omitted variable problem, we should first note that Tutsi were not the only victims of the 1994

events. Educated (or richer) Hutu were also killed, both in the genocide as well as in the war with the Rwandese Patriotic Front (RPF). The literature offers dramatic examples of this. Mamdami (2001) reports, for example, that, in order to escape killing, Tutsi girls '*had to dress and behave like peasants* 'implying that the victims were also targeted based on class (rich vs. poor or urban vs. rural). Since our dependent variable captures all deaths in 1994, not just in the three months of the genocide, it includes all deaths in the genocide and the war (Tutsi as well as Hutu) as well as deaths by disease (e.g. in the refugee camps in Democratic Republic of Congo).

Our econometric strategy is as follows: the 1992 DHS contains the ethnicity of the respondents. We are thus able to analyse differences between Hutu and Tutsi in 1992. Panel A of table 2 analyzes the correlation between being Tutsi, and education and urban residence in the female sample of the 1992 DHS. The results show that even when controlling for region and age, there is a strong positive correlation between education, urban status and being Tutsi. This confirms our fear that the relationship between mortality in 1994 and education and urban residence is at least partially driven by the fact that Tutsi were more likely to die during the genocide.

Our next step is then to find a proxy for being Tutsi, a variable that would be correlated with Tutsi but that would *not* be correlated, by itself, i.e. independently from being Tutsi, with the probability of dying in 1994. We believe that the fact that Tutsi married at a later age satisfies these conditions. Panel B of table 2 indicates that even after controlling for education, urban residence, region and age, Tutsi women married later. Thus, age at marriage is positively correlated with being Tutsi. This fact had

already been documented in the 1991 Census of Rwanda where it was found that the age at marriage for Hutu women was 22.6 and for Tutsi women 25.6[2]

We will further argue that the only reason that women who married later have been more likely to die in the genocide is because they were Tutsi. In other words, our assumption is that the genocide made more victims among people who married later, not because they were targeted as such, but because they were Tutsi - who happen to marry later.

We therefore use in the 2000 DHS age at marriage as a proxy for being Tutsi. Once again, we do not have the age at marriage of the individuals whose mortality we are investigating, but we are using the age at marriage of their respondent sister as the proxy. Table 3 implements this strategy. Like table 1, it contains three panels for the three different measures of education: primary education dummy, secondary education dummy and years of education. Column 1 repeats the specifications of table 1 but adds age at marriage as a proxy for being Tutsi. This regression limits the sample to siblings of married women. However, since for a given age, being married might be correlated with being a Tutsi, we want to avoid this truncation of the sample. Column 2 therefore introduces, for the full sample, an interaction between being never married and age at marriage as the proxy for being Tutsi.

We find that being never married and age at marriage are positively correlated with dying in 1994 (significant at the 10 percent level), which suggests that this is a good proxy. The coefficients on urban residence remain positive and significant, even after using the proxy in the three panels. The same is generally true for the coefficients on

[2] Recensement Général de la Population et de l'Habitat au 15 Aout 1991, Résultats Définitifs, Service National de Recensement, Ministère du Plan, Kigali, 1994, p. 186

education, even though with primary education compared with no education, the coefficient is not significant in column 2 of panel A. This set of results is suggestive evidence that the positive relationship between education, urban residence and mortality during the 1994 genocide in Rwanda was general and was not only driven by the fact that the Tutsis - who were more educated and more likely to live in urban areas, were targeted by the genocide.

6. Conclusions

This paper uses the maternal mortality module in Rwanda's 2000 Demographic and Health Survey to analyze how excess mortality during the 1994 Genocide in Rwanda was distributed in the population. We find that adult males were most likely to die, indicating that violent deaths represented a very large share of the excess mortality. Using the characteristics of the respondent sister as a proxy for the socio-economic status of the family, we also establish that individuals with an urban or educated background were more likely to die.

The econometric strategy does not allow us to conclude that we completely solved the omitted variable bias due to the absence of the ethnic variable in the 2000 DHS. Age at marriage is only an imperfect proxy for being Tutsi. The coefficients on education and the type of residence in table 3 may still be picking up part of the ethnic effect. Nevertheless, we have gone one step further in addressing the omitted variable bias and our evidence suggests that, over and above targeting Tutsi, mortality in 1994 in Rwanda was more likely to be concentrated among the urban and educated groups of the population. We can certainly conclude that the genocide disproportionately affected educated and urban groups and therefore, over and above the lost lives, had a further

impact in depriving Rwanda of its most skilled inhabitants. This is true independent of the omitted variable bias.

References

Akresh, Richard and Damien de Walque. 2008. "Armed conflict and schooling : evidence from the 1994 Rwandan genocide". World Bank Policy Research Working Paper 4606, The World Bank, Washington, DC.

André, Catherine and Jean-Philippe Platteau. 1998. Land Relations under unbearable stress: Rwanda caught in the Malthusian Trap. *Journal of Economic behaviour and Organisation*, 34, 1– 47

Bundervoet, Tom. 2009. Wealth, Density and Political Power: the 1993 Killings in Burundi, *Journal of Peace Research*, forthcoming

Chrétien, Jean-Pierre. 2000. Afrique des Grands lacs : deux mille ans d'histoire , Paris, Aubier.

De Lame, Danielle. 1996. Une Colline entre mille ou me calme avant la tempete, Transformations et Blocages du Rwanda Rural, Musée Royale de l' Afrique Centrale, Tervuren

de Walque, Damien. 2005. "Selective Mortality During the Khmer Rouge Period in Cambodia", *Population and Development Review* 31 (2): 351-368.

de Walque, Damien. 2006. "The Socio-Demographic Legacy of the Khmer Rouge Period in Cambodia, *Population Studies*, 60 (2): 223-231.

Gakidou, Emmanuela and Gary King. 2006. "Death by Survey: Estimating Adult Mortality without Selection Bias from Sibling Survival Data." *Demography, 43(3), 569-585.*

Heuveline, Patrick. 2001(a). "Approaches to Measuring Genocide: Excess Mortality During the Khmer Rouge Period." In D. Chirot and M. Seligman, eds., *Ethnopolitical Warfare. Causes, Consequences and Possible Solutions.* Washington D.C.: American Psychological Association.

Heuveline, Patrick. 2001(b). "The Demographic Analysis of Mortality Crises: The Case of Cambodia, 1970-1979." In H. E. Reed and C. B. Keely, eds., *Forced Migration and Mortality*. Washington, D.C.: National Academy Press.

Kalyvas, Stathis. 2006. The Logic of Violene in Civil War, Cambridge University Press, Cambridge

Mamdami, Mahmood. 2001. When Victims become Killers, Princeton University Press.

Newbury, Catherine. 1988. The Cohesion of Oppression: clientship and ethnicity in Rwanda, 1860-1960, New York, Columbia University Press

Prunier, G. 1995. The Rwanda Crisis, History of a Genocide, University of Columbia Press, New York

Reyntjens, Filip.1994. L'Afrique des Grands Lacs en Crise, L' Harmattan, Paris

Service National de Recensement, Ministère du Plan. 1994. « Recensement Général de la Population et de l'Habitat au 15 Aout 1991, Résultats Définitifs », Kigali.

Verwimp, Philip. 2003 (a). "The Political Economy of Coffee, Dictatorship and Genocide." *European Journal of Political Economy* 19: 161-81.

Verwimp, Philip. 2003 (b). "Testing the Double Genocide Thesis for Central and Southern Rwanda." *Journal of Conflict Resolution* 47: 423-42.

Verwimp, Philip. 2004. "Death and Survival during the 1994 Genocide in Rwanda." *Population Studies* 58: 233-45.

Verwimp, Philip. 2005. "An Economic Profile of Peasant Perpetrators of Genocide." *Journal of Development Economics*. 77: 297-323

Table 1: The socio-economic determinants of mortality in 1994 in Rwanda

Dependent variable: Died in 1994

A. Education is measured by comparing primary education with no education

Male	0.013
	[0.005]***
Sister with at least some primary education	0.017
	[0.008]**
Sister was living in an rural area in 1994	-0.035
	[0.008]***
N =	44568

B. Education is measured by comparing secondary education with lower schooling

Male	0.013
	[0.005]***
Sister with some secondary education	0.045
	[0.016]***
Sister was living in an rural area in 1994	-0.032
	[0.008]***
N =	44568

C. Education is measured by the years of education

Male	0.013
	[0.005]***
Sister's years of education	0.003
	[0.001]***
Sister was living in an rural area in 1994	-0.032
	[0.008]***
N =	44522

Marginal effects of logit regressions, dummies for age in 1994 included. The data is taken from the siblings' mortality data of the Demographic and Health Survey, 2000, Rwanda. The data are weighted as recommended by the data provider, and adjusted to account for unequal probability of selection into the sample by a factor of 1/number of surviving females age 15-49 in each family. When more than one respondent in the same household reports on the same sibship, only one respondent is randomly retained. The background of the family is derived from the characteristics of the sister who answered the survey. For sisters who never moved or moved for the last time before 1994, the actual location is recorded. Sisters who moved after 1994 are assumed to have been living in 1994 in the same type of location as the one reported, in 2000, as the previous one. Clustered standard errors between square brackets. ***, **, *: significant at the 1, 5 and, 10 percent confidence interval, respectively.

Table 2: The relationship between ethnicity, education, urban residence and age at marriage.
Analysis of the 1992 Rwanda Demographic and Health Survey

A. Dependent variable: Indicator for being Tutsi (females only)

Urban	0.066	0.063	0.056
	[0.018]***	[0.027]**	[0.026]
Years of education	0.009	0.007	0.008
	[0.0013]***	[0.0012]***	[0.013]***
Region dummies	No	Yes	Yes
Age dummies	No	No	Yes
N =	6498	6498	6498

B. Dependent variable: age at marriage (Married females only)

Tutsi	1.325	1.238	1.145
	[0.216]***	[0.220]***	[0.208]***
Urban	0.138	0.151	0.063
	[0.171]	[0.178]	[0.169]
Years of education	0.178	0.173	0.190
	[0.013]***	[0.013]***	[0.013]***
Region dummies	No	Yes	Yes
Age dummies	No	No	Yes
N =	4341	4341	4341

Marginal effects of logit regressions in panel A, linear regressions in panel B. The data is taken from the Demographic and Health Survey, 1992, Rwanda. The data are weighted as recommended by the data provider. Clustered (by enumeration area) standard errors between square brackets. ***, **, *: significant at the 1, 5 and, 10 percent confidence interval, respectively.

Table 3: The socio-economic determinants of mortality in 1994 in Rwanda, using age at marriage as a proxy for ethnicity

Dependent variable: Died in 1994

A. Education is measured by comparing primary education with no education

	(1)	(2)
Male	0.018	0.013
	[0.006]***	[0.005]***
Sister with primary education	0.024	0.014
	[0.010]***	[0.009]
Sister was living in an rural area in 1994	-0.022	-0.036
	[0.010]**	[0.008]***
Never married	-	0.069
		[0.032]**
Age at marriage if married	0.003	0.003
	[0.001]**	[0.001]**
N =	31523	44568

B. Education is measured by comparing secondary education with lower schooling

Male	0.019	0.013
	[0.006]***	[0.005]***
Sister with secondary education	0.045	0.040
	[0.020]**	[0.016]***
Sister was living in an rural area in 1994	-0.022	-0.033
	[0.010]**	[0.008]***
Never married	-	0.061
		[0.031]**
Age at marriage if married	0.003	0.002
	[0.001]**	[0.001]*
N =	31523	44568

C. Education is measured by the years of education

Male	0.019	0.013
	[0.006]***	[0.005]***
Years of education (of sister)	0.004	0.003
	[0.001]***	[0.001]**
Sister was living in an rural area in 1994	-0.020	-0.034
	[0.010]**	[0.008]***
Never married	-	0.061
		[0.032]*
Age at marriage if married	0.003	0.002
	[0.001]*	[0.001]*
N =	31496	44522

Marginal effects of logit regressions, dummies for age in 1994 included. The data is taken from the siblings' mortality data of the Demographic and Health Survey, 2000, Rwanda. The data are weighted as recommended by the data provider, and adjusted to account for unequal probability of selection into the sample by a factor of 1/number of surviving females age 15-49 in each family. Where more than one respondent in the same household reports on the same sibship, only one respondent is randomly retained. The background of the family is derived from the characteristics of the sister who answered the survey. For sisters who never moved or moved for the last time before 1994, the actual location is recorded. Sisters who moved after 1994 are assumed to have been living in 1994 in the same type of location as the one reported, in 2000, as the previous one. Clustered standard errors between square brackets. ***, **, *: significant at the 1, 5 and, 10 percent confidence interval, respectively.

Figure 1: Number of deaths by year among siblings of women aged 15-49. Rwanda Demographic and Health Survey 2000.

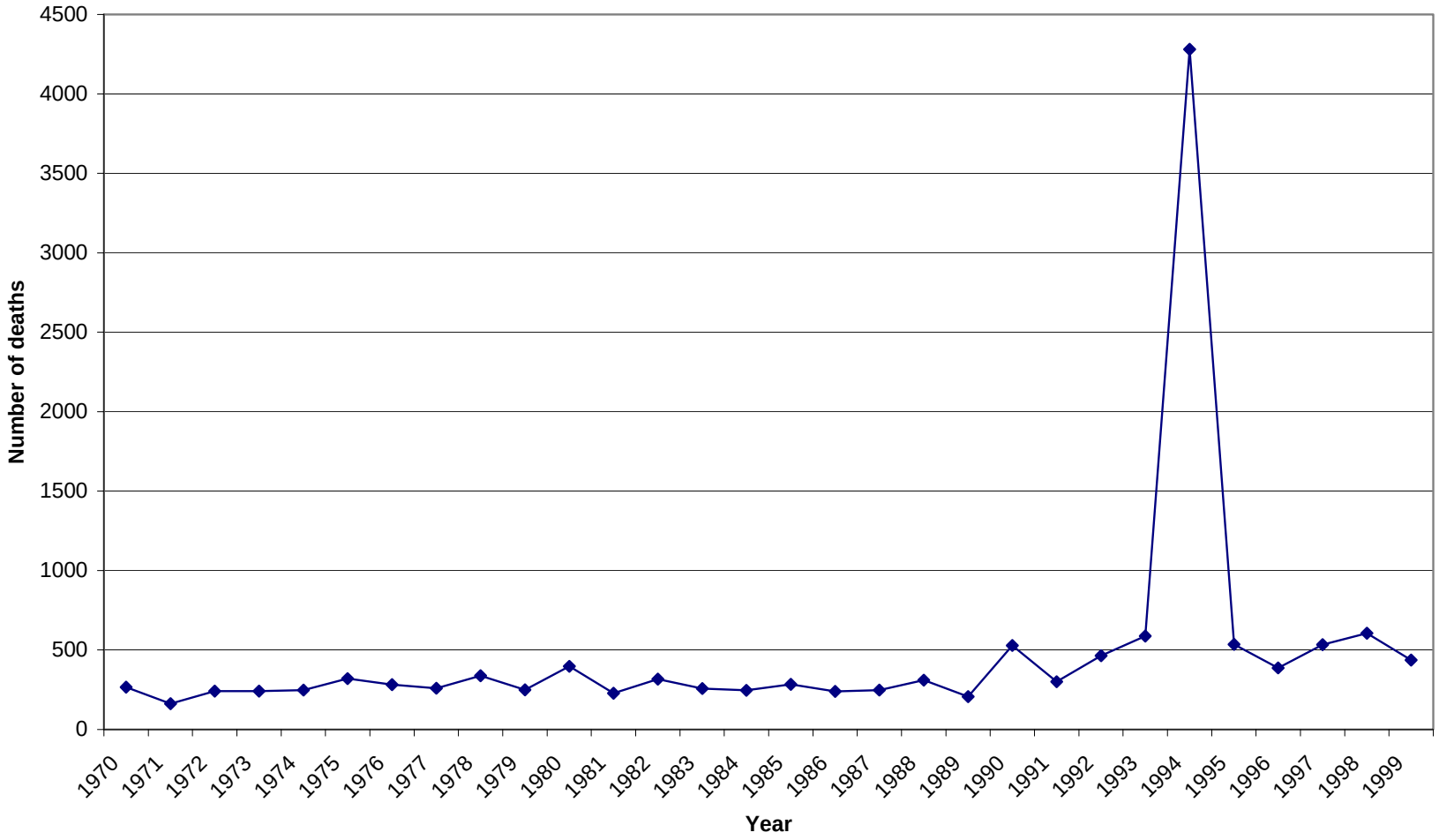


Figure 2: Death probability in 1994, by age and gender.
From siblings' mortality data, Demographic and Health Survey, Rwanda 2000.

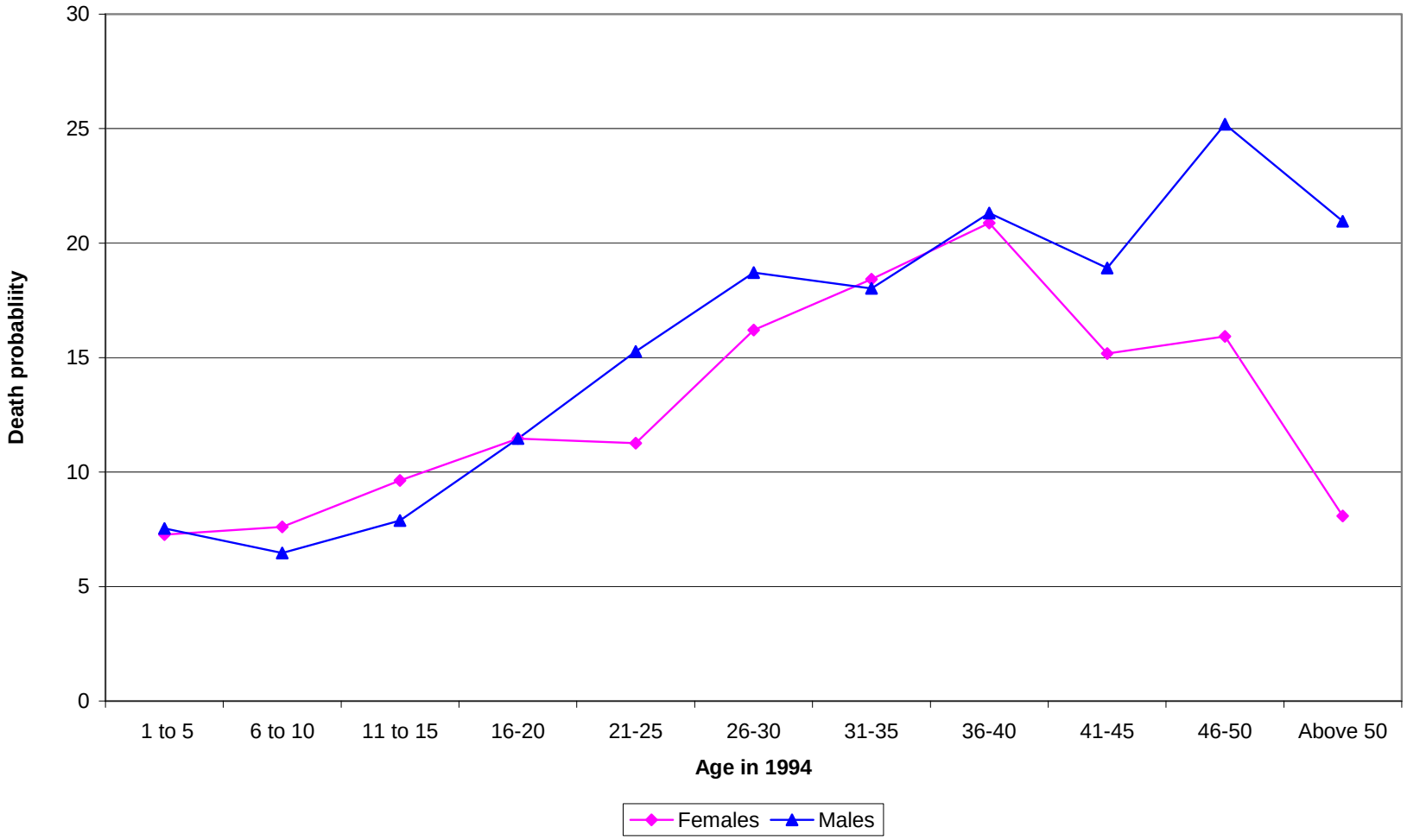


Figure 3: Death probability by rural/urban location of family in 1994.
From siblings' mortality data. Demographic and Health Survey, 2000, Rwanda.

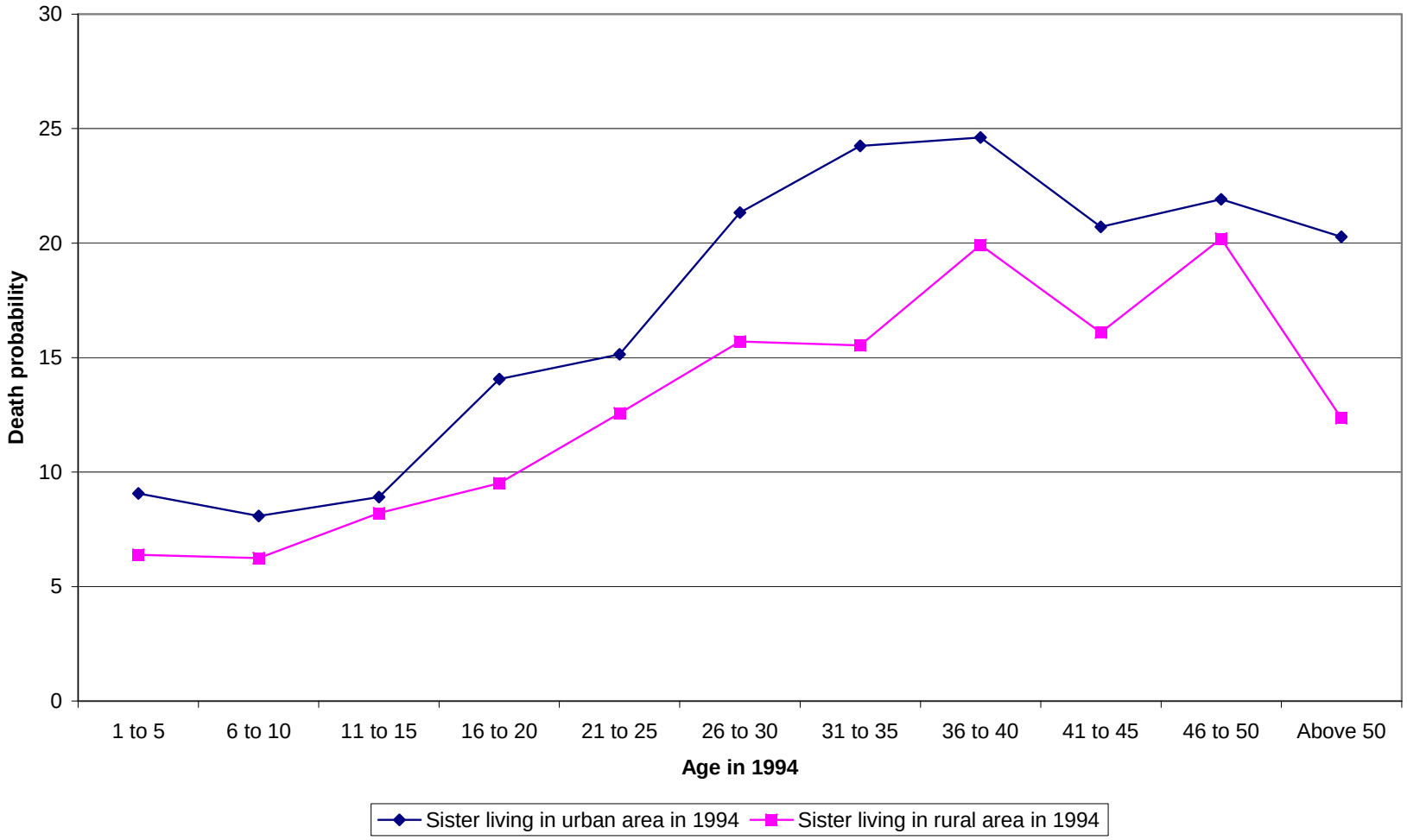


Figure 4: Death probability by educational background of the family.
From siblings' mortality, Demographic and Health Survey 2000, Rwanda.

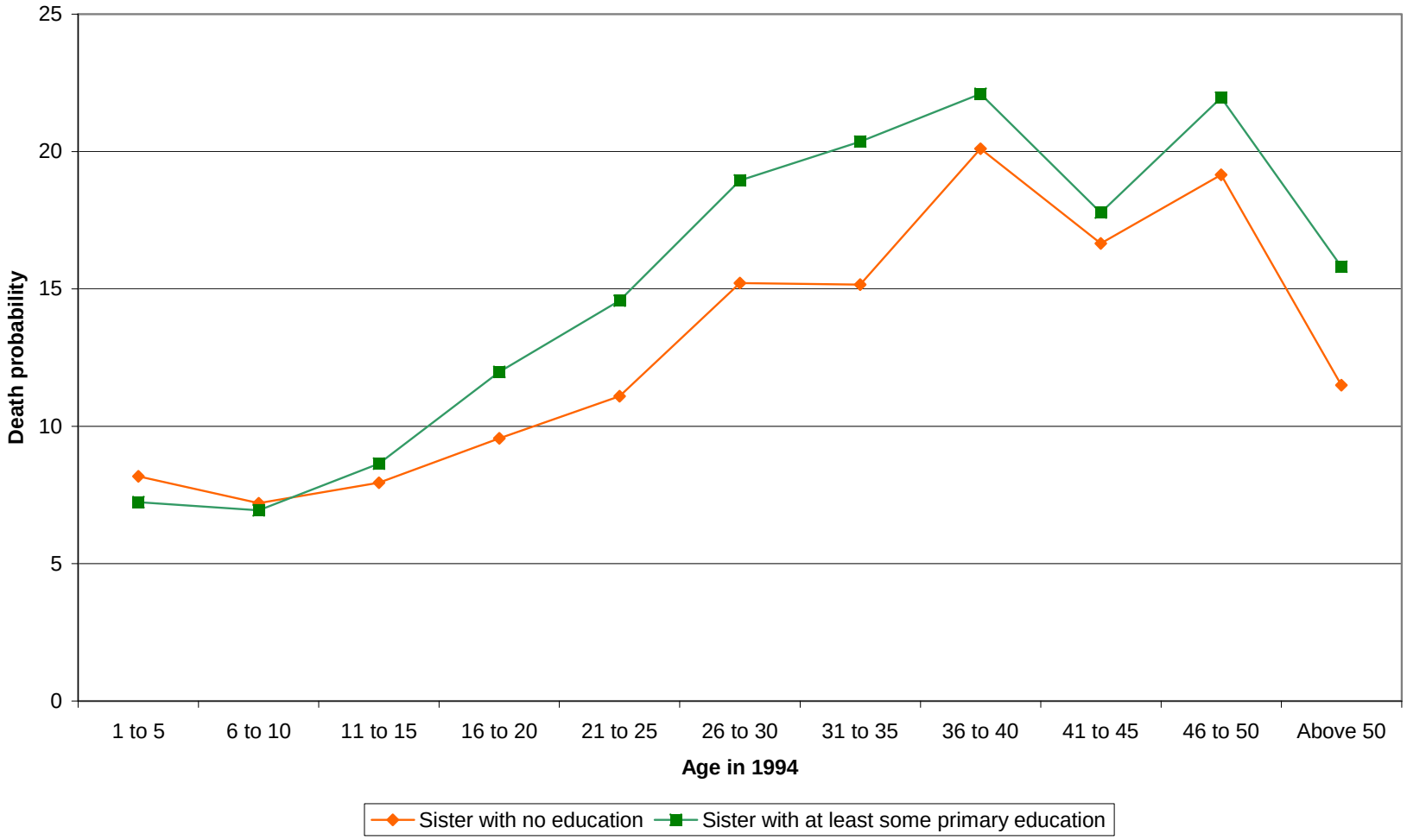


Figure 5: Death probability in 1994 by level of education of the sister.
From siblings' mortality: Demographic and Health Survey, 2000, Rwanda.

