

Sibling and Gender Effects on Children's Chance to Continue Primary Education in Rwanda

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Abstract

Rwanda has made a huge effort to arrive at universal primary education, but many children do not qualify to sit the leaving exam before they reach the age of 14. Using the Heckman probit model on data from the Integrated Household Living Conditions Surveys 2000 and 2011, this study explores the school careers of 12,539 children ages 13-17 who had the opportunity to continue primary education. The combination of extreme poverty and having younger siblings or being an orphan or foster child, still leads to very high dropout rates regardless of gender. To improve completion rate for primary education, Rwanda should put more emphasis on disadvantaged children from larger families.

Keywords

Primary education; sibling competition; poverty; resource dilution; gender; Rwanda

Education is the passport to the future, for tomorrow belongs to those who prepare for it today.

Malcolm X, *Speech at the Founding Rally of the Organization of Afro-American Unity, 1964*

Introduction

Rwanda faces many development constraints: poverty, scarcity of land, high fertility and absence of mineral resources. Given these constraints, the Rwandan government has decided to switch from an economy based on subsistence-oriented agriculture to a modern service-oriented economy by focusing on investment in the quality of the nation's principal asset: its people. Investing in education is also important in order to achieve the second Millennium Development Goal (MDG), while education in itself is a powerful driver of progress towards also achieving the other MDGs (Bruns, Mingat & Rakotomalala, 2003). Completed primary education is pivotal, as it is a prerequisite for enrollment in secondary education or in vocational education, which will enable youngsters to become skilled workers.

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There is an increasing consensus that the completion of primary education and the subsequent participation in secondary education or vocational training makes the difference between depending on subsistence agriculture and informal trade, or being able to become a socially, economically and geographically mobile member of the modern labor force (Lloyd & Blanc, 1996; Strode, Wylde & Murangwa, 2007). Nations that have attained universal primary education (UPE) and have almost achieved universal secondary education, continue to rank high in per capita income (Cigno, 2011; Mukudi, 2004). Seen in this light, the Rwandan pursuit of modernity has to be linked with the development of a labor force that acquires formal knowledge while still at school, and hence with greater investment in education (Banya & Elu, 1997).

The Rwandan government first took steps to facilitate the enrollment of children in primary education a decade ago. In October 2002, Rwanda set up a remedial program to enable dropouts who want to get back into the formal system, to do so as easily as possible (Kanamugire & Rutakamize, 2009). Since 2003, the abolition of school fees and the introduction of food-for-schooling programs are among the major interventions geared towards increasing the participation of disadvantaged groups in primary education (Nkurunziza, Broekhuis & Hooimeijer, 2012).

In 2009, the free education policy was extended in two steps to 12 years in an attempt to achieve six years of primary and six years of post-primary education for all by 2015. This extension of free education might have a positive impact on primary education retention and completion rates, because the Rwanda country report states, "There is [...] evidence that parents are more likely to keep their children in school if the children will be able to continue into the secondary phase" (United Nations Development Programme, 2010).

Although the free education and associated policies have increased enrollment and reduced dropout rates, achieving UPE proved unrealistic. The problem has shifted from non-enrollment to dropping out before completion. The Rwanda Education for All (EFA) profile reported that primary education completion remains a major challenge, with just 54% of school-aged children reaching the end of the cycle in 2008 and the repetition rates remain almost five percentage points above the Fast Track Initiative (FTI) benchmark of 10% (United Nations Educational, Scientific and Cultural Organization, 2012).

Repetition puts a greater burden on households, especially poor households, and increases the chances of dropout, thus, hindering a smooth educational career (United Nations Educational, Scientific and Cultural Organization, 2009). In addition, repeating school years consumes a substantial share of the financial resources allocated to primary education. For Africa as a whole, Dembélé and Oviawe (2007) estimated that grade repetition and dropout before completion are estimated to consume about 25% of the financial resources allocated to primary education. Yet, at the family level, increases in family size and sibling complementarity (where one child's labor may make it possible for another child to go to school) both lead to resource dilution, and both are probable causes for keeping children away from school and making them work (Greenspan, 1992; Morduch, 2000; Nkurunziza, Broekhuis & Hooimeijer, 2012). It should be noted that there is no single cause responsible for dropping out of school, but in addition to the families' socioeconomic situation, residential area as well as the local economy and culture could also be constraining or enabling factors of children's educational attainment.

This study identifies the teenagers who, since the introduction of free education and the associated policies, get a greater chance to complete primary education, by looking at conditions of poverty, household composition and the position of the pupil within the household (i.e., sibling and gender effect). We use data from the 2000 and 2011 Integrated Household Living Conditions Surveys (IHLCS), the contents of which are broadly similar. This allows us to compare the situation before and after the introduction of free education and the associated policies. We first present the theoretical context of the constraining and enabling factors for retention in primary education. This is followed by subsections on data, methodology and selected variables. We then present and discuss the results of the modeling. We end by presenting our conclusions and several policy implications.

Theoretical Framework

As Rwandan children officially commence their education at the age of seven and undergo a primary cycle of six years, children in the 14-17 age group who are still at primary education level are classified as “overage” children. Despite the remarkable progress in getting children in developing countries into basic education, sustained educational access remains problematic in the poorest regions of the world (United Nations Educational, Scientific and Cultural Organization, 2011). Continuation rates to the last primary grade in sub-Saharan Africa average out at 70.3%, meaning that nearly a third of the children drop out of the system (United Nations Educational, Scientific and Cultural Organization, 2011). Whatever the cause of overage pupils (later entrance, repeated classes or resuming the school career after dropping out), being an older pupil intersects with polarized student gender identities in various ways that discourage remaining in school for girls in particular (Dunne & Ananga, 2013). Dropping out of school is often a process rather than the result of a single event, however, and therefore has more than one proximate cause (Hunt, 2008).

A child's educational attainment is a result of a wide spectrum of factors at various levels: the child's personal capabilities and characteristics, the household resource allocation decisions, the accessibility and quality of the school system, and labor market conditions (Akresh, Bagby, de Walque & Kazianga, 2012; Al-Samarrai & Reilly, 2000; Sabates, Akyeampong, Westbrook & Hunt, 2010). At the household level, the educational career of a child is a function of the costs, the expected future returns of the schooling, the number of siblings and the child's position among them, and the household poverty level.

The relation between schooling and poverty links with a third factor: child labor. Poor households sometimes withdraw their older children from school in order to work as part of their coping strategy to meet costs and generate resources to support the schooling costs of the younger children (Hunt, 2008). Cash revenues earned by a child can form a necessary addition to the total household resources, or even a substantial part of the resources of poor households (Rena, 2009; Sabates, Akyeampong, Westbrook & Hunt, 2010). Poor children can easily enroll in school, but as they grow older, the opportunity costs of education become larger, increasing the pressure to drop out (Sabates, Akyeampong, Westbrook & Hunt, 2010). Various mechanisms contribute to this tendency. Even without school fees, other direct costs (e.g., uniforms, books) cannot be avoided. Children from poor households therefore have a greater chance of an interrupted formal education (Ananga, 2011; Basu & Tzannatos, 2003).

The reasons for pupils leaving school are closely tied to the local economy and culture, as well as to health challenges (Colclough, Rose & Tembon, 2000; Leach, Fiscian, Kadzamina, Lemani & Machakanja, 2003; United Nations Development Programme, 2010). In the sphere of the local economy, Ananga (2011) reported that “Specific work-related tasks – for example, full-time childcare and work at peak agricultural times – often clash with school hours.” In the cultural sphere of subsistence farming communities, families feel that it is important to involve children in productive activities and household tasks and equip them with the basic life skills useful for their future as adults (Admassie, 2003). Even if children go to school, they still have to do household chores and work on the farmstead or help their parents run their small enterprises (Munene & Ruto, 2010). Girls are involved in time-consuming activities such as cooking, washing and childcare to prepare them for their future roles as housewives and mothers (Admassie, 2003). When this unpaid household work is taken into account, girls work more hours than boys (Basu & Tzannatos, 2003).

A lack of parental support is linked to poverty in more than one way. For instance, parents do not have time to follow school careers intensively while struggling to make ends meet (Ministry of Education, 2003). The low appreciation of child education and lack of interest could also relate to the parents’ own limited educational training (Ersado, 2005; Lloyd, Mete & Grant, 2009). The higher the education of the parent, the greater the child’s chance of increased access and regular attendance, and the lower the dropout rate (Connelly & Zhen, 2003; Duryea & Arends-Kuenning, 2003). The absence of follow-up on or interest in children’s school career results in higher dropout rates or repetition of classes.

Our focus is on the effects of resource dilution or sibling competition for schooling. The effect of having young siblings on the school attendance of older brothers and sisters in the case of limited household income has two non-exclusive major components. The presence of young siblings could push their older brothers out of school to assist in the family’s economic activities, and push older sisters out of school to perform domestic chores at home (Greenspan, 1992). This sibling competition is probably more linked to moderate poverty than extreme poverty, as in very poor families all the children have to work, whereas in non-poor families all the children go to school (Basu & Tzannatus, 2003). In moderately poor families, siblings have to compete for limited household resources, which are insufficient to pay for the education of all the children (Downey, 1995). In the case of resource dilution, children opt for or have to step down for younger siblings to be educated by entering the labor market (Greenspan, 1992; Owuamanam & Alowolodu, 2010).

Findings from previous research differ on the gender aspect in these matters, but a general tendency is that girls face more discrimination than boys for various reasons. In Ghana, dropout rates are significantly higher and educational attainment levels lower for girls with younger siblings compared to boys with younger siblings (Lloyd & Gage-Brandon, 1994). However, in a review of seven other sub-Saharan countries, significant negative relationships were found in only two nations, namely Kenya and Namibia (Lloyd & Blanc, 1996), while boys were found to drop out earlier than girls in Lesotho (United Nations Development Programme, 2010).

Diluting parental resources is less problematic if the extended family system and the practice of fosterage redistribute resources across families in ways that buffer educational inequality (Akresh, 2005; Isiugo-Abanihe, 1985). Within a context of limited resources and economically valued alternative roles for children, extended family networks in sub-Saharan Africa have probably enabled a greater number of children to be educated than would

otherwise have been possible had biological parents alone born the full private cost of their children's education (Lloyd & Blanc, 1996).

Family structure is related to educational attainment in more than one way (Ginther & Pollak, 2004). Children from intact families receive, on average, more psychological support or more social, cultural and economic resources than children in blended or single-parent families. A parental death reduces in particular the primary education of girls under the age of 12 (Evans & Miguel, 2007). In a related line of research, Case, Paxson & Ableidinger (2004) examine the impact of orphanhood on children's schooling in 10 Sub-Saharan African countries. They argue that the death of the mother may leave children especially vulnerable, even among those who continue to live with their father and who experience no reduction in household income. The effect on schooling of double orphanhood and amount of household chores is even greater than the sum of the effects of a maternal and a paternal death (Ainsworth & Filmer, 2002; Bicego, Rutstein & Johnson, 2003; Case, Paxson & Ableidinger, 2004; Siaens, Subbarao & Wodon, 2003). This less advantaged position of orphans and foster children compared to own-children relates to the saying "Charity begins at home," and the theory that since the closeness of biological ties governs altruistic behavior, outcomes for orphans depend on the relatedness of orphans to their household heads (Case, Paxson & Ableidinger, 2004).

In many sub-Saharan countries, rural children are less likely than urban children to attend school and are more likely to drop out (Sabates, Akyeampong, Westbrook & Hunt, 2010). Income differentials between rural and urban societies are probably part of the reason for this disparity, along with structurally inadequate provisioning of school facilities and transport services (Al-Samarrai & Reilly, 2000; Hunt, 2008).

As underscored in this literature review, there is no single cause responsible for dropping out of school, and some of the effects of having younger siblings on education achievement are debatable. First, the effect can differ depending on the level of poverty, and can even be absent not only in non-poor households but also in extremely poor households. Second, the argument that girls suffer more from these effects finds limited support in empirical evidence and rests on the assumption that household chores are more important than other forms of child labor. Third, the effects are confounded by a number of other factors that are correlated with smaller families, such as urban living, shorter distance to school and the educational level of the parents.

This paper adds to the growing literature highlighting the problem of overage children in primary education and on the causes of school dropout and repeat classes. We focus on children who did not have a better chance to complete primary education on time, by elaborating poverty, sibling and gender effects, and comparing the situation before and after the introduction of remedial programs, free education and related policies in Rwanda. We expect that having young siblings compromises the school career of overage children from poor or extremely poor families. By combining the gender of the pupil and the presence of parents in the household, we expect to find higher dropout rates for girls who are maternal orphans and for boys who are paternal orphans. We also checked other economic, demographic and geographic factors to find the ones that are detrimental to the second chance to complete primary education.

Data and Methodology

The analyses presented in this paper rely on two sources of data: the Integrated Household Living Conditions Surveys (IHLCS) 2000/01 and 2011 conducted by the National Institute of Statistics of Rwanda (NISR) in order to monitor the results of poverty reduction policies. Together, these two surveys provide basic sociodemographic data on 100,551 household members as well as on their economic activities, their amenities and their use of services. Our sample ($n=12,539$) from these datasets included all children ages 13 to 17. Most of the selected group (74.0%) are sons or daughters of the household head. The children were identified by questions related to age; completion of primary education status, status of school attendance during the last 12 months preceding the interview and the highest level completed in primary. It should be noted that the youngest age of 13 is the child's age during the 12 months preceding the interview (equivalent to 14 years during data collection time). Few 13-year-old children have reported that the highest level completed in primary is level 5 (P5) and they were attending school during the 12 months preceding the interview. All of those children in P5 were classified in the group of the ones who will complete primary education in a timely fashion. We did so for the reason that the 13-year-old children who were attending P6 during the 12 months preceding the survey have not repeated any class and therefore are more likely to complete primary education on time. In other words, the 13-year-old children who were not attending P6 during the 12 months preceding the survey are more likely to complete primary education after the age of 14.

The highest boundary of 17 years (equivalent to 18 years during the data collection time period) is fixed on a basis of two main policy documents: the National Policy for Orphans and Other Vulnerable Children, and the Rwanda National Child Labor Policy. The two policy documents outline that children under the age of 18 are only allowed to perform jobs that are not interfering with children's education and thus denying them the opportunity to attend school.

In the case of a primary education cycle of six years and a legal enrollment age of seven years, three exclusive possible situations can occur when children are 14 years old. A child could:

1. have completed primary education (21% of the selected group had done so). Of the children who completed primary education, 71.3% continued into secondary education in 2000 and 85.8% in 2011.
2. still be attending primary school (50%) because of late entrance, repetition of classes or having retaken classes after a dropout period; or
3. have dropped out of school before completing year 6 of primary education or have never been to school at all (29%).

Regressing dropout on socioeconomic characteristics for the 13- to 17-year-old children who didn't complete primary education would lead to biased results, as the ones who have finalized their primary education on time will not be included in the sample. Therefore, we performed a Heckman probit analysis to control for sample selectivity and provide asymptotically efficient estimates for all the parameters.

As the dependent variables are dichotomous, we applied bivariate probit regression. The model involves two probits in simultaneously estimating two equations: the first estimates the probability of not completing primary education (selection equation) and the second estimates the probability that a child dropout of primary education (outcome equation)

despite the status of not completing primary education. The equations are presented as follows:

Outcome equation:

$Y = \beta X + \varepsilon$ (1) where Y is observed only if $Y' = 1$ (have not completed primary education)

Selection equation:

$Y' = \beta' X' + \varepsilon'$ (2) where $Y' = 1$ if $(\beta' X' + \varepsilon') > 0$, and $Y' = 0$ if $(\beta' X' + \varepsilon') \leq 0$

Correlation $(\varepsilon, \varepsilon') = p$ (3)

Where:

- Y is the log of the dependent variable and X a set of independent variables of the outcome equation (dropout of primary education);
- Y' is the log of the dependent variable and X' a set of independent variables of selection equation (dropout primary education status);
- β & β' reflect the impact of independent variables;
- ε & ε' are the residuals of the selection and outcome equations and,
- p is the coefficient of correlation between the errors of the two equations.

The response variable for the outcome equation is the "*completion of primary education status*," taking the code 1 for a child who has not completed primary education and the code 0 for a child who has completed primary education. In the selection equation, the dependent variable is the "*primary education attendance status*," coded 1 if a child is still attending primary education after age 14 and 0 otherwise.

To highlight the effect of having younger siblings on delayed completion or dropping out, we combined the position of the child among all children in the household with the family poverty level into one variable in the outcome model, while we kept them separated in the selection model. A household generally consists of a group of people living in the same accommodation and recognizing one person as its head. It may include related and unrelated members (Nkurunziza, Broekhuis & Hooimeijer, 2012). Although gender inequality seems non-existent at the national level, we combined gender and the parental co-residence status to detect whether the absence of one or both parents has a differential impact on completion of primary education for boys and girls.

To control for differences between the two datasets and to estimate the development over time, we established two separate analyses by the year of the survey and added an extra column to highlight the type of changes over time. The extra column was obtained by pooling the two datasets together, including year of interview as the main effect in selection and outcome equations, and using an interaction effect of the year of the survey with different predictors from each equation. But due to length limitation, we reported only the significance status of the interaction effect with the predictors.

Tables 1a and 1b present the descriptive statistics of potential primary education attainment predictors of our research population. The tables show that although the level of completion of primary education did not change between 2000 and 2011 (Table 1a), the portion of those who have not completed primary education on time and who continue to attend primary education after age 13 increased substantially (Table 1b). The percentages were calculated by rows for each data set.

It should be noted that we avoided using the variable “time spent on housekeeping chores” as a constraint of school attendance. We did so for two reasons. As the questionnaire refers only to work at home, we might have missed other jobs that could hamper completion or cause school dropout. More important, however, is the endogeneity problem: Children who are not at school are supposed to spend more time on housekeeping chores than those at school (Nkurunziza, Broekhuis & Hooimeijer, 2012).

The family poverty level is calculated on the basis of the household consumption expenditure including purchases, but also consumption from other sources like own production and payments received in kind. Our approach follows standard international practices by adjusting for differences in prices faced by households (price deflator) and by taking into account the household composition (household size measured in terms of adult equivalents). Given the prices in January 2001, the poverty line was set at RWF 64,000 (USD 120) per adult per year, and an extreme poverty line was RWF 45,000 (USD 85) per adult per year. These 2001 lines correspond to RWF 118,000 (USD 221) and RWF 83,000 (USD 156) in 2011 (NISR, 2012).

Table 1: Descriptive statistics on completion of primary education for overage children in 13-17 age group as per Integrated Household Living Conditions Surveys (IHLCS) of 2000 and 2011.

Table 1a. Have or have not completed primary education

Predictors	IHLCS 2000		IHLCS 2011	
	Yes (%)	No (%)	Yes (%)	No (%)
All observations	890 (20.5)	3,445 (79.5)	1,691 (20.6)	6,513 (79.4)
Age				
Age 13	75 (8.1)	848 (91.9)	91 (5.7)	1,506 (94.3)
Age 14	129 (14.4)	764 (84.6)	202 (11.3)	1,589 (88.7)
Age 15	187 (20.0)	749 (80.0)	330 (19.5)	1,362 (80.5)
Age 16	237 (31.2)	522 (68.8)	469 (30.6)	1,063 (69.4)
Age 17	262 (31.8)	562 (68.2)	599 (39.6)	993 (62.4)
Education level of household head				
Primary education or more	260 (28.8)	642 (71.2)	853 (31.8)	1,831 (68.2)
Up to five years primary	75 (23.5)	244 (76.5)	473 (15.3)	2,621 (84.7)
No education	555 (17.8)	2,559 (82.2)	365 (15.0)	2,061 (85.3)
Residential type				
Urban areas	370 (39.5)	567 (60.5)	483 (40.6)	706 (59.4)
Rural areas	520 (15.3)	2,878 (84.7)	1,208 (17.2)	5,807 (82.8)
Position among siblings				
Youngest child	160 (31.5)	348 (68.5)	446 (27.1)	1,198 (72.9)
Middle child	267 (21.5)	977 (78.5)	461 (20.2)	1,826 (79.8)
Oldest child	349 (18.1)	1,577 (81.9)	583 (18.0)	2,662 (82.0)
Only child	114 (17.4)	543 (82.6)	201 (19.6)	827 (80.4)
Family poverty level				
Child from non-poor family	600 (31.4)	1,313 (68.6)	1,262 (29.1)	3,069 (70.9)
Child from poor family	127 (16.3)	653 (83.7)	239 (13.7)	1,504 (86.3)
Child from extremely poor family	163 (9.9)	1,479 (90.1)	190 (8.9)	1,940 (91.1)
Occupational status of the household head				
Head in non-agricultural activities	195 (36.2)	343 (63.8)	449 (32.3)	943 (67.7)
Head in agricultural activities	695 (18.3)	3,102 (81.7)	1,242 (18.2)	5,570 (81.8)

Table 1b. Still attending primary education or dropping out without completing primary education

Predictors	IHLCS 2000		IHLCS 2011	
	Yes (%)	No (%)	Yes (%)	No (%)
All observations	1,350 (39.2)	2,095 (60.8)	4,968 (76.3)	1,545 (23.7)
Age				
Age 13	577 (68.0)	271 (32.0)	1,409 (93.6)	97 (6.4)
Age 14	399 (52.2)	365 (47.8)	1,391 (87.5)	198 (12.5)
Age 15	238 (31.8)	511 (68.2)	1,102 (80.9)	260 (19.1)
Age 16	82 (15.7)	440 (84.3)	663 (62.4)	400 (37.6)
Age 17	54 (9.6)	508 (90.4)	403 (40.6)	590 (59.4)
Education level of household head				
Primary education or more	246 (38.3)	396 (61.7)	1,420 (77.6)	411 (22.4)
Up to five years primary	76 (31.1)	168 (68.9)	2,020 (77.1)	601 (22.9)
No education	1,028 (40.2)	1,531 (59.8)	1,528 (74.1)	533 (25.9)
Residential area				
Urban areas	198 (34.9)	369 (65.1)	473 (67.0)	233 (33.0)
Rural areas	1,152 (40.0)	1,726 (60.0)	4,495 (77.4)	1,312 (22.6)
Poverty and position among siblings				
Youngest child from non-poor family	74 (46.0)	87 (54.0)	465 (73.2)	170 (26.8)
Middle child from non-poor family	157 (55.1)	128 (44.9)	598 (79.8)	151 (20.2)
Oldest child from non-poor family	233 (38.8)	368 (61.2)	871 (72.9)	323 (27.1)
Only child from non-poor family	87 (32.7)	179 (67.3)	337 (68.6)	154 (31.4)
Youngest child from poor family	30 (44.1)	38 (55.9)	220 (78.3)	61 (21.7)
Middle child from poor family	80 (40.2)	119 (59.8)	373 (82.2)	81 (17.8)
Oldest child from poor with family	109 (38.0)	178 (62.0)	495 (84.0)	94 (16.0)
Only child from poor family	29 (29.3)	70 (70.7)	124 (68.9)	56 (31.1)
Youngest child from extremely poor family	41 (34.5)	78 (65.5)	222 (78.7)	60 (21.3)
Middle child from extremely poor family	206 (41.8)	287 (58.2)	471 (75.6)	152 (24.4)
Oldest child from extremely poor family	250 (36.3)	439 (63.7)	681 (77.5)	198 (22.5)
Only child from extremely poor family	54 (30.3)	124 (69.7)	111 (71.2)	45 (28.8)
Gender and presence of parents				
Male lives with parents	337 (47.7)	370 (52.3)	1,476 (82.1)	322 (17.9)
Male lives without father	181 (39.2)	281 (60.8)	554 (72.5)	210 (27.5)
Male lives without mother	37 (40.2)	55 (59.8)	97 (80.8)	23 (19.2)
Male lives without parents	101 (28.1)	258 (71.9)	396 (58.6)	280 (41.4)
Female lives with parents	311 (42.3)	424 (57.7)	1,388 (84.9)	246 (15.1)
Female lives without father	218 (40.6)	319 (59.4)	546 (76.3)	170 (23.7)
Female lives without mother	33 (39.3)	51 (60.7)	70 (72.9)	26 (27.1)
Female lives without parents	132 (28.1)	337 (71.9)	441 (62.2)	268 (37.8)

Results

We built separate models for two years (Table 2) to check the effect of different policies on the retention of children in primary education. To test the hypothesis that the introduction of free education and associated programs in 2002/03 improved the probabilities that poorer children would have a chance to continue their primary education, the right-hand column in Table 2 shows whether the parameters are significantly different between the years. The selection model estimates the probability of not completing primary education, as this is the population at risk for dropping out after age 13 (high opportunity cost). The Wald test of independence shows that control for selectivity bias is appropriate in both years. The $\chi^2=8.10$ ($p<0.01$) in 2000/01 and the $\chi^2 = 30.00$ ($p<0.01$) in 2011 (at the bottom of Table 2). Rho (ρ) in Table 2 is an estimate of $(\varepsilon, \varepsilon') = p$ and indicates that the correlation coefficient between error terms as in equation (3) is very significant in both period. Hence we should use Heckman's technique instead of separate probits models.

In the selection model, the intercepts indicate that among the reference category (13-year-old children, who are youngest child from an urban non-poor family, whose household head completes primary education and involves in non-farm activities) most of the children do not complete primary education on time. The probability of not completing primary education for the reference category is slightly higher in 2011 (0.452) than in 2000 (0.236), indicating that timely completion (at age 13) has dropped over the years (the shift over time is significant at the 0.01 level). After age 15 we find significantly lower chances of not completing primary education in 2011 (from -0.848 for 15 years to -1.377 for 17 years) compared with 2000 (from -0.548 for 15 years to -0.912 for 17 years), indicating that the retention rate is effective in generating larger proportions of continuing primary education and its completion later. Access to good schools is certainly of importance in educational attainment. In rural areas, the probability of not completing primary education is slight higher in 2000 (0.476) and 2011 (coefficient is 0.486) than for towns. Single children and eldest children have higher probabilities of not completing primary education in time, but the effects are less strong in 2011 (0.303 and 0.311 respectively for single and eldest child) compared to 2000 (0.581 and 0.417 respectively for single and eldest child). The effects of poverty on non-completion have not changed over the years and the effect of limited education of the parents (household head without education level) is stronger in 2011 (0.489) compared with 2000 (0.144).

The intercepts in the outcome models provide evidence that the reference category (13-year-old male children, who are a youngest child from a non-poor intact family, whose household head completes primary education) is most likely to remain in primary education, and hence to complete it later. The child of the above group (reference category) is less likely to drop out of school but the probability of not dropping out is higher in 2011 ($|-2.095|$) compared to 2000 ($|-1.283|$). In other words, the chances of still attending primary education are higher in 2011 compared to 2000.

For 2011 – eight years after the introduction of free education and nine years after the introduction of the remedial program – this result indicates a net increase in overage children using the opportunity to continue with primary education and to complete it later.

Our main variable of interest was the combination of poverty and position among siblings. Taking care of children younger than primary-school age is one of the housekeeping core and is supposed to be an impediment to the school enrollment of full and maternal orphans (Thomas, 2010). But, due to an endogeneity problem and lack of information in our data set on an inclusive time spent on housekeeping chores, we have not used the variable representing time spent on housekeeping activities. Given this limitation, the results of the sibling effect are striking, yet somewhat different between the years. For 2000, irrespective of the position of the child among its siblings, the dropout rate was high according to the poverty level, but shows a decreasing trend. The effect of being the eldest child is apparent across all poverty levels but with a high probability of dropping out for ones from extremely poor households (0.730 in 2000 and 0.488 in 2011) and poor households (0.590 in 2000 but does not appear in 2011). Poverty level itself is a strong determinant of completion of primary education. Youngest children from extremely poor families have a higher probability of dropping out (0.530 in 2000 but does not appear in 2011) than the reference category of youngest children from non-poor families, hence less chance of later completion. Yet if the first group is the eldest child, the probability of dropping out is much higher and relatively equal in both in 2000 (0.441) and 2011 (0.418).

In 2011, regardless of the household poverty level, the probability of dropping out for eldest children exists only in non-poor and extremely poor families (0.308). Being the eldest children from non-poor and extremely poor families tremendously decreases the chances of continuing primary education because the probability of dropping out is respectively 0.310 and 0.730. For moderately poor teenagers, the overall probability of continuing primary education and completion are slightly better than they are for the extremely poor, even for the eldest ones in 2011. Among the non-poor, the eldest has significantly higher probability to dropout in 2000 (0.310) and even in 2011 (0.308). Being an only child correlates with higher dropout rates regardless of the poverty level only in 2000 (0.623 for extremely poor, 0.585 for poor and 0.296 for non poor) and appears only for extremely poor teenagers in 2011 (0.314). The effects are probably related not to resource dilution, but to being put to work at an earlier moment in life.

The absence of one or both parents is another impediment to continue primary education, as it strongly increases the chances of dropping out. Children living without both parents, regardless of gender, are particularly disadvantaged, and the difference between the two periods is small. The results support the hypothesis of the complementary gender of the child to the single parent in 2011. Girls living without mothers and boys living without fathers have higher chances of dropping out in 2011, during which the probabilities are respectively 0.418 and 0.308. The loss of a mother does not have a significantly greater effect for girls than the loss of a father for boys.

The Heckman probit models show the expected outcome of the education level of the household head on schooling among their children. In particular, if the head did not complete primary education, the probability of dropping out is much higher in 2000 (0.338), but there is a decreasing trend later (0.167 in 2011). Parents or caretakers with an education, even if only up to five years of primary education, show the expected results in more often sending and keeping their children in school.

In testing whether variables had significantly different effects between 2011 and 2000, the study shows a significantly increased likelihood that a middle child from a poor family and a youngest child or an oldest child from an extremely poor family would have a greater chance to complete their primary education. The high probability of dropping out for an oldest child from a non-poor family doesn't differ in the 2011 set compared to the one from 2000. The high probability of dropping out for only children in 2011 also doesn't differ significantly from the 2000 data. Girls living with both parents clearly have an improved greater chance to complete primary education in 2011 compared to 2000.

Table 2: Heckman probit sample selection bias model for primary education

	IHLCS 2000	IHLCS 2011
Number of observations	4,335	8,204
Censored observations	890	1,691
Uncensored observations	3,445	6,513
Wald chi2(24)	369.65	596
Prob > chi2	0.000	0.000
Log pseudo likelihood	-3,739.5	-6,236.12

Table 2a. Probability of not having completed primary education

Selection equation	B	S.E	Sig. level	B	S.E	Sig. level	Shift over time
Age 13 (Ref. Cat.)							
Age 14	-0.298	0.084	**	-0.459	0.067	**	n.s
Age 15	-0.548	0.080	**	-0.848	0.064	**	**
Age 16	-0.937	0.081	**	-1.189	0.064	**	*
Age 17	-0.912	0.080	**	-1.377	0.064	**	**
HH with primary education or more (Ref. Cat.)							
HH with up to five years primary	0.037	0.095	n.s	0.457	0.041	**	**
HH with no education	0.144	0.062	*	0.489	0.046	**	**
Youngest child (Ref. Cat.)							
Middle child	0.188	0.074	*	0.184	0.049	**	n.s
Oldest child	0.417	0.071	**	0.311	0.048	**	n.s
Only child	0.581	0.087	**	0.303	0.062	**	**
Urban areas (Ref. Cat.)							
Rural areas	0.476	0.057	**	0.486	0.047	**	*
Child from non-poor family (Ref. Cat.)							
Child from poor family	0.324	0.067	**	0.400	0.046	**	n.s
Child from extremely poor family	0.590	0.060	**	0.625	0.047	**	n.s
Head in non-agricultural activities (Ref. Cat.)							
Head in agricultural activities	0.175	0.070	*	0.163	0.046	**	*
Constant	0.236	0.103	*	0.452	0.077	**	**

Table 2b. Probability of dropping out before completing primary education

Outcome equation	B	S.E	Sig. level	B	S.E	Sig. level	Shift over time
Age 13 (Ref. Cat.)							
Age 14	0.352	0.065	**	0.313	0.065	**	n.s
Age 15	0.841	0.081	**	0.528	0.064	**	**
Age 16	1.239	0.137	**	0.981	0.067	**	*
Age 17	1.480	0.154	**	1.381	0.082	**	n.s
HH with primary education or more (Ref. Cat.)							
HH with up to five years primary	0.338	0.106	**	0.167	0.048	**	n.s
HH with no education	0.081	0.062	n.s	0.239	0.050	**	n.s
Youngest child from non-poor family (Ref. Cat.)							
Middle child from non-poor family	-0.091	0.124	n.s	0.107	0.078	n.s	n.s
Oldest child from non-poor family	0.310	0.111	**	0.308	0.070	**	n.s
Only child from non-poor family	0.296	0.131	*	0.006	0.085	n.s	n.s
Youngest child from poor family	0.239	0.188	n.s	-0.025	0.103	n.s	n.s
Middle child from poor family	0.478	0.135	**	0.175	0.093	n.s	**
Oldest child from poor family	0.590	0.127	**	0.152	0.089	n.s	**
Only child from poor family	0.585	0.176	**	0.224	0.119	n.s	n.s
Youngest child from extremely poor family	0.530	0.154	**	0.010	0.106	n.s	**
Middle child from extremely poor family	0.441	0.120	**	0.418	0.083	**	n.s
Oldest child from extremely poor family	0.730	0.116	**	0.488	0.078	**	**
Only child from extremely poor family	0.623	0.156	**	0.314	0.129	*	n.s
Male lives with both parents (Ref. Cat.)							
Male lives without father	0.194	0.081	*	0.308	0.062	**	n.s
Male lives without mother	0.170	0.143	n.s	-0.034	0.139	n.s	n.s
Male lives without parents	0.492	0.105	**	0.636	0.070	**	n.s
Female lives with parents	0.173	0.067	*	-0.114	0.052	*	**
Female lives without father	0.176	0.073	*	0.201	0.062	**	n.s
Female lives without mother	0.274	0.148	n.s	0.418	0.142	**	n.s
Female lives without parents	0.554	0.096	**	0.557	0.065	**	n.s
Constant	-1.283	0.131	**	-2.095	0.092	**	**
Rho	0.585	0.155		0.689	0.081		
Wald test of Indep.(rho=0): $\chi^2=8.10$ p=0.004				30.00	0.000		

n.s: not statistically significant, * p<0.05, ** p<0.01

Conclusion and Policy Implications

We expected to find that free education, remedial education and food-for-schooling programs had made considerable contributions to keeping Rwandan children at school after the statutory age of 13. The results indicate that these policies have indeed increased the likelihood that children, and especially girls, make use of a chance to attain and to complete primary education. Targeting girls rests on the assumption that they are more disadvantaged. There are several indications in the literature that this might be the case in sub-Saharan Africa. Particularly the older daughters in large, poor families are assumed to drop out of school in order to take care of their younger siblings.

Our results support the assumption that being the oldest child severely compromises the school career of teenagers in non-poor or extremely poor families. Being the oldest child in extremely poor families, and to a lesser extent in poor families, comes with an expectation to enter the labor market to increase household resources. Rwandan rural families have, on average, small landholdings as their only economic asset, and need additional non-agricultural income to overcome the resource dilution effect, especially for female-headed households. This is in line with the conclusion of the World Food Program (2006) that the most urgent domestic responsibility of older children is not taking care of younger children, but of helping their families make ends meet.

This might also explain why children without siblings turn out to be more disadvantaged: Being the family's only source of extra income probably means that they need to start working at an earlier age and have fewer opportunities to complete their schooling. Again, this was particularly true for boys and girls living without parents. This refutes the hypothesis of Basu and Tsannatos (2003) that sibling competition for schooling is associated particularly with moderately poor living conditions and less with non-poor or extremely poor conditions. We did find a strong effect of sibling competition among children in extremely poor living conditions, on top of the effect of extreme poverty on schooling for each sibling status.

The household's poverty level and the child's position among their siblings are by far the most dominant factors that decrease the child's chances of continuing primary education in 2000, but the sibling effect decreased and even disappeared for the moderately poor in 2011. Abolishing school fees, running remedial programs and providing pupils with food are not enough. The absence of a poverty effect on dropout in 2011 for youngest children is related to poverty reduction strategies applied by the government. At the national level, the poverty level fell from 58.9% in 2000/01 to 56.7% in 2005/06, and then to 44.9% in 2011. This partly reflects much faster growth in the second five years, and partly reflects the inequality, which fell in the second five-year period after rising slightly in the first five-year period (National Institute of Statistics of Rwanda (NISR), 2012).

The absence of a poverty effect on dropout in 2011 can also be attributed to the local authorities' willingness to supervise the parents who fail to give children their basic rights, including education. One cartoon in 2010 illustrated the local authorities' serious commitment: "If you don't take your children to school, we shall punish you," was a warning message from the mayor of Rwanamagana District in the Eastern Province of Rwanda (New Times Editorial Cartoon of the Day, 2010).

Other factors that hamper school success — such as absence of one or both parents and living in a rural area — turn out to be very strong, even after controlling for poverty. Among the fraternal orphans, boys have higher dropout rates than girls. Among the maternal orphans, girls have higher dropout rates than boys. Yet our overall findings on gender suggest that the policy focus on gender equity is successful. This result is supported by the data on the 2011 Primary Leaving Exams: Girls accounted for 54% of the 167,166 registered candidates (Kwizera, Ngabonziza, Rwembeho & Nkurunziza, 2011).

Rwanda would do well to concentrate on affirmative action and proactive policy interventions to promote the completion of primary education, particularly by orphans and by children from extremely poor and poor families, as well as from rural areas. Free education combined with enforcing the laws on mandatory school attendance and the prohibition of child labor under the age of 15 are steps towards reducing the dropout rate, but their effectiveness depends on successful poverty reduction strategies. Rwanda chose to tackle poverty in general through its poverty reduction interventions, labeled as Social Protection Policy (Nkurunziza, Broekhuis & Hooimeijer, 2015). The policies should specifically continue to target poor families and orphans in general.

A major limitation of our analysis is that we could not measure the effect of school quality directly. However, other evidence on a lack of quality due to overcrowding is available. The current policy of stimulating enrollment has contributed to this overcrowding, as many now continue their primary education after age 13. There is little evidence so far, however, that this also leads to higher completion rates. Efforts to ensure and maintain education quality in primary education are facing serious challenges.

Between 2005 and 2011, the fertility level of Rwandan women dropped substantially. At the macro level, this means that the growth in the influx of new pupils in primary education will slow down in the near future. At the micro level of the individual child, it means less sibling competition and resource dilution. We have shown that this has a positive effect on children in non-poor and extremely poor households in particular, helping them to complete their schooling and continue into secondary education or vocational training. In the long run, this may prove to be a beneficial cycle, as educational attainment leads to increased fertility control through later marriage and the spacing and limiting of births, helping to meet the qualitative rather than just the quantitative demand for education.

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