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Teenaged, married, and out of school: Effects of early marriage and childbirth on school exit in Eastern Africa

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Abstract This article investigates the relationship of early marriage to school participation and whether other factors, including individual or family characteristics and childbirth, moderate the relationship. It uses national household survey data for Eastern Africa, pooled at the regional level. Overall, findings confirm that marriage and schooling appear largely incompatible across the Eastern Africa region at present. The results of the main analysis indicate that married girls are roughly 31 percentage points less likely to be attending school than their unmarried peers. The effect of marriage on school participation trumps other observed factors, including childbirth. Based on an extended analysis using the timing of marriage and two consecutive years of education data in Malawi and Kenya, the article concludes that marriage is a predictor of subsequent school exit.

Keywords Early marriage · School participation · School exit · Childbirth · Eastern Africa

With the expansion of universal primary enrolment policies in sub-Saharan Africa, gender balance in primary school participation improved considerably, and girls now attend primary school at almost the same rate as boys. Gains in primary, however, have not carried

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over to secondary. For every 100 boys, only 84 girls enrolled in upper secondary school across the region in 2018, up from 80 in 2000 (UIS 2020). The reasons for this gender gap are numerous: school fees, greater travel distances to secondary schools, absence of water and sanitation facilities, and financial pressures on families often disproportionately affect girls.

In addition to these obstacles, a small but growing empirical literature and a more extensive advocacy literature suggest that the social and cultural pressures for young women to marry and begin a family at school-going ages are linked to lower female school participation (Klugman et al. 2014; Samati 2013; UNFPA 2012). On the one hand, girls who marry early (before the age of 18) are said to have marital responsibilities at odds with school going, and limited agency over their education and other matters. On the other, an absence of schooling opportunities or a lack of employment options may lead to early-marriage decisions. In other words, girls may drop out for other reasons and then, unable to continue their education, enter marriage (Lloyd and Mensch 2008).

In this article, we investigate the relationship between early marriage and school participation across Eastern Africa in our main analysis, followed by an extended analysis on Malawi and Kenya. We bring two analytical innovations to the topic. First, by pooling national household survey data at the regional level, we can control for a greater number of background factors and conditions than has been possible in other studies. Second, we use a propensity score weighting adjustment to address bias stemming from fundamental differences in the characteristics of married and unmarried girls in our data. This approach allows us to account for the differential effects of background characteristics on the likelihood of marriage within each country while maintaining the statistical power that a pooled sample allows in analysis. In the analysis, we consider: (a) how a teenage girl's marital status affects her participation in school; (b) how the effect of childbirth compares to the effect of marriage on school participation; and (c) whether factors associated with higher school participation rates moderate the relationship of marriage to attendance.

This article is structured as follows: We first situate our study within existing research on early marriage and education and review the policy context surrounding early marriage in Eastern Africa. Then, we introduce our dataset, measures, and analytical approach before discussing findings from our main analysis and the extended Malawi and Kenya analysis. Finally, we conclude with a review of results and their policy implications.

Early marriage and education

While both boys and girls are at risk of child marriage, girls tend to marry young at higher rates (UNFPA 2012) and, therefore, are the focus of this article. Early marriage undermines social outcomes in numerous ways. Health arguments stress that young girls are often not physically ready for pregnancy and childbirth (which often follow marriage), that they are less equipped to defend against sexually transmitted diseases and less prepared to raise healthy children (Otoo-Oyortey and Pobi 2003; UNFPA 2012). Human rights arguments observe that early marriage violates the rights of children, including rights to protection against violence and to education, and women's sexual and reproductive rights (UNFPA 2012). Economic arguments maintain that the low skills and missed earnings potential of girls who marry young and drop out of school stifle both individual opportunities for marketplace participation and national economic development (Vogelstein 2013; UNICEF 2001). Taken together, these impacts mean that

early marriage significantly curtails the agency of such wives. Moreover, the disadvantages that follow early marriage extend to the next generation, with children, especially girls, of mothers who married young less likely to attend school (Delprato et al. 2017).

A small but growing empirical literature focuses specifically on the relationship of early marriage to education. In a study of 5 countries in sub-Saharan Africa, Lloyd and Mensch (2008) find that between 5% and 33% of young women who left school early report marriage as the cause. Nguyen and Wodon (2014) examine the impact of marriage on educational outcomes in 27 countries in sub-Saharan Africa and conclude that marriage before the age of 18 is associated with lower probability of being literate, participating at the secondary school level, and completing secondary school. Similarly, in a mixed-methods study in Uganda, Wodon et al. (2016) show that early marriage is linked to lower participation and completion of secondary school, and they reinforce this conclusion with qualitative evidence from parents and teachers who perceive early marriage to be a common reason that girls leave school.

Girls may drop out of school due to marriage or, conversely, become married because they are out of school. In the latter case, an absence of educational opportunities or anticipated low returns on investment in schooling (due, for example, to a lack of employment options for educated girls or low academic performance in school) may influence household choices on marriage. In other words, girls sometimes leave (or do not start) school for other reasons and then, unable to pursue an education, enter marriage (Lloyd and Mensch 2006).

Financial needs often shape decisions about both education and early marriage. In their literature review, Parsons et al. (2015) note that where it is customary for a bride's family to pay a dowry, the dowry of young brides with low education levels is likely to be smaller, disincentivizing investment in girls' schooling before marriage. Elsewhere, the practice of bride price means an immediate financial reward to a bride's family that may provide an impetus for resource-strained households to marry their daughters young (Parsons et al. 2015). Although the problem of early marriage is not confined to poorer households, it is more prevalent there. In their analysis of 54 countries, Klugman et al. (2014) find that girls from poorer homes have twice the chance of being married before age 18 as girls from better-resourced ones.

Similarly, religious or cultural norms influence whether early marriage is common and acceptable, though practices are deeply localized and context-dependent and, thus, one cannot attributed them to specific ethnic or religious groups (Gemignani and Wodon 2015; Klugman et al. 2014; Parsons et al. 2015). Girls in rural areas are also twice as likely as their urban peers to marry young (Klugman et al. 2014). Rural girls may be more vulnerable to early marriage precisely because returns from education, as an alternative to marriage, are lower. Delprato et al. (2017) point out that this may be because of the greater likelihood of being over-age in school in rural areas, which makes it harder to complete schooling before adulthood, or because fewer jobs require schooling compared to those in urban areas.

In short, the literature suggests that different factors—especially poverty, rural residence, being over-age or underperforming in school, and the persistence of certain social or cultural beliefs—place some girls at higher risk of early marriage, as well as of teenage pregnancy (Yakubu and Salisu 2018), than others. Notably, these factors are also associated with school exit, meaning that the relationship of early marriage to education is deeply complex. This has implications for our analytical approach, and we discuss it further in the section on methodology.

This study contributes to the existing literature in several ways. Building on existing knowledge about factors that contribute to decisions on early marriage, we explicitly model the likelihood of the event first, using observable characteristics for each country as predictors. This allows us to home in on the specific effects of the marriage event itself, and to compare its magnitude with that of the added burden of childbirth. Secondly, as we form our matched datasets within countries, we pool data from across the region—which allows us to examine, at a higher level of power and precision, regional patterns and interactions between risk factors for dropout. Finally, we are able to examine the sequencing of marriage and school-exit events, a topic prior research has tended to explore only retrospectively through reports by adults on reasons for school dropout. By using information concerning both the timing of marriage and consecutive years of attendance to understand the sequencing of lifecycle events, we enable better causal inference into the ways that early marriage undermines educational opportunity.

We intend insights from the study not only to inform policymaking to end early marriage but also, by exploring the timing of school exit decisions and whether there are factors that enable girls to continue their schooling after marriage, our results help shed light on how policymaking might best support educational opportunities for girls, much as Madhaven and Thomas (2005) do in their study of teenage pregnancy and schooling in South Africa. Because pregnancy is another known risk factor for dropout (Lloyd and Mensch 2008; Madhaven and Thomas 2005) and low educational attainment (Biney and Nyarko 2017)—and one that has arguably received greater policy attention in some sub-Saharan African countries (for example, in South Africa, Kenya, and Malawi, among others, legislation allows girls to return to school after having a baby)—our study, building on Lloyd and Mensch (2008), also compares the effects of early marriage and young motherhood on education to gain insights into how these events shape the educational opportunities of girls.

Regional policy context

Across Eastern Africa, early marriage rates have declined in recent decades, though the rate of improvement is often shallow, suggesting that many countries must continue to grapple with issues of early marriage in the coming decades (Bongaarts et al. 2017). Regional averages, however, mask country-specific trends in the incidence of teenage marriage, with notable progress in countries such as Kenya and Zimbabwe (Jensen and Thornton 2003) and Rwanda (UNFPA 2012) but rising rates of early marriage in countries such as Malawi and Madagascar between approximately 1993 and 2010 (Bongaarts et al. 2017). While, in practice, early marriage remains prevalent, the regional policy landscape, in principle, safeguards children from marriage. The African Charter on the Rights and Welfare of the Child (ACRWC), adopted in 1990, protects girls and boys below the age of 18 from marriage, establishes the right of children to education, and encourages support for girls who become pregnant to help them complete their education. Of the 10 East African countries in our analysis, all have signed and, with the exception of Zambia, also ratified the ACRWC.

National policies in each of the 10 countries establish 18 or 21 as the minimum legal age to marry without parental consent, as shown in Table 1. However, earlier marriage is still possible with parental consent in 9 of those countries (only Rwanda does not allow it) and under religious or customary law in 3 countries: Uganda, Zambia, and Zimbabwe. As these exceptions imply, legal pathways still exist to early marriage, and the ACRWC standards remain aspirational. Moreover, marriage laws are not always enforced, and slow-changing

Table 1 Legal marriage age in selected sub-Saharan African countries without/with parental consent. *Source:* World Policy Analysis Center

	Minimum legal marriage age for girls	Are there exceptions that allow earlier marriage for girls under religious or customary law?	Are there exceptions that allow earlier marriage for girls with parental consent?
Burundi	21	No	Yes
Kenya	18	–	Yes
Madagascar	18	No	Yes, but with additional requirements
Malawi	18	–	Yes
Mozambique	18	No	Yes
Rwanda	21	No	No
Tanzania	18	No	Yes
Uganda	21	Yes	Yes
Zambia	21	Yes	Yes
Zimbabwe	18	Yes	Yes

local traditions and customs maintain acceptance of and demand for young brides. Consequently, early marriage persists to the detriment of girls more than a decade and a half after the ACRWC's adoption, and the importance of continued efforts to understand the full impact of child marriage on society—including through education—is as high as ever.

Methodology

Data

Our analyses draw on Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS). Both programs conduct nationally representative household surveys with similar survey design approaches and used the same or comparable questionnaire items for school attendance and attainment topics, marital status, and the other measures that we employed.

For each country in our analysis, we recoded the DHS and MICS age variable to adjust girls' ages to the beginning of the school year referenced by current attendance questions in each country. Although the women's questionnaire, from which marriage information is drawn, is administered only to 15- to 49-year-olds, adjusting for the time lapse between the beginning of the school year and the time of survey enumeration allowed us to include girls as young as 14 in the main analysis, since some girls who were 15 at the time of the survey were 14 at the beginning of the school year. We used 17 as the upper age limit for the sample to ensure that we included only girls of secondary school age.

For the extended analysis, we chose Malawi and Kenya because the Malawi 2014 MICS and the Kenya 2014 DHS sampled an unusually large number of women and collected attendance information for 2 consecutive school years, 2013 and 2014. This data allowed us to adjust ages back an additional school year to look at girls aged 13–17.

Dataset construction

To create datasets with educational and marriage histories, we merged information from the household roster dataset, which contains school attendance history for 5- to 24-year-olds, and the women's dataset, which includes marriage histories for women ages 15–49, for each country. (For all countries in the study, surveys administered the detailed women's interview to all women aged 15–49 from the household questionnaire, so a one-to-one merge was possible.) The dataset includes 8 DHS surveys—Burundi 2010, Kenya 2014, Madagascar 2008, Mozambique 2011, Rwanda 2014, Tanzania 2010, Uganda 2011, and Zambia 2014—and 2 MICS surveys—Malawi 2014 and Zimbabwe 2014. This resulted in country samples of 14- to 17-year-old girls ranging from 1,433 in Tanzania and 1,436 in Uganda to 3,603 in Malawi and 4,405 in Kenya. We then appended the datasets for each country to create a pooled dataset for the main analysis, totaling 24,395 girls ages 14 to 17.

Pooling the dataset at the regional level allowed us to explore the phenomena of early marriage and school participation across a larger aggregated sample and, hence, to control for more background factors and conditions. Constructing the pooled dataset required realigning the survey weighting structure for use in a cross-national sample. To do this, we performed a weight adjustment, transforming relative weights to raw weights for each country following the methodology recommended by the DHS program (ICF International 2012). By pooling discrete country surveys, we in essence treated the region as a special

case of a "multipopulation sample" (Kish 1965), much like country-level analyses sometimes treat subnational units (i.e., states or provinces) as mere parts of a larger whole. (See Skinner and Mason 2012 for more detail on the methodological treatment of country weights in cross-national regressions.)

Measures

Next, we introduce the measures used as dependent and independent variables in the main and extended analyses.

Dependent variables measuring school participation

In the main analysis, we defined "school participation" as attendance or nonattendance in the most recent school year. The few girls who had already completed secondary school were removed from the analysis, so that these girls, for whom we consider nonattendance to be unproblematic, are not counted as out of school in our analysis. In the extended analysis on Malawi and Kenya, the availability of two years of school attendance data allowed us to explore further, focusing on school exit, i.e., situations where girls attended at some time during the 2013 school year and then did not attend during the 2014 school year. Our analysis of school exit included only girls who attended in the 2013 school year. For comparison, we ran regressions that used nonattendance in the 2013 school year as the dependent variable, regardless of attendance in earlier or subsequent years.

All measures of school participation and school exit had binary coding. As an important caveat, attendance measures from these DHS and MICS surveys mean attendance *at any time* during the reference school year and, therefore, do not distinguish girls who attend regularly from those who do not. As a result, we likely overestimated educational participation for some girls.

Independent variables

Marriage   Our central independent variable is early marriage, which we measured with a binary variable indicating whether a girl was officially married or cohabitating. In the main analysis, girls were considered married if their marriage/cohabitation began at any point before the *end* of the school year. In the extended Malawi and Kenya analysis, we restricted the dataset to girls who were unmarried at the start of the 2013 school year, which allowed us to look at the impact of marriage during that school year on school exit or retention the following school year. For this study, we did not distinguish formal marriage from cohabitation, and use the respondents' definition of "union".

Covariates   Our regression models also accounted for childbirth. Our binary variable childbirth indicated whether a girl had ever given birth and accounted for the dates of childbirth relative to the school year, as the marriage variables did.

Additionally, our analysis included key background characteristics predictive of both marriage and school participation from our literature review. These are: urban-rural residence (which we also refer to as "locality"), socioeconomic status captured through wealth indices in the DHS and MICS datasets (the wealth asset index is reported by the household head in the household where girls were residing at the time of the data collection), and educational history (how many years a girl had already completed in school, with more

years of schooling indicating stronger investment by a household in a girls' education, a more on-time start, and better progression through—and sometimes "success" in—the system). We also added age, as younger girls are less likely to be married and more likely to be attending. The main analysis also controlled for the year of survey enumeration and for country-level fixed effects, while the extended analysis controlled for ethnicity using the groups defined by DHS and MICS for Kenya and Malawi. While data and literature show that incidences of marriage and school attendance do not change rapidly, simple controls for survey year account for unknown and unobserved variance associated with the surveys in each year.

Descriptive statistics

We now turn to descriptive statistics for key measures. Table 2 presents the percentage of 14- to 17-year-old girls who are married and the percentage attending school; rates of school exit for 13- to 17-year-olds in Malawi and Kenya; and sample sizes at the country and regional levels.

As Table 2 documents and Figure 1 illustrates, rates of early marriage and attendance both vary considerably. Across the region, 12.6% of girls are married, though country estimates range from 0.6% in Rwanda, where early marriage has been nearly eliminated (consequently, we excluded Rwanda from our main analysis), to 32.4% in Mozambique, where early marriage remains widespread. The average attendance rate in the region is 59.6%, ranging from a high of 81.5% in Kenya to a low of 37.8% in Madagascar.

It is consistently more common for girls who are older, have lower educational attainment, and come from poorer backgrounds to have higher marriage and lower attendance rates. Across all countries, marriage is more common for girls from rural areas, with attendance rates usually lower there, though Rwanda and Uganda are exceptions. These general patterns across the region suggest we can pool data across countries to understand broader relationships between early marriage and school participation. However, because the magnitude of disadvantage associated with different characteristics and their relative importance varies considerably by country, models must take into account the country-level factors during analysis.

Table 3 looks at the percentage of girls who had experienced marriage, childbirth, or both events as well as the typical sequencing of these events. Across the region, 8.1% of girls reported marriage (only) and an additional 4.5% reported marriage and childbirth. By comparison, 1.8%—or just under a third of girls who had given birth—reported having had a child but being unmarried. Turning to the sequencing of events, marriage and childbirth occurred within one year for 57.1% of girls. Marriage preceded childbirth by at least a year for 36.6% of girls, compared to just 6.4% who gave birth at least a year before marriage. While marriage is more common than childbirth and tends to occur before or coincide with childbirth in cases where girls have experienced both, a distinct population of girls has given birth without being married—a situation we explore further in the main analysis.

Correcting for differences between married and unmarried samples

One challenge to analyzing the impact of early marriage on school participation lies in the potential for the sample of married girls to be fundamentally different from the sample of unmarried girls. We know from our literature review that early marriage is not a random event. Certain observed and possibly unobserved individual and environmental

Table 2 National marriage, attendance, and school exit rates for the sample

	BDI	KEN	MDG	MOZ	MWI	RWA	TZA	UGA	ZMB	ZWE	REGION
Early marriage rates											
Overall	5.5%	6.8%	29.0%	32.4%	12.5%	0.6%	12.4%	12.7%	11.6%	12.8%	12.6%
Childbirth											
Yes	82.4%	60.1%	87.8%	85.5%	70.1%	13.1%	56.9%	71.8%	59.8%	78.6%	71.1%
No	4.3%	4.0%	20.0%	25.0%	7.8%	0.4%	8.0%	9.0%	7.5%	8.2%	8.6%
Locality											
Urban	5.2%	6.9%	19.2%	19.6%	8.7%	1.2%	7.0%	10.5%	6.6%	5.2%	9.6%
Rural	5.5%	6.8%	31.1%	39.8%	13.3%	0.5%	14.5%	13.2%	16.0%	15.9%	13.5%
Wealth											
Poorest	8.1%	12.2%	47.9%	45.2%	19.2%	0.7%	18.5%	23.6%	23.2%	15.9%	19.7%
Poorer	4.8%	7.2%	36.6%	41.1%	14.3%	0.6%	16.5%	19.1%	15.7%	17.8%	14.9%
Middle	5.0%	5.8%	30.5%	37.5%	12.6%	1.0%	17.7%	10.7%	13.2%	14.8%	13.4%
Richer	5.2%	4.8%	21.1%	38.5%	11.5%	0.3%	12.1%	8.4%	11.8%	15.5%	11.6%
Richest	4.7%	3.6%	16.7%	8.8%	7.1%	0.7%	2.1%	7.5%	1.6%	2.5%	5.6%
Attainment[a]											
Low	10.2%	18.9%	39.1%	46.0%	14.6%	0.9%	36.6%	13.0%	26.5%	18.8%	22.1%
High	0.0%	3.7%	14.6%	8.7%	6.8%	0.0%	1.7%	6.4%	4.7%	8.4%	4.5%
Age											
14	0.2%	1.0%	13.5%	14.6%	1.2%	0.0%	4.1%	0.8%	1.0%	2.2%	3.2%
15	1.6%	2.8%	17.4%	25.6%	4.8%	0.1%	7.6%	2.6%	5.0%	6.0%	6.7%
16	3.8%	6.3%	29.4%	34.6%	11.3%	0.8%	10.6%	18.3%	15.3%	12.1%	13.0%
17	15.9%	15.5%	45.1%	54.4%	26.3%	1.3%	21.7%	28.6%	24.8%	22.1%	24.4%
Attendance rates											
Overall	58.5%	81.5%	37.8%	47.1%	71.4%	62.2%	47.7%	69.0%	65.2%	58.8%	59.6%
Childbirth											

Table 2 (continued)

	BDI	KEN	MDG	MOZ	MWI	RWA	TZA	UGA	ZMB	ZWE	REGION
Yes	0.0%	17.6%	1.2%	10.1%	7.4%	3.2%	4.0%	5.5%	20.1%	2.6%	7.7%
No	59.4%	85.0%	43.5%	52.3%	76.7%	63.2%	52.0%	72.9%	69.1%	62.7%	63.1%
Locality											
Urban	58.8%	73.9%	60.6%	69.8%	79.1%	57.1%	60.1%	58.5%	75.0%	63.3%	65.5%
Rural	58.5%	84.1%	33.0%	34.2%	70.0%	63.5%	42.8%	71.4%	56.8%	57.0%	57.8%
Wealth											
Poorest	46.1%	72.7%	12.5%	21.1%	55.5%	53.0%	35.9%	52.5%	42.7%	51.7%	45.4%
Poorer	53.4%	85.4%	24.9%	30.1%	67.5%	58.6%	35.0%	70.4%	55.6%	59.1%	54.9%
Middle	58.6%	87.0%	29.0%	37.6%	67.5%	67.1%	44.1%	73.0%	63.5%	64.9%	59.5%
Richer	66.3%	84.7%	49.4%	51.0%	78.2%	70.1%	52.7%	78.9%	63.6%	52.4%	65.8%
Richest	66.5%	74.2%	60.9%	81.5%	83.7%	60.8%	62.0%	65.3%	87.3%	63.6%	68.6%
Attainment[a]											
Low	25.3%	44.7%	9.8%	19.9%	46.4%	45.1%	6.6%	57.0%	21.2%	10.4%	25.9%
High	95.4%	92.6%	88.6%	91.1%	90.2%	89.8%	85.5%	81.7%	79.2%	70.5%	88.0%
Age											
14	78.4%	92.7%	45.3%	60.2%	85.3%	75.3%	49.8%	84.7%	84.4%	90.4%	76.0%
15	65.3%	90.4%	46.5%	50.9%	82.5%	73.2%	58.7%	82.7%	71.8%	73.9%	68.8%
16	56.6%	78.1%	36.6%	45.7%	69.4%	58.4%	47.5%	61.3%	58.6%	60.3%	56.1%
17	34.8%	66.1%	27.8%	31.8%	55.7%	49.7%	36.1%	46.9%	44.7%	37.0%	41.9%
Overall school exit rates		6.9%			11.5%						
N (ages 14–17)	1,938	4,405	2,716	2,235	3,603	1,761	1,433	1,436	2,765	2,103	24,395
Data source	DHS 2010	DHS 2014	DHS 2008	DHS 2011	MICS 2014	DHS 2014	DHS 2010	DHS 2011	DHS 2014	MICS 2014	

Estimates of marriage, attendance, and school exit rates use standard survey weights and account for survey design and stratification. Subsequent analyses use the number of years of schooling completed.

[a]Low attainment is four or fewer years completed; high attainment is eight or more years completed.
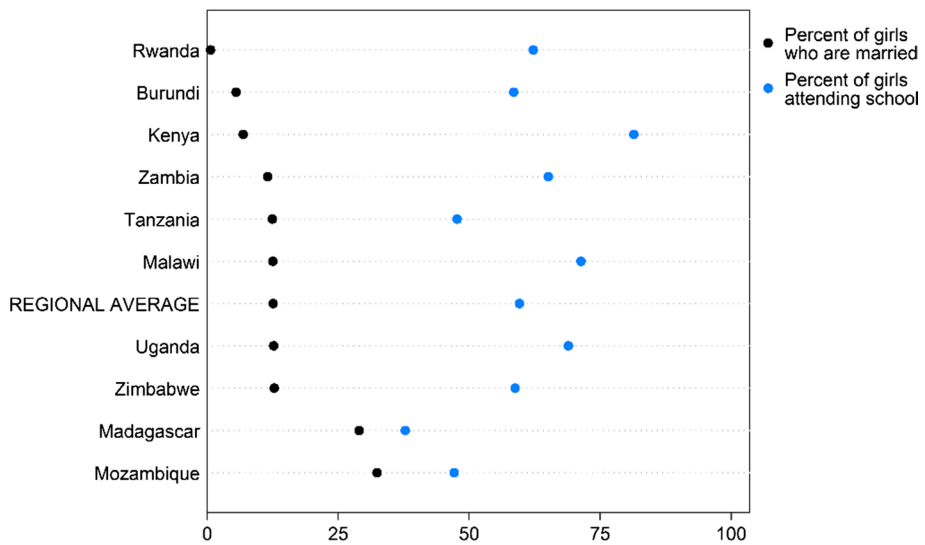
Figure 1 National marriage and attendance rates across Eastern Africa for girls ages 14–17

characteristics make some girls more likely to marry early compared to their peers, and, moreover, these same characteristics are often associated with lower school participation or poorer performance in school. This introduces a potential source of bias and, indeed, there are statistically significant differences between married and unmarried girls on key background characteristics as shown in Table 4, which presents the results of t tests comparing group means. These underlying differences make it difficult to separate the effects of marriage as an event from the effects of the background factors that made marriage more likely in the first place.

To minimize the bias resulting from these fundamental differences, we turn to propensity score weighting adjustment (Rosenbaum and Rubin 1983). The propensity score modeling approach seeks to estimate the amount of bias using observable characteristics and reduce its effect on the relationship in question, through either sample restriction or weighting. In our modeling, the propensity score model draws on factors we observe or hypothesize to be predictive of both marriage and education outcomes: wealth, age, locality, prior school attainment, basic literacy skills, country and ethnic or religious group affiliation (as defined by DHS or MICS), and year of observation. (This was done in Stata using the psmatch2—version 4.0.11, 22oct2014—command written by Edwin Leuven and Barbara Sinanesi.) The propensity scores are estimated at the country level and appended in a regional dataset. This allows us to account for the differential effects of background characteristics on the likelihood of marriage within each country, while maintaining the statistical power that a pooled sample allows in analysis.

As a second step, we seek to reduce selection bias by weighting the sample by propensity scores, creating inverse probability of treatment (IPT) weights that estimate the average effect of treatment on the treated (ATT). In this weighting scheme, the control observations (unmarried girls) were given a weight of $\hat{p}/(1-\hat{p})$, while treated observations (married girls) retained a weight of 1, following Lanza et al. (2013) and Hirano and Imbens (2001). It is important to note that corrections using propensity scores are limited to reducing bias associated with observed variables only. It is our assumption that unobserved factors, to

Table 3 Co-occurrence of marriage and childbirth, and sequencing of marriage and childbirth

	BDI (%)	KEN (%)	MDG (%)	MOZ (%)	MWI (%)	RWA (%)	TZA (%)	UGA (%)	ZMB (%)	ZWE (%)	REGION (%)
Co-occurrence of marriage and childbirth											
Marriage only	4.2	3.8	17.4	22	7.2	0.4	7.3	8.5	6.9	7.7	8.1
Childbirth only	0.3	2	1.6	1.8	2.3	1.4	3.9	1.7	3.1	1.4	1.8
Marriage and birth	1.3	3	11.6	10.4	5.4	0.2	5.1	4.2	4.7	5.1	4.5
Sequencing of marriage and childbirth where both events occurred											
Marriage preceded childbirth by at least one year	26.6	33.7	42.2	44.5	38.8	21.3	35.7	35.6	31.5	33.9	36.6
Childbirth preceded marriage by at least one year	0	9.6	3.2	7.3	9.2	17	2.3	10.8	10.2	1.3	6.4
Marriage and childbirth events occurred within one year	73.4	56.7	54.7	48.1	52.1	61.6	62	53.6	58.3	64.8	57.1

Estimates of marriage, attendance, and school exit rates use standard survey weights and account for survey design and stratification.

Data source: DHS and MICS surveys.

Table 4 Comparison of sample balance between treatment and control groups (i.e., married and unmarried girls) on background characteristics before and after IPT weighting adjustments

	Unweighted			IPT weighted		
	Married	Unmarried	Difference	Married	Unmarried	Difference
Main analysis						
Wealth: Poorer	0.227	0.175	0.052*	0.227	0.224	0.003
Wealth: Middle	0.206	0.190	0.016	0.206	0.202	0.005
Wealth: Richer	0.179	0.198	−0.018	0.179	0.172	0.007
Wealth: Richest	0.118	0.270	−0.153*	0.118	0.124	−0.007
Age	16.282	15.564	0.718*	16.282	16.277	0.005
Locality	0.794	0.678	0.116*	0.794	0.793	0.001
Attainment	4.784	6.691	−1.907*	4.784	4.497	0.287*
Year	3.512	4.269	−0.757*	3.512	3.397	0.115*
Literacy	0.47	0.778	−0.308*	0.47	0.467	0.003
Country, group	*Included in analysis but not reported*					
Malawi analysis						
Wealth: Poorer	0.261	0.168	0.093*	0.261	0.252	0.009
Wealth: Middle	0.217	0.196	0.021	0.217	0.225	−0.008
Wealth: Richer	0.179	0.233	−0.053*	0.179	0.184	−0.005
Wealth: Richest	0.107	0.245	−0.138*	0.107	0.110	−0.003
Age	16.280	15.034	1.246*	3.280	3.305	−0.025
Locality	0.912	0.839	0.073*	0.912	0.904	0.008
Attainment	5.849	6.497	−0.648*	5.849	5.900	−0.051
Literacy	0.646	0.807	−0.162*	0.646	0.648	−0.003
Group	*Included in analysis but not reported*					
Kenya analysis						
Wealth: Poorer	0.182	0.234	−0.052*	0.182	0.180	0.002
Wealth: Middle	0.193	0.218	−0.025	0.193	0.205	−0.013
Wealth: Richer	0.123	0.176	−0.053*	0.123	0.119	0.004
Wealth: Richest	0.032	0.129	−0.097*	0.032	0.034	−0.002
Age	15.941	14.834	1.107*	2.941	2.969	−0.028
Locality	0.690	0.705	−0.015	0.690	0.674	0.015
Attainment	5.765	7.465	−1.701*	5.765	5.689	0.075
Literacy	0.592	0.880	−0.288*	0.592	0.581	0.012
Group	*Included in analysis but not reported*					

*Indicates statistical significance at the 10% level.

the extent they are present, are correlated with the observed ones, so that the weighting strengthens comparability between married and unmarried girls.

Our balance analysis pre- and post-propensity score weighting shows that weight-adjusted observations are substantially better balanced between the married and unmarried groups (Table 4). While statistically significant differences remain between group means for educational attainment and observation year for married and unmarried girls, the means are far closer in the weighted sample; e.g., differing for attainment by 0.35 years rather than by 1.8 in the unweighted sample. (There are also

statistically significant differences for year and for three country-ethnic groups, but we take these variables to be of lesser conceptual importance.) Additionally, the distribution of propensity scores for unmarried girls better mimics that for married girls when we use propensity score weights (analysis available upon request). For the extended Malawi and Kenya analysis, propensity score weights also improve sample balance across the propensity score distributions. Consequently, we conclude that the propensity score adjustment indeed helped reduce selection bias by estimating the effects of marriage for girls who are otherwise similar in their characteristics. For comparison, we reported both the adjusted and unadjusted results.

Model specification

The first phase of our analysis used the pooled regional dataset to examine the relationship between early marriage and school participation. It involved logistic regression analysis with school attendance as a binary outcome variable, allowing examination of the combined influence of several factors on school participation. We tested several specifications of regression models, starting with a simple binary model, with marriage as the sole predictor, and moving to more saturated models that account for the key background variables.

In subsequent models, we tested the hypothesis that background factors influence the magnitude of the dependency of school participation on marriage through a logistic regression with interactions between marriage and each of the background measures (age, educational attainment, locality, and wealth). We also tested a model with marriage interacted with childbirth as well as a model where childbirth is estimated conditional on marriage. Though these interaction effects were only possible to explore with a larger dataset (hence the pooling), we also fitted country-specific regression models without interaction terms (results available upon request), though comparisons of point estimates across country-specific models should be done only with extreme caution due to the small number of married girls aged 14–17 in each country.

For the extended Malawi and Kenya analysis, we explored the timing of major life events—marriage and childbirth—relative to shifts in school participation, testing whether a girl who was in school before marrying or having a baby stopped attending in the subsequent school year. As with the main analysis, we used logistic regression for the extended analysis.

We share two versions of each model in the main analysis and the extended analysis: one with standard survey weights and another with the IPT weights outlined previously. Given the substantial initial differences between the samples of married and unmarried girls discussed earlier, we assume that the models that do not correct for these differences (the models using standard survey weighting) may be biased. In fact, these models do consistently yield higher, and potentially inflated, estimates of the effect of marriage on attendance in the main analysis. Therefore, in the Results and Discussion section that we now turn to, our findings refer to the models using IPT weights, which produce results that are likely more accurate and, at a minimum, more conservative.

Results and discussion

Main analysis

Early marriage and attendance: Base models with lower-order variables

To test the relationship between early marriage and attendance, we started with a simple logit model with only one independent variable—marital status—and refined the model by adding the other predictors of school participation, with results of the full model presented in Table 5 and results of additional models available upon request. In all lower-order models, the effect of early marriage is significant at p < 0.01. Results from all models point to dramatically lower attendance among married girls and indicate that the influence of other predictors remains modest in comparison to marriage.

Early marriage, childbirth, and attendance

In models looking at the effect of childbirth, marriage, and their interplay (Model B in Table 5), like in the base model, both marriage and childbirth have a statistically significant negative effect on attendance. Further, the effect of marriage is larger than of childbirth: married girls are 30.5 percentage points less likely to be attending school than unmarried girls, while girls who have had a child are 13.5 percentage points less likely to be attending than girls who have not. The data differentiate between these two life events, distinguishing between girls who are not married but have children, and vice versa. Inclusion of the interaction term modestly strengthens the effect of childbirth and weakens that of marriage, signaling that this model may better account for the way the intersection of these two life events, or their absence, impacts attendance.

Figure 2 shows predicted probabilities of attendance, based on Model B. It illustrates two key points. First, having a child or marrying, or both, severely limits the likelihood of a girl's going to school. Second, of the two life events, marriage appears to have more serious consequences for attendance. Even without a child, a married girl has only an 8.7% chance of attending; with a child, that drops to a mere 3.2%.

To examine the marginal effect of childbirth and other characteristics, in Model D we restrict the sample to girls who are married. The model shows that all effects are substantially smaller in magnitude. Notably, only an additional 4.9 percentage-point drop in attendance is associated with childbirth for married girls, supporting our hypothesis that whether or not girls have children in marriage is less consequential for their school participation than marriage itself.

These conclusions reinforce findings from Lloyd and Mensch (2008) about the stronger relative effect of marriage and may suggest that while early childbearing and marriage both curtail a girl's agency, marriage does so more absolutely. Marriage may come with responsibilities and expectations incompatible with school-going and leave a girl with limited opportunity to advocate for her education. Girls who have children, on the other hand, may be able to rely on family networks to share in the responsibilities of childcare, particularly if they are not married and not living with their husband's family.

Table 5 Average marginal effects from logistic regression analysis on the relationship of early marriage to attendance across Eastern Africa

	Model A1 Survey weights	Model A2 IPT weights	Model B1 Survey weights	Model B2 IPT weights	Model C1 Survey weights	Model C2 IPT weights	Model D Unweighted
	Base model		Base model looking at interaction of marriage and childbirth[a]		Base model looking at interaction of marriage related to improved attendance[b]		Childbirth conditional on marriage: base model only for girls who have ever been married
Married	−0.446***	−0.309***	−0.456***	−0.305***	−0.474***	−0.310***	
	(0.018)	(0.008)	(0.019)	(0.008)	(0.020)	(0.008)	
Has had a child	−0.287***	−0.126***	−0.314***	−0.135***	−0.284***	−0.125***	−0.049***
	(0.029)	(0.012)	(0.031)	(0.013)	(0.029)	(0.012)	(0.008)
Age	−0.085***	−0.049***	−0.084***	−0.049***	−0.084***	−0.048***	−0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Educational attainment	0.080***	0.054***	0.080***	0.054***	0.080***	0.052***	0.027***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Wealth: Poorer	0.008	0.008	0.008	0.008	0.008	0.009	−0.003
	(0.012)	(0.010)	(0.012)	(0.010)	(0.012)	(0.010)	(0.015)
Middle	0.005	0.001	0.005	0.001	0.005	0.003	−0.011
	(0.013)	(0.011)	(0.013)	(0.011)	(0.013)	(0.011)	(0.014)
Richer	0.010	0.015	0.010	0.015	0.009	0.017	0.014
	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.015)
Richest	−0.019	0.021	−0.019	0.020	−0.017	0.014	0.011
	(0.016)	(0.014)	(0.016)	(0.014)	(0.016)	(0.014)	(0.017)
Rural	0.055***	0.010	0.055***	0.010	0.057***	0.009	0.000
	(0.012)	(0.010)	(0.012)	(0.010)	(0.012)	(0.009)	(0.010)
Year	0.006	−0.017*	0.006	−0.016*	0.006	−0.017*	−0.015
	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.009)	(0.012)
Country	*Included in analysis for all models but not reported*						

Table 5 (continued)

	Model A1 Survey weights	Model A2 IPT weights	Model B1 Survey weights	Model B2 IPT weights	Model C1 Survey weights	Model C2 IPT weights	Model D Unweighted
	Base model		Base model looking at interaction of marriage and childbirth[a]		Base model looking at interaction of marriage related to improved attendance[b]		Childbirth conditional on marriage: base model only for girls who have ever been married
Observations	21745	20316	21745	20316	21745	20316	3165
Pseudo R-squared		0.44		0.441		0.447	

Standard errors in parentheses.

Tables report average marginal effects and show the discrete change in probability of attendance from the base level

Symbols for p-values: *0.10; **0.05; ***0.01

[a]Includes the following interaction term: marriage#childbirth

[b]Includes the following interaction terms: marriage#attainment, marriage#age, marriage#wealth, and marriage#rural

Figure 2 Average marginal effects for school attendance by marital status and childbirth (Model B2)
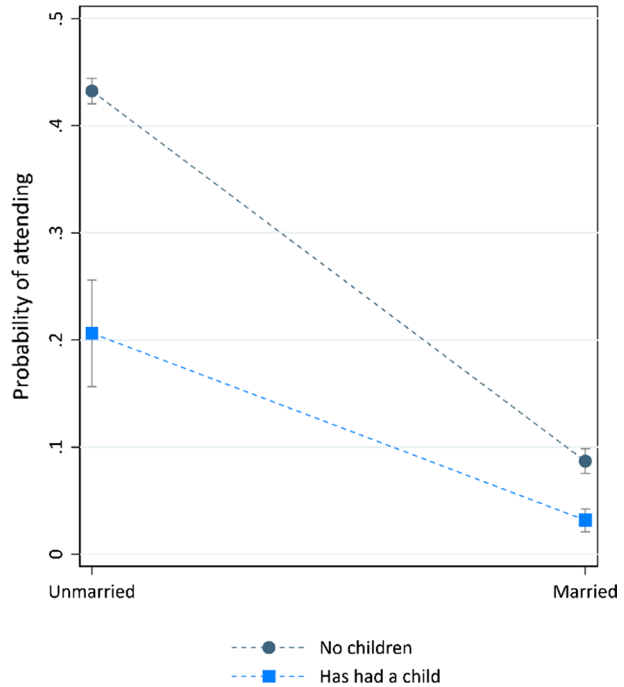
Early marriage, relative advantage, and attendance

Next, we examine whether the negative influence of early marriage on school participation is tempered by advantages in other areas, using a logit model that adds interaction terms between marriage and other factors associated with attendance. Table 5, above, presents the results of this model (Model C), in terms of average marginal effects. Compared to Models A and B, the slightly higher McFadden's Pseudo R-squared value for Model C suggests better model fit. However, substantively, the magnitude and statistical significance of effects from early marriage, wealth, locality, attainment, and age remain similar to previous models—meaning the interaction terms add little to our understanding of the relationship of marriage to attendance. In short, it appears that some characteristics, especially attainment and age, do exert influence on attendance but provide only a modest safeguard to school participation for married girls. This reinforces our conclusions from our earlier models and corroborates findings from other studies (Lloyd and Mensch 2008; Wodon et al. 2016) that participation in formal schooling is rarely compatible with marriage. Indeed, according to Model C2, which uses IPT weighting and is our preferred specification for reporting throughout this section, the average girl is approximately 31 percentage points less likely to be attending school if she is married.

As Figures 3 and 4, above, show, age and prior educational attainment do little to moderate the dramatic effect of marriage on girls' school participation: while the patterns present for unmarried girls still exist, they hardly change the trajectory for girls after marriage. Similarly, Figure 5, below, visualizes the comparative effect of marital status on the predicted probabilities between very advantaged and very disadvantaged girls, further emphasizing how severely marriage constrains educational opportunity. We define "very advantaged" as having high attainment (9 years), living in an urban area, and being from
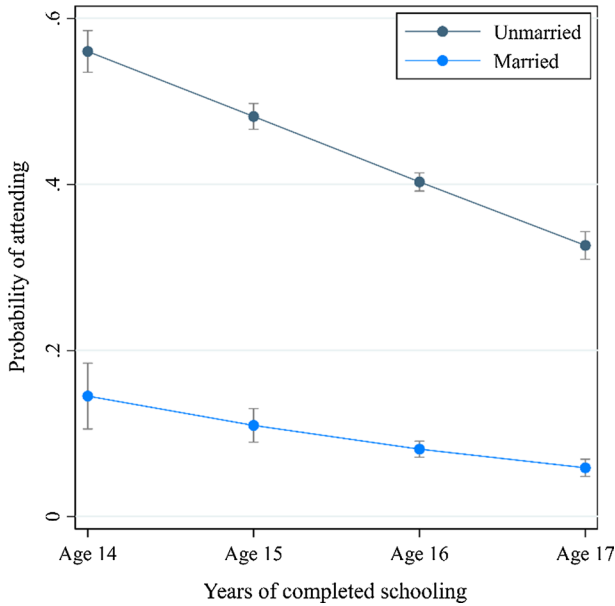
Figure 3 Average marginal effects for school attendance, by marital status and age (Model C2)
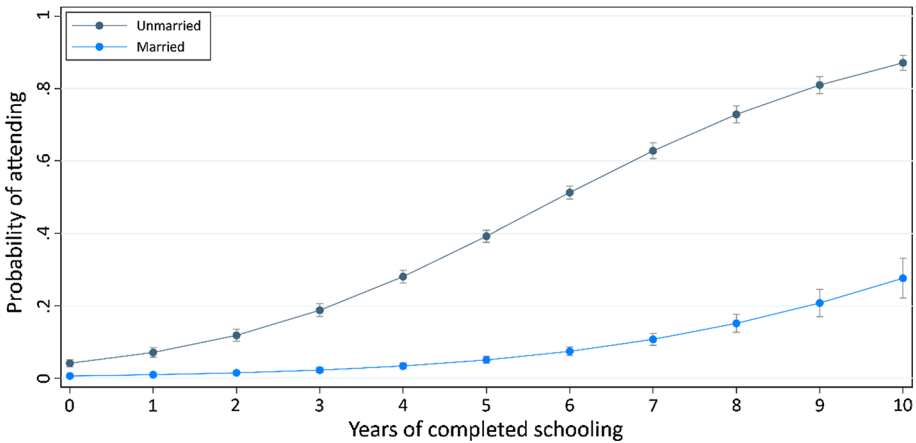

Figure 4 Average marginal effects for school attendance, by marital status and educational attainment (Model C2)

the highest wealth quintile; and "very disadvantaged" as having low attainment (4 years), living in a rural area, and being from the poorest wealth quintile. "Very advantaged" married girls are a small group, with 75 girls married and meeting or exceeding the "very advantaged" criteria in the pooled sample—representing about 3.6% of the "very advantaged" girls overall in the sample. "Very disadvantaged" married girls, on the other hand, are more common: of the 1,696 girls in the pooled sample at or below these criteria, 30% were married. Even with "every" advantage, a married girl has only a 33.8% probability of

Figure 5 Average marginal effects for school attendance by marital status, by relative advantage or disadvantage (Model C2)
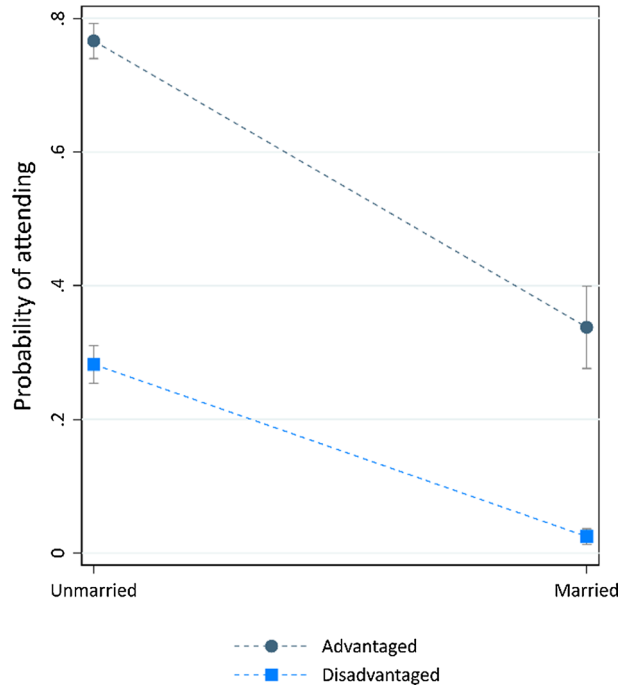
attending, compared to 76.6% for her unmarried peer; while, for disadvantaged girls, the probability of being enrolled drops from 28.3% to almost none: 2.5%.

In sum, the examination of known demographic factors alongside marriage is informative: it shows the dramatic effect of the marriage event on school participation and *may* signal that the antithetical relationship of marriage and schooling is a matter of cultural expectations for brides more than of resource constraints. However, in drawing conclusions, we caution that the main analysis looks broadly at whether girls who marry young are less likely to attend school than their unmarried peers. This says nothing about what came first, marriage or schooling decisions. A young woman may have dropped out of school for a reason not related to marriage or the factors we account for, or made a decision to marry because of an inability—or disinterest—to continue her education. Of note, the main analysis may underestimate the negative effect of marriage if withdrawal from school is driven by *anticipated* marriage for girls who are coded as "unmarried" in our sample. Indeed, important events like marriage are often planned well in advance and school attendance patterns may be altered to accommodate those plans in a way that we cannot capture in our analysis. Specifically, it is possible that a household would elect to withdraw the child from school prior to the beginning of the school year, anticipating that a marriage will take place partway through the reference school year. In this hypothetical case, the withdrawal from school precedes the marriage, but causality still flows from the marriage to the withdrawal.

In the next section, we refine our conclusions by considering the sequencing of marriage and school-exit decisions using the two-year data from Malawi and Kenya.

Extended analysis: Marriage and school exit in Malawi and Kenya

While the main analysis points to the extremely low prospects of a married girl being in school even with advantages in other areas, it does not allow us to limit the timing of focal events—of marriage and childbirth as well as school exit. A girl may have left school as a child and then married as a teenager, or she may have married and then had to end her education. Using the Malawi 2014 MICS and the Kenya 2014 MICS and taking advantage of their large female samples and two years of attendance information, we look specifically at whether marriage or childbirth, rather than background characteristics, precipitate school exit, facilitating better inferences concerning the relationship of these consequential events.

As in the main analysis, the results of the Malawi and Kenya logit regressions in Table 6 reiterate that early marriage is a strong and significant predictor of school exit. Marriage exerts greater influence on school exit than any other variable in both countries, and the magnitude of the marriage/school-exit relationship is far greater than the estimates seen with the regional models. Based on our preferred model (Model B2) and controlling for the other factors, the likelihood of school exit is 67.2% higher for a girl who becomes married the prior school year than for an unmarried girl in Malawi. In Kenya, the impact is even more severe: the likelihood of school exit for a girl who marries the prior school year is 84.2 percentage points greater than for her unmarried peers.

The influence of childbirth on school exit is less clear. The childbirth variable is statistically significant at the $p < 0.01$ level for Malawi and Kenya only in the survey-weighted Model B1. In our main model (Model B2), childbirth is a significant predictor only in Malawi and, even then, only at the $p < 0.10$ level. The magnitude of childbirth effects in Malawi is more modest than marriage; girls who gave birth in that country are 22.1 percentage points more likely to leave school than girls who did not give birth, though this still makes it an important factor in school exit. This is consistent with the finding from our main analysis, where childbirth showed only a minimal additional effect on attendance, once the sample was restricted to married girls.

Figure 6, below, summarizes the findings on school exit and shows that the probability of school exit for girls who became married during the previous school year is alarmingly high. This is especially concerning given that, by looking at school exit, we restricted our analysis to girls who were attending during the 2013 school year—a marked achievement for a teenage girl in the region and one that conveys some basic value placed on girls' education. These results (a) solidify our finding from the main analysis regarding the large negative association between marriage and school participation; and (b) extend this finding to show that the events are temporally linked and, therefore, provide greater support for causality between marriage and school exit—though we caution that numbers of married girls in the analysis were relatively small.

The more equivocal findings for childbirth might be due to two important limitations. First, it may be that much of the variation associated with having children may be captured in the measure of marriage, or we may not have enough information from the timespan captured by the survey to fully consider the ramifications of childbirth on education. In Malawi, girls who become pregnant must withdraw from school and are permitted to reenroll one year after childbirth through the 1993 Readmission Policy. Similarly, in Kenya attendance during pregnancy is discouraged, with the 2003 Gender and Education Policy allowing reentry after childbirth. With this policy in mind, Model A looks at the impact of events in the 2013 school year on whether a girl is attending that same year, regardless of her attendance status the previous year. It consistently shows that having a child has a

Table 6 Average marginal effects from logistic regression analysis on the relationship of early marriage to school exit and nonattendance in Malawi and Kenya

	Malawi				Kenya			
	Model A1	Model A2	Model B1	Model B2	Model A1	Model A2	Model B1	Model B2
	Survey weights	IPT weights	Survey weights	IPT weights	Survey weights	IPT weights	Survey weights	IPT weights
	Outcome: Out of school in SY−2013	Outcome: Out of school in SY−2013	Outcome: School exit	Outcome: School exit	Outcome: Out of school in SY−2013	Outcome: Out of school in SY−2013	Outcome: School exit	Outcome: School exit
Married in SY-2013	0.330*	0.298***	0.654***	0.672***	0.335***	0.368***	0.868***	0.842***
	(0.052)	(0.031)	(0.068)	(0.043)	(0.057)	(0.032)	(0.060)	(0.034)
First child in SY-2013	0.357***	0.237***	0.580***	0.221*	0.230***	0.140**	0.323***	0.015
	(0.049)	(0.050)	(0.098)	(0.127)	(0.048)	(0.060)	(0.075)	(0.121)
Age	0.064***	0.063***	0.042***	0.033**	0.055***	0.068***	0.030***	0.041**
	(0.006)	(0.014)	(0.009)	(0.015)	(0.004)	(0.014)	(0.005)	(0.017)
Poorer	−0.028	0.008	0.001	−0.072*	0.013	−0.017	−0.021	0.024
	(0.021)	(0.040)	(0.023)	(0.044)	(0.014)	(0.043)	(0.016)	(0.032)
Middle	−0.016	0.025	0.036	0.031	0.010	0.004	−0.018	0.018
	(0.025)	(0.043)	(0.027)	(0.037)	(0.015)	(0.044)	(0.015)	(0.033)
Richer	−0.035*	0.024	0.001	0.022	0.053***	0.145***	−0.017	0.027
	(0.021)	(0.046)	(0.018)	(0.044)	(0.020)	(0.037)	(0.018)	(0.034)
Richest	−0.028	0.059	0.039	−0.051	0.121***	0.099	0.003	0.053
	(0.026)	(0.061)	(0.030)	(0.053)	(0.025)	(0.069)	(0.022)	(0.053)
Rural	−0.079***	−0.060	−0.045	−0.027	−0.063***	−0.026	−0.037**	0.004
	(0.028)	(0.065)	(0.041)	(0.045)	(0.016)	(0.037)	(0.016)	(0.027)
Educational attainment	−0.060***	−0.074***	−0.025***	−0.020***	−0.039***	−0.061***	−0.011***	0.000
	(0.003)	(0.006)	(0.005)	(0.007)	(0.002)	(0.005)	(0.003)	(0.004)
Group	*Included in analysis for all models but not reported*							
Observations	4075	3704	3359	2989	4617	4600	3995	3984

Table 6 (continued)

	Malawi				Kenya			
	Model A1	Model A2	Model B1	Model B2	Model A1	Model A2	Model B1	Model B2
	Survey weights	IPT weights	Survey weights	IPT weights	Survey weights	IPT weights	Survey weights	IPT weights
	Outcome: Out of school in SY−2013		Outcome: School exit		Outcome: Out of school in SY−2013		Outcome: School exit	
Pseudo R-squared		0.274		0.446		0.444		0.546

Standard errors in parentheses.

Tables report average marginal effects and show the discrete change in probability of attendance from the base level.

Symbols for p-values: *0.10; **0.05; ***0.01.

Figure 6 Average marginal effects for school attendance by marital status and country
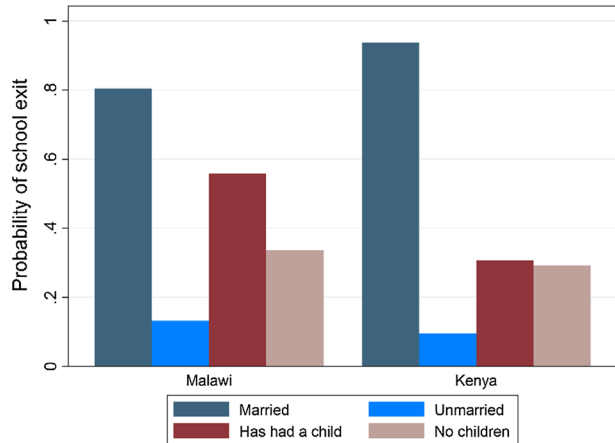
significant, positive effect—especially strong in Malawi—on the likelihood of being out of school. In Kenya, the effect of marriage remains more substantial across all models.

While we cannot, based on this analysis, provide empirical insight into how the local policy environment influences the comparative effects of marriage and childbirth, it may be important that readmission policies for teenage mothers in Malawi and Kenya help to broadcast the notion that having a child does not necessitate the end of a young mother's schooling. It may be that the window of opportunity for continued formal education is slightly wider for girls who have a child compared to girls who marry, possibly due to greater constraints on a girls' agency stemming from a new status and responsibilities in her husband's household. Ultimately, however, our findings point to both early marriage and childbirth as important problems, ones with implications for the education levels of women and their opportunities in society, that policymakers must continue to address.

Conclusion

This study explores the nuances of early marriage and educational opportunity across Eastern Africa. Our results show that marital status has a strong effect on attendance. Married girls are roughly 31 percentage points less likely to be attending school than their unmarried peers, making it a near certainty that a girl married at the age of 14–17 in Eastern Africa will be out of school, even if previously enrolled and even with high prior attainment. Although married girls make up a relatively small portion of the region's population, their marital status appears to trump all other individual and household characteristics associated with school participation for the population at large.

To put the scope of the early-marriage challenge into perspective, estimates from our regional descriptive and logit regression analysis suggest that, in Eastern Africa, 13 of every 100 girls ages 14 to 17 are married, and, of those, approximately 12 are out of school. This represents a substantial population of girls facing a unique set of circumstances related to the responsibilities and social expectations for wives (and daughters-in-law). Marriage severely undermines their ability to pursue education and seems largely incompatible with formal schooling.

We also find that the effect of marriage on school attendance across Eastern Africa is stronger than that of teen childbirth and is mitigated only slightly by other factors, mainly age and prior educational achievement. These results may suggest that, while a multitude of factors, including young motherhood, low education levels, and poverty, may limit girls' agency, marriage represents an even stronger, more absolute constraint, one that ends formal schooling and thus further restricts future opportunities. This may in large part be due to the systems of social norms and behaviors expected of young brides, ones deeply at odds with education.

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