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IMPACT OF CHILD MARRIAGE ON LITERACY AND EDUCATION ATTAINMENT IN AFRICA

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Child marriage has been referred to as a hidden crisis – and is an issue that is now being considered directly at high levels in development policy. More than 40% of all girls in sub-Saharan Africa continue to marry before the age of 18. Using an instrumental variable approach and data from Demographic and Health Surveys, we estimate the impact of early marriage on literacy and education attainment in Africa. In the preferred specification of the model, each additional year of early marriage reduces the probability of literacy among women who married early by 5.7 percentage points, the probability of having at least some secondary schooling by 5.6 points, and the probability of secondary school completion by 3.5 points. The results are robust to changes in model specification.

1. Introduction

There is widespread consensus that child marriage violates the rights of girls, limits their school attainment, learning, and future earnings, and has negative impacts on their health and that of their children. Child marriage clearly contributes to poverty.² And yet the practice remains highly prevalent despite efforts by many developing country governments to discourage and even outlaw the practice,³ among others through reforms of family law. The incidence of child marriage is dropping, but only very slowly.⁴ In many countries, laws have been adopted to prevent marriage below 18 years of age, but they are often not well-enforced and more needs to be done. The attention given to the issue is however growing – for example, in July 2014 the United Kingdom government and UNICEF jointly hosted the first ever Girl Summit to mobilize efforts to end child, early, and forced marriage as well as female genital mutilation.

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² See for example Otoo-Oyortey and Pobi (2003). For a broader analysis of the “girls’ dividend”, see Chaaban and Cunningham (2011).

³ See for example Toyo (2006).

⁴ Why does child marriage remain so prevalent? As shown by Gemignani and Wodon (2014) in Burkina Faso, multiple socio-cultural and religious factors contribute to the persistence of the practice, but there are differences in the role of various factors depending on the area or ethnic community considered. In some areas the root causes of child marriage include gender roles and social expectations, prevailing conceptions about Islamic Law, and the fear of pregnancy before marriage. In other areas the cost of schooling plays a larger role.

Estimates by Nguyen and Wodon (2012, 2014a) based on data from 60 low and middle income countries suggest that about 40% of girls in those countries still marry today before the age of 18, and often several years earlier (in sub-Saharan Africa, 45.4% of girls born between 1985 and 1989 married early).⁵ The practice has been found to have negative effects on health outcomes,⁶ and there is concern that child marriage may have a major negative impact on education, which is the focus of this paper (for recent reviews on child marriage and policies that could help eliminate the practice, see among others Malhotra et al, 2011, Brown 2012, UNFPA 2012, and Vogelstein, 2013).

Responses in household surveys to questions about the reasons for not pursuing one's education have been used to suggest that child marriage is an important factor leading girls to curtail their education, even if it is not necessarily the main factor explaining drop-outs (Lloyd and Mensch, 2008; see also Nguyen and Wodon, 2014b for an analysis for Nigeria). Yet this type of analysis does not provide precise estimates of the potential impact of child marriage on education attainment. Few studies have actually attempted to carefully measure what that impact might be, probably in large part because of endogeneity issues.

The main problem for estimating the impact of child marriage on education attainment is that the decision by a girl (or her parents) to marry early is likely to be itself a function of the girl's education potential. Girls with lower education prospects for example because they are weaker academically, face smaller expected losses in future earnings and thereby have lower incentives to continue to study than girls who are academically stronger. These girls may be more willing to marry early or their parents may be more inclined to let them marry early. Similarly, girls less interested in pursuing their education independently of their academic abilities may also decide to marry early, and they might have dropped out anyway even in the absence of marriage. Said differently, education and marriage decisions are jointly made. It is thus necessary to find instrumental variables that explain the decision to marry, but not education outcomes conditional on the decision to marry, which is not always easy.

A study along those lines by Field and Ambrus (2009) finds that in Bangladesh, for each additional year of delay in the age of marriage, a girl will benefit on average from 0.22 additional year of schooling and an increase in the probability of literacy of 5.6 percentage points. The authors use the variation in the timing of menarche (puberty) as the instrumental variable for the age at first marriage, given that in many cultural and religious traditions, including in Bangladesh, girls often are not allowed to marry before reaching puberty.⁷

Unfortunately, information on menarche is often not available in multi-purpose surveys that have information on both the age at marriage and education attainment, and when (some) information on menarche is available, it is often not detailed enough to be of use here. For example, while Demographic and Health Surveys do ask questions about the age of marriage, information on

⁵ For previous estimates, see for example Mensch et al. (2005).

⁶ The negative impact of child marriage on health outcomes and psychological well-being is substantial. The practice has been linked to various psychological and health risks (UNICEF 2001, Nour 2004), including vesico-vaginal fistulae (Akpan 2003) and a higher likelihood of acquiring HIV/AIDS, in part because early marriage often eliminates a girl's ability to abstain from sex and thus increases the frequency of intercourse while also decreasing condom use (Clark 2004).

⁷ One of the authors is now involved in an evaluation of different types of interventions that could help reduce child marriage and empower girls in Bangladesh (see Field and Glennerster, 2013). On early marriage in Bangladesh, see also Bates et al. (2007). On child marriage in South Asia, see also (among others) Dubey and Rao (1999), Faizunnisa and UI haque (2003), Sagade (2005), and much more recently ICRW et al. (2013).

exactly when a woman reached puberty is not available – there is only a question about the last time that girls and women had menstrual period.

An alternative identification strategy however consists in using measures of child marriage at the level of the primary sampling unit (PSU) in which a girl or woman lives as instrumental variables – this can be done contemporaneously, or in the recent past, by looking at child marriage in, say, the previous decade. These PSU-level incidence variables are likely to affect strongly the probability that a girl will marry early, but not educational attainment when controlling for other PSU-level determinants of such attainment. This instrumentation strategy can be implemented in many countries given the similarities of the DHS questionnaires across countries, and it can yield estimates of the impact of child marriage on education attainment for each of those countries, or for a region as a whole. This is the approach followed in this paper for sub-Saharan Africa. It turns out that our estimate of the impact of child marriage on literacy in sub-Saharan Africa is close to that obtained for Bangladesh by Field and Ambrus (2009). We also provide in addition estimates of impacts on secondary education.

The data and methodology are discussed in section 2. The results are provided in Section 3. They suggest that child marriage has a large negative impact on both literacy and secondary education attainment for the girls who marry early. A brief conclusion follows.

2. Data and model

The analysis is based on data from more than two dozen (27) sub-Saharan African countries that have a relatively recent Demographic and Health Survey publicly available. Many of the surveys were implemented in 2005-2009, although there are a few exceptions, including Cameroon, Chad, Malawi, and Mozambique for which the latest survey available is for 2004, Burkina Faso (2003 survey), Gabon (2000 survey), and South Africa and Togo (1998 survey). The surveys ask about the age at first marriage for all women in the sample aged 15-49. We rely on various parts of that sample for different variables of interest. For example, literacy should be achieved by age 15, so our age group for the definition of the sample starts at that level for that outcome. By contrast, secondary completion cannot be achieved before at least 18 years of age, and it is better to give a few more years in the sample to girls to complete the cycle, as some will have repeated previous years. So for that outcome, we look at women with at least 24 years of age. In addition, for each outcome of interest, we use a sufficiently broad range of years in defining the sample, but we also want to avoid going too much back in time by expanding this range (or using the same range for all outcomes), as this would then represent conditions in the countries further away in time – we are trying to be as close as we can to current conditions, thereby looking at girls and women who are just above the age when a specific education outcome could be expected, whether we consider literacy or secondary school attainment.⁸

Denote by y_1 the level of educational attainment – this is a categorical variable that takes a value of one if the girl reaches a certain level of schooling, and zero otherwise. We will consider three measures of attainment in the empirical work – whether a girl is able to read (literacy), whether she has at least some secondary education, and whether she has completed secondary school. Next, denote by y_2 the number of years of early marriage for a girl in case

⁸ Also, note also that we restrict the sample to girls who did get married eventually, early or not, although for literacy, we include all girls. Still, this means that we broadly analyze the impact of early marriage on education for girls who did marry or are expected to marry, not considering girls who became women and never married.

marriage took place before the age of 18. For a girl who married at or after 18 years of age, y_2 takes on a value of zero. If a girl marries at age 12, and if the age threshold for early marriage is set at 18, then y_2 takes a value of six, given that the girl marries six years too early, and so on.

While the analysis is implemented here with the assumption of a legal age of marriage of 18, it could be replicated with a different minimum age at marriage. The reason for using the age threshold of 18 here is that this is often the minimum legal age for marrying when such an age is prescribed in the law. In addition, as assessed by Dixon-Mueller (2008) on the basis of various physiological and social criteria⁹ and data from a large number of DHS surveys, boys and girls aged 14 and younger are quasi universally too young for sexual, marital, and reproductive transitions, while 15-17-year-olds may or may not be too young, depending on circumstances. This suggests that the cut-off point of 18 years of age is appropriate for defining child marriage.

As explained in the introduction, in the estimation of the determinants of y_1 , the number of years of early marriage y_2 must be treated as endogenous given that education prospects themselves influence the decision to marry early. The econometric model is as follows:

$$\begin{aligned} y_1^* &= z_1\delta_1 + \alpha_1 y_2 + u_1 \\ y_2 &= z_1\delta_{21} + z_2\delta_{22} + v_2 = z\delta_2 + v_2 \quad (1) \\ y_1 &= I[y_1^* > 0] \end{aligned}$$

where (u_1, v_2) has a zero mean and a bivariate normal distribution, and is independent of z .

Following Rivers and Vuong (1988) we assume a homoskedastic-normal model for the reduced form for the determinants of y_2 and use OLS estimation for the first stage regression. That is, we regress y_2 on a vector of exogenous variables z_2 , including instruments that affect the likelihood of being married early, but not educational attainment conditional on marrying early. The instruments are the leave-out-mean contemporaneous and past incidence of child marriage in the primary sampling unit where a girl lives, as measured through the share of girls marrying at ages 12 through 17, as well as associated variables (see the exact specification in section 3).¹⁰ We use two instruments for each age of early marriage, one contemporaneous, and one based on data on early marriage for the previous decade, and all shares of girls marrying early at

⁹ The criteria considered by Dixon-Mueller are: "(1) the physiological maturation of the body; (2) the cognitive capacity for making safe, informed, and voluntary decisions; and (3) institutionalized concepts of "old enough" for consent to sexual intercourse and marriage as reflected in legal frameworks and international standards" (Dixon-Mueller, 2008: 247).

¹⁰ We know to which PSU households and individuals in the survey belong, so we can compute mean values for the share of girls marrying at various ages in each PSU, whether this is done for the current sample of girls/women in the regression (the contemporaneous sample), or an older sample of women (the past values incidence). The PSU leave-out-mean variables capture social norms at the PSU level as well as other factors that may affect child marriage. In order to avoid endogeneity, we compute leave-out-means for those variables, where the term leave-out-mean indicates that the PSU level variables are computed for all girls except the one considered in the regression. That is, for each girl/woman, the variables are computed among all the other girls/women living in the same PSU.

various ages are computed without factoring in a girl's own marriage decision (hence the use of the terminology 'leave-out-mean'). Tests suggest that these variables are valid instruments.¹¹

The second stage regression is a probit model whereby y_1 is regressed against another set of exogenous variables z_1 , which may include some but not all of the variables in z_2 as well as y_2 , and the residuals \hat{v}_2 from the first stage regression. Denoting by $\hat{\theta}_{\rho 1}$ the coefficient of \hat{v}_2 and by τ_2^2 the error variance estimator from first step OLS regression, the coefficients $\beta_1 = (\delta_1', \alpha_1)'$ used to estimate average partial effects are obtained from the two-step estimates as follows:

$$\hat{\beta}_1 = \hat{\beta}_{\rho 1} / (1 + \theta_{\rho 1}^2 \tau_2^2)^{1/2}. \quad (2)$$

We need to adjust the coefficients because the estimated coefficients from the second stage estimation are the vector of scaled coefficients, conditional on the residual of the first stage estimation. But as noted by Rivers and Vuong (1988) it is the unscaled coefficients that must be used to estimate average partial effects (APEs). Given the unscaled coefficient estimates $\hat{\delta}_1$ and $\hat{\alpha}_1$, we report from the probit estimation average partial effects (with the above correction) for all variables in z_1 as well as the various values of y_2 with reference to the age threshold of 18. In comparison with partial effects computed at the mean of the distribution that are usually reported when estimating probit regressions, the advantage of the APEs is that they better represent the average effects over the whole distribution of a change in value for the regressors.

For a continuous variable z_{1i} in z_1 , if N denotes the sample size, the APE is estimated as:

$$\hat{\delta}_{11} \left[N^{-1} \sum_{i=1}^N \phi(\hat{\alpha}_1 y_{2i} + z_{1i} \hat{\delta}_1) \right]. \quad (3)$$

Note that the APE for the number of years of early marriage can be computed by treating y_2 as a continuous variable and considering small marginal changes in the number of years of early marriage. But we can also compute the APE by considering discrete changes in y_2 by one year intervals (this is actually what we observe in the data, since we don't have information on a monthly basis). The APE for a discrete change in y_2 from y_2^0 to y_2^1 is estimated as:

¹¹ For two stage regression models where the first stage is an OLS and the second stage is probit, we are not aware of readily available tests to assess the validity of the instruments. But we tested the validity of the instruments based on the two stage OLS estimation. The results suggest that the number of years of early marriage is endogenous (Durbin and Wu-Hausman statistics over 10, $p=0.0015$). This is also suggested by the statistical significance of the residuals in the second stage regression. The joint F-test on the instrument variables is above 250, suggesting joint significance of the instruments. Stock and Yoyo's test suggests that the test statistics is much higher than the critical value (256 vs.21), indicating that the instruments are not weak. The over-identification test returns a Sargan-Basmann statistics at about 18 which is not statistically significant ($p=0.18$), suggesting that we can reject the null hypothesis of over-identification of an incorrectly specified structural equation.

$$N^{-1} \sum_{i=1}^N [\Phi(\bar{\alpha}_1 y_2^1 + z_{1i} \bar{\delta}_1) - \Phi(\bar{\alpha}_1 y_2^0 + z_{1i} \bar{\delta}_1)]. \quad (4)$$

In section 3, we will report the APE for y_2 obtained with both the continuous and discrete approaches above. In the discrete case, we will compute the APEs for changes in the value of y_2 from the child marriage age threshold of 18 years where y_2 is equal to zero to the various observed values of y_2 from one to six years of early marriage, corresponding to a girl getting married at ages 17 to 12 years (some girls do get married before 12, but because of a smaller sample size and thereby standard error at that level, these estimates are not reported). All standard errors for the APEs are obtained through bootstrapping with 500 replications.

3. Results

Table 1 provides data on girls and young women between the ages of 15 and 34 who did marry in the DHS sample. The table shows the share of the girls and young women who are literate, have at least some secondary school education, or have completed their secondary education, according to whether they married as children or not, and if they did marry below the age of 18, according to the age of (first) marriage. The three education attainment measures are estimated on slightly different samples, as explained earlier, with secondary enrollment and completion estimated among girls aged 25 to 34 to allow plenty of time beyond the normal number of years to complete secondary education and thereby account for the possibility of grade repetition. For literacy, given that it is normally to be achieved at the end of primary school, we consider a younger sample, from 15 to 24 years of age, again allowing additional years for the completion of primary school or other study. All statistics and estimations are based on the sample of women who have married, with the analysis focusing on the difference made by marrying as a child (that is, below the age of 18) or later in life. Standard errors are very small due to the very large sample size obtained by combining the data for multiple countries.

There are large statistical differences in education attainment according to whether a girl has married as a child or not. The literacy rate among women who did marry, but not as children, is 53.7%, as compared to 29.0% for women who married as children. The earlier a girl married, the lower the likelihood that she is literate. Large differences are also observed as to whether girls have some secondary education, and whether they have completed their secondary education. For example, while 13.4% of married women aged 25 to 34 who did not marry as children have completed their secondary education, the proportion is at less than 2% for those who married as children. For some secondary education, the respective proportions are 36.2% and 10.7%. Systematically, marrying earlier tends to reduce further the level of education attainment of a girl, at least statistically.

Do these results still hold once controls are introduced? It could be that other factors correlated with the probability of marrying early are the cause of the lower level of education attainment of the children who marry early, and the likelihood of marrying early is itself endogenous with respect to a girl's education prospects. In order to assess the marginal impact of early marriage on the three measures of education attainment, we estimate the model presented in the previous section for each of the three education outcomes.

Summary statistics on the various variables are provided in **Table 2** (statistics on the country and age dummy variables are provided in appendix). We include in the estimation a number of independent variables: the location of the girl (urban or rural) since child marriage tend to be much more prevalent in rural areas and education outcomes are also lower there, especially

when access to secondary schools is limited; whether the girl is an orphan given that in some countries, the practice of marrying orphans earlier is widespread, in part to protect the girl, and that being an orphan may negatively affect education attainment; whether the girl had a child before getting married since this may affect education outcomes substantially (most children are born after marriage in most of the African countries); the religious affiliation of the girl since there are large differences in the incidence of child marriage between groups, with higher incidence among other among Muslim and traditional groups, and there are also differences in education attainment by religion, with Muslim girls often faring less well for a variety of cultural reasons; the leave-out-mean rates at the level of the primary sampling unit in which the girls lives of early marriage at various ages both in the sample used for the estimation and among older women since these variables capture social norms in favor or not of child marriage at the local level as well as other factors that may affect the decision to marry early; and a number of other controls at the level of the primary sampling unit which capture living conditions that could also affect the decision to marry early as well as education attainment.

The additional controls at the PSU level are the leave-out-mean share of households in the PSU that belong to the bottom two quintiles of the distribution of wealth, the share of the adult population in the PSU that is not working, the share of households in the PSU that have access to electricity, that do not have a toilet, and that do have access to pipe water. The regressions also include controls for all countries in the sample and for the age of the individuals on whom the estimation is carried. Unfortunately, we do not have data on other characteristics of the girls or their households before they got married, so we cannot control for those.

Table 3 provides the results of the first-stage regressions. The key in those regressions for the purpose of this paper is that the instruments – the contemporaneous leave-out-means and the past incidence of child marriage at the PSU level – are statistically significant. These variables have, as expected, a strong positive impact on the likelihood that a girl will marry early. We estimated several versions of the model by including various sets of instruments – in all cases the instruments had large and statistically significant impacts on the number of years of early marriage. In addition, having a child before marriage (this happens for about 10% of the sample) is reducing the number of years of early marriage. This is as expected, given that girls who have a child before marriage tend to be older as compared to those who do not.

There are also substantial differences in the number of years of early marriage according to the religious affiliation of the girl. In comparison to the reference category of Catholics, Muslims, those who declare having no religion, and those with traditional or Animist beliefs tend to marry earlier. Being an orphan does not seem to have a statistically significant effect on the number of years of early marriage. While this may seem surprising given that child marriage has often been presented as being in part motivated by the need to protect orphan girls by integrating them into new families, our finding is actually similar to that of Palermo and Peterman (2009).

Results from the second stage regressions are provided in **Table 4** (for space constraint we do not show the country dummy variables). The impact of early marriage is substantial and statistically significant. The average partial effect obtained for an additional year of early marriage is provided in the first row of the table. One more year of early marriage reduces the probability of literacy by 7.5 percentage points, and it reduces the probability of having some level of secondary education by 9.6 points. The negative impact on secondary school completion is 7.5 points per year of early marriage. The estimates are provided also for the impact of marrying at 17, 16, 15, 14, 13, and 12 years of age, as compared to marrying at age 18 or later, showing how marrying very early has a larger negative impact.

Note that these impacts are obtained after controlling for a range of variables, including the leave-out-mean literacy and education attainment variables at the level of the PSU in which the women live, which as expected have large positive effects on the dependent variables. Urban location is associated with a higher probability of having some secondary education or completing secondary school, but the effect on literacy is not statistically significant. Being an orphan reduces the likelihood of being literate, and having a child before marriage has a negative effect on all three measures of education attainment. There are also large differences in education enrollment by religion, with Catholics typically being better educated and more likely to be literate. Early pregnancy has a negative impact on literacy and education attainment, but one should consider these estimates with caution.¹² The additional PSU control variables also have the expected effects – women living areas where the population is poorer, not working, or without access to electricity and water tend to fare less well. A larger share of the sample without access to toilets is also associated with lower education attainment. Note also that the residuals from the first stage regression are statistically significant for secondary school completion, suggesting endogeneity of the decision to marry early with respect to completing secondary education.

One potential issue with the estimates in Table 4 is that we do not control for individual wealth effects, which may have an impact on education attainment. For the girls who got married, we do not observe their level of household wealth before the marriage, since we only observe their wealth in the new household that they have formed or joined by marrying. But it is not unreasonable to assume that most girls marry within the same broad socio-economic background. If we assume that girls do marry into households with similar levels of wealth as measured by quintiles, then we can include wealth quintiles in the regression.¹³

The results are provided in the first panel of **Table 5**. Introducing wealth reduces slightly the magnitude of the estimates, as expected, but they remain statistically significant. With the wealth quintiles included in the specification, one more year of early marriage reduces the probability of literacy by 5.7 percentage points, and it reduces the probability of completing secondary education by 3.5 points. The negative impact on secondary school attendance (that is, the girl/woman has some secondary school education even if the cycle was not completed) is 5.6 points per year of early marriage.¹⁴ As mentioned in the introduction, these impacts are fairly similar to those provided for Bangladesh by Field and Ambrus (2009) who find that in

¹² Early pregnancy may be endogenous with respect to education attainment and literacy, in the same way as child marriage is. Ideally, the early pregnancy variable should be instrumented. Unfortunately, the econometric method used to obtain the average partial effects assessing the specific impact of each year of child marriage on education outcomes does not enable us to instrument at the same time and separately early pregnancy in the same specification. So we face a choice of including early pregnancy without instruments, or not including the variable at all. We believe it is better to include the early pregnancy variable, as not doing so could result in estimates of the impact of child marriage on education that could be too high when girls who marry early also have an early pregnancy (the impact of early pregnancy might be captured by the child marriage variable). We may then overestimate the impact of early pregnancy on education by not instrumenting that variable, but because the paper focuses on the impact of child marriage, this is less of a concern than overestimating the impact of child marriage.

¹³ We may have some measurement error in doing so for some girls who married into much poorer or much wealthier households, but the estimations with the wealth quintiles are likely to be better than those without.

¹⁴ The coefficients and level of statistical significance for the other independent variables in the regression do not change too much, so they are not reproduced in Table 5.

Bangladesh each additional year of delay in the age of marriage is associated with an increase in the probability of literacy of 5.6 points. We consider these effects are our better estimates.

Another potential issue is that by using PSU-level instruments, we assume implicitly that girls marry within their PSU. This is not completely unreasonable, given that especially in rural areas where child marriage is more widespread PSUs may cover relatively large geographic villages including quite a few villages. Still, another way to test for robustness of the results consists in using a higher level of geographic aggregation for the instruments and run the model again. The results are shown in the bottom two panels of Table 5, with and without wealth dummies. Qualitatively, the results are similar for secondary school attendance and completion, but the effects on literacy become statistically insignificant. It is likely that the regional level is too broad for the estimation, and we believe that the better estimates are those obtained with the PSU-level instrumentation and the inclusion of the wealth quintiles. But at least for two of the three education outcomes considered here, it is reassuring that the results are not affected too much by the level of geographic aggregation of the instrumentation.

It is important to emphasize that as expected, marrying at age 12 does not have the same negative impact on education outcomes than marrying at, say, age 17. Consider the first panel of Table 5 with our preferred estimates. Marrying at age 17 reduces the probabilities of literacy, secondary school attendance, and secondary school completion by respectively 3.6 percentage points, 4.6 percentage points, and again 4.6 percentage points versus marrying at age 18 or later. By contrast, marrying at age 12 reduces these three probabilities by much larger margins, respectively 20.3 percentage points, 21.1 percentage points, and 12.4 percentage points. Clearly, the younger a girl marries, the larger the negative effects on education outcomes are.

4. Conclusion

Almost half of girls in sub-Saharan Africa born between 1985 and 1989 married before the age of 18. It is often argued that child marriage has serious negative impacts on the girls' education and health, as well as that of their children. Yet few studies provide precise estimates of such impacts, essentially because of endogeneity issues. Using an instrumental variable approach, we estimated that in the region as a whole, each additional year of early marriage reduces the probability of literacy under the preferred specification by 5.7 percentage points, a finding very similar to that of Field and Ambrus (2009) for Bangladesh using different instruments. Furthermore, each additional year of early marriage reduces the probability of secondary school completion under the preferred specification by 3.5 percentage points, and the impact on the probability of attending secondary education is 5.6 percentage points. These estimates are large and they suggest that further efforts to curtail the practice of child marriage could have large positive effects on the education of girls in sub-Saharan Africa.

What can be done to reduce child marriage and improve schooling for girls? In many countries, laws have been adopted to prevent marriage below 18 years of age, but these laws are often not enforced. The laws are needed, but they are not enough. Interventions to reduce the cost of schooling for girls and the quality of the education available to them show more promise.

Conditional or unconditional cash transfers are often mentioned and have been proved successful in many different settings, and may have an impact on child marriage (Baird et al., 2010, 2011). Other interventions, such as the availability of a secondary school nearby and public transportation to go to secondary schools that are further away may help, as can improvements in the quality of schooling so that the benefits for girls from enrolling are higher.

Another alternative is to condition transfers on not getting married, with some programs suggesting positive impacts. For example, in rural Ethiopia the *Berhane Hewan* program focuses on income earning projects for families sending their daughters to school and a pregnant ewe is presented to the girl and her family at graduation (Erulkar and Muthengi, 2007, 2009; see also Edmeades and Hayes, 2014, on Ethiopia). Another example is the program *Apni Beti Apna Dhan* (Our Daughter, Our Wealth) in the state of Haryana in India which has provided since 1994 financial incentives to parents if they give birth to a daughter and if she remains married until 18. The incentives consist of an immediate cash grant upon birth and a long-term savings bond redeemable on the girl's 18th birthday if she is unmarried with additional bonuses for education. Sinha and Young (2009) suggest on the basis of the limited data available that the program may have positive impacts on the sex ratio of living children, on the investments by parents in their daughters' human capital, and on the likelihood that girls achieve higher education attainment conditional on enrolling in school.

It is however also important to emphasize that reframing the transition of girls to marriage requires a policy dialogue with religious and community leaders who have a great deal of influence on those issues. Meeting with these leaders to critically examine the causes and consequences of early marriage can help in building support for policies against child marriage. In some countries, this dialogue could be part of broader discussions on family law reform.¹⁵

¹⁵ On the broader issue of women's empowerment and how it relates to legal rights and opportunities, see for example Hallward-Driemeier and Hasan (2013) in the case of Africa.

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Table 1. Education attainment outcomes by number of years of early marriage

	Literacy Age 15-24	Secondary school attendance Age 25-34	Secondary school completion Age 25-34
Comparison between girls married before or after 18			
Married after 18 years of age	0.537 (0.004)	0.362 (0.002)	0.134 (0.002)
Married before 18 years of age	0.290 (0.002)	0.107 (0.002)	0.019 (0.001)
Difference of means (<i>married as a child vs not</i>)	0.258*** (0.004)	0.260*** (0.003)	0.123*** (0.002)
Comparisons by age of marriage			
Married at 17	0.411 (0.005)	0.164 (0.004)	0.029 (0.002)
Married at 16	0.357 (0.005)	0.130 (0.004)	0.020 (0.001)
Married at 15	0.252 (0.005)	0.082 (0.003)	0.014 (0.001)
Married at 14	0.196 (0.005)	0.072 (0.003)	0.013 (0.001)
Married at 13	0.174 (0.007)	0.063 (0.004)	0.012 (0.002)
Married at 12	0.174 (0.009)	0.064 (0.005)	0.016 (0.003)
Number of observations	56617	84322	84322

Source: Authors' estimations based on DHS surveys. Standard deviations in parentheses

Table 2. Summary statistics for variables used in the estimations by model

	Literacy	Secondary school attendance	Secondary school completion
	Age 15-24	Age 25-34	Age 25-34
Dependent variable	0.369	0.234	0.076
Leave out mean of dependent variable	0.373	0.255	0.067
Years of early marriage	1.956	1.495	1.495
Urban location	0.283	0.316	0.316
Orphan (one deceased parent)	0.014	NA	NA
Girl had first child before marriage	0.072	0.121	0.121
Religion			
Catholic	0.220	0.232	0.232
Protestant	0.182	0.188	0.188
Muslim	0.330	0.291	0.291
Traditional/Animist	0.022	0.028	0.028
No Religion	0.041	0.032	0.032
Other Christians	0.134	0.155	0.155
Other Religions	0.030	0.031	0.031
Missing	0.040	0.042	0.042
Instrumental variables – Contemporaneous values			
PSU leave out mean (share) of CM at 12	0.025	0.021	0.021
PSU leave out mean (share) of CM at 13	0.047	0.039	0.039
PSU leave out mean (share) of CM at 14	0.083	0.071	0.071
PSU leave out mean (share) of CM at 15	0.119	0.104	0.104
PSU leave out mean (share) of CM at 16	0.102	0.093	0.093
PSU leave out mean (share) of CM at 17	0.103	0.097	0.097
PSU leave out mean (share) of CM before or at 17	0.495	0.441	0.441
Instrumental variables – Past values			
PSU LOM (share) of CM at 12, previous 10 years	0.026	0.026	0.026
PSU LOM (share) of CM at 13, previous 10 years	0.050	0.046	0.046
PSU LOM (share) of CM at 14, previous 10 years	0.088	0.079	0.079
PSU LOM (share) of CM at 15, previous 10 years	0.123	0.119	0.119
PSU LOM (share) of CM at 16, previous 10 years	0.110	0.103	0.103
PSU LOM (share) of CM at 17, previous 10 years	0.115	0.110	0.110
PSU LOM (share) of CM before or at 17, pr. 10 years	0.536	0.502	0.502
PSU LOM years of early marriage, previous 10 years	2.839	2.895	2.895
PSU level controls			
Leave out mean share of households in bottom two quintiles	0.424	0.390	0.390
Leave out mean share of unemployment	0.385	0.380	0.380
Leave out mean access rate to electricity	0.177	0.213	0.213
Leave out mean share of household with a toilet	0.363	0.340	0.340
Leave out mean access rate to pipe water	0.265	0.296	0.296
Number of observations	56617	84322	84322

Source: Authors' estimations based on DHS surveys.

Table 3. First stage OLS regressions for the number of years of early marriage

	Literacy	Secondary School attendance	Secondary school completion
Leave out mean years of early marriage	-0.381***	-0.489***	-0.857***
Urban location	-0.032*	-0.012	-0.047***
Orphan (one deceased parent)	0.091	-0.365	-0.336
Had first child before marriage	-0.922***	-0.986***	-0.993***
Religions (reference: Catholic)			
Protestant	-0.048**	-0.006	-0.001
Muslim	0.133***	0.240***	0.246***
Traditional/Animist	0.231***	0.231***	0.258***
No Religion	0.265***	0.298***	0.335***
Other Christians	0.042	0.030	0.036
Other Religions	-0.025	0.069*	0.073*
Missing	0.026	0.035	0.046
Instrumental variables - Contemporaneous			
PSU leave out mean (share) of CM at 12	4.262***	5.220***	5.343***
PSU leave out mean (share) of CM at 13	3.122***	3.901***	4.006***
PSU leave out mean (share) of CM at 14	1.819***	2.540***	2.600***
PSU leave out mean (share) of CM at 15	1.496***	1.788***	1.858***
PSU leave out mean (share) of CM at 16	0.676***	0.981***	1.050***
PSU leave out mean (share) of CM at 17	-0.138	0.198**	0.242**
Instrumental variables - Previous 10 years			
PSU LOM (share) of CM at 12, previous 10 years	0.006	-0.260***	-0.278***
PSU LOM (share) of CM at 13, previous 10 years	0.019	-0.009	-0.031
PSU LOM (share) of CM at 14, previous 10 years	0.009	0.013	-0.005
PSU LOM (share) of CM at 15, previous 10 years	0.039	0.107**	0.096**
PSU LOM (share) of CM at 16, previous 10 years	0.070	0.076*	0.062
PSU LOM (share) of CM at 17, previous 10 years	0.156**	0.054	0.046
Constant	1.054***	0.997***	0.975***
Number of observations	56,617	84,325	84,325

Source: Authors' estimations based on DHS surveys. Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Country and age dummies are included in the regressions but not reported here

Table 4. Second stage regressions for literacy and education attainment

	Literacy		Secondary school attendance		Secondary school completion	
	Probit	APE	Probit	APE	Probit	APE
Years of early marriage	-0.146***	-0.075***	-0.225***	-0.096***	-0.421***	-0.075***
Married at 17		-0.038***		-0.063***		-0.089***
Married at 16		-0.077***		-0.122***		-0.155***
Married at 15		-0.115***		-0.179***		-0.201***
Married at 14		-0.153***		-0.230***		-0.230***
Married at 13		-0.191***		-0.277***		-0.248***
Married at 12		-0.227***		-0.318***		-0.258***
LOM of dependent variable	2.032***	0.503***	1.918***	0.468***	1.659***	0.275***
Urban location	0.019	0.005	0.081***	0.020***	0.075***	0.012***
Orphan (one deceased parent)	-0.098*	-0.024				
Had first child before marriage	-0.141***	-0.035***	-0.126***	-0.031***	-0.416***	-0.069***
Religions (reference: Catholic)						
Protestant	-0.069***	-0.017***	-0.005	-0.001	-0.012	-0.002
Muslim	-0.446***	-0.110***	-0.476***	-0.116***	-0.414***	-0.069***
Traditional/Animist	-0.530***	-0.131***	-0.621***	-0.151***	-0.944***	-0.156***
No Religion	-0.377***	-0.093***	-0.526***	-0.128***	-0.663***	-0.110***
Other Christians	-0.061**	-0.015**	-0.101***	-0.025***	-0.105***	-0.017***
Other Religions	-0.222***	-0.055***	-0.240***	-0.059***	-0.336***	-0.056***
Missing	-0.308***	-0.076***	-0.261***	-0.064***	-0.123	-0.020
PSU controls						
LOM share in bottom two quintiles	-0.185***	-0.046***	-0.100***	-0.024***	-0.245***	-0.041***
LOM share of unemployment	-0.073**	-0.018**	0.081**	0.020**	0.303***	0.050***
LOM access rate to electricity	0.308***	0.076***	0.475***	0.116***	0.549***	0.091***
LOM share of household with a toilet	-0.199***	-0.049***	-0.279***	-0.068***	-0.323***	-0.053***
LOM access rate to pipe water	0.039**	0.010**	0.110***	0.027***	0.182***	0.030***
Residual from first stage regression	0.028		0.045**		0.184***	
Constant	-0.614***		-0.885***		-0.726***	
Number of observations	56,617	56,617	84,323	84,323	84,323	84,323

Source: Authors' estimations based on DHS surveys. Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Country and age dummies are included in the regressions but not reported here

Table 5. Robustness tests for second stage regressions

	Literacy		Secondary school attendance		Secondary school completion	
	Probit	APE	Probit	APE	Probit	APE
LOM at PSU level with Wealth Quintiles (Preferred specification)						
Years of early marriage	-0.142***	-0.057***	-0.214***	-0.056***	-0.393***	-0.035***
Married at 17		-0.036***		-0.046***		-0.046***
Married at 16		-0.072***		-0.087***		-0.078***
Married at 15		-0.106***		-0.125***		-0.099***
Married at 14		-0.140***		-0.158***		-0.112***
Married at 13		-0.172***		-0.186***		-0.119***
Married at 12		-0.203***		-0.211***		-0.123***
LOM at Regional Level without Wealth Quintiles						
Years of early marriage	0.002	0.001	-0.121***	-0.071***	-0.340***	-0.077***
Married at 17		0.000		-0.032***		-0.079***
Married at 16		0.001		-0.065***		-0.146***
Married at 15		0.001		-0.099***		-0.198***
Married at 14		0.001		-0.132***		-0.237***
Married at 13		0.002		-0.166***		-0.264***
Married at 12		0.002		-0.199***		-0.283***
LOM at Regional Level with Wealth Quintiles						
Years of early marriage	-0.020	-0.011	-0.118***	-0.043***	-0.312***	-0.031***
Married at 17		-0.005		-0.029***		-0.039***
Married at 16		-0.010		-0.057***		-0.068***
Married at 15		-0.015		-0.084***		-0.090***
Married at 14		-0.021		-0.110***		-0.105***
Married at 13		-0.026		-0.135***		-0.115***
Married at 12		-0.031		-0.158***		-0.121***

Source: Authors' estimations based on DHS surveys. Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Country and age dummies are included in the regressions but not reported here

Appendix. Summary statistics for country and age variables in the model (representing shares)

	Literacy Age 15-24	Some secondary education Age 25-34	Secondary education completed Age 25-34
Country dummies			
Burkina Faso 2003	0.047	0.042	0.042
Benin 2006	0.052	0.074	0.074
Congo Democratic Republic 2007	0.038	0.033	0.033
Congo (Brazzaville) 2005	0.023	0.023	0.023
Cameroon 2004	0.046	0.034	0.034
Ethiopia 2005	0.046	0.046	0.046
Ghana 2008	0.010	0.015	0.015
Guinea 2005	0.027	0.027	0.027
Kenya 2008	0.025	0.027	0.027
Liberia 2007	0.019	0.023	0.023
Lesotho 2009	0.023	0.022	0.022
Madagascar 2008	0.071	0.059	0.059
Mali 2006	0.072	0.053	0.053
Malawi 2004	0.090	0.088	0.088
Mozambique 2004	0.055	0.043	0.043
Nigeria 2008	0.105	0.115	0.115
Niger 2006	0.040	0.034	0.034
Namibia 2006	0.011	0.019	0.019
Rwanda 2005	0.020	0.033	0.033
Sierra Leone 2008	0.021	0.029	0.029
Sao Tome and Principe 2008	0.008	0.010	0.010
Swaziland 2006	0.008	0.011	0.011
Chad 2004	0.027	0.022	0.022
Tanzania 2010	0.029	0.033	0.033
Uganda 2006	0.030	0.030	0.030
Zambia 2007	0.023	0.026	0.026
Zimbabwe 2005	0.033	0.029	0.029
Age dummies			
15	0.021		
16	0.036		
17	0.057		
18	0.101		
19	0.090		
20	0.169		
21	0.105		
22	0.149		
23	0.136		
25		0.148	0.148
26		0.098	0.098
27		0.100	0.100
28		0.115	0.115
29		0.082	0.082
30		0.153	0.153
31		0.068	0.068
32		0.091	0.091
33		0.073	0.073
Number of observations	56617	84322	84322

Source: Authors' estimations based on DHS surveys