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The Death Toll of the Rwandan Genocide: A Detailed Analysis for Gikongoro Province

Marijke Verpoorten*

Though counting the number of victims of a genocide is a historical and political necessity, it is always an extremely hazardous exercise. Regarding the Rwandan genocide of 1994, none of the estimates produced until now were based on records held by the communes. Focusing on Gikongoro Prefecture, Marijke VERPOORTEN not only evaluates the number and the profile of genocide victims, but also describes the geographical pattern of killings. This difficult assessment is based on local population registers and census data and applies a rigorous approach which starts with a detailed analysis of the data sources. It confirms the highest death toll estimates.

Unrest started in Rwanda at the end of 1990, when the RPF (Rwandan Patriotic Front) started launching attacks from Uganda. Intermittent hostilities and negotiations resulted in a power-sharing agreement between the government and the RPF. But on 6 April 1994 the plane carrying president Habyarimana was shot down. Thereafter, Rwanda descended into chaos. Within hours, the military, administrators, the *Interahamwe* militia⁽¹⁾ and ordinary people started to kill Tutsi, moderate Hutu and Hutu leaders from political parties rival to the president's party, the MRND (*Mouvement révolutionnaire national pour le développement*). Simultaneously, the war

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⁽¹⁾ *Interahamwe* literally means “those who stand together” or “those who attack together”. This militia was formed by Habyarimana's political party in 1992, when the party started giving military training to its youth.

between the Rwandan army and the RPF resumed. A large percentage of the population took refuge in neighbouring countries. In July 1994 the massive killings came to an end⁽²⁾.

During and after the genocide, many tried to estimate the number of casualties, first through body counting, later using demographic data. About 20 days after the start of the genocide, Human Rights Watch reported 100,000 casualties. Just a few days later, Médecins Sans Frontière (MSF) doubled this estimate. In May 1994, Radio Muhabura, the RPF radio, talked about 500,000 persons killed, and adjusted the figure downwards to 300,000 several days later. These figures were guesses rather than estimates, since they were not based on any systematic counting (Prunier, 1998, p. 262). After the genocide, the accuracy of the estimates did not improve. The UN report of November 1994 (UN 1994) took a safe range between 500,000 and one million victims. These figures include both Tutsi and Hutu.

Demographic data should provide a means to estimate the Tutsi death toll more accurately. The last population census prior to the genocide was conducted in 1991. This census reported 596,400 Tutsi living in Rwanda, representing 8.4% of the population. Based on an annual population growth of 3%, the number of Tutsi would have been 650,900 at the end of July 1994 (under the no-genocide scenario)⁽³⁾. The next step is to obtain an estimate of surviving Tutsi. At the end of July 1994, head counting in refugee camps resulted in an estimated 105,000 Tutsi survivors. According to Prunier (1998, p. 265) 25,000 survivors who did not go to camps should also be added. Human Rights Watch (HRW, 1999, p. 15) adds another 20,000 surviving Tutsi in Zaire (now Democratic Republic of the Congo) and Tanzania. This gives a total of 150,000 Tutsi survivors. By subtracting the number of survivors from the estimated Tutsi population under the no-genocide scenario, we obtain an estimate of 500,900 Tutsi killed in the genocide, a loss of 77.0% of the Tutsi population of Rwanda.

Many readers may question the estimates regarding the number of survivors. Indeed, we will probably never really know how many Tutsi managed to survive without seeking refuge in camps, and counting in the camps was also prone to error. Moreover, since it is no longer politically correct in Rwanda to talk about ethnicity, the latest census of 2002 does not provide information on the current size of the Tutsi population. Another problem is the reliability of the 1991 census. Two criticisms have been put forward. First, to avoid discrimination, an undetermined number of Tutsi registered as Hutu. Second, the Habyarimana regime is said to have deliberately under-reported the number of Tutsi in order to keep their school enrolment and public employment quotas low. Until now, this allegation has not been documented. However, this strong suspicion alone led

⁽²⁾ For a discussion of the causes of war and genocide in Rwanda, see Mamdani (2001); Prunier (1998); Newbury (1998); Uvin (1998); Verwimp (2003); Baines (2003).

⁽³⁾ $P_{July\ 1994} = (1 + 0.03)^{time\ span} \times P_{August\ 1991}$; $time\ span = 2.96$ years. A discussion on the assumption of 3% annual population growth can be found in Appendix III.

G. Prunier (1998) to estimate the actual Tutsi population in 1994 at 12% of the total population instead of 8%, the estimate put forward by the Habyarimana regime. If we repeat the same exercise as above with this larger proportion, the death toll of the genocide increases from around 500,000 to some 800,000 Tutsi killed (Prunier, 1998, p. 264), representing the annihilation of about 84% of the Tutsi population in 1994.

A number of Hutu also lost their lives during the genocide and its aftermath. Moderate Hutu were killed, especially in the first few weeks of the genocide. They were often adversaries of the MRND and the CDR (*Coalition pour la défense de la république*), the two political parties that most fanatically supported the idea of "Hutu Power". No figure has yet been put forward to quantify these killings, but the order of magnitude is likely to be small because, from 12 April onwards, political leaders of the MRND and the CDR tried to unify all Hutu in a common fight against Tutsi. Once the Tutsi population had been defined as the common target, murders of political opponents and moderate Hutu slowed down (HRW, 1999, p. 201). However, many Hutu died in refugee camps in Zaïre, Tanzania and Burundi. The cholera epidemic in Goma is believed to have taken around 30,000 lives (Prunier, 1998, p. 303). Also, an unknown number of Hutu were killed by the RPF, both in the course of combat and in acts of revenge after the genocide. Estimates range between 6,000 and 60,000, but there is no data to confirm these figures (Prunier, 1998, p. 324; HRW, 1999, p. 16)⁽⁴⁾.

In short, estimating the victims of the war and the genocide in Rwanda is a hazardous enterprise. The counting of Hutu and Tutsi casualties during the war and genocide was not systematic and the analysis of demographic data is hampered by two unanswered questions. First, how many Tutsi lived in Rwanda prior to the genocide? Second, how many Tutsi survived? The present study does not answer these questions, but it contributes to the debate on the death toll of the genocide in two ways. A first objective is to provide evidence for the under-reporting of Tutsi in the 1991 census. A second objective is to analyse the geographical pattern of killings during the genocide and estimate the survival chance of Tutsi in Gikongoro, a prefecture located in southern Rwanda (Map 1, Appendix I).

The first contribution is made by comparing the 1991 census data with population data of 1990 from the local administration of Gikongoro. The second contribution takes these latter data as a starting point. The 1990 local population data provide information on the proportion of Tutsi in 117 administrative sectors of Gikongoro Prefecture. These data are

⁽⁴⁾ Using population data from various sources, Reyntjens (1997) argues that the total number of Rwandans who "disappeared" from the population in 1994, whether Hutu, Tutsi or Twa, lies between 1,050,000 and 1,150,000. Subtracting the number of Tutsi casualties from this estimate would give a reasonable approximation for the number of Hutu who "disappeared", since Twa accounted for only 0.4% of the population prior to April 1994. However, the disappearance of Hutu stems from several causes that cannot be disentangled: (1) killed by the perpetrators of the genocide, (2) killed by the RPF, (3) died from disease in refugee camps or, (4) fled to neighbouring countries (to escape prosecution).

compared with local population data of 2002 for the same 117 administrative sectors. Since the local administration stopped recording ethnic identity after 1994, the death toll among Tutsi living in these sectors cannot be derived from a mere comparison between the number of Tutsi in 1990 and 2002. However, much can be revealed from a study of the sector's population growth between 1990 and 2002, and its sex ratio in 2002.

First, we present the local population data of Gikongoro Prefecture, discuss their reliability, and compare them with the census data of 1991. Next, a nonlinear least square (NLS) regression analysis is used to explain population growth and changing sex ratios across the 117 sectors of Gikongoro, and estimate the proportion of Tutsi killed during the genocide. We will examine what factors explain the unequal impact of the genocide in Gikongoro. Lastly, we present in our conclusion a new and better substantiated estimate of the number of Tutsi who were killed during the genocide.

I. Evidence for under-reporting of Tutsi in the 1991 census

1. The 1991 population census

Since its independence in 1962, Rwanda has organized three population censuses: in 1978, 1991 and in 2002. The first two censuses recorded the ethnic identity of the population. After the genocide this was no longer done. Since the census of 1991 was the last census prior to the genocide, the information it provided concerning the size of the Tutsi population in Rwanda has been used to estimate the death toll of the genocide (Prunier, 1998, p. 265; HRW, 1999, p. 15). According to this information, shown in Table 1, the Tutsi population amounted to 8.4% of the total *de jure* population of Rwanda.

However, many scholars have raised and repeated the allegation that this percentage is unreliable (Prunier, 1998, p. 265; HRW, 1999, p. 15). In the early seventies, the Hutu regime introduced an ethnic quota system for the appointment of civil servants and for school enrolments. This policy required that places be distributed between Hutu and Tutsi according to their proportion in the total population (Reyntjens, 1985, pp. 501-503). As the government wanted to restrict the power held by the Tutsi, they had a motive for keeping quotas for Tutsi in education and administration low, and to this end, may have under-reported the proportion of Tutsi. This accusation has often been levelled, but never proved. In addition, there are many stories of Tutsi reporting as Hutu in the population census in order

TABLE 1. – DISTRIBUTION OF THE POPULATION OF RWANDA^(a)
BY PREFECTURE AND ETHNIC GROUP IN 1991

Prefecture	Percentage distribution				Total population
	Hutu	Tutsi	Twa	Others	
Butare	82.0	17.3	0.7	0.0	753,868
Byumba	98.2	1.5	0.2	0.0	775,935
Cyangugu	88.7	10.5	0.5	0.3	551,565
Gikongoro	86.3	12.8	0.8	0.1	465,814
Gisenyi	96.8	2.9	0.3	0.1	731,996
Gitarama	90.2	9.2	0.6	0.1	848,027
Kibungo	92.0	7.7	0.2	0.1	648,912
Kibuye	84.8	14.8	0.4	0.0	469,494
Rural Kigali	90.8	8.8	0.4	0.1	905,632
City Kigali	81.4	17.9	0.3	0.4	221,806
Ruhengeri	99.0	0.5	0.4	0.1	766,795
Total	91.1	8.4	0.4	0.1	7,099,844

^(a) *De jure* population of Rwandan nationality.
Source: Census of Rwanda 1991 (SNR, 1994).

to avoid discrimination. Therefore, even the census report itself urged caution with respect to the figures on ethnicity (SNR, April 1994, p. 114):

“Given that the declaration of the ethnic group is not a simple matter in Rwanda, one may wonder whether the current proportion of Hutu is not overestimated. Indeed, some members of other ethnic groups report that they are Hutu. This practice has existed since the end of the Tutsi Monarchy (1961)”

The same reasons for caution apply to the 1978 census, according to which Tutsi made up 9.7% of the total population (SNR, 1982). But the colonial rulers had no reason to misreport the relative size of ethnic groups. From 1930 onwards, the Belgian colonial administration counted the population almost every year using sample techniques. For three years, 1933, 1952 and 1956, data on ethnicity are available. These data show much higher proportions of Tutsi than under the Hutu regime: respectively 15.3%, 17.5% and 16.6% (Mamdani, 2001, p. 98; HRW, 1999, p. 40; Reyntjens, 1985, p. 28; Inforcongo, 1959, pp. 31-40). However, this hardly constitutes evidence for the under-reporting of Tutsi in the 1978 and 1990 census. The percentages reported in 1978 and 1991 even seem very plausible if we take into account the number of Tutsi who left the country between 1959 and 1990, or who were killed during this period⁽⁵⁾. Then again, this extrapolation is not very convincing since the exact number of Tutsi exiles and casualties during this period is unknown. In addition, prior to the Hutu revolution of 1959, a number of wealthy Hutu registered as Tutsi (SNR, 1994, p. 110).

⁽⁵⁾ Von Meijenfeldt (1995) mentions that in early 1994, there were about 600,000 Rwandan Tutsi living in exile.

2. *The population data of the local administration*

In the administrative subdivision of Rwanda, “prefectures” are followed by “communes”, “sectors” and “cells”, which are the smallest codified administrative units, including on average 150 households. Even within the cell, households live in organized units of ten households, “*nyumbakumi*” or ten-house agglomerations. The structure is marked by the dominance of the national government all the way from the centre via prefectures, communes, sectors and cells to the *nyumbakumi*⁽⁶⁾. Few African countries are so well organized and use existing structures so extensively as Rwanda⁽⁷⁾.

One of the tasks of the local administration of each commune is to file reports on its population four times a year. A personal file recording all vital events and migration on each individual aged 17 and over is kept at the commune. The *nyumbakumi* leaders report to the leaders of the cells, who report to the leaders of the sector, and so on. This dense administrative structure records all births, deaths, immigrations and emigrations. Prior to the genocide, in addition to the age and sex, the ethnic identity of every individual was recorded⁽⁸⁾.

In contrast to the doubts concerning the reliability of the population censuses, there is no reason to suspect any systematic under-reporting of Tutsi in the local population data. Since everybody knows each other at the local level, it would have been almost impossible for Tutsi to deceive the local administration about their true ethnic identity. Whereas census interviewers sent by the central government were not allowed to ask for the respondent’s identity card (on which ethnic identity was mentioned), no such restriction was imposed on the local administration (SNR, 1994, p. 109). In addition, the local administration had no incentive to misreport the size of the local Tutsi population. The quota policy was centralized and implemented at the national level. Even if the local administration had been inclined to influence this policy, it could not have done so by modifying its reports. Each of the reports made by the communes was filed to the Interior Ministry in Kigali, but none of these reports were ever made public, and the quota policy remained solely based on census reports as published. By comparing census data with local population data, we could assess the extent of under-reporting of Tutsi in the population census. Unfortunately, local population data are not readily available. The present study uses local population data of only one single prefecture, Gikongoro⁽⁹⁾.

⁽⁶⁾ The *nyumbakumi*, the fifth administrative level at the bottom of the chain, is not codified by the law however (Samset and Dalby, 2003).

⁽⁷⁾ As a grim example of this, the organizers of the genocide exploited these structures to reach all Rwandans and to incite or force Hutu into participating in the slaughter. On the role of local authorities in the genocide and “Rwandan political tradition”, see, among others, Mamdani, (2001, p. 194, p. 199 and p. 218) and Prunier, (1998, p. 138).

⁽⁸⁾ Children from an inter-ethnic marriage took the ethnicity of the father.

⁽⁹⁾ If authorization could be obtained from the Rwandan authorities, it would be possible to put together much of the local population data by systematically checking the reports filed at the communes, prefectures and in the Interior Ministry in Kigali.

3. *The population data of the local administration of Gikongoro Prefecture*

Before the administrative reorganization of Rwanda, Gikongoro was one of the country's eleven prefectures⁽¹⁰⁾. At the time of the genocide, Gikongoro counted 13 communes and 125 sectors (see Map 2 in Appendix I). Authorized by the Rwandan government to do research on economic issues, we were able to get local population data for 1990 as well as for 2002 from the Statistical Unit of Gikongoro Prefecture.

The data for 1990 concerned the *de facto* population, distinguished by sex and ethnic group and were complete for 117 out of the 125 sectors. The eight missing sectors were those of Rwamiko Commune. A separate page with aggregated information by commune did provide some summary statistics for Rwamiko Commune, presenting population by sex and age group, but not by ethnicity. The data of the 117 sectors were listed by commune, each time on a separate page entitled "*Répartition de la population par sexe, ethnité et par secteur administratif au 31/12/1990*"⁽¹¹⁾. Each page had a similar typewritten table. An example of such a table is given in Appendix II⁽¹²⁾. The local population data for 2002 show the *de facto* population by sector. They were complete for all 125 sectors and had a similar format as the 1990 data. These data included information by sex but not by ethnic group.

The information derived from the local population data is summarized in Table 2. Using data at the sector level, we obtained, at the commune level, the proportion of Tutsi in 1990, the total population in 1990 and 2002, the sex ratio in both of these years and the average annual population growth between 1990 and 2002. For now, only ethnicity data listed in the first column are discussed. The other data presented in Table 2 will be analysed later.

According to the local population data, 17.5% of the population of Gikongoro was Tutsi in 1990. The geographical distribution of Tutsi in Gikongoro was very unequal. The commune with the highest proportion of Tutsi was Mubuga, with around 43%, followed by Nyamagabe and Muko. Map 2 in Appendix I illustrates the ethnic distribution in more detail at the sector level. The western part of the prefecture counted many sectors with almost no Tutsi, whereas Tutsi were very well represented in the northern

⁽¹⁰⁾ During the administrative reform of the Rwandan territory in December 2000, Umutare was added as the twelfth prefecture. The terminology also changed. "Prefectures" became "provinces", and "communes" became "districts". In this paper, we use the old terminology and administrative subdivisions as they were in place at the time of the genocide.

⁽¹¹⁾ "Population distribution according to sex, ethnicity and administrative commune on 31 December 1990"

⁽¹²⁾ On eight of the twelve pages the population figures were handwritten. The mayor signed eight out of the twelve pages, four had an official stamp of the commune and on seven pages the date of the signature had been added. Although the title on each page mentioned 31/12/1990 as the survey date, the dates of signature differed. The seven dates mentioned were 17 January 1991, 19 January 1991, 16 March 1991, 14 May 1991, 19 December 1991, 27 December 1991, and 3 February 1992. The dates of signature probably correspond to the time of sending the reports from the commune to the prefecture. The delays might result from the fact that the commune had to wait for the data from each sector, and had to summarize them on one page.

TABLE 2.— ETHNICITY, POPULATION GROWTH AND SEX RATIO
FOR THE 13 COMMUNES OF GIKONGORO PREFECTURE, RWANDA IN 1990 AND 2002

Commune	Proportion of Tutsi in 1990 (%)	Population in 1990	Population in 2002	Annual population growth 1990-2002 (%) ^(a)	Sex ratio 1990	Sex ratio 2002
Karama	13.3	30,347	30,710	0.104	93.2	87.0
Karambo	18.4	25,875	28,752	0.921	91.1	89.3
Kinyamakara	3.2	34,155	32,838	-0.341	93.8	90.0
Kivu	17.1	40,685	46,929	1.249	85.5	93.9
Mubuga	43.3	39,274	22,471	-4.739	93.4	83.6
Mudasomwa	4.5	44,399	59,791	2.622	90.7	89.9
Muko	34.6	40,952	56,436	2.828	100.8	86.1
Musange	16.7	29,722	34,392	1.277	96.1	88.6
Musebeya	0.9	36,777	49,809	2.673	87.6	91.0
Nshili	3.7	43,366	54,299	1.974	92.8	88.2
Nyamagabe	42.8	36,036	40,397	0.998	91.3	87.7
Rukondo	12.9	36,623	32,029	-1.159	95.4	88.9
Rwamiko	NA ^(b)	28,240	22,929	-1.798	92.5	81.5
Gikongoro	17.5	466,451	511,776	0.810	92.5	88.6

^(a) The time span used to calculate the annual population growth is 11.5 years.
^(b) The local population data for Rwamiko were not available by ethnicity or sector.
Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

and eastern parts of Gikongoro. In five sectors a majority of the population was Tutsi⁽¹³⁾. In fact, the government created the prefecture of Gikongoro shortly after independence. The southern and western outskirts of the Nyanza region were attached to what is now the eastern part of Gikongoro, a highland area inhabited largely by Hutu. The aim was to weaken Tutsi influence around the former royal capital Nyanza, located in the north-western corner of Butare (HRW, 1999, p. 303).

This proportion of 17.5% is calculated without the data for Rwamiko. There are three reasons to suspect that the missing Rwamiko data cause an underestimation rather than an overestimation of the proportion of Tutsi in Gikongoro. First, Rwamiko was surrounded by areas with a large Tutsi population. Indeed, Rwamiko Commune borders Butare Prefecture (Map 1), the prefecture with the highest proportion of Tutsi (17.3% according to the 1991 census) (Map 2 in Appendix I). Moreover, the populations of most sectors surrounding Rwamiko were more than 40% Tutsi⁽¹⁴⁾. Second, the population decline of Rwamiko Commune is striking, with a decrease from 28,240 inhabitants in 1990 to 22,929 in 2002, corresponding to an annual decline of 1.8%. Given that women have six children on average (ONAPO, 2001), a decline of this size can only be explained by exceptionally high emigration or by a high death toll. A third piece of evidence for a high pre-genocide proportion of Tutsi in Rwamiko is provided by the change in the sex ratio. For Gikongoro, on average, the sex ratio decreased from 92.5 in 1990 to 88.6 in 2002⁽¹⁵⁾. The decline was much

⁽¹³⁾ In Yonde, Gitondorero, Rususa, Muganza and Nyarusovu.

⁽¹⁴⁾ For example: Rususa, Buremera, Kibeho, Nyarushishi and Muganza.

more pronounced in Rwamiko, where it fell from 92.5 to 81.5 (Table 2). These three facts suggest that the proportion of Tutsi in Gikongoro would have been even higher if the population of Rwamiko had been included.

4. Evidence for the under-reporting of Tutsi in the 1991 census

According to the population census of 1991, the proportion of Tutsi in Gikongoro was 12.8% (Table 1). The local population data of 1990 revealed a much higher proportion of at least 17.5%. This suggests that the under-reporting of Tutsi in the 1991 census was quite high. However, to provide solid support for this argument, we must ensure that the local population data is reliable. To this end, we compared other aspects, besides ethnicity, such as the number of men and women and the total population, with census data. If the local population data are of good quality, we should find a close resemblance with census data.

Table 3 shows figures for the total population, the male and female population, and the proportion of Tutsi for 117 sectors of Gikongoro. The first and second columns list the figures based on respectively the census of August 1991 and the local population data of December 1990. The third column provides an estimate of the population in August 1991 based on the local data of December 1990. In the calculations, we use an average annual growth rate of 1.8% which corresponds to the growth rate for Gikongoro Prefecture between 1978 and 1991. This rate is quite low compared to the national average of 3.1% during the same period since Gikongoro is a net-emigration region in Rwanda⁽¹⁶⁾.

The last column of Table 3 shows by what percentage the prediction based on the local population data deviates above (+) or below (–) the census data of 1991. The deviation is less than 1% for the figures in the first three rows. Thus, local administration data for total population and population by sex match very well with those from the census⁽¹⁷⁾. In sharp contrast, the proportion of Tutsi differs strongly and the deviation amounts to 37%. Since the local authorities had no reason to over-report the proportion of Tutsi in their population, this is convincing evidence that the proportion of Tutsi in the census was under-reported.

The question remains as to whether the government under-reported to restrict the quota for Tutsi in education and civil service or whether

⁽¹⁵⁾ The decrease in the sex ratio may be explained both by emigration and by casualties of the war and genocide. Gikongoro as a whole is a net-emigration region (MINECOFIN, 2002).

⁽¹⁶⁾ For more details on the choice of the annual population growth rate used, see Appendix III.

⁽¹⁷⁾ After this exercise of comparison we checked the local population data for outliers and found that 7 sectors had unusual sex ratios. We replaced these by the sex ratios of the census data. In two sectors, the number of inhabitants deviated strongly from the census. They were also replaced by figures from the census. Table 2 and the regression analysis of section 3 are based on the corrected data.

TABLE 3.— LOCAL POPULATION DATA OF 1990 VERSUS CENSUS DATA OF 1991 FOR THE 117 SECTORS OF THE PREFECTURE OF GIKONGORO^(a)

	Population census, August (<i>de jure</i>) ^(b) (1)	Local population data, December 1990 (<i>de facto</i>) ^(b) (2)	Estimate of population in August 1991 based on local population data December 1990 ^(c) (3)	% Difference [(3) – (1)]/(1)
Total population	438,122	430,917	436,099	– 0.46
Male population	210,067	207,602	210,098	+ 0.01
Female population	228,055	223,315	226,000	– 0.90
Proportion of Tutsi	12.8 ^(d)	17.5	17.5	+ 37
<p>(a) Local population data by sector of Gikongoro Prefecture were complete for 117 out of 125 sectors.</p> <p>(b) The local administration used “present population” as a criteria whereas in the report of the population census of 1991 the residency criteria is almost always used. This could explain part of the difference between the first and third column. The census report does give present population at the commune level and according to these figures the present population of the 117 sectors was 436,291 in August 1991. Comparing this figure with 436,099 we find a difference of only 0.044%.</p> <p>(c) $P_{August\ 1991} = (1 + r)^{time\ span} \times P_{December\ 1990}$ with $r = 1.8\%$ (growth rate 1978-1991 for Gikongoro) and $time\ span = 8\ months\ or\ 0.67\ years$. We assume that the growth rate is independent of the ethnic group (see also Appendix III).</p> <p>(d) The sectors of Rwamiko are included in the 12.8% (since the census of 1991 does not provide the proportion of Tutsi per commune, only per prefecture). They are not included in the 17.5% (since local population data of Rwamiko commune were lost).</p> <p>Sources: Census of Rwanda (SNR, April 1994) and local administrative data (1990) provided by the author.</p>				

Tutsi themselves registered as Hutu in order to avoid discrimination. It is still also unclear whether the under-reporting was systematic. It would greatly help if we could obtain local population data for other prefectures⁽¹⁸⁾. There is at least one argument supporting the idea that the under-reporting was not limited to Gikongoro Prefecture alone. In Rwanda, it is generally accepted that Butare is the rural prefecture with the highest proportion of Tutsi⁽¹⁹⁾. Therefore it is no surprise that in the census report Butare leads with 17.3% Tutsi (see Table 1). But, having found that the proportion of Tutsi in Gikongoro is actually at least 17.5% instead of 12.8%, the ranking would be reversed unless the figures of Butare and other prefectures were also misreported.

5. Implications for the estimation of the genocide death toll

In sum, the large gap between the officially reported proportion of Tutsi in Gikongoro (12.8%) and the estimate based on local population data

⁽¹⁸⁾ HRW has local population data by ethnicity for some communes of Butare Prefecture and repeatedly requested other data from the Rwandan government. Since several communes of Butare are missing, HRW's current data cannot be used for comparison with the census data of 1991 that reported the size of ethnic groups only at the prefecture level.

⁽¹⁹⁾ It is believed that Tutsi started to settle in Rwanda from the 8th or 9th century onwards. Coming from the east, they first settled in the dry eastern parts of present day Rwanda, but they gradually moved westwards to the wetter highlands. In the 14th century the Tutsi feudal monarchy dominated the central parts of the country and Nyanza, in the north-western corner of Butare, became its royal capital.

(17.5%) confirms the suspicion that the 1991 census under-reported the proportion of Tutsi in the population. Admittedly, there is no good reason to assume that the under-reporting occurred on exactly the same scale in all prefectures. But interestingly, if the scale of under-reporting at the national level was the same as that found in Gikongoro — i.e., about 40%⁽²⁰⁾ — the calculated death toll would be close to 800,000, in the order of magnitude put forward by Gérard Prunier, taking account of speculations about the systematic under-reporting of Tutsi in the 1991 census report (Prunier 1998, p. 265).

Indeed, with 40% under-reporting at the national level, the proportion of Tutsi at the national level would have been 11.79% instead of 8.4%. This would mean that there were 837,100 Tutsi in Rwanda in 1991 instead of 596,400, and, under the no-genocide scenario, 913,600 Tutsi at the end of July 1994. By subtracting the estimated 150,000 Tutsi survivors (see above), we obtain a death toll of 763,600 Tutsi, representing about 83.6% of the Tutsi population. However, there are several possible scenarios. Appendix III summarizes the results of several different under-reporting scenarios. For example, one alternative scenario would be that there was only misreporting for the prefectures that had a relatively large proportion of Tutsi. If we assume, for example, that besides the figures for Gikongoro, only the figures of the prefectures with an even higher proportion of Tutsi were under-reported by 40% (Butare, Kibuye and Kigali City), this scenario leaves the ranking of prefectures by ethnicity intact. Rwanda would count 717,300 Tutsi in 1991, i.e. 10.1% of the population. The death toll would be estimated at 632,900 Tutsi, a loss of about 80.8% of the Tutsi population in 1994.

The evidence presented here is far from able to answer the two questions needed to make a sound estimate of the genocide death toll. How many Tutsi lived in Rwanda prior to the genocide? How many Tutsi survived? Regarding the first question we can now safely say that the use of data from the 1991 census report leads to an underestimation of the death toll. With respect to the numbers of survivors, the estimation of an absolute number for the death toll is beyond the range of our data. However, the next section shows how the local population data can be used to estimate the average survival chance of Tutsi in Gikongoro and to study the geographical pattern of killings in this prefecture.

⁽²⁰⁾ For Gikongoro, we found a deviation of 37% (Table 3), but we argued that the deviation would be even higher when including the sectors of Rwamiko. For example, if we assume that Rwamiko counted 28% Tutsi, Gikongoro would count 18% Tutsi and the deviation would increase from 37 to 40%.

II. The pattern of killings in Gikongoro Prefecture

As a consequence of war and genocide, Rwanda has experienced population decline and a decrease in the sex ratio. For Rwanda as a whole, the annual population growth slowed down from 3.1% in 1978-1991, to 1.2% in 1991-2002. Comparing the same periods, the sex ratio decreased from 95.1 to 91.3 (SNR, 2003). These demographic changes vary across as well as within prefectures, at the commune level and at the sector level. Since Tutsi were targeted during the genocide, we expect to find that the larger the proportion of Tutsi in a sector in 1990, the stronger the sector's population decline and the lower its sex ratio in 2002. The local population data presented in the previous section can be used to assess this relationship for the sectors of Gikongoro Prefecture. We will now study the effect, in Gikongoro, of the proportion of Tutsi in a sector in 1990 on respectively population growth between 1990 and 2002 and the sex ratio in 2002. Three questions will be addressed: what was the average survival chance of Tutsi (men/women) in Gikongoro? which sectors deviated significantly from this average? and why did Tutsi (men/women) in these sectors have a higher or lower chance of survival?

1. *The relationship between the proportion of Tutsi and population decline*

Preliminary evidence

The local population data of Gikongoro reveal that the annual population growth rate for 1990-2002 varied across communes and sectors. For example, Table 2 shows that the communes of Mubuga, Rukondo and Rwamiko experienced a sharp population decrease during this period, corresponding to a yearly decline of respectively 4.74%, 1.16% and 1.80%. At the sector level, the variation is even more pronounced. Figure 1 shows the estimated kernel density function of the annual population growth rate for 117 sectors of Gikongoro⁽²¹⁾. The range between the minimum and maximum annual population growth is very large. Moreover, we observe that the curve is asymmetrical.

The shape of the density function can largely be explained by three facts. First, during the 1990-2002 period, quite a few sectors had annual population growth close to 1.8%. Second, only a handful of sectors had an

⁽²¹⁾ Kernel density estimators approximate the density function $f(x)$ from observations on x . So, basically they give the probability of observing x_i (population growth of sector i) in the sample. Consequently, the estimates of $f(x)$ integrate to 1. As opposed to frequency tables, kernel density estimates have the advantage of being smooth and of being independent of the choice of origin. More formally, the data is divided into intervals and estimates of the density at the centre of the interval are produced. The intervals are allowed to overlap. The smoothness of the figure depends on the width of the interval chosen. In Figure 1, the width is set at 0.84.

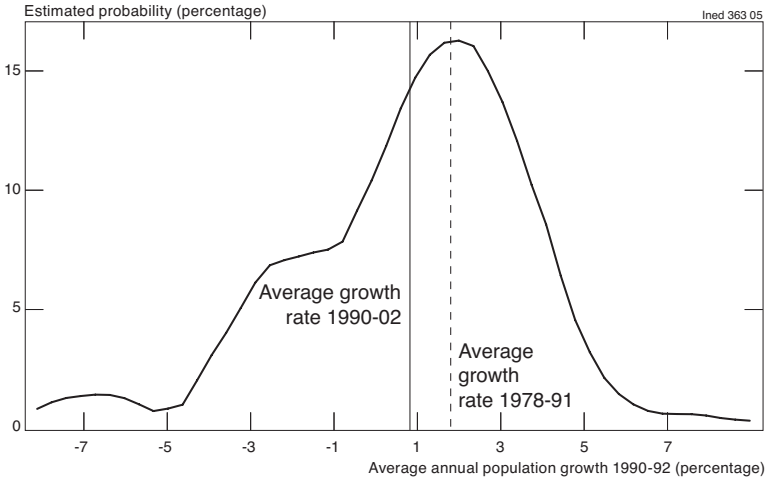


Figure 1.— Kernel density of average annual population growth between 1990 and 2002, for 117 sectors in Gikongoro Prefecture

Reading of y : the estimated probability of observing an annual population growth of x

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002; SNR (2003) for the average growth rate 1978-1991

annual population growth above 5%. This stems from the fact that Gikongoro has few trading centres and only one small urban hub, Gikongoro City. Finally, there were 37 sectors with a negative population growth, including six with an annual population decrease of more than 5%. This explains the bump in the left tail of the density function.

We expect to find that the sectors whose rates of increase are shown in the left tail of the figure were those with the largest proportion of Tutsi in 1990. A comparison between Maps 2 and 3 in Appendix I provides us with preliminary evidence. The south-eastern part of Gikongoro is an especially striking illustration of the relationship between the proportion of Tutsi in 1990 and population decline. This relationship is somewhat less evident in the centre of the prefecture, around Gikongoro City, but it is again pronounced in the north-eastern part of Gikongoro. This visual impression is confirmed by Table 4. Here the sectors were divided into five categories according to the proportion of Tutsi in the sector. The categories are the same as those used to colour the sectors in Map 2. The mean annual population growth rate clearly declines across the five categories, from 2.02% for sectors with less than 5% Tutsi to -1.10% for sectors with more than 40% Tutsi.

TABLE 4.— RELATIONSHIP BETWEEN THE PROPORTION OF TUTSI IN 1990 AND THE MEAN ANNUAL POPULATION GROWTH BETWEEN 1990 AND 2002 FOR 117 SECTORS OF GIKONGORO

Proportion of Tutsi in the sector (1990)	Number of observations	Mean annual population growth 1990-2002 (%)	95% confidence interval
< 5%	46	2.02	[1.39–2.65]
5-10%	14	1.39	[0.76–2.02]
10-20%	17	0.62	[– 0.40–1.63]
20-40%	17	– 0.22	[– 1.66–1.21]
> 40%	23	– 1.10	[– 2.61–0.42]
Total	117	+ 0.81	[0.29–1.32]

Source: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

Estimation of the survival chance of Tutsi in Gikongoro

The relationship between the proportion of Tutsi in 1990 in a sector and population growth can be used to estimate the survival chance of Tutsi in Gikongoro Prefecture. The population in sector *i* in 2002 can be expressed as follows:

$$P_{2002,i} = P_{1990,i}(1 - T_i\delta_i) (1+g_i)^{11.5} \tag{I.1}$$

with

$P_{2002,i}$: the population of sector *i* in June 2002

$P_{1990,i}$: the population of sector *i* in December 1990

T_i : the ratio of Tutsi to the total population in sector *i* in 1990

δ_i : the proportion of Tutsi killed in sector *i* in 1994

g_i : birth rate (BIR_i) – net emigration rate ($neMIG_i$) – mortality rate (MOR_i) (besides the mortality rate of Tutsi during the genocide) in sector *i*

11.5 years: time span between December 1990 and June 2002

Taking logarithms and rearranging [I.1] we obtain:

$$G_i = \left(\frac{1}{11.5}\right) \times \ln(1 - T_i\delta_i) + \ln(1 + g_i) \tag{I.2}$$

with $G_i = \left(\frac{1}{11.5}\right) \times \ln\left(\frac{P_{2002,i}}{P_{1990,i}}\right)$

the annual population growth rate in sector *i*.

Since we do not know BIR_i , $neMIG_i$, and MOR_i , we cannot directly derive δ_i from equation [I.2]. However, we can obtain an estimated value for the average proportion of Tutsi killed (δ_i) by estimating the following equation with nonlinear least squares (NLS):

$$G_i = \left(\frac{1}{11.5}\right) \times \ln(1 - T_i\delta) + \alpha + \varepsilon_i \quad i = 1, \dots, N = 117 \tag{I.3}$$

with α a constant, equal to the average value of $\ln(1 + g_i)$ over the 117 sectors. The NLS estimator for δ is consistent if the disturbances ε_i are independently and identically distributed with expected value zero and finite variance σ^2 (Malinvaud, 1970). This condition implies that the proportion of Tutsi in 1990 in sector i is totally uncorrelated with the net immigration rate, the birth rate and the non-genocide mortality rate. Formally:

$$\text{Cov}\{T_i, neMIG_i\} = 0 \quad [A1]$$

$$\text{Cov}\{T_i, BIR_i\} = 0 \quad [A2]$$

$$\text{Cov}\{T_i, MOR_i\} = 0 \quad [A3]$$

In what follows, we proceed in two steps. First, we discuss the plausibility of assumptions [A1], [A2] and [A3] and present variables that may proxy $neMIG_i$, BIR_i and MOR_i . If these variables are good proxies, the three assumptions can be relaxed. Second, we estimate equation [I.3] to obtain the survival rate for Tutsi in Gikongoro.

Four different forms of migration can be distinguished: migration in search of cultivatable land, migration to urban areas, female exogamy and distress migration in response to insecurity. The latter form may cause correlation between T_i and $neMIG_i$. It is believed that two million people from all parts of Rwanda were displaced during the genocide. The vast majority of them were Hutu who fled in fear of the advancing RPF army. Most returned to their homes after spending some months or even years in refugee camps. But, some, especially Hutu men who took part in the genocide, did not return. If these men came from sectors with a high Tutsi population prior to 1994, $\text{Cov}\{T_i, neMIG_i\} > 0$. In addition, after the genocide, and upon the death of their husband, widows may have chosen to move back to their native sector. This choice might have been motivated by the desire to move away from their assailants or the place of terror, or by the search for land⁽²²⁾. Also, upon the destruction of their houses, many Tutsi survivors were left without shelter. They might have moved to so-called *imidugudu*, houses provided under a government housing project. Again, the result would be that $\text{Cov}\{T_i, neMIG_i\} > 0$. On the other hand, the death toll of the genocide resulted in a decline in the labour-land ratio in sectors with a high ratio of Tutsi (T_i). This may have attracted farmers from other sectors, such that $\text{Cov}\{T_i, neMIG_i\} < 0$.

The birth rate is the ratio of live births to the population. According to the 1991 census report, Tutsi women gave birth to fewer children (TFR = 5.82) than Hutu women (TFR = 7.40) (SNR, 1994), such that $\text{Cov}\{T_i, BIR_i\} < 0$. Considering that both ethnic groups have shared a common history and lifestyle for many centuries, this difference seems quite large. Rather than stemming from different social values and cultural

⁽²²⁾ Especially if a widow has no sons recognized by her family-in-law, her customary right to land might be challenged.

norms, it may result from under-reporting of births by Tutsi parents (cf. discussion in Appendix III). Ideally, one should control for the number of Hutu casualties in a sector. A relatively small number of Hutu were killed because they opposed the genocide. In addition, the RPF killed an unknown number of Hutu in the course of combat and in acts of revenge after the genocide. Moreover, acts of sexual violence were frequent during the genocide. Therefore, AIDS may have increased mortality rates after 1994, such that $Cov \{T_i, MOR_i\} > 0$.

If the three assumptions are violated, the estimate for δ (proportion of Tutsi killed during the genocide) will be inconsistent. Such omitted variable bias can be reduced by including proxies for $neMIG_i$, BIR_i and MOR_i . However, data at the sector level are limited. Besides T_i (the ratio of Tutsi in 1990), the available variables are: total population in 1990 and 2002, the sex ratio in 1990, the sex ratio in 1990 and 2002, and the area (km²) of each sector⁽²³⁾. To control for emigration trends in the sectors prior to the genocide, we will use three indicators: population density in each sector in 1990, the square of this density and the sex ratio in 1990. Density represents pressure on land and may capture both migration in search of cultivatable land and rural-urban migration in the absence of war. The sex ratio in 1990 may also be informative about future migration: a high proportion of women may be linked to a continued tradition of male emigration which gives rise to female exogamy.

Based on the previous discussion, we estimated several models based on equation [I.3], including the population density in 1990, the squared population density in 1990 and the sex ratio in 1990. The results of model A are presented in the first column of Table 5⁽²⁴⁾. The estimate for the coefficient δ is 0.745. This means that about three out of four Tutsi were killed in April 1994, and the t -test shows that the coefficient is significantly different from zero.

The spatial pattern of killings in Gikongoro

For a more in-depth analysis of the geographical pattern of killings, we plotted the 117 data points in Figure 2. The horizontal axis measures the proportion of Tutsi in 1990 (T_i). The curve represents the estimated relationship between T_i and G_i :

$$\left(\frac{1}{11.5}\right) \times \ln(1 - T_i\delta). \text{ Its slope is } -\delta \times \left(\frac{1}{11.5}\right) \times \left(\frac{1}{(1 - T_i\delta)}\right) \text{ with } \delta = 0.75.$$

⁽²³⁾ In 2002, the country's surface was re-estimated with the help of the Information Management Unit of the United Nations Development Programme (IMU/UNDP). In December 2003, we received these data by e-mail from the SNR (Service National de Recensement du Rwanda).

⁽²⁴⁾ We experimented with the functional form of δ in model A, allowing for nonlinearities in the relationship between δ and T_i , but the alternative nonlinear models were rejected in favour of model A. Finally, we performed a model-specification link test for single-equation models. The test result fails to reject the assumption that the model is correctly specified.

TABLE 5.— PROPORTION OF TUTSI KILLED DURING THE GENOCIDE ESTIMATED FROM A NLS^(a) REGRESSION ON THE AVERAGE ANNUAL GROWTH RATE (1990-2002) FOR 117 SECTORS OF GIKONGORO (MODEL COEFFICIENTS)

	Model A	Model B	Model C
Proportion of Tutsi killed during genocide (δ)	0.745***	0.801***	0.340***
Sex ratio in 1990	0.074***	0.044***	0.060***
Population density in 1990 ^(b)	-2.0×10^{-4} ***	-7.7×10^{-5} *	-1.3×10^{-4} **
Squared population density in 1990	1.3×10^{-7}	1.5×10^{-8}	2.7×10^{-8}
Communes of Gikongoro ^(c)			
Muko		0.030***	
Musange		0.002	
Nyamagabe		0.031***	
Musebeya		0.010	
Rukondo		-0.020 ***	
Mudasomwa		0.011	
Karama		-0.001	
Kinyamakara		-0.008	
Kivu		0.009	
Mubuga		-0.024 ***	
Nshili		1.4×10^{-4}	
Mayor opposed genocide			0.005
Near Kaduha massacre			-0.024 ***
Near Kibeho massacre			-0.043 ***
^(a) Nonlinear least square regression ^(b) To calculate population density we used the local population data of 1990 and recent data on surface by sector. In 2002, the country's surface was re-estimated with the help of IMU/UNDP. ^(c) The reference group in Model (B) is Karambo commune. Note: The equation underlying regression (A) was transformed to obtain homoscedastic error terms; inferences are based on Hubert/White robust standard errors. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Sources: Local population data (provided by the author) for 117 sectors of Gikongoro for 1990 and 2002.			

The dots around the curve are the error terms of equation [I.3], i.e., the deviation from the predicted annual population growth. The curve can be used as a benchmark to identify in which sectors the extent of killings significantly deviated from the mean. Especially at the right of the figure, the curve does not fit well to the data points. This indicates that the genocide was considerably more deadly in some places than in others.

How can the unequal impact of the genocide be explained? One answer may be that in some sectors with a large Tutsi population, the Tutsi succeeded in protecting themselves by grouping together to outnumber the attackers (as happened for example at the Catholic diocese of Kabgayi in Gitarama Prefecture). Where this strategy failed, the genocide had devastating consequences (e.g. Kibeho and Kaduha parish in Gikongoro). A second reasoning is that local authorities might have succeeded in some places in resisting the genocide, or at least in slowing it down or weakening its effectiveness. In other sectors and communes, local authorities were actively involved in organizing the killings. The 800-page report by

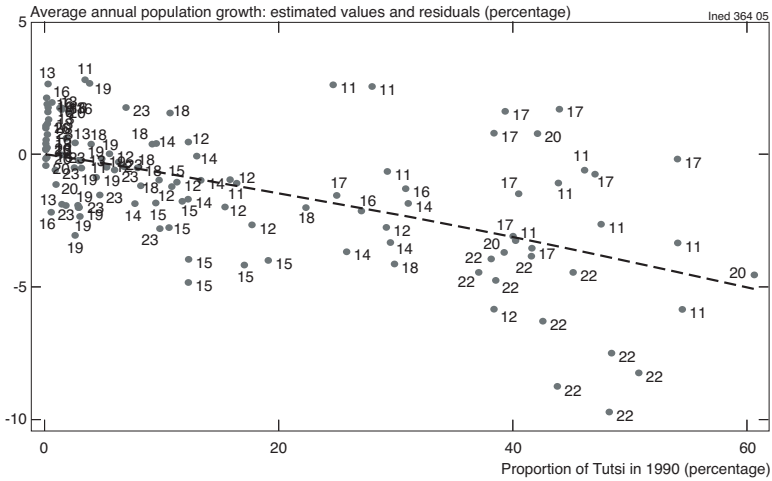


Figure 2.— Relationship between the proportion of Tutsi in 1990 and the annual population growth rate between 1990 and 2002, estimated for 117 sectors of Gikongoro

Note: The prediction (curve) is based on the following equation: $(1/1.5) \times \ln(1 - T_i\delta)$ with δ (average proportion of Tutsi killed) = 0.75 and T_i = the ratio of Tutsi in 1990. The dots are the residuals of regression A (See Table 5). The numbers correspond to the sectors of the following communes: Muko (11), Musange (12), Musebeya (13), Karambo (14), Rukondo (15), Mudasomwa (16), Nyamagabe (17), Karama (18), Kinyamakara (19), Kivu (20), Rwamiko (21), Mubuga (22), Nshili (23).

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

Human Rights Watch (HRW 1999) details the events of the genocide. A comparison of their findings with our data sheds more light on the unequal impact of the genocide. For the purposes of comparison, we numbered the observation points in Figure 2, each number corresponding to a commune.

In Figure 2, the observations for Mubuga Commune (22) are practically all located well below the line of our benchmark, implying that the Tutsi in Mubuga Commune had little chance of surviving. The commune counted 43% Tutsi among its population and recorded an annual population growth of -4.74% . The northern part of the commune was most severely hit⁽²⁵⁾. This result is supported by the fact that assailants from Rwamiko carried the violence into Mubuga and that a massacre took place at Kibeho parish and college (HRW, 1999, p. 313). Another commune with a large proportion of Tutsi (43%) is the partly urban commune of Nyamagabe (17). Despite its high proportion of Tutsi, Nyamagabe had an average population growth of 1.0% . At first sight, one might think that urban growth in Nyamagabe would have flattened out the relationship between the genocide and population decline. But, even after controlling

⁽²⁵⁾ Kibeho, Nyarushishi, Nyarusovu, Nyarwumba and Kabirizi

for rural-urban migration with the square of population density in model A, the sectors of Nyamagabe are characterized by higher growth figures than those estimated by the model⁽²⁶⁾. Also in Muko Commune (11) a considerable number of Tutsi seem to have escaped the killings. It recorded 2.83% growth despite its large Tutsi population (35%). The three sectors that recorded the lowest population growth were those in the east, close to Musange⁽²⁷⁾. This might have been because the Tutsi of these sectors tried to take refuge in the church of Kaduha and were slaughtered while on their way or later in the massacre at the church (HRW, 1999, p. 336). Although Rukondo (15) was largely Hutu (87%), its population declined on average by 1.16%. The sectors that recorded lower than expected population growth were those close to the border with Karambo and Musange⁽²⁸⁾. A large number of Tutsi in these sectors may have been victims of the killings at Kaduha parish in Karambo.

The communes discussed till now, Mubuga, Nyamagabe, Muko and Rukondo, show a large difference with respect to the benchmark. For Mubuga and Rukondo this difference points to lower survival chances for Tutsi compared to the benchmark. The opposite is true for Nyamagabe and Muko. For the other communes, the difference is not pronounced or only noteworthy for one or two sectors of the commune⁽²⁹⁾. A new model was estimated, including dummy variables for the communes (Model B, Table 5). The reference group was Karambo Commune. The estimated coefficients for Muko and Nyamagabe are positive and significant; those for

⁽²⁶⁾ However, this result depends on the square of population density being a good proxy to capture migration. To verify this, we used the IHLCS (Integrated Household Living Conditions Survey) (MINECOFIN, 2002) to calculate immigration by commune for Gikongoro (The data cannot be used to calculate emigration at a communal level). The IHLCS has information on 2,461 individuals in Gikongoro. We calculated the proportion of immigrants among these individuals for each commune over the last ten years. It appears that Nyamagabe is indeed the commune with by far the largest proportion of immigrants; 9.4% of its population in 2002 were immigrants who settled in the commune between 1990 and 2002. But, even when introducing the proportion of immigrants into model A, the results for Nyamagabe remain unchanged (these results are not reported, but can be obtained from the author on request). This suggests that the square of population density does sufficiently capture immigration into Nyamagabe. We can thus be quite sure that the Tutsi in Nyamagabe had higher than average survival chances.

⁽²⁷⁾ Sovu, Gitondorero and Yonde

⁽²⁸⁾ Gikoni, Mbazi and Remera

⁽²⁹⁾ All sectors of Karambo closely follow the fitted line in Figure 2. This suggests that the genocide in Karambo was neither more nor less severe than the average of Gikongoro. The same applies to Karama. In Kinyamakara, the proportion of Tutsi was very small (3.2%), which makes it difficult to judge whether or not the genocide struck hard. The same is true for Musebeya (0.9%) and Nshili (3.7%). Tutsi were also a small minority in Mudasonwa, but they were almost all concentrated in two sectors bordering Nyamagabe (Nyamigina and Buhoro). Here, the killings appear to have been neither more nor less severe than the average of the prefecture. The eastern part of Kivu counted a sizeable Tutsi population, but the killings do not seem to have been as severe as in Mubuga. Mutovu in particular has much higher than expected population growth; maybe because it is somewhat more distant from Mubuga and Rwamiko, the communes that brought the violence into Kivu. The mayor of Kivu tried to oppose the genocide (HRW, 1999, p. 303) and he might have achieved some effective opposition in these communes. Finally, in Musange, the killings seem to have been in line with the average. One sector performing worse was Joma, at the crossroads between Karambo and Rukondo. This ties in with the fact that attacks in Musange were being launched from Karambo (HRW, 1999, p. 313).

Mubuga and Rukondo are negative and significant. This confirms the analysis based on Figure 2.

While discussing Figure 2, we pointed to some explanations for the diversity of survival rates across communes and sectors. These explanations can be studied more explicitly. There were three communes where the mayor opposed the genocide (HRW, 1999): Kinyamakara, Kivu and Musebeya. However, the mayor from Kinyamakara only opposed initially, and later even helped organize the killings in his commune (HRW, 1999, p. 340). In model C we added a dummy variable that equals one for the sectors of Kivu and Musebeya (where the mayor did not change his mind about opposing the genocide). The dummies “near Kaduha massacre” and “near Kibeho massacre” equal one when a sector is near Kaduha Parish and Kibeho Parish respectively⁽³⁰⁾. We included these two locations since they were the sites of the two worst massacres in Gikongoro Prefecture, each with several thousands of dead. The dummy for the opposition of a mayor has the expected sign, but is not significant. The estimated effect of the massacres is significant and highly negative. HRW (1999, p. 338) reports the killings in Kaduha as follows:

“As the attacks expanded from one hill to the next and from one commune to another, Tutsi found it impossible to stay in their homes and increasingly difficult to hide with Hutu neighbours. Assaultants in Muko, for example, were threatening to make Hutu protectors kill any Tutsi whom they had sheltered. First hundreds, then thousands of people from Musebeya, Muko, Karambo, and Musange Communes gathered at Kaduha parish center, in the church itself, in the adjoining schools, in the health center and in all the spaces in between. Tutsi from more distant regions, like parts of Muko, came first. Tutsi in the immediate vicinity of the church moved there only about April 14, when they were threatened with attacks by Hutu from the hills. Many Tutsi had come on their own, but some had come with the help of local officials, like those transported from Musebeya. In Muko, and perhaps elsewhere, the burgomaster had at first refused to help Tutsi flee to Kaduha, but later changed his position and began encouraging them to go there. Some survivors believe that authorities decided at a meeting at the sub-prefecture to attract Tutsi to Kaduha for one enormous massacre rather than to continue killing them in smaller numbers throughout the area. Such a decision would have been consistent with the pattern of killings elsewhere in the country.”

Conclusion

The genocide was severe in Gikongoro. We calculated that Tutsi in Gikongoro had on average 25% chance of surviving the genocide. Some communes significantly deviated from this benchmark. In several cases, the results for the sectors within a single commune varied considerably. We could explain part of the variation by their proximity to the location of massacres, such as those of Kaduha and Kibeho, or by the spreading of violence from one commune to another⁽³¹⁾. Very few mayors opposed the

⁽³⁰⁾ Sectors qualified as “near” are those bordering Kibeho and Nyakiza sector and those not further than one sector distant from Kibeho and Nyakiza sector.

genocide in Gikongoro. Those who opposed were eliminated, constrained or started to fear for their own safety (HRW, 1999, p. 303-352). Although there is no doubt that their opposition saved a number of lives, it did not succeed in preventing the killings. By contrast, the strategy used by the assailants had a strong impact. The genocide was much worse in sectors where assailants convinced Tutsi to gather in Kibeho or Kaduha Parish, after which thousands were massacred in these announced places of safety.

Finally, our finding of an extremely deadly genocide in Gikongoro corresponds to previous research. One of the rare studies that use household data to examine the effect of genocide found a survival percentage of only 10.7% in Gikongoro (Verwimp, 2003). This percentage is based on a very small sample of 28 Tutsi, located in five different sectors⁽³²⁾. Moreover, the HRW report (1999, p. 303) based on testimonies and interviews, summarizes the genocide in Gikongoro as follows:

“Some of the earliest attacks as well as some of the worst massacres of the genocide took place in Gikongoro. MRDN supporters launched the violence at three points and from there spread it into adjacent areas, much as they expanded disorder outward from Kigali and its vicinity into the prefecture of Gitarama. In some communes, like Musebeya, Kivu and Kinyamakara, administrators opposed the genocide and initially drew strength from the people in their communes who refused to kill. But as prefectural authorities failed to act against the violence and national authorities pressured for more and faster slaughter, they lost power to local rivals who saw the killing campaign as an opportunity to establish or re-establish their power. The dissenters judged continuing opposition futile and dangerous and either withdrew into passivity or themselves took up the role of killers.”

2. The relationship between the proportion of Tutsi and the sex ratio

Preliminary evidence

In this sub-section, the geographical pattern of sex ratios in Gikongoro are mapped and explained. Figure 3 presents the kernel density function of the sex ratio in 2002 for 117 sectors of Gikongoro. The vertical line at 92.5 represents the average sex ratio in 1990. We note from the density function that by 2002, the mean of the density function had shifted to the left, to 88.6. The density function is quite symmetrical, with a slightly larger frequency of below-average sex ratios. It spans a wide range, from below 75 to above 100. This wide range may stem from the existence of sectors with a high out-migration of men and others with a high in-migration of men, such as sectors with tea plantations. The low mean and thick left tail may be the consequences of war and genocide or of continued

⁽³¹⁾ From Rwamiko to Mubuga, from Mubuga to Kivu, and from Karambo to Musange (HRW, 1999, p. 313).

⁽³²⁾ These sectors are Bitandara, Kibirizi, Gasaka, Kamegeri, Kigoma and Gorwe.

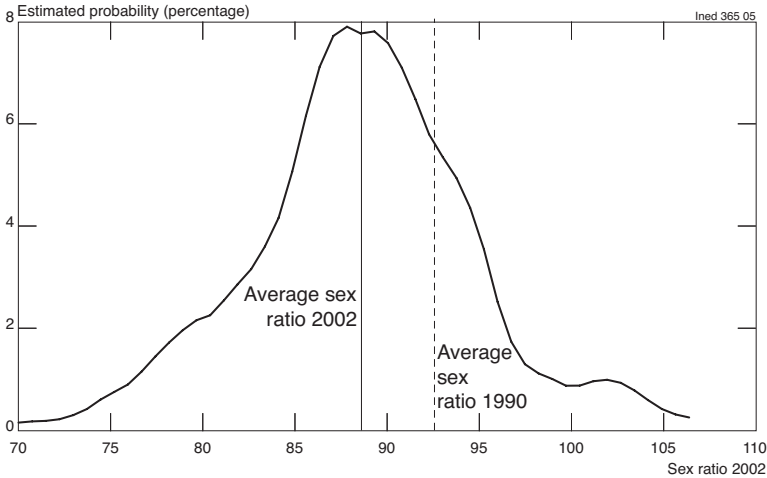


Figure 3.— Kernel density function of the sex ratio in 2002, for 117 sectors in Gikongoro Prefecture

Reading of y: the estimated probability of observing a sex ratio of x

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

male emigration. From the information in Maps 2 and 4 of Appendix I, we notice that, at first sight, the effect of the genocide on the sex ratio is less clear than it was for the population growth. We observe low sex ratios in Mubuga, Rwamiko and in some parts of Rukondo, Karambo and Muko. From Table 6 we note a rather weak negative relationship between the proportion of Tutsi in a sector and the sex ratio in 2002. For a more detailed analysis, we now proceed as in the previous section, with a regression analysis and a plot of the observation points.

TABLE 6.— RELATIONSHIP BETWEEN THE PROPORTION OF TUTSI (1990) AND THE SEX RATIO (2002) FOR 117 SECTORS OF GIKONGORO

Proportion of Tutsi in the sector (1990)	Number of observations	Mean sex ratio 2002	95% confidence interval
< 5%	46	89.9	[88.3–91.5]
5-10%	14	91.5	[88.2–94.8]
10-20%	17	86.4	[84.1–88.8]
20-40%	17	87.5	[85.7–89.4]
> 40%	23	86.4	[83.8–88.9]
Total	117	88.6	[87.5–89.6]

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

*Estimation of the survival chance
of Tutsi men and women in Gikongoro*

The sex ratio in 2002 can be written as follows:

$$SR_{2002,i} = PM_{1990,i}(1 - Tm_i\delta m_i)(1 + gm_i)^{11.5} / PW_{1990,i}(1 - Tw_i\delta w_i)(1 + gw_i)^{11.5} \quad [\text{II.1}]$$

with

$SR_{2002,i}$: the sex ratio in June 2002 in sector i

$PM_{1990,i}$: number of men in sector i in December 1990

$PW_{1990,i}$: number of women in sector i in December 1990

gm_i : male birth rate – net emigration rate – mortality rate (excluding the mortality rate of Tutsi men during the genocide) in sector i .

gw_i : female birth rate – net emigration rate – mortality rate (excluding the mortality rate of Tutsi women during the genocide) in sector i .

Tm_i : the ratio of Tutsi men to total men in sector i in 1990

Tw_i : the ratio of Tutsi women to total women in sector i in 1990

δm_i : the proportion of Tutsi men killed in sector i in 1994

δw_i : the proportion of Tutsi women killed in sector i in 1994

11.5 years: time span between December 1990 and June 2002

Taking logarithms and rearranging [II.1], we obtain:

$$\ln(SR_{2002,i}) = \ln(SR_{1990,i}) + \ln(1 - Tm_i\delta m_i) - \ln(1 - Tw_i\delta w_i) + 11.5 \times \ln(1 + gm_i) - 11.5 \times \ln(1 + gw_i) \quad [\text{II.2}]$$

Again, we do not have sufficient information (about gm_i and gw_i) to directly derive δm_i and δw_i from [II.2]. We therefore estimate the following equation⁽³³⁾ with NLS:

$$\ln(SR_{2002,i}) = \ln(SR_{1990,i}) + \ln(1 - Tm_i\delta m) - \ln(1 - Tw_i\delta w) + \beta + \varepsilon_i \quad [\text{II.3}]$$

$$i = 1, \dots, N = 117$$

with β the average difference between $11.5 \times \ln(1 + gm_i)$ and $11.5 \times \ln(1 + gw_i)$ for the 117 sectors of Gikongoro. A necessary condition for consistency of the NLS estimate for δm and δw is that T_i does not correlate with $neMIG_{i,men/women}$ and $MOR_{i,men/women}$, i.e. the ratio of the net-emigration of men to the net-emigration of women, and the ratio of the mortality of men to the mortality of women. Formally:

⁽³³⁾ The equation [II.3] is estimated under the constraint that $\delta w = [\delta - \delta m \times (\text{Tutsi men/total Tutsi})] / (\text{Tutsi women/total Tutsi})$.

$$Cov\{T_i, neMIG_{i,men/women}\} = 0 \tag{A4}$$

$$Cov\{T_i, MOR_{i,men/women}\} = 0 \tag{A5}$$

These assumptions might be violated. On the one hand, if T_i (ratio of Tutsi in 1990) is strongly correlated with casualties of Hutu men, then $Cov\{T_i, MOR_{i,men/women}\} > 0$. On the other hand, if sexual violence during 1994 resulted in HIV/AIDS infections and other sexually transmitted diseases, then $Cov\{T_i, MOR_{i,men/women}\} < 0$. Furthermore, if many Tutsi widows moved out of their sector after the genocide, $Cov\{T_i, neMIG_{i,men/women}\} < 0$.

TABLE 7.— PROPORTION OF TUTSI MEN AND WOMEN KILLED DURING THE GENOCIDE ESTIMATED FROM A NLS^(a) REGRESSION ON THE (LOG) SEX RATIO IN 2002 FOR 117 SECTORS OF GIKONGORO, (MODEL COEFFICIENTS)

	Model D	Model E	Model F
Proportion of Tutsi men killed during genocide (δm)	0.791***	0.768***	0.763***
Proportion of Tutsi women killed during genocide (δw)	0.710***	0.732***	0.737***
Log sex ratio in 1990	0.047	0.161	0.041
Population density in 1990 ^(b)	$- 5.8 \times 10^{-4}***$	$- 3.4 \times 10^{-4}*$	$- 6.3 \times 10^{-4}***$
Squared population density in 1990	$7.2 \times 10^{-7}***$	$5.4 \times 10^{-7}**$	$7.5 \times 10^{-7}***$
Communes of Gikongoro ^(c)			
Muko		- 0.073*	
Musange		- 0.067*	
Nyamagabe		- 0.045	
Musebeya		- 0.031	
Rukondo		- 0.063	
Mudasomwa		- 0.054	
Karama		- 0.090*	
Kinyamakara		- 0.073	
Kivu		0.018	
Mubuga		- 0.140***	
Nshili		- 0.057	
Mayor opposed genocide			0.036
Near Kaduha massacre			- 0.001
Near Kibeho massacre			- 0.073**

(a) Nonlinear least square regression

(b) To calculate population density, we used the local population data of 1990 and recent data on surface by sector. In 2002, the country's surface was re-estimated with the help of IMU/UNDP.

(c) The reference group in Model E is Karambo Commune.

Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

However, if alleged (mostly male) perpetrators of the genocide took refuge abroad and did not return, the reverse is true: $Cov\{T_i, neMIG_{i,men/women}\} > 0$.

To reduce omitted variable bias, we added the population density in 1990 and the squared population density in 1990 to equation [II.3]. The latter variable may capture rural-urban migration of men. The sex ratio of 1990, which is included in [II.3] controls for inertia in the sex ratio, and

may capture migration. Table 7 shows the results. In model D the estimated values for the parameters δm and δw are respectively 0.791 and 0.710 and they are significant. The link-test fails to reject the null hypothesis that the model is correctly specified. We may conclude that whereas Tutsi men had a 21% chance on average of surviving the genocide, the survival rate for Tutsi women was not much higher, only 29%. This small difference is in line with the observation of Human Rights Watch (HRW 1999, p. 296) that in 1994 assailants did not often spare the lives of Tutsi women.

“In many communities women and children who had survived the first weeks of the genocide were slain in mid-May. In the past Rwandans had not usually killed women in conflicts and at the beginning of the genocide assailants often spared them. When militia had wanted to kill women during an attack in Kigali in late April, for example, Renzaho (Colonel, and prefect of Kigali) had intervened to stop it. Killers in Gikongoro told a woman that she was safe because ‘sex has no ethnic group’. The number of attacks against women, all about at the same time, indicates that a decision to kill women had been made at the national level and was implemented in local communities. Women who had been living on their own as well as those who had been kept alive to serve the sexual demands of their captors were slaughtered.”

The spatial pattern of survival chances of Tutsi men and women in Gikongoro

In order to explain the geographical pattern of sex ratios, we plotted the observation points in Figure 4. The horizontal axis measures the proportion of Tutsi in a sector. The curve gives the estimated relationship between

T_i and $SR_{2002,i}$: $\frac{(1 - T_{m_i} \delta m)}{(1 - T_{w_i} \delta w)}$, with $\delta m = 0.79$ and $\delta w = 0.71$. The dots

are the error terms from equation [II.3], i.e., the deviation from the predicted sex ratio. Figure 4 shows considerable variation around the curve, with the sectors of Nyamagabe and Muko Commune lying both far below and far above the curve. Only the sectors of Mubuga Commune show a clear pattern below the benchmark. In regression E, Mubuga has a coefficient that is highly negative and significantly different from zero. This corresponds to our earlier discussion where we found that the genocide was particularly severe in Mubuga Commune. In regression F, the coefficient for the dummy of the Kibeho massacre in Mubuga Commune is significantly negative.

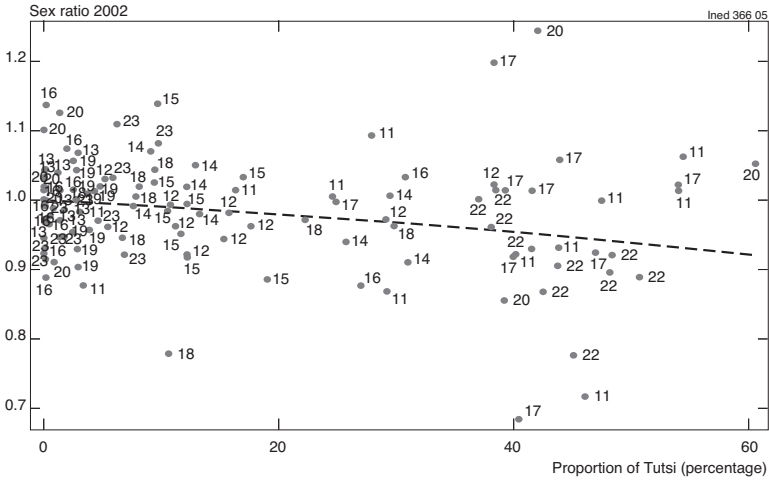


Figure 4.– Relationship between the proportion of Tutsi in 1990 and the sex ratio in 2002, estimated for 117 sectors of Gikongoro

Note: The prediction (curve) is based on the following equation: $(1 - Tm\delta m)/(1 - Tm\delta w)$, with δm (average proportion of Tutsi men killed) = 0.79 and δw (average proportion of Tutsi women killed) = 0.71, Tm_i = the ratio of Tutsi men in 1990 and Tw_i = the ratio of Tutsi women in 1990. The dots are the residuals of regression D (See Table 7). The numbers correspond to the sectors of the following communes: Muko (11), Musange (12), Musebeya (13), Karambo (14), Rukondo (15), Mudasonwa (16), Nyamagabe (17), Karama (18), Kinyamakara (19), Kivu (20), Rwamiko (21), Mubuga (22), Nshili (23).

Sources: Local population data (provided by the author) for 117 sectors of Gikongoro, for 1990 and 2002.

Conclusion

This paper provides evidence for the allegation that the number of Tutsi in the 1991 population census was under-reported. This allegation has often been made on the basis of two arguments. On the one hand, because of its ethnic quota policy, the Rwandan government had a motive for under-reporting the proportion of Tutsi in the population. On the other hand, Tutsi themselves, trying to avoid discrimination, had a motive to register as Hutu. The evidence presented stems from a comparison between the 1991 census data and the 1990 population data from the local administration of Gikongoro Prefecture. The former reported 12.8% Tutsi in the population of Gikongoro, while the latter reported a much higher proportion of Tutsi, 17.5%. By contrast, other population characteristics, such as population size and the sex ratio hardly differ across both data sources. If the extent of under-reporting was similar in other prefectures, the number of Tutsi at the outbreak of the genocide would have been about 40% higher than the number extrapolated from the 1991 census.

After the genocide, the Rwandan government no longer reported ethnic identity in the population statistics. This complicates the estimate of Tutsi survivors. Using the local population data of Gikongoro Prefecture, we estimate that only 25% of Tutsi in Gikongoro survived. Some communes in Gikongoro clearly deviated from this benchmark. Especially in Mubuga and Rukondo the genocide was much more deadly. The opposite was true for Nyamagabe and Muko. The location of huge massacres and the way violence spread across communes were strong determinants of the survival chance of Tutsi in a sector. The opposition of local authorities in Gikongoro did not make a significant difference. The lives of Tutsi women in Gikongoro were not spared: it is estimated that Tutsi women had 29% chance of surviving, compared with a 21% chance for Tutsi men.

Gikongoro is only one of the eleven prefectures in Rwanda, accounting for less than 7% of the total population and about 10% of the Tutsi population. Extrapolating evidence from Gikongoro to the whole of Rwanda cannot therefore provide one sound estimate for the overall death toll of the genocide. However, the case of Gikongoro brings the estimated death toll closer to its true value and narrows the interval around the estimate. Based on the presented evidence and a sensitivity analysis (Appendix III), we estimate that the number of Tutsi killed during the genocide lies between 600,000 and 800,000, and that only 25 to 30% of the Tutsi population survived the genocide of 1994.

Acknowledgements: I am grateful to two anonymous referees and an assistant editor from this journal for their useful comments. I thank Alison Des Forges, Florence Mukamugema, Filip Reyntjens, William Seltzer and André Twagiramungu for answering many of my questions. I also received support and comments from my colleagues at the department. Special thanks is owed to Romain Houssa, Pablo Rovira Kaltwasser, Jorre Renterghem, Filip Heremans, Herman Van Belle, Geert Dhaene and Lode Berlage. All opinions expressed and any errors remain my own.

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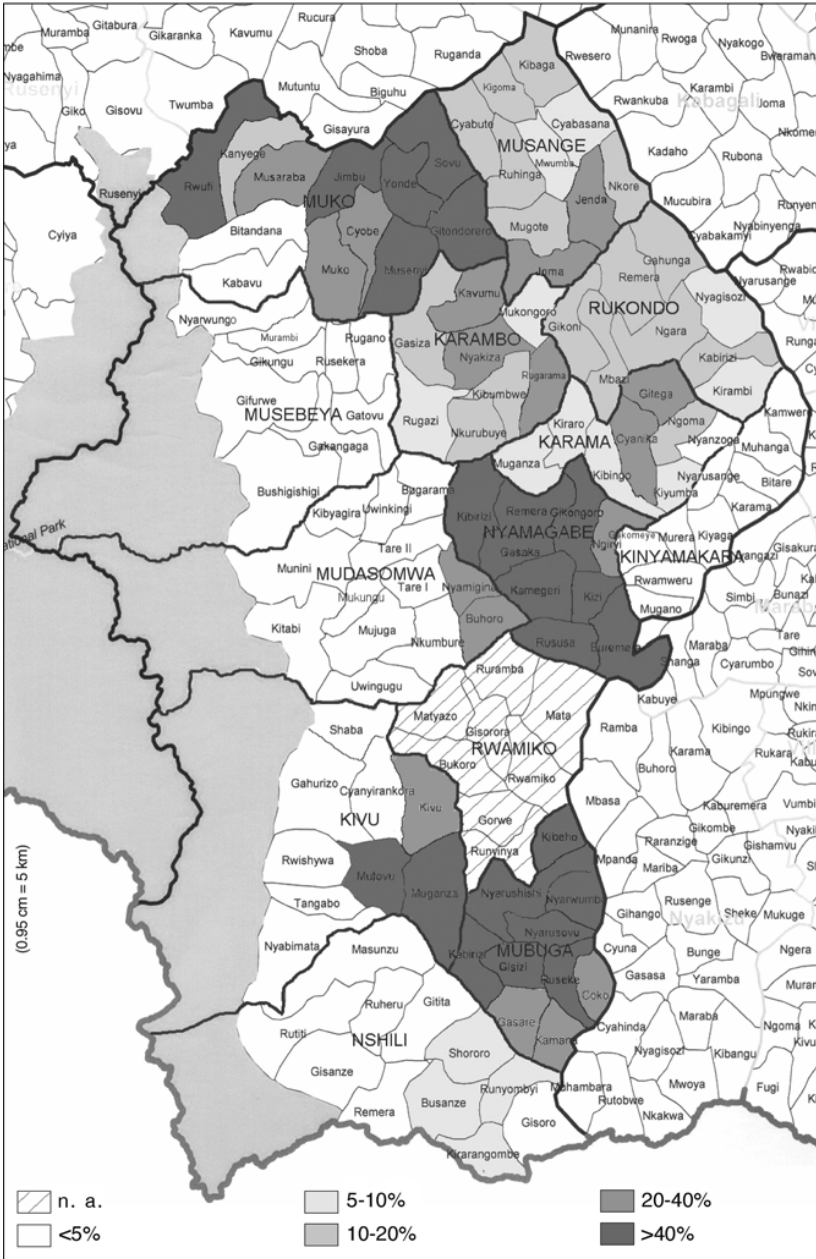
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APPENDIX I



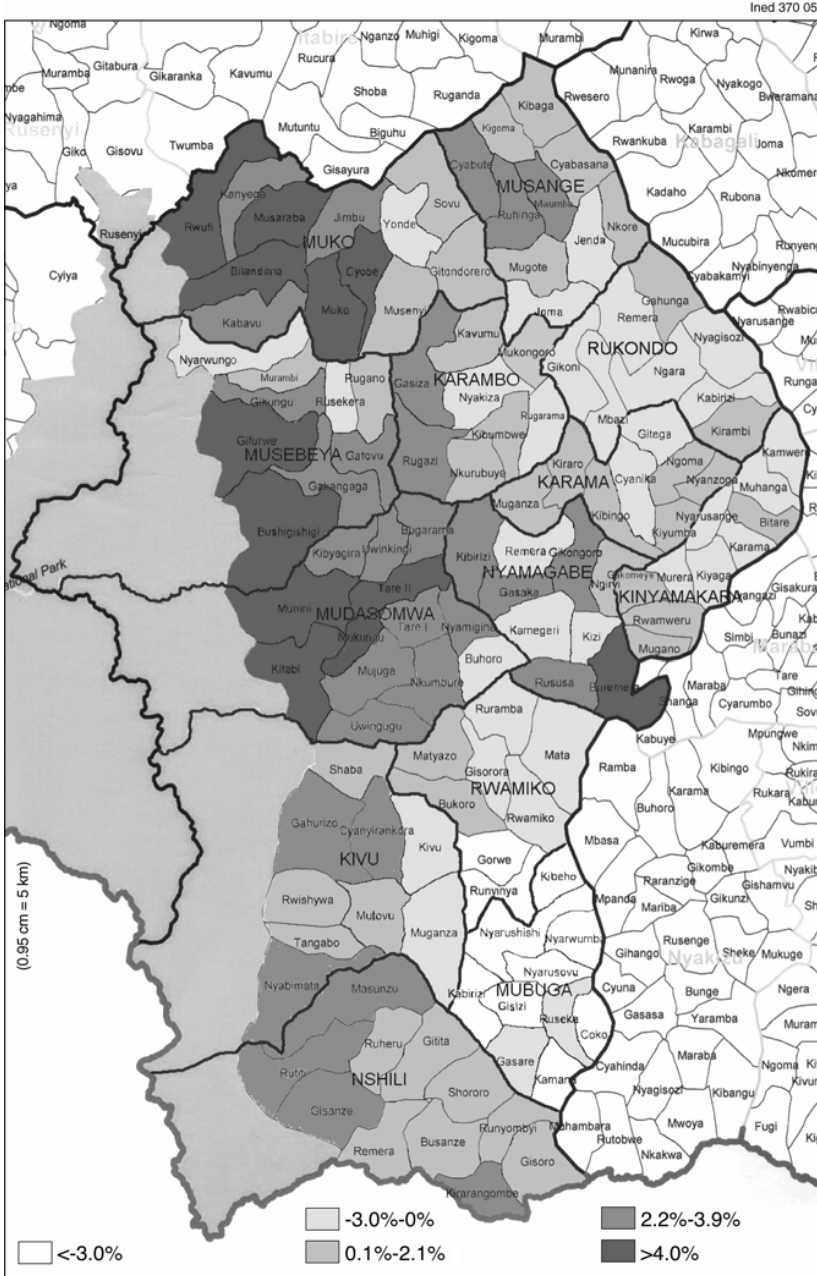
Map 1.— Rwanda, administrative map of 1993

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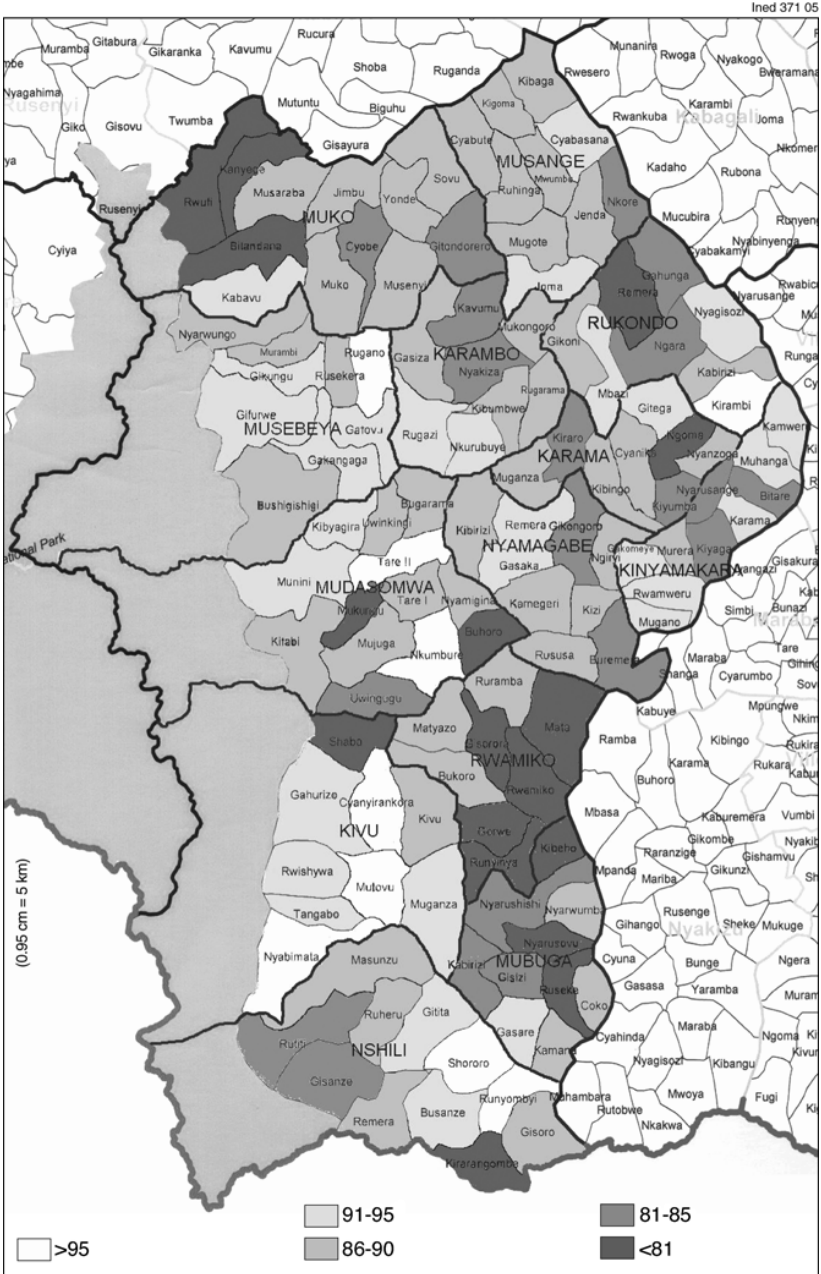
Map 2.– The proportion of Tutsi at the sector level in Gikongoro Prefecture, 1990

Source: Service national de recensement (SNR), January 2003



Map 3.- : Population growth over 1990-2002 at the sector level in Gikongoro Prefecture

Source: Service national de recensement (SNR), January 2003



Map 4.– Sex ratio in 2002 at the sector-level in Gikongoro Prefecture
 Source: Service national de recensement (SNR), January 2003

APPENDIX III

TABLE A.— SENSITIVITY ANALYSIS FOR ESTIMATING THE GENOCIDE DEATH TOLL

Assumptions made for the annual population growth rate (for Tutsi) between 1991-1994:	Assumptions made for the number/proportion of Tutsi surviving
<p>We estimate the number of Tutsi in July 1994 as follows:</p> $P_{July\ 1994} = (1 + 0.03)^{time\ span} \times P_{August\ 1991};$ <p><i>time span</i> = 2.96 years; the annual population growth of 3% is a choice made on the basis of the following:</p> <ul style="list-style-type: none"> -Between 1978 and 1991 the annual population growth was 3.1% on average. Between 1991 and 2002, it decreased to 1.2%, but this is largely due to high mortality rates during war and genocide. The number of children born per woman remained high, at 5.8 in 2000. It was 8.5 in 1983 and 6.2 in 1992 (ONAPO, 2001). -The high incidence of HIV infection may have increased mortality rates after 1991. However, this is likely to have played a significant role only after 1994, as a result of the displacement of the population during the war and genocide, and sexual violence committed on a large scale. -The 1991 census reports a lower fertility rate among Tutsi, and a lower population growth for Tutsi between 1978 and 1991 (1.9% versus 3.2% for Hutu). This difference might stem from the fact that more Tutsi live in urban areas than Hutu. However, it might also be a consequence of less under-reporting of Tutsi in the 1978 census than in the 1991 census, which was carried out in a climate of civil war and great fear among Tutsi. This may not only have affected growth rates for Tutsi, but also the recording fertility. To increase the chances of enrolling their children in public high schools, Tutsi parents used to make arrangements with Hutu friends to adopt their children before they completed primary school. Officially belonging to their Hutu adoptive family, these children were recorded as Hutu in the census. -To study the sensitivity of the death toll among Tutsi to the assumed population growth rate, we repeated the calculations using an annual growth rate of 2%. 	<p>We make three assumptions regarding the survival rate:</p> <ul style="list-style-type: none"> -150,000 Tutsi survived: these are the survivors counted by aid organizations at the end of July 1994 -25% survived: section II of this paper estimated the Tutsi survival rate in Gikongoro at 25%. -30% survived: together with Butare and Kibuye, Gikongoro is one of the prefectures believed to have suffered most from the genocide. Therefore, we suspect that the survival rate for the whole of Rwanda lies above 25%. HRW estimates that 25% of Tutsi in Butare survived (HRW, 1999). Verwimp (2003a) finds that less than 25% of Tutsi in Kibuye survived (based on a large data set from IBUKA), while more than 50% escaped the killings in Gitarama (based on a small household data set).

TABLE B.— SENSITIVITY ANALYSIS ASSUMING AN ANNUAL POPULATION GROWTH RATE OF 3%

Scenarios for the reliability of the census report	Plausibility of this scenario	Tutsi population in August 1991	Tutsi population in 1991 as % of total population	Tutsi population in July 1994, "no genocide scenario"	Number of Tutsi survivors (and percentage) at end of July 1994	Number of Tutsi killed	Tutsi killed as % of total Tutsi population in 1994
No under-reporting	Given the evidence presented in the second section of this paper, this scenario is highly unlikely.	596,400	8.400	650,900	150,000 (23.0%) 162,700 (25.0%) 195,300 (30.0%)	500,900 488,200 455,700	77.0 75.0 70.0
Under-reporting of 40% only in Gikongoro	It is hard to believe under-reporting would be limited to one prefecture. This scenario implies a proportion of 28% of Tutsi in Rwamiko (the commune with the missing data), and on average 18% in Gikongoro.	621,700	8.757	678,500	150,000 (22.1%) 169,600 (25.0%) 203,600 (30.0%)	528,500 508,900 475,000	77.9 75.0 70.0
Under-reporting of 50% only in Gikongoro	There are several reasons to assume that the proportion of Tutsi in Rwamiko was high. This scenario implies a proportion of 45% Tutsi in Rwamiko, and on average 19% in Gikongoro.	627,700	8.841	685,100	150,000 (21.9%) 171,300 (25.0%) 205,500 (30.0%)	535,100 513,800 479,600	78.1 75.0 70.0
Under-reporting of 40% in Butare, Gikongoro, Kibuye and Kigali City	This type of under-reporting would leave the ranking of prefectures by ethnicity intact.	717,300	10.103	782,900	150,000 (19.2%) 195,700 (25.0%) 234,900 (30.0%)	632,900 587,200 548,000	80.8 75.0 70.0
Under-reporting of 50% in Butare, Gikongoro, Kibuye and Kigali City		747,100	10.523	815,400	150,000 (18.4%) 203,900 (25.0%) 244,600 (30.0%)	665,400 611,600 570,800	81.6 75.0 70.0
Under-reporting of 40% in all prefectures	This scenario is plausible. The relative proportions of Tutsi in the different prefectures would be maintained.	837,100	11.790	913,600	150,000 (16.4%) 228,400 (25.0%) 274,100 (30.0%)	763,600 685,200 639,500	83.6 75.0 70.0
Under-reporting of 50% in all prefectures		896,900	12.633	978,900	150,000 (15.3%) 244,700 (25.0%) 293,700 (30.0%)	828,900 734,200 685,200	84.7 75.0 70.0

TABLE C.— SENSITIVITY ANALYSIS ASSUMING AN ANNUAL POPULATION GROWTH RATE OF 2%

Scenarios for the reliability of the census report	Plausibility of this scenario	Tutsi population in August 1991	Tutsi population in 1991 as % of total population	Tutsi population in July 1994, "no genocide scenario"	Number of Tutsi survivors (and percentage) at end of July 1994	Number of Tutsi killed	Tutsi killed as % of total Tutsi population in 1994
No under-reporting	Given the evidence presented in the second section of this paper, this scenario is highly unlikely	596,400	8.400	632,400	150,000 (23.7%) 158,100 (25.0%) 189,700 (30.0%)	482,400 474,300 442,700	76.3 75.0 70.0
Under-reporting of 40% only in Gikongoro	It is hard to believe under-reporting would be limited to one Prefecture. This scenario implies a proportion of 28% of Tutsi in Rwamiko (the commune with the missing data), and on average 18% in Gikongoro.	621,700	8.757	659,200	150,000 (22.8%) 164,800 (25.0%) 197,800 (30.0%)	509,200 494,400 461,500	77.2 75.0 70.0
Under-reporting of 50% only in Gikongoro	There are several reasons to assume that the proportion of Tutsi in Rwamiko was high. This scenario implies a proportion of 45% Tutsi in Rwamiko, and on average 19% in Gikongoro.	627,700	8.841	665,600	150,000 (22.5%) 166,400 (25.0%) 199,700 (30.0%)	515,600 499,200 465,900	77.5 75.0 70.0
Under-reporting of 40% in Butare, Gikongoro, Kibuye and Kigali City	This type of under-reporting would leave the ranking of prefectures by ethnicity intact.	717,300	10.103	760,600	150,000 (19.7%) 190,200 (25.0%) 228,200 (30.0%)	610,600 570,500 532,400	80.3 75.0 70.0
Under-reporting of 50% in Butare, Gikongoro, Kibuye and Kigali City		747,100	10.523	792,200	150,000 (18.9%) 198,100 (25.0%) 237,700 (30.0%)	642,200 594,200 554,500	81.1 75.0 70.0
Under-reporting of 40% in all prefectures	This scenario is plausible. The relative proportion of Tutsi in the different prefectures would be maintained.	837,100	11.790	887,600	150,000 (16.9%) 221,900 (25.0%) 266,300 (30.0%)	737,600 665,700 621,300	83.1 75.0 70.0
Under-reporting of 50% in all prefectures		896,900	12.633	951,000	150,000 (15.8%) 237,800 (25.0%) 285,300 (30.0%)	801,000 713,300 665,700	84.2 75.0 70.0

VERPOORTEN MARIJKE.– The Death Toll of the Rwandan Genocide: A Detailed Analysis for Gikongoro Province

The death toll of the Rwandan genocide remains highly debatable. The frequently quoted estimate of 500,000 Tutsi killed is based on the population census of 1991. However, two unanswered questions make this estimate unreliable. First, how many Tutsi lived in Rwanda prior to the genocide? Second, how many Tutsi survived? With respect to the first question, critics say that the proportion of Tutsi was under-reported in the 1991 census. By comparing the census data with population data of the local administration of Gikongoro Prefecture, we provide evidence for this allegation and study how the under-reporting may affect the estimate of the genocide death toll. We also use local population data for 117 administrative sectors within Gikongoro Prefecture to make a detailed analysis of the spatial pattern of killings in Gikongoro. We find that Tutsi in Gikongoro had, on average, a 25% chance of surviving the genocide. The survival rate for women was only slightly higher than for men: 29% versus 21%. The location of huge massacres and the way violence spread across sectors were more decisive for the Tutsi survival rate than whether or not local authorities opposed the genocide.

VERPOORTEN Marijke.– Le coût en vies humaines du génocide rwandais : le cas de la province de Gikongoro

Le coût en vies humaines du génocide rwandais reste une question très controversée. L'estimation souvent avancée de 500 000 Tutsis assassinés est fondée sur le recensement de 1991. Mais deux questions non résolues mettent en doute ce chiffre. D'abord, combien y avait-il de Tutsis au Rwanda avant le génocide ? Ensuite, combien ont survécu ? En ce qui concerne la première question, certains observateurs avancent que le recensement de 1991 sous-estime la proportion des Tutsis dans la population. En comparant les chiffres du recensement avec les données démographiques de l'administration locale de la préfecture de Gikongoro, nous apportons des preuves à l'appui de cette thèse et nous examinons la manière dont la sous-estimation peut biaiser l'évaluation du nombre des victimes du génocide. Les statistiques démographiques de 117 secteurs administratifs de la préfecture de Gikongoro permettent en outre une analyse approfondie de la distribution spatiale des massacres dans cette zone. Nous avons calculé que les Tutsis de Gikongoro avaient en moyenne une chance sur quatre de survivre au génocide, la probabilité de survie des femmes n'étant que légèrement supérieure à celle des hommes (29 % contre 21 %). Les chances de survie des Tutsis tiennent plus à la localisation des grands massacres et à la manière dont la violence s'est répandue dans les divers secteurs administratifs qu'aux éventuelles interventions des autorités locales pour empêcher le génocide.

VERPOORTEN Marijke.– El coste en vidas humanas del genocidio ruandés: el caso de la provincia de Gikongoro.

El coste en vidas humanas del genocidio ruandés sigue siendo una cuestión muy controvertida. La estimación citada con frecuencia de 500,000 Tutsis asesinados se basa en el censo de 1991. Sin embargo, dos preguntas no resueltas ponen en duda esta cifra. En primer lugar ¿cuántos Tutsis vivían en Ruanda antes del genocidio? En segundo lugar ¿cuántos sobrevivieron? En cuanto a la primera pregunta, algunos observadores indican que el censo de 1991 subestimó la proporción de Tutsis en la población. Comparando las cifras del censo con las cifras de población de la administración local de la prefectura de Gikongoro, aportamos evidencia en apoyo de esta tesis y analizamos el posible impacto de tal subestimación en las estimaciones del número de víctimas del genocidio. Los datos demográficos de 117 sectores administrativos de la prefectura de Gikongoro permiten por otra parte un análisis más exhaustivo de la distribución espacial de las masacres en esta zona. En base a tales datos calculamos que los Tutsis de Gikongoro tenían en promedio una oportunidad sobre cuatro de sobrevivir al genocidio, siendo la probabilidad ligeramente superior para las mujeres que para los hombres (29% frente a 21%). La probabilidad de supervivencia de los Tutsis dependió en mayor medida de la localización de las grandes masacres y del modo en que la violencia se expandió entre los sectores administrativos que de las eventuales intervenciones de las autoridades locales para impedir el genocidio.