UNITED NATIONS
UNIVERSITY
UNU-WIDER

This paper is a draft submission to the

WIDER Development Conference

Human capital and growth

6-7 June 2016 Helsinki, Finland

Marriage Age, Social Status and Intergenerational Effects in Uganda

Naveen Sunder*

Department of Economics, Cornell University

[Latest Update: May 16, 2016]

Abstract

I use a nationally representative dataset for Uganda to estimate the impact of marriage age on later life outcomes for women and also on their children's health outcomes. I use plausibly exogenous variation in the age of menarche of women to instrument for their marriage age. A delay of one year in physical maturation of women leads to an increase of 0.45 years in their marriage age. Using age at menarche as an instrument in a Two Stage Least Squares (2SLS) framework, I find that a one year delay in marriage leads to an increase of 0.5-0.75 years of education and an increase of about 5-10 percent in the chance of being fully literate. I also find large and significant negative effects of earlier marriage on other outcomes such as labour force participation, decision making power, perceived social status, contraceptive use and spousal characteristics. Additionally, In terms of intergenerational effects of early marriage, I find significant negative effects of early marriage on the child's hemoglobin levels, probability of being anemic and severely anemic. I also find negligible negative effects on Body Mass Index (BMI), height and weight. Using diagnostic checks and several robustness checks, I provide evidence that the instrument satisfies the inclusion and exclusion restrictions, thus raising the causal nature of the estimates.

JEL classification: O15, I15, J22, I25

Keywords: Economic Development, Health, Labour Supply, Education

*Address: Uris 443, Cornell University, Ithaca, New York- 14853 , e-mail: *fn63@cornell.edu*. I thank Christopher Barrett, Francine Blau, Averi Chakrabarti, Levon Barseghyan, Gary Fields, Alfonso Flores-Lagunes, Vidya Reddy, David Sahn and Joerg Stoye. Additionally, I thank participants at the Cornell Economics Students Research Seminar, Cornell Development Microeconomics Research Seminar and APPAM 2015 for their useful comments. I am grateful for the financial assistance provided by the Cornell Population Center and the Cornell Economics Department. All remaining errors are my own. The earliest draft of this paper was dated: 10 December 2014.

1 Introduction

For many years now, there has been a growing consensus that addressing the gender divide in a society is necessary for poverty reduction and equitable growth. This divide starts from an early age in the form of discrimination in feeding and schooling practices and percolates into adulthood. One way this divide manifests itself is through the practice of child marriage. Child marriages are not only a health hazard for the women themselves, but they also imply an early age of first birth which affects the health of the future generation. Early marriage continues to be prevalent in the majority of the developing world and especially in Sub-Saharan Africa. More specifically, within Sub-Saharan Africa, this problem is extremely rampant in Uganda. According to statistics from UNFPA and UNICEF, overall incidence of child marriages[1] is more rampant in South Asia (45 percent), but the rates are fairly high in Sub-Saharan Africa (37 percent) as well. The same data reveals that Uganda falls amongst the worst countries in Africa in terms of women's age at marriage, with almost 46 percent of all girls under the age of 18 being married.

Academics have amply demonstrated the association between age at marriage and outcomes such as women's schooling, health, bargaining power within the household, fertility decision making and maternal mortality across different geographical and cultural contexts (Jensen and Thornton [2003], Clark [2004], Field and Ambrus [2008], Raj et al. [2010], Hicks and Hicks [2014]). A good summary of results from countries across different parts of the world is provided in Jensen and Thornton [2003]. In countries as varied as Benin, Colombia, India and Turkey, they find persuasive evidence that women who marry younger have systematically poorer outcomes. Some find that the overall incidence of early marriage is impacted by various factors affecting demand and supply of young brides, which leads them to argue that focusing policy on either demand or supply forces would not be enough to stop child marriages.

This paper revisits this relationship using a nationally representative dataset from an

[1]Child Marriage is defined as one where at least one of the spouses is below the age of 18 years.

African country (Uganda) in a plausibly causal manner- an Instrumental Variables (IV) estimation approach. A regular OLS regression of a woman's outcome variable on her marriage age and other controls cannot be interpreted as being the causal effect of marriage age. The reason is the endogeniety issue that arises due to confounding factors that affect *both* the marriage age and the outcome variable. Consider the case where one wants to estimate the impact of early marriage on the woman's education level. In this case, an OLS regression of effect (number of years of education) on the cause (age at first marriage) might ignore several other covariates that impacts both the cause and the effect variables. For example, it might be the case that before marriage a woman may belong to a family in which the parents are extremely supportive of getting more years of schooling. It is entirely possible that this family would also be in support of a later marriage for their daughter. Therefore, it might be the parents preferences that might be impacting both the education and marriage age decisions, rather than age at marriage impacting years of education. Similarly, while examining the effect of marriage age on their post-marriage decision making power, it is difficult to separate out the effect of a single factor. It might be the case again that it is pre-marriage parental or familial preferences that shape the behaviour (assertiveness) of a woman in her childhood, which in turn determines her later life behaviour. These preferences might systematically differ across households and could determine both the outcome (decision making power) and the causal (marriage age) variable simultaneously.

Following a novel methodological approach introduced by Field and Ambrus [2008], I use the plausible exogenous variation in the age at puberty and use it as an instrument for age at marriage. Field and Ambrus [2008] explore the effects of early marriage on the educational outcomes of women in Bangladesh. They find that each additional year of delay in marriage results in 0.22 years of additional schooling and 5.6 percent higher literacy. Sekhri and Debnath [2014] use a similar methodology to explore the consequences of early marriage on the test scores of children born to these young brides in India. They find that the effect of delaying marriage by one year increases their children's probability of being able to solve math problems by 3.5 percentage points.

A priori, it seems intuitive to believe that early marriage should have a negative impact on the woman's education, literacy, labour force participation and other social indicators such as decision making power, societal perceptions and marriage market outcomes. At the same time it is not very clear whether early marriage would have a positive or negative intergenerational impact. Early marriage might negatively impact the educational or literacy level of the mother and thus negatively affect the health outcomes of their children. There might also be a countervailing positive effect of having better marriage prospects at a younger age- because of the preference for younger virgin brides. In my analysis, I find a significant negative effect of earlier marriage on the highest grade attained by the women, their chances of being fully literate and being part of the labour force. I also find significant negative effects of earlier marriage on the decision making power, societal status perception and marriage market outcomes. I then find some evidence of negative intergenerational effect of early marriage on child health outcomes. Unfortunately, due to data limitations, I cannot comment on the mechanisms through which these effects operate.

The contribution of this paper is fourfold: It establishes a causal link between a women's marriage age and post-marriage socioeconomic outcomes, which is an important policy question that needs to be tackled. Secondly, in addition to women's schooling and literacy, I also explore the impact on other longer term outcomes including but not limited to the women's post marriage labour force participation, decision making power and their social perceptions related to wife beating. Again, all of these are linked to extremely pertinent policy questions. Thirdly, this paper explores the intergenerational impact of early marriage of women on the children born in these marriages. The context being an African country, makes it one of the first causal pieces of evidence of this phenomenon in an African context. Finally, this paper would be the first attempt of external validity of the empirical technique pioneered by Field and Ambrus [2008] using a nationally representative dataset- Demographic and Health Survey (DHS) data (from Uganda). Additionally, Uganda has very different social and cultural norms as compared to countries in which this method has been applied before- Bangladesh (Field

and Ambrus [2008]) and India (Sekhri and Debnath [2014]). Therefore, this paper also seeks to be an external validation of this empirical technique in a different socioeconomic environment.

The paper is organized as follows: In the next section I discuss the social setting related to gender and marriage in Uganda and provide some summary statistics. In section 3, I explain the sources of data used in this paper. In section 4, I explore in detail the empirical strategy employed in this analysis. I also discuss the measures I have taken to mitigate some concerns with the econometric technique and associated data constraints. In section 5, I provide the results from my analysis and in Section 6, I conclude with policy implications and some closing remarks.

2 Gender and Marriage in Uganda

Africa in general has high child marriage rates and Uganda is one of the countries that is plagued with this issue. The Constitution of Uganda through Article 31 stipulates the legal marrying age to be 18 years for both males and females. Legally, this is in line with international standards set by the *Convention on the Elimination of All Forms of Discrimination Against Women* (CEDAW). At the same time it must be noted that the practical implementation of this law has been traditionally poor in developing countries, especially in Uganda. In my sample, nearly 30 percent of women report being married by the age of 15 years and nearly 60 percent marry before the minimum legal marrying age of 18 years. It is interesting to note that in Uganda child marriage has been practiced for a long time and hence its causes are deep rooted in the society.

There is a large literature that explores the practice of bride prices and dowries in several different disciplines. As the focus of this paper is not on this issue, I am not going to discuss this literature in great detail. There are some key works in the economics discipline that provide great theoretical and empirical insight into these issues (Becker and Becker [1991], Rao [1993], Zhang and Chan [1999], Anderson [2003], Siow and Botticini [2003]). Anderson [2007] provides an excellent review of the economics and non-economics literature pertaining

to this set of issues[2]. In the following paragraphs I will provide a brief overview with some contextual information to motivate my analysis.

Historically, the practice of bride wealth played an important role in the determination of marriage age and it still does. Bride price is a traditional custom as per which the groom is supposed to pay the parents of the bride a certain amount of money in exchange for the right to marry their daughter. The custom has been historically prevalent in Ugandan society as shown by the fact that nearly 98 percent of households reported practicing it (Huzzayin and Acsadi [1976]). The reason for the prevalence of the practice of bride price is that it offsets the loss to the bride's family due to the future loss in the labour income. At the same time it has also been perceived to reduce the decision making power and perpetrated unequal gender roles in the household (Kaye et al. [2005]).

In general, the amount of money exchanged varies from one situation to the other, but younger and virgin brides would command a higher bride wealth. Dekker and Hoogeveen [2002] show that the amount of transfers can go up to nearly four times the annual income of the household. This also was an important indirect way in which bride wealth affected marriage age as parents tried to get their daughters married soon after puberty as they were worried for their safety and security.

In recent years the institution of marriage has undergone a lot of change in Uganda. There has been a growing trend of urbanization and a copying of western culture and ideas. This has meant that there has been a steady decline in the adherence to traditional cultural practices. In fact, Bishai and Grossbard [2010] found that bride price has an effect on the sexual fidelity of the partners within the marriage.

Along with the influx of western ideas and practices there has been a rise in the number of monogamous marriages. Islam had been one of the main religions in the country, which

[2]Interested readers should surely refer to this for a more detailed discussion.

implied that polygamy had been an integral part of Ugandan society.This manifested mostly as polygyny (multiple wives) and not as polyandry (multiple husbands), because polyandry was not societally acceptable. Polygamy is practiced by both christians and muslim, but it has been on the fall in the past three to four decades due to a fall in the proportion of muslim population. This is mainly because polygamy is more common amongst muslims, but that is not to say that the importance of other factors like urbanization, increase in education and literacy was low. There has also been a general decline in the practice of parents choosing the marriage partners for their children (Tumwine [2015]).

In Uganda, as expected, post marital gender roles disproportionately favour the males. In the colonial era, women did most of the domestic chores whereas men were responsible for providing for the family. In the post colonial times, the roles have changed a little but the position of women is not much better. Women have now became more responsible for labour intensive tasks in the household. But at the same time, their access to productive resources, their decision making autonomy and labour force participation has remained low. A lot of these disparities are built into the culture and value system in the country and a major example of this is the lack of land inheritance laws for women. It had been assumed traditionally that women do not need direct access to land as they have indirect access to it through their husbands. Factors like this coupled with the fact that wife beating is still socially acceptable, guarantees that the social position of women is very low despite advancement in economic well-being.

3 Data

In this paper, I use the 2001 Uganda Demographic and Health Survey (UDHS) data. This is a nationally representative dataset that comprise of three separate modules- Household, Women (15-49 years) and Men. Women in the age range of 15-49 years were administered a detailed survey consisting of questions on household characteristics, schooling, labor force participation, fertility, infant and reproductive health, antenatal and postnatal care among other topics. As part of this survey, these women were also asked to recall the age at which they experienced

onset of menarche. The women who were asked this question form the main sample for the analysis in this paper. Following Field and Ambrus [2008], I restrict my sample to women who reached puberty within the ages of 11 and 18 years, which consists of 98.4 percent of the sample of women who report their menarche age. This is done to address the concern that extremely early or late menarche onset is closely related to extreme social or physical conditions. For example, natural calamities (like droughts, earthquakes or floods) in infancy may affect the onset of puberty of women. Since these factors would confound the analysis, I exclude these women from the analysis. In crux, our sample consists of women who were between 15 and 49 years old when the survey was administered and had experienced puberty between the ages of 11 and 18 years of age. Similarly, the child level dataset is created by restricting the sample to children who have both parents alive and present in the household at the time of the survey. The reason for this is that any household with a single (or no) parent would systematically differ from other households.[3]

4 Key Variables

I now discuss the definition and construction of the key variables used in the analysis. To measure women's education, I use the highest grade attained by the women. The woman's literacy variable is a dummy that takes a value one if the mother is fully literate[4] and takes value zero otherwise. The mother's labour force participation is also a dummy variable which is equal to one if the woman reports to be part of the labour force currently, and zero otherwise. The decision making power of the woman is captured using six questions that related to the amount of say she had in various aspects of the decision making of the household.[5] There are six possible responses to each of these questions- *Respondent alone*, *Husband/Partner alone*, *Respondent and Husband/Partner jointly*, *Someone else individually*, *Someone else and respondent jointly*, *Not Applicable*. Based on the responses, I create two categorical variables for decision

[3] Nearly 7 percent of all households are single parent families.

[4] The woman can read/write in a native language.

[5] The six questions were as follows: Who in your family usually has the final say on the following decision: "*Your own health care?*", "*Children's health care?*", "*Making large household purchases?*", "*Making household purchases for daily needs?*", "*Visits to family or relatives?*", "*What food should be cooked each day?*".

making- the first is a full decision making power variable which takes a value one if the woman makes the decision individually and zero otherwise. The other variable takes a value one if the woman has some say in the making of these decisions i.e. if the respondent mentioned one of the following three options- *Respondent alone*, *Respondent and Husband/Partner jointly*, *Someone else and respondent jointly*. As the six questions pertain to different aspects of a household's decision making power, I consider each of these categories individually in my analysis rather than aggregating across them.

I examine the impact on the perceived social status of woman through her perceptions on wife beating. The DHS asks women if wife beating is justified in five different scenarios - (a) *If she goes out without telling him?*, (b) *If she neglects the children?*, (c) *If she argues with him?*, (d) *If she refuses to have sex with him?*, (e) *If she burns the food?*. The woman can respond with a Yes or a No to each of these situations. Based on the responses to these questions I measure the impact of early marriage on perceptions of wife beating. This can potentially be interpreted as a measure of perceived societal status of these women.

I use the women's knowledge about AIDS as a proxy of the women's health knowledge. The survey asks questions about different aspects of AIDS. Based on the responses, I categorize whether her knowledge as being factually correct or not. In this analysis, I focus on the responses to the following 2 questions: (a) *Can people reduce their chances of getting the AIDS virus by having just one sex partner who has no other partners?*, (b) *Can the AIDS virus be transmitted from a mother to a child?*. The first question relates to a pervasive issue in Africa- multiple sex partners and the second question is relevant to this work as it talks about inter-generational effects. Again, I do not aggregate the responses to these questions, but rather assess them separately. I create dummy variables which take a value of one for a correct answer (and zero otherwise). Contraceptive use is measured as a dummy variable that takes value one if the respondent mentions using any form of contraception.The survey has the following options for methods of contraception- Pill, IUD, injections, condom, female sterilization, male sterilization, periodic abstinence, withdrawal, lactational amenorrhea, foam, jelly or others.

I analyze some other measures of reproductive behaviour and knowledge- woman's time to first child, age at first birth and usage of antenatal care. Time to first child for woman is measured in number of months between marriage and birth of first child. Woman's age at first birth is self explanatory and measured in years. I use a dummy variable to characterize usage of antenatal care- it takes a value of one if the woman reports having used antenatal care in the first trimester of her most recent pregnancy.[6]

For measuring intergenerational effects, I use health outcomes of children between the ages 0-5 years. I measure health outcomes using standardized z-scores of height, weight, hemoglobin and BMI based on World Health Organization (WHO) norms. WHO conducted Multicentre Growth Reference Study (MRGS) to revise the way anthropometric z-scores were calculated. I use these updated standards for the analysis in this paper.[7]

I end this section with a short discussion on the instrumental variable (age of onset of menarche) used in this analysis. Analyzing 753 women in Mozambique, Padez [2003] finds that their average age of onset of menarche is 13.2 years with a standard deviation of 1.18 years. In similar analyses using samples from certain regions, Adebara and Ijaiya [2013], Zegeye et al. [2009] and Leenstra et al. [2005] find that the median age at menarche was 13.2, 15.7 and 15.8 years in Nigeria, Ethiopia and Kenya respectively. The data in this paper shows that the average age of menarche in Uganda is 14.4 years with a standard deviation of 1.4 years. The median age of menarche in the sample is 14 years.

5 Empirical Strategy

I use an Instrumental Variable (IV) approach to correct for the endogeniety bias in estimating the impact of age at marriage on later life outcome. Age at puberty provides plausible

[6] I use the most recent pregnancy because of data limitations

[7] To create a globally representative sample, measurements were taken from the following 6 countries- Brazil, Ghana, India, Norway, Oman and the USA. The data from all the countries was combined to form the final measurement standard- which I use in this paper.

exogenous variation that I require for identifying the causal impact in an IV setup. I show that the instrument is not weak while simultaneously exploring other potential concerns with the instrument. I discuss how these concerns might impact my analysis and present steps that I take to mitigate these concerns.

In this paper, I employ a Two Stage Least Squares (2SLS) estimation strategy. I explore the effects of early marriage of a woman on her later life outcomes and the health of her children. The difference in the two analyses is the unit of observation. When examining the effect on women's later life outcome, the analysis is at the woman level, whereas, for the child level analysis the unit of observation is a child born to a woman in the sample.

Let Y_j be the outcome variable for woman j, $MarriageAge_j$ be the age at marriage of the woman j, $Woman_j$ be the characteristics of the woman and $WomanChildhood_j$ be the variables pertaining to the socio-economic condition in which the woman grew up. Then the main estimation equation would look as follows:

$$Y_j = \kappa_0 + \kappa_1 MarriageAge_j + \kappa_2 Woman_j + \kappa_3 WomanChildhood_j + \nu_j \tag{1}$$

Let $MenarcheAge_j$ be the age at which a woman hits puberty. Then, the 2SLS IV approach would lead to a two stage estimation process where the estimation equations would be as follows (I have combined all the variables apart from the variable of interest into one variable called $Controls_j$):

$$\begin{aligned} \text{First Stage :} \quad & MarriageAge_j = \alpha_0 + \alpha_1 MenarcheAge_j + \alpha_2 Controls_j + \eta_j^1 \\ \text{Second Stage :} \quad & Y_{ij} = \delta_0 + \delta_1 MarriageAge_j + \delta_2 Controls_j + \eta_j^2 \end{aligned} \tag{2}$$

The specification for the child level outcomes is similar, but now each observation is a single child born to a particular woman in the sample. Let Y_{ij} be the outcome variable for child i born to woman j, $MarriageAge_j$ be the age at marriage of the mother of child i, $Father_j$ and $Mother_j$ be the characteristics of the father and the mother of the child i respectively, $Child_{ij}$

be the characteristics of child i of mother j. Then the main estimation equation would be as follows:

$$Y_{ij} = \beta_0 + \beta_1 MarriageAge_j + \beta_2 Father_j + \beta_3 Mother_j + \beta_4 Family_j + \beta_5 Child_{ij} + \epsilon_{ij} \tag{3}$$

The main IV approach would then lead to a two stage estimation process where the estimation equations would be as shown below. I have combined all the variables apart from the variable of interest into one variable called $Controls_{ij}$.The set of controls used in these regressions include dummy for the presence of multiple wives, religion and ethnicity dummies, household size, wealth index, urban dummy, presence of telephone dummy.

$$\begin{aligned} \text{First Stage :} \quad & MarriageAge_j = \alpha_0^c + \alpha_1^c MenarcheAge_j + \alpha_2^c Controls_{ij} + \zeta_{ij}^1 \\ \text{Second Stage :} \quad & Y_{ij} = \delta_0^c + \delta_1^c MarriageAge_j + \delta_2^c Controls_{ij} + \zeta_{ij}^2 \end{aligned} \tag{4}$$

While using an IV estimation technique, we need the instrument to be highly correlated with the variable that is being instrumented. Through figure 1 I show diagrammatically that the distributions of marriage age and menarche age move together but the peak of the marriage age distribution is to the right of the peak of the menarche age distribution. This is in line with apriori expectations that the ages of marriage and menarche move together and that marriage age peaks at a higher age than the menarche age. This is consistent with parents getting their daughters married within a certain period after the onset of puberty. In fact, in my sample nearly two-thirds of women get married within three years of onset of puberty.

For a causal interpretation of an IV analysis, the instrument has to satisfy two important restrictions- the inclusion and the exclusion restriction. The inclusion restriction is that instrument has to be correlated with the endogenous variable. The exclusion restriction states that the instrument should affect the outcome only throught he endogenous variable and no other variable. Therefore, it is important that the instrument should not affect the outcome variable directly. (Bound et al. [1995], Angrist and Imbens [1995], Angrist et al. [1996], Angrist

and Krueger [2001]). In this case, verifying the exclusion restriction reduces to the non-trivial task of examining whether the onset of puberty affects women's schooling (for example) directly or through any other channels apart from marriage age.

Through some robustness checks that I perform, I provide some evidence in support of the exclusion restriction. using causal mediation analysis, I compare marriage age with other potential mediators of the effect of menarche age on women's outcomes. I find that marriage age is the major mediator of this effect. Additionally, other work that has looked at the association between menarche age and schooling outcomes for women has found relatively small effects. Oster and Thornton [2011] in Nepal (a developing country) find that the effect of onset of menarche on girls' school attendance is around one day per school year [8]. This kind of an effect although statistically significant is a very small at best. Therefore, this further alleviates the concern that menarche age might directly affect schooling of girls.

Another potential concern with the main IV estimation strategy is that the age at which a woman reaches puberty might be directly affected by her childhood socio-economic and nutritional conditions, which might make the instrument endogenous with her later life outcomes(Freedman et al. [2005]). There is evidence (Berkey et al. [2000], Chowdhury et al. [2000], Ellis [2004], Rah et al. [2009], Dahiya and Rathi [2010], Odongkara Mpora et al. [2014]) which shows that early life external factors play a crucial role in determining menarche age. On the other hand, there is research which suggests that genetic composition or endowment at birth matters more than other post-birth environmental factors (Shayesteh Jahanfar [2013], Sørensen et al. [2013], Adair [2001], Kaprio et al. [1995], Campbell and Udry [1995]). This means that there are conflicting findings regarding the importance of genetic and non-genetic factors in the determination of age at menarche. To be on the safe side, I consider that there might be some non-genetic factors that might be important in determining the age of puberty onset. Below, I discuss various steps that I undertake to alleviate these concerns.

[8] In their study, a school year consists of 180 days

Studies have shown that low nutrition at a young age leads to delayed age of maturation (Ellis [2004] and Victora [2008]). Also, it is well established that the first thousand days after birth are extremely critical for later life health outcomes like BMI, hemoglobin and height (Almond and Currie [2010], Burke et al. [2014]). Therefore it is easy to see that the nutritional inputs that a woman receives in her childhood would impact her later life health (include onset of menarche). Therefore, I use this intuition to control for nutritional input at a young age using the women's adult height. A woman's adult height significantly depends on childhood height (Martorell and Habicht [1986], Martorell [1993], Herrinton and Husson [2001]), which itself is a function of childhood nutrition. Obviously, the ideal way to control for a woman's childhood socio-economic status would have been to control for characteristics of the woman's parents and the childhood environment in which she was raised. In the absence of these details, I include the woman's adult height as a "catch all" control variable to do the best I can to avoid an omitted variable bias.

Another concern is that adverse events early in life might also impact menarche age and other outcomes simultaneously. Havin said that, in a recent paper, Odongkara Mpora et al. [2014] find that early life adverse events do not have an effect on the age at menarche in Uganda. This finding is mostly at odds with the literature which shows that adverse events in infancy do affect adult health outcomes (Shah and Steinberg [2013], Currie [2011], Almond and Currie [2011], Almond et al. [2005], Gluckman and Hanson [2004], Fogel [1991], Fogel [1990], Martorell and Habicht [1986]). To mitigate the effect of early life adverse events affecting age at puberty, I include birth year fixed effects for the women which will account for any adverse events like flood, famine, drought or any other socio-economic shock that could impact the household in that year.[9]

Additionally, it has been found in some cases that geographical factors like temperature and altitude could also potentially affect the age at puberty (Kapoor and Kapoor [1986],

[9]I have tried including dummies for the first two years of life and find very similar results to the ones reported here.

Saar et al. [1988]). A check for whether this is the case in Uganda or not would be to run a regression of the age at menarche on temperature, altitude and other potential determinants of age at menarche and check if these coefficients are significant. Therefore, for the time being[10], I include altitude and district level dummies to capture time invariant locational effects.[11] This set of dummies is in addition to the birth year dummies.

Recall Bias may be a concern as the women are trying to remember an event that happened a while ago. This would imply that remembering the exact age of onset of puberty might be challenging. Firstly, because onset of menarche is a big event in the cultural context of many developing countries like Uganda, there is a reason to believe that the women will remember at least the year with a fair bit of accuracy. Leenstra et al. [2005] and Ellis [2004] provide some evidence that recall data of onset of puberty is worth using in analyses. Additionally, a concern might be that women might recall the menarche age in relation to the marriage age. This will not be a concern if it raises the accuracy of the recall. Conversely, it might be a concern if it introduces spuriously high correlation between marriage age and menarche age. Here, the correlation between marriage age and menarche age is 0.18 which is not high enough to cause this concern.

6 Results

Based on the IV methodology described in the previous section, I find statistically significant negative effects of early marriage of women on their later life outcomes. Early marriage reduces the highest grade obtained in school, their chances of being literate and the probability of them being part of the labour force. Also, I also show that early marriage reduces the amount of decision making power that the women have in their respective post-marital households. I use multiple definitions of decision making power as potential robustness checks. Additionally, I find negative impacts on variables related to reproductive behaviour

[10] I am planning to extend this to include actual weather data

[11] The altitude is measured at the *cluster* level and hence including the altitude variable is equivalent to including cluster level fixed effects.

like contraceptive use, age at first birth, usage of ante natal care, knowledge of AIDS, and other variables such as women's perceptions towards wife beating, spousal education status and spousal age gap. Further more, I examine the impact on intergenerational health variables i.e. health outcomes of children born in these marriages. I find negative effects of early marriage on hemoglobin, height and BMI of the children born in these marriages.

As seen in the two panels of table 2, for the same model specification, Ordinary Least Squares (OLS) underestimates the coefficient on the marriage age variable as compared to the IV estimate. This implies that the OLS estimate is attenuated either due to the presence of measurement error or due to an omitted variable bias. This is consistent with a situation where younger brides systematically marry into economically and socially better off households. This is consistent with the social norm that younger (and virgin) brides have a higher demand in the marriage market in Uganda.

Many of the outcome variables that are explored here are binary variables- they only take values of zero or one. Therefore, for these types of outcomes the model that I use for the analysis has to be one of the following- Linear Probability Model (LPM), Probit or Logit. The choice between the three is not always straightforward, especially in the case of IV estimation. Each method has its advantages and limitations. With LPM, the most basic criticism that is made is that the error term is not independent of the covariates in the model (unless there is just a single binary covariate). Another fairly common criticism of the LPM is that the predicted values are sometimes outside the zero to one (feasible values) range. The typical response to these criticisms is that the purpose of the LPM is not to make predictions for the entire support of the covariates, but rather for a subset of the support. Additionally, LPM has a constant marginal effect that might be preferable in a variety of circumstances.

In the same vein, Probit and Logit models have their own pros and cons. While they are both non-linear models of binary choice affording more flexibility, they impose some strong assumptions on the error term of the structural model. It is hard to check if these assumptions

are the right ones for the data provided, unless there is some theory supporting these assumptions. In crux, the choice between the LPM, Logit and Probit is a difficult one to make in most cases and especially so in cases where the theory does not provide for plausible assumptions on the error term. In this paper, to alleviate concerns relating to model selection, I use both, a non-linear (Probit) and a linear (LPM) model and then compare results from these models. I observe that there are almost no differences in the coefficient from the LPM and the marginal effect[12] from the Probit model. Nevertheless, using both models not only makes the analysis more complete, but also serves as a check for the sensitivity of the results to model selection.

For clean identification of the effect in an IV estimation, there needs to be a strong relation between the instrument (age of puberty) and the instrumented variable (marriage age). The first stage regressions in table 1 confirm that this relation is strong in our dataset. The *marriage* variable is significant at the one percent level in all the specifications presented here. This result is robust to the addition of a variety of control variables. Additionally, the F-statistic of the excluded regressor in the first stage is reported in the table. It is well above the critical value of 10, the cutoff suggested by Staiger and Stock [1997] for a weak instrument problem. Now I present the main results of this paper.

6.1 Schooling Outcomes

I begin my analysis by examining the impact of early marriage on women's highest grade attained and their chances of being literate- which depends on their number of years of schooling. Here, I calculate the treatment effect on the treated and the Intent-To-Treat (ITT) effects. The treatment effect on the treated provides more precision when a fairly large proportion of the population is outside the influence of the treatment. To calculate this, using intuition in Field and Ambrus [2008], I restrict the sample to female children who were enrolled in schools at the age of nine.[13] The age of nine is chosen as a cutoff point because the earliest puberty

[12] calculated at the mean value of the covariates

[13] For this purpose I create a dummy variable which takes a value of one if the woman was not in school at age nine and one otherwise. Since starting age of schooling in Uganda is six years, I assume that women who have attended at least the third grade were in school when they were nine years old. Because the women could have been in school till the age of nine but not have achieved third grade (due to grade repetition), this method potentially

onset is around 11 years of age and the first signs of puberty may show up nearly two years prior to it's actual onset. For sake of completeness, I also calculate the average treatment effect by considering the IV estimates for the entire population. To measure the impact on literacy, I use data on whether the woman was able to read none/part/complete sentence that is posed to her. As explained earlier, interviewers were provided with cards on which these sentences were printed and they were trained to make a judgment on how to classify a certain woman.

Specification 6 of Panel A in Table 2 shows that the effect of a one year delay in marriage raises the highest grade attained in school by 0.49 years. This is an ITT estimate whereas the corresponding average treatment effect is a reduction of 0.75 years in highest grade attained (specification 4). The exact magnitude of the effect varies depending on the model specification but the lower bound of the estimate is 0.48 years. Similarly, table 3 shows that an increase in the marriage age by a year leads to an increase in the probability of being literate by around 6 to 10 percent. This result is robust to model selection- LPM or Probit. Both these results imply that there are potentially large gains in female education to be realized if their marriage is delayed. For example, even a meagre increase in the average age of marriage from 17 years to the legal marrying age of 18 years, would imply an increase in highest grade achieved for the whole population by around 5 percent.

6.2 Societal Status

Next I look at outcomes related to the status of women in the society- both actual and as perceived by the women themselves. I use variables related to a woman's labour force participation, decision making power in the household and perceptions related to the practice of wife beating to quantify their societal status.

Table 3 shows the estimates of the effect of marriage age on chances of being part of the labour force. As explained earlier, I use both the LPM and Probit specifications to find the size of the effect as it serves the dual purpose of including linear and non-linear models along

underestimates the number of women who were in school at age nine.

with serving as a robustness check. The results suggest that there is a statistically significant negative effect of early marriage on the probability of labour force participation in the order of 1-4 percent depending on the covariates included in the model. The effect is statistically significant in almost all of the specifications. I only report the probit estimates in the table, although I verify that the LPM IV estimates also give similar results.

Similarly, I measure the impact of early marriage on the post marriage decision making power of women by defining decision making power in two alternative ways- having some say in the decision making process and actually making the decision herself. Both of these measures are useful as they quantify different aspects of the decision making process. If the woman takes important decisions related to the household herself, then she is perceived to have a high standing in the household.[14] Even if women have some say in the decision making process, then it shows their involvement in the decision making process of the household, which is also a sign of a relatively high position in the household hierarchy. In some cases, when there are other older members in the household, it might be unreasonable to expect the relatively younger female to take all the decisions.[15] Therefore, having some say in decision making power is a more reasonable measure of the role women play in decision making in the household.

As described earlier, the decision making power variables are computed based on a question in the survey that asks for the role played by the woman in the decision making process in the household with regard to six categories- own health care, children's health care, large household purchases, purchases for daily needs, visiting family and daily cooking decisions. While measuring if the woman has full decision making power in any of these decisions, we create a variable that takes a value of one if she responded to having full power in that particular decision category, or zero otherwise. I do not aggregate across the different

[14] I exclude all households headed by the females (who are part of our our sample) because they will be systematically different in their decision making process as compared to other households in the sample.

[15] My sample consists of women aged 15-49 years. Therefore, there are lots of young women who cannot always be expected to play a role in the decision making of the household.

categories of decisions because each represents a different type of decision and if I aggregate across them, then there might be valuable information lost. Analogously, I create a variable that takes value one if the woman says that she has some say in a decision category and zero otherwise. I follow the same steps as above to get a variable for some say in decision making process.

Panels A and C of Table 4 provide an estimate for the effect of marriage age on full decision making power. The outcome variables are dummy variables and I estimate the effect using both the LPM and the Probit method. I find that both the models give similar results. Similarly, panels B and D of the same table I show that there is a statistically significant positive effect of later marriage on having some (or partial) power in decision making in the household. The effect size is largest on decisions related to own health and to those related to what should be cooked at home. These are important decisions in the household as they affect the health and well being of all the members in the family. This links itself neatly with literature that talks about how women having more decision making power related to food and food expenditures then the leads to households being better off.

Similarly, in panels B and D of Table 4 I show that there is a significant positive effect of marrying later on partial participation in decision making process across all categories. In this case the magnitude of the effect is in the order of 2-10 percent depending on the specification and the particular decision category in consideration. The striking aspect of the estimates in panels B and D is that the magnitude of the effect is fairly high and uniform across the different categories of decision. These results provide important insights from a policy perspective. It shows that there are large gains in decision making power to be realized for women by raising their age at marriage.

Along with decision making power, I look at how women perceive their status in the household viz-a-viz the practice of wife beating. Wife beating is very prevalent in Uganda with studies showing that nearly 30 percent of women experiencing physical threats or abuse from their partner (Koenig et al. [2003]). In Table 5, I show the results from the estimation of

the impact of marriage age on perception of women towards the practice of wife beating. As explained earlier, this data is based on the women being asked questions about whether they feel that it is justified for the husband to beat the wife in five hypothetical scenarios.[16] I created categorical variables which take a value of one in case the woman mentioned that the practice of wife beating was acceptable in that scenario (and zero otherwise). Note that this does not imply anything about whether that woman herself was subject to this practice or not. This is simply an indicator of the woman's perception towards wife beating.

As per Table 5, the coefficient on the marriage age variable is statistically significant and negative. This implies that a higher marriage age means a lower chance that the women would say that wife beating is justified. The magnitude of the effect is 1-7 percent depending on the covariates included in the model. This result is unique because it studies the perception of women towards a socially prevalent but unacceptable practice that is oppressive towards their gender. In that sense it shows that women marrying later are somehow more socially emancipated and feel that practices such as wife beating are not justified. This would make them more inclined to stand up against such things within their household and in the community. This hints towards a higher perceived social status for later married women.

6.3 Sexual Behaviour and Knowledge

Now, I shift my attention to the effect of marriage age on sexual behaviour and related knowledge. Firstly, I look at the impact on contraceptive use and knowledge about the AIDS virus. Then, I focus on the impact on timing of the first child after marriage, age at first birth and usage of antenatal care resources.

Table 6 shows that there are highly significant positive effects of marriage age on the probability of using any type of contraception. The effect is in the range of 1-2 percent and is statistically significant at the five/ten percent level of significance. This result is fairly robust

[16] (1) *If she goes out without telling him?*, (2) *If she neglects the children?*, (3) *If she argues with him?*, (4) *If she refuses to have sex with him?*, (5) *If she burns the food?*.

to the addition of covariates to the model. Again, using both LPM and Probit IV specifications serves as robustness checks to model assumptions and I find that there is little difference in the coefficients from LPM and the marginal effects from the Probit model. The same table uses a LPM model to show that there is a small effect of a higher marriage age on knowledge of AIDS. I use two different first stage specifications to check the robustness of these results.

In panels A, B and C of Table 7 I estimate the effect of marriage age on time to first child, mother's age at first birth and ante natal care taken respectively. The time to first child is measured as the number of months from marriage to the birth of the first child. [17] Panel A shows that there is a large statistically significant negative effect on the time to first child i.e. when women get married at an older age, then their first child is born sooner. Additionally, using Table 7 it can be seen that there is a statistically significant one is to one increase in the woman's age at first birth with an increase in the marriage age of the woman.[18] This is of particular significance in contexts where there are high rates of child marriage. This is because of the concerns accompanying the early birth of first child which in turn implies complications that might affect the child's health.

I measure antenatal care usage by defining a dummy variable that takes a value of one if the woman accessed any form of ante natal care in the first trimester of the pregnancy. As this is a dummy variable, I use both the LPM and Probit IV models to measure the effect of marriage on antenatal care use. The results in Table 7 suggest there is a small and insignificant positive effect on using ante natal care. The coefficients are almost all positive i.e. they show a positive impact of marriage age on ante natal care usage, but they are mostly significant only in the Linear probability model. Ensor et al. [2014] find that usage of antenatal care increases the chances of using institutional delivery mechanisms and also maternal knowledge. Similarly, Halim et al. [2011] show that when prospective mothers use antenatal care then it significantly

[17] In the data there were 851 women who had a child before marriage i.e. a negative value for the time to first birth. I have not considered these women in this analysis.

[18] For this table I only consider women who had children after marriage. The reason is that mothers who have children before marriage will be systematically different from other women in the population. Therefore they might face widely varying constraints related to marriage and menarche.

improves the health of the children in infancy and early childhood. My results suggest that marriage age could indirectly impact these outcome variables through it's effect on antenatal care usage. An important caveat of the analysis here is that I only consider the quantity of antenatal and not the content(quality) of it- which Bloom et al. [1999] point out is also critical in assessing antenatal care because of wide variance in provision of services.

6.4 Marriage Market

I estimate the effects on marriage market outcomes for the women by examining the effect that age at marriage has on the highest grade attained by the spouse and the spousal age gap. I use these as proxies for the quality of the marriage- higher spousal education and a lower age gap are more desirable. The spousal education is defined as the highest grade attained by the spouse and the age gap is measured as the difference (in years) in the husband's and wife's age. Panel A in Table 8 shows the impact on spousal education. The coefficient of marriage age is positive and significant. This implies that women who get married later do so with *more* educated grooms. Because the highest grade of the spouse is measured when they are an adult and not at the time of marriage (although they could be the same), we can interpret this as a slight increase in marriage market prospects. A more equitable marriage might also be seen through the reduction in the education gap between the spouses. Results from the analysis here suggest that a higher marriage age increases the education of the woman (Table 2) and her husband(Table 8). But it might be the case that the educational gap between a woman and her spouse might go up. Therefore, in panel B of Table 8 i present estimate of the impact of marriage age on the spousal education difference. The coefficient is negative and significant which shows that the spousal education gap falls.

Table 8 uses the IV method to calculate the impact on marriage quality as measured by spousal age gap. The average age gap between the spouses is 6.7 years with a relatively high standard deviation of 6.6 years. The coefficient on marriage age is negative which implies that that the spousal age gap falls as marriage age rises. Kelly et al. [2003] find that a higher age gap leads to a greater chance of HIV infections which is a major concern in a context like Uganda

where HIV prevalence rates are extremely high. Although I find significant positive effects of a higher marriage age on marriage quality, I am not able to explain the mechanisms through which this might operate using this dataset.

6.5 Intergenerational Impacts

Until this point, I have been focusing on the effect of marriage age on later life outcomes of the woman herself. Now I turn my attention to the effects of marriage age of a woman on the outcomes of her children i.e. the next generation. Because I am looking at how the characteristics of one generation impacts the outcomes of the next generation, I term it as Intergenerational Impacts. Towards this end, I use outcome data related to the children's health. I use the height, weight and BMI measures to construct Z-scores for each health indicator based on standard World Health Organization (WHO) definitions. I use the absolute level of the hemoglobin level in my analysis. The analysis in Tables 9 and 10 suggests that there is a statistically significant positive effect of marriage age on hemoglobin levels, height z-score and BMI z-score, although the effect on BMI is weak. The impact on weight is also positive, but it is not statistically different from zero.

Table 9 shows that there is a statistically significant positive effect of higher marriage age on the hemoglobin level of child. Table 9 measures the impact on a dummy variable that takes value of one if the hemoglobin level of the child is below 11 g/dl. This cutoff has been prescribed by the World Health Organisation (WHO) as the threshold below which a child would be considered anemic. Table 9 shows that the coefficient on marriage age is negative and significant which implies that later marriage reduces the chances that the child's hemoglobin will be less than the acceptable level of 11 g/dl. In addition, Table 9 shows that the probability of the child being severely anemic (below 7 g/dl) also falls but the estimates are small and significant mostly in the Probit specification only.

These results are consistent with the narrative that we obtain from the results discussed previously in this paper. An earlier marriage means lower level of education, literacy and de-

cision making power for a women. This would imply that the women have a lesser say over the resource distribution in the household and are less able to impact the quality of life of their children. For the children's health indicators, the direction of the effect is consistent with this theory, but some of the estimates are not statistically significant. This is further supplemented by the fact that I find a negative effect of earlier marriage on decision making power of the women with respect to their childres's health (Table 4). All together, this provides weak evidence that there is a positive intergenerational impact of increased marriage age. The results here can be taken as a starting point and there needs to be further analysis of this question to draw stronger conclusions on this issue.

7 Robustness Checks

Throughout the analysis I show that my results are robust to the addition of a wide variety of control variables, fixed effects for the birth year of the woman and district dummies. This alleviates some concerns related to spurious correlations and data mining. As an basic robustness check, I use alternative ways of defining variables related to the marriage age of the woman. I use two different definitions of "early" marriage- marrying under the age of 16 years and marrying under the age of 18 years. Marriage age of 18 years is almost universally accepted as an appropriate minimum age for marriage and hence is a useful threshold to examine. In the Ugandan context, examining a cutoff of 16 years also make sense as almost 43 % of the population got married under or at the age of 16 years. I explore how my results are impacted when I use these alternate definitions of the main independent variable of interest. Tables 11 and 12 show that the results obtained remain fairly robust. Almost all the coefficients have the expected sign and these are consistent with findings in the earlier tables. Having said that, some coefficients do lose significance, but this is not a major concern as they more or less retain the same sign and do not impact the overall conclusions that can be drawn from this analysis.

One of the central concerns of any IV analysis is the exclusion restriction, that is the

instrument should not affect the outcome directly or through any channel other than the endogenous variable. Earlier in the paper, I address concerns related to potential other channels through which the instrument could affect the outcome variable. To add further credibility to my results, I use causal mediation analyses described in Sobel [1982] and Imai et al. [2010]. Both these papers employ different approaches to causal mediation analysis, which decomposes the total effect that a dependent variable has on an independent variable into two parts- the direct effect and the indirect effect through a mediator. In my context, I am trying to test as what proportion of the effect of the instrument (menarche age) on an outcome (like woman education) is direct and how much is mediated through the marriage age.

I deally, i would find that the direct effect of menarche age on an outcome is mostly mediated through marriage age and not through other channels. Using the two different causal mediation techniques mentioned above, I do find that the bulk of the effect that menarche age has on any outcome variable flows through the mediator of interest (age of marriage). I check if the effect of marriage age on education is mediated through other channels like health (mother's height), women's parent's education[19] (spousal education) etc. I find that the mediation through these channels is orders of magnitude lesser than through age of marriage. This further reduces concerns related to the exclusion restriction of the instrument.[20]

As is the case in almost all IV analyses, the exclusion restriction is not perfectly testable. The mediation analysis enhances the plausibility of the exclusion restriction but it does not guarantee that the exclusion restriction is satisfied. As a further robustness check of the results, I look at what happens to the impact estimates if I assume that the exclusion restriction is violated, i.e. there is a non-zero direct effect of the instrument on the outcome. Conley et al. [2012] explore this idea and come up with techniques of inference while relaxing the complete exogeneity assumption in an IV analysis. I employ the Union of Confidence Intervals (UCI)

[19] A woman with parents who are richer or have more socio-economic resources would marry with potentially higher educated males i.e. positive assortative matching in the marriage market

[20] You can contact the author for more details on this.

procedure outlined in their work[21]. Basically, this method creates a union of confidence regions based on a researcher specified value of γ, which is the size of the direct effect of the instrument on the outcome variable. The higher the value of γ, the higher is the extent of violation of the exclusion restriction. Once the researcher specifies the value of γ, this technique provides an interval in which the effect of interest would lie in.

Although this method provides a technique to test the sensitivity of the results to violation of the exogeneity assumption, one should be careful in using such a technique. Conley et al. [2012] warns readers that one of the caveats of this technique is that it might give a wide confidence interval, which might not be very informative. In this case it turns out to be useful as rather than using this method to predict the coefficient of interest, I am using this as a robustness check. Because it provides a wide confidence interval, this method provides a sterner test of the true effect size. For example, in Table 2 I find that the impact of an increase in marriage age by one is an increase in highest grade attained by 0.75 years. If I relax the exogeneity assumption and find that the estimate retains it's sign and statistical significance, then it would further increase the reliability of these estimates.

Ideally, IV estimation requires that γ be zero i.e. the direct impact of the instrument on the outcome be zero. I increase the value of γ in steps of 0.025 and see that at even a level of $\gamma = 0.25$, the confidence interval on the estimate of marriage age on education does not include the value of zero. This means that even in the presence of a moderate direct effect of the instrument on the outcome, the effect size does not become insignificant. Given that the results are robust to so many different specifications and tests, I would cautiously interpret them as being the causal effects.

[21] For a detailed discussion on this, please look at Conley et al. [2012]

8 Conclusion

In this paper, I find that there are large and significant effects of early marriage on later life outcomes of women like education, literacy and labour force participation. There are significant negative effects of early marriage on other outcomes like decision making power and perceived societal status as measured by perceptions of wife beating. I also find significant effects on women's marriage market outcomes and their reproductive behaviour. I extend the analysis to examine impacts on children's health outcomes. I find that there are significant negative effects of earlier marriage on hemoglobin and probability of being anemic and severely anemic. I find negligible effects on other health outcomes like height, weight and BMI. Together, all of this implies a significant social cost of an early marriage on the women and their children. Conversely, this implies large gains to be reaped by a more strict adherence of the marriage age laws.

References

Linda S. Adair. Size at birth predicts age at menarche. *Pediatrics*, 107, 2001.

IO Adebara and Munir'deen Ijaiya. Relationship of biosocial factors and hemoglobin genotype with age of menarche among school girls in ilorin, nigeria. *Nepal Journal of Obstetrics and Gynaecology*, 7(1), 2013.

Douglas Almond and Janet Currie. Human capital development before age five. Working Paper 15827, National Bureau of Economic Research, March 2010.

Douglas Almond and Janet Currie. Killing me softly: The fetal origins hypothesis. *The journal of economic perspectives: a journal of the American Economic Association*, 25(3):153, 2011.

Douglas Almond, Kenneth Y Chay, and David S Lee. The costs of low birth weight*. *The Quarterly journal of economics*, 120(3):1031–1083, 2005.

Siwan Anderson. Why dowry payments declined with modernization in europe but are rising in india. *Journal of Political Economy*, 111(2):269–310, 2003.

Siwan Anderson. The economics of dowry and brideprice. *The Journal of Economic Perspectives*, pages 151–174, 2007.

Joshua D. Angrist and Guido W. Imbens. Two-stage least squares estimation of average causal effects in models with variable treatment intensity. *Journal of the American Statistical Association*, 90(430):431–442, 1995. doi: 10.1080/01621459.1995.10476535.

Joshua D. Angrist and Alan B. Krueger. Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments. *Journal of Economic Perspectives*, 15 (4):69–85, 2001.

Joshua D Angrist, Guido W Imbens, and Donald B Rubin. Identification of causal effects using instrumental variables. *Journal of the American statistical Association*, 91(434):444–455, 1996.

Gary Stanley Becker and Gary S Becker. *A Treatise on the Family*. Harvard university press, 1991.

Catherine S. Berkey, Jane D. Gardner, A. Lindsay Frazier, and Graham A. Colditz. Relation of childhood diet and body size to menarche and adolescent growth in girls. *American Journal of Epidemiology*, 152(5):446–452, 2000.

David Bishai and Shoshana Grossbard. Far above rubies: Bride price and extramarital sexual relations in uganda. *Journal of Population Economics*, 23(4):1177–1187, 2010. ISSN 0933-1433. doi: 10.1007/s00148-008-0226-3.

Shelah S Bloom, Theo Lippeveld, and David Wypij. Does antenatal care make a difference to safe delivery? a study in urban uttar pradesh, india. *Health Policy and Planning*, 14(1):38–48, 1999.

John Bound, David A. Jaeger, and Regina M. Baker. Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association*, 90(430):443–450, 1995.

Rachel Burke, Juan.S. Leon, and Parminder. S. Suchdev. Identification, prevention and treatment of iron deficiency during the first 1000 days. *Nutrients*, 2014.

Benjamin C. Campbell and J. Richard Udry. Stress and age at menarche of mothers and daughters. *Journal of Biosocial Science*, 27(2):127–127, 1995.

S Chowdhury, AK Shahabuddin, AJ seal, KK Talukder, Q Hassan, RA Begum, Q Rahman, A Tomkins, A Costello, and MQ Talukder. Nutritional status and age at menarche in a rural area in bangladesh. *Annals of Human Biology*, 27(3):249–256, 2000.

Shelley Clark. Early marriage and hiv risks in sub-saharan africa. *Studies in Family Planning*, 35 (3):149–160, 2004.

Timothy G Conley, Christian B Hansen, and Peter E Rossi. Plausibly exogenous. *Review of Economics and Statistics*, 94(1):260–272, 2012.

Janet Currie. Inequality at birth: some causes and consequences. Technical report, National Bureau of Economic Research, 2011.

Monika Dahiya and Vinod K Rathi. Relationship between age at menarche and early-life nutritional status in india. *British Journal of Sports Medicine*, 44, 2010.

Marleen Dekker and Hans Hoogeveen. Bride wealth and household security in rural zimbabwe. *Journal of African Economies*, 11(1):114–145, 2002.

Bruce J Ellis. Timing of pubertal maturation in girls: An integrated life history approach. *Psychological Bulletin*, 2004.

Tim Ensor, Paula Quigley, Cathy Green, Abdul Razak Badru, Dynes Kaluba, and Seter Siziya. Knowledgeable antenatal care as a pathway to skilled delivery: modelling the interactions between use of services and knowledge in zambia. *Health Policy and Planning*, 29(5):580–588, 2014.

Erica Field and Attila Ambrus. Early marriage, age of menarche, and female schooling attainment in bangladesh. *Journal of Political Economy*, 116(5):pp. 881–930, 2008.

Robert Fogel. The conquest of high mortality and hunger in europe and america. Working Paper 16, National Bureau of Economic Research, 1990.

Robert Fogel. New sources and new techniques for the study of secular trends in nutritional status, health mortality and the process of aging. Working Paper 26, National Bureau of Economic Research, 1991.

David S Freedman, Laura Kettel Khan, Mary K Serdula, William H Dietz, Sathanur R Srinivasan, and Gerald S Berenson. Racial differences in the tracking of childhood bmi to adulthood. *Obesity research*, 13(5):928–935, 2005.

Peter D Gluckman and Mark A Hanson. Living with the past: evolution, development, and patterns of disease. *Science*, 305(5691):1733–1736, 2004.

Nafisa Halim, Alok K Bohara, and Xiaomin Ruan. Healthy mothers, healthy children: does maternal demand for antenatal care matter for child health in nepal? *Health Policy and Planning*, 26(3):242–256, 2011.

Lisa J Herrinton and Gail Husson. Relation of childhood height and later risk of breast cancer. *American journal of epidemiology*, 154(7):618–623, 2001.

Daniel.L. Hicks and Joan Hamory Hicks. Lucky late bloomers: The consequence of early marriage for women in western kenya. *Working Paper*, 2014.

SA Huzzayin and GT Acsadi. *Family and Marriage in some African and Asiatic countries*, volume 6. Cairo Demographic Centre, 1976.

Kosuke Imai, Luke Keele, and Teppei Yamamoto. Identification, inference and sensitivity analysis for causal mediation effects. *Statistical Science*, pages 51–71, 2010.

Robert Jensen and Rebecca Thornton. Early female marriage in the developing world. *Gender & Development*, 11(2):9–19, 2003.

A.K. Kapoor and Satwanti Kapoor. The effects of high altitude on age at menarche and menopause. *International Journal of Biometeorology*, pages 21–26, 1986.

J Kaprio, A Rimpelä, T Winter, RJ Viken, M Rimpelä, and RJ Rose. Common genetic influences on bmi and age at menarche. *Human Biology*, 1995.

D.K. Kaye, F Mirembe, A Johansson, A.M. Ekstrom, and G.B. Kyomuhendo. Implications of bride price on domestic violence and reproductive health in wakiso district, uganda. *African Health Science*, 5(4), 2005.

Robert J Kelly, Ronald H Gray, Nelson K Sewankambo, David Serwadda, Fred Wabwire-Mangen, Tom Lutalo, and Maria J Wawer. Age differences in sexual partners and risk of hiv-1 infection in rural uganda. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 32(4): 446–451, 2003.

Michael A. Koenig, Tom Lutalo, Feng Zhao, Fred Nalugoda, Fred Wabwire-Mangen, Noah Kiwanuka, Jennifer Wagman, David Serwadda, Maria Wawer, and Ron Gray. Domestic violence in rural Uganda: evidence from a community-based study. *Bulletin of the World Health Organization*, 81:53 – 60, 01 2003. ISSN 0042-9686.

Tjalling Leenstra, LT Petersen, SK Kariuki, AJ Oloo, PA Kager, and FO Ter Kuile. Prevalence and severity of malnutrition and age at menarche; cross-sectional studies in adolescent schoolgirls in western kenya. *European journal of clinical nutrition*, 59(1):41–48, 2005.

Reynaldo Martorell. Enhancing human potential in guatemalan adults through improved nutrition in early childhood. *Nutrition Today*, 28(1):6–13, 1993.

Reynaldo Martorell and Jean-Pierre Habicht. Growth in early childhood in developing countries. 1986.

B. Odongkara Mpora, T. Piloya, S. Awor, T. Ngwiri, P. Laigong, and Z. Mworozi, E. A. & Hochberg. Age at menarche in relation to nutritional status and critical life events among rural and urban secondary school girls in post-conflict northern uganda. *BMC Women's Health*, 2014.

Emily Oster and Rebecca Thornton. Menstruation, sanitary products, and school attendance: Evidence from a randomized evaluation. *American Economic Journal: Applied Economics*, pages 91–100, 2011.

C. Padez. Age at menarche of schoolgirls in maputo, mozambique. *Annals of Human Biology*, 30(4):487–495, 2003. doi: 10.1080/0301446031000111401.

JH Rah, AA Shamim, UT Arju, AB Labrique, M Rashid, and P. Christian. Age of onset, nutritional determinants, and seasonal variations in menarche in rural bangladesh. *Journal of Health, Population, and Nutrition*, 2009.

Anita Raj, Niranjan Saggurti, Michael Winter, Alan Labonte, Michele R Decker, Donta Balaiah, and Jay G Silverman. The effect of maternal child marriage on morbidity and mortality of children under 5 in india: cross sectional study of a nationally representative sample. *BMJ*, 340, 2010.

Vijayendra Rao. The rising price of husbands: A hedonic analysis of dowry increases in rural india. *Journal of political Economy*, pages 666–677, 1993.

E. Saar, C. Shalev, I. Dalal, and U.A. Sod-Moriah. Age at menarche: the influence of environmental conditions. *International Journal of Biometeorology*, pages 33–35, 1988.

Sheetal Sekhri and Sisir Debnath. Intergenerational consequences of early age marriages of girls: Effect on children's human capital. *The Journal of Development Studies*, 50(12):1670–1686, 2014.

Manisha Shah and Bryce Millett Steinberg. Drought of opportunities: contemporaneous and long term impacts of rainfall shocks on human capital. Technical report, National Bureau of Economic Research, 2013.

Isthrinayagy S. Krishnarajah Shayesteh Jahanfar, Munn-Sann Lye. Genetic and environmental effects on age at menarche, and its relationship with reproductive health in twins. *Indian Journal of Human Genetics*, 2013.

Aloysius Siow and Maristella Botticini. Why dowries? *American economic review*, 93(4):1385–1398, 2003.

Michael E. Sobel. Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology*, 13:290–312, 1982.

Douglas Staiger and James H Stock. Instrumental variables regression with weak instruments. *Econometrica: Journal of the Econometric Society*, pages 557–586, 1997.

Kaspar Sørensen, Anders Juul, Kaare Christensen, Axel Skytthe, Thomas Scheike, and Tina Kold Jensen. Birth size and age at menarche: A twins perspective. *Human Reproduction*, 2013.

F.R. Tumwine. Changes in marriage practices among the bafumbira of western uganda. 2015. doi: 10.5897/JGRP2014.0473.

Adair L. Fall C. Hallal P. C. Martorell R. Richter L. Victora, C. G. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet*, 2008.

Desalegn T Zegeye, Berihun Megabiaw, and Abay Mulu. Age at menarche and the menstrual pattern of secondary school adolescents in northwest ethiopia. *BMC Women's Health*, 9(1):29, 2009.

Junsen Zhang and William Chan. Dowry and wife's welfare: A theotrical and empirical analysis. *Journal of Political Economy*, 107(4):786–808, 1999.

FIGURES

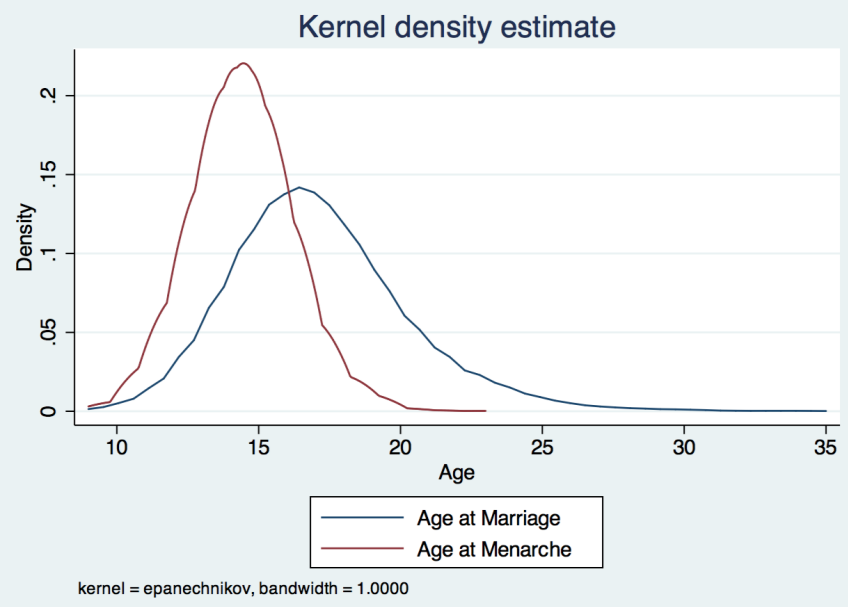

Figure 1: Kernel Density for the full sample.

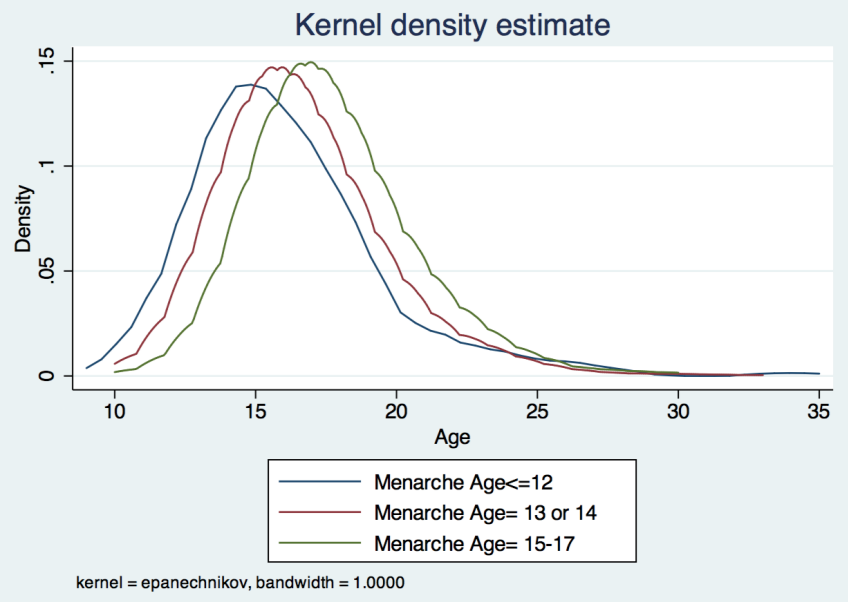

Figure 2: Kernel Density estimate of Age at Marriage for sub-populations divided on the basis of Age of Menarche. This clearly shows that Age at Marriage shifts systematically with Age at Menarche. we will be using this in the justification of the instrument.

TABLES

Table 1: **First Stage Regressions- Dependent variable is Age at First Marriage**

	(1)	(2)	(3)	(4)	(5)	(6)
menarcheage	0.49***	0.48***	0.47***	0.45***	0.43***	0.49***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.06)
mheight		0.03***	0.03***	0.02***	0.02***	0.03***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
motherage		0.06***			0.07***	0.06***
		(0.01)			(0.01)	(0.01)
Catholic		0.39*	0.38*	0.35*	0.67**	0.04
		(0.22)	(0.22)	(0.20)	(0.26)	(0.28)
Protestant		0.14	0.12	0.11	0.26	-0.00
		(0.22)	(0.23)	(0.20)	(0.27)	(0.28)
Muslim		-0.11	-0.11	-0.08	0.07	-0.32
		(0.26)	(0.27)	(0.25)	(0.32)	(0.35)
Universe	All	All	All	All	Inschool9	Outschool9
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	No	No	Yes	Yes	No	No
District Dummy	No	No	No	Yes	No	No
Observations	5316	4935	4935	4935	2690	2231
F-Statistic	208.3	183.8	181.3	167.6	79.7	80.0

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Note: The dependent variable in these regressions is Age at First Marriage. The control variables include Dummy for the presence of multiple wives in HH, a wealth index for the household, household size, Urban dummy, altitude, Regional dummies and dummy for living in a brickhouse. The standard errors are robust and clustered at the district level. The unit of observation is a woman i.e. one observation corresponds to a woman in the dataset.

Table 2: **Female Highest Grade Attained**

Panel A: Instumental Variable Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	0.75***	0.75***	0.75***	0.75***	0.48***	0.49***
	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)
Universe	All	All	All	All	In at 9	In at 9
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	No	No	Yes	Yes	Yes	Yes
District Dummy	No	No	No	Yes	No	Yes
Observations	4925	4921	4921	4921	2690	2690

Panel B: OLS Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	0.26***	0.26***	0.26***	0.26***	0.19***	0.18***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Universe	All	All	All	All	In at 9	In at 9
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	No	No	Yes	Yes	Yes	Yes
District Dummy	No	No	No	Yes	No	Yes
Observations	4925	4921	4921	4921	2690	2690

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone and altitude I have verified that the results in this table are robust to the use of different first stage specifications (shown in Table 1).

Table 3: **Female Literacy and Labour Force Participation**

Panel A: Literacy- Probit IV

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagef	0.15***	0.19***	0.20***	0.29***	0.14***	0.23***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)
Marginal Effect	0.05	0.07	0.07	0.09	0.05	0.07
Universe	All	All	All	All	In at 9	In at 9
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	No	No	No	Yes	No	Yes
District Dummy	No	No	No	Yes	No	Yes
Observations	4909	4909	4909	4906	2677	2674

Panel B: Literacy- LPM IV

	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	0.10***	0.10***	0.10***	0.10***	0.08***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Universe	All	All	All	All	In at 9	In at 9
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	No	No	No	Yes	No	Yes
District Dummy	No	No	No	Yes	No	Yes
Observations	5286	4913	4909	4909	2677	2677

Panel C: Labour Force- Probit IV

	Probit Instrumental Variable					
marriageagesa	0.16***	0.06**	0.05*	0.06*	0.06*	0.12**
	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Marginal Effect	0.04	0.04	0.01	0.02	0.02	0.03
Universe	All	All	All	All	In at 9	In at 9
Birth Year FE	No	No	No	Yes	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4932	4932	4932	4932	2687	2624

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone, living in a brick house, region dummies and altitude. I have verified that the results in this table are robust to the use of different first stage specifications (shown in Table 1).

Table 4: **Decision Making Power of Women**

Panel A: Full Decision Power- LPM IV

	Child Health		Own Health		Daily Purchase		Large Purchases		Visit Family		Cooking Food	
marriageagef	0.05***	0.02**	0.07***	0.02**	0.05***	-0.00	0.06***	0.01	0.05***	0.00	0.05***	0.02**
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4925	4925	4925	4925	4924	4924	4922	4922	4923	4923	4923	4923

Panel B: Full Decision Power- Probit IV

	Child Health		Own Health		Daily Purchase		Large Purchases		Visit Family		Cooking Food	
marriageagef	0.18***	0.06**	0.20***	0.07***	0.19***	0.01	0.21***	0.05*	0.16***	0.02	0.20***	0.05*
Marginal Effect	0.054	0.017	0.071	0.023	0.045	0.001	0.063	0.014	0.049	0.006	0.045	0.012
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4921	4921	4921	4921	4920	4920	4918	4918	4919	4919	4919	4919

Panel C: Some Decision Power- LPM IV

	Child Health		Own Health		Daily Purchase		Large Purchases		Visit Family		Cooking Food	
marriageagef	0.08***	0.05***	0.07***	0.04***	0.09***	0.03***	0.10***	0.03***	0.07***	0.02**	0.05***	0.03***
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4921	4921	4921	4921	4920	4920	4918	4918	4919	4919	4919	4919

Panel D: Some Decision Power- Probit IV

	Child Health		Own Health		Daily Purchase		Large Purchases		Visit Family		Cooking Food	
marriageagef	0.22***	0.12***	0.21***	0.10***	0.26***	0.09***	0.25***	0.07***	0.21***	0.05**	0.27***	0.13***
Marginal Effect	0.079	0.042	0.069	0.033	0.093	0.030	0.093	0.026	0.069	0.017	0.043	0.020
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4921	4921	4921	4921	4920	4920	4918	4918	4919	4919	4919	4919

Table 5: **Wife Beating Perceptions**

Panel A: Probit IV

	Go Out		Burn Food		Neglect Child		Argue		Refuse Sex	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
marriageagefa	-0.03	-0.03	-0.15***	-0.15***	-0.03	-0.03	-0.15***	-0.15***	-0.09***	-0.10***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Universe	All	All	All	All	All	All	All	All	All	All
Birth Year FE	No	No	No	No	No	No	No	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4930	4930	4931	4931	4931	4931	4931	4931	4931	4931
Marginal Effect	-0.013	-0.012	-0.039	-0.039	-0.011	-0.010	-0.051	-0.054	-0.028	-0.029

Panel B: Linear Probability IV

	Go Out		Burn Food		Neglect Child		Argue		Refuse Sex	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
marriageagefa	-0.02**	-0.02**	-0.05***	-0.05***	-0.02**	-0.02**	-0.06***	-0.07***	-0.03***	-0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Universe	All	All	All	All	All	All	All	All	All	All
Birth Year FE	No	No	No	No	No	No	No	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4930	4930	4931	4931	4931	4931	4931	4931	4931	4931

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy and altitude.

Table 6: **Contraception & Knowledge of AIDS**

Panel A: Contraceptive

	Probit Instrumental Variable				Linear Probability IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
marriageagesa	0.04**	0.04*	0.05*	0.02	0.02***	0.01*	0.01*	0.01
	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Marginal Effect	0.012	0.011	0.013	0.005				
Universe	All	All	All	All	All	All	All	All
Birth Year FE	No	No	No	Yes	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4921	4921	4921	4918	4921	4921	4921	4921

Panel B: AIDS Knowledge (Transmission to child)

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagesa	0.007	0.012*	0.021***			
marriageagefa				0.011*	0.016**	0.025***
Universe	All	All	All	All	All	All
Birth Year FE	No	No	Yes	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4929	4929	4929	4939	4939	4939

Panel C: AIDS Knowledge (Multiple Partners)

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagesa	0.010***	0.011**	0.012**			
marriageagefa				0.011***	0.012***	0.012**
Universe	All	All	All	All	All	All
Birth Year FE	No	No	Yes	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4397	4397	4397	4405	4405	4405

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone, living in a brick house, region dummies and altitude.

Table 7: **Reproductive Behaviour**

Panel A: Time to First Child

	Second Stage Equation of IV Regression					
	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	-33.55***	-38.45***	-38.00***	-24.61	-39.42***	-23.24
	(11.04)	(12.48)	(12.36)	(16.79)	(12.79)	(17.16)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4939	4597	4593	2513	4593	2513

Panel B: Mother's Age at First Birth

	Second Stage Equation of IV Regression					
	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	1.00***	1.01***	1.02***	1.04***	1.01***	1.03***
	(0.04)	(0.04)	(0.05)	(0.07)	(0.05)	(0.07)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4098	3807	3805	2037	3805	2037

Panel C: Ante Natal Check up- First Trimester

	Probit Instrumental Variable				Linear Probability IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
marriageagefa	-0.04	0.01	0.02	0.01	0.08	0.11*	0.12*	0.11
	(0.03)	(0.04)	(0.04)	(0.07)	(0.05)	(0.06)	(0.06)	(0.07)
Marginal Effect	-0.004	0.001	0.002	0.001				
Universe	All	All	All	In at 9	All	All	All	In at 9
Birth Year FE	No	No	No	No	No	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3420	3420	3420	1886	3532	3532	3532	1952

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone, region dummies and altitude.

Table 8: **Marriage Market Outcomes**

Panel A: Years of Education of Spouse

	Second Stage Equation of IV Regression					
	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	0.42***	0.38***	0.38***	0.32**	0.39***	0.32***
	(0.09)	(0.10)	(0.10)	(0.13)	(0.10)	(0.12)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5048	4707	4703	2552	4703	2552

Panel B: Difference in Spousal Education

	Second Stage Equation of IV Regression					
	(1)	(2)	(3)	(4)	(5)	(6)
marriageage	-0.34***	-0.35***	-0.35***	-0.16	-0.35***	-0.15
	(0.08)	(0.09)	(0.09)	(0.12)	(0.09)	(0.11)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5040	4703	4699	2555	4699	2555

Panel C: Spousal Age Gap

	Specification I			Specification II		
	(1)	(2)	(3)	(4)	(5)	(6)
marriageagef	-0.46**	-0.40**	-0.37*			
	(0.18)	(0.18)	(0.22)			
marriageage4				-0.46**	-0.36*	-0.36*
				(0.21)	(0.22)	(0.21)
Universe	All	All	All	All	All	All
Birth Year FE	No	No	Yes	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4063	4063	4063	4063	4063	4063

[1] The coefficients are from the second stage of a 2SLS IV estimation. *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered. The control variables include dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone, region dummies and altitude.

Table 9: **Child Hemoglobin**

Panel A: Hemoglobin Levels (g/dl)

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagefa	0.16***	0.18***	0.17***	0.17***	0.18***	0.18***
	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Observations	4969	4969	4969	3339	4969	3339

Panel B: Probability of being Anemic (below 11 g/dl)

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagefa	-0.09***	-0.12***	-0.12***	-0.12***	-0.13***	-0.12***
Marginal Effect	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Observations	5302	5302	5302	3557	5302	3557

Panel C: Probability of being Severely Anemic (below 7 g/dl)

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagefa	-0.06**	-0.05*	-0.06**	-0.07*	-0.03	-0.04
Marginal Effect	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Observations	5302	5302	5302	3557	5268	3529

Table 10: **Child Health**

Panel A: Height Z-Score

	(1)	(2)	(3)	(4)	(5)	(6)
teenmarriagef	-0.562**	-0.216	-0.280	-0.770*	0.142	-0.262
	(0.25)	(0.31)	(0.32)	(0.39)	(0.56)	(0.54)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
District FE	No	No	No	Yes	Yes	No
Observations	5002	5002	5002	3369	5002	3369

Panel B: BMI Z-Score

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagefa	0.027	0.084*	0.054	0.041	0.108*	0.047
	(0.04)	(0.05)	(0.05)	(0.07)	(0.06)	(0.07)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Observations	4997	4997	4997	3364	4997	3364

Panel C: Weight Z-Score

	(1)	(2)	(3)	(4)	(5)	(6)
marriageagefa	0.032	0.017	0.006	0.015	0.001	0.003
	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.06)
Universe	All	All	All	In at 9	All	In at 9
Birth Year FE	No	No	No	No	Yes	Yes
Observations	5096	5096	5096	3427	5096	3427

Table 11: **Robustness Check- Teen Marriage (Under 18 years)**

Panel A: First Stage

	Full	Full	Full	Full	Inschool9	Outschool9
menarcheage	-0.05***	-0.05***	-0.05***	-0.04***	-0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	5316	4935	4935	4935	2690	2231
F-Statistic	91	81	80	73	43	43

Panel B: Woman Level Outcomes

	Edu	Labour	Literacy	Contraception	Spouse Edu	Spouse Edu diff
teenmarriage	-7.67***	-0.07	-0.98***	-0.29***	-3.74***	3.74***
	(0.94)	(0.10)	(0.13)	(0.10)	(0.91)	(0.93)
Observations	5294	5312	5286	5316	5048	5028

Panel C: Decision Making Power

	Child Health	Own Health	Large Purch	Daily Purch	Visit Fam	Cook Food
teenmarriage	-0.20	-0.15	-0.06	-0.10	-0.12	-0.14*
	(0.12)	(0.11)	(0.12)	(0.12)	(0.11)	(0.07)
Observations	5316	5316	5315	5312	5314	5314

Panel D: Child Health Outcomes

	Hemo	Hemo<11	Hemo<7	zhfa	zbmi	zwfl
teenmarriagefa	-1.21***	0.31***	0.04	-0.13	-0.47	-0.43
	(0.32)	(0.07)	(0.03)	(0.27)	(0.39)	(0.31)
Universe	All	All	All	All	All	All
Birth Year FE	No	No	No	No	No	No
Observations	4969	5302	5302	5009	5004	4971

[1] In this table, I use a dummy for teen marriage (equal to one if married under the age of 18) as the main independent variable of interest. Panel A shows the first stage association between menarche age and teen marriage. All the regression results reported here control for birthyear fixed effects, district fixed effects and other variables including dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone and altitude. In Panel A, *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered.

Table 12: **Robustness Check- Teen Marriage (Under 16 years)**

Panel A: First Stage

	Full	Full	Full	Full	Inschool9	Outschool9
menarcheage	-0.08***	-0.08***	-0.08***	-0.07***	-0.07***	-0.08***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Observations	5316	4935	4935	4935	2690	2231
F-Statistic	304	262	254	234	95	134

Panel B: Woman Level Outcomes

	Edu	Labour	Literacy	Contraception	Spouse Edu	Spouse Edu diff
teenmarriage1	-4.65***	-0.04	-0.60***	-0.17***	-2.31***	2.30***
	(0.46)	(0.06)	(0.07)	(0.06)	(0.55)	(0.53)
Observations	5294	5312	5286	5316	5048	5028

Panel C: Decision Making Power

	Child Health	Own Health	Large Purch	Dialy Purch	Vsit Fam	Cook Food
teenmarriage1	-0.12*	-0.09	-0.04	-0.06	-0.07	-0.08*
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.04)
Observations	5316	5316	5315	5312	5314	5314

Panel D: Child Health Outcomes

	Hemo	Hemo<11	Hemo<7	zhfa	zbmi	zwfl
teenmarriage1fa	-0.91***	0.21***	0.03	-0.08	-0.35	-0.34
	(0.24)	(0.05)	(0.02)	(0.21)	(0.27)	(0.22)
Universe	All	All	All	All	All	All
Birth Year FE	No	No	No	No	No	No
Observations	4969	5302	5302	5009	5004	4971

[1] In this table, I use a dummy for teen marriage (equal to one if married under the age of 16) as the main independent variable of interest. Panel A shows the first stage association between menarche age and teen marriage. All the regression results reported here control for birthyear fixed effects, district fixed effects and other variables including dummy for the presence of multiple wives, household size, wealth index, Urban dummy, presence of telephone and altitude. In Panel A, *In at 9* here means that the woman was in school when she was 9 years old. The standard errors are clustered.